

Science, Warfare and Society in the Renaissance, with particular
reference to fortification theory

VOLUME II: The texts

(Volume I, separately bound)

phd.

LEEDS BROTHERTON

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Table of Contents

VOLUME II

Table of contents	ii
List of Plates	iii
The conventions used and the presentation of the texts	v
Abbreviations	vii
Notes on some of the terms discussed and used in the work	ix
Texts	
Battista della Valle	1
Niccolò Tartagli	5
Pietro Cataneo	27
Giovanni Battista Zanchi	31
Giacomo Lanteri	41
Girolamo Cataneo	51
Girolamo Maggi & Iacomo Castriotto	59
Domenico Mora	65
Carlo Theti	70
Galasso Alghisi	81
Vincenzo Locatelli	86
Aurelio da Pasino	90
Antonio Lupicini	103
Jacopo Aconcio	108
Gabriello Busca	109
Eugenio Gentilini	119
Giovanni Scala	120A
Buonaiuto Lorini	121
Giovanni Battista Belluzzi	137
Francesco di Marchi	142
Gian Tommaso Scala	152
Albrecht Dürer	156
Reinhard von Solms-Lich	164
Walter Herman Ryff	175
Leonard Fronsperger	183
Daniel Specklin	186
Paul Ive	194
Simon Stevin	196
Claude Flamand	202
Ambroise Bachot	207
Cristóbal de Rojas	212
Diego Gonzales de Medina y Barba	215
Jean Errard	216
Bibliography	223
Plates	1/59

List of Plates

- iii
1. Battery of a square fortress. ZNACHI (1554)
 2. Design in accordance with the principle of no dead ground. Girolamo
 3. Battery of a fortress. CATANEO (1564)
 4. A field fortification. " (1571)
 5. Different traces on the principle of no dead ground. MAGGI (1564)
 6. A structure floating on pontoons. "
 7. Trace of a pentagonal fortress. ALGHISI (1570)
 8. An alternative trace of a pentagonal fortress. "
 9. A 21 sided fortress. "
 10. "Case, overo palazzi fatti in fortezza" LURINI (1609)
 11. A triangular fortress. (A) "
 - Defences after Durer. (B) RYFF (1547)
 12. Regularisation of an old enceinte. LORINI (1609)
 13. " "
 14. A fortress with a citadel. MARCHI (1599)
 15. A pentagonal fortress. "
 16. A pentagonal fortress with counterguards. "
 17. A fortress with a citadel. SCHILLE (1580)
 18. The castle of Milan. RYFF (1547)
 19. A sinuous field fortification. FRUNSPERGER (1571/3)
 20. A field fortification with rondells. "
 21. A partly flanked field fortification. "
 22. Pioneer with a square fortress in the background. "
 23. A round bastion. "
 24. A pointed bastion. "
 25. Method of designing the trace of a fortress. SPECKLIN (1589)
 26. Fortress traces. "
 27. Pairs of bastions. "
 28. Details of a casemate in the neck of the bastion. "
 29. Part of a fortress front. ""
 30. A perspective view of a fortress. "
 31. Design of a 12 bastion fortress. "
 32. Castle sites. "
 33. " "
 34. Perspective view of a bastion. BACHOT (1598)
 35. Perspective view of a bastion with shading. "
 36. Attack on two bastions of a fortress. ERRARD (1604)
 37. "Quarre compose". "
 38. An oval fortress. "
 39. Regularization of an old enciente. "
 40. Figures for a ship's lines. GARCIA DL PALACIO (1587)
 41. Figures for another ship's lines. "
 42. Design of ships. From Oliviero, after LUPES DL
 43. Device for regularising a ship's lines. MINDUNLA (1898)

List of plates (cont.)

- 44/47. Geometrical ship design. George WAYMOUTH Jewell of Artes
- 48/49. Forts. " " "
- 50. Dialling diagram SCHÜNER (1572)
- 51. " " "
- 52. Perspective exercises. COUSIN (1560)
- 53. " " "
- 54. Perspective representation. BARBARO (1568)
- 55. " " "
- 56. Fronsperger's ballistic diagram. FRONSPERGER (1571/3)
- 57. Fronsperger's construction analysed. " "
- 58. Fronsperger's construction regularised and Aquilone's construction.
- 59. Musical harmony. CAESARINI (1521)

The conventions used and the presentation of the Texts

Underlined letters in a word indicate a ligature, or the long German 's'. A number in a box thus [29], indicates one of the plates appended here. Reference to the bibliography given here are by way of a capitalization of the author's name and a bracketed date to give the work or edition, e.g. VALLE (1524). Works that have not been seen have an asterisk against them, e.g. (1589*). No general solution to the problem of the capitalization of titles has been found and therefore no particular significance should be attached to the form given. Exact references to a text are given by way of f. (folio) or p. (page), depending on whether the sheets are numbered on only one (f.) or on two (p.) side; 'a' or 'b' have been used to indicate the different sides of a folio, and recto (r.) and verso (v.) only occasionally for particular reasons. The unnumbered sheets at the beginning of works have been generally given a notional numeration, by way of f. or p. depending on the way the leaves of the work are numbered and with a bracketed roman numeral, counting the title page as (i), e.g. p. (viii) or f. (vib). Signatures (Sg.) have generally been referred to throughout when the leaves are unnumbered in a work. Generally, references to the different volumes here have been by way of a Roman I or II thus underlined. 'Below' or 'above' refer to the same volume. Biog. refers to the biographical sections of Pt. I:(i). Reference to the texts given here in volume II have been by way of a page, and generally a line reference (l.). These line references are purely internal. A reference to the place in the original work where the text occurs is found at the beginning of each section of text except when one section begins on the same page on which the last finishes. Where a change of page occurs in the original work an asterisk will be found in the margin. ¶ indicates a new paragraph, generally. In quoting texts, generally, the intention has been to follow as far as possible the original text quoted in terms of spelling, printing style, and the use of abbreviations. 'sic' has not generally been used and errors have been given as in the original, although the difficulties of proof reading preclude any absolute guarantee on this being given. There are a number of reasons for the presentation of the texts in volume II as has been done. These texts indicate how discussion on practical matters often had a strong philosophical cast. Taken singly the pieces of text quoted, generally formed only a very small portion of the works from which they come, and hence are all too easily passed over lightly, or dismissed. Yet assembled they do show a common concern with wide ranging problems. Secondly, what is manifest in these texts are the assumptions that their authors held, rather than substantive points which their authors wished to put forward. These assumptions often have to be 'teased' out, but when this has been done these same assumptions can be seen working at many other places in the texts, where this at first sight may be by no means so clear. Only a substantial body of texts allows this to be done, and the commonness of these assumptions to be demonstrated. Thirdly, the authors in many of these texts tended often to drift from idea to idea with no very definite linking notions, and without definite breaks in expression. It is difficult therefore to excise brief sections to illustrate their views without distortion, and the continuous text needs to be examined. Fourthly, what these texts manifest is not particularly

the appearance of new ideas, or the steps in the development of an idea, or ideas, so that only the relevant texts have to be quoted to show what idea was expressed at any particular time, but rather the widely held assumptions of the writers involved and the variation in emphasis they gave to some of them. In order to demonstrate any such effect the technique must be relatively exhaustive, and hence the amount of texts given.

Translation of the texts into English has been undertaken for a number of reasons. Firstly, there is no better way to get at the details of the ideas involved than by attempting to translate the texts in which they occur. Ambiguities in one language often do not occur when an equivalent term in another language is used, and hence force decisions about the underlying ideas, for example. The very attempt at modernization that automatically occurs equally often forces decisions to be made which help to clarify the original. The translations given are thus seen as a commentary on the original texts, and are in no way intended to stand alone. This sort of commentary has been considered desirable because in many cases while the surface language may seem relatively clear, the thinking behind it may be relatively confused and unclear. On the other hand in many cases it seems that in a search for elegance of expression and diction -- possibly to impress the patron -- these often relatively unlettered writers drift into awkward and convoluted language which does require at least the attempt to unravel their thoughts in order to be even fairly sure that their meaning is being assimilated. In order to follow the underlying ideas as faithfully as possible word order in the original language has often been followed at the expense of an English version that can become very awkward, but this has been found necessary because as soon as paraphrasing is resorted to the roughness and vagueness of the original, can be all too easily lost. In the translation of particular words or terms, when an English word, particularly of a similar form to that of the original language, has a common root meaning or meanings with that of the original, it has often been preferred, even though the different usages may vary somewhat in emphasis. (See for example VIRTU in the section on terms given here.) In terms of grammatical forms either of singular or plural of nouns, or of the different forms or aspects of verbs, for example, the translations are not intended as faithful renditions, rather grammatical equivalence has been given a low priority as against expression of the underlying ideas, when these can be more happily expressed in English in another way. These translations are thus in no way definitive, particularly from a linguist's point of view, but, as has been stated, are commentary on the texts.

- Act. Int. Cong. Art. History: Actes of the International Congress of Art History. (Or. as similarly given in other languages.)
- Act. Int. Cong. Hist. Sci.: Actes of the International Congress of the History of Science. (Or. as similarly given in other languages.)
- ALLG DEUT BIOG: Allgemeine Deutsche Biographie (Leipzig 1875/1912)
- Am. Hist. Rev.: American Historical Review
- Antiq Jour.: Antiquaries Journal (of the Society of Antiquaries, London.)
- Arch. Stor. Ital.: Archivio Storico Italiana.
- Arch. Stor. Lodigiano: Archivio Storico Lodigiano.
- Art Bul.: Art Bulletin.
- Atti di Cong. Int. de Sc. Stor.: Atti di Congresso Internazionale di Scienze Storico (Or. as similarly given in other languages.)
- BALTEAU: Dictionnaire de biographie francais. Sous le direction de J. Balteau ...M. Barroux...M. Prevost (Paris 1933-)
- Bib.: Bibliography, and similar forms in other languages.
- BIB NAT PRS: Bibliothetique Nationale Paris.
- Bib. Naz. Cent. Fir.: Biblioteca Nazionale Centrale di Firenze.
- BIOG NAT DE BELGE: Biographie nationale, publiee par l'Academie Royale... de Belgique (Bruxelles 1866-)
- BIOG UNIV: Biographie universelle ed. Louis Gabriel Michaud (Paris 1843/65)
- Bk.: Book.
- Bod.: The Bodleian Library, Oxford.
- B.M.: British Museum; the older designation used here for what is now the British Library, Reference division, Bloomsbury, Dept. of Printed Books, and of manuscripts.
- Brit. Jour. for the Phil. of Sc.: British Journal for the Philosophy of Science.
- Bul. Senese di Stor. Patr.: Bullettino Senese di Storia Patria.
- Cap.: Chapter.
- Cat.: Catalogue.
- Comm.: Commentary, commentator.
- Desc.: Description.
- D.N.B.: The Dictionary of National Biography ed. Leslie Stephen and Sidney Lee (London 1939)
- D.S.B.: Dictionary of Scientific Biography ed. Charles Coulston Gillespie (New York 1970-)
- DZ BIOG ITAL: Dizionario enciclopedico di architettura e urbanistica. Diretto da Paolo Portoghesi (Roma 1968-)
- Ec. Hist. Rev.: Economic History Review.
- ed.: edition, editor, edited.
- ENC ITAL: Enciclopedia Italiana di scienze, lettere ed arti (Milan 1929/39)
- ENC UNI ILL EUR AM: Enciclopedia Universal Ilustrada Europeo-Americana (Barcelona 1907-)
- Eng. Hist. Rev.: English Historical Review.
- f.: folio, a sheet numbered on one side only, in contrast to a page (p.).
- fcs.: Facsimile.
- fac.: Fascicule.
- GR DZ ITAL: Grande dizionario della lingua Italiana (Turin 1960-) ed. Salvatore Battaglia.
- GR ENC PORT BRAZ.: Grande Enciclopedia Portuguesa e Brasileira (Lisboa, Rio de Janeiro 1936/60)
- INDEX AUR: Index Aureliensis. Catalogus librorum sedecimo saeculo impressorum (Aureliae Aquensis 1962-)
- I.M.: Imago Mundi.
- Jour.: Journal.
- Jour.:of Econ. Hist.: Journal of Economic History.
- Jour. of the Hist. of Ideas: Journal of the History of Ideas.

- Jour. of the Soc. of Arch. Hist.: Journal of the Society of Architectural Historian.
- Jour. of the Warb. and Court. Inst.: Journal of the Warburg and Courtauld Institutes.
- Jour. RIBA: Journal of the Royal Institute of British Architects.
- l.: line.
- l.h.: left hand.
- lit: literally.
- Misc. di Stor. Ital.: Miscellanea di storia Italiana.
- m.s., mss. Manuscript(s).
- n.: note
- NEUE DEUT BIOG: Neue Deutsche Biographie (Berlin 1953-)
- No.: Number.
- NOU BIOG GEN: Nouvelle Biographie Universelle (Generale) (Paris 1852/66) ed. ed. Johann C.F. Hoefer.
- N.U.C.: The National Union Catalogue (London 1968-)
- O.E.D.: The Oxford English Dictionary (A New English Dictionary on Historical Principles) (Oxford 1884/1933)
- p.: page, a sheet numbered on both sides as opposed to a folio, (f.).
- Pl.: Plate.
- Proc. Int. Cong. Hist. Sc.: Proceeding of the International Congress of the History of Science.
- r.h.: right hand.
- rpr.: reprinted.
- SALVAT: Diccionario enciclopedico Salvat (Barcelona 1960)
- Ser.: Series, and similar forms in other languages.
- Sg.: Signature.
- Soc.: Society.
- s.l.: Without place.
- s.d.: Without date.
- T & C: Technology and Culture.
- t.p.: title page
- Tom.: Tome.
- trs.: Translated, translator.
- Trans.: Transactions.

Notes on some of the terms discussed and used in the work¹

ART (v. SCIENCE): Generally modern commentators warn the reader that art and science during the renaissance were equivalent terms. It is certainly true that these terms could be synonymous, but this is only part of the story. See I p. 76, & n. 4ff. and the citations from Errard there.

BASTION: While this term was in use during the renaissance the treatise writers much more frequently employed the term bulwark (or its equivalent term in the relevant language). However modern usage favours the use of 'bastion' in such phrases as 'the angle bastion form'; or 'the pointed bastion system', and this usage has been generally followed throughout, to indicate the characteristic structure designed in accord with the principle of no dead ground. The term 'bulwark' has been reserved for a wider usage to indicate any strong defensive mass.

BEAUTY (v. STRENGTH): I p. '84, n. 7.

CASEMATE: Typically this term in English suggests an enclosing masonry structure containing guns. It has been used here without this implication of the structure being a totally enclosing one, particularly to refer to the gun positions in the neck of the bastion. (As it was sometimes used in the contemporary period -- see Rojas II p. 214, l. 41.) The English term 'flanker' for such an emplacement has not been generally used as not translating any particular contemporary Italian term very well. Most commonly here Italians referred to the 'piazza' (d'alto, da basso, etc.), which does not translate directly into English in any easy way.

CITADELLE: This spelling has been used here to emphasise that what is being referred to is the characteristic structure to the pointed bastion trace, of a relatively compact size, which was so often built with an urban enceinte as a garrison container. See, for example Theti, II p. 72, l. 6/14.

DISEGNO: See I p. 42, n. 6.

FORBICI: lit. scissors. On plan a re-entrant trace, most commonly conceived to ensure that shots strike the curtain at an angle.

INGEGNO: The 16th. century treatise writers tended to use this term as merely equivalent to 'skillfulness'. However the root notion of 'ingenuity', particularly of mind, and a sense of being 'art'-full, with all the connotations that involved, was probably always present to some degree when they used this term. The pairs 'ingegno/ingegnere' and 'ingenious/engineer', bring across something of the same relationship in Italian and English, and thus 'ingenious' and 'ingenuity' have been used here more frequently than otherwise would be the case. See Castriotto II p. 62, l. 37/8, who directly related the terms of the Italian pair.

METHOD: 'Metodo' the Italian term, during the 16th. century had very much the sense which attaches to the way Descartes, for example, used the term.

GR DIZ ITAL for Example give a citation from Benedetto Varchi 1503/65 'metodo'...."una via o un modo dritto e breva, cioe agevole e spedito, col quale s'insegna alcuna arte ovvero scienza, conciosiacosache niuna arte ovvero scienza non si puo....apprare senza alcuno metodo..." Yet this

¹. This is not intended to be an exhaustive list, particularly in regard to technical fortification terms. Such terms have generally been eschewed here, except for a relatively small number (such as 'ravelin' and 'cavalier') whose meaning is clear and commonly accepted, in order not to suggest a pseudo precision through the use of technical terms which had often a very wide and variable usage. Again artillery nomenclature is not considered here as the relevant terms could be very variable in this field also.

X

term was rarely used by the treatise writers considered here. They much more frequently referred to doing things by or according to rule(s), in an orderly way, or by reason, or 'rationally', or the like. There may have been a number of reasons for this. On the one hand in fortification the notion of the orders of architecture was probably always very much to the fore in the minds of the writers concerned. On the other, this term occurred relatively frequently in the titles of works in Latin (like Aconcio's), which were generally learned works heavily dependant on the ancient authors with a strong Aristotelean cast, and were not concerned with any mathematical 'method' as in the treatises considered here. Thus it may be that to writers in the practical mathematical sciences eschewed this term in order not to become entangled in debate with such learned writers. Be that as it may, the underlying notion at work in the treatises considered here seems to be so very much that of 'method', that that term has been continually used here without reservation.

PIATTAFORM(S): This rather 'bastard' term has been used here for the rectangular platforms intermediate between bastions, found so often in earlier 16th. century structures. The English term 'platform' is too general.

PORTULAN/PORTOLAN: There have been disputes about nomenclature here. The form 'portulan' has been used to refer to the 'true' portulans, or lists of sailing instructions. While the form 'portolan' has been used in the phrase 'portolan charts' to make the distinction quite clear.

PRACTICAL GEOMETRY: In Italian and French during the 16th. century this terminology referred most characteristically to surveying, but also to mensuration in general. This sort of usage sometimes had a tendency to a wider extension, as for example, when Thomas Salusbury referred to Benedetto Castelli's work in hydraulics as practical geometry. This does not seem to have been very common however. This terminology because of this kind of ambiguity has not been generally employed here.

PRACTICAL MATHEMATICAL SCIENCES: This is not a contemporary usage. Undoubtedly the practitioners in the fields considered here, were keen to emphasise the quality of science in their efforts; and mathematics had a major role in the fields at issue; equally these fields were directed towards practice. Yet it is difficult to conceive that the practitioners involved would have happily accepted this type of usage. Their move was centrally to assimilate to contemplative study their disciplines, hence the formal distinguishing of their arts as of a practical nature would hardly have been congenial to them. On the other hand to a modern mind the idea of '16th. century science' tends to suggest speculate/contemplative knowledge, if not, in some way modified. The whole phrase thus takes what would be acceptable to renaissance views in terming the relevant areas 'mathematical sciences', while the modifier 'practical' precludes any confusion in terms of modern usage.

The division of the 'practical mathematical sciences' into the various disciplines involved, is by no means an absolute one. One might include under, or with, surveying, general mensuration as an allied or sub-section of a single discipline, with perhaps gauging as a sub-section of general mensuration. But it has not been considered necessary to give much attention to these fields as separate disciplines here. Another possible candidate for inclusion as one of the practical mathematical sciences of the period is music, which clearly had its mathematical theory during the renaissance.

But the idea of practical application is too distant from this discipline. Certainly one might say that perspective for producing beautiful views, is very similar to mathematical analysis of sounds for the production of sweet music. But perspective was very much a practical (engineering) tool in the 16th. century as well as being conceived as the method for producing beautiful views. But music was relevant to architectural practice. It is a matter of degree. Perspective was a drawing technique relevant to design in many areas. Music had only relatively tenuous connections with architecture, and so has not been included for consideration here.

RETRENCHMENT: Any ad hoc work built behind a fixed defence line, into which the defenders might retire when their permanent works were breached.

RITIRATA: = Retrenchment.

RIPARATIONE, FORTIFICATIONE & EDIFICATIONE: The tripartite distinction of the 16th. century treatise writers. (See I p. 81, Texts II p. 62/3 & p. 77.) The idea of 'edifications' is perhaps not so clear as the others, but Castriotto's account seems to be of the design and carrying out of a total scheme of a fortress such as Palma(nova), as against a mere fortifying or strengthening a place.

SCIENCE see ART & PRACTICAL MATHEMATICAL SCIENCES For an older usage see II p. 2, n. 1.

TERMINI: See I p. 41, n. 5.

TERREPLEIN: (= Ital. 'terrapieno'). A bank, particularly, forming a level platform behind the parapet, especially for mounting guns.

TYPE FACE DIAGRAM: The 16th. century treatises when discussing arrays, often used ordinary characters from the printers font to represent the different units in an array, different letters indicating different types of troops, so forming diagrams which have been thus referred to here.

TECHNOLOG/Y, (IES): O.E.D. for example gives "the scientific study of the practical or industrial arts"; and Webster's "The science of the application of knowledge to practical purposes". It is in this general sense that this term has been used here. Yet sometimes to the modern mind what is most characteristically suggested by this term is knowledge relative to industrial, particularly productive, processes, or, on the other hand to machines or processes associated with machines. In this sense to consider surveying for example as a technology may seem rather obscure. But this is fully in accord with the root idea, with all its history, of the difference between practical and contemplative knowledge. Generally when discussing and describing such areas in their historical context, the terminology of the 'practical mathematical sciences' has been preferred. On the other hand when concerned with these areas more generally, and as involving a certain kind of knowledge, the term 'technology' has been more frequently employed.

VIRTU: The English term 'virtue' has been used as equivalent to the Italian form quite unrepentantly. Commentators often warn that it is not equivalent to 'virtu' in Italian. Undoubtedly as it was used in the 16th. century the notion involved was not a great deal more than that of a certain force or effectiveness. Yet a certain residual sense of rightness simply because of effectiveness seems to form a halo around that usage. In English while a general sense of (moral) rightness seems to suffuse the equivalent term most characteristically, there is a perfectly good equivalent usage in, 'in virtue of', or 'by virtue of' (and an older usage again equivalent to the Italian when the virtue of plants or minerals was referred to). Thus equivalence between the Italian and English terms has been accepted, while the difference in emphasis must always be kept in mind.

1

BATTISTA DELLA VALLE

Vallo.... (1st ed. 1521*)¹

Bibliography: This work went through a large number of editions, including: Napoli, 1521*¹; Venetia 1524²; Venezia 1526*²; Venetia 1528*³; Venetia 1529; Vineggia 1531*³; Vineggia 1535; Venetia 1538*⁴; Vineggia 1539; Vineggia 1543; Vineggia 1550; Vineggia 1558; Venetia 1564*^{4,5}.

A French version appeared at Lyon in 1529*³ and 1554.

A German translation of parts of this work appeared in Kriegs und Archeley Kunst Hieronymum Ruscellum, (Francofurti 1620.)

General Description: A rather small volume 4½"x2½" text, (viii)+ 71 folios, with many woodcuts and typeface diagrams.

Contents:

f. (1a): Title page: Vallo libro cõtinente appertene ad Capitanii, retener & fortificare una Cit/ta cõ bastioni, con noui artificii de/ fuoco aggiõti, come nella tabola ap/pare, & de diuerse sorte poluere,/ & de expugnare una Citta cõ põ/ti, scale, argani, trõbe, trenciere,/ artigliarie, caue, dare auisa/menti senza messo allo/ amico, fare ordi-/nanze, batta-/glioni, Et/ponti de disfi/da con lo pingere,/ opera molto utile con la/ experientia de larte militare.

f. (1b): Dedicatory verse.

f. (1ia/va): Table of contents.

f. (vb/viifb): "Capitoli tre de Artificii de fuoco nouamenti aggiõti".⁶

f. 1a/2a: Dedication "alo excellentissimo et molto strenuo caualliero, S. Hẽrico Pandone Conte de Venafra lhumil seruidor Baptista de la Valle Venafrano."

f. 2a/20a: Bk. I: Discusses topics relevant to a captain's duties and the defence of a place by various means, the use of earth gabions as temporary or remedial works, and the use of artillery fire, in particular.

f. 20a/29a: Bk. II: Discusses methods of attack. Shows zig-zag and sinuous trenches defended by gabions. Also contains descriptions and illustrations of machines.

f. 29b/53 : Bk. III: This section is mainly concerned with the formation of orderly arrays of infantry armed with the pike, though occasionally some hand guns are involved (Capt. X, for example). It contains also an illustration of a diver's mask.

f. 53 /71a: Bk. IIII: "questo quarto, et ultimo libro trattare de Duello, et prima qual sia maggior nobilitabile arme, o le lettere".

Colophon: Finisse Libro intitolato VALLO pertinente ad militi Con noui Capitoli di artificii de fuoco agionti Como nelle soa tabola appare. Stampata in Venetia. Nel anno de Signore Dio nostre.M.D.XXIIII. Adi.XI.Marzo.

1. See AYALA (1854), discovered by him.

2. After AYALA (1854). Neither RICCARDI (1893), nor N.O.L. know this edition.

3. N.O.L.

4. RICCARDI (1893).

5. COCKLE (1900) gives an edition of 1631 which seems to be a misprint for 1631.

6. Ayala gives the title page of the Naples 1521 edition as reading exactly the same as the above, so that the three chapters added at the beginning are not extra to that edition as one might suppose, and these chapters do not appear in the table of contents despite what the title page states; they are equally unpaginated. The same pattern holds in all other copies examined.

7. Of the 1524 edition.

Vallo....(1524); Texts.

f, 2a. QVANTVNQUE molti famosi Scriptori de scientia¹, & arte Militare & de Duello scripto habbiano opere molto utile, & de memoria dignissime con altiloquo stilo, & terse, elegante, & limitate parole composte, nientedimeno la lor compositione e stata solamente per authorita, & imitatione de altri authori, & non per propria exercitatione, Ma io elquale da mei teneri, & giouenil anni in gli exercitii de larme me son io exercitato non ho scripto, altro in questo mio libretto excepto quello che per longa experientia ho experto, & prouato con continue fatiche....

Et pero primamente secondo il mio iudicio dico che al buon capitano de Fātaria in prima e necessario & gli conuiene p exercitare la militia sapere mettere in ordināza² qualse voglia numero, saperlo spartire, smembrare, & unire in battaglione con arte & ragione

f. 4b. QVando mancasseno le fascine per riparare bisogna fare de molti gabioni tondi a modo de botte aperti sotto, & sopra & drizando in piede, & metterli doue e il bisogna, e impiarli di terra, & calcarli ben forte, & questi gabioni sono molti utili, & mettendoli uno poco larghetti luna da laltro acio si possa far uenire le candonere³. Et quando mancasse il modo de fare li gabioni bisogna hauere de le botte uacue, & sfenestrarle da una banda, & impiarle di terra bene, & calcarli como hai fatto a gli gabioni. Et quando mancassero le botte bisogna prendere sacconi de letti pieni de paglia,

In as much that many famous writers of the science¹ and art military, and of the Duel, have written works, very useful, and of the most worthy memory, and of the highest style, with short, elegant, and few words composed; nevertheless their compositions have been purely from authority and (in) imitation of other authors and not from personal experience. But I, who from my tender and juvenile years, exercised in the practice of arms, have not written anything in this little book of mine except that which through long experience I have tried and proved with continuous travail....

But firstly, according to my judgement, I say that to the good captain of infantry, it is first necessary and proper to him, for his military practice, to know how to marshall in array² whatever number, to know how to separate and divide them and unite them in battalions, with art and reason....

When fascines for repairs are lacking it is necessary to make many round gabions like casks open above and below and straight in the base, and to put them where they are needed, and fill them with earth, well packed down; and these gabions are very useful and putting them one a little wider, the one to the other one can form the embrasures³. And when the means of making gabions is lacking it is needful to have empty casks, to close them at one and fill them with good earth and compact them as you have done with the gabions. And when casks are lacking it is needful to take bed sacks full of straw, and flock and feather matt-

1. Valle's use of the term 'scientia' here, and throughout his work, seems to indicate not a great deal more than prudent consideration, or as he puts in the next passage "art and reason". This usage was of course traditional. In a military context for example, Egidio COLONNA (1502) Pt. III, Cap. i, wrote "Quare sicut nullus efficiendus est magister in aliis scientiis: nisi constet ipsum esse doctum in arte illa. Sic nullus assumendus est ad dignitatem militarem: nisi...." See also Lull II p. 275.

2. Florio. "Ordinanza di soldati: An array, a marshalling, or putting of soldiers in ranks". FLORIO (1611)

3. Taking 'candonere' = 'cannoniere', for just previously Valle wrote "torette con case matte con soe candonere che battano per fianchi". (f. 4b.)

mattarazi de letti, & piume & altre tap-
 ezarie per non mancare al reparare,
 perche non solo e la perdita de gli huom-
 ini per non riparare, ma la importantia,
 e che ogni diece di dentro importa per
 cento di fuori.¹

f. 6a. QVesto e modo de Bastione quadro
 con le soe chiaue² & candonere con doe
 case matte, elquale bisogna Como e stato
 ditto che sta al sapere murare le soe
 manocchie, & calcarli como per l'altro e
 dicto, & facendose como conuene & con
 larte & intendimento pertinentente ad epso
 sera de gran perfetione. Et piu e da
 sapere che li Bastioni son trouati per
 molti boni respeti, prima son piu exped-
 itiuu alla guerra chel Muro, & se rese-
 ccano piu presto chel muro, & mancho
 spesa, & anchora resisteno piu ad colpi
 de artellarie....

f. 7a. MODO DE FARE VNO BASTIONE tondo
 per defendere con le soi chiaue, & case
 matte, & cannonieri.

EDa notare anchora di questo Bastione
 tondo per defendere in uno luoco che sia
 apto, & necessario, Nel quale bastione
 gli siano doe case matte con soe candone-
 re come q appare³ & con soe chiaue le
 quale ueneno calando cō soi bisogni &
 nella parte di sopra ci uiene uno Caua-
 liero con uno parapetto, & el ditto bast-
 ione e da tanta uirtu facendose alloco
 ditto che le de marauiglia.

f. 53b. DELLA NOBILITA DE LITERE

f. 53b. El preuenire de grandeza, Titoli
 & gradi, et nobilita aduiene per longo
 tempo stentare in lettere & quelle pseru-
 ando studiare in puerile eta el princi-
 pio, in la eta perfetta il mezo, in la
 eta decrepita lo optimo fine, & quante

resses, and other tapestries, so as to not
 lack in repairing, because not only are
 men lost through not repairing, but the
 importance is that every 10 on the in-
 side carry 100 on the outside.¹

This is the way of a square bastion with
 its walls and embrasures with two case-
 mates, for which, as has been said, it is
 necessary to know how to lay its turves
 and pack them, as for the other said, and
 made properly and with skill and the rele-
 vant understanding, it will be of great
 perfection. And to know further that
 the(se) bastions are devised for many
 good qualities, firstly they are more
 expeditious in war than (masonry) walls
 and are repaired more quickly than (such)
 walls, and cost less, and yet resist
 better the blows of artillery....

The first way of making a round bastion
 for defence with its sides and casemates
 and embrasures.

Now further note this round bastion for
 defence in a place where it is suitable
 and necessary. In which bastion there
 should be two chambers and
 their embrasures as here appears³, and
 with their sides which are reduced as
 necessary⁴, and in the part above there
 comes a cavalier with a parapet and the
 said bastion is of such virtue (when)
 made in the said place that it is marvel-
 lous.

Precedence in greatness, titles and deg-
 ree, and nobility, occurs through long
 labour in letters, and those preserving
 to study in youth the beginning, in matu-
 rity the middle, and in old age the high-
 est results, and such are the labours of

1. The meaning is a little obscure here. What seems to be implied is that lack of attention in repairing will lead to casualties among the defenders, which are all the more significant because one defender can match 10 attackers.

2. "Chiaue", the French (1554) version gives "claves" which is equal to 'hurdle' or 'fence' in the singular. Valle talks about 'fastines', which suggests such hurdles or fences as forming the sides or faces of the structure. The term "chiave" however, ultimately refers to 'keys'. The root sense then seems to be the framework that keys the face together. JAHNS (1889) p. 777, stated "Lchiave sind Klammern Querhölzer".

3. Unfortunately, Valle's illustrations are very obscure.

4. Taking Valle to be referring to the batter, or tapering of the walls in thickness.

sono le fatiche de mente, & de corpi con
 quanti incomodi notte & giorno de aud-
 ire & legere, perdono il sonno, et nutr-
 menti de cibi per attendere ad studiare
 non temendo freddo, fame, sete, & fatiche,
 incomodi grandi, solo per uenire a
 questa nobile, Eccellente & utile scien-
 tia, per laquale se gouerna & regge
 tutte l'uniuerso, che senza lei non se
 potrebbe uiuere rectamente. O quanta
 differenza, o quante insidie, o quanti
 adulti, o quante roine de corpi, & de
 *popoli, de regni, de amici, questa
 scientia admodesta, applaca, concorda,
 & unisce, o beato e quello che la
 reuerisce, & tene, o beato e quello che
 lama, & continuamēte seque, o qual cosa e
 piu appresso a Dio che la sapientia,
 sicche Dio e somma sapientia; et la sap-
 ientia e in a Dio adoncha e da pensare
 che quello che se inueste de raggio diu-
 ino se puo dire nobile & grande.

DELLA NOBILITA ET GRANDEZA della militia

IN prima se dice la scientia e il fiore,
 & la militia el frutto, adōcha de una
 gran cosa ue e principio, mezo, & fine,
 per tanto non e da fondarse come el fiore,
 ma dico al frutto, & quello demonstra la
 perfettione del suo optimo, & bel fine, e
 piu dico...che dio non sia somma sapien-
 tia, ma anchora e somma potentia...sicche
 della degna & nobile, & splendissima mil-
 itia titolato Capitano, elqual Capitano
 nō uolse tanto adoperare la scientia, ma
 la magnanimita della forza dico uero mil-
 itia....

Firstly it is said, that science is the
 flower and warfare the fruit, so that of
 one great thing there is beginning,
 means and end, in as much as it is not to be
 based as the flower, but I say, as
 the fruit, and that demonstrates the per-
 fection of its exquisite and beautiful
 end, and further I say...that God being
 not only the sum of wisdom, but also the
 highest power...so that of the worthy,
 noble and most splendid military title of
 Capitan, that Capitan should not so much
 employ science but (rather) the magnan-
 imity of the force truly called military...

1. This whole passage and its relation to the previous section is somewhat obscure. Della Valle seems to have been indulging in a very peculiar kind of argument here. He relates "science" and warfare in a process which he describes through the use of a biological analogy for reasons which are unclear. Then the equation warfare = fruit = final cause is considered to give value to warfare, perhaps partly because final causes are equated to perfection, but also because science, valuable in itself, being equated with the flower, is only an early stage to the final end, which is the fruit, and equal to warfare. However, the peculiarities of this argument do not obscure the general tenor of della Valle's contention that valuable as such 'science' may be the nature of military art does not depend fundamentally on such knowledge but on power.

2. This elision concerns the hard labour and dangers attendant on the acquisition of military skills.

NICCOLO TARTAGLIANova Scientia (1st ed., 1537)

Bibliography: Vinegia 1537¹; Venetia 1546*²; "con una giunta al terzo Libro", Venetia 1550; do. Vinegia 1551*³; do. Venetia 1553*⁴; do. Vinegia 1558; do. Venetia* 1562*⁵; do. Venetia 1583*⁶; In Opere... Venetia 1606.

French translation Jules RIEFFEL (1845).

English translation of the first two books Stillman DRAKE and I.E. DRABKIN Mechanics in 16th century Italy (1969).

General Description:³ A short work unpaginated, 6"x3 1/2" text, 48 folios. Set out in propositions. Many good quality geometric diagrams, and illustrations.

Contents:

Sg. *1a. Title page: NOVA SCIENTIA DA NICOLO TARTALEA.B., over woodblock illustration with figures labelled Philosophy, Geometry, Music, etc., and Plato, Aristotle and Euclid, this last allowing entry into the first of two enclosures, in which a cannon and a mortar are shown firing. The second enclosure is only entered through the first and shows Philosophy and Plato inside, with Aristotle guarding the door. Plato holds a banner with the well known inscription denying entry to all those but who know geometry. At bottom: *Disiplinae Mathematicae loquuntur/ Qui cupitis Rerum varias cognoscere causas/ Disate nos: Cunctis hac paret una uia.*

Sg. *11a/b. List of contents headed: *Inuentione nouamente trouata da Nicolo Tartalea brisciano: vtilissima p ciasuno speculatio Mathematico Bōbardiero & altri intitolata Sciētia noua: diuisa in cinque libri....*

Sg. *111a/111b. Dedication of 5 folios to Francesco Maria Feltrense dalla Rouere Duca di Urbino. Dated XX di Decembrio.MDXXXVII.

Sg. B1a/D1b. Book I: 9 folios on the nature and effect of heavy bodies under two different kinds of motion, i.e. natural and forced.

Sg. D11a/H1a. Book II: 15 folios on patterns of artillery fire and proportions of ballistic paths.

Sg. H1b/L11a. Book III: 14 folios on the measuring of heights and distances.

Colophon: *In Vinegia per Stephano da Sabio. Ad instantia di Nicolo Tartalea brisciano il qual habita a San Salvador MDXXXVII.*

Con gratia et priuelegio dal Senato Venato che niuno ardisca ne prosuma di stampare ne stampati in altroue uendere come se contien etc.

1. The Venetian archives contain a notice concerning a vote to allow Tartaglia the concession he asked regarding the printing of a work. It is dated 17th May 1538. This date does not correspond to any known work of Tartaglia's so it is just possible that it does refer to the first edition of the Nova Scientia which Tartaglia had already had printed in 1537 as it is dated, but for some reason did not get his privilege granted until the next year, so that the work may only have been issued in 1538. The late date of the dedication (20th December 1537) tends to support this. But of course the notice may in fact refer to another edition of this same work, or, to another work altogether. This notice is given by Vincenzo TONNIBAZZA: "Frammenti di nuove ricerche intorno a Nicolo Tartaglia". Atti del Congresso Internazionale di Scienze Storiche 1903, Vol 12 (Rome 1904), 293/307.

2. After RICCARDI. (1893)

3. Of the first edition.

4. This table of contents lists books 4 and 5 which in fact do not appear in the work. Book 4 on the proportions of all ranges of all sorts of artillery. Book 5 a discussion after Galen, Avicenna and others on gum, oils, minerals and other materials for use in powder. This same list, in slightly altered form, appears in the later editions although books 4 and 5 are still not given in any of them

Nova Scientia (1537): Texts

Sg. A11b.Ma poi fra me pensando in giorno (Magnanimo Duca) mi parue cosa biasmeuole, uituperossa, et crudele, et degna di nō puoca punitiōe appresso a Iddio, a uoler studiare di assotigliare tal essercitio dannoso al pssimo, Imo destruttore¹ della specie humana, & massime de Christiani in lor continue guerre. Per ilche (o eccellente Duca) non solamente pospossi totalmēte il studio di tal materia & attesi a studiar in altro, ma etiam strazzai, & abrusciai ogni calculatione & scrittura da me notata: che di tal materia parlasse. Et molti mi dolsi, & auergognai dil tempo circa a tal cosa speso, et quelle particolarita, che nella memoria mi restorno (contra mia uolunta) iscritte mai ho uoluto palesarle ad alcuno, ne per amicitia ne per premio (quantunque sia stato da molti richiesto) perche insignandole mi pareva di far naufragio e grande errore. Ma hor uedendo il lупpo desideroso de intrar nel nostro armento² et accordato insieme alla difesa ogni nostro pastore non mi spar licito al presente di tenere tai cose occulte, anzi ho deliberato di publicarle parte in scritto, et parte uia uoce a ogni fidel christiano, accioche cadauno sia meglio atto si nel offendere come nel diffendersi da quello, Et molte mi doglio (Signor Magnanimo) che tal studio all' hora abandonai, perche son certo che hauendo seguito fin hora harei trouato cose di maggior ualore (massime nella cōposition de fuochi)³

But then thinking to myself one day, Great Duke, that it appeared to me a blameworthy, shameful and cruel thing, and worthy of no little punishment under God, to wish to study and sharpen this practice, dangerous at the very least, (and) at its lowest destructive to human kind, and especially of Christians in their continual wars. Therefore, O excellent Duke, I not only put off totally the study of such matters and attended to other studies, but also tore up and destroyed all calculations and writings set down by me, that spoke of the subject. And it saddened and shamed me greatly, the time spent on such a thing; and those details which in my memory remained inscribed, against my wishes, I have never wished to reveal to anyone, neither for friendship nor for reward, although it has been requested by many, because teaching them seemed to me a disaster and great error. But now the wolf comes desiring to intrude into our flock, and all our shepherds coming together for defence, it does not seem legitimate to me at the present to keep such things secret; thus I have decided to publish them partly in writing and partly by word of mouth to every faithful Christian, so that each one will be better prepared in attack as in defence against that. And much it pains me, great lord, that I had abandoned such

1. The 1550 edition reads "dannoso al prossimo, anzi destruttore". DRAKE & DRABKIN (1969), p. 68. give "to study and improve such a damnable exercise, destroyer of the human species".

2. The Ottomans are the clear culprits here, and in 1537 the Sultan had marched to Valone in Albania preparatory to attacking Italy, at the same time as attacks were made on the Venetian strongholds along the Adriatic coast and on the isle of Corfu (see Cambridge History of Islam, I p. 327). And in the Quesiti et Inventioni (f(ia) 1546ed.) Tartaglia gives the Turkish movements of this date as the significant ones. But the Turks had been a threat to the Christian world in one way or another, from time to time all through the 1530's.

3. DRAKE & DRABKIN, op. cit., omit this clause altogether. It is in fact dropped in the 1550 and other later editions, presumably because Tartaglia dealt with this topic in the 3rd book of the Quesiti et Inventioni. But the above authors claim to translate the 1537 edition and it is a rather crucial remark to drop. In his table of contents to this present work Tartaglia gave book 5 as discussing such matters (see II, p. 5, n. 4) yet in this place indicates that he only hopes to do great things in this area. Thus it would appear that Tartaglia was tending to advertise himself as able to do more than he had yet done. This then throws doubt on Tartaglia's apparent claim implicit in the description of book 4 to be able to give detailed range tables for artillery on theoretical grounds: "In lo quarto se dara la proportione & l'ordine dil crescere callar che fa ogni pezzo de artiglieria nelli suoi tiri....mediante la notitia dun tiro solo". Of this Drake & Drabkin (op. cit. p. 63) say "a project far beyond Tartaglia's powers". Yet Fronsperger's construction does just this nicely (see I, p. 178[9]) and as it was unlikely to have been Fronsperger's own invention it may well have come from Tartaglia himself, for it certainly had to come from someone rather like him. However the point remains that Tartaglia was probably claiming more than he could actually yet achieve in this purported 4th book.

come spero in breue anchora di trouare...

study till today, because I am certain that had I followed it until now I would have found things of great value, especially in the composition of powder, as I hope shortly yet to find....

Sg. Aiiib.Et se in questi tre libri non satisfaccio plenariamēte uostra Eccellentissima Signoria insieme con le pre-detti suoi peretissimi bombardieri, spero in breue con la practica del quarto & quinto libro non gia in stampa (per piu rispetti) ma ben a penna ouer uiua uoce di satisfar in parte uostra Sublimata insieme con queglii....

And if in these books I do not fully satisfy your most excellent lordship, together with the above said, your most skilled gunners, I hope shortly (to do so) with the experience of the 4th, and 5th, books, not yet printed, for various reasons; yet truly to satisfy in part your highness, by pen or verbally, together with those (of your choice).....

Euclide Megarense (1543): Text

f.1b. Quale, & quante siano la scientie, ouero discipline Mathematiche

What, and how many are the sciences or Mathematical disciplines

LE SCIENTIE, ouero discipline Mathematica, secondo il volgo sono molte, cioe, Arithmetica, Geometria, Musica, Astronomia, Astrologia, Cosmographia, Geographia, Corographia, Perspectiva, Specularia, La

The sciences, or mathematical disciplines according to the vulgar, are many, that is Arithmetic, Geometry, Music, Astronomy, Astrology, Cosmography, Geography, Topography, Perspective, Optics, the science

1. It is difficult to know how seriously to take this whole passage. On the one hand there seems no reason to doubt Tartaglia's assertion that he found the cultivation of knowledge concerning artillery distasteful for the sorts of reasons he gave and that a new onslaught by the Turks was significant in stimulating him to publish such work. But to accept such an account as the whole story would be rather naive. Especially in view of the way Tartaglia claims that he had been offered payments for his results previously, yet would disclose nothing; but now is willing to publish his results partly in writing and partly by word of mouth. It is difficult not to read this as if Tartaglia was delicately indicating that he might rightfully expect payment from those so taught. The table of contents claiming more apparently than Tartaglia had yet achieved was presumably there to encourage such as might wish to hear the verbal part of his teachings. Thus the possibility of financial benefit from the publication of this work does not seem to be too distant from the motives behind it. But this does not mean that Tartaglia has to be taken as completely insincere in the above passage, rather, perhaps quite genuine feelings went along with the opportunity Tartaglia saw, with some particular new movement of the Turks, to publish some earlier work to the benefit of the Christian commonweal (and keeping part secret for viva voce teaching was of course completely consistent with this) as well as to aid his own advancement when this suitable opportunity arose.

2. 'practica': experience or practice. It is not clear here whether Tartaglia means his own practice in creating the 4th and 5th books, or the practice that is contained in these books. The difficulties at the very level of the language of this whole passage and its vagueness ("per piu rispetti" = "for many reasons") further suggest something off-key about these two unpublished books.

3. Title page "...Delle Scientie Mathematiche....Talmento chiara, che ogni mediocro ingegno, senza la notitia, ouer suffragio di alcun'altra scientia con facilita, sera capace a'poterlo intendere." Colophon: "Stampato in Vinegia per Venturino Roffinelli ad Instantia e requisitione de Guilielmo de Monferra, & de Pietro di facolo de Vinegia librero, & de Nicolo Tartalea Brisciano Tradottore: Nel Mese di Febraro Anno di nostra salute M.D.XLIII". General privilege granted to Tartaglia 11th. December 1542 by the Venetian Senate for this work and others. See TONNI-BAZZA (1904) p. 294.

4. A preliminary note before the dedication.

5. Prospettiva, Specularia: It is not too clear in which sense Tartaglia is using 'perspective' here - as synonymous, as it was in the middle ages, with present day (geometric) optics, or as the English word 'perspective' is used about paintings and the like. The conjunction with 'Specularia' suggests that he may have been using it to cover the painter's perspective and dioptrics with catoptrics added to cover the whole of both fields, but on the other hand he may simply have been contrasting catoptrics and dioptrics.

scientia de' pesi, la Architettura, & molte altre. Ma alcuni Sapienti, prendono solamente le quatro prime, cioe, Arithmetica, Geometria, Musica, & Astronomia: & tutte le altre dicono esser subalterne, cioe, dependente dalle dette quatro: Alcuni altri moderni (per alcune sue ragioni) vogliono che le dette Mathematiche siano cinque, peroche alle dette quatro aggiungono la Prospettiva. Nientedimeno il Reuerendiss. Pietro de Aliaco,² Cardinale, nella prima questione sopra Giouanni di Sacrobusto, conclude la Musica, & la Astronomia, & similimente la Prospettiva non esser pure mathematice (come è il vero) ma medie fra le mathematiche & la science naturale; per ilche seguita, che solamente la Arithmetica, & la Geometria siano pure mathematice & tutte le altre esser medie, ouero dependente & miste dalle mathematiche discipline, & della natural Philosophia: eccettuando la Astrologia iudicaria, la qual egli conclude esser pure naturale, & in quanto alla sua essentia.

¶ Ma molti philosophi determinano, le parti della sapientia esser due, cioe, speculatione, & operatione, ouero prattica, & theorica.... Et tutti li antiqui Discruttoatori delle cose affermano toccarse piu la verita nelle mathematiche (cioe nelle Arithmetica, & Geometria) che in qualunque altre arte liberali; per ilche determinano, quelle esser nel primo grado di certezza.... queste due discipline, & massime della Geometria.... in quella si contenga il puro cibo della vita intellettuale; Perche il Geometra non si cura delle linee, ouero figure materiale, di legno, ouer di alcuno metallo, ma solamente si cura di quelle come che sono in se medesime; Auegna che quelle non si trouano fuori della materia, ma l'occhio sensible guarda le figure sensible, accio che le mentali possano esser viste dalla mente:

of Weights, Architecture and many others. But some wise men, take only the first four, that is Arithmetic, Geometry, Music and Astronomy; and all the others they say are subordinate, that is dependent on the said four. Some other moderns - for their own reasons - would that the said Mathematics are five, because to the said 4 they add Perspective. Nevertheless the most reverend Cardinal Pietro de Aliaco in the first question on John Sacrobosco concludes that Music and Astronomy and similarly Perspective are not pure mathematics - which is true - but in between mathematics and natural philosophy, from which it follows that only Arithmetic and Geometry are pure mathematical disciplines and all the others are between and dependent and a mixture of the mathematical disciplines and of natural philosophy excepting iudicial Astronomy which he concludes is purely natural (philosophy) in essence.

....many philosophers define the parts of knowledge to be two, that is speculation and operation or practice, and theory.... and all the ancient commentators of the subject affirm the truth is more touched in mathematics - that is Arithmetic and Geometry - than in any other liberal art, because they determine them to be of the highest degree of certainty.... these two disciplines and especially Geometry.... in which is contained the pure nourishment of the life of the intellect, because Geometry does not have regard of lines or figures, material, of wood or any metal but purely takes account of those as they are in themselves. It happens that these are not found apart from matter, but the sensible eye attends to sensible figures, in order that the mental (figures) can be seen in the mind.

1. These of course form the quadrivium.

2. Peter of Ailly 1350/1420. ALLIACO (1498) Sg. ailib "Verū cū duplex sit scienciarū mathematicarū genus: hec quid sunt pure mathematica vt arithmetica & geometria. Ille vero mixte aut inter phicas & mathematicas medie musica ecz pspetina & astrologia...."

3. Literally 'discussants'.

Ne etiam la mente vede le figure mentale
men vere, di quello che vede l'occhio
corporale le sensible: ma tanto piu vere
quanto che la mente uede quelle figure
s in se separate dalla alterita della mat-
eria....²

Not that the mind sees mental figures
less truly than the corporeal eye
sees the sensible (figures) but as
much more truly, because the mind sees
those figures in themselves separate from
the accidents¹ of matter.

A. III. b. ³E tanta è l'utilità, oltre la soavità
dolcezza di studio che si troua nelle
contemplationi mathematiche, piene di
certezza⁴, che Archimede siracusano per
il studio di quelle con suoi mecanici
ingegni diffese vn tempo la Citta di
Siracusa.... Per mezzo di queste si fanno
varii, & diuersi modelli: fabricansi pon-
sti con archi, quasi alla natura impossi-
bili.⁵ Anchora chi con l'intelletto ben
considera tutte le sorte di antique &
moderne machine, & stromenti bellici....
come dimostra Vettruio.⁶... Delle noue
inventioni per me trouate sopra il tirar
delle modern machine tormentarie (dette
dal volgo, artiglierie)... in parte pub-
licato. Basta solamente a dire, che per
consiglio di queste (senza alcuna pratt-
ica in tal exercitio) la maggior parte
ritrouai. Da queste medesimo discipli-
ne germoglio, & nasce ponderibus, la
scienza di pesi.... per mezzo della
questa scienza Aristotle nelle sue que-
stioni mecanice assegna la causa d'ogni

And so much is the usefulness, besides
the pleasant sweetness of the study that is
found in contemplative mathematics, full of
certainty, that Archimedes of Syracuse,
through his study of these with his artful
machines defended at one time the City of
Syracuse.... By means of this are made
varied and diverse models, are built bri-
dges with arches, almost impossible to nat-
ure. Further who with the intellect clearly
considers all sorts of ancient and modern
machines and instruments of war.... as
Vitruvius demonstrates.... (and)... the
new invention discovered by me concerning
the firing of modern hellish machines -
by the common man called artillery.... in
part published. Enough simply to say that
solely by the counsel of these - without
any exercise in such practice - the grea-
ter part I found. From these same disci-
plines springs and is born ponderibus -
the science of weights.... by means of
these sciences Aristotle in his mechanical
questions assigns the cause of every marv-

1. Literally 'alteration' of matter.

2. It becomes clear in the section after the passage quoted why Tartaglia wanted to differentiate Geometry and Arithmetic. He argues that physical figures or solids only roughly approximate to the ideal figures of triangles, cubes and the like - and thus the universals cannot be found to matter. With Arithmetic it is far more difficult to say that 5 somethings are not precisely 5. There seems to be nothing very original in this passage, the ideas being fairly common coin. Tartaglia gave Aristotle in the *Metaphysica* as the source of the distinction between the various kinds of knowledge; and gave Nicolas of Cusa as the source of the later notions of the passage, such as the certainty of mathematics.

3. From the dedication to "Gabrielle Tadino Prior de Barletta signor suo". (There are two folios marked III, this is from the first of them.)

4. The idea that mathematics was distinguished by its certainty was of course an old one. The sort of place Tartaglia must have come across it was just the sort of work he quotes in his pre-dedication note on the sciences, by Peter of Ailly (see above, p. 8, n. 2) in which one finds for example "sciencie inquit mathematice sunt in primo summo gradu certitudinis" (ibidem). But Peter of Ailly was quite emphatic that the "mixt" sciences were only certain insofar as they were mathematical while Tartaglia in this passage rather glosses this over, referring to the certainty of mathematics and then going on the extol its use in the "mixt" disciplines, without mentioning this sort of reservation. Indeed he seems to state here that Archimedes' efforts in defending Syracuse stemmed from the certainty of mathematics in what were mixed disciplines. Equally he seems to ignore the fact that Ailly's discussion was more concerned with contemplative knowledge while Tartaglia's own emphasis was on practical knowledge.

5. This can be taken as "almost impossible in nature" equivalent to: of a type almost impossible, or - almost impossible to be created by the ordinary processes of the natural world. It is difficult to decide which - perhaps the two senses are assimilated here. The arch was of course one of the things Vitruvius had almost nothing to say about. There seems also to be very little evidence of any mathematical treatment of the arch in the ancient world.

6. Vitruvius gives the rule for the relation of the basic module of a catapult to its projectile weight, which involved a square cube relationship. This had been elaborated earlier by Heron. It was perhaps one of the most beautiful pieces of applied mathematics of the classical period. However it is probable that this was no more than a codification of existing practice rather than a tool to enable new results to be achieved in practice. See MARSDEN (1969). Tartaglia may also have been thinking here of tuning catapults by their musical note which Vitruvius mentions.

miracolosa mecanica inuentione. Di quanto aiuto e presidio siano le dette due scientie, ouer discipline alla Architettura Vitruuio Pollione....lo fa manifestato. Anchora che ben considera & guarda la scientia Perspettiua....Che diremo della Cosmographia, & Geographia: Non ci dimostra Phtolomeo, & tutti li altri eccellentissimi Cosmographi, & Geographi, quanto gli siano necessarie queste due scientie, ouero discipline. Quando de tutto l'uniuerso, debitamente pportionando li lor gradi delle longitudine, e latitudine, rendano in vna piccol carta tutte le famose Prouincie....siti maritimi & mediterranei (come piu volte insieme con V.R. sopra la sua carta nauigatoria, habbiamo discorso....Et quella sappia¹ che non per altra causa al presente e penuria di buoni, & eccellenti Astronomi....Bartolo da Sassoferate.... espressamente dimostra la Geometria esser necessarie in iure....non dimostra apertamente il R. Cardinale Nicolo di Cusa....senza detta Geometria non poterli alli intelletti nostri comunicare... Ma piu, eglie di tanta necessita questa Geometrica disciplina, & scientia, che non solamente li huomini mortali nelle sue cose commensurabile vsano quella (come di sopra piu volte e detto) ma anchora il magno Iddio, il qual e misura di tutti le cose,² in formar le parte del corpo humano non si gouerna senza quella, con laqual anchora questi Compositori di imagini, & pittore eccellenti si conformano, ad ogni

ellous mechanical invention. How much aid and help is in the said two sciences or disciplines to Architecture Vitruvius Pollomakes clear. Further that well handles and guards the science of Perspective... What will we say of Cosmography and Geography - is it not shown by Ptolemy and all the other excellent Cosmographers and Geographers how much are necessary these two sciences or disciplines when the whole universe, duly proportioned in its degrees of longitude and latitude, shows in a little sheet all the famous provinces....(and) sites maritime and mediterranean - as many times together with your worship upon your sea charts we have discussed....And that knowledge is the cause that there is a lack of good and excellent Astronomers at present....Bartolo da Sassoferate....expressly shows Geometry to be necessary to lawdid not Cardinal Nicolas of Cusa show clearly that without Geometry it would not be possible for our intellects to communicate....But further this Geometrical discipline and science, is not so much necessary that only mortal men with regard to measurable things use it -- as above many times is said -- but also the great God, who is the measure of all things, in forming the parts of the human body was not the ruler, without that, to which also these creators of images and excellent painters conform, for every member, using their compass. . Wherefore also the most experienced Architects ...search with every diligence for the proportion

1. Presumably the "lack of that knowledge" which the context calls for but which the language does not make very clear at this point.
 2. This has the ring of a catch phrase rather than being an attempt to precisely define relationships of measurement and geometry between God and the world; Tartaglia just previously had quoted the well known phrase from the Book of Wisdom, that God had created everything by number, weight and measure. (See I p.119, n.2.)

membro usando il suo compasso¹. Per il che of the Temple² and their other public
 etiam li pertissimi Architetti....cercano private buildings in similarity to the
 con ogni dilligentia di proportion la Aede,³ human body, because - as is said - the
 & altri suoi publici, e priuati edificii highest architect with due measure built.
 alla similitudine del detto corpo humano, Further is known the nobility, excellence
 per esser quello (come è detto) dal sommo and grandeur of the said Geometry by the
 Architetto, con debite misure fabricato.³ great fame and names of those who have
 Anchora el si cognosce la nobilita, ecce- laboured to adorn and study the said sci-
 llentia, & altezza di detta Geometria, per ence...
 la grande fama, & nome di quelli, liquali
 hanno dato opera ad exornar, e studiar
 dette scientia....⁴

1. Presumably Tartaglia had in mind such detailed studies as that by Durer on the proportions of the human body. But of course this general idea was a fairly well known one during the period. It is surprising that Tartaglia does not use the example of the painter's perspective here, presumably a much more familiar example. Perhaps Tartaglia considered the complexity of the human body to give his kind of example the greater effect.

2. From the Latin.

3. This of course was a fairly common notion during the period. As in Leonardo's notebooks, Francesco di Giorgio Martini sketched a fortification superimposed on a human body, the extremities of the limbs positioning towers, while the head was crowned by the mastio or keep. See also Pietro Caetano who in his I Quattro Primi Libri de Architettura (1554) showed a temple so defined. f37a.

4. Tartaglia gives a long list here mainly of 'pure' geometricians from the ancient world but he also includes "Iordano & Vitruuio Architetto" and very clearly conceived the "nobility excellence & grandeur" of Geometry to be just as much a part of the 'operative' field as of the field of contemplative knowledge.

Quesiti et Inventioni (1st ed. 1546)¹

Bibliography: Venetia 1546; Venetia 1550* with the addition to the 6th book; Venetia 1551* do.; Venetia 1554 do.; Vinegia 1562* do.; In the Opere 1606. French version of Bk 6 Reims 1556*³. English version of Bks I, II and III by Cyprian Lucar London 1588. Modern facsimile of the 1554 edition, edited by MASOTTI, A. (Brescia 1959). German translation of parts in Ryff (see below here). French translation of parts REIFFEL (1845).

General Description: Rather average quality production. 7"x4½" text with many illustrations and small diagrams in the text (11) + 132 folios. Dialogue form generally.

Contents:

f. (1a). Title Page: QUESITI, ET INVENTIONI DI-/VERSE DE NICOLO TARTALEA/ BRISCIANO./ Con gratia, & priuilegio dal Illustrissimo Senato Veneto, che niuno ardisca ne presuma, di stampare la presente opera, ne stampate altroue uendere ne far uendere in Venetia, ne in alcuno altro luoco, o terra del Dominio Veneto, per anni dice sotto pena de ducati trecento, & perdere le opere, el terzo della qual pena immediate che sia denontiate, si applica al Arsenale, & un terzo sia del magistrato, ouer rettore del luoco doue se fara la assecutione, & laltro terzo sara del denuntiante, ouer accusatore, & sara tenuto secreto, come nel priuilegio appare.

f. (1b). Verse to the reader.

f. (1ia)/1a. Dedication to Henry VIII, "per la Dio Gratia Re de Anglia, de Francia, et de Hibernia, etc."

f. 1b/2b. List of Errors.

f. 3a/4b. Tables of contents.

f. 5a/33b. Book I: On artillery according to its position and elevation.

f. 34a/39b. Book II: Discussion of shot of different material - lead, stone, iron, etc.

f. 40a/46a. Book III: Powder.

f. 46b/58a. Book IV: The organisation of squadrons.

f. 58b/68b. Book V: Surveying with a compass.

f. 69b/75b. Book VI: This is given in the table of contents as - "Del modo del fortificar le Citta a questi tempi per oufare alli uigorosi colpi delle Arteglie per uigor della forma."

This book includes two very small maps of Turin as a square with very small bastions at its corners. In discussing fortification here Tartaglia did not give actual designs of how a fortified city should appear. He gave rather 6 conditions or determinants relative to how such a fortification should function. Namely, (1) Shots from attacking artillery should strike the curtain obliquely.⁴ (2) There should be no place in which the attacker can place his guns in battery so that they are nearer the wall which he is attempting to breach, than they are to the defenders' guns.⁵ (3) Attacking troops should be covered from at least four sectors by the defenders'

1. JAHNS (1889) p. 597, mentioned an edition of 1538 with a copy in the Bib. des Zeughauses zu Berlin, and DE LA CROIX (1963) follows him. However this edition is not generally accepted, nor is an earlier one of 1528. (See for example MASOTTI (1962) p. 52, n.46) DE LA CROIX (1963) also gave Sul modo de fortificare la citta rispetto la forma (1536) which is very close to the title of Bk. VI of the Quesiti et Inventioni, but of which there seems to be no other trace.

2. RICCARDI (1893). There is a good deal of doubt about these editions. (See MASOTTI *ibid*.)

3. See MASOTTI *ibid*.

4. See below p. 17, l. 27/32.

5. f. 71a. "La seconda qualita, ouer conditione, e questa, che bisogna ben antiuendere di assetter tutte le sue cortine, & baluardi, con tal modo e forma che li nemici non possano trouar luoco alcuno di poter piantare le sue arteglie, che sempre non sia menor distantia dal detto luoco a quella cortina che desiderarano da battere."

guns.¹ (4) Beaten down walls should provide more of an obstacle than they did when standing.² (5) At the moment of assault it should be possible to attack the assailants generally.³ (6) When a city is threatened by a great power it should be able to resist for a period of years.⁴

f. 76a/80b. Book VII: Discussion of the Mechanics of Aristotle.

f. 81a/98b. Book VIII: Science of Weights.

f. 98a/132a. Book IX: Various problems of Arithmetic and Geometry, and speculations in Algebra. (La Practica Speculativa di Algebra)

Colophon: Stampata in Venetia per Venturino Ruffinelli ad instantia et requisition, & à proprie spese de Nicolo Tartalea Brisciano Autore.⁵ Nel mese di Luito 'anno di nostra salute. M.D.XLVI.

Quesiti et Inventioni (1546): Texts

<p>{7c.D.⁶ Questa mi pare una cosa molto dura da credere, & tanto piu che nel uostro libretto (a me intitolato) uoi diceti che mai tirasti di artiglieria, ne di schioppo,⁷ & colui che fa un giudicio di una cosa della quale non habbia uisto lo effetto, ouer isperientia, la maggior parte delle uolte se ingaña, per che solamente lo occhio è quello che ne rende uera testimonianza delle cose immaginate. N.⁸ Eglie ben uero che il senso isteriore, ne dice la uerita nelle cose particolare, ma non nelle uniuersale, per che le cose uniuersale sono sottoposte solamente al intelletto, & non ad alcun senso. D. Basta se me fareti ueder questo (cosa che non credo) el me pareo un miracolo.</p>	<p>D. This appears to me (to be) a thing very hard to believe, and much more, that in your book - addressed to me - you said that you have never fired artillery or musket; and he that makes a judgement of a thing whose effect he has not seen or experienced is deceived the most part of the time, because only the eye is that which renders us true testimony to the thing conceived. N. It is very true, that the exterior sense speaks the truth about things in particular, but not of universals, because universals are subject only to the intellect and not to any sense. D. Enough, if you would make me see this -- a thing I do not believe -- it would seem a miracle to me.</p>
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1. f. 71b "La terza conditione, è questa che el bisogna, che la forma di tal citta sia talmente disposita che se li nemici deliberasseno di darui una battaglia ordinata, chel non si troui alcuna parte di quella tal citta, che possar esser assaltata da nemici che quelli non possano sempre esser offesi da quelli dalla terra almen da quatro diuerse bande con le artiglierie."

2. ibid. "La quarta, conditione che si conuien, nel fortificar una citta rispetto alla forma della mura è questa. Che nel far fabricar & in alzar le sue mura, ouer cortine. Bisogna fra le altre cose esser cauto de farle in alzar con tal modo è forma, che se per caso quelle fusseno ruinate da nemici con artiglierie, che tal mura cosi ruinata, redano quasi maggior difficulta, & pericolo alli detti nemici uolendo quelli intrar nella detta citta...." See also below p. 17, 137, et. seq.

3. f. 72a "...occorendo che li nemici uenisseno per scalarla con scale che con facilità ui si potesse rompere totalmente ogni suo disegno, & con suo grandissimo danno, & uergogna....Et per tanto dico che bisogna prepararui cose che offendano li detti nemici in generale,...."

4. f. 73a "La sesta qualita, ouer conditione è questa. Quando che la citta, che se ha da fortificare, se dubitasse del Turco....ouer de qualche altra potentia simile, cioe che fusse atta, & sufficiente à mantenerui molti anni l'assedio...."

5. The very specific wording here makes clear Tartaglia's own central role in the production of the book.

6. D = Duca.

7. Cf. Nova Scientia Sg. *111a "E a benche in tal arte io nō hauesse pratica alcuna (per che in uero Eccellente Duca) giamai discargheti artiglieria, archibuso, bombardarda, ne schioppo....niente di meno....di poi che habbi ben masticata et ruminata tal materia, gli conclusi et dimostrarai con ragioni naturale, et geometriche...."(1537)

8. N = Nicolo.

69. P.¹ Non credeti uoi che lo ingegno del
 huomo al presente sia peruenuto à quel
 sublime grado doue sia possibile à peruen-
 ire, per fortificare una citta. N. Di
 questo non ui saprei risponder, perche
 non solamente ho praticado poco per Ital-
 ia, & manco fuor de Italia²....La causa fu
 che à quel tempo non mi dilettaua, de tai
 particolarita, ne mai hebbi in animo di
 dilettarmene in conto alcuno, ma questi
 sospetti, & mouimenti turcheachi³ me
 hanno dato nouamente occasione di ponerui
 alquanto cura, come cosa utile & necessa-
 ria....N. Lo ingegno del huomo, nel for-
 tificar una citta (secundo il mio parere)
 se conosce per la forma, & non per la
 materia, perche a fortificare una citta
 semplicemente per uigore & forza de mat-
 eria, La non mi pare cosa molta ingeniosa,
 ne di molto laude degna. P. Io non ue in-
 tendo. N. Dico, che a fortificar una cit-
 ta ui concorre la materia, & la forma, &
 che lo ingegno del huomo se approua per
 la forma delle sue mura & non per la mat-
 eria, cioe per la grossezza de quelle. Et
 per tanto quantunque habbia uisto la gro-
 ssezza delle mura, & torrioni de tai cit-
 ta, non hauendo considerata la sua forma
 non posso far guidicio di quello, che me
 ha adimandato uostra Signoria, perche
 quella (se ben me aricordo) me ha adiman-
 dato, se a me mi pare che lo ingegno del
 huomo sia peruenuto a quel sublime grado
 doue sia possibile de peruenire, nel fort-
 ificare una citta. Onde se lo ingegno del
 huomo, in simel caso (come di sopra è
 detto) se approua per la forma, & non hau-
 endo lo considerato alcun forma non posso
 far alcun guidicio.⁴

P. Do you not believe that human ingenuity
 has at present reached to that sublime deg-
 ree which it ought to be possible to attain
 in the fortification of cities. N.
 I should not know how to answer you beca-
 use not only have I practised little in
 Italy, and less outside....the reason was
 that at this time (i.e. previously) I did
 not take pleasure in such details, neither
 had I any spirit to delight in any
 account, but these suspicious (doings)
 and movements of the Turks have newly
 given me occasion to give to this some
 care as a thing useful and necessary....
 N. The ingenuity of man in fortifying a
 city - it seems to me - is known through
 the form and not through the material,
 because to fortify a city merely through
 the strength and force of the material -
 that does not seem to me, very ingenious
 or worthy of much praise. P. I do not
 understand you. N. I say that in fortify-
 ing a city the material and the shape go
 together, and human ingenuity is confirmed
 through the form of the walls and not
 through the material - that is through their
 massiveness. And, in as much as although I
 should have seen the greatness of the
 walls and towers of such a city, not hav-
 ing considered its form, I cannot judge of
 that which your excellency has asked me,
 because that - if I well remember - you
 have asked me whether it seems to me that
 human ingenuity has reached to that sub-
 lime degree which it ought to be possible
 to attain, in fortifying a city. Whereby if
 human ingenuity, in such cases - as is
 said above - is approved through the
 form, and not having considered any form
 I cannot make any judgement.

1. P = Priore = Prior di Barletta.

2. The elision is mainly concerned with Tartaglia agreeing that he has passed thro-
 ugh or lived in many famous places but never paid much attention to their fortifica-
 tions. He explained then that for the past 12 years he had not been outside Venice
 except once to Verona on business. This dates this section as of 1546 because
 Tartaglia moved to Venice in 1534.

3. The Sultan had in fact agreed to make peace with Venice in 1540. In 1545 he had
 signed a peace treaty with Charles V through the intermediary of Francis I and 2
 years later he signed a 5 year truce with both Charles and Ferdinand. Cambridge His-
 tory of Islam I, p.327/8. Perhaps it was the end of the 1545 truce with attendant move-
 ments that concerned Tartaglia, but the number of Turkish scares all through the
 period, as well as before and after it, makes this reason seem even less significant
 than in the case of the Nova Scientia.

4. The emphasis of this passage is rather odd from some points of view: Tartaglia
 did not consider the function of a fortification as the starting point in
 assessing particular structures; rather it was the signs of ingenuity in their
 design that he considered important and which he insisted could only be found
 in their particular form. Thus the whole problem of the assessment of structures
 seems to take precedence over function in determining what were the significant
 characteristics of structures, rather than function in any direct way.

f. 69. b. Quesito secondo...

P. Vedeti qua questo è il disegno della pianta de Turino,¹ qual dalli huomini de ingegno è giudicato esser inespugnabile. Hor che diceti di questa figure. N. In questa tal figura, non ui discerno alcuna gran sutilita de ingegno. P. O uoi seti, non solamente contra alla opinione de ogniuno, ma anchora contra à tutto quello che per sperientia se è ueduto, tocato, e palpato. N. Non dico ne manco, uoglio dire che Turino non sia forte, & forse fortissimo, perche una citta puo essere alle uolte forte per la natura del luoco doue che la se ritroua, & alle uolte solamente per atificio del huomo, & alle uolte per luno, e per laltro.² Quelle che sono forte solamente per la natura del luoco, (cioe quando che quella fusse cinta, ouer circondate da acque, soffumi, ouer paludi) io nō ne parlo, perche el laude di tal sua fortezza si debbe attribuire piu presto alla natura, che à l'ingegno del huomo. Ma quelle che sono forte solamente per artificio del huomo, tal sua fortezza puo accadere in duoi modi, cioe tal hora puo esser forte, piu per uigor³ della pura materia, che della forma, cioe piu per uigor delle sue grosse, mura, bastioni, larghe, & profonde fosse, che dalla forma di quella, elqual modo, anchor che faccia quasi lo effetto desiderato, a me non pare che sia de molto ingengo. L'altro modo è che tal hora a una citta puo esser forte piu per uigore della forma, che della materia, cioe

Second Enquiry....

P. Look here, this is the drawing of the plan of Turin which is judged to be impregnable by ingenious men. Now what do you say to this figure. N. In this figure I do not see any great subtlety of art. P. O, you are not only against the opinion of everybody but also against all that which through experience is seen, touched and felt. N. I do not say, no less wish to say, that Turin is not strong, perhaps of the greatest strength, because a city can be sometimes strong through the nature of the place where it is found, and sometimes by human artifice alone, and sometimes by the one and by the other. Those which are strong purely through the nature of the place - that is when it should be girdled or surrounded by water, or rivers or bogs - I do not speak of them, because the praise of such strength ought to be sooner attributed to nature than to human ingenuity. But those that are strong purely through human artifice alone, such strength can occur in two ways, namely sometimes they can be strong, more by the strength of their material alone, than by their form, that is more by the strength of their great walls, bastions, wide and deep ditches, than by the shape of these, which manner, even though it gives nearly the effect desired, does not appear to me to represent much skill. The other way is that sometimes a city can be strong more by the strength of its form, than of its material, that is that the form of

1. The plans of Turin are extremely poor in detail and badly out of scale with the bastions being proportionately far too small in comparison with other probably more accurate representations of the early 16th century layout. As for example in "Breve Ragioni del Fortificate di Francesco Horolloggi Vicentino". Bib. Naz. Fir. XIX. 127, which shows a rectangle of proportions 19:17 with the faces of the bastions in ratio of 3:17 to the short side of the rectangle and with a piattaforn on the west (?) side. Also indicated is the old rocca on the north (?) side. This system joins onto the old medieval walls as Tartaglia elsewhere indicates Quesiti et Inventioni (1546) f. 70a, so that what is represented is probably the same scheme as Tartaglia was discussing and not a later one.

2. i.e. Sometimes a city is strong by nature (of the site), and sometimes through human skill, and sometimes by both together. The language is slightly ambiguous, but the context makes this the most likely interpretation.

3. Vigór(e); FLORIO (1611) gives "vigor, force, strength, courage, vertue, lustiness or liueliness". This description has then a slightly different emphasis from that of the term 'forte' which seems to convey more a passive strength as in 'fast-holding', one of the translations Florio gives for that term. At the other pole is the adjective often used in similar contexts by many authors: 'gagliardo', strong, lusty or nimbly disposed of body, as Florio put it -- a much more active kind of strength. The term Tartaglia chose then, 'vigore' seems to be a strength rather between these other more passive and more active kinds. This adjective could then be applied to both material, and form, equally implying neither too active nor too passive a strength for one or the other.

che la forma della mura del circuito de tal citta, potria esser alle uolte di tal forte che quella non saria di menor impedimento, ouer ostaculo alli nemici, di quello che saria le sue grosse mura, bastioni, larghe, & profonde fosse, la qual cosa essendo guidicarei tal opera esser composta, ouer ordinata da non mediocre ingegno.¹

f. 70b. Quesito Terzo.

10 P. Voi concludesti hiersera che la detta citta de Turino, nō ha in se gran fortezza, per uigor della forma delle sue mura, ma solamente per uigore delle grossezza de quelle, et delle sue profonde,
 15 & larghe fosse hor uoria che me dicesti, le conditioni, qualita, ouer particolarita,² che a uoi pare se doueria fare, ouer che doueria hauere la forma delle mura de una citta a douer esser forte
 20 per uigor de tal forma, accio che io sappia in che riprendeti, ouer in cosa pecca, ouer manca la forma de Turino. N. Le conditioni, qualita & particolarita, che doueria hauere, ouer che si
 25 potria adattare, alla forma, & mura de una citta, si per resistere a questi tempi alli uigorosi colpi delle artiglierie, come anchora per potere con facilita, rebattere,³ & offendere in uarij modi li nimici in ogni lor impetuoso assalimento, eglie da credere, che siamo⁴ molti. Ma quelle che cosi per al presente me ho immaginate, sono solamente sei, & perche queste sei se possono alterare, & uariare in
 35 uarij & diuersi modi secondo uarij, &

the wall of the circuit of such a city can be sometimes of such strength, that it will not be of less impediment or hindrance to the enemy, than that which will be of great walls and bastions, and of wide and deep ditches, which being the case, such a work I would judge to be composed or organised with no little skill.

Third Enquiry

P. You concluded last evening, that the said city of Turin does not have in it great strength, by the robustness of the form of its walls, but only by their strength and massiveness, and by its deep and wide ditches. Now I wish that you would tell me, the conditions, qualities or aspects, which seem to you, that ought to be made, or which ought to have the form of the walls of a city to be strong by the robustness of its form, so that I should know in what you condemn, or what is faulty, or lacking in the form of Turin. N. The conditions, qualities and aspects, which ought to be, or which can be adapted to the form and wall of a city in order to resist in these times the forceful blows of artillery, as also to be able to easily beat back and attack the enemy in many ways in their every headlong attack, it is to be believed, are many. But those as much as I have at present conceived are only six, and because these six can be varied and altered in many and diverse

1. Tartaglia puts forward in this passage the definitive position in 16th century fortification, not only for the first time in print but also in perhaps its starkest and clearest form. Fortifications are strong by nature and by artifice. These last are of the greatest interest because they show human artifice to the greatest extent and this is the crucial factor. Amongst those strong by artifice only those that are strong by way of their form rather than by way of their material, for the same reason, are of real interest. Tartaglia puts this all very clearly and the interruptions and insistence by the Priore that he does not understand seem to function only to emphasise precisely what it is that Tartaglia is saying. But on one point the discussion does seem a little weak, because the notion of a structure being strong by virtue of its form is not defined (here) in itself, but only understood as something somehow parallel to, or as a substitute for, strength by way of mere material. Of course, strength by way of form was understood in 16th century fortification to arise through the principle of flanking fire. But Tartaglia does not seem to want to refer to any such notion here, that belongs rather with his 6 conditions (See above, p. 12/13, contents.). Thus Tartaglia appears to be searching here for a justification of a general nature to support that approach. This is seen the way in which he accepted ongoing practice even as he tried to generalise and improve on it.

2. "particolarita": Tartaglia continually uses this word in the sense of 'a quality' or 'characteristic'. But the word has also in part the sense of detail and Tartaglia seems to be using it to refer to particular aspects of the structure. Thus this last word has been used here in translation.

3. rebattere = "ribattere": to beat or strike back or again? FLORIO (1611).

4. "siano" as in later editions.

diuersi rispetti, à me saria necessario (à uolere à sufficientia ben dechiarire, & con ragione dimostrare di cadauna di quelle particolarmente sia ualuta) à designare, uarie, & diuerse piante, ouer à fabricare materialmente uarii, & diuersi modelli, la qualcosa non si puo fare così al improuiso, anzi ui uol tempo, & non poco, & massime à me, che nel operar manuale non son molto isperto. P. Anchor che così al improuiso, non possiati designare le dette piante, ne fabricar materialmente li detti modelli, non poteti almen sotto breuita narrare la conditione, & proprieta di queste uostra sei imagineate particolarita, & dapoi designare con uostra comodita le dette piante, ouer modelli. N. Le posso dir sì. P. Mo ditteli adunque consequentemente, l'una drieto l'altra, perche in effetto à me mi pare che sia quasi impossibile di poter tassare la forma de Turino de un solo, non che de sei diffeti. N. La prima cosa che à me mi pare, che doueria hauere la forma delle mura de una citta, ouer che uise doueria fare uolendo à questi tempi fortificar quella è questa, che mai in conto alcuno se doueria far pala de alcuna sua cortina, ouer muraglia, talmente che li nemici ui potessono percotere, ouer tirare perpendicolarmente con le artiglierie, perche, ogni muraglia cede molto piu facilmente alle percussioni delle balle che feriscono perpendicolarmente sopra à quella, di quello fa à quelle che gli feriscono obliquamente, cioe in squinzo.

f. 72a. N. Questo è vero che la saria quasi piu forte, perche se le mura cadute, & riunite causerano quasi maggior difficulta, & pericolo alli nemici à uoler intrar dentro della, detta citta, di quello fariano essendo intiere & sane. Seguirà de necessita che la detta citta sia piu forte con le mura ruinate che con quelle intiere è sano. P. Io non posso quasi credere questa cosa. N. Quando che

ways, after varied and diverse respects, it will be necessary for me - wishing to sufficiently well discuss with demonstrated reasons the value of each of these aspects - to design many and diverse plans, or to make in material many and diverse models, which it is not possible to do extempore, without not a little of your time, and especially for me, who in manual work is not very expert.

P. As much as extempore you can not design the said plans, nor make in material the said models, can you not at least briefly relate the condition and quality of these six conceived aspects of yours, and afterwards at your ease design the said plan or model. N. I can do it. P. My delight therefore follows immediately, because in effect it seems to me, that it is nearly impossible to be able to tax the form of Turin with but one, let alone six defects. N. The first thing, which it seems to me that the form of the wall of a city ought to have, or which ought to be made in it, wishing at this time to fortify this or that: that the face of the curtain or wall should never on any account be made in such a way that the enemy can there strike it or shoot perpendicularly with artillery, because all walls yield much more easily to the impact of the balls, which strike perpendicularly, than to those which strike obliquely, that is asquint....

This is true that it (i.e. the city) will be almost stronger, because the fallen and ruined walls will cause almost greater difficulty and danger to the enemy who wishes to enter into the said city, than would be if they were entire and sound. It necessarily follows that the said city is more strong with the walls ruined, than with them whole and sound. P. I find it hard to believe this

1. The usual Tartaglia disclaimer as to any familiarity with manual practices.

2. pala: literally a spade or shovel, particularly a flat one; but also applied to many characteristically flat-shaped objects, the blade of an oar, for example, hence the flat of anything. Thus here the flat face of the wall. See FLORIO.(1611)

3. From ferire: literally to wound or hurt.

4. An idea to appear from time to time all through the renaissance. In the early part by way of the splays at the bottom of the walls; later in the 'forbici' as Tartaglia described it in the Gionta to the 1554 edition.

uostra Reuerentia hauera uisto el modello de tal forma de mura son certo che quella affermara tutto quello, che hauemo detto. Ma piu che gli faro uedere, & con ragion toccare, potersi, tal particolarita condur ad effetto in tre diuersi modi. P. Quando che questo fusse la uerita, le artiglierie haueriano perso la mita della sua reputatione, nelle ispugnation della citta.¹

f. 74b. N. A me non pare che nelli cauallieri, ne simelmente nelli baluardi uisi conuengono cosi grossi pezzi, perche li pezzi grossi sono (secondo il mio parere) solamente per ruinar le mura delle citta, & non per tirar nelli esserciti, & li pezzi pizzoli, & mezzani, sono per tirare nelle ordinanze, ouer nelli esserciti, & non per ruinar le mura delle citta, perche un pezzo pizzolo, ouer un mezzano, a me mi pare esser di tanta faccione, per tirare in una banda de fantaria che uenisse sotto a tal citta, quanto che saria un canon da .50. ouer da .100. & forse piu. P. Questa uostra opinion non me dispiace, perche un sacro, & altri pezzi simili, nel tempo che uora uno di detti pezzi grossi a tirarlo due uolte, se potranno tirare, tre uolte, & forse piu & tanto effetto fara forse luno quanto laltro per cadauna uolta. N. Così è da credere, oltra che sariano di molto menor spesa, et occupariano manco luoco. P. Certamente pensando sopra di uoi stago stuprefatto che non hauendo uoi mai tirato, ne dilettrato, da tirare di artegliaria, archibuso ne schioppo, ne esserui giamai essercitato, nell'arte militare, ne praticado doue se fortifichi alcuna citta ouer fortezza. Et che ui basti l'animo non solamente di parlare, ma di tratter di queste cose. N. El non è da marauigliarsi di questo, perche l'occhio mentale uede piu intrinsecamente nelle cose generale, & di quello che fa l'occhio corporale, nelle particolare....

N. When your reverence has seen the model of this form of wall I am certain that this will confirm all that which we have said. But more, I will make you see, with the reasons touching it, that this aspect can be achieved in three different ways. P. When this will be the truth, artillery will have lost the myth of its reputation in the taking of cities.

N. It does not seem to me that such large pieces belong in the cavaliers or similarly in the bastions, because the large pieces are (as it seems to me) purely for the battery of the walls of a city and not for shooting in the army, and the little pieces or medium (ones), are for firing in the array, or in the army, and not for battering the wall of the city, because a little piece or a medium (one) seems to me to be of as much effect for firing at a troop of infantry that comes underneath (the walls of) such a city, as will be a cannon of 50 or 100, or perhaps more. P. This opinion of yours does not displease me because a sacro or other similar piece, in the time a larger piece would fire twice, can fire three times and perhaps more, and the one with as much effect as will be the other perhaps, for every round. N. This is to be believed, besides which they will be of much less cost, and take up less space. P. Truly your thinking here amazes me, that you not having even fired, or delighted in the firing of artillery, archibuses or muskets, nor having ever practised in the military art, nor experienced where was fortified any city or fortress, and yet you dare not only to talk, but to deal with this subject. N. There is no marvel in this because the mental eye sees more deeply into things in general, than that which does the physical eye in particulars

1. This seems to be an idea of Tartaglia's all his own, and an unusual exaggeration of the value of desirable form, even for the period.

2. This idea that the defensive guns needed only to be of light calibre and that the heavy bombards were really to be reserved for battery was common coin in the 16th century treatises and in all probability was equally well known among the military men of Tartaglia's time, if only because of its practicability. The whole passage then is not so much Tartaglia trying to claim how clever he was, but to illustrate again his favoured principle that knowledge about such matters could be cultivated apart from practice.

3. "Stago" ?

f. 75b. Senza dubbio della maggior parte. N. Without a doubt, I will design the greater part first in its plan, afterwards upon that I proceed to raise its curtains, and bastions as they will occur.

Quesiti et Inventioni (1554)

General Description: This edition is similar to the 1546 edition but of a rather better quality, and contains an appendix to the sixth book.

Contents:

Title page: QUESITI ET INVENTIONI DIVERSE/ DE NICOLO TARTAGLIA;/ DI NOVO RESTAMPATI CON VNA/ GIONTA AL SESTO LIBRO, NELLA/ quale si mostra duoi modi di redur una Citta inespugnabile./ CON PRIVILEGIO/ APRESSO DE L'AUTORE/ MDLIIII.

The appendix to the sixth book: This appendix contains 7 folios (70b/77b) with 3 perspective type illustrations (one with a scale) and one diagram of a bastion. One of the illustrations shows a zig-zag front with bastions at the points and reentrants. Another shows curtains meeting at an acute angle and defended by a cavalier on the external point with a splayed off face.

This appendix has a special privilege printed immediately after it on the same lines as that of the first edition.

In the appendix Tartaglia goes some way to indicate how he thought his six aims as set out in the first edition could be met, as for example with his zig-zag front. He also discusses the section of a wall that will be more of an obstacle after battery than before.

Colophon: In Venetia per Nicolo de Bascarini, ad instantia & requisitione, & à proprie spese de Nicolo Tartaglia Autore. Nell'anno de nostra salute. M D LIIII.

Quesiti et Inventioni (1554): Texts.

La Gionta del Sesto Libro.

672a.N...Et questa tal uia uenira à esser ottimamente guardata, et difesa, non solamente dalli baluardi, et dalli due cauall-
eretti....et dalli falconetti che starāno sotto à quelli argenetti della sua oppo-
site cortina, ma ancora piu minutamente sara guardata, et difesa da quelli archibuseri, che sarāno sotto alli medesimi arginetti....

And this (covered) way comes to be guarded to the best extent, and defended not only from the bastion and from the two little cavaliers....and by the falconetts which stand under those little banks (which make the covered way) of the opposite curtain, but also more in detail will be guarded and defended by those archibusers which will be under the same little bank....

1. While in an earlier section (above p.11, l. 37/46.) he had applied the notion of desirable form to the section of the wall, here Tartaglia gave expression to the standard emphasis on the plan in 16th. century fortification.

2. During the later 16th century the use of handguns in defence of fortification came to be emphasized much more than formerly, particularly in defining the distance between bastions. Tartaglia's suggestions for their use are rather different, for here they are to fire across the reentrant area of the 'forbici'.

f.73^bN. Perche se l'angolo¹ .b. fosse retto, ouer acuto (uolendo procedere regolarmente) saria necessario à far li angoli .a. & .c. di quella medesima qualita, & nelli angoli retti, ouer ottusi non ui se puo far baluardo, che uaglia, & questo procede, perche l'angolo del baluardo è necessario a farlo minore del angolo delle dette cortine, perche, che lo facesse uguale, ouer maggior di quello, el saria impossibile tal baluardo a poter esser guardato da alcun delli altri dui circostanti baluardi.

N. The angle 'b' being right or acute - wishing to proceed regularly - it will be necessary to make the angles 'a' and 'c' of the same amount, and on right angles or obtuse (?) one cannot make worthwhile bastions and this arises because the angle of the bastion must be less than the angle of the said curtains because if it were equal or greater it would be impossible for the bastion to be able to guard the other two standing next to it.

Trattato di Numeri et Misure (1st. ed. 1556/60)

Bibliography:²

Vinegia 1556/60; The first part was published as Trattato di arithmetica Venetia 1556* (& 1560*); & Venice 1592/3*.

French translation of the Arithmetic Paris 1578; Anvers 1578*; Paris 1613* .

General Description: A large very dense production usually found in three volumes. 9"x5½" text with much working in relatively wide margins. Vol. I: Part I, f. 1/277 (1556); Vol. II: Part II, f. 1/186 (1556); Part III, f. 1/51 (1560); Vol. III: Part IV, f. 1/63 (1560); Part V, f. 1/90 (1560); Part VI, f. 1/44 (1560).³

Contents:

Part I: Title page: Gives subject as - "tutti gli atti operativi, pratiche, et regole necessarie non solamente in tutto l'arte negotiaria, & mercantile, ma anchor in ogni altra arte, scientia, ouer disciplina, doue interuenghi il calcolo." Con Li Suoi privilegi.

In Venegia per Curtio Troiana dei Nauo MDLVI.

Dedication to Richard Wentworth dated 23 March 1556.

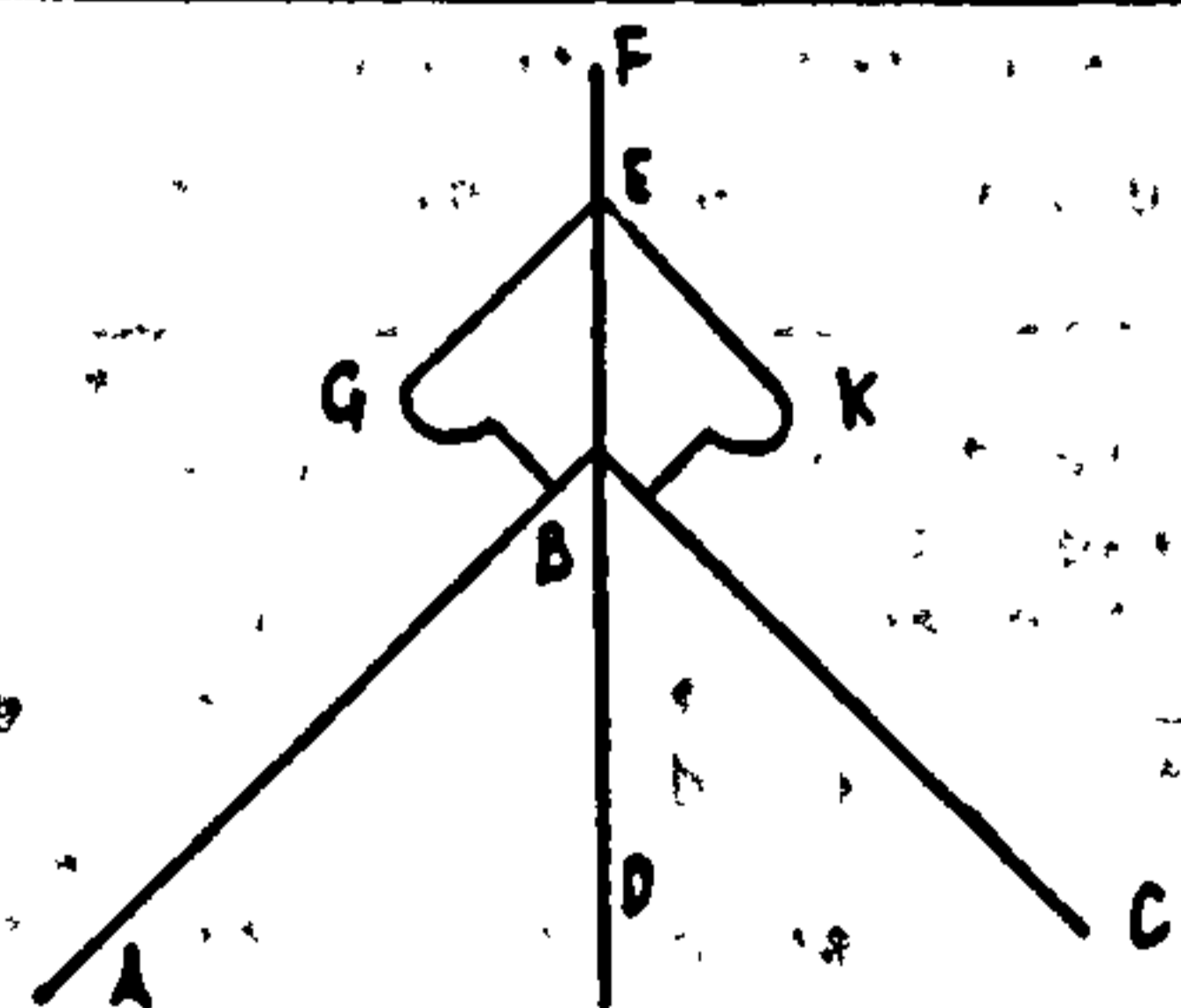
Part II: Title page: contents given as - "la piu elevata et speculativa parte della practica Arithmetica, laqual è tutte le regole, & operationi praticali delle progressioni, radici, proportioni, & quantita irrationali."

Con priuilegio della santita di Papa Paolo IIII. Della Illustrissima Signoria di Venetia, & dell'eccellentissimo signor Duca d'Urbino.

In Vinegia per Curtio Troiano de i Nauo MDLVI.

Appresso dell'Autore.

Dedication to Conte Antonio l'Andriano dated 3 April 1556.



1. Tartaglia's diagram

2. All unexamined editions on the authority of Riccardi.
3. Ignoring unpaginated leaves generally.

- Part III: Title page: Contents given as - "i primi principii, et la prima parte delle Geometria... dimostrasi oltra di cio, la pratica del Misurare, ciascuna cosa, con brioue, & facile via."
 In Venetia per Curto Troiana MDLX, with privilege to him.
- Part IV: Title page: Contents given as - "nella quale si riducono in numeri quasi la maggior parte delle figure, cosi superficiali, come corporee della geometria."
 Same date printer and privilege.
- Part V: Title Page: Contents given as - "il modo de essequire con il compasso, et con le regha tutti li problemi geometrici di Euclide et da altri philosophi... non men'utile che necessaria a Geometrici, Designatori, Perspettiui, Architettori, Ingegneri; & Machinatori, si naturali, come Mathematici."
 Same date, printer and privilege.
- Part VI: Algebra. Same date, printer and privilege.

Trattato di Numeri e Misure Vol. I (1556): Texts

- (119) GLI antichi sapienti, honorando signor compare (come scriue Ptolomeo nel principio del Almagesto) di uiderno la sapientia in due parti, la prima dellequali dal detto Ptolomeo è detta speculatione, & l'altra è chiamata operatione, lequali due parti comunamente anchora a l'una è detta Theorica, ouer speculatione, & l'altra Practica, ouer attiuu, ouer operatione, fra lequali due parti (come afferma esso Ptolomeo) non u'è puoco differentia, la causa è che tendono a diuerso fine, perche il fine della scientia speculatiua (come dice Aristotile nel secondo della Metaphysica) non è altro che la uerita, & della operatione, ouer pratica l'opera compita, & abenche la speculatione (per esser inuestigatrice delle propinque cause, et augmentatrice della scientia) sia molto piu nobile della operatione, ouer pratica operatiua, laquale solamente attende a sapere con diligenza essequire, & condur attualmente execute and actually lead to an end, or to
- The wise ancients, honourable sir whom I address, divided wisdom - as Ptolemy writes in the beginning of the Almagest - into two parts. The first of which after the said Ptolemy is called speculation and the other is named operation, which two parts are commonly further called on the one (hand) Theory or speculation, and on the other Practice or activity or operation: amongst which two parts - as affirms the same Ptolemy - there is no little difference, the cause is that they hold to different ends, because the end of speculative science - as Aristotle says in the 2nd. (book) of the Metaphysics - is no other than the truth; and that of operations, or practice, the work accomplished; and although speculation - through being the investigator of proximate causes and the augmentor of science - is much more noble than labour or practical work, which only harkens to knowing how to diligently

1. Dated 29 July, f.(1b).

2. "Those who have been true philosophers, Syrus, seem to me to have very wisely separated the theoretical part of philosophy from the practical. For even it happens that the practical turns out to be theoretical prior to its being practical, nevertheless a great difference would be found in them; not only because some of the moral virtues can belong to the everyday ignorant and it is impossible to come by them by the theory of the whole sciences without learning, but also because in practical matters the greatest advantage is to be had from a continued and repeated operation upon the things themselves, while in theoretical knowledge it is to be had by a progress onward." *The Almagest* trs R. Catesby TALIAFERRO (1952) p.5.

3. "It is also right for philosophy to be called 'a science of truth'. For the end of a theoretical science is truth, but the end of a practical science is performance." *Metaphysics* trs H.G. APOSTLE (1966) p 35.

a fine, ouer ad effetto tutte le cose
 gia speculatiuamente ritrouate, notif-
 icate, & regolatamente in atto poste,
 nondimeno per quanto posso considerare,
 sa me mi pare, che quanto piu la parte
 speculatiua ecceda di nobilita la parte
 operatiua, tanto piu la parte operatiua
 ecceda, non solamente di utilita, la
 parte speculatiua, ma anchora di laude,
 perche, come dice M. Tullio¹ nell primo
 de officis, ogni laude della uirtu con-
 siste nell'attione, ouer operatione.
 Onde considerando un giorno honorando
 signor compare, che hauendo io a comun
 beneficio (come sapeti) tradutto, & del-
 ucidato nella nostra lingua Italiana la
 speculatiua dottrina Geometrica, & Ari-
 thmetica di Euclide Megarese, che in tal
 faculta ottiene il principato, guidica
 tal mia fatica esser di pochi lauda deg-
 na, se appresso di quello non mostrasse
 la pratica di saper operare, & attualme-
 nte essequire, & esemplificar qual si
 uoglia propositione in tal due scientie,
 ouer discipline da esso Euclide adutta.
 E per tanto deliberai nella mente mia di
 componere a comun beneficio un general
 trattato di numeri, & misure, si secondo
 la consideration naturale, come Mathem-
 atica, & non solamente nella pratica di
 Arithmetica & di Geometria, & delle prop-
 ortion & proportionalita, si irrationali,
 come rationali. Ma anchor nella practica
 speculatiua dell'arte Magna detta in
 Arabo Algebra, & Almucabala, ouer regola
 della cose....

put into effect by rule all the things al-
 ready by speculation discovered and known;
 nevertheless in as much as I am able to con-
 ceive, it seems to me, that however much
 more the speculative part exceeds the
 working part, in nobility, so much the
 more the operational part exceeds, not
 only in utility, the speculative part, but
 also in praise, because, as Cicero says in
 the 1st. (book) of De Officiis, any praise
 of virtue consists in action, or operat-
 ion. Whereby considering one day, honour-
 able Sir, that I have to the common good -
 as you know - translated and made clear in
 our Italian language, the speculative
 Geometrical and Arithmetical doctrines of
 Euclid of Megera, in which faculty is obt-
 ained the beginning, I judged such labour
 of mine to be little worthy of praise, if
 besides that was not shown the practice
 of knowing how to operate and actually
 execute, and exemplify, whatever proposi-
 tion is wished in these two sciences, or
 disciplines, brought out by the same Euclid.
 And thus I though in my mind to compose,
 for the common good, a general treatise on
 numbers and measure, as much according to
 natural consideration as mathematics, and
 not only in the practice of Arithmetic
 and Geometry, and in proportion and prop-
 ortionality, rational and irrational, but
 also in the speculative practice of the
 great art of the Arabs called Algebra and
 Almucabala, or rule of the thing....

1. "For the whole glory of virtue is in activity" (Virtutis enim laus omnis in actione consistit.) De Officiis trs Walter MILLER (1913) Bk I, VI.

The Tartaglian argument about the importance of form in design

The argument that Tartaglia put forward in Bk. VI of the Questi-
et Inventiones (1546) had a relatively simple structure. Places strong by
nature do not demonstrate any ingenuity on the part of the designer. Only
those made strong through human skill can demonstrate such ingenuity. But of
those made strong by human skill, those strong through their great size and
mass of material, equally do not demonstrate much skill on the part of the
designer. Only those strong in virtue of their form truly demonstrate a designer's
ingenuity. The conclusion, never made explicit by Tartaglia, but undoubtedly
his central point, was that one ought to concentrate on form in order to design
the most perfect fortress.

But this argument is defective in that it is only by assuming that
form is the central aspect of design, that the conclusion holds, that form ought
to be concentrated on in design, so that the argument is hopelessly circular.

However there is a certain kind of plausibility to Tartaglia's
remarks so that it is worth examining this argument in some detail to see what
kind of factors may have been at work in it. Firstly, it might plausibly be
contended that an object designed for any purpose will have to have a particular
form. That very generally, and particularly with the sorts of objects at issue,
form will relate to function to some fair extent. That therefore, by and large,
the better designed an object is, the better the form will it have. So that,
with this type of design the provision of the best form is an important aspect of
the design process. But what can be argued further, from the conclusion that,
the provision of the best form is an important aspect of design? What can be
concluded about the nature of the design process? That it ought to concent-
rate on form? But if this is the case, we fall into the trap of circularity
because all we have concluded is what we were willing to assume. That is, that
form is an important aspect of the sorts of objects that are under consideration.
We therefore learn nothing more about what should be concentrated on in the
design process. One course open here would be an attempt to fall back on the
general premise that any physical object has a form which is central to its
functioning, and hence form must be a basic consideration of design. If this
were true for all physical objects, the conclusion that we do have to concent-
rate on form in design would tend to follow. But this general premise simply
does not hold. If one wants to design a teddy-bear, texture and resilience
may be the most important considerations, not form. Experiments in fact show
that it is texture that is all important in the behaviour of neo-natal monkeys
with regard to surrogate mothers, for instance. Or what about a mattress?
Carpet? Brake-lining? Electrical circuit? Thus we can not fall back on
any general premise about form.

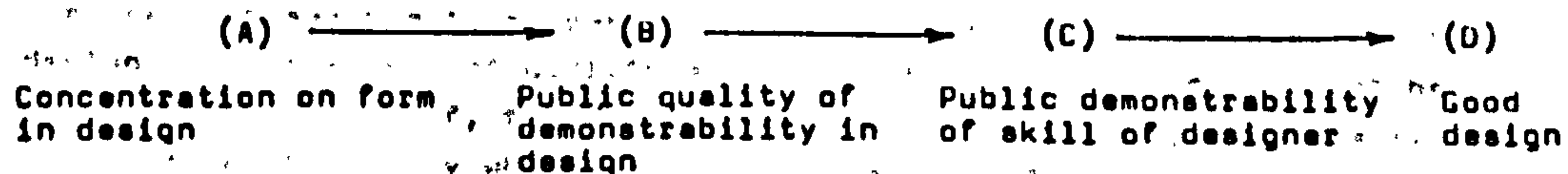
Another possibility is to consider the Tartaglian argument as
indicating something of a heuristic nature about design. That is, that in
such cases that we do know that form is an important aspect of the effectiveness
of the desired object, we ought to concentrate on form in design. But again
this enlightens us little, if at all. What we want to know here is how form
is to be constrained in design. In fact Tartaglia in his first condition
considered form to be determined in such a way as to organise the material to
best resist impact in the face of attacking artillery, while the most common
approach of the 16th. century treatise writers was to determine form by ref-
erence to the needs of defending artillery. In both cases the same argument
was used to support these different approaches, so this argument can hardly be
taken to distinguish anything about the way form ought to be constrained in
design.

Possibly then under such circumstances -- that is when form is known to be crucial -- the Tartaglian argument indicates how one is to recognise the designer's skill or efficiency: which after all was one of the things Tartaglia strongly emphasised. Mora, further, suggested quite reasonably, that 'any simple man' could fortify using great masses of material. Therefore what now seems to be at issue is efficiency in design, obviously an important characteristic for us to be able to recognise. Thus we may now conceive the discussion as an attempt to show that only in the manipulation of form can the efficiency of the design be recognised. But the situation here is that what is to count as a good design is a design which shows ingenious manipulation of form. This therefore can not simultaneously act as a criterion of the designer's skill. For, if skill in designing an object is producing an object that fulfils some function effectively, which it seems reasonable to assume, that effectiveness must be independently assessable if we are to be able to judge how effectively this task has been achieved. If it is not, the skill relates to no function except its own fulfillment and this may be relevant, or it may not, in the production of the required object. But, we may say, we have previously agreed that form is relevant. However, we are then only back in the same position as before because the argument increases understanding in no way, over and above what was assumed in the first place.

The Tartaglian argument then, in anything like the simple form in which it is given above, seems to be little more than an insistence on the assumption of the importance of form in design. Indeed, in putting forward his position Tartaglia may have been indicating something like this by his reservation "it seems to me".

However, there is more to the Tartaglian argument than the somewhat simplified account given above. Tartaglia in fact implicitly insisted that a good design should have (relatively simple) publicly, apparent, demonstrable, desirable characteristics. He admitted that he had no experience in fortification. Yet he insisted that in his examination of a design such as that of Turin, that the subtlety of the design should be plainly inherent in it for him to discover, if it were a good design. Clearly the geometric plan form of the fortress was something which could manifest this kind of quality very well. So the demand for concentration on form in design seems to have been tied up with the demand for publicly, demonstrable, evaluable characteristics, in design. Thus a more complex argument bringing in this aspect needs to be examined in order to elucidate the possible lines of thought underlying the Tartaglian type of argument.

Now it seems possible to argue thus: If geometric form in concentrated on in design (A) (which Tartaglia clearly called for), then, a public quality of demonstrability in design will tend to easily follow (B). If this (B) is true, then, public demonstrability of the skill of the designer, will ensue (C), (which Tartaglia called for). If (C), then, good design will follow (D). This last inference seeming to hold because, if good (and pertinent) reasons can be given for a design it should surely be a good design. Schematically then it seems possible to argue:



Then A → D, seems reasonable. But even if it is true that concentration on

form in design leads to good design, it is an elementary logical error to argue from this alone, that if one does not concentrate on form good design will not occur. That is that one must necessarily concentrate on form in design.

In fact this is how the Tartaglian argument in the hands of many of the treatise writers seems to have operated. That is, by proceeding from the idea that since concentration on form in design gave good results, particularly by giving public demonstrability of the advantages of the design, that as a result one necessarily had to concentrate on form in design. Thus they assumed not merely, if A then D, but if and only if, A then D, which is in no way supported by the Tartaglian argument.

However if it were possible to argue that each of the implications in the chain A to D, was of the form of if and only if, rather than just the plain implication, then $A \leftrightarrow D$ would hold, so this must be examined.

Now considering $C \rightarrow D$: here the Tartaglian argument seems to conflate two things. A well designed object undoubtedly shows, manifests, or demonstrates some kind of skill on the part of the designer in functioning effectively: it must do so to be a good design. Equally it is reasonable to suppose that this has to be the result of the ingenuity of the designer, generally. But does the how or the why of this ingenuity have to be demonstrated by the design for it to be a good design? Obviously not, because, a watch for example may demonstrate it is a good design by keeping good time. Even if we open up its back, or examine the drawings that were used in its construction, it may be by no means clear why it keeps such good time. The designer's ingenuity may in fact relate a good deal to his providing a design which was suited to the available skills of construction; and to the selection and treatment of the materials that went into its construction, which may be by no means immediately obvious. Thus one can not argue generally that a design has to manifest the designer's ingenuity in the sense of making plainly obvious why it functions well, for it to be a good design. Even though one can perhaps argue that a good design must demonstrate the designer's skill, by functioning well. The conflation of these two notions of demonstrating the designer's ingenuity, however, tends to support the contention that, if and only if, the design demonstrates the designer's ingenuity -- in the sense of making clear why it is is a good design -- will a good design ensue. That is, $C \leftrightarrow D$, which does not in fact hold. If however we modify C to C', that is to simply demonstrating the skill of the designer -- by way of functioning well -- then we do seem to get $C \leftrightarrow D$, and this part of the chain A to D can then be seen to allow the implication in the opposite direction.

With regard to $A \rightarrow B$ (concentrating on form leads to demonstrability in design), it does not appear immediately obvious that only through concentration on form does public demonstrability of the design's good qualities arise. A design might appear obviously clever because of the selection of particular materials of which it is constructed and their known qualities, as in the case of a water mattress, say. However if we consider the quality Tartaglia had in mind of Euclidean geometry involving relatively simple intellectual demonstration of the way the design works, with certainty, (B'), it seems far less implausible to suggest that only if form is concentrated on in design will this type of quality appear in the design. Thus it might be argued, if and only if, form is concentrated on in design, then simple public demonstrability which is intellectually certain follows. That is

$A \leftrightarrow B'$. It only remains then to get $B \leftrightarrow C$ for $B \rightarrow C$ to close the chain to get $A \leftrightarrow D$ for $A \rightarrow D$.

Now it seems reasonable to agree that if B, that is the design manifests public demonstrability, then C, the ingenuity of the designer will be publically demonstrated, and further $B \leftrightarrow C$. But to close the chain we now need the same type of implication between B' and C'. Certainly we might argue $B' \rightarrow C'$: that is if a design has simple, publicly and intellectually demonstrable good qualities, it will then demonstrate the ingenuity of the designer by functioning well, generally. But the idea that only if B' -- that is the design being simply and publicly demonstrated as a good design -- will the design manifest the ingenuity of the designer, that is C', by functioning well, certainly can not be accepted. The designer's skill which leads to an object functioning well being such a variable thing as the above noted examples show.

Thus as we strengthen parts of the Tartaglian argument $A \rightarrow D$ in order to try and get $A \leftrightarrow D$, other parts of the chain which before might have been reasonably acceptable, are weakened if not destroyed. This is probably why, in part, the Tartaglian argument seems to have a certain plausibility as an argument of necessity. Its parts independently can be seen as relatively strong, even though when taken together the strengthening of one involves the weakening of another.

On the other hand the desire for both public demonstrability of good qualities in design, together with the concentration on form in design by way of a geometrical treatment, were mutually supporting aspects of the discussion. In so far as either was conceived to be independently valuable, the other tended to follow, so that the treatise writers tending to favour both qualities for their own reasons often felt that they had an inescapable argument to necessity on the lines of the Tartaglian argument.

PIETRO CATANEOI Quattro Primi Libri di Architettura (1st ed. 1554)

Bibliography: Vinegia 1554; enlarged edition Venetia 1567, under the title L'Architettura¹. fcs. of the 1554 ed. 1964 Ridgewood N.J.

General description:² A large high quality production, 10½"x6½"-text. Folios (ii) + 1/56. Many marginal notes, and large good quality woodblock illustrations, often in perspective.

Contents:

f. (i): Title page: I QVATTO PRIMI LIBRI/ DI ARCHITETTURA/ DI PIETRO CATANEO SENESE:/ NEL PRIMO DE'QUALI SI DIMOSTRANO/ le buone qualità de'siti, per l'edificazioni delle città/ & castella, sotto diuersi disegni:/ NEL SECONDO, QVANTO SI ASPETTA/ alla materia per la fabrica:/ NEL TERZO SI VEGGONO VARIE MANIERE/ di tempii, & di che forma si conuenga fare il principale/ della città: & dalle loro piante, come ancora/ dalle piante delle città & castella, ne/ sono tirati gli alzati per ordine di Prospettiuas:/ NEL QVARTO SI DIMOSTRANO PER/ diuerse piante l'ordine de piu palazzi & casamenti,/ uenendo dal palazzo regale & signorile,/ come di honorato gentilhuomo,/ sino alle casi di persone/ priuate./ Con priuilegio del sommo Pontefice per anni X./ & dell'illustrissima Signoria di Vinegia/ per anni XV.

f. (11a): Dedication to Enea Piccochomini.

f. 1a/25b: Book I on fortification.

f. 1a/10b: Cap. I/VII: General discussion about the architect's role; the need for protection for men in cities; choice of a site; the buildings of a city and its various parts.

f. 10b/14b: Cap. VIII/XI: Setting out of the regular cities - square, pentagonal, hexagonal and heptagonal.

f. 14a/18a; 20b/24b: Cap. XII/XV; XVIII/XIX: Cities on various sites - on mountains and hills, and in maritime situations.

f. 18a/20b: Cap. XVI/XVII: Citadelles in general and a pentagonal citadelle with a regular 10-sided city.

Cap. VIII gives the length of a foot set out on the page.

Most of the cities are illustrated by both a plan and a bird's eye view (perspective) type presentation.

f. 26a/35a: Book II on materials.

f. 35b/46a: Book III on temples (or churches).

f. 46b/54a: Book IIII on royal palaces and lesser houses.

f. (55a/56a): List of chapters.

Colophon: In Vinegia, in casa de' figliuoli di Aldo. M.D.LIIII.

1. See the next work below.

2. Of the first edition.

f. (11a)¹. SE la nobilità del soggetto, come ben sa la S. V. illustrissima, nobilita la scienza che ne tratta; la piu bella parte dell'Architettura certamente sarà quella, che tratta della città, doue piu moltiplicano gli huomini, & fioriscono le notitie & esercitti humani. le quali essendo modernamente offese dalle artiglierie, che non haueuano gli antichi; non sarà presontione la mia, se io mostrerò di edificarle altrimenti, per difenderle da quelle offese, alle quali essi non hanno potuto prouedere, per non hauerle hauute al istempto loro...

If the nobility of the subject - as well knows your most illustrious - ennobles the science which treats of it, the most beautiful part of Architecture will certainly be that which treats of the city, where men increase the most, and flourishes knowledge and human practice; which, now being attacked by artillery which the ancients did not have, it will not be presumptuous of me if I show how to build differently, to defend against this attack, against which they did not have to be able to provide, through not having had it in their time....

f. 1a. ESSENDO l'Architettura scienza di piu dottrine & uarij ammaestramenti ornata, & col giudicio di quella approuandosi tutte l'opere, che dalle altre arti uasi finiscono; sarà di bisogno ancora à chi uorra fare professione di buono Architteto, essere scientifico, & di naturale ingegno dotato. però che essendo ingegnoso senza scienza, ouero scientifico senza ingegno, non potrà farsi perfetto Architteto. Doue gli sarà necessario, prima che si possa rendere bene istruutto di questa arte, o scienza, essere bono disegnatore, eccellente Geometra, bonissimo Prospettiuo, ottimo Arithmetico, dotto Istoriografo; & habbia tal cognitione di Medicina, quale à tale scienze si conuiene; & sia prattichissimo nell'adoperare bene la Bossola. peroche con quella potrà pigliare qual si uoglia sito in propria forma, essendo che di fuore, o di dentro si possono uedere l'estremità de'suoi anguli, & per quella conoscerà le regioni del cielo col ferimento de i uenti....Ma se l'Architteto non sarà Prospettiuo, non

Architecture being a science adorned by many doctrines and varied disciplines,² and with the judgement of which are approved all the works that by the other arts are finished, it will also be necessary of who would undertake the profession of a good architect to be scientific³ and endowed with natural skill, because whoever is skilful without science, or scientific without ingenuity, cannot make a perfect Architect. Wherefore it will be necessary before he can be rendered well instructed in this art, or science, to be a good designer, excellent geometer, the best of perspectivists, exceptional arithmetician, learned historian, and to have such knowledge of medicine, whatever of this science is relevant; and to be practised in using the compass, because with this he will be able to take whatever site is wished in its proper form, when from outside or inside the extremities of its angles can be seen and thus he will know the regions of the sky with the variation of the winds... But if

1. From the dedication.

2. This work does focus almost entirely on the city, and the way it may be defended comprises a good part of the work. Pietro here felt it necessary to justify his not following the lessons of the ancient's in fortification.

3. Lit. 'instructions'.

4. This is a straight rendering of Vitruvius. "Architectura est scientia pluribus disciplinis, & uarijs eruditionibus ornata, cuius iudicio probantur omnia quae ab caeteris artibus perficiuntur opera". Opening to BkI cap I (Florentiae 1522, p.5). 'Finished' = 'brought to their desired end'. 'Perficio' in Latin having the sense of to finish, perfect, bring to completion.

5. The use of "scientifico" = 'scientific' was not very frequent during the period. FLORIO (1611) for example gave it = scientiato = scienced, skilful full of sciences, learning or knowledge. O.E.D. gives the earliest use in English of this word (in roughly Pietro's sense) as 1589.

6. "ferimento" = variamento.

potrà mai così ben ne honorarsi, ne mostrare per disegno il suo concetto, per eccellente disegnatore ch'ei si fusse...

E questi sono gli studi, in che più l'Architetto si debbe esercitare. & se piace à Vetruiio, che lo Architetto debbi ancora hauere cognitione de Filosofia, d'Astrologia, da Musica, e di Legge...¹

f. 7a. Primieramente gli antichi nell'edificare città o castella usorono la figura circolare. così anco mostra Vetruiio che si debbi fare. ma essendo l'angulare più atta à difendersi coi fianculi & angulari baluardi dalla moderna artiglieria, per esser tale offesa noua; non si scema in tal caso l'antica virtù loro con l'auuertenza mia da edificar le città non circolari, ma angulari, in modo che tutte le parti della muraglia possino facilmente difendere, & scoprire dalle cannoniere o feritoie de i fianchi de gli angulari baluardi. È da considerare dipoi, che, essendo la città più di ogni altra fabrica importante, & per esser ricetto de gli huomini, & di qualunque altro edificio, che ancora la più importante cosa di tutta l'Architettura, oltre al recinto delle mura, sono i buoni compartimenti & distributioni delle strade...

f. 11a. Ma nel recinto delle città grandi, per douersi fare di molti più angoli, si potranno per la uicinità loro difendere le mura in tutto con gli archibusi da posta², o da mano, il che per mio auiso è da laudare .

f. 26a. NON debbe il buono Architetto, Illustrissimo Signor, hauer manco notizia della materia atta ad ogni generatione di edificio, che de qual si uoglia altra cosa....

the Architect will not be a Perspectivist, he will never be able to be clever and honoured, nor to show by design his concepts as an excellent designer would be... And these are the studies in which mostly the Architect ought to be practised, and also it pleases Vitruvius that the Architect ought further to have knowledge of Philosophy, Astrology, Music and Laws...¹

Mainly the ancients in building city or castle used the circular figure, a thing further Vitruvius shows ought to be done, but the angular being more suited to defend with little flanks (?) and pointed bastions against modern artillery, because this attack is new, the virtue of the ancients is not reduced in this case with my advisement that the city should be angular, and not circular, in the manner that at all the parts of the wall can be easily defended and uncovered to the cannoniers or loops in the flanks of the pointed bastions. And to consider afterwards, that the city being the most important of all other constructions, through being the receiver of men and of whatever other buildings, that then the most important thing in all Architecture, apart from the walled enceinte, are the good divisions and distributions of the streets...

But in the enceinte of a large city because it ought to be made of many more angles, it is possible because of their nearness, to defend the walls wholly with the archibus 'da posta'² or of the hand, and that is to my advice to be praised:

The good Architect, good sir, ought not to have less knowledge of materials suited to every type of building, as to whatever is wished, other thing....

1. While Cataneo finishes here by rejecting Vitruvius' view as requiring too much of a man, his whole account of an Architect's skills has a rather Vitruvian ring, e.g. in the need for medicine - which is needed to judge healthy sites. Pietro like Vitruvius sets up a wide range of skills as necessary to the Architect including History for example. On the other hand the very strong emphasis on Perspective is new. The title to the chapter from which this comes, in fact, has as subtitle "di quanta importanza gli sia l'esser buono Prospettiuo". His position was perhaps something between the differing positions of Alberti and Vitruvius.

2. Lit. 'set or placed'. A gun that was set on the wall or on a special rod.

L'Architettura (1567)

General Description: This is an enlarged version of I Quattro Primi Libri di Architettura to which the author added 4 new books. It is a production similar to the earlier edition. (iv) + 196 + (viii) pages.

Contents:

p.(1): Title page: L'ARCHITETTURA/ DI PIETRO CATANEO/ SENESE/

Alle quale oltre all'essere/ stati dall'istesso Autore riuisti,/ meglio ordinati, e di diuersi dise-/gni, e discorsi arricchiti i primi quat/tro libri per l'adietro stampati,/ Sono aggiunti di piu il Quinto, Se-/sto, Settimo, e Ottauo libro;/ Nel quinto si tratta di quel che s'aspetta all'/ornato per le fabbrichi. /Nel sesto si mostrano le buone qualità dell' acque per l'uso del uiuere: e cosi simil-/mente dell'acque de i bagni, con/ alcuni loro disegni./ Nel settimo s'adducono quelle cose di Geo-/metria, & de gli elementi suoi, che piu/ all'Architetto faccino di bisogno: / con un nuouo, & facil modo/ di pigliare in propria/ forma qualunque/ fabbrica, sito,/ o luogo./ Nell'ottauo s'insegna a operar praticamente,/ nelle case di Pros-
pettia, cominciando/ da i primi principii, & elementi/ di quella./ CON PRIVILEGIO.

p.(111) Dedication to Francesco di Medici.

p. 1/109: Books I/IIII as in the 1554 edition.

p. 110/136: Book V: Ornamentation, deals with various features of the various orders.

p. 137/149: Book VI: Deals with the supply of water to the city, and baths.

p. 150/174: Book VII: Geometry and surveying.

p. 175/197: Book VIII: Perspective.

p. (198/203): List of chapters.

Colophon: In Venetia M.D. LXVII.

L'Architettura (1567): Texts

Per il quale si dimostrano quelle cose di Geometria, & elementi di quella, che all'Architetto sono piu necessaria, con un nuouo e facil modo di procedere nel pigliare in propria forma qualunque fabbrica, sito, o luogo.¹

By which is shown the subject of Geometry and the elements of which that are most necessary to the Architect, with a new and easy way to go about taking in proper form whatsoever building, site, or place.¹

Di tutte l'arti o scienze che appartengono all'Architettura, non è cosa che possa porgere piu sicurtà, e rendere cosi honorato l'Architetto, quanto l'Arismetica, e Geometria. Onde prima ch'esso faccio professione d'Architettura gli bisogna di quelle essere intelligentissimo, però che non hauendo di tali scienze buona cognitione, non potrà dare all'edificatore vera notizia della spesa, ne anco mai alcuno edifitio ben terminare....Vedesì dunque l'Arismetica e Geometria esser basa, e fondamento dell'Architettura, si come ben dimostra Vetruiuio², nel primo capitole del suo primo libro....

Of all the arts or sciences which belong to Architecture, nothing can offer more security, or render the Architect honour, as much as Arithmetic and Geometry. Whence firstly to him who would make a profession of architecture it is necessary that he is of the greatest intelligence, because if he does not have a good knowledge of these sciences, he will not be able to give to the builder² true information about the cost, or even to determine any building well....Arithmetic and Geometry are seen to be the base and foundation of Architecture, as Vitruvius shows³ well in the first chapter of his first book....

1. Subtitle to 7th book, p. 150.

2. That is the client, as the later context makes clear.

3. This is somewhat of a distortion for Vitruvius tended rather to emphasize the many different skills necessary to an Architect.

GIOVANNI BATTISTA ZANCHI

Del Modo di Fortificar le Città (1st ed. 1554) [3]

Bibliography: Venetia 1554; Venetia 1556²; Venetia 1560; Venetia 1601, with Lanteri and Lupicini.

French version Lyons 1556* by De La Treille.²

General Description: A small book of some 64 pages. 3½"X5½" text. 8 woodblock illustrations of an average quality.

Contents:

p. 1: Title page: DEL MODO DI FORT- / IFICAR LE CITTA' / TRATTATO DI M. GIOVAMBATTISTA / DE ZANCHI DA PESARO, / AL SERENISSIMO ET INVITISSIMO / Re MASSIMILIANO d'Austria, Re di Boemia / IN VENETIA PER PLINIO PIETRASANTA M D LIIII

p. 3r. Portrait encribed 'Giovanni Batista Bonadio di Zanchi da Pesaro'.

p. 5/9: Dedication.

p. 10/12: A i lettori.

p. 13/14: Della Intentione dell'Opera.

p. 15/59: Short chapters, unnumbered: "Degli Instrumenti Offensivi" (p.15/16); "De gli Effetti et Forze dell'Artiglieria" (p.17/19); "Delle Fortezze de i luoghi, cosi Naturale, come dall'Arte" (p.19/22); "Della Forma de i luoghi Forti in universale" (p.22/23); "Delle Forma Perfetta" (p.24/28); "Delle Modo Accompagnar la Forma Perfetta" (p.29/33); "Essempio della Forma Quadrata" (p.34/39); "...i Beluardi et le Cortine" (p.40/42); "...le Fossa....cauallieri, porte, & contrascarpe" (p.43/47); "Delle Case Matte" (p.47/50); "De i vantaggi de gli Offensori et Difensori" (p.50/53); Hill or Plain sites (p.53/56); "Delle Conditioni che si Richieggono al vero Artifice delle Fortezze" (p.57/59).

p. 60/63. Letter of Girolamo Ruscelli headed: Al Molto Magnifico et Eccellente Signore, Il S. Dottor Nicola Manuali. Dated Venice 14 Luglio M,D,LIIII.

Colophon: In Venetia, Per Plinio Pietrasanta MDLIIII.

Del Modo di Fortificar le Città (1554): Texts

p.5. ANCORA che una delle più necessarie, & principali fortezze della città sia posta nella beneuolenza, & uero amore de' ualorosi popoli, i quali con la dirrita amministrazione di giustitia, & con la collatione de' benefitij hora nel publico, hora ne i priuati si acquistano, nondimeno oue saranno quelle delle mura, & de gli altri edifitij ad esse appartenenti, aggiunte; chi non sa, Serenissimo,

Although one of the most necessary and principal strengths of a city is set in the good will and true love of the valorous people, which with the equitable administration of justice, and the conjunction of benefits acquired now by the public, now by private persons, nevertheless where these will be joined to the walls and the other structures to these appertaining, who know⁵

1. RICCARDI (1893).

2. See CORNEWYLE, R. The manner of Fortification of Cities, Towns and Castles and other places (1972, Farnborough). Introduction by Martin BIDDLE, who gives a location of this rare edition. WHITEHORNE (1562) f. 16/23 gave an English translation of some sections of Zanchi's work. CORNEWYLE (1972) is a facsimile of an English m.s. version of this work, of 1559, with some additions and rearrangements.

3. Of the first edition.

4. Zanchi does not indicate what other structures he is thinking of here, perhaps ravelins and outworks; maybe barracks or other inner structures.

5. Dropping the not as an emphatic, from the later context.

& inuittissimo Rè, che uie maggior sicu-
rezza appoteranno, in tanto che par dif-
ficil cosa il discernere qual delle due,
dico ò quella de gli animi de' cittadini,
s' ò quella delle mura sia da essere ante-
posta? anco che, secondo l'opinione di
molti savi, & giuditiosi filosofi à gli
animi il prima luogo dar si douesse, ^{però}
come che io così leggiermente non lo con-
ceda, nondimeno essendo che molti della
loro edificatione habbiano per li passati
tempi, & ne i presenti ancora ciascuna
regola, & fondamento con grande studio,
& dottrina dimostrato; gran marauiglia
s'ci dee porgere il non uedere che pur'un
solo di quella delle mura habbia partico-
lar memoria lasciato, essendo elle così
necessaria cosa per dar perfettione à
questa fortezza, come le uicine dispositi-
oni alla materia, se alcuna particolar
forma riceuer deue. Là onde sopra questo
discorrendo talhora facilmente harei giu-
dicato, ciò poter essere accaduto, però
che interamente da alcuno, nè prima, nè
a spocia intesa si fusse; se non che molti
ualorosi soldati, & essercitati, & giudi-
ciosissimi Capitani, ritrouati ne ho, &
anco per fame conosciuti, iquali non
credo che restassero mai di tal cosa a' p-
osteri lasciare, inuidiosi, ch'altri
nell'otio, & piaceri apparandola quello
di honor procacciar si potesse, che con
grandissime fatiche, & lunghe esperienze
essi di acquistar si ingegnarono. Perciò
che sola à pratici, & giudiciosi nell'ar-
te, leggendo di pienamente raccoglierne il
frutto, lecito saria stato; ma più tosto
ho sempre creduto, che doppo il ritrouar
dell'artiglieria, nuouo magisterio nel
fortificar le cittadi, & non quel solo
che da gli antichi si usaua, richiedendosi,
non è ad alcuno ualoroso Capitano così
facilmente accaduto in poco spatio d'anni
l'hauer

most serene and enuiable King, which way
brings the greatest security, in as much
as it appears difficult to perceive which
of the two, (as) I say, either that of the
spirit of the citizens, or that of the
walls, is to be put foremost? and further
that according to the views of many wise
and judicious philosophers, the first
place ought to be given to the spirit --
which I do not lightly concede, neverthe-
less (the case) being that many of their
structures in the past and still in the
present, had each one a rule and founda-
tion with great study and doctrine
demonstrated. A great marvel, of what it
ought to yield to us not even one of that
of the walls has bequeathed a specific
memory, it being a necessary thing to
give perfection to this strength,
as in the relative dispositions of
the material in whatever particular
form it ought to receive. Wherein in dis-
cussing this I may have sometimes judged
too easily, what can have happened, but
that not wholly in no way, either in
the beginning or afterwards, should be
understood; if not that many valorous
soldiers and practised and most prudent
captains, I have discovered and also throu-
gh reputation known, who, I do not bel-
ieve, would ever allow such a thing to be
left to posterity, envious, that others in
ease and peace learning that by which
can be gained honour, which with great
labour and long experience, these strove to
acquire. Therefore only to the practised
and judicious of the art, reading to the
fullest to collect the fruit, will it
legitimately belong; but I have always
sooner believed that since the discovery
of artillery, new master in the fortific-
ation of cities, and not that merely wh-
ich the ancients used, it is necessary
that, to no valorous captain will it eas-

1. This of course is pure assumption on Zanchi's part despite his arguments below.

2. I.e. the rule and foundation of design.

3. This last section is merely an attempt by Zanchi to explain away that fact that the sort of evidence about the walls of cities being based on demonstrated methods did not exist.

4. It is not fully clear why the invention of artillery should make as much difference in Zanchi's terms. Probably he considered its power made it that much more in need of human ingenuity to deal with it.

di molte conclusioni senza aiuto dell' opinioni de gli huomini de' passati tempi recogliere potuto, però che alcuna regola de se per suo natural fondamento, molte, & non sonolenti esperienze ricerca, et s'alcuno ha lungamente la militia essercitata, & è in essa talmente vissuto, che sopra diverse pruoue habbia potuto come sopra fermissime basi numero di cōclusioni fondare, che à pochi ciò puote essere auenuto, per auentura questi pochi ò diffidatisi del poterle esprimere, ò come quelli, che alla sola essercitatione della militia, & nō alla dotrina attendeano, tal cosa sprezzando, se ne sono tacitamente passati, & tanto più facilmente, che non ne essendo alcun notabile uero principio da altri sin' hora, ch'io sappia, dimostrato, à chi in tal materia dar regole, & modi intendea, si facea la uiamen facile, anzi maggiormente essa difficoltà per la uarie arti che in simile exercitio di necessitā, concorrono, si aumentaua, delle quali non così facilmente ciascun soldato, per ualorose, & graue ch'egli si sia, capace si ritroua. Ora auenga ch'io nō mi presuma essere in fatto quel ueterano & espertissimo di guerre soggetto, che à ciò fare basante saria, nè meno mi reputi pienamente hauere quelle arti apprese, che à così fatto negocio necessarie sono, nondimeno desideroso in cosa nobile, & grande insieme à molti porgendo utilità, far'anco seruitù al gran nome, & allo incōparabile ualore di V. Serenissimo.....

ily happen that in the space of a few years, that he will have many conclusions without the aid of having been able to collect the opinions of men of past times, unless that every rule from its essential foundation, a great deal and not indolently, he searches for, and if anyone has long practised militarily, and in this way so much seen, that upon diverse proofs he can have, as upon the most firm base, numerous conclusions founded, but this can have happened but little, for by chance these are few, or distrustful of being able to express it, or like those, that attend only to military practice, and not to doctrines, which, scorned, if they are not silently passed by, and as much more easily, there not being any notable true beginning by others up to now, that I know, demonstrated, by which in this subject to give rules and purposeful methods, is made the way less easy, on the contrary this difficulty is greatly increased through the many arts that in the same practice of necessity concur, which not easily by every soldier through the valour and weight that in his capacity are found. Now it happens that I do not presume to be in fact a veteran and expert on the subject of war, to that extent that will be sufficient, no less do I deem myself to have fully learnt the arts that are necessary to the business, nevertheless wishing in this noble and grand topic, which also is very yielding of usefulness, to do further service to your great name and incomparable valour, your serene Majesty.....⁴

1. Lit. natural.

2. There seem to be a number of ideas in Zanchi's mind here. Certainly that long military service, without attention to doctrines will not produce the relevant understanding. Equally those that have this relevant understanding do not express it or else there are too few of them to provide any worthwhile advance. On the other hand the notion of proven results on firm foundations from first principles, also figures as an important contributor to the relevant knowledge. But in this passage Zanchi gives no very clear indication of how this sort of approach relates to practice.

3. This is an echo of Vitruvius' extensive list of the Architect's skill.

4. This is an aspect of the usual type of disclaimer as to the author gaining benefit from publishing his work.

p. 11....di non picciola lode degni sono reputati....i quali non principalmente per tal desio, ma per beneficio della posterità, & per commune, & publico interesse in qual si voglia cosa affaticandosi a uarii traugli & infiniti pericoli di sottoporsi non schifano? Certo è, che tanto in me ha questo di honesta, & morale, & cristiana sembianza, che al consiglio della presente opera gagliardamente spingere mi ha potuto; nella quale si come molti ne i passati secoli di qualche egregio & lodeuole edificio per eternamente rimanere dopo gli altri nella memoria di i posteri fare s'ingegnarono, qual piramidi, qual anfiteatri, cerchi, & colossi drizzando; così io per lungamente douer altrui giouare, non particolari fabriche come piantar si debbono, d'insegnare mi sono affaticato; ma si bene di mostrare a ciascuno certo modo, & uniuersal regola di talmente edificare, & fortificare le città, & per conseguenza i regni, che i Maestrati, Principi, & Republiche con le sue leggi, facultà, & honori ageuolmente entro ui si conseruino, non solo dall'impeto delle fiere sicuri, ma ancora da quello de' più numerosi, potenti, et perfidi huomini, che in loro danno nascere ci potessero....¹

p. 13. DOVENDO inuestigar la maniera di fortificar le città, castella, et altri luoghi serrati necessaria cosa e prima che ad altro si uengan, conoscere in quanti modi si possano espugnare, accio che da quali di questi restino per tale artificio sicure, apertamente si ueda; & oue bisogno sia, chi custodirle disidera ne gli altri, come gouernar si debbe, & altronde douerlo apprendere, si conosca. Et perche tre sono al mio giuditio i mezi, co' quali le espugnationi delle fortezze si conseguscano; la forza, il tradimento, & quello che in apparenze e quasi di questi nel mezo, dell'uno & l'altro partecipando, ne semplicemente nell'uno, o nell'altro collocare

....are (not) reputed as worthy of no little praise those (who act) not mainly in such desire (i.e. for fame, etc.), but for the benefit of posterity and for the common and public interest, in whatever thing laborious and subject to many troubles and infinite dangers, they do not shun? It is certain, that as much as I have in me of honesty, morality and Christian bearing, it has strongly pushed me as far as it has been able in the council of the present work; in which if like many in past centuries, who, excellent and praiseworthy buildings eternally to remain after others in the memory of posterity they endeavoured to make, as the pyramids, amphitheatres, circuses, and large statues erected; thus I for a long time earnestly others to aid, not in how particular structures ought to be planned, have I laboured to teach, but rather to show to each certain method and universal rule of such wise to build, and fortify a city, that, as a result, the kingdoms of Rulers, Princes and Republics, with their laws, power and honour are easily conserved within them, not only from the violence of wild beasts secure, but also from those more numerous, powerful and wicked men which to their danger can arise....¹

In order to investigate the way of fortifying cities, castles or other closed places it is necessary as the first thing before others are come to, to know in what ways they can be captured, so that how they from these remain secure by such art, is clearly seen; and where it is necessary, he who will wish to hold it from others, as to how it ought to be governed, and what else he ought to learn, is known. But because in my judgement there are three ways by which the capture of a fortress follows - force, treachery, and that which in appearance is nearly the mean of these, the one and the other being a part of it, not merely to the one, or to the other, being able to be assimilated, by us will be cal-

1. This section is obscure in detail although the main ideas are clear enough.
2. Chapter heading "Della Intentione Del l'Opero". It is typical of Zanchi's rather convoluted language in these early more general sections.
3. i.e. strength and treachery interacting.

potendosi, da noi sarà detta rubbamento; auuertir si deue, che qualunque uolta si parlerà delle fortzze concio sia cosa, che alcune consistano ne gli animi di quelli, ch'entro alle città dimorano, & altre nelle mura, & edificij, che intorno di quelle si fabricano, delle sole esteriori intendendo; onde procedendo il semplice tradimento dalla debolezza, & uitio de gli animi principalmente, & non da difetti delle mura, l'opporsi a simil mezo non sarà intentione del present trattato, ma si bene il dar regola di talmente fabricare esse mura, & sue parti, che possano ragioneuolamente alla forza de'nemici per l'ordinario resistere, ne quanto a loro sieno capaci di apportare occasione di rubbamento, dico quanto a loro, però che non solo si possono rubbare le città per difetto delle mura, & suoi edificij; ma anco senza questi per la neglgentia di quelli, che le custodiscono, la quale non essendo uolontaria, fa che non si chiama tradimento come se malittosamente succedesse, tradimento ueramente chiamar si douerebbe, & similmente espugnar si possono, non solo per la moltitudine delle forze, ma anco per alcun difetto di i custodi, ouera della fabrica, alla qual sola, parte di remedio dare al nostro artefittio si appartiene, come che a quella dell'assedio ancora che forza sia niente intenda di riparare, nè punto è in questi tre capi dettati, da star sospeso, se ben sempre pare, che la forza gl'altri due accompagni, essendo che senza quella nè i tradimenti, nè i rubbamenti possono hauer pieno effetto; però che con tutto questo ha ella il suo luogo da gli altri due modi separato, come quando quei di dentro sono di sincero animo, & uigilanti, di maniera, che ad essa sola forza resista di far pruoua per la espugnatione, & allora ueramente fa bisogno, che la fortezza sia bene intesa douendole in fatto resistere, dico quella delle mura, & parlo delle forze, con le quali ad esse si contrasta,

led robbery; note ought to be taken that when strength will be spoken of, because such in part consists in the spirit of those who live within the city, and part in the walls, and structures which are built relevant to these only the exterior are understood. Wherein simple treachery proceeds from the weakness and fault of the spirit mainly, and not from defects of the wall - its opposition by similar means will not be the intention of the present treatise, but rather to give the method to such wise construct these walls and their parts, that it can reasonably resist the force of the enemy generally. In as much as they can support the occasion of robbery I say something of them, because not only is it possible to rob the city through the defect of the walls and their buildings, but also, without these, through the negligence of those who have charge of them, which not being voluntary, is not called treachery, as when it malevolently occurs, which ought to be truly called treachery. And likewise capture is possible not only by the greatness of the force, but also by any defect of the guards or of the structure, which part alone to give remedy to is belonging our skill as when those of the siege do not intend to repair their strength -- in no way is it in these three said headings -- through it being suspended, so that it ever appears, that the strength of the other two accompanying, being without it, neither treachery nor robbery can have full effect. However all this has its place distinct from the other two ways, as when those within are of sincere spirit and watchful in such a way to this alone force resists to make proof by the capture, and then truly it is necessary that the fortress should be well designed for resistance. I say that of the walls, and talk of the force, against which it is opposed, and in this manner intending to show the ends and the reasons of construct-

1. "delle sole esteriori intendendo"? The walls?

2. Or: that it can with reason ordinarily resist the face of the enemy.

3. What Zanchi seems to mean is that being resolute precludes robbery or treachery.

& di tal maniera intendendo di mostrare gli termini, & le ragioni di fabricare la nostra, per quanto sarà possibile per gli siti come poco appresso ne suoi luoghi diffusamente si dirà prima de i modi d'offendere, ch'usauano gli antichi, & moderni alcuna cosa, si discorrerà.

p. 15. ESSENDO in questo trattato l'intentione di regular le fabriche delle fortezze si fattamente, che per quanto comporteranno i siti, & le necessità del fortificare, tutto quello, che possibile è all'humano intellecto di operare per difenderle dalle forze de nemici, & farle meno atte ad esser rubbate ui si accomodi, non uolendo comprehendere la difesa che all'espugnationi, lequali per uia di tradimenti o altra maniera di forza, & negligenza di guardatori facendosi conuenirebbe; ma sola quella, che nel modo di fabricare si comprende....

p. 16.onde gli antichi diuersamente fabricauano anco da quello, che noi oggidì facciamo, però che le loro armi, & bellicose machine offensive erano anco molto disimili, perche non si battono più hora le mura con gli Arieti & testudini, ma con piu impetuosi, & gagliardi instrumenti in luogo di quelli, & così come soessi usauano argini, & caue sotteranee, noi mine, & trincere facciamo; co quali tutti se ben' hora molto più di rado si conquistano le fortezze, non è però che gli Arieti, & simili antiche machine in luogo delle quali hora l'artiglieria è succeduta non erano così atti alla difesa oltra l'offesa come essa è; dalla qual principalmente guardandosi di essere offese le città & le fortezze restano difese, & quanto alla fabrica de' loro circuiti inespugnabili, onde intendendo dar regole di fortificarle in tal guisa, egli è necessario prima alcuna cosa preporre intorno alla forza di essa artiglieria, scaccio che intendendosi il modo de' gli effetti suoi, si mostri più facilmente, & si troui la uia alla difesa.

ions of ours, as far as it will be possible from their lack of propinquity in their places. First in detail will be discussed the methods of attack which the ancients, and sometimes the moderns used.

The intention of this treatise being the order of the building of fortresses in such wise, in as much as will allow the sites and the necessity of fortifying, all that which it is possible to the human intellect to use to defend them against the force of the enemy and make them less suitable to be robbed, not wishing to consider the defence which is against seizure by way of treachery, or other manner of force and negligence of the guardians, which could be made to occur, but only that which in the mode of construction is understood....

...whereas the ancients constructed differently from that which we do, because their arms and warlike machines of attack were very dissimilar (to ours), because the walls are not battered more now with Rams and Tortoises, but with more forceful and robust instruments in place of those (of theirs), and where they used banks and underground excavations, we make mines and trenches; with all which, if truly now the conquest of fortresses is much more rare, it is not that the Rams and similar ancient machines -- in place of which now artillery has succeeded -- were not so suited to the defence as the attack, as this is, by which mainly are guarded cities from being attacked, and the fortresses stand defended, and as to the construction of their impregnable circuits wherein intending to give the rules of fortification in this wise, it is first of all necessary to set forth something concerning the strength of this artillery so that the nature of its effects being understood, is shown more easily and is found the way of defence.

- p. 17.però che'l fortificare de' nostri tempi è per lo piu in questi istrumenti, così nell'offendere, come nel difendere fondato.....Massimigliano nell'assedio di Padua le uso, che secondo, ch'io n'ho udita relatione uintiquattro piedi di terraglio², fresco però, passarono.....
- p. 19. Sono i luoghi. ò per sola natura forti, ò per artificio humano à quella accompagnato, ouer senza beneficio di essa natura, per la sole arte usataui, & ciascuna di queste tre maniere di fortezze uiene ad esser tale per due soli capi; cioè per la quantità della materia, & per la forma d'essa. Della natura sono forti quando son posti in monti, laghi, paludi, ò in mare, ò in alti fesse³....in alcuni de'quali non solo la natura ha dato forma, ò materia conueniente; ma ancora dall'arte ui è stata aggiunta, come facilmente si manifestrebbe à chiunque per le loro qualità discorrer uolesse. Di materia, & dall'arte, come fu anticamente Babilonia⁴, la qual'hebbe sì alte, & grosse mura, & come oggidi si uede Padua; & di forma, come alquãto la Città di Pesaro. Dalla natura, & arte insieme, per forma, & materia; difficil cosa è di trouer luogo cõpiutamente forte; peroche oue il sito, per natura sarà tale di forma, non è facil cosa che la materia ui sia accompagnato, & per il contrario; e se questi haurà per natura, auerrà forse che dall'arte non possa riceuere il simigliante, come in molti casi manifestamẽte si ueda.....
-but, the fortification of our time is founded more in these instruments (i.e. artillery) -- as much in attack, as in defence.....Maximilian at the siege of Padua used them, according to which I have heard they passed through 24 feet of rampart, albeit it was new made...
- Places are strong through nature alone, or through human skill accompanying this; or without the benefit of such nature, (and) only through the art used; and every one of these three types of strength comes to be such under but two heads -- that is by the quantity of the material, and by its form. Those strong by nature are placed in mountains, lakes, marshes, or in the sea, or in heigh clefts....in any of which not only has nature given an appropriate form or material, but art has been conjoined to it as can be shown to whoever would wish to discuss their qualities. Of material and of art, as was anciently Babylon⁴, which had as high and massive walls as today is seen at Padua; and of form as somewhat the city of Pesaro. From nature and art together, through the form and the material -- it is difficult to find a place completely strong, because where the site by nature will be of such a form, it is not easy for the material to accompany it, and to the contrary; and if these will be had by nature it will have perhaps that it can not receive the like from art as in many such is clearly seen.....

1. The shots of the artillery.

2. FLORID (1611) gives "terraglio" = "terrapieno"

3. The elision gives Siena and Perugia in the mountains; Mantua in a lake as well as S. Leo on a height, and Ischia.

4. A favourite example.

5. Cf. Tartaglia's views. This echoes them of course but it is difficult to decide whether they are both quoting something that was commonly expressed in the business or whether Zanchi was following Tartaglia directly. Zanchi's claim above (p. 23) that nobody had given a proper demonstration of a true beginning in the art would seem to go against his knowing Tartaglia's remarks. But the clarity of the expression and the ideas expressed in comparison to some of Zanchi's distinctions such as between, treachery, force robbery and surprise, make it likely he was using an expressed version and hence probably Tartaglia's. On the other hand Zanchi's work was in m.s. before it was printed as is known from Ruscelli's letter (see above p. 31) so Zanchi's work could have been the earlier.

p.21....però fortificando è necessario non solo per esso sito governarsi, il qual talhora si ben la necessità del fabbricare ricercerebbe di poter gran corpo di genti così à piedi, come à cavallo per custodia del Regno, è d'altri presidij, & bisogni, tenerui; è fosse fronte, è passo, è per altri rispetti douessi esser grande, & quanto à se non lo comportasse; allora fa bisogno di trouar modo con l'arte di supplire al difetto della natura in esso....
 sommente, auuertir si deue che tutti i luoghi, i quali sono piccioli, & estremi sono deboli per cagione di non hauere campo da ritirarsi...però è da fuggire l'estremo della picciolezza, & alla mediocrità tener si deue....

...therefore it is necessary in fortifying not to be governed by the site alone, which sometimes it is very necessary in building to seek to be able to hold in it a great body either of foot or horse, to protect the kingdom, or other garrison, and necessities; or if it would be the frontier or a pass, or for other reasons ought to be large, and as much as if it will not suffer it, then it is necessary to find a way with art to make up for the faults of nature in this.... above all it ought to be noted that all the places which are small and extreme, are weak by reason of not having a field for retrenchment therefore extreme smallness ought to be shunned, and the mediocre held to....

p. 22. FRA tutti i particolari che si ricercano à luoghi per fare, che riescano forti, di uie¹ maggior'importanza di chiascun'altro è, che sieno di buone forme accomodati, le qualli alli loro siti conuenueuolmente rispondano; però anche se con ragione sopra quelli saranno introdotte, & secondo le occorrenti necessità ben'intese; sempre à nemici, che offenderli disegnassero, maggior difficoltà apporteranno, onde se per il contrario di non ragioneuoli, & male intesa si fabbricassero; come di triangolari, & quadrate & altre diuerso, che per lo piu hanno gli angoli, è tutti, è la maggiore parte non ottusi, & anco talhora acuti, a quali di necessità li Beluardi difformi, & acuti succedano, molto piu facile à nemici la uie dell'offendere si scuopre; ma perche il mostrare di ciascuna forma à parte quali sieno li difetti & uantaggi loro, seria cosa piu tosto tediosa, che utile à gli intendenti, come anco il discorrere sopra la diuersità di molti particolari siti, & loro conuenienti forme, non solo tediosissima, ma forse anco impos²

Amongst all the particulars that are looked for in places that they should prove strong, of much¹ greater importance than any other is that they should be suitable to a good form, to which their site conveniently answers. Because if with reason these will be introduced and following the required necessity, well directed, they will always cause the greatest difficulty to the enemy who designs to attack them. Whereas on the contrary if unreasonably and with bad intentions they should be made, as in the triangle and square and various others, which for the most have the angles, either altogether or in the majority not obtuse, and further sometimes acute, from which of necessity deformed and acute bastions arise, much more easily are the ways of attack discovered by the enemy. But because to show of every form its defective parts and its advantages would be something sooner tedious than useful to the listeners, as also discussion upon the diversity of many particular sites, and their convenient forms -- not only the most tedious, perhaps even impossible², thus reduced to brevity I will talk first

1. Taking "uie" = piu.

2. Tedious yes. But why impossible? A good classification to make this possible seems not an unreasonable thing to expect of Zanchi.

sibile, però riducendomi alla breuità, parlerò prima delle forme perfette, ò, a' quelle alquanto vicine, discorrendo in parte sopra le utilità, & comodi. suoi; dal che ancora che ragioneuolmente, parlando, fossero a tutti paesi i difetti delle altre; non resterò però a maggior chiarezza della cosa dimostrare uno esempio anco nelle quadrate, lequali sono le piu imperfette di quelle che sieno in uso di esser fabricate, però che le triangolari, & di due soli angoli,¹ come che imperfettissime sieno, quanto con minor numero di quelli² sono formate, non truouo, che da alcuno sieno mai stata usate, & però che questo corpo di mura si costituisce necessariamente in tre parti principali, & una meno alle difensione, però che piu nella quiete, che ne in rumori si opera, dico, di Beluardi, cortine & caualieri....

p. 24. LE FORME, che alla circolare figura piu s'auicinerranno da pratici, & giuditiosi soldati, & anco da gli architetti sopra tutte le altre sono ragioneuolmente lodate.....

p. 57. Delle conditioni che si richieggono al vero artefice delle fortezze.

of the perfect form or that somewhat near it, discussing in part its utility and handyness, from which also with reason talking, should be to all manifest the defects of others. I will not omit therefore, to the greatest clearness of the subject from showing as an example further in the square, which is the most imperfect of those that are commonly built, because the triangle and that of only two angles,¹ as being the most imperfect, in as much as those formed with less sides,² I do not find, that any have ever been used, and because this body of walls is necessarily made up of three main parts, and at least one to the defence, but that more in the quiet, than in the hubbub is done, I say (then) of the bastions, curtains and cavaliers.....

³The forms which to the figure of the circle most nearly approach, by practised and judicious soldiers, and by architects, are above all, with reason, praised.....⁴

Of the conditions that are required in the true art of fortification.

1. The form of two angles only seems impossible. But if it is remembered that the angles were the key points of the bastions, one might conceive of two bastions joined by a line. The idea is not then complete nonsense, only very close to it, for the bastions set out in terms of flanking fire in such a case would become so acute as to be lines themselves.

2. This passage become more and more obscure as it continues. "con minor numero di quelli", 'with less than these' seems to mean less than the triangle of one of two angles. What can that be? An isolated bastion? Then Zanchi seems to imply there is some practical difficulty about using this figure. The three principle parts are equally obscure, presumably sides, of which at least one is for defence. But what does that mean? The clause which seems to close this set of ideas, 'in the quiet, etc' may perhaps be meant to cover these sorts of difficulties by suggesting this is a very abstract type of discussion, with rather difficult theoretical problems requiring much discussion.

3. WHITEHORNE, P (1562) f. 15c, gives "The forme which unto the circular fatiò doth most resemble, of expert and skilful soldiers, is above all other with most reason praised."

4. For the usual reasons of obtuseness of the bastions, if sufficient can be employed with requisite length of curtains. There is a size factor implied here.

La principale, al mio giudicio, & di ciascuno, che l'intende è l'hauere le già dette regole, non solo per ragione intese, ma anco per esperienza altrui, ò sendo possibile, ancor propria, alle quali parti seruono la prôtezza, & uiuacità dello spirito, & l'uso de lungo della militia, l'uno quali dalla natura principalmente si riceue, l'altro dall'essercitatione, & propria deliberatione depēde.¹ Vi giouano poi, & in parte son necessarie la geometria, l'aritmica, per numerare, & diuider le misure delle fortezze, la prospettiuua ui ha parte, & per poter cōsiderare le distantie, & altezze, la manuale architettura de' modelli,² per far palese le idee del suo intelletto à ciascuno....

GIROLAMO RUSCELLI³

p. 60. QUESTA età nostra si come nelle scifre, nel nauigare, & in moltissime altre cose si uede di gran lunga auanzar d'antiche de' Romani, de' Greci, & d'ogni altra famosissima natione, così si uede chairamente auanzarle & fin qui tutte intorno al modo delle fortezze.

The main (thing is) to my judgment and that of everyone who understands it, is to have the already mentioned rules -- not only through reason itself, but also through the experience of others, or, it being possible also personally, in which parts serve the quickness and vivacity of the mind, and long military usage, the one of which is mainly received from nature, the other depending on practice and personal deliberation.¹ Subsequently in this there help and in part are necessary geometry and arithmetic, to number and divide the fortress; perspective has a part there to be able to consider distances and heights; the manual architecture of models² to make clear the idea of ones intellect to everyone.....

This era of ours, in figuring, in navigation and in many other things, sees a great long advance over the ancient Romans and Greeks, and over other famous nations, as is clearly seen advanced hitherto all that which concerns the method of fortification.

1. Zanchi's dicotomies here are not altogether clearly expressed. To the true method there is necessary, first reason and experience, experience being personal or by way of that of others. Now presumably we return to the original dicotomy between reason and experience, so that the former is supported by greatness and vivacity of mind, while the later depends on actual military practice; and equally the former is found in the person's nature, while the other on practising -- but then Zanchi adds -- and personal deliberation. He then seems to be seeing reason as having a separate role from practice and the discussions that go along with it. Geometry and arithmetic are then added in as useful tools, rather than being central to the rules, or method, and their reasons.

2. I.e. craftsmanship in model making.

3. See contents above p. 31.

GIACOMO LANTERI

Delle Fortezze Secondo Euclide (1st. ed. 1557)

Bibliography:¹ Venetia 1557; with Zanchi and Lupicini, Venetia 1601.

General description:² A fairly average production. 6" x 4½" text. (viii) + 95 pages. A number of small illustrations in the text all using the diagrammatic style of geometry. In dialogue form.

Contents:

p. (1): Title page: DVE DIALOGHI/ DI M. IACOMO DE'LANTERI/ DA PARATICO, BRESCIANO:/ NE I QUALI S'INTRODUCE MESSER/ Girolamo Catanio Nouarese, & messer Francesco Trevisi/ ingegnere Veronese, con un Gioiuno Bres-/ciano, a ragionare/ DEL MODO DI DISEGNARE LE/ piante delle fortezze secondo Euclide;/ ET DEL MODO DI COMPORRE I MODELLI,/ & torre in disegno le piante delle Città./ Con priuilegio dell'Illustrissimo/ Senato Veneto/ In Venetia appresso Vincenzo Valgarsi, & Baldassar/ Lonstatini MDLVII.

p. (iii/vi): Dedication to Marc'Antonio Moro.

p. (vii/viii): A i benigni lettori.

p. 1/42: Book I with no internal divisions. After a short introductory section about the use of geometry the first problem dealt with is the construction of the regular polygons. Next is given the construction of the trace of a bastion for the case of a pentagon (diagram p. 13). The construction of a stretched hexagon is then discussed. Then the fact that the angle of the point of the bastion is always less than the internal angle of the curtains, is proved (diagram p. 25). Next it is proved that the greater the number of sides the regular polygon has the better it is because the bastions are less pointed. The fact that the larger the size of the area fortified, the more angles it can have, is then discussed. Round bastions are next dealt with and it is shown that there must always be an area of dead ground by way of a Euclidian proof (diagrams p. 36 & 37).

p. 42/43: Introduction to the second book, addressed to Giovambattista Gavardo.

p. 44/93: Book II: Beginning with a general discussion of architecture and fortification the text then goes on to discuss the use of the magnetic compass in the taking of plans of sites, and the production of drawings to scale. An irregular trace is then discussed. There follows an analysis of the chain of a drawbridge and the rate of its raising, in terms of the geometry of the situation. The rest of the text involves discussion on the compass, a square fort, and general remarks about a bastion trace.

p. 94/95: Closing letter addressed to Olivero Conte d'Arco.

1. AYALA (1854) lists other editions of 1559 & 1583 not otherwise known.
2. Of the 1557 edition.

Delle Fortezze Secondo Euclide (1557): Texts

p. (iv).....mi risolsi di douer mandare . . . being resolved I ought to publish for
 in luce per publica vtilità¹ questi due the common good² these two dialogues of
 miei dialoghi, sotto il nome d'alcuno mine, under the name of some of my
 de'miei compatrioti gentil'huomini. la gentlemen compatriots, whereby is made
 sonda fatta vna diligente essaminatione, a careful examination, I thought no one
 à niuno pensai meglio conuenire questo better suited to this, than
 primo, che a V.S. sendo egli quasi vn you sir, it being almost a repetition
 ritratto di molte propositioni d'Euclide, of many propositions of Euclid, in the
 della lettura delle quali (come m'ha reading of which -- as Mr Girolamo
 certificato messer Girolamo catanio Cataneo of Piedmont has certified to
 Piedmontese) sò che vi pigliate non me -- I know you will take no little
 poco diletto; si como ancho nò cess- delight, as also because at no point
 ate punto di dar'opera à gli alti studi does it cease to involve the high study
 della Diuina philosopha.³ of divine philosophy.⁴

isp. (vii). Tutti coloro, che per il All those that in the past spent
 passato spesero il tempo in qualche the time in whatever honest study
 honesto studio, si sforzarono di giou- strove to give aid -- according to
 are (secondo il potere delle forze loro) the power of their strength -- to mort-
 à i mortali, onde da' posteri poi non als, whereby from posterity afterwards
 poco laude molti di loro conseguirono, no little praise many of them att-
 à i quali noi douemo insieme con que- ained, to whom we ought, together
 che doppo noi verranno confessare d' with those who will come after us, to
 essere non poco obligati. Al che confess to be no little obliged. Having
 hauendo io riguardo, grandissimo des- regard to this a great desire
 siderio mi venne (s'io potessi) di fare came to me -- if I could -- to do some
 alcuna operatione, dalla quale il mondo execution, from which the world could
 pigliasse qualche giouamento. Et rauol- take some benefit.³ And revolving in
 gendomi nella mente à quale di molti my mind to which of many studies I
 studi io mi douessi appigliare, per ought to apply myself, to put my desire
 mettere in esecutione il mio desiderio, into effect, the study of mathematics
 allo studio delle mathematiche diedi I laid upon as the most certain of all
 delle mani, come al più certo di tutti the others -- excepting that of sacred
 gli altri (eccetto quello delle sacre letters -- in which I being practised,
 littere), nel quale essercitandomi, thinking how I would be able by such to
 spensaua come io me ne potessi seruire, fulfil my aim, when it came to me
 per adimir' il mio pensiero; Quando vna that one of the most necessary things
 delle più necessarie cose del mondo mi in the world is the method to be kept
 si parò dauanti, cioè l'ordine⁴ che si in fortifying cities, in which -- for
 dee tenere in fortificare le città, the most -- the walls being saved from
 nelle quali (per il più) conseruate che the fury of the enemy its inhabitants
 siano le mura del fuoco de'nimici, sono

1. 'for the common good': this sort of statement needs generally to be taken not too literally. All the more so in Lanteri's case with his extremely abstract approach.

2. Quite why Lanteri thought "divine philosophy" was involved is not altogether clear. Perhaps he meant that being geometrical his work was a part of that divine activity known as philosophy.

3. Again this needs to be taken only loosely.

4. Cf. The 'orders' of Architecture.

altrési conseruati gli habitatori di are also preserved. Whereby I, seeing
 quelle. La onde vendendo lo quanto pochi hou few up to now have been those
 siano fin'ad hora stati coloro che di that of this have written, I set
 ciò habbino scritto, mi posi à scriuere myself to writing these two dialogues in
 questi due dialoghi, ne i quali potra which everyone can understand the way to
 ognuno imparare il modo di disegnare design the plan for the city, which it
 le piãte, così delle città che si vog- is wished to fortify, as well of those
 iliono fortificare, come di quelle che which are fortified, and the way also
 sono fortificate. & il modo altrési di of taking the plan with a compass; and
 motorle in disegno con bosoio; & di fab- of making models. And because all those
 ricare i modelli. Et perche tutti que' that write ought to take care to write
 che scriuono deono procurare di scriuere of things certain and not
 cose certe, & non false, lo perciò mi false, I am therefore forced
 sono sforzato di ridurre in questo mio in this brief treatise of mine to re-
 breue discorso tutte quelle propositi- hearse all those propositions of
 toni d'Euclide, che mi parvero dovermi Euclid that appeared to me as should
 conuenire, accioche quelli che legger- be suited, so that those who
 anno queste mie fatiche sappiano di will read this work of mine
 ritrouarui cose che certissime sono, should know how to discover what is
 così come la esperienza lo dimostra. God- most certain, similarly as experience
 steui adunque begnign lettori questi, showe it. Enjoy then kind reader these,
 fin che lo ui dia impressi quattro untill I give you printed four books
 libri d'architettura, i qual ui inseg- of architecture, which will teach you
 neranno a parte per parte il modo non bit by bit the means, not only of
 solo di sapere fortificare le città, knowing how to fortify a city, but of
 ma di saper ancho in quelle (occorrendo) knowing also when it occurs how to def-
 da'nimici difenderui. Et se da questa end against the enemy. And if from this
 mio scriuere ui uerra alcuno giouamento, writing of mine should come to you any
 rendetene gratie al sommo fattore di help, give thanks to the highest maker of
 tutte le cose, pregando la sua Diuina all things, praying the Diuine Iord,
 Maesta, che tanto d'intelletto, & d' that he has given me as much under-
 ingegno mi doni ch'io possa di bene in standing, and skill, that I can help
 meglio glouarui, & laude dell'altissimo you to the best, and praise his high-
 Nome suo, al quale sia sempre gloria, & est name, to which is always glory
 & honore.

p. 4...La perfetta cognitione di così ...the perfect knowledge of this beaut-
 bella arte può più tosto esser per- iful art can be more quickly perfected
 fatta, & chiara con lo studio hauete and clarified with the study you have
 detto, che con la esperienza della mentioned, than with experience of war,
 guerra, però che la scienza è quella because science is that which renders
 che il tutto rende chiaro con prova... everything clear with proof....

...Me lo non credo, che M. Girolamo ..But I do not believe, that Mr.
 habbi esperienza ne di guerra, ne di Girolamo has experience either of war,

1. There is something slightly ambiguous in the language here from the last 'al',
 as if experience might have been needed to conform the certainty of Lanteri's
 results. But the whole tenor of his work suggest that he meant rather the
 certainty of Euclid was a substitute for experience.
2. "lo studio delle mathematiche scienze", previously noted.

quel¹ che noi parliamo. à cui rispose il Conte Felix: come dite che non ha cognitione di questo? egli mi par pure d'hauer² istesso, ch'egli non solo intende & dichiara benissimo Euclid (il qual'è la chiave di queste scienze) ma che presso à ciò molto bene ragiona del disegnare piante di fortezza d'ogni maniera.^{2,3}

rep. 5. Diteci di gratis, per quale via si può egli render conto, così del disegnare le piante delle città, come del delle fortezze istesse?....egli fa di mestieri (à colui che di ciò vuole perfettamente esser'istrutto,) sapere le propositioni de i sei primi libri d'Euclide; perche per via di quelli si può d'ogni maniera di piante benissimo trattare.^{3,4}

rep. 7. Si che potete comprendere ch'egli fa di mestiero (per intendere le cose difficili) prima sapere le facili.⁵

p. 8.M. Girolamo, hauendo fatto vn lato d'vna pianta, ouero (vulgarmente parlando) vna cortina, come si debba procedere à far' il rimanente de i lati della pianta. oltre di ciò fatto il primo & secondo lato, vorrei sapere, come si possa fare che venghino tutti gli angoli simili: primo, fatto nella congiuntione de i due primi lati ò cortine.....⁶ Voi dite bene, che à farci da capo, & passando il tutto per ordine à poco à poco, si verra piu ordinatamente ad intendere il tutto. Et però quanto alla prima parte, credo che vi rammenti, che la prima petitione d'Euclidica⁷, che se gli conceda, che da vn punto ad vn'altro punto si possa tirare vna linea retta. Sappiate adunque

or of that¹ which we talk, to which replies Count Felix: How say you that he has no knowledge of this? He seems to me to have fully such, because he not only understands and discusses Euclid very well -- which is the key to these sciences -- but along with this reasons very well on designing a fortress in every manner.^{2,3}

Tell us please in what way can an account be given of the designing of the plan of the city, as of the fortress itself?....it is necessary -- for those who wish to be perfectly instructed -- to know the propositions of the first six books of Euclid because by this method can everything be best treated.^{3,4}

If you would understand what is necessary -- to understand the difficult things, first know the easy....⁵

....Mr. Girolamo, having made one side of a plan, or -- commonly speaking -- a curtain, how ought one to proceed in making the remaining sides of the plan, and further, having made the first and second sides, I would wish to know, how can it be done that all the angles come out similar to the first, made by the conjunction of the first two sides or curtains.....⁶ You say well, that brings it to a head, and passing methodically through the whole little by little the whole will be more with order understood. But for the first part I believe that you remember that the first petition⁷ of Euclid⁸ says that it is granted that from one point to another it is possible to draw a straight line. You should know then that the first

1. Of war and fortification and the like.

2. This dialogue described is the basic dialogue of the book which is put in "1542 ch'io habital ad Arco" (p. 3), Girolamo speaking.

3. These two passages give the standard defence of science against practice in this literature. Being able to handle things by way of Euclid was constantly assumed to be able to give valuable answers.

4. But see below p.47 on canoniers where the implication is quite against this.

5. This is with reference to starting with the first principles of Euclid.

6. Girolamo Cataneo, the protagonist of Lanteri's ideas.

7. This is the term generally use in the 16th. century. See

HILLINGSLEY (1570) in his translation of Euclid.

8. In Tartaglia's translation (1543), the sort of work one expects Lanteri to have known, the 1st. petition is given thus: "Andiandomech'l ce sia concesso che da qualunque ponto in qualunque pont. si possi condurre una linea retta".

che la prima linea che tirerete, nel voler disegnare vna pianta (delle cortine dico) sarà di necessità, che sia tirata per questa prima petitione; poi sia di bisogno (per la terza diffinitione del detto primo)¹ che sia terminata da due punti la detta prima linea; dall'vno de'quali, per la seconda petitione,² tirerete vn'altra linea retta non terminata, ma alquanto maggiore della prima; & da questa non terminata poi. ne taglierete vna parte eguale alla prima, per la terza propositione del primo.³ fatto ciò, hauerete due lati della vostra pianta equali l'vno all'altro, quali verranno à formare vn'angolo nel mezo di loro, quale poniamo caso, che si retta, voi piglierete il compasso, & nel punto doue terminera il secondo lato, vi formarete vn'angolo simile al primo, fatto nella congiuntione de'due primi lati, per la vigesima terza propositione del primo.⁴...tirerete il quarto lato .ad. quale si congiungerà col primo .ab. in punto .a. per essere la pianta quadrata; ma se fosse la pianta di maggior numero d'angoli, voi seguireste in questa maniera, per infino ch l'ultimo lato si congiungesse col primo, tal che hauerete al fine la vostra pianta di lati, & d'angoli equali, come vedete che è venuta la figura .abcd. di quattro lati, & di quattro angoli equali. F.⁵

Questo per quanto io veggio sia quadrato perfetto. G. Voi dite il vero, per la trentesima diffinitione del primo.⁶ Giul.¹⁰ Non si potrebbe egli più breuemente (se ben mi ricordo) fare vna figura ò pianta quadrata per la quarantesima sesta del

line which you will draw, in wishing to design a plan, of the curtain, I say, it will be necessary, that it is drawn by this first petition; then it is necessary -- by the 3rd. definition of the first (book of Euclid)¹ -- that the said straight line ends in two points, from one of which by the second petition² you draw another straight line without an end, but somewhat greater than the first, and on this not terminated line then you will cut a part equal to the first by the 3rd. proposition of the 1st. (book of Euclid).³ This done you will have two sides of your plan equal, one to the other, which form an angle between them, which we put the case,⁴ that it is right; (so) you will take the compass and in the point where the second line will end, you will form an angle similar to the first, made by the meeting of the first sides, by the 23rd. proposition of the 1st. (book of Euclid).⁵... (then) you will draw the 4th. side 'ad' which is joined to the 1st. 'ab' to create the square plan. But if the plan was of greater number of angles you should procede in this way, until the last side shall be joined to the first, such that you have in the end your plan of sides and angles equal, as you see happened in the figure 'abcd' of 4 equal sides and angles. F.⁶ This in as much I see (it) shall be a perfect square. G. You speak the truth by the 30th. definition of the 1st. (book of Euclid).⁷ Giul.¹⁰ Can not a square figure or plan be made more quickly by the 46th. of the first (book of

1. The 3rd. definition of the 1st. Bk. reads, *ibid*, "La linea retta è la breuissima estensione da uno ponto ad un'altro che riceue l'uno e l'altro di quelli nelle sue estremita."

2. The 2nd. petition, *ibid*. "Anchora adiamandamo che ci sia concesso che'l si possi alongare una retta linea terminata dirrettamente in continuo quanto ne pare."

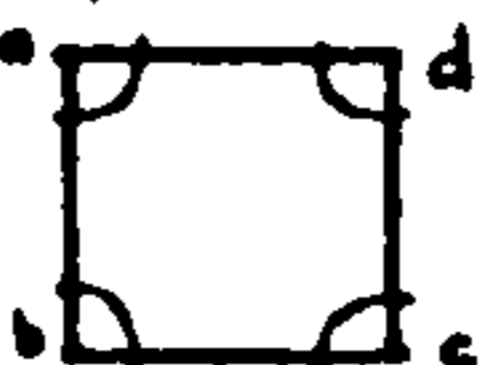
3. Proposition 3, *ibid*., "Proposte due linee rette ineguale, dalla piu longa di quelle possiamo tagliarne una parte eguale alla minore."

4. I.e. assume.

5. Proposition 23, *ibid*., "Data una linea retta, sopra un termine di quella, potemo designare un angolo rettilineo eguale à qualunque angolo rettilineo pposto."

6. The elision contains a long detailed instruction about drawing each side one after the other all equal and at right angles to the last.

7. Lanteri's diagram, p. 9,



The letters at the intersections of the curves and the straight lines, are omitted here.

8. Francesco Trevisi ingegnere Veronese, see title page, above p. 41.

9. This involves simply the definition of a square (in some traditions of numbering).

10. Giulio = un Giouene Bresciano, see title page above p. 41.

primo? G. Certo sì, ma perché noi supponemmo nel principio, che al primo angolo si douessero fare tutti gli altri eguali, per le regole ordinarie, perciò non mi curai di dirvi che la quarantesimasesta vi soddisfacesse, perciò che ella solamente serue à i quadrati, & non ad alcun'altro figura, à tal che se voi voleste disegnarne vna pianta di cinque angoli equilatera, & equiangolare, vi sia di bisogno procedere come vi dissi disopra, non volendovi seruire delle regole del quarto libro d'Euclide. Sì che per questo rispetto fu forse il mio ragionare alquanto più lungo, à vostra giudicio, che non faceua di bisogno, quale non potea però esser più breue, che si sia stato, douendd questa regola seruirvi in tutte le maniere di piante. Giul. Volendo adunque disegnare vna pianta di sette, ouer otto lati, & angoli, mi sia di mestiero procedere come m'hauete mostrato? G. Così a punto vi bisogna operare, non solo nelle piante di sette & d'otto lati, & angoli, ma in quelle altresì di noue, di diece, d'vndici, dodici, & sedici, et di quantivorette voi in infinito, & pochi & molti, come vi piacerà. Giul. Perché disopra vi senti ricordare il quarto d'Euclide, m'è venuto in mente (se bene mi si ramenta) che il detto quarto benissimo insegna à descriuere le figure di lati, & d'angoli eguali. G. Egli è vero, per via del circolo, voi le vi rammentate benissimo, per quel ch'io veggo, piacemi che il mio hauerleui lette, & il vostro hauermi vdito non sia in vano.

Euclid) -- if I remember well. G. Certainly, but because we supposed at the beginning that to the first angle all the other angles ought to be made equal, by a common rule, therefore I did not care to say to you that the 46th. could satisfy you, because this only serves the square and not any other figure, such that if you wished to design a plan of 5 equal sides and angles, you need to proceed as it was said above, not wishing to use the rules of the 4th. book of Euclid. If in this respect my discussion was perhaps somewhat longer, in your judgment, that could not, but be necessary not being able to be shorter, than has been done here, given that this rule ought to serve all manner of plans. Giul. Wishing then to design a plan of 7 or 8 sides and angles, I need to proceed as you have shown me? G. In this way you need to proceed not only in the plan of 7 or 8 sides and angles, but in the others of 9 or 10, 11, 12, and 16, and whatever you wish, to infinity, and smaller and greater as you will please. Giul. Because above you brought to mind the 4th. (book) of Euclid, it came to my mind -- if I well remember -- that the said 4th. (book) very well teaches to describe the figures of equal sides and angles. G. It is true by way of the circle -- you remember it very well -- by which I see pleasingly that you have understood me and heard me not in vain.

1. The 46th. proposition of book one gives two constructions for a square. The first involves raising two perpendiculars from the ends of a given line and equal to it. The second is more like Lanteri's construction. A perpendicular is raised from one end of the given line; and equal segment is cut off. But then a line parallel to the first line is drawn, and a segment equal to the first cut off from it to allow the 4th. side to be drawn. (In Tartaglia's version.)
2. Bk. IV of Euclid gives constructions for the square, pentagon, hexagon, and quindecagon. At the end of this book Tartaglia in his version noted "In questo loco, in la primo tradottione egli è stato aggiunto uno modo da diuidere vno angolo in tre parti eguali, & consequentemente a descriuere vna figura nonangolo equilatera & equiangola in vno dato cerchio, ma perché tal suo procedere non è demonstratio lo hauemo interlassato come cosa inutile."
3. "Describe", a very typical Euclidian usage as in 'describe a circle'. Not give an account of, but rather produce, set down.
4. Lit. 'read me'.

p. 14.v'habbiate dimenticato
 à dirci alcuna cosa sopra le
 cannoniere. G. Io non mi ricordo d'
 haverui promesso di dir sopra di ciò
 cosa alcuna, & se pure io vi haueggi
 promesso, non veggo come per via d'
 Euclid si possa nelle piante dar
 regola delle cannoniere sendo ciò
 appertinente più tosto à i modelli,
 che alle piante, nelle quali non si
 può dimostrare alcuna parte de gli
 interiori.¹

p. 23.di necessita bisogna che
 l'angolo d'vn beluardo, fatto sopra vn'
 angolo retto, venghi sempre minore
 dell'interiore, sopra del quale sarà
 formato, ò fabricato; la onde sendo
 fabricato sopra l'angolo retto, direi
 che ne diuenisse acuti.

20maggior parte di architetti
 di i nostri tempi..... procedendo
 al contrario de gli antichi
 eccellenti, studiano solo à
 disegnare piante senza numero, & à far
 25 modelli per via d'vna certa pratica
 lasciandosi à dietro la cognitione
 delle mathematiche scienze. la onde
 segue loro quel che ad alcun rozo huomo
 incontrerebbe, alle cui mani peruenisse
 30 qualche bella pietra ò margarita di
 grandissimo valore, il quale non bene
 cognoscendola, cola se la ponesse fra
 suoi boscherrecci arnesi, oprandola à
 qualche suo seruigio vilmente, & non
 35 come farebbe vn valente gioielliere,
 che cognoscendo il valore di quella,
 con l'ingegno suo l'adornerebbe di
 maniera, che più sarebbe stimata, che
 non ne cauerebbe in mill'anni colui che
 40 non bene se ne sapesse seruire. Chi dub-
 itera, che nõ facciano il simile questi
 della bellissima arte che così strap-
 azzano, che apparando solo la pratica
 (come vi ho detto lasciano da parte lo
 45 studio delle mathematiche, tanto ad
 ogni conditione humana necessarie.....

p. 27. Oltre di ciò (come vogliono i
 filosofi) era di mestiero, che il mondo
 hauesse vna forma simile al mndo arch-

You have forgotten
 to say something
 about the casemates. G. I do not rem-
 ember having promised you to talk on
 any such thing, and if yet I had prom-
 ised I do not see how it is possible
 by way of Euclid in the plan, to arrange
 the casemates, this belonging sooner
 to models than plans, in which it is
 not possible to show any parts of the
 interior.¹

....of necessity the angle of a bastion
 made upon a right angle always comes
 less than the interior (angle) upon
 which it will be formed or constructed
 whereby being made upon a right angle
 I say that it becomes acute.

....(the) greater part of the arch-
 itects of our time....proceeding
 oppositely to the ancients ex-
 perts, attempt only to design plans
 without number, and to make models,
 by way of a particular practice, leav-
 ing aside the knowledge of the math-
 ematical sciences whereby it happens to
 them like it occurs with any rough
 man into whose hands comes some
 beautiful stone or pearl of great value,
 which he does not properly understand,
 so that he puts it among his crude
 instruments, working it to his own
 detriment, and not as would do a good
 jeweller who knows its value and who
 with his skill would adorn it in
 such wise that it will be more val-
 uable, which they could not achieve
 in a thousand years by those who do
 not know well how to achieve it. Who
 will doubt that those will not do
 likewise to the fine art. which thus
 they mistreat, that learn only
 practice, as I have said to you, leav-
 ing aside the study of mathematica so
 much to every human condition necessary.

Besides which -- as the Philosophers
 would have it -- it was necessary
 that the world should have a form like

1. Cf. above p. 44, l. 10/11. Yet the casemates were a critical part of the type of fortification design Lanteri was discussing. Consider in comparison also, the representational techniques of Bachot to do what Lanteri wanted here, without models. Lanteri presumably knew no such techniques.

etipo, quale era la idea della diuina sapientia, prima che questo creasse che noi vediamo...La onde dico che (al parer mio) tutte le forttezze, o scittà che più s'auicianauo a questa forma nel recinto delle muraglie loro siano più perfettamente forti, che quelle che le si discostano, come e la quadrangolare....sopra de'quali (per le dimostrazioni già datteui) è di necessità che gli angoli de' baluardi venghino acuti, & per consequente deboli.

p. 48. Giul.vorreste voi forse, che i nobili essercitassero quest'arte manualmente? F. Sò ben'io, che voi non m'hauete per huomo di così poco discorso, che possiate credere ch'io vollesse, ch'eglino si essercitassero a prezzo, ouera che si ponessero a fabricare per se medesimi le case. Anzi questo sarebbe molto da biasimare.

....F. Anzi vi dico, che con ragione io consiglierei tutti i virtuosi ad hauere di questa (per via di scienza non di pratica) qualche cognitione; perche così sarebbero sforzati ad impararne molte altre, sendo che quella, non si più perfettamente hauere così per se sola....Vitruuio...vno che fosse perfetto architetto, potrebbe ancho direi, ch'egli non solo fosse buono humanista, ma filosofo, medico, & astrologo. Ma lasciamo pure; che à tutte queste non si voglia dar'opera, attendasi almeno à vno sola....studiar almeno i principij di filosofia, per la quale l'huomo viene in cognitione della grandezza dell'opere miracolose de Iddio ottimo massimo fabricate...lo studio delle buone arti non è cosa da huomini volgari...l'architettura può dopo l'agricoltura ottenere il primo luogo.

the archetypal world, which was an idea of the divine wisdom, before this created what we see....whereby I say that -- it appears to me -- all the fortresses or cities that most approach this form in the enceinte of their walls are more perfectly strong than those that are distant from it, as is the square....about which -- by the demonstrations already given you -- it is necessary that the angles of the bastions occur acute and in consequence weak.

Guil. ...would you perhaps, that the nobles should practise these arts with their hands. F. I know well, that you do not have me as a man of such little talk, that you would believe that I would wish, that they ought to practise for pay, or that they are themselves put to constructing houses. Rather this would be very blameworthy

....F. Rather I say to you that with reason I council all the virtuosi to have in this (by way of science and not by practice) some understanding because thus they will be forced to learn much else, it being the case that one can not perfectly have this (knowledge) on its own....(as) Vitruvius (says).. one who would be a perfect architect, it can also be said that not only should he be a good humanist, but philosopher, physician and astronomer. But finally, that all those who would not wish to do the work, to attend at least to one single (area)...to study at least the foundations of philosophy, by which man comes to know the greatness of the miraculous works built by God the very greatest....the study of the good arts is not a thing of base men....architecture after agriculture can obtain the first place.

1. That is of the circle.
2. This rather Platonic, or perhaps more strictly neo-Platonic approach seems to support the approach of some writers. But noticeably this rather general attitude is quickly shifted to the common and very mundane point about acutely pointed bastions being too weak.
3. Architecture.
4. 'humanista' = humanist, one who studies rather 'belles lettres' than sciences and philosophy.
5. BARBIERI (1961) in this context pointed out some rather conflicting strands in Lanteri's ideas. He described Lanteri as "aristocrato e spirito mattinato", who emphasised the traditional values of the aristocracy, insisting for example that their sumptuous palaces would not be fitting residences for merchants, and emphasised the value of agriculture in this context. While on the other hand Lanteri argued against those who suggested trade was not an honourable occupation, and insisted that it ought to be practised more by those of high estate. Views which were wholly consistent with Lanteri's stance in fortification.

p. 50.che si faccia vn breue discorso, di quanti gentilhuomini conosciamo in questa città, che si dilettono delle scienze, ouera d'alcuna particolare virtù, per la quale meritino esser chiamati di quei che nelle operationi, o costumi volgari tutto di non se rauuolgono.¹

...(I would) that is made a brief discourse of how many gentlemen we know in this city, that delight in the sciences, or of any particular virtue by which they merit to be named to those who do not apply themselves in everything to labour or common practices.¹

p. 53. Ma fù vostro argomento di voler prouare, se era possibile, à far vn' architetto senza gli ordini, che vi si ricercano. Come sarebbe à dir se si volesse fare vn Vescouo senza mitra, ouero vn frate senza scapulare. Guil. Non lo vi dissi à cotal'effetto certo, ma solo perche mi pareo, che fosse à bastanza il saper disegnare. Perche mi credei che con questo senza altra scienza, potesse l'huomo disegnare così vna pianta di città, come ogni altra cosa.³

But was your argument to wish to prove, if it were possible, to make an architect without the orders, which are required there. As if to say that one would make a bishop without a mitre, or a monk without a cowl. Guil. I did not say to you to this effect with certainty, but only because it seems to me, that it² would be sufficient to know how to design. Because I believed that with this (i.e. mathematics), without any other science, can a man design the plan of a city, as any other thing.³

Fortificationi di terra (1st. ed. 1559)

Bibliography: Vinegia 1559; with Zanchi & Lupicini Venetia 1601; Latin version Venetiis 1563 De modo substruendi terrena munimenta; and Venetiis 1571

De subtilitate ac stratagemate utenda in rebus bellicis; which is the same text.

General description:⁴ 6½" x 4" text, marginal notes. (ii) + 16 + 114 pages. Some large pullout illustrations.

Contents:

p. (i): Title page: DVO LIBRI/ DI M. GIACOMO LANTERI DI PARATILO DA BRESCIA./ DEL MODO DI FARE LE FORTIFICATIONI/ di terra intorno alle Città, & alle Castella/ per fortificarle./ Et di fare così i Forti in campagna per gli alloggiamenti de gli/ esserciti; come anco per andar sotto ad una Terra, & di fare i Ripari nelle batterie./ IN VINEGIA, APPRESSO BOLOGNINO ZALTIERI./ CON PRIVILEGIO DEL SENATO VENITIANO,/ ET DEL RE CHRISTIANISSIMO, PER ANNI X.

p. 1/3: Dedication "Allo Illustriss. et Eccellentiss. Signore, il Signor Don Alfonso de Este, Principe di Ferrera". Dated Venice 2nd. October '59.

p. 4: A i lettori.

p. 5/6: List of errors.

p. 7/26: Alphabetical list of contents.

p. 1/27: Book I:

p. 1/6: Promeo. Cap. I/II: Introductory discussion. Sites.

1. This refers to a passage that is to appear at the end of the book and which is not given at this point.

2. That is knowledge of mathematics.

3. This very radical sentiment, expressing a belief in the possibility of designing in architecture without the orders, which were such a part of that activity of the time, and by way of mathematics alone -- which was good enough to design anything, was in fact put very tentatively. It is only given as a belief and not as something certain. It is also put in the mouth of Giulio who can be taken here as a rather over impetuous youth. Yet for all that the sentiment seems to have been accepted by Lanteri and it is not set up to be knocked down as ridiculous, but rather for the reader to ponder after another repetition of the value of certainty that is got from mathematics.

4. Of the 1st. edition.

p. 6/7: Cap. III: "Come si debbiano multiplicare gli angoli, il che fatto con ragione, rende la forma più perfette".

p. 7/23: Cap. IIII/VIII: Discussion of various parts of the fortress: Bastions, the fosse, counterscarpe, etc.

p. 24/66: Cap. VIIII/XXV: Most of this section is concerned with materials: earth and clay for banks, stakes and branches for reinforcement, foundations, and so on.

p. 67/72: New title page and promeo.

p. 73/109: Book II:

p. 71/82: Cap. I/V: Setting out of the pointed bastion, etc.

p. 83/109: Mostly practical details though some general points are discussed. Cap. XI. p. 92/4 gives an algorithm for setting out the regular polygons.

p. 110/113: Dedication to Horatio Toscanella, Venice 10th. July 1559.

Colophon: Stampato in Vinegia per Francesco Marcolini M.D.LVIII.

Fortificazione di terra (1559): Texts

p. 1. ¹NIVNA cose è più necessaria, e più expediente al soldato tra le molte che gli sonno & ispedienti & necessarie, che l'intendere l'ordine delle fortificationi; et per me reputo, che un' essercito, il quale nō habbia almeno i capi, che siano di ciò benissimo intellegēti, deggia sempre essere di gran lunga inferiore & piu infelice....

Nothing is more necessary and more convenient to a soldier among the many that are both expedient and necessary, than to understand the rules of fortifications; and to my opinion an army that does not have at least the leaders, in this of the best informed must always be a great way inferior and unhappier.....

10 p. 3. LA PRIMO cosa, che à colui che si uole dilettere delle fortificationi, fa mestiero; è la cognitione delle forme, la quale non si puo in uero perfettamente possedere, senza la
15 Geometria, il perche à molti, che ne fanno professione, ciò si mostra, & è difficile; Però in questa cognitione douerà il soldato sopra tutto essercitarsi, & se non potrà per uia della
20 Geometria, douer allo fare col lungo praticare, e spesso con persone, che di questo soggetto siano bene intelligenti, & da se stesso in quel mentre che gli ne uerrà l'occasione, douerà
25 essercitare il proprio intelletto, discorrendo fra se medesimo, percioche (come dice Vitruuio) tutta l'Architettura nasce de fabrica, & discorso.²

The first thing, to those who wish to delight in fortification, that is necessary, is the knowledge of form, which cannot truly be perfectly possessed without Geometry, because to many who make a profession of it, such is shown, and it is difficult. Therefore in this knowledge the soldier ought to be practised in above all, and if it is not possible by way of Geometry, it ought to be done with long practice, spent with persons who in this subject are of good understanding, and in himself in this, whilst there would be the occasion he ought to practise his personal understanding, arguing within himself, because -- as Vitruvius says -- all architecture originates from construction and discourse.

1. Of the main pagination.

2. "Architectura est scientia pluribus disciplinis, & uarijs eruditionibus ornata, cuius iudicio propantur omnia quae ab caeteris artibus perficiuntur opera. Ed nascitur ex fabrica, & ratiocinatione." VITRUVIUS (1522) Bk. I, Cap. I, opening passage. According to GRANGER (1934) this traditional reading is in error. But this is the way it was read in the renaissance. See also Bk. I Cap. I, Sect. 15, "ex duabus rebus singulas artes esse compositas. ex opere, et eius ratiocinatione." on architecture in general again. (1522) f. 9a/b.

p. 93.come partendo sei angoli retti compresi dal pentagono, ne viene fuori uno et un quinto, & ciascun'angolo del pentagono contiene un angolo retto, & un quinto d'un'angolo retto. Per tanto hauendo fatto le due line, AB, & AC, l'angolo retto, BAC, ui si aggiungerà una quinta parte del detto angolo, BAC, e si formerà in qual modo l'angolo d'un pentagono giusto.

.....as, dividing six right angles contained in the pentagon, there comes out one and a fifth, and every angle of the pentagon contains a right angle and a fifth of a right angle. In as much as having made the two lines 'AB' and 'AC' at right angles, you add one fifth part of the said angle 'BAC' and in this way is found the angle of the true pentagon.

GIROLAMO CATANEO

Rote Perpetue (1562)³

Title page: ROTE PERPETVE, / PER LE QUALI SI PUO' CON QUAL NVNERO DI DVE DADI / SI VOGLIA, OVERO CON DUE DADI / secondo l'horologio d'Italia ritrouar quando si fa la/Luna: le Feste mobile.....Di M. Girolamo Lataneo Nouarese delle arti / Matematiche professore.

Colophon: In Bressa Per Ludovico de Sabbie M D LXII.

Description: Calenderical work for finding phases of the moon, dates of religious festivals, etc. Presented in the form of circular table in $7\frac{1}{2}$ " x $7\frac{1}{2}$ " squares. (ii) + 29 folios.⁴

A formare una giustissime battaglia (1st. ed. 1563)

Bibliography: Brescia 1563; Brescia 1567⁵; it also appeared as part of the same author's Dell' Arte Militaire from 1571 on; an English version appeared London 1574; London 1588.

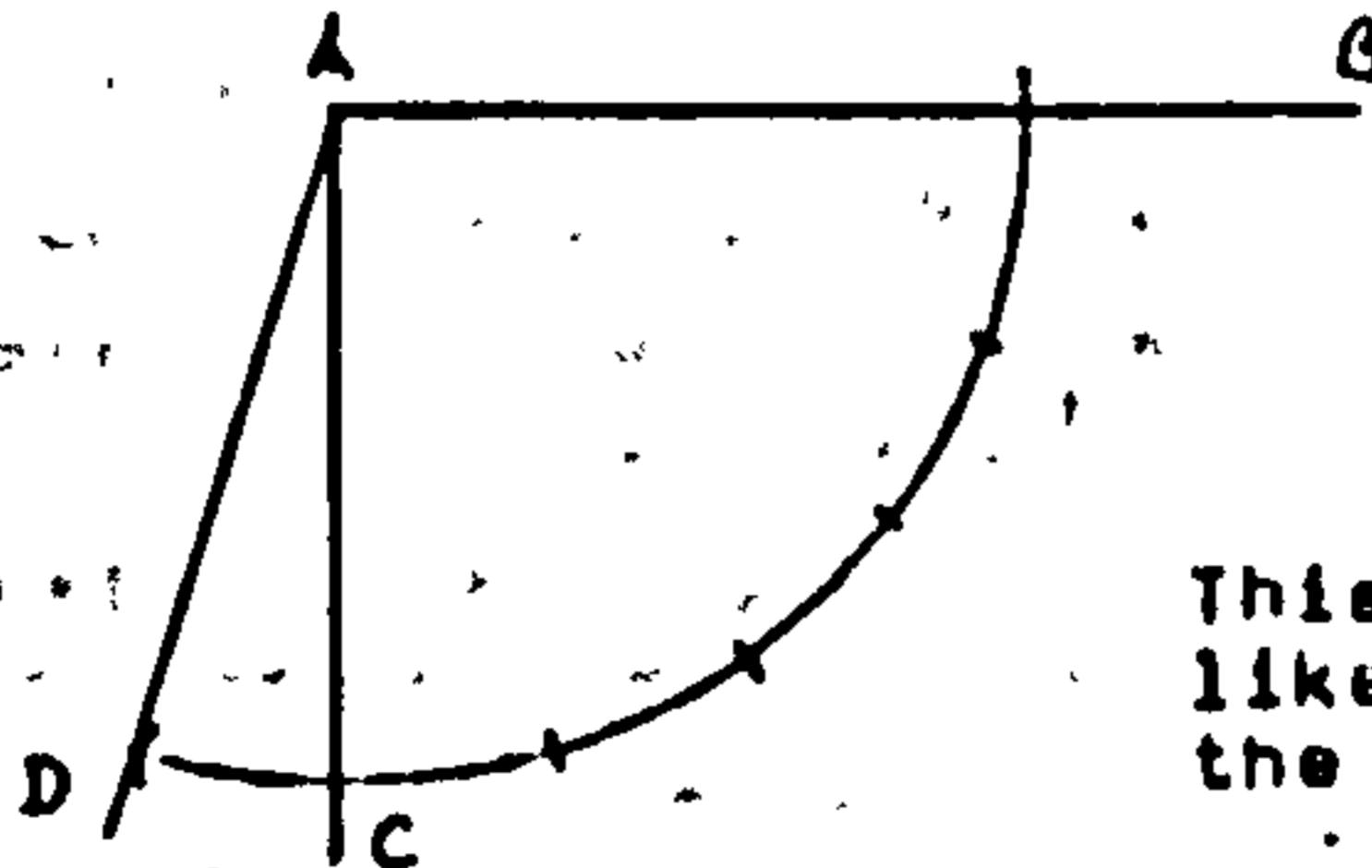
Description:⁶ A small book 3 " x $4\frac{1}{2}$ " text. (vi) + 38 folios, $23\frac{1}{2}$ of tables.⁷

Title page: TAVOLE BREVISSIME / PER SAPERE CON PRESTENZA / quante file uanno a formare una / giustissime battaglia....

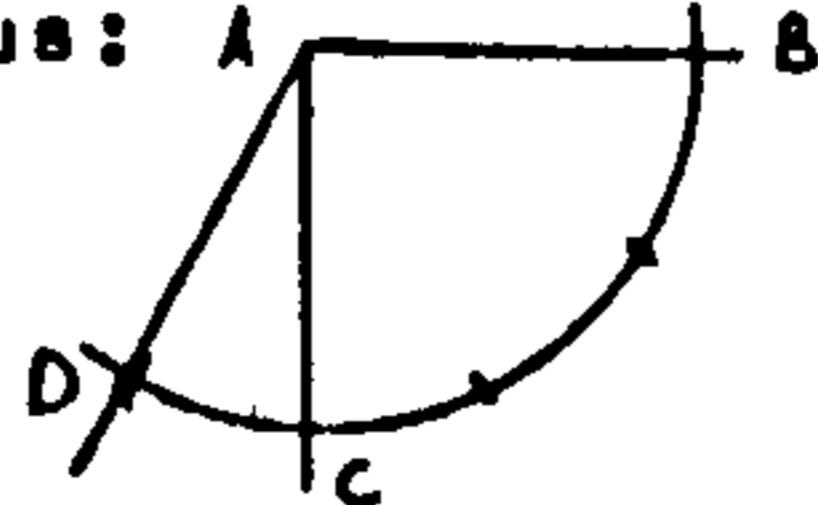
Colophon: In Brescia Apresso Ludouico di Sabbi M.D.LXIII.

1. Lanteri had explained just previously (p. 92) "che tutte le figure rettilinee di lati, & d'angoli eguali, contengono in se due volte tanti angoli retti, in quanti triangoli elleno si ponno diuidere, cioè pel mæco numero de'triangoli..."

2.



This is what Lanteri's diagram should have looked like. The one given in the book is actually for the hexagon, thus:



3. No other edition known.
 4. Dedication dated 8 Sept. 1562.
 5. RICCARDI (1893).
 6. Of the 1st. edition, dedication dated Brescia 5 July 1563.
 7. These tables are elaborate listings of how particular numbers of men, from 100 to 22,600, by 50s up to 1000 and by 100s thereafter, may be arrayed. They rather dominate the work.

A formare una giustissime battaglia (1563): Texts

f. (iia). Per laqual cosa à tanto bisogno desiderando io soccorrere, mi son posto à breuemente dar modo, come tosto si possa ridurlo in battaglia; & quella tosto armare, così di corsaletti, come di Archibugieri, et caualleria. Affine che tutto quello, che io per lo spatia di trenta & piu anni ho da prudenti Capitani osseruato, et con la sperienza della persona propria, così alla guerra, come nelle discipline mathematiche imparato, in poco tēpo ogni mediocre ingegno comprender possa: & da qui conosca, come in così fatte occorrenze, per lo piu con l'ingegno, che con la forza à l'impeto del nimico ualorsamente si resista.

Wherefor I have taken vpon mee, being desirous to helpe at so great a neede, to shew briefly the way howe it maye quickliye bee brought into a maine battaile, and how readely to arme the saide battaile aswell with Corslettes, as harkabuzers, and horsemen. To the ende that euery meane wit, may vnderstande all that, which I, by the space of thirtie yeeres and more, have obserued from wise Capitaines, proued by experience in person, and learned aswell by the warres, as by the Mathimaticall disciplines: Whereby eche one may knowe how at neede, valiantly to resist the vnset of the enemies, and that for the most times, not so much by force as by policie.

Opera Nuova de Fortificare (1st. ed. 1564) [2], [3], [4]

Bibliography: Brescia 1564; Brescia 1567; with other material under the title of Dell' arte militare Brescia 1571; Brescia 1608*; French translation, without the gunnery instruction Lyon 1574; Lyon 1593; Lyon 1600*; Latin version 1600*.

General description: Pleasantly produced work. 6" x 4" text. (vi) + 93 folios. Good quality illustrations, some of a pull out type.

Contents:

f. (1a): Title page: OPERA NUOVA/ DI FORTIFICARE, OFFENDERE/ ET DIFENDERE; ET FAR GLI ALLOGGIAMENTI CAMPALI, / secondo l'uso di guerra. / AGGIONTUVI NEL FINE, / VN TRATTATO/ de gli'essamini de' Bombardieri, & di far/ fuochi arteficiati. / COSA MOLTA VTILE, ET DILETTEVOLE. / DI GIROLAMO CATANEO NOVARESE. / IN BRESCIA, / Apresso Gio: Battista Bozola M.D.LXIII.

f. (iia/va): Table of contents.

f. (vb/via): List of errors.

f. (vib): Lines giving different measures, and a graphical indication of the weight of a ball from its diameter.

f. 1a/b: A I Lettori.

f. 2a/b: Avvertimenti intorno alla presente opera.

f. 3a/14a: Cap. I: Exposition of elementary geometrical constructions.

f. 14b/19a: Cap. II: The setting out of the bastion by referedce to flanking fire.

f. 19a/31a: do. : Foundations of a bastion.

f. 31b/46b: do. : Mainly the internal construction of a bastion, with some attention to the curtain.

-
1. From the English edition of 1574.
 2. RICCARDI (1893)
 3. Under the title Le Capitaine.
 4. Of the first edition.

- f. 47a/50b: Cap. III/V: Defence of a fortress.
 f. 51a/54b: Cap. VI: Attack on a fortress.
 f. 55a/64b: Cap. VII: Defence of a fortress with many nice two page illustrations of methods of attack and the relevant response to it.
 f. 65a/70a: Cap. VIII: Field fortifications.
 f. 70b/71a: Cap. IX: To dislodge an enemy.
 f. 71b/73a: "Avvertimenti, et Essamine intorno a Bombardieri, & fuochi arteficiate".
 f. 73b/83b: Essamine di Bombardierie -- elementary hints on gunnery.
 f. 84a/93a: Powder, grenades, incendiary devices.
 Colophon: In Brescia, Apresso Lodouico di Sabbio. MDLXIII.

Opera Nuova de Fortificare. (1564): Texts

f. 1a. PERCHE con l'ingegno, qual egli si sia, donatomi dalla bonatà d'Iddio, niuna cosa piu uolontieri procure di fare, che di essere con gratia de gli amici, & Signori miei conosciuto per huomo piu tosto desideroso in uia uoce con le discipline matematiche giouar altrui,¹ che dando alla stampa esser tenuto per troppo audace, & presuntuoso; in publishing², for a good space of time I have not been able to be convinced to publish this my treatise on the fortification of fortresses and their attack and defence....

f. 2a. NON è dubbio alcuno, che fra le operationi, che fanno i Prencipi, per la conseruatione di gli stati loro, che le fortificationi delle Città, & delle Castella, possono essere connumerate fra le principali, et impertanti, che essi facciano; hauendo à dipendere da quelle in parte la saluezza de populi, e stati loro. Et come che intorno à ciò molte considerations si asconuengano, per quel poco di sapere, che mi concedono le matematiche discipline, & per quella isperienza, che io ho per lungo tempo³ acquistata ne parlerò piu particolarmente, che per me sia possibile; non facendo mentione d'i molti, & accorti auisi di coloro, che thereof, in detail as far as it is possible to me, not making mention of the many and wise advices of those

1. This is in accord with Lanteri's picture of Cataneo's teaching from a mathematical base with the Count of Arco in 1542. See above p. 44, n. 2.

2. Lit. 'giving to the press'.

3. "Estates" rather than "estates" because below he writes of the "peoples' estates".

4. Of at least 30 years by the indications of the last noted work. See above p. 52.

dell'edificare delle Città, & delle molte conditioni, che intorno alla bontà dell'aere, dell'acqua, del terreno, & del resto s'appartengono di sapere. Delle quali cose per essere state copiosamente, & ben trattate da loro, mi par cosa vana il ragionare. Et tanto più perche l'intention mia è stata di parlare solamente delle fortificationi, della qualità delle machine à questo negotio appartenenti, secondo il costume di tempi nostri. Dico adunque, che quello, che ha nell'animo di fortificare una Città, o altro luogo, primieramente debbe hauer riguardo al sito, perche tale si ellegga, che bisognando esser frontiera à nemici così in difendersi, come in offendere altrui...

(other writers), which in the building of cities and the many conditions that concern the goodness of the air, of the water and the land, and the rest, belong to knowledge (here). Which things have been well and in detail treated by them, it seems to me a vain thing to discuss. And as much more because it being my intention to talk only of fortifications, and the characteristics of the machines belonging to this business, according to the custom of our times. I say then, that one that has in mind to fortify a city or other place, firstly he ought to have regard to the site, because such is chosen needing to be a frontier to the enemy in defence, as in attacking others...

20...egli sarebbe molto meglio il far del tutto una nuova fortezza, ouero un nuovo riparo in buon sito posto, che cōseruare quei luoghi mal aggiati, et pericolosi....²

...it would be much better to make wholly a new fortress, or a new repair in a well placed site, than to conserve such places cursed and dangerous....²

3a. Douendo io mostrar' il modo di far le piante, & le fabriche delle Fortezze, con gli Alloggiamenti di Campagna, & altre cose, che all'arte militare appartengono, & hauendo bisogno d'alcune operationi Geometriche, le quali molte volte occorrono nel uoler fare le predette cose, andarò breuemente dichiarando quelle, che al proposito mi pareranno esser più necessarie.

It being necessary that I show the means of making plans, and the construction of the fortress, with the camps of the field, and other things, which belong to the military art, and having need of some geometrical operations, which occur many times, in wishing to make the above said things, I proceed briefly to discuss those, which to the business seem to me more necessary.

f. 71b. ...necessario intendersi di poluere; d'Arteglia; di fuochi artificiali; & de Bombardieri; come cose senza le quali la militia del tempo d'hoggi sarebbe di niun valore;

...(what is) necessary to be understood of powder; artillery; of artificial fire; and of Bombardiers; as things without which soldiering today would be of no value, I have

1. I.e. those other writers implied above. Presumably-Vitruvius-and his renaissance commentators, like Pietro Cataneo, would have formed a good part of the people Girolamo was thinking of here.
 2. By not being suitable yet having a castle or the like which the sovereign wishes to preserve, for example.
 3. From the "Essamine intorno a bombardieri".

ho ridotto in brieui, & utilissimi auuertimenti quanto intorno a questo negotio per esperienze propria, & per auso di alcuni esperienti miei amici me è paruto esser bisogno.

(1571) edition

f. 16a.¹ Queste regole di dissegnare fortezze, ouera forti; è necessario di sapergli ben dissegnare sopra carta, con le sue misure; & ancor mettergli in modello, per poterli mostrare à piu pareri...

brought into brief and most useful notices as much concerning this business, by personal experience and through the advice of some of my expert friends what appears to me to be necessary.

(In) this method of design of fortresses or forts, it is necessary to know well how to design them on paper with their measures and also to model them to be able to show them more clearly....

Nuovo Ragionamento (1571)²

General description: (iv) + 35 folios. 6" x 4" text. A clearly produced work with many diagrams in the text and some on pull out sheets. Dialogue form.

Contents:

f. (ia): Title page: NUOVO/ RAGIONAMENTO/ DEL FABRICARE LE/ FORTEZZE;/ SI PER PRATTICA, COME/ PER THEORICA;/ Due diffusamente si mostra tutto quello che à tal scientia si appartiene./ DI GIROLAMO CATANEO/ NOVARESE./ IN BRESCIA,/ APPRESSO GIO: FRANCESCO, ET PIETRU MARIA,/ FRATELLI DE' MARCHETTI. M.D.LXXI.

f. (iia/iiia): Dedication to "il Signor Conto Girolamo di Lodrone; signore, et patron mio sempre osseruandissimo". Dated Brescia 21 June 1571.

f. (iva): Table of errors.

f. (ivb): Dedicatory verseto the dedicatee.

f. 1a/2a: A' lettori.

f. 2a/35b: The main body of the text divided into 34 questions of a fairly elementary sort concerned mainly with rudimentary geometrical constructions for fortification traces. The first 4 folios for example, questions 1 to 6, are concerned with the angle of the bastion, and pretty well all that ensues is an instruction on how to replicate a given angle.

Nuovo Ragionamento: (1571): Texts

f. 1alo Illustre Signor Cavalier, Guilio Foresto, huomo che hebbe, (oltre la gran cognitione di lettere recõdite & politissime) grauissima & singlar eloquenza, atta ad esprimere con grandissima facilità, & dolcezza ogni sorte di dottrina, & di scienza, de quali

....the illustrious Signor cavalier Guilio Foresto, a man that had -- besides great knowledge of letters, recondite and most polished -- weighty and particular eloquence, suited to express with the greatest ease and sweetness every sort of doctrine and

1. This passage does not occur in the first edition.

2. Only edition noted. It formed Bk. II of Dell'Arte Militare (1584), and later editions.

egli era ornatissimo; era intendentissimo de le cose di Aristotile, & di Platone; e pareua l'anima del nostra grand'Euclide, cosi bene dichiaraua le secrete dottrine¹ di questo gran matematico; & di questo si seruiua egli, si in molte cose, ma specialmentenelle cose appartenenti à la guerre, à la quale era per natura inclinatissimo.

science, with which he was much adorned; he was the most understanding of the topics of Aristotle and Plato, and seemed the spirit of our great Euclid, thus discussed truly the secret doctrines¹ of this great mathematician, and by this was served in many things, but especially in what belongs to war, to which he was by nature much inclined.

Opera del Misure (1st. ed. 1572)

Bibliography:² Brescia 1572; Brescia 1582*³; Brescia 1584; Brescia 1589*⁵; Brescia 1608*³; Brescia 1682*³ (two editions); Brescia by Policroto Turlini, s.d.⁶

General description: 6" x 4" text. (iv) + 56 + (ii) + 64 folios in 2 books. A well produced book with a text full of diagrams, calculations and tables, but generally of a pretty elementary level often simply being concerned to show how to work out the relevant calculations. The second part with a separate title page was mainly concerned with volumes, while the first considered areas.

Title Page: OPERA/ DEL MISURARE/ DI M. CIRULANO/ CATANEO NOVARESE/ LIBRI II/ NE PRIMO S'INSEGNA A/ Misurar, & partir'/ i Campi,/ NEL SECONDO A'MISVRAR LE MVRAGLIE,/ imbottar, Grani, Vini, Fieni, & Strami; col leueller/ l'Acque, & altre cose necessarie a gli Agrimensori.

Colophon: In Brescia, appresso Vincenzo Sabbio; Ad instantia di Francesco, & Piet: Maria di Marchetti, Fratelli. M.D.LXXII.⁷

Opera del misure (1572):Texts

of. 2a. IN TUTTE le scienze, & arti liberali, le quali s'insegnano con dritto ordine, inanzi che si vāghi a trattare le cose le quali pertēgono al soggetto loro, è ben fatto che prima s'insegnino i principi d'esse. Conciosia che da quelle dipendono tutte l'altre cose; & sopra questi, come ne'fondamenti si drizza tutto il rimanente; E contenendosi i principij in se medesimi, & la forza di tutte l'altre cose, lequali s'insegnano doppo loro, è necessario che nel porre & stabilire i principij, si ponga diligente fatica, accioche stabiliti, & ben collocati piu facilmente l'altre cose s'intendino. Hora volendo io trattare della Geometria

In all the sciences and liberal arts which are taught with just method, before one comes to treat of the things belonging to the subject, it is well done that first its principles are taught, because on these depend all the other things; and upon these as foundation all the rest is erected, and being contained in the principles, themselves and the force of all the other things, which are after them taught, it is necessary that into the setting out and establishing of the principles, is put diligent labour, so that established, and properly assembled the other things are more easily understood. Now wishing to deal with

1. Euclid's secret doctrines? Possibly, merely closed, hidden, i.e. just difficult.
2. The same work often appeared with the title Dell'arte del misurare.
3. RICCARDI (1893).
4. In a uniform edition with Dell'Arte Militare. S. N. U. C.
5. B.M. Cat. gives 1585? RICCARDI (1893) & N. U. L. c. 1650. INDEX AUR shows this printer active in the last quarter of the 16th. century.
7. The final colophon. An internal colophon at the end of Bk. I, and both title pages omit any mention of Sabbio.
8. Lit. Just to put, to set.

pratica, inanzi che à particolari discenda, è di bisogno, che si pongano e quei principij, e termini, i quali mestiarli alla intelligenza di quest' arte.^{1,2}

f. 4a.dico, che la Geometria versa attorno³ alla quantità continua; ma non tutta, perioche il tēpo, & il moto⁴ sono d'altra cōsideratione, che del Geometria; perioche gli considera solamente la linea, la superficie, & il corpo; ò per dir meglio gli accidenti, & le passioni loro, come sono figure, grandezze, equalità, inequalità, & simili altri accidenti; Ma considera molto diversamente di quello, che fa l'Astronomo, il prospettiuo, & il Filosofo naturali; conciosia che l'Astronomo considera i corpi celesti, la terra, & la lor grandezza, & il lor moto, ne in tutto separa gli accidenti dalla materia; perioche tratta egli di essi in quanto sono, nel Sole, nella Luna, & ne gl'altri corpi celeste, ma non con quelli mezi che fa il Filosofo naturale, ne in quanto in essi è naturale; il prospettiuo tratta di linee, di superficie, & di corpi, & de i loro accidenti, in quanto cascano sotto il senso del vedere; ma con prove matematiche. Il naturale filosofo, considera tutte le cose in quel modo che hāno l'essere, nella sua propria materia sensibile; Ma il Geometra questo fa differentemēte da ciascun de i sopra detti; Conciosia che con l'intelletto separa le cose, ch'egli considerà, dalla materia sensibile dal moto, e da qualunq; alteratione; che se bene l'essere della quantità è ne corpi

practical geometry, before I descend to specifics, it is needful that I should set out those principles and terms, which are necessary to the understanding of this art.^{1,2}

....I say that Geometry concerns continuous quantities. But not all (such), because time and motion⁴ are of other concern than of geometry because it considers only the line, the surface, and the body, or to say better, their accidents and their passions, as are figure, greatness, equality, inequality, and other like accidents. But it considers more diversely than does Astronomer, perspectivist, and natural philosopher, because the Astronomer considers the celestial bodies, the earth, and their size, and their motion, wholly in the accidents separate from matter, because it treats of them in as much as they exist in the sun and moon and other celestial bodies, but not with those means that the natural philosopher does, not in as much as in them is such a nature. The perspectivist treats of lines, surfaces and bodies and their accidents as much as these fall under the sense of sight, but with mathematical proofs. The natural philosopher considers all the things in the way that they have being in their particular sensible matter. But the Geometer does this differently from all the above said, because with the intellect he separates the things which he considers, from the sensible matter of motion, and whatsoever changes as well can be of

1. This sort of remark seems to be in part an excuse for the rather over simple treatment given. Perhaps as much a reflection on the audience he hoped to reach as on the author's abilities.

2. See also not long afterwards where Girolamo stated (f. 2b) "etiandio necessario prima trattare qual sia il soggetto, & la materia, cerca la quale versa il Geometra, conciosia che dalla intelligenza di questo si apporterà gran luce alle cose, le quali si diranno nel progresso di tutta l'opra."

3. "versa attorno" = "spreads over", "covers" (?)

4. That is motion considered as more than any mere spatial displacement. Girolamo seems to be thinking here of such Aristotelian notions as natural and violent motion.

Naturali, nondimeno con l'intelletto le considerà senza materia, e senza gli accidenti sensibili. Il perche nelle diffinitioni delle quantità, & degli accidenti, i quali sono considerati dal Geometria, non si piglia nome alcuno, il quale non si possa immaginare senza concetto sensibile, onde non si fa menzione di moto, di tempo, di leggerezza, di grandezza, di caldo, di bianchezza, ò d'altri simil accidenti. Et quantunq; le diffinitioni, & i principij della Geometria siano intelligibili, & astratti da i sensi; nondimeno si accomodano ancora nella Astronomia, nella prospettiva, nella meccanica, & nella filosofia naturale; & per il mezo loro si prouano le propositioni in ciascheduna di queste scienze, doue si tratta delle grandezze, & delle figure, delle linee, delle superfici, e de'corpi soggetti al moto, & alla materia sensibile, si come chiaramente si veda, non solo in infiniti luoghi appresso di Aristotile; ma ancora d'altri Filosofi.¹

Hora se altre scienze si seruono di i principij della Geometria contemplatiua; quanto più a me sarà lecito di usarli in questa opra di Geometria pratica? Et come da la pratica è nata la Geometria semplice, & astratta, & dalle cose osseruate nel cotidiano uso del misurare ha ella hauuto il suo principio, così è cosa ragioneuole che essa accomodi se medesima alla pratica, come a quella, a cui è obligata. Naque la Geometria appresso gli Egittij
...²

quantity and in natural bodies. Nevertheless with the intellect he considers them apart from matter and the sensible accidents. Therefore in the definitions of the quantities and of the accidents which are considered by Geometry, no name is taken, which can not be imagined without sensible concepts, whereby it does not make any mention of motion, time, lightness, greatness, of heat, whiteness or other similar accidents. And although the definitions and principles of Geometry are intelligibili and abstracted from the senses, nevertheless they belong also in Astronomy, in perspective, in mechanics and in natural philosophy; and by means of them are proved the propositions in every one of these sciences, where is treated greatness, shapes, lines, surfaces, and bodies subject to motion, and of sensible materials, as is clearly seen not only in many places in Aristotle, but also in other philosophers.¹

Now if other sciences are served by the principles of contemplative Geometry, how much more will it be licit for me to use them in this work of practical Geometry? And as from practice simple Geometry is born and abstracted, and from the things observed in the daily practice of measurement has it had its beginning, then it is reasonable that this accommodates itself to practice, as to that, to which it is indebted. Geometry was 'born under the Egyptians...'²

1. Girolamo seems to view geometry here as a tool. It is distinguished from the other disciplines by its general applicability in many other disciplines which in turn have their own subject matter, although in some, that subject matter is handled almost entirely mathematically, as in Astronomy. It then is seen as giving powers to those disciplines because it provides the means of proof. The implication at the end of the passage that Aristotle exploited mathematics at many points is rather intriguing.

2. The elision gives the traditional account of the invention of geometry in Egypt because of the flooding by the Nile and the need for surveying. The conclusion in this passage seems fairly clearly to be that contemplative geometry ought to 'accommodate itself' to practice, because it sprang from it, although the language is perhaps not altogether clear. This is of course a rather radical position with respect to contemplative geometry -- that it should accommodate, i.e. adapt itself to practice. But 'accomodare' has also the sense of to lend itself to, and Girolamo's sense may be not a great deal more than 'to allow itself to be applied to' rather than adapted. However the one notion tends to merge into the other.

*Geometria prattica, laquale insegna l' arte, & il modo di misurare, piani, altezze, profondità, ò bassezze, che dir vogliamo, capacità & ampiezze de corpi, caui, ò solidi....

Practical geometry which teaches the art and means of measuring planes, heights, depths, or lowness, as we would wish to say capacity of bodies, hollows or solids....

8k. II, f.(iia). GIA molti mesi humanissimi Lettori, hauendo io posto fine à questa seconda parte della Geometria prattica, del misurar muraglie, imbottar Biade, Vini, Fieni, & altri strami, col liueller le Acque, & altre cose necessarie à gl' Agrimensori....

Many months, most human reader, have I put an end to this second part of practical geometry of measuring walls, encasking grain, wine, fodder and other straw, with the levelling of water and other things necessary to the surveyor

Opera del Misur (1584 ed.): Texts

f. (iia)¹.nobile d'ingegno & di scienza M. Girolamo Catanio Nouarese, professore² eccellentissimo delle scienze Mathematiche, il quale hauendo composti diuersi uolumi & trattati sopra il misure delle terra, del condur acque, & d'altre cose importanti intorno all'arte militar.

¹...(the) noble skill and science of Mr. Girolamo Catanio of Novara, most excellent professor² of the mathematical sciences, who has composed many sundrie volumes and treatise upon the measure of the earth, the conduction of water and other important things concerning the military art.

GIROLAMO MAGGI & IACOMO CASTRIOTTO

Della Fortificatione della Città (1st. ed. 1564) [5], [6]

Bibliography: Venetia 1564; Venetia 1583³; Venetia 1584; German trans. Grissen 1620.^{*3}

General description:⁴ An elaborate work 5 $\frac{1}{2}$ " x 9 $\frac{1}{2}$ " text. (iv) + 140 folios, with many marginal notes. The production is nice and clear but though it contains many large, clear, wood cuts, they are generally rather crudely done and often sprawl over the page, or are set out to close together so that parts have to be curtailed. This work is not so much a collaborative one, as rather a compilation with sections by the different authors occuring at different places.

Contents::

f. (ia): Title Page: DELLA/ FORTIFICATIONE/ DELLA CITTÀ,/ DI M. GIROLAMO MAGGI, E' DEL/ CAPITAN IACOMO CASTRIOTTO,/ Ingegniero del Christianiss. Re di Francia,/

1. From the dedication by the printer Pietro Maria Marchelli.
2. Of course purely an honorary title with no institutional significance.
3. After RICCARDI (1893).
4. Of the first edition.

- LIBRE III/ Ne'quali, oltre le molte inventioni di questi Autori, si contiene tutto quello di più importanza, che fino/ ad hora è stato scritto di questa materia; con infinite cose, che da molti Signori, Capitani, / & Ingegneri dell' età nostra si sono hauute./ Discorso del medesimo MAGGI sopra la Fortificatione de gli alloggiament de gli esserciti./ Discorso del Capitan FRANCESCO MONTPELLINO sopra la fortificatione del Borgo di Roma./ Trattato dell'Urdinanze, o uero Battaglie del Capitan GIOVALCHINO da Loniano./ Ragimamento de sudetto CASTRIOTTO sopra le fortezze della Francia./ CON PRIVILEGIO./ In Venetia, Appreso Rutilio Borgominiero, al segno di San/ Giorgio, MDLXIII.
- f. (iia/b): Dedication to "il Sig. Conte Eugenio Sinclitico, Gran Siniscalco di Cipro, & Collateral dell' Illustrissimo Dominio Vinitiano" by Rutilio Borgominiero, dated 15 May 1564.
- f. (iiia/b): Table of contents.
- f. (iva/b): Dedication to Phillip of Spain by Maggi dated Venice, 1st. May 1564.
- f. 1a/40b: Book I: Cap. I/II, f. 1a/6a: General description of the background to cities and their history, together with their different sites, mainly from the ancient authors, by Maggi.
- Cap. III, f. 6a/10b: The plans of ancient cities and in contrast a number of plans in modern style of a square and a six sided city, discussed by Maggi.
- Cap. IIII/VIII, f. 10b/19a: Miscellaneous topics discussed, generally, such as the site, supply, castles within a city or not, and the gates of the city, mainly from the ancient authors, but with some modern opinions from books and experience, by Maggi.
- Cap. IX, f. 18a/20b: By Castriotto discussing fortification terms together with illustrations showing flanking fire determining the trace.
- Cap. X/XII, f. 21a/33b: The different parts of the fortress discussed in detail, e.g. curtain, walls, bastions etc. The ancient authors not predominating though still being frequently mentioned, by Maggi.
- Cap. XIII, f. 33b: Different measures by Castriotto.
- Cap. XIIIII/XV, f. 34b/37b: Details of fortresses, their size etc., by Castriotto.
- Cap. XVI, f. 37b/40b: Surveying by Castriotto.
- f. 40b/76b: Book II: Cap. I/III: f. 41a/43a: Gadgets for determining the scarp of a wall and its profile. I by Maggi, II & III by Castriotto.
- Cap. IIII/XXIX, f. 44a/72a: This section mainly by Castriotto, with a few Maggi insertions. It is characterised by a great many illustrations which rather overwhelm the text, many rather crudely done, over elaborate and somewhat fantastical.
- Cap. XXX, f. 72b/74a: Maggi on the fortifications of an ancient city.
- Cap. XXXI/XXXIII, f. 74a/76b: Maggi on counterforts, and the laws of a city. Description of Sermoneta by Castriotto.

1. In this Maggi wrote of "quante mie fatiche d'intorno alla fortificatione della Città" (emphasis added).

- f. 77a/139b: Book III: Cap. I/VIII: f.77a/84b: Maggi and Castriotto on ports, lighthouses and forts in water.
- Cap. IX/XI, f. 85a/89a: Maggi on fortifications in small states; foundations; and materials.
- Cap. XII/XV, f. 89a/107b: The mass of this section gives descriptions of many existing fortifications by Castriotto.
- f. 107b: Dedication relevant to the further sections of the work, by Maggi to Francesco della Torre.
- f. 108a/113b: Maggi on fortifications in the field.
- f. 114a/118a: Montmellino on the Borgo di Roma.¹
- f. 118a/b: Further dedication by Maggi to della Torre.
- f. 119a/134b: Giovacchino on the ordering of battle ranks.
- f. 135a/139b: Castriotto on fortresses in France.

Colophon: In Venetia Apresso Rutilio Borgominiero M.D.LXIII.

Della Fortificatione della Città (1564): Texts

f. 1a. DOVENDOSI in quest'opera trattare della fortificatione delle Città, parmi cosa conueniente dir prima qualche cosa della origine, e ragione, di edificar case e Città, che cosa sia Città, & il fine di essa. Presupposto sempre adunque, come si richiede, per uerissimo, quello, che nelle sacre lettere si legge della creatione dell'huomo, e della edificatione della prima Città, dico che, secondo i Gentili⁴, che non hebbono, o non uolsono hauere la cognitione delle uerità, i primi huomini, quali habitarono la terra, offesi dalla ingiuria dell'aria, per cagione delle mutationi de'tempi, e mossi dalla natura, qual ci persuade il fuggir le cose, che ci apportano impaccio, e danno; cercarono sedi schermirsi, e da quella quanto loro era concesso, difendersi. Il perche alcuni si messero ad habitare le grotte, & altri di legnami, sassi, & terra con roza, e sconcia opra fabricarono habitatione.....

As this work treats of the fortification of cities it seems to me convenient to say first something of the origin of the building of houses and cities, and what a city is and its end.³ Presupposing always thereto, as is required, for truth, that what is read in sacred letters of the creation of man and the building of the first city, I say that according to the gentiles⁴ who did not have, or did not wish to have knowledge of the truth, the first men who inhabited the earth, attacked by the injuries of the air, because of the changes in the weather and the movements of nature, which persuaded them to flee the things which brought disturbance and danger, they searched to fence themselves off, and from that as much as possible to be defended. Thus some proceeded to inhabit caves, and others of wood, stone, and earth, with rude and rough work, built habitations.....

f. 2b. HAVENDO la diuina natura (come lasciò scritto Marco Varrone) dato à gli huomini la campagne, l'art humana edificò la Città.

The divine nature having given men the fields, as Marcus Varro wrote, human art built the City.

1. Dated 1548.
 2. Maggi.
 3. i.e. purpose.
 4. Literary way of referring to the classical authors.

f. 7b. ¹ORA quanto alle piante delle Città, che si haueranno à disegnare, deuate sapere, che la forma triangolare e la quadra sono le più imperfette, quanto alla fortificatione, e le più dannose che si trouino; auuenghi che, douendosi ne gli angoli, e cantoni di tai forme disegnare e'Balluardi, le punto loro uengono ad esser troppo acute, massimamente nelle forme triangolari....

f. 14a. ¹Sonno hoggi di le fortezze indefensibili per cagione delle Artiglierie.....

f. 18a. ²E u'ho posto anchora due forme, l'una co'Balluardi di più facce, ³che non s'usa troppo, e l'altra circolare: le quali, como appare, saranno difese à bastanza. E quanto sia vtile il tornarle in opera, s'intenderà benissimo a' suoi luoghi, facendo io argomento per più d'una ragione ch'addur ui si potrebbe, che di leggierissima importanza siano quelle minutte, ⁴che in tali opere trouassero alcuni non difese. Questo è ben da sapere che di grosso, e molti più alle percosse può resistere l'opera circolare, che quella co' le linee rette. ⁵Hora per sequitar l'intento mio, dirò, che nell'essercitio di guerra, la principale e più importante cosa è, che ciascuno di questa professione, e massimamente i grandi c'habbiano ad hauer carichi, debbono hauer qualche intelligentia dell'arte d'Architettura grossa, che così chiamo io quella de'solcati, che volgarmente in ciò son chiamati Ingegneri, perchè applicano il loro ingegno à così nobile essercitio. Da costoro, per conseruare gli stati, le Città, le terre, e le fortezze, nascono tre manieri d'ordini d'opere: l'un è dotta Riparatione, l'altra fortificatione; e la terza Edificatione. ⁶La Riparatione

Now concerning the plans of the cities which have to be designed, you ought to know that the triangular form and the square are the most imperfect, in regard to fortification, and the most dangerous that are found. It happening that, having on the angles and corners of such forms to design the bastions, their points come out too acute, especially in the triangular form....

Today fortresses are indefensible because of the artillery...

And I have put to you two forms, the one with bastions of more faces which is not much used; and the other circular, which as appears, will defend sufficiently. And how useful is the circular form in action will be well understood in its place: I making argument for more than one reason that can be aduced in it, that it is of the lightest importance there being minutiae that in such works can not find any defence. This is well to know, that greatly and much more can circular works resist the blow than that with straight lines. ⁶Now in following my intention, I will say that in the practice of war, the first and most important thing is that everyone of this profession and especially the great, that have to have charge, ought to have such understanding of the art of architecture in mass -- as this I call what is of the soldiers who commonly are named engineers, because they apply their ingenuity to this noble practice. From these men, for the conservation of States, Cities, countries and fortresses arise three manners of orders of the work. One is called 'Repair', the other 'Fortification', and the third 'Building'. Repair is used.

1. Maggi.

2. Castriotto.

3. Illustration showing the bastions thus

4. Minutiae: Any very small thing.

5. At f. 60a, Castriotto repeated his contention that round forms could be sufficiently defended.

6. Cf. Locatelli below

s'opera ogni uolta che un Prencipe habbia necessità di difendere una terra, per una soprapresa, che'l nemico facesse all'improuiso in una carestia di tempo: nella quale è lecito aiutarsi con l'ingegno, come si può, senza rispetto d'ordine, b' regola di detta Architettura. La Fortificatione s'adopera, quando un Prencipe o una Republica sa, che à qualche tempo una sua piazza gli habbia ad essere assalita: e quest'opera, perche u'ha tempo a proposito da poterla accomodare, debbe con ordine piu d'una uolta dentro e fuora esser uisitata. Come poi sono state ben uedute e considerate l'offese e le difese, si debbe disegnare il luogo nel foglio² con tutto il suo giro di muraglia, & appresso accomodarui all'intorno ne' luoghi necessarij i Balluardi, le Piatte forme, & i Denti³, e per dentro ualere à luogo per luogo da gli angoli delle muraglie, facendoui Cauallieri oue bisogna, e seruencosi quanto si può dell'opera già fatte. L'Edificat-ione si fa cō la cōmodità di tēpo, & si mette in opera con quella maturezza d'ingegno, che l'huomo fa e può adoperare in questo modo. Debbesi speso uisitare il luogo, e deue si disegna far l'habitationi s'hà d'auuertire alla salubrità dell'aria.....L'opera non si douerà fare senza consiglio di molti huomini pratici in guerra, à quali l'esperientia hà mostro quello che si debbe fare.....

f. 21a.⁴ NON è dubio alcuno, che la fort-
ezza della muraglia consiste più nelle
forma, che nella materia; auuenghi che
s'ella non sarà aiutata dall'ingengo
dell'Architetto con detta forma, per
grosse ch'ella si faccia, e di qual si

any time a Prince has the necessity to defend a land, from an overtaking¹ that the enemy should make of a sudden, in a dearth of time, in which case it is legitimate to be aided by ingenuity, as it may be, without regard to the rule and method of the said architecture. Fortification is employed when a Prince or Republic knows that at some time one of his positions may be assaulted, and this work, because there is time to the purpose be able to make it suitable, ought with method to be viewed more than once within and without. As then are well seen and considered the attack and defence, (and so) the place ought to be designed in folio², with all its circuit of walls, and with regard to the necessary places, accomodated the Bastions, Piattaformes and the teeth, and from the inside going from place to place, at the angles of the walls, making cavaliers where necessary and being served as much as possible by the work already made. building is done with a sufficiency of time and is put to effect with that mature skill, that a man can employ in this way. Time ought to be spent to visit the place and where is designed to make the habitations, notice has to be taken of the healthness of the air..... The work ought not to be made without the council of many men practised in war, to whom experience has shown what ought to be done.....

There is no doubt that the strength of the wall consists more in the form than in the material, for it happens that if it will not be aided by the skillfulness of the architect with the said form, to the greatness with which it

1. Or surprise.

2. In folio = on a sheet of paper.

3. Maggi f. 31a, "quelle sorti di muraglie, che si chiamano Denti, Forbici, e stelle", i.e. saw-toothed.

4. "Edificatone". Cf. the title of Alberti's well known work, De Re Aedificatoria

5. Maggi.

uoglia sorte di pietra, ò di matone, che gagliardamente resiste alle percosse, sarà nondimeno da' colpi dell' artiglieria, ò con picconi, ò con mine abbatuta, ò con scale, e machine superata.

f. 60b.¹ La forma circolare ne' fianchi,² e Baluardi, è piaciuta non solo à Vitruuio,³ à Leon Battista Alberti, & ad altri Architetti, ma ancora ad Alberto Durerò, per la molta fortezza che de queste nasce. la quale pare tanto più degna d'essere approvata, quanto che si uede.⁴....nondimeno...perche le linee de' tiri che uengono da' fianchi, nõ strisciano tutto il Baluardo, io non lodo questa forma....⁵

f. 92b.⁶ Per dar adunque à tal cosa principio, dico che hauendo chiaramente compreso nella guerra fatta del 1552. alla Mirandola, l'opere moderne non esser molto à proposito in tutti i luoghi: però son stato forzato porre in figura un nuovo modo forse al parere di gli intendenti perfettissimo: il quale se non sarà ornato di quella polita, e bella uista, che all'Architettura sottile si conuiene, niuno se ne deve marauigliare, per che l'architettura militare e grossa, non è soggetta alle regole della sottile, & ancora per che uolendola imitare, ciò non passerebbe senza gran danno de' soldati.

should be made, and of whatever sort of stone, or brick, that robustly resists the blows, it will nevertheless be overcome by the blows of the artillery, or with picks, or with mines, or with ladders and machines.

The circular form in the flanks² and the bastions pleased not only Vitruvius³ and Leon Battista Alberti, and other architects, but also Albrecht Dürer, through the great strength that through this arises, the which appears so much more worthy of approval, as much as is seen.⁴...nevertheless... because the lines of fire that come from the flank do not graze all the bulwark I do not praise this form..⁵

To give then this subject a beginning, I say that having clearly comprehended in the war of 1552 of Mirandola, (that) modern works are not much to the purpose in every place, so I have been forced to put in diagrams a new method, perhaps to the opinions of experts very good, which, if it will not be ornate and of such a polished and beautiful appearance as belongs to fine Architecture, no one ought to marvel because military architecture is massive,⁷ and not subject to the rules of the fine (style), and also because if anyone wishes to imitate such, that can not be but with great danger to the soldiers.

1. Maggi.

2. "In the flanks" is not altogether clear. The accompanying drawing shows this type of trace, with towers at the points and in the re-entrants. Perhaps Maggi meant these 'internal' towers.



3. VITRUVIUS (1522) f. 17a. "Turres itaque rotundae, aut $\omega\lambda\lambda\gamma\omega\gamma\epsilon\alpha$ sunt faciendae quadratas enim machinae celerius dissipant, quae angulos arietes tundendo frangunt, in rotundationibus autem (uti cuneos) ad centrum adigendo, laedere non possunt." (Bk. I, Cap. V, Sect. 5.)

4. Maggi adduced here round structures in animals after Aristotle to indicate their value, as well as the Vitruvian point.

5. See also f. 22b. where Maggi expressed exactly the same sentiment on the need to avoid dead ground, against the views of these authors, and Castriotto.

6. Castriotto.

7. Lit. gross, big, fat.

DOMENICO MORATre Quesiti (1567)

General description: 6" x 3½" text. iv + 70 folios. some small illustrations in the text and typeface diagrams. Dialogue form.

Contents:

- f. (ia): Title page: TRE QUESITI/ IN DIALOGO/ SOPRA IL FARE BATTERIE,/ FORTIFICARE VNA CITTA./ ET ORDINAR BATTAGLIE QVALHATE,/ con una disputa di precedenza tra/ l'arme & le lettere,/ DI M. DOMENICO MORA, BOLOGNESE,/ gentilhuomo Grisone, & cavalliere Academico Storditi./ All'Illustris. & Excellent Signore, Il S. DUCA/ DI FIRENZE, ET DI SIENA,/ Primo fondatore, & gran Maestro della religione/ de cavallieri DI S. STEFANO./ CON PRIVILEGIO./ IN VENETIA, per Giovanni Varisco, & compagni/ MDLXVII.
- f. (iia/iib): Dedication to "il S. Duca di Firenze et di Siena", dated Bologna 9 March 1567.
- f. (iiaa/iva): Address "Alli Nobilissimi Signori Academici Storditi di Bologna."
- f. (ivb): Errors.
- f. 1a/24b: Quesito primo: Sopra il fare Batterie: A very general discussion on how far to place the guns from the attacked wall, weight of ball to be used, and the like, beginning with some remarks on the qualities of soldiers. No illustrations.
- f. 25a/52b: Quesito secondo: Sopra il fortificare: The first 8 pages of this section discuss the nobility of arms as against letter (f. 25a/28b). Then follows a general discussion about the length of the curtain, the size of various parts of the fortress, and lines of fire (f. 29a/40a). The final part (f. 40b/52b) is taken up with four examples of different ways of fortifying, each of which gives a small drawing showing a small section of an enceinte. Each example has a piattaforma while the curtain between the bastions is slightly varied from case to case.
- f. 52b/68b: Quesito Terzo: Di por battaglie quadrata: This is the usual type of discussion on putting soldiers into ranks, with type face diagrams.
- f. 69a/70b: Alphabetical table of contents.

Tre Quesiti (1567): Texts

- f. 25b.tutto il giorno ueggo molti,every day I see many supplied
forniti assai piu d'arditezza, che di much more with daring than with judg-
giudicio, sforzarsi di dare ad intendere ment, forcing the world
al mondo d'essere d'acutissimo ingegno, to understand them as of the most acute
& di profondissime scienze, & uoler skilfulness and profound science, and
antiporsi a soldati di molto honore & wishing to be set before soldiers of
& dignità, con tanta mia mala sodisfat- great honour and dignity, so much to
tione, che adirato molto ni rimango, & my poor satisfaction that I remain much
& simile ad un leone, ferito da pungente enraged like a lion wounded by sharp
dardo. onde ciò dissi, del tutto dis- darts, whereby I would say, of all
posta di mostrare ad alcuni dottori, disposed to show to any wise men, that
che tal opinione ostinatamente mantengono, (quantunque a soldati non appar- they obstinately hold such an opinion---
tenga il difendersi con parole, come although it does not belong to sold-
si fa da loro) che essi non sono degni iers to defend themselves with words,
in modo alcuno ne in tempo di guerra, as it does to them -- that these are
ne di pace d'essere antiposti a soldati. time of war, nor of peace, to be set
& mi perdoneranno que'dottori, che per before soldiers, and they will excuse
1. Only known edition.

loro singolari uirtù sono degni d'ogni honore, & d'essere meritamente con perpetua lode commendati. per cioche io sono sforzato per lo particolare interesse, & altresì per l'universale,¹ come amatore & protettore di soldati, di tenere la loro protectione pel giusto, essendo alcuni disposti a uolere con certe loro ragioni concludere, che solamente ne'tempi di guerra il soldato debba precedere il dottore, & non ne'tempi di pace....

f. 28b.i filosofi, sapendo le cause de gli effetti, per conseguente sono piu huomini & piu atti a governare che i leggisti.....

f. 35b. Voi dunque hauendo desiderio di saper perfettamente fortificare un luogo, bisogna, che consideriate principalmente due cose, le quali si richiedono al fortificare. la prima è la materia, & la seconda è la forma. adunque coloro, che semplicemente daranno opera a fortificare alcun luogo di pura materia, non saranno da alcuni riputati saui, ne ingegnosi. percioche non è dubbio, che ogni simplice huomo, disposto di fortificare un luogo, con fare muraglie d'un smisurata grossezza solo potrà mandare ad essecutione, ma con un costo intolerabile, & tempo lunghissimo;² ilquale forse non gli sarà concesso da coloro, che desiderano tuttauia d'offenderlo;³ oltre che tal materia potrebbe egli porre in opera, che di poco ualore sarebbe, essendo le pietre uiue⁴ di grandissimo pregiudicio, nelle muraglie delle fortezze, per non poter elle resistere al tiro dell'artiglieria⁵ ma lasciando ciò da parte, dico che primieramente bisogna considerare & trouar forma, che uaglia, & secondo la qualita de'siti & luoghi.

me, those wise men, that by their particular virtue are worthy of every honour and of being commended with merit and perpetual praise, therefore I am forced by particular interest and also generally,¹ as a lover and protector of soldiers, to hold their protection more just, being some disposed to desire for certain reasons of theirs, to conclude that only in time of war ought soldiers to precede the learned, and not in time of peace...

....the philosophers, knowing the causes of the effects, are in consequence more fully men and more suited to govern than the lawyers....

You then having a desire to know how perfectly to fortify a place, it is necessary that you should consider firstly two things which are required in fortification. The first is the material, the second is the form, Thus those who work merely to fortify some place purely through material will not be by any reputed as wise and clever, because there is no doubt that any simple man, intending to fortify a place, by making walls immeasurably large will be able to put it into practice, but with an intolerable cost and the greatest of time;² which perhaps will not be conceded by those, who desire always to attack it.³ Apart from which, such material which will be put into effect, would be of little value, living stone⁴ being of the greatest prejudice to the walls of the fortress, as not being able to resist the fire of artillery,⁵ but leaving this aside, I say that firstly it is needful to consider and find the form, that it is worthwhile, and according to the quality of the places and sites.

1. I.e. Mora admits that he has a personal self interest as a soldier as well as a general interest in the correct position.

2. This is only another version of the idea expressed earlier by Tartagli, but the way Mora puts it makes clear that he was thinking along the lines of the old saw -- that an engineer is only someone who can do for a penny what anyone else can do for two pence. However it is the economy of effort that is taken to indicate the designers skill here, and economy is conceived to be achieved through the best form, while in Tartaglia's account form was significant because it was considered only through this could skill be judged.

3. This is slightly ambiguous but the implication seems to be as given here, that many would not accept the point made, rather than that "ilquale" refers to the resultant fortress.

4. 'living' that is strong, forceful.

5. Mora seems rather to want it both ways. I.e. that a simple man could so construct a fortress, although others might disagree, but anyway one can't get material to resist artillery.

Il Soldato (1st. ed. 1569)

Bibliography: Venetia 1569¹; Venetia 1570².

General description: 6" x 3½" text. (xvi) + 254 pages. Some small illustrations and type face diagrams.

Contents:

- p. (i): Title page: IL SOLDATU/ DI M. DOMENICO/ MORA, BOLOGNESE,/ GENTILHOMO
 * GRISONE, ET/ CAVALLIERI ACADEMICO STORDITI:/ NEL QUALE SI TRATTA DE/ tutto
 quello, che ad un uero Soldato, & nobile Caualliere si con-/uiene sapere, &
 essercitare nel meistiere dell'arme./ ET QUESTA, SECONDO L'ORDINE DA NOI/ posto
 è la quarta Gioia congiunta all'Anella della nostra Collana Historica./
 ALL'ILLUSTRISSIMO, ET ECCELLENTISSIMO/ Signor, il signor Duca di Parma,
 * Piacenza/ & Castro,/ Gran Confaloniere di Santa Chiesa./ CON PRIVILEGI/
 IN VENETIA APPRESSO GABRIEL/ GIOLITO DI FERRARII./ M D LXX.
- p. (iii/iv): Dedication to "S. Ottauio Farnese, Luca di Parma" etc., dated
 Venice 23 June 1569, by Mora.
- p. (v/xii): Dedication to "Signore il Marchese Loduico Malaspina" by Thomas
 Poracchi dated Venice 18 Nov. 1569.
- p. (xii/xv): List of chapters.
- p. (xv): Dedication to "S. Marc'Antonio Fiubbi, Acadameo Storditi, mio
 Signore", dated 23 June 1569, by Mora. List of errors.
- p. 1/40: Book I: "Qual si possano nominar Soldati & Cauallieri d'honore:
 Della precedenza tra l'arme & le lettere....."
- p. 41/174: Book II: "contiene cio, che particolarmente à tutti gli Vfficiali
 della fanteria appartiene....."
- p. 175/218: Book III: "contiene, che cosa siano le Città, Fortezze, & Fort-
 ificationi....con l'artiglieria necessarie à guardarle..."
- p. 219/254: Book IV: "come si leuino piante di Città; liuelli una distanza
 & altezza.....s'operino l'artiglierie..."
- Colophon: In Venetia Per Giovan Grissio, MDLXIX.

Il Soldato (1570): Texts

- | | |
|---|--|
| <p>p. 3.: non il titolo ci capit-
 ano fa l'huomo soldato; ma l'essercit-
 atione dell'arme nelle guere campali....
 nò le toghe & i libri fanno gli huomini
 , dottori & letterati; ma le scienze &
 uirtù loro ministrare & dimostrare.
 Laonde non uaglia al dottore il uolersi
 attribuire questo grado di caualliere
 anchora: percioche malageuolmente
 possono le scienze, atte à far con-
 onciare uno per letterato & scientiato,</p> | <p>..... the title of captain does not
 make a soldier, but the exercise of
 arms on the battle field...nor do
 the toga and books make a man wise
 and highly literate, but the sciences
 and virtues governed and demonstrated
 by them. Whereby it is not worthy of
 wise men to wish to be attributed
 to the grade of the cavalier also,
 because (only) with difficulty can the
 sciences, suited to make one known as</p> |
|---|--|

1. RICCIARDI (1893)

2. The second edition used here was a reissue of the first with merely the addition of the dedication by Thomas Poracchi, and bears the same colophon. Other somewhat doubtful editions are sometimes quoted.

stare insieme con l'arme; poi che le scienze non si apprendono se non con lungo studio & gran riposo & quiete d'animo¹....dico....che colui, il quale desidera di caminare per lo uero sentiero, oue i soldati & cauallieri pongono il piede, deue esser historico & cosmografo. Cosmografo, accio sappia benissimo condurre uno essercito con l'antiuedimento de fiumi, de monti... Onde dico non potere fermamente esser uero soldato colui, chi si truoua priuo della cognitione di tal lettere, & che non sappia almeno disegnar tanto, quanto gli basti à prouedere ad una riparatione, & a fortificare un luogo secondo l'occasioni. Et per far cio, bisogna, che del tiro dell'artiglierie habbia piena cognitione....

p. 175.benche il CASTRIOTTO habbia presa non picciola fatica in mostrare uarie & diuerse sorti di forme & modi, che si possono tenere intorno à cio: le quali ueramente per esser molto bene considerate & fatte con grandissime ragioni, sono degna di ogni laude, & di esser uedute da ogni spirito gentile: pure essendoui anche molte cose, che piu à studenti si conuengono, che à soldati, con molte cose superflue, le quali ingombrano il desio della buona intelligenza;³ mi sono sforzato in questo mio fare scelta delle cose principali, & di mostrare agli piu importanti membri....

literary and scientific, exist together with arms, for science is not learnt but with long study, and great ease and peace of mind¹...I say...that those who desire to travel the true path where soldiers and cavaliers place their feet, ought to be historians and geographers: geographers in order to best know how to conduct an army, with anticipation as to rivers and mountains....Whereby I say that those can not properly be soldiers that are found devoid of the knowledge of such letters, that do not know at least how to design as much as is sufficient to provide repairs, and to fortify a place according to the occasion. And to do this it is needful that they have good knowledge of the firing of artillery,....

...although Castriotto has performed no little labour in showing varied and sundrie sorts of forms and ways which can be taken concerning this, which truly in being very well considered, and done from the best reasons, are worthy of every praise and of being seen by any of gentle spirit: truly including there many things that belong more to the student, than to the soldier, with many superfluous things which encumber the desire for good understanding.³

I am forced in this (work) of mine to make a choice of the main things and show the more important parts.....

1. And of course soldiering requires the opposite.
2. I.e. fortification.

3. Castriotto and Maggi's work was no doubt the one with the greatest range of designs available at that time. Mora's attribution of his discussion to Castriotto emphasises his concern with the practical aspects of the art. However there appears to be a good deal of tension in this passage with Mora praising Castriotto and then condemning him pretty harshly as giving 'superfluous things which encumber the desire for understanding' and hence writing really only for students and gentle folk, seeming to imply dilettantes. But this is probably an over modern reaction. Contemplation of much that would hardly ever, if at all, be met with in practice was probably thought by Mora to be no mere dilettantish activity, rather a valuable one in the right circumstances, considering the importance he attached to nobility.

Il Cavaliere (1589)¹

General description: 5½" x 4" text. (viii) + 289 + (29) pages. A very poor quality production. Title page: Il cavaliere in riposta del gentilhuomo del sig^r: mutio iustinopolitano, nella precedenza Del armi, et delle lettere, Del cavaliere domenico Mora Bolognesi Gientil'huomo Grisone, & Colonello del Intuitissimo & Serissimo sismundo Terzo, Re de Polonia.....In vilna appresso Daniella Lanciense. 1589.

As the title page indicates this is a work on the theme of whether arms or letters should take precedence. It is very generally argued with a great deal from the ancient authors. Dedication dated 10 June 1589.

Il Cavaliere (1589): Texts.

p. 109.la citacagione di tanto bene, le scienze l'arti, & tutte quelle cose buone, che in terra si trouano; sottoposte all'humano uso & così ordinato della diuina bōta, la quale per essersi valsa, dell'opera dei valorosi, per stabilire secondo il suo volere, la machina, fatta de lui, per seruicij de gli'huomini, & non de discorsi de letterati come inutili per tale beneficio, perciò a questi, si le deue dare ogni prima nobilita in ogni luogo.....

.....the city, cause of so much good, the sciences, the arts and all those good things which on earth are found, subject to the use of man as ordained by the divine goodness, which for their worth, by the work of the valiant to establish according to his will the machine made by him, to serve men, and not by the discourses of the literati -- usless for such benefit; therefore these ought to be given the highest nobility in every place.....

p. 259.²l'armi, il discorso delle quali con le operationi e fermissimo, & sicurissimo, per diffendere la verita, con hauere dato a voi ancho comodo di discorrere, sopra la sfera, & sopra delle cose celesti, come dite, anche fanno letterati li quali fondando le fabbriche loro in aria, ogni leggier vento le alterra, ma soldati & Cau^{ri}: si pongano al fermo, per cio che quello che dite,, che vegono letterati sopra tauole, stando nelle pprie case, & de paesi, & dei fiumi, & del aque, & dei monti, & dalle sue virtu, li' Cau^{ri}: vi vanno loro stessi in persona, a vederle queste cose, & sopra il fatto scoprono molte bugie de scrittori.....

....of arms, the discussion of which with its operations in most firm and secure for the defence of truth, having already given to you ease of discourse on the sphere and upon celestial things, as it is said, that do the men of letters founding their constructions in the air, every light air changes them, but soldiers and cavaliers are set on the ground, because as is said, what the literary men see on the table remaining in their own houses, and of the countries, rivers, the waters, mountains, and their virtues, the cavaliers go there themselves in person to see these things and in action discover many untruths of the writers.....

1. Only known edition.

2. p. 258, a little previous to this passage "stragieme, che solo dal pratico, nel esquire possono essere conosciute....."

GIROLAMO MUZIO

p. 240.¹nella operatione delle Mathematiche: le quali sono anche quelle, che fanno honore à soldati, & senza quelle non compiutamente si sesercita la guerra.

....in the operations of Mathematics which are also those that give honour to the soldier, and without which war cannot be fully practised.

p. 281.²da letterati si hanno le arti del ben parlare, & del dirittamente scriuere; del persuadere, del discernere il vero dal falso; de' numeri; delle misure; de' suoni, & delle voci; dell'edificare; delle bisogne della uilla: Et in somma, che anche le arte militare apperendono i soldati da gli scrittori.³

....from writers is had the art of talking well and carefully writing; of persuasion, of discerning the true from the false; of number; of measure; of sound and voices; of building; of the affairs of the town: and in sum that also the soldiers learn the military arts from the writers.

CARLO THETI

Discorsi di Fortificationi (1st. ed. 1569)⁴

General description:⁵ A small rather poorly produced work. 4 $\frac{1}{2}$ " x 7" text. 30 folios. Many line diagrams in the text. No division of the work into chapters, or headings of any kind. The text generally is not very well organised; it slides from topic to topic, often only to return to the same idea at a later point.

Contents:

- f. 1a: Title page: Discorsi/ DI FORTIFICATIONI,/ DEL SIG. CARLO THETI/ NAPOLITANO./ AL SERENISSIMO ET/ POTENTISSIMO/ IMPERATORE MASSIMILIANO/ SECONDO D'AVSTRIA/ SVO Signore/ Con Priuilegio./ ROMA,/ Per Guilio Accolto. 1569.
- f. 2a/b: Dedication.
- f. 3a/b: Introductory remarks about different types of sites.
- f. 4a/13a: Discussion of the bastions, its pointedness etc., with much emphasis on the geometrical significance of retired flanks.
- f. 13a/15b: Different types of curtains.
- f. 16a/18b: Cavaliers.

1. From Il Gentiluomo del Mutio Iustinopolitano (Venetia 1571) which Mora attacked in Il Cavaliere (1589). Girolamo Muzio, 1496/1576, published in poetry and religion. His Il Duello was published in 1550. ENC ITAL. See also GIAXICH (1847).

2. Mathematics of course being written by men of letters.

3. A marginal note against this passage reads "Delle arti liberali".

4. For bibliography see below p. 79/80.

5. Of the first edition.

f. 19a/20b: Intermediate structures to be used where the bastions are too far apart.

f. 20b/24a: General topics such as raised bridges, the counterscarp wall to be higher than the surrounding countryside, and so on.

f. 24b/26b: Discussion of citadelles and castles in relation to the city enceinte.

f. 26b/27b: Argument against circular bastions.

f. 27b/29b: General topics -- site not to be dominated by mountains etc.

f. 30a: Defence of old enceinte.

Discorsi di Fortificationi (1569): Texts

f. 3a. ESSENDO cosa solita di tutti i buoni architettori; di constituir le loro fortezze non in ogni parte doue il sito in quanto alla positura¹ sua si ritroua atto ad esser fortificato, ma solamente doue il bisogno richiede, mi pare douendo questo in ogni modo osseruarsi, ch'io debba dire come potendo il luogo che necessariamente ha da fortificarsi.....

"It being the common custom of all good architects to establish their fortresses not in any part where the site, in so far as its setting² is found, is suited to be fortified, but only where the business requires it, it seems to me that owing to this being observed in every way, I ought to say how it is possible (to fortify) the place that has necessarily to be fortified....

f. 8a.parlar prima delli baluardi, liquali si faceuan uoti di dentro, anchor che fussero ritrouate l'artiglierie³, e in ciaschedun di loro faceuan due o tre piazze, con far uolte su quella che ueniua al par del piano della fossa, e poco piu in alto, questi baluardi anchor che fussen stati fatti grandi, e con grosse mura, eran deboli per esser uacui, e bisognando non ui si posseua far ritirata, ne star in battaglia, e mentre si batteuano, cosi chi staua di su, come di giu, non era sicuro, ne per li sassi che bastauano⁴ per le percosse, dell'artiglierie, ne per le uolte intronate, e conuassate per lo batter de gli nemici, e per lo peso e tremore causato da l'artiglierie, ch'ui si adoprauen dentro, oltre che nelle piazze di giu che ueniuan coperte, ui si chiudeua il fumo in guisa

...to talk first of the bulwarks, which were made empty inside, although artillery was discovered³, and in each one was made 2 or 3 floors, by making vaults; one that came at the level of the fosse, and one a little higher. These bastions which further were made large and with thick walls, were weak through being empty, and necessarily it was not possible to make 'retirate' there, or to remain in battle whilst they were battered, as much as whoever was above or below, was not safe, neither from the stones which jumped through the blows of the artillery, nor through the vaults reverberated and shaken by the battery of the enemy, and for the weight and vibration caused by the artillery which was employed within them, apart from which the stages below which were covered in, there was trapped the smoke in such wise

1. In any particular site or place rather than in terms of the parts of the site, although "positura" is somewhat ambiguous, and can have the sense of 'posture' as of a person's body, in English; hence the relative disposition of the different parts of the site could be suggested by this term.

2. This passage is from a section in which the flanks are being discussed.

3. 1575 edition (p. 15) "Soleuano già, e non è molti tempo farsi li beloardi uoti di d'eto, anchor che fusse ritrouata l'artiglieria di metallo..."

4. Taking "bastauano" as "balzauano" as the 1575 edition gives.

tale, che non bastauano gli esalatoi
 costituiti per tal effetto far che
 persona alcun potesse starui dentro..

that did not suffice the vents which
 were made for such effect to enable an
 anybody to remain within.....

f. 24b. Li castelli o cittadelle si
 soglion fare per uoler tener il
 pupulo in freno, e per non tener
 ordinariamente il presidio di gente
 assai in un luogo piu d'importanza,
 percioche essendo custodito il cast-
 ello, ilche si puo fare con non molta
 spesa, per uia di quello si portria
 recuperar la città che fosse stata
 rubata, hauendo però quel che bisogna
 per tal ricuperatione....

Castles and citadelles are customarily
 made in order to hold the populace in
 a bridle and not ordinarily to contain
 the garrison of sufficient men of a
 place of more importance, because the
 castle being held safe, which can be
 done with not much cost, by way of it
 can be recaptured the city that has
 been taken, having therefore that which
 is needed for such recovery.....

15f. 26b. L'opinion d'alcuni è che, in
 far un baluardo del mode ch'apparare
 nella pianta che segue uenghi piu
 grande per l'approssimarsi, è somig-
 liarsi piu alla forma circolare e
 per conseguente piu gagliardo, onde
 rispondendo.....¹

The opinion of some is that in making
 a bastion the way that it appears in
 the plan that follows, it comes bigger
 by its approach and similarity to a
 circle in form and in consequence
 stronger, but I answer....¹

Discorsi delle Fortificationi (1575)

General description: This is an improved version of the 1569 edition with a
 second book added. 4" x 6 1/2" text. (viii) + 119 + (viii) pages. The text is
 reworked quite considerably at many points in comparison to the earlier edition
 with many marginal notes. It is now divided into chapters and somewhat better
 organised. At the end of the second book are some good quality pull-out wood
 cuts, showing plans and profiles.

Contents:

p. (i): Title page: DISCORSI/ DELLE FORTIFI- /CATIONI./ Del Sig. Carlo Tetti./
 Que diffusamenti si dimostra, quali debbano essere i siti/ delle Fortezze, le
 forme, i recinti, fossi, baloardi,/ castelli, & altre cose à loro appartenenti,/
 con le figure di esse./ Hora di nuouo da lui medesimo ricorretti, & ampliati/
 del Secondo libro./ Con gli Elenchi di tutti i Capitoli; & Tauola di tutte/ le
 materie; che in essi si trattano./ CON PRIVILEGIO./ IN VENETIA/ Apresso
 Bolognino Zaltiero. M.D.LXXV

p. (iii/iv): Dedication to Maximilian II.

1. Tetti seems to mean
 that the circular form
 thus, is bigger than the
 pointed form.



- p. (v/vi): A' lettori benigni.
- p. 1/84: Book I:
- p. 1/6: Cap. I: Sites.
 - p. 7/8: Cap. II: Historical roots of fortification.
 - p. 9/11: Cap. III: Pointedness of the bastion.
 - p. 11/20: Cap. IV: Flanks.
 - p. 21/22: Cap. V: Parapets.
 - p. 22/38: Cap. VI/VIII: Flanking defences and different types of curtain.
 - p. 38/46: Cap. IX/X: Platforms and cavaliers.
 - p. 46/48: Cap. XI/XII: Gates and exits.
 - p. 48/54: Cap. XIII: The fosse.
 - p. 54/59: Cap. XIII/XV: The casemates of the fosse and the covered way.
 - p. 60/66: Cap. XVI: The measure of the fortification.
 - p. 67/69: Cap. XVII: Castles and citadelles.
 - p. 69/84: Cap. XVIII/XVIII: Of retire and a general discussion including a new profile for old walls.
- p. 85/6: Dedication to "Ridolfo, Serenissimo et invittissimo Re di Ungaria, et Arciduca d'Austria, Signor mio."
- p. 87/119: Book II:
- p. 87/97: Cap. I: New style of fortification.
 - p. 98/104: Cap. II: Revetments.
 - p. 104/119: Cap. III/V: Surveying with various gadgets, descriptions and drawings.
- 7 pages of tables of contents.

Discorsi delle Fortificationi (1575): Texts

p. 1. VSANO per ordinario tutti li buoni Architettori di costituire le loro fortezze, non ouunque il sito quanto alla positura sua si conosce fatto ad esser fortificato: ma solamente doue il bisogna richiede. La qual regola, ancor che veramente in se stessa non pati difficulta, potendo nondimeno il luogo che necessariamente ha da fortificarsi, hauere e piano, e monte, & aqua salsa, o morta, o pur riuiera di alcuna di queste: & hauendo la diuersita di questi siti dato materia a molti di lodare per questo effetto uno piu dell'altro luogo; ho pensato, hauendo io a trattare delle fortificationi, non esser fuori di proposito, per modo solamente di discorso, e non per determinare hora quel parere io habbia giudicato migliore, ragionare prima breuemente di molte parti buoni, e cattive, che in ciascun sito possono considerarsi:

Commonly all the good architects establish their fortresses not wherever the site with regard to its position is recognised to be suited to be fortified, but solely where the business requires. Which rule, although truly in itself does not carry difficulty, nevertheless the places that necessarily have to be fortified can be plain, or mountainous, and salty water, or dead, or wholly riverine, or some of these, and having the diversity of these sites given subject to many to praise for that (or this) effect, one more than another. (Thus) I have thought, in having to treat of fortification, not to be without the intention by way of discussion only, and not to determine now, what opinions I have judged better, to discuss first briefly the many good and bad points that in every site can be considered, so that weighing one against the other, per-

acciò che contrapesando l'uno con l'altro, possano le persone di giudicio, à cui solamente io intendo di parlare, ageuolmente apprendersi al migliore. ¶
 Et dunque da sapere, come ciascun che uorrà fortificare in siti piani, il più delle volte potrà per il recinto de la fortezza fare elezione di quella figura che egli vorrà. onde auene, che quella si possa fare più perfetta, si perche con mancho recinto si può chiudere più superficie di terreno, come che quelli angoli che ue intrauenissero si potrian formare più migliori, è manco tristi del che segue che la fortezza si possa fare più presto & assai meglio defendere con manco quantità d'huomini, e di munitibni... oltre che per la capacita sua potrebbe seruire per frontiera....

sons of judgement, to whom I alone intend to talk, easily understands the best. Then it should be known, to everyone who would fortify on sites on a plain more times is it possible for the enceinte of the fortress, to make the choice of what figure he wishes, where by it happens, that it can be made more perfectly, as much because a lesser enceinte can enclose a greater area of ground, as that the angles which occur can be made much better and less badly; from which it follows that the fortress can be made more quickly and much better for defence with less men and provisions..... apart from which because of its capacity it can serve on the frontier....

p. 4. Nelli monte da l'altra parte l'uomo non può far elezione di quella forma che più li piace....⁴

In the mountains on the other hand, one can not make choice of what form pleases one more.....⁴

p. 7. Questi si faceuano piccole e di mura nõ grosso, quãdo non si erano ancor trouati gli arieti, ne altri istrumenti per rouinarle: ma sopravuenendo ultimamente l'artiglierie di più forza, & di maggiore impeto di quelli, fu necessario anco farle mura migliori, le torre più grosse, per hauer spatio da tenerui li pezzi dentro, & più distanti l'vna da l'altra, per esser maggior il tiro di queste, che quelle delle balestre, e de gl'archi. Parue dopo à quelli che uennero appresso, che gli angoli nelle torre causaggero debolezza: e così di quadre che esse erano, le mutarono in tonda, & le nominarono Torrioni.⁸

These were made little and of not very thick walls, when the ram and other instruments to demolish them were not yet found; but afterwards finally arrived artillery of greater strength and from the greater force of this it was necessary then to make the walls better, the towers greater to have space to contain the pieces within, and more distant the one from the other, the range of these being greater than that of the crossbow and the (long) bow. It seemed then to those who came after, that the angles of the towers caused weakness, and thus those that were square they changed to circular, and called 'torrioni'.⁸ Afterwards with

1. Because the enceinte can avoid unnecessary zig-zags.

2. Undoubtedly Theti was thinking of the acuteness of the bastion being less, but the text does not say so unless 'tristi' is to be taken in this sense.

3. Not less men to construct it, so much, but rather to defend it, presumably.

4. Theti has just been listing the advantages of mountain sites.

5. The square towers of ancient enceints.

6. This reads in the 1569 edition, p. 21, "Ma essendosi ritrouate ultimamente l'arteglierie di piu forza, e di maggior empito di quelli, non resistendoli alcuna fabrica antica, fu necessario far le mura anchor migliori, le torri piu grosse....."

7. "per.....dentro" bracketed in the 1589 edition.

8. "Torrione" FLORIO (1611): any great tower, or strong keepe in the midst of a castle.

Poscia co'l tempo, & con l'esperienza
 s'auuidero, che nelle quadre,
 ne le tonde erano buone, non essendo
 le faccie loro nettate dalli fianchi,
 come manifestamente si ueda nelle pia-
 nta che segue¹...Et non essendo queste
 fabbriche di torri, & torrioni molto
 grandi ne terrapienate, ne potendouesi
 accomodar ritirate, ne hauendo li
 pezzi dell'artiglierie la loro rin-
 culata come è di ragione; erano molto
 inutili; e per poco che fussero
 battute, non ui si poteua star più
 dentro. onde ultimamente si è prou-
 veduto a questi difetti, & si sono
 anco fatte le faccie loro in modo
 che siano ben nettate, come si uede
 nella....piante....²

p. 9. MA per esser ragione l'acutezza
 di molte cose cattive, si hauranno
 principalmente da fuggire non solo li
 recinti triangolari, ma li quadran-
 golari.....³

p. 85. IO credo, anzi tengo per certo,
 Serenissimo Rè, che fra l'infinite
 infelicità, alle quali è sottoposta
 la maggior parte de gli huomini; sia
 la principale il persuadersi di non
 potere errare, e spetialmente in quei
 particolari, doue non è meno necessaria
 l'arte di quello, che si sia la
 sperienza. Hor parlando assolutamente
 delle cose pertinenti alla guerra,
 dico, che come che si uegga, e prouoi
 con ragione, che per apparere qual si
 voglia arte, per bassa che sia, ui
 bisogna tempo e fatica; nelle cose di
 guerra nondimeno, che sono così dif-
 ficili, come importanti....

time, and with experience it was per-
 ceived that, neither the square
 nor the round (forms) were good, the
 faces not being scoured from the flanks
 as is clearly seen in the plan following¹
 ...and these structures of towers and
 'torrioni' not being very great, or terre-
 plained, nor able to accomodate 'ritirati',
 nor having the pieces of art-
 illery, their recoil, as is reasonable.
 They were of very poor use, and batter-
 ed a little while, it was not possible
 to remain within them, whereby finally
 to provide for these defects, their
 faces are now made so that they
 can be well scoured, as can be seen in
 the plan....²

But the acuteness being the cause of
 badness in many things, we have to
 flee not only the triangolar enceinte
 but also the square....³

I believe, or rather hold for certain,
 most serene king, that amongst the in-
 finite unhappiness, to which is subject
 the greater part of mankind, the princ-
 iple (one) is to be persuaded of not
 being able to err, and particularly in
 those places where art is no less
 necessary, than is experience
 Now talking wholly of things pertinent
 to warfare, I say, that it is seen
 and proved with reasons, that to learn
 whatever art, hoever basic it is,
 requires time and effort, which in
 warfare nevertheless are as difficult
 as important.....

1.  Theti's diagram. The elision simply explains the
 area of dead ground at 'D'.



3. Because the points of the bastions that occur are too acute.
 4. Lit. absolutely.

...p. 87. HAVENDO io nelli miei primi discorsi dimostrato quanto in pochi anni sia variato il modo del fortificare le città, e luoghi simili; & che riceuto il danno è stato solito pensare alrimedio.....

Having in my first discourse shown how much in a few years has varied the method of fortifying a city and similar places; and receiving the damage it is customary to think of the remedy....

'Discorsi delle Fortificationi' (1589)

General description: A large rather elaborate work. 11" x 7½" text. (iv) + 49; (iv) + 86; +70; pages in 8 books. Books I & II are the same as the 1575 edition, and have their own separate pagination. Books III to VI, have their own separate pagination and are introduced with their own special title page dated 1588. Books VII & VIII have no such title page but appear with their own separate pagination. The work is generally quite impressive in its comprehensiveness though still rather unorganised.¹

Contents:

p. (i): Title page: DISCORSI DELLE/ FORTIFICATIONI,/ Espugnationi, & Difese delle Città, & d'altri Luoghi./ DI CARLO THETI./ Diuise in Libri Otto./ Oue diffusamente si dimostra, quali debbano essere i siti delle fortezze, le forme, i recinti,/ fossi, baloardi, castelli, & altri cose à loro appartenenti, con le figure di esse./ Hora di nuouo da lui medesimo ricorretti, & ampliati./ Con gli Elenchi di tutti i Capitoli; & Tauola di tutte le materie, che in essi si trattano./ CON PRIVILEGIO./ IN VENETIA, M.D.LXXXIX./ Apresso Francesco de Franceschi Senese.

p. (iii): Dedication to Maximilian.

p. (iv): A lettori begnini.

p. 1/49: Books I & II, very similar to the 1575 edition including the dedication to 'Ridolfo' (p. 35).

p. (i): Title page:² DISCORSI DELLE/ FORTIFICATIONI/ DI/ CARLO TETHI./ Diuisi in Libri Quattro./ AL SERENISSIMO FERDINANDO/ Medici Cardinale, Gran Duca di Toscana./ CON PRIVILEGIO./ IN VENETIA,/ APPRESSO NICOLO MORETTI./ M.D.LXXXVIII.

The remainder of this work -- Books III/VIII -- contains a varied collection of topics ranging from complex outworks to discussion of actual sites such as Comar in Hungary, and Antwerp, the topics tending to be directed towards relatively practical problems.³

1. MARINI (1810) stated of Theti's work "è scritta con cattivo metodo, e noioso stile".

2. This is the separate title page to Bks. III/VI.

3. With an internal dedication to "Ferdinando Medici Cardinale, Gran Duca di Toscana" dated Venetia 15 Feb: 1587.

Discorsi delle Fortificationi (1589): Texts

p. 44.¹² Sarà ancor da considerer la differenza ch'è fra il fortificare, & il riparare: & come, & quando, questi due particolari si possono, & debbon fare: concio sia che il fortificare, è necessario farlo nelle parti che facesser frontiera con altri paesi, & nelli principali città che dentro le frontiere di dette paesi fosser di maggior importanza, & tali fortezze (dove però) i siti fosser di maniera, ch'in tutta, ò nell maggior parte di ciascun d'esse (la natura non u' hauesse fatto cosa gagliarda) nõ si possono far buone, che non ui bisogni assai tempo, & spesa. Nel riparare; ciò è nel ridur i luochi in termini da poterli ancor difendere per non poco tempo: ui bisogna consequentemente, manco tempo, & si suol fare, per cagioni inaspettate, seruaci per esempio, ch'un luogo di frontiera fosse preso, ò stesse per perdersi, il che suol spesso accadere, per non esser conosciuto il difetto del sito, ò dell'arte con qual fosse stato fabricato, o che se pur fosse stato conosciuto si fosse per trascuraggine la lasciato di nõ far le prouisioni necessarie; può ancor accader di riparar luoco, l'importanza del quale fosse stata conosciuta tardi.³

² Further, to consider the difference between fortification and repair, and how and when these two things can and ought to be done, because fortification is necessarily done in places that make a frontier with other countries and in the main cities that within the frontiers of the said country are of greatest importance and such fortresses -- where therefore the sites are of a kind that wholly, or in the greater part of each of them -- nature not having there made a strong thing -- it is not possible to do well, without much time and cost. In repairing, that is to reduce a place to the ends of being further able to defend for no little time, in consequence of it being necessary, lacking time, and if it would be done, for unexpected reasons, to give an example, that a place on the frontier would be taken, or would be lost, which cost occurs, through not being known the defects of the site, or of the art with which it should be built, or that if fully known, through negligence allowing that the necessary provision was not made, and can also occur the repair of a place, the importance of which was known late.³

1. From the 3rd. pagination, Bk. 8.

2. Cf. Castriotto

3. Theti here does not really explain fully what is the difference between fortifying and repair, he explains when one or the other may be necessary. Repair is clearly something done under pressure of conditions. What he seems to be implying is that repairs do not involve a full scheme.

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Carlo Theti: Bibliographical problems and the evolution of his treatise

The bibliography of Theti's writings poses problems. Attributable with certainty are Discorsi di Fortificationi by Giulio Accolto, Rome 1569; Discorsi delle fortificationi by Bolognino Zaltiero, Venice 1575; and the same title by Franceschi Senese and Nicolo Moretti in some combination, Venice 1589.¹ An edition by Giacomo de Franceschi at Vicenza of 1617 is also well authenticated.²

However a number of other editions are sometimes mentioned. RICCARDI (1893) quotes a French version at Lyon of 1589, after Venturi.³ This may have appeared although there seems to be no authoritative modern account of it.⁴

MAGGIOROTTI (1933/9) mentions other editions of 1577 and 1585⁵, without locations. He gave as sources Ayala and Promis.⁶ Now PROMIS (1874) does not know these editions. AYALA (1854) however does quote an edition at Rome in 1585. But he gave a title page reading which pretty well exactly replicates the title page of the 1589 Venice edition; and this title page can hardly belong with an edition of this earlier date because it describes the work in detail which appeared in 1589 with Theti's dedication of 1587.⁷ Thus this 1585 work appears to be a ghost edition.

MAGGIOROTTI (1933/9) also mentioned two other works published by Theti. Dell'espugnazione e delle difese delle fortezze (1585) and L'Istruzione per i bombardieri (1584). These works are not known by any other authorities.⁸ The first title is not unlike the clause that comes after "Discorsi delle Fortificationi" in the title to Theti's 1589 edition and there may be some confusion here. Further these titles are disquietingly similar to the titles to two works published by Busca at just those dates.⁹ Of course these titles are of a common enough type, but the similarities are still disturbing. Maggiorotti also states that Theti's work was published many times in the 17th. century and these editions are nowhere else reported either.

COCKLE (1900) also gave the 1585 Rome edition, but in his Theti entry he stated that the 1st. edition (1569) was "afterwards rewritten and enlarged to about eight times the original size...The eds. of the new treatise are.." and then proceeded to give the 1575 edition on. But the 1575 edition was only a little enlarged from the version of the 1569 edition in its 1st. Bk., with the second book added; it is definitely not the version in 8 Bks.

1. See above p. 70; 72; 76. Copies of these are held by B.M. for example and are detailed in Riccardi.

2. Detailed in N.U.C., given in RICCARDI (1893) and BIB NAT PRS.

3. VENTURI, Giambattista Memoria intorno alla Vita ed alle Opere del Capitano Francesco Marchi (Modena 1816).

4. Neither BIB NAT PRS, N.U.C., B.M know it.

5. Vol. 2, p. 28.

6. In his biographical note Vol. II p. 441. However he gives as reference there Promis XVI. This is presumably a misprint for XIV the number of the Promis volume of Misc. di Stor. Ital. in which Theti's biography appears, which is the only work Maggiorotti lists that this could be, apparently.

7. And the internal title page of 1588. See above p. 76. Ayala also seems inaccurate on this entry in that he gives the next edition at Venetia 1589 by Nicolo Moretti. But Moretti's name appears only on the internal title page dated 1588, while the main title page with the 1589 date lists Francesco di Franscesi Senese. RICCARDI (1893) Vol. II, 1st. series, mentions a m.s. entry of an edition of 1588 by Moretti with the first two books. But this does not tie up with Ayala's entry, and it may be the confusion is arising from the internal title page.

8. N.U.C., BM., BIB NAT PRS, AYALA (1854), MARINI (1810), PROMIS (1874), RICCARDI (1893), RUMPF (1824), COCKLE (1900), JAHNS (1889), although this last does list a m.s. of c 1583 "Zwei Bücher von Erbauung und Belagerung der Festungen" as well as some writings of Theti relative to gunnery.

9. Istruzione de' bombardieri (Larmagnole 1584) and Della espugnazione et difesa delle fortezze (Turino 1585). See below p. 109, & III.

10. That is apart from the well authenticated 1611 edition and the bare date of an edition of 1619 given by Ayala.

which are only first firmly established in the 1589 edition.¹ Cockle's entry is therefore somewhat confusing, and he probably took the 1585 Rome edition which he lists from Ayala.²

In view of the amount of confusion and vagueness that exists with regard to the bibliography of Theti's works, in order to assess the evolution of Theti's treatise it seems advisable to consider the three authenticated editions of 1569, 1575 and 1589 as the only Italian 16th. century editions, and to suppose that all the other editions listed are ghost editions, until an authoritative and detailed modern account establishes any or all of them.

The development in Theti's treatise from the 1st. edition of 1569 to the second of 1575 is clear. The 1569 edition was published at Rome during Theti's period at Vienna, against Theti's wishes, not having been reduced to its proper intention, as he stated.³ The original book was extensively rewritten⁴ and enlarged, and a second book added introducing a "new method of fortification" along with a section on surveying, in the 2nd. edition of 1575, all by Theti himself.⁵

The evolution of the 1589 edition is however problematic. The work as published comprised 3 distinct sections, each with a separate pagination, the three sections being Bks. I/II; III/VI; and VII/VIII. The first stage of the evolution of this compilation involved Bk. III/VI, which are introduced by a separate title page, which refers to 4 books, gives the printer as Nicolo Moretti and the date of 1588; and which has a separate dedication by Theti dated 15th. February 1587.⁶ A separate work comprising these 4 books was probably in production in 1487/8 then.⁷ A decision must then have been taken to produce a much expanded version, rather than one of just those four books. Theti then presumably wrote or worked up the final two books which were given a separate pagination.⁸ These last two books together with the four new books, and two other books comprising almost exactly the contents of Theti's treatise of 1575, together with the original dedication and the internal dedication to "Ridolfo",⁹ as the first two books of the treatise, were then assembled to form the 1589 edition. PROMIS (1874) suggested that these first two books as the beginning of the work were added by an editor, after Theti's death.¹⁰ Certainly one would have expected Theti to write a new dedication to the full 8 books

1. See above, p. 72 & 74.

2. JAHNS (1889) mentions this edition too, probably from the same source.

3. Dedication to the 1575 edition "questi miei pochi discorsi di Fortificatione, fatti da me ristampare, & che già senza mia volontà (non sendo da me stati ridotti a quel termine ch'io desideraua"

4. Cf. above, p. 71 & 73, to see the extent to which the language was changed sometimes, without becoming as clear as one would have liked.

5. For its description see p. 72.

6. It is difficult to see why the special title page with a printer different from that of the main title page was included in the work if this was not the case.

7. As indicated the original book must have been in production for the subsidiary title page to have appeared in the final edition, but printing can not have taken place because each page at the head gives the number of the book to which it belongs in the final series of 8 books. The type had then probably been set up, and all that required changing (or adding) for the final version were these headings.

8. Bk. VII p. 3. "di questo particolare, io n'habbia trattato nel terzo & quinto libro di miei discorsi" suggesting that the 8 book version was then at least projected, although this might have been an editorial emendation.

9. See above p. 72.

10. Theti died in 1589. See the inscription printed by PROMIS (1874).

and perhaps to have modified the first two books, if he had been alive during the final stages of the production of the work.

However the condition of Theti in the last period of his life, penurious, entangled in controversy, and dying of tuberculosis,¹ suggests a pattern connected with the evolution of this final edition which makes this postulated editor by no means necessary.

It is by no means unlikely that Theti began to put together the Bks. III/VI when already suffering from the effects of his terminal disease, and not able to undertake his customary work.² Certainly the decision, that must have come after the beginning of 1588,³ to expand the projected 4 Bk. version was likely to have been connected with some such cause.⁴ Theti then got out Bks. VII/VIII. The addition of Bks. I/II could then have occurred while Theti was still alive but too weak to do very much on the last stage of working up this final version.⁵

The picture that then emerges is of Theti as not over anxious to rush into print. The first 1569 version published against his will, and the second 1575 edition in part in response to the first,⁶ because from illness he had the opportunity to work it on it. The 1589 version, written or at least prepared for publication by a sick man towards the end of his life, with employment difficulties.

The general characteristics of the different editions tend to support this pattern. All the editions tend to lack a strong framework within which different aspects of the subject and particular topics could be discussed.⁷ They have the ring of worked up collections of notes or m.s. treatises, rather than of works thoroughly conceived in purpose before beginning to be written up.⁸ The process of the development of Theti's treatise was then a gradual one in which various ideas on different topics, or different ideas on the same topic were, for different reasons, at different times, added together, without any too great insistence on the importance of their organisation, to form an eventually quite compendious work.

1. Ibid. the inscription gave his cause of death.

2. The internal dedication to Bks. VII/VI is dated 14 Feb. 1587. Theti died 10 Oct. 1587. The 2½ year interval is perhaps just short enough to suggest that he was already substantially affected by the disease. In the 1575 ed. "Alettori begnini" he complained of bad health, stating of the work "Il che haurei piu presto, & forse meglio fatto, si trauagli cosi del animo, come l'indispositione del corpo haussero almeno per poco spatio di tempo fatto con me triegua."

3. The date of the internal title page of Bks III/VI.

4. Perhaps the penurious condition of Theti at the end of his life and the hopes of some money accruing through the new work, was the reason for his publishing again after so long. But a sick man's search for a significant occupation may be the most likely explanation here, as seems to have been the case with the 1575 edition.

5. The text follows very close the 1575 edition but not exactly word for word, a word here and there has been changed, punctuation altered, and corrections made. For example Cap. II BK. I began "La Causa" in the 1575 edition, which became "La Cagione" in the 1589 edition. See also above p. 74, n. 7. Such minor titivations seem to be better attributed to a sick Theti rather than an editor, who would have been more likely to have done more correcting or none at all.

6. One can not of course make too much of Theti's claim that the 1st. edition was not to his satisfaction. All sorts of claims were made in such passages which can not be taken too seriously. But the better arrangement of the 2nd. edition makes such a claim not unreasonable.

7. The first edition had no chapter title headings or subject divisions. The second added a new way of fortification in the second book and then went on to discuss surveying. The 1589 work was conceived in different stages. Bks. III/V & VII/VIII lack subject headings and are not divided into chapters.

8. See Marini's remark above p. 16, n. 1. He also described the book as simply consisting of "varii utili dettagli ed inventioni". JAHNS (1889) noted some of the relevant mss, and of course the 1st. edition was taken from Theti's m.s. (See also PROMIS (1874)).

GALASSO ALGHISIDelle Fortificationi (1st. ed. 1570) [7], [8], [9]Bibliography: (Venetia) 1570; Venezia 1575.¹

General description:² An extremely large, elaborate and finely produced work. 7½" x 11½" text with many marginal notes. (lxii) + 406 pages. Very high quality engravings many on a double page spread.³

Contents:

p. (i): Title page: Elaborate engraving in an architectural style,⁴ surrounding: DELLE/ FORTIFICATIONI/ DI M. GALASSO/ ALGHISI DA CARPI/ ARCHITETTO/ DELL'ECCEL-
LENTISS./ SIGNOR DVCA/ DI FERRARA./ LIBRE TRE,/ ALL'INVITTISSIMO/ IMPERATORE/
MASSIMILIANO/ SECONDO,/ CESARE AVGVSTO./ M.D.LXX./ D.O.M./ CHE DIFENDERA SIGNORI
ET CH'AVMENTATA GLI VOSTRI/ IMPERI, VOI SOLE VERTV, ET ARTI INSIEME.

p. (iii/iv): Dedication dated Venice 28 Nov. 1570.

p. (v): Laudatory verses to Alghisi.

p. (v):⁵ Con Priuelij & Scommunica generale del Sommo Pontefice, & della
Illustriissima Signoria de Venetia, per anni XXV.

p. (ix /lxii): An extremely detailed table of contents.

p. 1/8: Preface.

p. 9/31: Book I: This book is a general discussion about the needs of arch-
itecture, the defects of existing systems in fortification, an attack on Maggi
and Castriotto, and an outline of the benefits of the new system Alghisi⁶ was
putting forward. il

p. 34/308: Book II: The first section of this book up to page 102 is a prelim-
inary discussion, to some extent on general topics, but centering around the
design of a fortress with five bastions according to Alghisi's method, and
the nature of the geometrical construction involved. It also includes a dis-
cussion of a gadget for surveying the site of the fortress, and discusses the
profile of the walls of the fortress. The remainder of the book, pages 103/308
deals separately with the case of each regular fortress from that of 5 bastions⁵
to that of 21 bastions. Each of these cases is dealt with separately and seq-
uentially in a standard manner. First comes a chapter describing the geomet-
rical construction of the particular fortress at issue, together with a large
double page spread engraving of its plan. Then follows a chapter on the prop-
ortions of the various lines in the plan of the fortress, and another on the
measure of its angles. Next comes a chapter on the measure of the fortress,
followed by one discussing the bastion of this particular fortress, with a
large single page engraving of one such bastion. In each case each particular
fortress is discussed with about the same amount of detail; and each discussion
includes a good deal of explanation as to what line is equal to which, in the
setting out plan,⁶ and likewise for the angles, to an extent that seems wholly

1. After RICCARDI (1893).

2. Of the first edition.

3. These are properly bound in as in collections of maps so that they can
open out fully.

4. The architectural feature has four statues in niches labelled "Archit.";
"Geom"; "Arith"; "Astr".

5. The case of the pentagonal fortress here has a different solution to that
of the earlier general discussion (p. 34/102).

6. For example p. 184. "Hora finite le dimostrazioni delle proporzioni geo-
metriche della fortezza d'undeci belloardi, si dichiareranno alcune de le
principali misure d'essa fortezza."

gratuitous and of no real benefit.

p. 309/406: Book III: This book contains a series of discussions on various more practical topics including the choice of a site, the nature and use of various materials, choice of workmen and supervisor, earth fortification and ancient castramentation.

Delle Fortificazioni (1579): Texts

p. (iii). Ma de gl'antichi modi del fabricare si potiamo in questa nostra età seruire solamente d'una parte, come de gli edificij publici & priuati.....nel formare, & fabricar le fortezze delle città,¹ & castella habbiamo da procedere molto diuersamente da quello ch'essi² faceuano: Perioche essendosi per la malitia de gli huomini ritrouato in questi tempi nuoue machine, & nuoui modi d'offendere, & di atterrare le mura, quantūque grosse, è necessario ancora cō nuoui modi di difese soccorrere al loro impetuosi insulti: Però molti in questa nuoua età si sono affaticati in formar diuersi modi di fortezze, ma nissuno per mio giudicio hà potuto conseguir l'intento, & desiato fine, con quella perfectione necessaria a così potēti offese: La qual cosa considerando, & essendo io disideroso di giouar al mondo, à tutto mio potere son andato piu uolte discorrendo intorno à diuersi smodo di fortezze, & non n'ho potuto ritrouar alcuno che piu mia paia al proposito, di questo mio nuouo modo, che nel presente Libro hò descritto, & figurato, & ridotto io à quella perfectione di Theorica, & Prattica d'alcuno non mai piu fatto....

p. (v). Se quei, che di fortezze hanno tratto/ Senza regola ferma, anzi in confuso;/ E per prattica sol han posto in uso/ I lor precetti, lode han meritato./ Che direm noi del

But we can be served by the ancient ways of building in this time of ours, only in one part, as in public and private buildings....in forming and constructing the fortresses of cities² and the castles, we have to proceed very differently from what these³ did. Because, through the evilness of men in this time are found new machines, and modes of attack, and of demolishing the walls, however great, it is necessary then with new means of defence to aid against their violent attacks⁴; therefore many in this new era are toiling to form sundry types of fortresses, but no one to my judgement, having the ability to achieve the intention and desired end, with that perfection necessary to this powerful attack. Which thing considering, and being desirous to aid the world, as far as I am able, I have proceeded many times to discussion concerning the sundry ways of fortifying, and I have not been able to find anything which appears to me more to the purpose than this my new method, which I have in the present book, described, and illustrated, and reduced to that perfection of theory and practice greater than that yet achieved by any⁵ one....

If those that have treated of the fortress without definite rule and in confusion, and by practice alone have put in use their precepts, have merited praise, then what will we say of the

1. "Fortezze delle città" = strength of cities, cities as fortresses, not as having in them fortresses.

2. I.e. the ancients.

3. Lit. insults.

4. The usual claim.

5. Verse form.

modo inusitato/ Del dotto Alghisi, che
mostra l'abuso/ Delle Fortezze, onde
stupir quà giuso/ Farà ciascun per l'
Arte in ogni lato ?/ Ei certo con
ragion mostra i difetti/ Delle moderne,
e con acuto ingegno/ Perfette le con-
duce à parte à parte/ Onde darà à mat-
eria à i dotti petti...

p. 1. VARIE, e diuerse arti all'vso
humano pertinenti da nostra antichi
con gran studio ritrouate sono per
loro industria, e fatica à noi per-
uenute.....Ma dirò, bene che se fra
tutte le maggiori e le piu nobile
vorremo ricercare, si trouerà che
l'Architettura da quelle arti nõ deue
essere esclusa, le quali e per l'vtile
e p il diletto, & per la dignita siã
riguardeuoli: Ma prima che piu oltre
si proceda parmi conueniẽte di far
manifesto qual debba essere l'Archit-
etto, a buõ fortificare. Percioche p
tale non s'intẽde vn semplice artifice,
ne un semplice soldato, i quali si
vuogliano uguagliare à gl'huomini dotti,
e di quelle sciẽze esperti, che sono
necessarie alle grã professione dell'
Architettura: Percioche l'Architetto
vsa la mano di tutti gl'artefici pert-
inẽti alla fabrica, come suoi inst-
rumenti, & à rispetto à loro come l'
anima rispetto à i mẽbri, i quali
sono da lei mossi, e retti, si come in
molti luoghi ci ha insegnato il grãde
Aristotle. Colui adũque chiamerassi
vero Architetto, ilquale co'l giud-
icio, e cõ la mẽte espressa cõ mar-
auigliose ragioni, e modi di dis-
segnare mandarà ad effetto tutto ciò,
che dal mouimẽto de pesi, e cognitione
de'corpi, & aumẽtatione ad vso dign-
issimo de gl'huomini acconciamẽto s'
accõmoda: il che nõ può egli fare nõ
hauendo prima la cognitione delle cose
migliori, e piu nobili: Tale adũque
sarà l'Architetto buõ fortificatore.
Oltra di queste è necessario saper
l'origine di questa arte. Dicono
alcuni che 'l fuoco e l'acqua sono
state cagioni principali di cõndurre
gl'huomini ad habitare insieme.....

unused¹ method of the wise Alghisi,
which demonstrates the disorder of
fortification, whence to amaze justly
here everyone by the art in every side ?
He truly, with reason shows the defects
of the moderns, and with subtle skill,
perfectly leads them from part to part,²
and will give material to wise breasts..

Many sundry arts belonging to human
use, discovered by our ancestors with
great study, are, through their indus-
try and labour, come down to us...But
I will say, truly if among all the gr-
eatest and most noble we would search,
it will be found that Architect-
ure from these arts ought not to be
excluded, because for utility and for
delight, and for dignity it is worthy
of honour. But before proceeding fur-
ther it seems to me convenient to show
what ought to be the Architect and
good fortifier. Because by this is not
intended a simple craftsman, or a sim-
ple soldier, who would wish to be equal-
led to the men, wise and expert, in those
sciences that are necessary to the
great profession of Architecture.
Because the architect uses the hands
of the tradesmen concerned with build-
ing, as his tools, and relative to
them is as the mind to the limbs,
which are by him moved and ruled as in
many places has taught the great
Aristotle to us. He that therefore
would be named a true Architect is he
who with judgement and with the mind
expresses with wonderful reasons, and
ways of design, will show how to achieve
all that which of the movement of weights
and knowledge of bodies, and increase
to the most worthy human use rightly
belonging, which he can not do not
having first the knowledge of things
better and more noble. Such therefore
will be the good architect and fortif-
ier. Besides which it is necessary to
know the origin of this art. Some
say that fire and water were the
principle causes bringing men to
live together.....

1. In the sense of not yet used, new, novel.

2. I.e. in the whole theory of Alghisi.

3. E.g. Alberti, whose sentiments are followed here. (See I p. 105.)

p. 9. ¹CONSIDERANDO io fra me stesso
 1 gran forza, e 1 grande impeto de
 colpi de l'artiglieria, m'è parso molto
 difficile, e quasi ancho impossibile il
 trouare materia alcuna, che sostener
 gli possa. E se pur se ne ritrouasse,
 quella non potere esser altro, che
 smisurata, e grossissima muraglia, e
 forse di quella maniera che si legge
 messere stata quella de Ninuiti, e di
 Semiramis in Bablonia....Nelle qual
 fabrica tanta spesa ci vorebbe quando
 alcuno volesse cingere vn luogo, che
 non is trouerebbe chi far potesse, o
 volessi. E quando pur si ritrouasse,
 forse anco non si farebbe tale, che
 resistere potesse alla continue per-
 cosse dell artiglieria. E chi nol
 crederebbe? Venendo ch'1 durissimo
 marmo cedendo al continue impeto de le
 gocce dell'acqua...Per la qual cose es-
 end'io sempre stato desideroso di giou-
 are altrui, me sono sforzato con l'aiuto
 dell'arte, e del mio debole ingegno di
 riformare una maniera di fortezze cō
 ragione geometrica, che non possa
 esser battute dalla artiglieria....
 Pregando ogni dotto & ingegnoso
 lettore, che ritrouando ui cosa che non
 gli piaccia, piu presto uoglia amor-
 volmente correggerla, che con malig-
 nità d'animo biasmarla....Essendo
 adunque l'intention mia di formare con
 l'aiuto dall'arte una sorte di fort-
 ezze, che sia sicura non solamente
 dalla batteria dell'artiglieria, ma
 ancora in buona parte dall'assedio piu
 che alcuna altra cō l'aiuto dell'arte
 fatta....

¹Considering in myself, the great
 strength and grand fury of the blows
 of artillery, it appeared to me very
 difficult and nearly impossible to
 find any material which can sustain
 it. And if surely such would be found,
 it could not be otherwise than immense
 and the greatest walls, and perhaps of
 that type which are read as being those
 of Nineva and of Semiramis in Babylon...
 In whose construction such cost would
 be when anyone would enclose a place
 that it would not be found possible to
 do it,² or would be wished. And when
 truly it would be found, perhaps even
 it would be such that it could not res-
 the continual blows of the artillery.
 And who would believe it, seeing
 that the hardest marble gives way to
 the continual impacts of drops of water³
Whereby I, being always desirous
 of helping others, am forced with the
 aid of art, and from my feeble skill,⁴
 to form a style of fortification
 with geometrical rules, that can
 not be battered by artillery....
 Praying any wise and ingenious reader,
 who discovers anything in it that does
 not please him, more quickly will cor-
 rect it in a friendly way than blame it
 from malevolence of spirit.... It
 being therefore my intention to
 fashion with the aid of art a type
 of fortress, which will be secure
 not only from the battery of artillery,
 but also in good part from the siege,
 more than any other with the aid of
 art made....⁵

p. 12. ..Ma in effeto per essere molto diu-
 erse le inegualita de monti non si può
 dare delle fortezze di tai luoghi
 regole forme....si deve fuggire di
 edificare fortezze in monte.

....But in effect through being very
 diverse the inequalities of the mount-
 ains, the fortresses of such places can
 not be given regular form....(and hence)
 building of fortresses in mountains
 ought to be shunned.

46p. 13.doue la natura ha mancato
 nel fare il sito forte, l'arte, la
 ragione, e l'ingegno humano può
 mirabilmente supplire in fare ta
 fortezze del piano inespugnabili.....

...where nature has lacked in making
 the site strong, art, reason and human
 skill can marvellously provide in the
 making of such fortifications of the
 plain, impregnable..

1. From the beginning of the Promeo.
 2. One might say much the same about Alghisi's schemes.
 3. But marble is still and all not a bad, and in fact quite a durable building
 material.
 4. A common disclaimer.
 5. The last section here after "artiglieria" is slightly obscure. Probably it
 should read with a comma after 'siege', the clause ending there having the
 sense of being secure from most aspects of siege warfare.

p. 20.la buono forma, ò figura, la quale per mio giudicio uale assai piu che tutto il resto, e deve esser fatta con proportione, co'l mezo de lineamenti tirati secondo l'arte geometrica.

Di questa sorte di fortezze¹ è stato scritto d'alcuni, come dal Castriotto, e dal Maggi, ma molto imperfettamente. Prima perche hanno errato nella forma di tutte le fortezze, poi perche hanno malamente composto i lor belloardi non solamente quanto alla forma, ma anchora quanto alla distanza....²

p. 21. Perche quanto piu s'auicinarà alla forma circolare, tanto piu sarà capace d'habitationi, & haurà gli angoli de belloardi ottusi....⁴

p. 22. Da questo si può manifestamente conoscere quanto piu siano difficili i fatti dalle parole, onde sono molti, che sanno con belle & ornate parole dire e proporre una cosa, la quale poi non sanno condurre ad effetto.⁵

p. 31. E Perche si potrebbe ritrouare che uolesse biasmare le dette fortezze con dire, che facēdo le cortine cosi con l'angolo, che rientra nel corpo della Città, ò fortezza, si perderebbe molte terreno dentro del corpo, ò recinto delle mura della fortezza; à questi riponderei prima, che l'intention mia è di formare fortezze inespugnabili, e non far un grã corpo di fortezza, che habbia sol gran spacio di terreno dentro dalle mura e poi sia debole...⁶

....The good form, or shape which to my opinion is worth much more than all the others, is when being made with proportion, by means of lines drawn according to the art of geometry.

This sort of fortress¹ has been written of by some, like Castriotto and Maggi, but very imperfectly. First because they have erred in shaping all the fortresses, then because they have badly composed their bastions not only according to form but also according to distance....²

Because as much will be approached³ the circular form, so much more will be the space for habitations and it will have the angle of the bastions obtuse..⁴

From this it can be clearly recognised how much more difficult are deeds a than words, whereby many with beautiful and polished words state and propose a thing which then does not lead to results.⁵

And because some could be found, that wish to fault the said fortresses by saying, that making the curtain with an angle which is re-entrant into the body of the city or fortress, much land within the body or enceinte of the fortress is lost. To them I reply first, that my intention is to form impregnable fortresses, and not to make a great body of the fortress, that only has a great space within the fortress, and then is weak...⁶

1. In the form of a star.

2. This last is peculiar. Alghisi goes on in this vein but does not explain in detail what he meant here. He explained however that it was he that thought of this form and therefore it was only to be expected that others who used what he had discovered did not understand it and hence got things wrong.

3. Lit. embrace.

4. The standard view actually quoted from Maggi and Castriotto, to show that they did not fully understand good traces, because they showed a square fort which is very bad in this, although at other places these authors said a pentagon was the trace with the smallest number of sides that should be used.

5. Re Maggi and Castriotto calling for no acute bastions yet showing the square. Alghisi then attacked Castriotto's acceptance of round bastions

6. Alghisi suggested that also one can grow crops and pasture animals on the large areas within his defensive front. As he gave no internal boundary to the enceinte in his plans, it is difficult to judge how great this area was, but it was certainly substantial, and his omission tended to distract attention from this.

p. 35. Si ha adunque da conchiudere
 esser necessario far prima il dis-
 segno picciolo della fabbrica inanzi
 che in opera si faccia il maggiore:
 ma à fare tal disegno picciolo in carta
 si ricerca così con la scienza la
 buona pratica à farlo in opera, anzi
 maggiore. Perche dalla buona pratica
 del minore s'impara la pratica de i
 maggiore, iquali sono l'opera istessa.
 Et che questo sia il uero si uedi che
 niuno ualēt huomo non farà mai fabbrica
 alcuna senza l'esempio delli suoi
 disegni, cognoscendo che si la facesse,
 la sarebbe male, e tanto peggio quanto
 essa fusse maggiore, e con sua gran
 vergogna, per la caggioni di sopra
 narrate. Onde mi marauiglio d'alcuni
 ignoranti, & inesperti, c'habbino
 tanto ardimento, che si mettana à
 fabricare senza alcun disegno, e senza
 alcuna ragione in loro, non potendo
 riuscire alli intelligenti e pratici
 le loro fabbriche senza disegno, il
 quale dopo l'Arithmetica, e Geometria
 è la piu importante parte dell' Arch-
 itettura, perche senza esso non è
 possibile fare cosa alcuna, che buono
 si giudicata: Perche tutte le fabbriche
 non sono altro, che disegno con
 Architettura, Arithmetica, Geometria &
 Prospettiva composte....

It has to be concluded therefore to
 be necessary to make first the little
 design of the edifice before in the
 work is made the greater. But to make
 that little design on paper is requ-
 ired as much science with good pract-
 ice in making the work, further
 (in the) large. Because from the good
 practice of the less is learnt the
 practice of the greater (ones), which
 are the work itself. And that this
 is true is seen from (the fact) that
 no valiant man will ever construct
 anything without the example of his
 designs, knowing that if he should it
 would be bad, and as much worse, as
 this would be greater, and with great
 shame for the above said reasons. Where-
 by I marvel, that some ignorant and
 inexpert persons, having so much daring,
 that they set about building without
 any design, and without any method in
 these, the intelligent and practised
 not being able to succeed in their
 building without design, which after
 Arithmetic and Geometry is the most
 important part of Architecture, bec-
 ause without this it is not possible
 to make anything of good judgment.
 Because all building is none
 other than design with Architecture,
 Arithmetic, and Geometry, and Persp-
 ective, composed.....

VINCENZO LOCATELLI

Invito Generale (1575)²

General description:³ A short unpaginated treatise. 36 pages, no diagrams, except one showing a scale.

Contents:

Title page: Recto: IVITO GENERALE/ DEL CAP. VINCENTIO/ LOCATELLI/ Da Cremona,/ CREATO DEL CAPITANO FRA/ DA MODONA./⁴

: Verso: Alli Professori del reparare, fortificara, & edificare Luoghi, & a quelli che dapoi costrutti detti luoghi accettano carico di difenderli contra la tremenda offesa hoggidi usato da Maumetani, cioè, de

1. I.e. the less design work is done.

2. Only known edition.

3. This work has only been examined by way of a microfilm. The description and make up of the work are somewhat problematic therefore.

4. This last clause is slightly ambiguous. It might refer to the putting together of the work. However as a youth Locatelli served in the house of Captain Fra so that it refers to Locatelli rather than his work.

de Canoni, Colubrine, Basilischi, Zappa, & Pala. Il qual pretende mostrar¹ non tanto che si può difendere le fortezze fatte alla moderna con li Beloardi, le uecchie con li Torrioni tondi, & l'antiche con li lor membri quadri, ma perpetuarle son che saranno prouiste, non alterando pressedio, nè munitione, nè altra spesa in tempo di guerra ordinaria contra la predetta offesa, coforme a quanto in questo s'intenderà.

Sg. B1a/D 3 b: In the form of a letter addressed to Pope Gregory XIII. Dated Bologna 12, Feb 1575, by Vicentio Locatelli. (17 pages)

Sg. B1a/C 2 b: This section puts forward in essence 11 conditions, or rather considerations², which would be necessarily considered to arrive at fortification proposals that conformed to what Locatelli thought desirable, in accord with the terms set out in his title.³

Sg. D1a/ 3. a: Here Locatelli sets out the administrative details of a competition within the framework of his 11 "quesiti" in order to get desirable proposals created.⁴

Sg. D 4 a/b: Section addressed to "mio Padrone colendissimo, Il Sig. Giacomo Boncompagni, Governator Generale dell'Armi di Sua Sanita". Dated Bologna 12 Feb. 1575.

Sg. D 4 b: Colophon: In Bologna, Per Alessandro Bencaci MDLXXV. Con licenza de' Superiori.

After Sg. D4b/f1b: This sections seems to have been printed after the above. It includes a dedication to "Don Giovan d'Austria mio signore" dated at Lucca 20 July 1575. An account of the publication of the Invito Generale. Correspondence with Giacomo Boncompagni, of 1574. Letters by Locatelli after the publication of the work claiming his good faith in the work, and that he could fortify as he claimed.

Invito Generale: Texts

<p>Sg. B1a. NON è dubbio alcuno (beatissimo Padre) che sendo le lettere, & l'armi li dui principali, & honoratissimi mezzi, onde posono gli huomini col</p>	<p>There is no doubt -- holy father -- that letters and arms are the two main and honourable means, whereby men can, by putting them in virtuous</p>
---	--

1. This work does not really 'pretend to show' how the following intentions might be achieved, except in the sense of laying down a framework within which this might be discussed. MARINI (1810) stated "Con quest'opera pretende l'Autore di provare, che si possono egualmente difendere tanto le fortezze fatte alla moderna, quanto quelle colle torri rotonde", which is slightly misleading. Perhaps he put too much weight on this title.

2. Sometimes referred to by Locatelli as "quesiti".

3. For the first two considerations see below p. 81/89 ; the third is for the fortress to remain secure not just for a time but perpetually against every attack; the fourth proposes the figure of a hexagon in four different cases with fronts of 200, 300, 400 and 500 paces between interior angles; the fifth and sixth each describe a particular site in detail, to be fortified; the seventh a particular flank to be defended; the eighth to impede the enemy who has captured the counterscarp; the ninth to prepare a battery in one day, for assault; the tenth to negate mines; the eleventh, Locatelli's central point, to defend old structures with round towers, and old square ones, which he claimed to be able to do himself, and generally to resist the Turk, on which he claimed to have already published.

4. These arrangements included: 1. Everyone interested in Locatelli's proposals to prepare 6 designs or models of the 6 places outlined; 2. to give profiles also; 3. 2 copies of each to be deposited for assessment; 4. all to deposit 2,000 scudi with their designs ("scudi 2.m"), which monies were to go to whoever was judged the best military architect; 5. 12 competitors coming together to chose 3 judges familiar with attack and defence, at least one to be a good mathematician, also a Prince as 'moderator', further 2 "depositari" to care for the designs, models and writings, and the money, 4 secretaries, one for each of the three judges and one for Locatelli; 6. choosing a prince as final arbiter by lot.

5. There are two leaves without signatures.

6. Including a reply to "Pompeo Floriano da Macerta", dated 20 July 1575.

porli in uirtuoso essercitio prepararsi practice prepare themselves entrance to
 edito al Cielo,¹ gloria nel Mondo, & the sky,² glory in the world, and fame for
 essaltatione alle famiglie loro, molti for their family; to which worthy acqu-
 per uenire a cosi degno acquisto, o isition, or to one or the other accord-
 all'Une, o all'altre secondo l'inchin- ing as their inclination; many
 atione loro si uolgono: onde è, che desire. Whereby it is that I from my
 sino da puerili anni sentendomi per youthful years feeling much more inclined
 natura assai piu inchinato alla mil- to arms than to study, I proposed to my-
 itia, che alli studi, mi proposi (ha self, already many years ago, to
 già molt'anni) di prouare i disagi experience the hardships and dangers
 & pericoli della guerra, massime in of war, especially in that part, where
 quelle parti, doue gli nemici delle the enemy of the holy father in Christ
 santa fede di Christo. N.S. maggior- our Lord hurt the most. Whereby in
 mente infestauano. La onde in questa this way for a long space of time I
 maniera per lungo spatio di tempo travelled my life, later having
 traualiado questa mia uita, doppo l' recognised that to the perfection of
 hauer conosciuto, che alla perfettione the true soldier, was not less con-
 del vero soldato non era men conuen- uenient and necessary; military arch-
 uole, & necessaria l'architettura mil- itecture.....

Sg. 8 3 a. Nel primo² proponend'io, che
 'l Corpo nominato fortezza consiste in
 sei cose, oltre le quattro principali,
 & elementarie.³ Tra quelle quali essendo
 il riparare, il fortificare, & l'edif-
 icare, & l'altra tre fosso, fianco,
 & piazza: senza le quali non possono le
 tre prima far'li lor debiti, & conuen-
 ienti effetti nel resistere alla super-
 ior forza, desidero che ciascuno prima
 chiarisca che cosa sia riparare, fort-
 ificare, edificare, poi la causa, il
 tempo, & il luogo, doue si mettono in
 essecutione queste tre cose, & final-
 mente gli effetti che fa ciascun da
 per se.

Nel secondo gli effetti, che fa cias-
 cuna dell'altre tre cose da per se,
 cioè, fosso, fianco, & piazza, chiar-
 amēte mostrando quelle misure prop-
 ortionate, che per dar la debite forma
 alli corpi tutto di ci mostrano li

In the first² I propose that the body
 called a fortress consists in 6 things,
 besides the 4 fundamental and element
 ary.³ Amongst which are Repair, fortif-
 ication and Building, and the other
 3, fosse, flank and platform,⁴ without
 which the first 3 cannot make their use-
 ful and due effects in resisting
 superior force. I desire that everyone
 first clarifies what are Repairs,
 Fortification and Building, then the
 cause the time and the place where
 these things are put in execution,
 and lastly the effects that each one
 makes of itself.

In the second the effects which does
 every one of the other three things
 of themselves, that is fosse, flank
 and platform, clearly showing those
 measures proportionately, that by
 giving the due form to the body.

1. I. e. to reach heaven.

2. These are the design conditions which Locatelli set up for his design comp-
 etition. See above p. 87.

3. The four elementary things: perhaps the four greek elements of fire, earth
 air and water, for nothing else seems to be indicated, unless it is the
 Cannons, Culverins, Sapps, and Spades, as mentioned below; but in his title
 Locatelli adds basilice, so these can not be four standard things.

4. The 'piazza da bassa' & 'd'alta' etc.

Canonii, Coulbrine, Zeppa, & la Pala,
che propriamente sono i veri nostri, &
approuati precettori.

show all the Cannons, Culverins,
Sappes and the spade, that properly
are our true approved preceptors.

Sg. Dia.tutti le cose, che gli
shuomini si propogono per essequire,
quando sono con regola & ordine da
loro trattate, riescono sempre piu
lodeuoli nel fine, che le confusam-
ente, & a caso¹ essequite.....

....all the things which humans can
propose to execute, when they are treat-
ed with their rule and order, prove
always more praiseworthy in function,
than the confusedly and to the case¹,
executed....

¶ Sg. D3b.se alcuni...desederi
uenire ad una spedita cognitione di
questa uerita², s'egli non sarà Principe,
o tale, che possi gratificarmi di
quegli honori che si richiederiano
a chi per proua mostrasse il vero
effetto di quanto io prometto, & dico,
facci deposito, o dia rispondente, che
s'oblighi per 60. in 100. m. scudi....³

...if any...wish to come to a speedy
understanding of the truth in this²,
if he will not be a Prince, or such,
that he can gratify me of such honours
which are required to who through proof
shows the true effect in as much as I
have promised, I say, let him make a
deposit,³ give an understanding to be
obliged to 60, or 100 thousand scudi...³

1. "a caso" the connotations are partly negative in the sense of haphazardly,
and partly of an act with an improvised nature as in ad hoc.
2. I.e. Locatelli's doctrines.
3. This seems a ridiculously large figure.

AURELIO DA PASINOL'Architecture de Guerre (1579)¹

General description: 8½"x5½" text. 95 pages + 5 sheets of engravings. Some figures in the text. No chapter divisions or headings generally. Some marginal notes.

Contents:

p. 1: Title page: DISCOVERS/ Sur plusieurs poincts/ DE/ L'ARCHITECTVRE/ DE GVERRE,/ CONCERNANTIS les fortifications tant/ anciennes que moderns./ ENSEMBLE le moyen de bastir & fortier vne place/ de laquelle les murailles ne pourrant aucunement/ estre endommagées de l'artillerie./ Par M. AVRELIO DE PASINO Ferrarois, architecte de/ tres-illustre Seigneur, Monsieur le Duc de BVILLON./ A ANVERS,/ De l'Imprimerie de Christophe Plantin,/ Imprimeur de sa Maiesté./ M.D.LXXIX.

p. 3/5: Dedication to William of Orange.

p. 6/8: Poem by "Ch. de Naviers sed. Gentilh."

p. 9/26: General discussion on the historical genesis of fortification; the difference between fortification and architecture in general; ancient weapons and siege techniques in comparison with contemporary types; the changes in style leading to 16th. century systems.

p. 26/34: General discussion of artillery, its use and effectiveness.

p. 34/64: Various points discussed: the basis of the geometrical bastion system, including whether to build anew or to modify old structures, especially with regard to different sites, as for example in the mountains; the advantages of Alghisi's style.

p. 64/91: Fortification using earth masking banks as 'counter-guards', with their details, discussed.

p. 91/94: "Instruction et Demonstration du Plant Geometrique, Pour Figurer la Fortresse ci-devant descrite."

p. 95: Closing remarks.

"L'Approbation: Ce liure ne contient que choses appartenantes à l'architecture, sans aucune mention des chose appartenantes à la foy, & pour c'il peut estre librement imprimé & vendu. Waltherus vander Steeghen, S.Theol. Licenciatus, canonicum Antuerpiensis."

There follows 5 pages of engravings² showing 12 examples of parts of curtain walls and bastions of very varied and odd shapes.

1. Only known edition.

2. This is the copy held by the B.M. 534.1.5(1). The plates show examples numbered 1 to 12. N.U.C. gives 8 plates.

L'Architecture de Guerre (1579): Texts.

- p. 3. Voyant aussi que tous bons esprits faisant profession de l'Architecture de guerre, s'efforcent pour le bien du public, d'employer tout ce que ce grand & sdiuven Ouurier leur a departi de science & pratique, à fin de n'estre point ingrats à la posterite.
- p. 7. A fin de s'opposer à cest infernal art, / Qui détruit la vertu si pourement meurtrie. / Ansi par l'art du Nombre, & la Geometrie, / Avec la Perspectiue inventions des Dieux³ Maint architecte docte, & en plans, studieux, / A tracé son dessein qui de lineature / S'est apres u'éleué par la manufacture / Des maçons & ouuriers.....Tant le temps a bien sceu de defences subtiles, / Spiritueliser les persons gentille, / Aquel nombre, Maurel, tu n'es des plus petits, /.....⁴
- 20p. 10. Et pour y paruenir, Dieu qui luy auoit reserué quelques rayons de ceste premiere cognoissance⁵, luy a fait voir par iceux les remedes de sa iuste defense; & engraué en l'entendement certaines sciences, par lesquelles il a apprins, en se bastissant vne maison⁶, se contenant & fortifiant en icelle, de iouir d'vne seureté
- Seeing also that all good spirits making a profession of the Architecture of war, endeavour for the public good, to employ all that which the great and divine workman has given them of science and practice¹, in order that they will in no way be unprofitable to posterity.
- In order to oppose this infernal art (i.e. of gunnery) which destroying virtue so miserably murders. Thus by the art of Number and of Geometry, With Perspective -- inventions of God, Many an architect, wise and practised in plans, Has traced his designs whose outline is afterwards raised by the industry of masons and artisans.... (which evil) as much of the time has well known clever defences -- which spiritualizes gentle persons², Amongst whose number you Maurel are not of the least.
- And to succeed there (i.e. in his defence), God who has reserved to him some rays of this first understanding, has made him see by them the remedies to his true defence; and engraved in the understanding certain sciences, by which he has learnt, in building himself a house, to contain and fortify himself in

1. = craftsmanship presumably.

2. I.e. the contemplation of the means of defence using geometry and perspective and so on, improves the minds of gentlefolk.

3. Number and Geometry are not perhaps very strange as inventions of God, but Perspective? The thought seems to be, not that God created the drawing techniques of perspective, but that he created the world in which perspective techniques were inherent. This would thus be on a par with many views of the relationships between God, mathematics, and the world.

4. Verse form.

5. Implicit reference to the Fall. Pasino a little previously contrasted animals, with their natural physical defences, horns, shells, etc., with man where "il a pourueu l'homme d'vn esprit docile & inuentif, retenant quelque scintille de ceste premiere lumiere, pour cognoistre, chercher & appliquer les remedes propres à sa necessité, laquelle les Anciens ont tresbien dit estre la maitresse des Arts".

6. Pasino seems to be giving a very strongly innate view of science here. This is probably no more than a product of his rather loose and general style. He certainly was thinking of some kind of innate quality of the human mind as important; but he was in no way concerned to be precise about what exactly is innate to the mind and how, or under what circumstances, this innate ability is expressed or may be brought out. In a general way what he seems to intend is that ability to act in accord with certain (rational) principles, is innate, even perhaps the principles of geometry, but that at least application of that knowledge has to be learnt by experience, and possibly, that attempts in practice help to call forth such a science.

& franchise inuiolable contre ses aduersaires.

CES sciences, desquelles par la grace de Dieu nos predecesseurs ont esté auteurs & inuenteurs, sont du nombre de celles qu'on appelle vulgairement les sept Arts liberaux: Et en pouons remarquer trois, à sçauoir Geometrie, Perspective, & Arithmetique. Ces trois coniointes ensemble seruent de principe, source & fondement à vne autre science, nommee Architecture (dont nous auõs à traiter en ce liure) laquelle, combien qu'elle ne soit mise au nombre des sept Arts liberaux, ains soit strangee entre les Mechaniques; toutesfois pour estre apuyee & entierement fondee sur les trois que nous auons dit, & estre allies & incorporees inseparablement ensemble, elle en est d'autant plus à priser, que avec la necessité & vtilité qui l'accompagne, elle participe de la liberalité & dignité de ses trois meres, que l'ont engendree, sans lesquelles elle ne peut subsister. Car quiconque se voudra mesler non seulement de l'architecture, mais aussi des autres ars Mechaniques, sans auoir l'intelligence de ces tres sciences: il est impossible qu'il face rien qui vaille, & seront ses ouvrages manque, ridicules, & deffectueux.³

that, and to exercise a security and freedom inuolate against his enemies. These sciences of which, by the grace of God, our predecessors have been the authors and inventors, are of the number of those which are called commonly the seven liberal Arts: and of these we can remark three known as Geometry, Perspective and Arithmetic. These three joined together provide the beginning, source and foundation to another science, called Architecture -- which we have to deal with in this book -- which, as much that it should not be put in the number of the 7 liberal arts, but should be ranged among 'the Mechanics': nevertheless in being supported and entirely founded on the three that we have said, and united and embodied indivisibly as a whole, it is so much the more to be prized, that with the necessity and utility which accompanies it, it participates in the liberality and worthyness of its three mothers, which have engendered it, (and) without which it could not exist. Because whoever would wish to master not only architecture, but also the other mechanical arts, without having understanding of these 3 sciences, it is impossible that he will make anything of value, and his works will be lacking, ridiculous and faulty.

1. These were of course the Quadrivium and Trivium of the mediaeval curriculum, which did not traditionally include perspective as a specific one of these seven, in the form of geometrical optics which was designated by 'perspective' in that period. (See PECKHAM ()). The painter's perspective which Pasino is concerned with was not in use at all then, of course.

2. "Liberal", as the OED puts it, was "Originally, the distinctive epithet of those 'arts' or 'sciences' that were considered 'worthy of a free man': opposed to servile or mechanical". Pasino was thus arguing more about the status of Architecture, than its nature.

3. Pasino goes on to quote the words over the entry to Plato's Academy, insisting all who entered had to know Geometry, as evidence for the importance of that study in many branches of knowledge. This helps to raise the status of mechanical knowledge so based, and hence to reduce any taint to architecture through being connected to the mechanical arts. The closing phrase in this section is, of course, pure assumption.

p. 13. Car l'ouurier n'est autre chose, en comparaison de l'Architecte, que sont les outils & instruments à l'ouurier par dessus lequel il doit estre plus respecté, & est d'autant plus digne, que l'ame est plus excellente que le corps... cest Art nommé Architecture, lequel l'homme a esté contraint chercher & inventer....pour trois causes principale: 1. Pour se defendre de l'iniure du temps. L'autre pour son assurance tant contre les hommes meschans & ennemis, que contre les bestes farouche. La tierce pour l'association mutuelle que les hommes ont establee entr'eux, & pour laquelle entretenir, ils ont edifié des bourgs, villes, citez.....

Or suivant la diuision que nous auons faite de l'architecture, son premier usage a esté pour seruir à la necessité de l'homme, & le mettre à couuert, tant les grands que le simple peuple. Ce qui a esté accompagné par succession de temps de certains enrichissemēs sumptueux, decorations & embellissemēs trouuez par les anciens Architect de sorte qu'au d' huy nous ne pouons imiter, inventer aucune chose pour estre bien, qui ne depede & ne se reigle selon les proportions & mesures qui iceux inuenteurs nous ont laisses.

L'autre vsage n'est pas si commun, d'autant qu'il ne peut estre pratiqué que par les Rois, Princes & Seigneurs qui ont le gouuernement des peuples: seruant de garde, force, tuition & defense aux bastiments ramassez & enclos en mesme lieu... j'ai entrepris...apres la diuision de ceste science, de monstrier la difference qu'il y a entre l'Architecture du bastiment particulier, & celuy qui bastit pour la force.

Because the artificier is nothing else, in comparison to the Architect, then are the tools and instruments to the worker, above which he ought to be more respected, and is of as much more dignity, as the soul is more excellent than the body.....this art called Architecture, which man has been forced to search for and invent.....for three main reasons: One, to defend himself against the injuries of the weather; secondly, for his security as much against evil men and enemies, as against wild beasts; thirdly, for the mutual association that men have established between themselves, and for the maintenance of which, they have built towns, villages, and cities.... Now following the division we have made in architecture its first usage has been to attend to the necessity of man, and to give him shelter, as much the great as the simple people. This has been accompanied during the passing of time, by certain sumptuous enrichments, decorations and embellishments, discovered by the ancient architects, of a kind that today we can neither imitate, nor discover anything better, which does not depend on, and is not governed according to the proportions and measures, which those inventors have bequeathed to us.

The other usage is not so common, in as much as it can not be practised except by Kings, Princes and Lords who are the government of peoples — serving as guard, strength, protection and defence to the buildings collected and enclosed in the same place...(and) I have undertaken...following the division of this science, to show the difference which there is between architecture of particular buildings and that which builds for force.

1. This analogy also points up the difference between an architect who works through manipulations in the intellect, and the building process that is purely physical. The metaphor of course comes from Alberti (see I p.185).

Il faut donc entendre, que combien que les deux parties portent vn mesme nom, si est-ce qu'il y a grande difference entre elles, tant pour la construction des bastimens que des mesures, proportions & lineaments, qui sont necessaires à l'une pour la beauté, & à l'autre pour la force. A celuy donc qui fait professiō de la premiere partie, qui cōsiste en la structure des maisons & beauté d'icelle, il est necessaire qu'il soit instruit non seulement es principes des sciences, dont i'ay fait ci dessus mention: mais aussi sache sur le doigt les enrichissemēs, desquels nous appelons Ordres des colonnes, inuentees par les Doriens, Ioniens & Corinthiens.....Ceste sciēce des ornemens a esté exactemente traitee par aucuns excellens personnages, comme Vitruue, Leon Batiste Albert, Sebastiano Serlio, & autres, quels les precepts seruent de guide à l'Architecte de la premiere partie.

La seconde, qui concerne la force, & qui est celle sur laquelle i'entends principalement m'arrester, est toute differente de la premiere, tant es lineaments Geometrique, que esleuations des corps. Car ayant ceste masse de pierre à soustenir & endurer plusieurs assauts....il est bien necessaire qu'elles soit tellement façonnee, plantee, fondee, bastie & asseuree par l'ingeniosité & experience du conducteur, qu'elle soit hors de la crainte de tous les susdits inconueniens. Ce que fera le bon & sage Architecte, quand il sera muni de ceste science, & la sçaura prudemment mettre en pratique. Et à fin d'entrer plus auant en matiere, il n'est point question de traiter icy des rudiments de ceux qui ont esté les premiers inuenteurs de la fermeture des villes ou chasteaux: Car autant de changemens que les ages

It ought then to be understood, that as much as the two parts carry the same name, so there is a great difference between them, as much for the construction of structures, as for the measures, proportions and outlines, which are necessary to the one for beauty, to the other (are necessary) for force. To those then who make a profession of the first part, which consists in the structures of houses and their beauty, it is necessary that he should be instructed not only in the principles of the sciences, which I have mentioned above, but also knowledgeable in the laws of the decorations which we call the Orders of columns, discovered by the Dorians, Ionians & Corinthians....This science of ornamentation has been exactly treated by some excellent persons, as Vitruvius, Leon Batista Alberti, Sebastion Serlio and others, whose precepts serve to guide the Architect of the first part.

The second, which concerns force, and which is that on which I intend principally to remain, is very different from the first, as much in the geometrical outlines as in raisings of bodies.¹ Because having this mass of stones to sustain and endure many assaults....(so) it is very necessary that they should be in such wise made, planted, founded, built and secured by the cleverness and experience of the creator so that they will be beyond the fear of the said inconveniences. That will be the good and wise Architect, when he is furnished with this science, and knowing wisely how to put it into practice. And in order to go further into the subject, there is no question of treating here of the beginnings of those who have been the first inventors of the closure of towns or castles. Because as much of change that the

1. This is somewhat ambiguous. Pasino apparently means that the two architectures are different in their geometrical form as well as in construction; rather than in their geometrical plans and in their elevations. The two meanings however, seem to be tending to fuse.

2. By artillery and the like.

nous ont amenez en l'art militaire pour assailler & ruiner, autant d'inuentions l'Architecte a esté contraint trouuer en son esprit, pour munir, reparer & defendre. Enquoy on peut cognoistre facilement, que la difference qui est entre les deux Architectes, n'est pas petite: Car l'vn, quelque bastiment qu'il face, n'oseroit sortir hors des reigles & instructions donnees par les anciens....L'autre selon le temps & l'occasion que se presente, il faut qu'il preuoye & excogite nouveaux remedes au mal....Je me doute, voire suis quasi certain, que plusieurs qui font profession de cest art, pourrōt en cest endroit me dire, que tous ceux qui iusques à present se sont meslez de conduire les fortifications, se sont bien acquitez de ceste charge, sans auoir prins la peine de chercher si profondement ceste science. Car (me diront-ils) dequoy sert vn nombre infini de lineaments Geometriques, sinon d'amuser ceux qui s'y arrestent? Il suffit auoir esté assiegé, cognoistre les lieux bien ou mal defendus, estre experimenté à la guerre: bref, scavoir mettre aucunement en dessein ou plan ce qu'on veut esleuer ou bastir, & conduire à l'oeil tous les traits, & faire planter le bastiment au lieu qui sera trouué propre, donnant la charge du surplus au maistre Macon....la force des inuentions d'Archimedes, procedants principalement de la vray & parfaite cognoissance de Geometrie; ou bien, s'ils veulent croupir en leur erreur & ignorance, ie les lairray là en la compagnie de ceux qui n'ont aucune volonté ou enuie de suiure les sciences & vertus: Et concluray sur ce point de la diuision de cest Art, que combien que les matieres dont les deux Architectes se seruent, soyent vne mesme chose, neantmoins quant à la science elle est differente.

ages have brought us in the military art, to attack and ruin, as much of inventions the Architect has been forced to discover in his spirit to arm, repair and defend. From which it can be recognised easily, that the difference that is between the two Architects, is not little: Because the one, whatever building he makes, does not dare to depart from the rules and instructions given by the ancients.... the other according to the time and occasion that presents itself, it is necessary that he foresees and thinks on new remedies to the evil.....I doubt, in truth am nearly certain, that many who make a profession of this art can at this point say to me, that all those who up to the present are involved in fortifications, are well acquitted in this obligation, without having taken the trouble to search this science so deeply. Because they say to me, what serves an infinite number of geometric outlines except to entertain those who tarry there? It suffices to have been besieged, to recognise the places well or badly defended, to be experienced in war. In brief, to know how to put something in design or plan of what one would raise or build, and bring to the eye all the qualities, and fix the place where it will be found suitable, giving the charge of the remainder to the master mason....(but) the force of the inventions of Archimedes arising mainly from the true and perfect knowledge of geometry: very well, if they wish to wallow in their error and ignorance, I leave them there in the company of those who have no wish or desire to follow the sciences and virtues, and will conclude on this point on the division of this Art, that in as much as the subject, by which the two Architects are served being the one same thing, nevertheless in regard to the sci-

1. I.e. those above who do not wish to know geometry.

2. "Sciences and Virtues", the common conjunction.

Car l'vn a sa leçon escrete deuant luy, laquelle il luy est defendu d'outrépasser, quant aux traits principaux: Et l'autre est contraint selon son iugement accompagné de l'Art, remedier aux accidens qui luy suruiennent bien souuent, lors que son bastiment est assailli.

p. 24. Ceste chose certaine que le Medecin qui voudra remedier à vn mal, en doit auoir premier la cognoissance, pour en apres y ordonner tels remedes qu'il cognoistra estre necessaires. De mesme sera vn bon maistre Maçon, lequel ayant à remedier à vn bastiment ruineux, cherchera le lieu d'où procede la faute; & l'ayant descouuert, par le secours qu'il luy apportera, le preseruera de ruine....

Et d'autant que son inuention, ses efforts & effects ont esté la principale cause du changement qui s'est fait aux bastimens des places de guerre, on peut dire qu'elle a serui d'esueilleer les esprits des Architects, & des plus grãds maistres, pour apprendre à bastir si dextrement contre vne telle violence, que peu de louange, n'acquerra celuy qui par ses inuentions s'en pourra bien defendre & garentir.

Surquoy il faut entendre, que l'artillerie est fort differente de toutes autres machines de guerre, dont les anciens ont usé, non seulement en sa construction, mais aussi en ses effects. Car les premieres machines inuentees, telles qu'elles ont esté du cōmencemēt basties, ainsi sont elles demeurees: faisans tousiours vn mesme effort, sans aucune augmentation de leurs forces, & sans qu'on y ait rien adiousté pour en tirer plus grand exploi-

ence it is different. Because the one has his lesson written before him, which he is prohibited from going beyond, as to its principal features; and the other is constrained according to his judgement accompanied by Art, to remedy the accidents which happen to him very often when his structure is assaulted.

It is certain that the Doctor who would minister to an illness, ought first to have a familiarity with it, in order afterwards to ordain such remedies as he knows necessary. The same will be a good master mason, who having to aid a ruined building, will search the place from which proceeds the fault, and having discovered it, through the help which he will bring to it, preserves the ruin....

In regard to its (i.e. artillery's) inuention, its efforts, and effects, have been the principal cause of the changes which have been to the structures of places of war, one can say that it has serued to raise the spirits of the Architects and great masters, in order to learn how to build so cleverly against such violence, that they acquire no little praise who by their discoveries, can well defend and protect against it.

On which it ought to be understood, that artillery is very different from all other machines of war, which the ancients used, not only in its construction, but also in its effects. Because the first machines invented, as they have been built first, so have they stayed, making always the same effect, without any increase in their strength, and without there having been anything altered in order to fire with greater effect.¹ But

1. Modern views do not support this. See for example Marsden. However, in the late Roman period there seems to have been little development after earlier more rapid improvements. (MARSDEN (1969).)

ct. Mais de celle-cy¹ il est bien autrement: car depuis sa cōstruction premiere elle n'a cessé d'estre tousiours amplifiée & renforcee. Ce qu'on pourra facilement cognoistre, si on la considere en ses premieres actions, & au progresz qu'elle a eu iusques à present. Et semble quasi que le mesme luy soit aduenü, qu'à toutes choses naturelles, lesquelles de leur premier estre commencent à se former & croistre petit à petit, iusques à ce qu'elles ayēt atteint l'age de perfection.

the latter¹ is very different, because since its first construction, it has not ceased to be always amplified and reinforced. Which can readily be recognised if its first actions are considered, and the progress it has had up to the present. It seems almost that the same should occur with it as to all natural things, which from their first being begun and formed, grow little by little until they have attained the age of perfection.

p. 26.la violence de ceste machine..
 ..A mon aduis...vne...muraille...semblable à celle que Semiramis fait construire en Babylone, laquelle auoit vne largeur telle, que quatre chariots de front marchoyent dessus bien à leur aise....ie ne sçay si elle pouroit faire resistance, estant exposée à ceste furie...

....the violence of this machine (i.e. artillery)..to my mind ..(is such that) ..a..wall..similar to that which Semiramis constructed in Babylon, which had such thickness that 4 chariots abreast travelled with ease on it..I do not know if it could make resistance, being exposed to this fury.²

p. 35: Or combien que ces tours rondes facent grande resistance aux concussions des machines; beaucoup plus que la muraille faite en droite ligne, & que la liaison d'icelles soit trop plus forte, à cause que toutes les pierres estant frappées tirent au centre: neantmoins on a esté contraint de changer cest maniere de defense ronde à la venue de l'artillerie, à cause que l'artillerie a commencé quant & soy vne autre forme d'assailier & de defendre, qu'on n'auoit auparauāt.
 Ceste difference est, que les anciens se defendoyent de haut en bas, & maintenant on se defend par les flancs....Ce qui ne se peut faire en vsant de la forme circulaire, d'autant qu'il est impossible d'atteindre & de frapper, & à l'oeil de descourir & voir la moitié⁴ de la circonférence de ce bastiment ronde.

Now as much that round towers make great resistance to the blows of machines, much more than that of a wall made in a straight line, and that the bonding of these are much more strong because, all the stones being struck, they tend³ towards the centre, nevertheless one has been constrained to change this manner of defence in the round by the coming of artillery, because when artillery began there was another form of attack and defence, that was not had before. This difference is, that the ancients defended themselves from high to low, and now we defend by the flanks.... This could not be done by using the circular shape, as much as it is impossible to reach and strike, and with the eye to discover and see, half⁴ of the circumference of a round structure.

1. I. e. gunpowder artillery.
 2. The implication is of course that it could not.
 3. Lit: 'draw.'
 4. This is of course rather an exaggeration in general terms. The proportion of the circumference of the tower which remains undefended depends on a number of factors, the main one being the value of the angle between the walls on which it is set. The value of half is close to the maximum value.

p. 38. De mesme en est il aduenü a plusieurs qui se sont ingere¹ de faire fortifier vn vieux circuit de ville ou chasteau, sans auoir en grande cognoissance des sciences qui y sont necessaires. Car on peu voir en plusieurs lieux qu'ils n'ont tenu aucun ordre ou mesure en leur bastiments, ayant fait vne defense grande, l'autre petite; vne courtine longue, l'autre courte; en somme, ils ont basti, non selon le vray art d'architecture, mais ainsi que la presumption les a guidez & conduits.

Or quant aux diuerses formes & figures des fortifications que l'on a iusques a present practiqué en bastissant de neuf, les vnes ont esté quarrees, les autres pentagones....

*p. 48. Mais on pourroit me demander: Que faudra-il donc faire de celles³ qui sont edifiées sur les limites & frontieres, lesquelles seruent comme des clefs aux prouinces, pour la garde desquelles elles ont esté basties? par ce qu'elles se trouuent, ordinairement plantees en tresmauuaises assiettes, faudra-il les abandonner, & choisir autres passages qui ayent leur situation propre pour construire vne fortreffe a son plaisir? quelles finances y pourroyent fournir? ne vaut-il pas mieux suppleer a leurs defauts par le scauoir & dextérité de l'Architecte....

Je responds, que voila deux pointcs, lesquels, si on veut s'y assubiettir,⁵ seront cause de faire perdre le temps, l'honneur, l'argent, & les hommes.

Le temps est perdu, quand on l'occupe a ce qui est de peu ou point de valeur. L'honneur est mort ou souffoqué, quand la honte le surmonte. L'argent est inutile, quand il ne profite point. Et l'homme est moins que rien, si

Similarly, it happens that many, concern themselves with fortifying an old circuit of a town or castle, without having a great understanding of the sciences that there are necessary. Because one can see in many places that they have not kept any order or measure in their structures, having made one defence long, the other short; one curtain long, the other short: in sum they have built not according to the true art of architecture, but in such wise that presumption guides and orders them.²

Now regarding the many forms and figures of fortification that have been up to the present practised in building anew, some have been square, others pentagonal....

But one can ask me: What therefore ought to be done about those³ which are built on the boundaries and frontiers, which serve as the keys to provinces, for the guard of which they have been built? Because they are commonly found set on very bad sites. Ought he abandon them and choose other passes which have their site; requisite to the construction of a fortress to his desire? What money can furnish it? Would it not be better to make good their defects through the knowledge and cleverness of the Architect....

I answer that here are two points, which, if one would submit to them, will be the cause of loss of time, honour, money and men: the time is lost when one is occupied with that which is of little or no value; honour is dead or suffocated when shame overcomes it; money is useless when it profits nothing. And a man is less than

1. "ingerer": lit. to meddle with.

2. This ignores of course the way actual sites may cause such irregularities.

3. Sites. 4. i.e. in whatever form he likes.

5. = assubiettir.

toutes ces choses luy deffailent. L'Architecte ne tombera-il pas en tous ces inconueniens, quand il entreprendra de fortifier vne place, en laquelle tout ce qu'il pourra faire & entreprendre, viēdra plustost à la ruine & detriment qu'à la conseruation des habitans? Ne sera-ce point perdre tout, quand on se verra exposé en proye à l'ennemy. Où sera le los¹ & reputation de l'Architecte, qui, pour auoir espargné vne somme d'argent, & hazardé avec son honneur la vie de tant de bons habitans, par son ignorance ou temerité, aura esté cause de leur mort & d'vn execrable violement de femmes & de filles, ensemble de la perte de leurs biens? Ne deura-lon pas plustost appeler telles oeures dissipations & follies, que fortifications? & la principale cause de ce mal sera l'aire² ou assiette mauuaise de tal lieu. Car comment pourra (quelque bon ouurier que ce soit) faire quelque chose de bon & profitable sur vn mauuais subject? Et pour respondre à ceux qui mettēt en auant la grande despense qu'ils pensent estre faite en laissant la mauuaise assiette d'vne place ia³ bastie en faire vne neuue: le me resouls qu'il y a plus de depense, peine & difficulté à l'esprit humain (a cause de l'impossibilité de changer & reduire aux reigles de l'art, ce que nature a produit mauuais & imparfait) que si de nouueaux on entreprend de bastir vne forteresse en lieu commode & applani.

nothing if all these things fail him. The Architect, will he not fall into all these inconveniences, when he undertakes to fortify a place, in which all that he can do and undertake will come rather to the ruin and detriment rather than the conservation of the inhabitants? It will be of no point, to lose all when one will see it exposed as prey to the enemy. Where will be the praise and reputation of the Architect, who, having expended a sum of money, and risked along with his honour the lives of so many good inhabitants, by his ignorance or recklessness, has been the cause of their death and of a horrible violation of wives and daughters, together with the loss of their goods. Ought not one sooner call these works dissipations and follies, rather than fortifications? And the main reason of this evil will be the bad place or situation of such a place. Because how can he -- however good a worker he should be -- make something good and valuable on a bad subject? And for answer to those who put forward the great expense that they think to be incurred in leaving the bad site almost built to make a new one, I consider that there is more expense, pain and difficulty to the human spirit -- because of the impossibility of changing and reducing to the rules of the art, that which nature has produced, bad and imperfect -- than if one undertakes to build anew a fortress in a place suitable and apt.⁴

1. COTGRAVE (1611) "los" = "loz" = "praise, commendation".

2. "aire" = a flat place, rather than 'air' whose badness might cause sickness.

3. COTGRAVE (1611) "ia" = "nigh, almost".

4. In all this long passage whose topic other writers generally covered by stating that one of the disadvantages of hilly sites was that one could not choose a preferred form there, Pasino never begins to make clear any particular view as to why such sites are undesirable. All he does is to plead for the following of the expert engineers' advice, no matter what the cost is of new building. He completely ignores the possible economic disadvantages of abandoning a frontier town. Building anew, of course, allowed the designer to choose his form, even in relatively complex sites, without the problems caused by existing structures.

p. 50. Mais en se faisant¹, il ne faut pas s'assubietter aux vieux circuits, comme on a coutume a faire; d'où vient la source du mal, qui conduit & meine la plus part de ceux qui sont profession de ceste science, à faire des fautes grandes, lourdes & inexcusables.

p. 52.l'opinion de ceux qui ont estimé, que ceste maniere de fortifier, ne depend & prouient que d'une pratique & experience acquise par longue & assiduele frequentation des guerres....Quant à moy, ie confesse qu'en telles enterprises la pratique peut servir de beaucoup, & excede la science; d'autant qu'en ceste sorte de fortification², il est besoin surmonter le naturel de la situation....Mais aussi ie ne leur cederay iamais en ce point: qui est, que si ceux qui auront esté en plusieurs sieges, soit dehors, soit dedans, quelques pratiques qu'ils soyent, & quelque experience qu'ils puissent auoir acquise, s'ils ne sont garnis en partie de la science requisite pour cest effect, iamais ne pourront s'acquiter deüement de leur devoir, & paruenir à fin heureuse de leur discours, combien qu'ils eussent quelque cognoissance tant des imperfections que des remedes necessaires a pourueoir aux places dont il sera question.³

p. 54.les causes qui contraignent les Princes d'entreprendre de fortifier & fermer les villes ou chasteaux qui leur appartiennent. Car si c'est pour conseruer leurs subiects des courses & rauages que pourroit faire vne armee passagere,

But in so doing¹ he ought not to submit to the old circuits as is commonly done; from whence comes the source of the evil which leads and brings the majority of those who make a profession of this science, to make great, heavy and inexcusable mistakes.

....the opinion of those that have reckoned, that this manner of fortification does not depend on, and proceed from anything but a practice and experience acquired through long and diligent following of the wars....As regards to me, I confess that in such undertakings, practice can serve greatly and surpass science in as much as that in this sort of fortification², the need is to overcome the nature of the site....But further I will never cede to them in this point, which is if those who have been in many sieges, without or within, however practised they should be, and whatever experience they have been able to acquire, if they are not furnished in part with the science requisite for this effect, never can they duly acquit themselves truly in their work, and reach the happy end of their discourse however much they should have some knowledge as much as of imperfections as of the remedies necessary to provide in the places which will be in question.³

....the causes which force Princes to undertake to fortify and close the towns and castles which belong to them. Because if this is to conserve their subjects from excursions and ravages that a passing army can do, during some civil war, and

1. Making use of a traditional site which is not unsuitable.

2. That which is necessary, in bad sites which can be remedied.

3. No argument offered here, Pasino simply asserts his bare belief in the need for 'science'.

pendant quelque guerre civile, & faire teste à l'ennemy, qui n'ayant les moyens d'assailir ouvertement, voudroit seulement user de surprises: ou bien si c'est pour se garder des volleurs, larrons, boute-feux, & autres especes de mauvais garnemens....les places, quelque mauuaise situation qu'elles ayent, n'auront que faire de tels remedes pour les garentir des incursions ennemies. Mais si la Prince veut fermer son pais....pour vray en telles enterprises tous hommes de bon iugement concluront qu'il n'y faut rien espargner sans auoir esgard à soulager la moindre partie qui pourroit estre interessée en ses biens, pour mettre tout le rest au hazard & danger d'une perte universelle.

p. 61. Et pour le regard du plan, lequel est le principal fondement sur lequel on bastit l'edifice, il faut l'accommoder & proportionner si bien par les lineamens. Geometriques, que le bastiment estant esleué sur iceluy, ne se trouue manque ou defectueux en aucune chose; ains que iustement il se rapporte au premier dessein imagine & conceu en l'esprit, tant pour les defenses hautes que basses.

p. 85deux poincts, lesquels n'estans observez en l'art de fortifications, peuuent amener perte & dommage....le premier est: Qu'ils se donnent de garde de certains escumeurs, qui vsurpent & s'attribuent le nom d'Ingenieurs, desrobans l'honneur (entant qui en eux est) des vrais Architects, n'estants garnis

to test an enemy who has not the means to attack openly, wishing only to use surprise; or rather if it is to guard against thieves, robbers, firebrands and other types of evil scamps....the places, whatever bad sites they have, they will not have to make but such remedies to guard them from enemy incursions. But if the Prince wishes to close his country....in truth in such undertakings all men of good judgement will conclude that economies never ought to be made without regard, that to scamp even to the least extent (which will be to the interest of their goods - (may be) to put all the rest to the risk and danger of a total loss.

In regard to the plan, which is the main foundation on which is built the structure, it needs to be accommodated and proportioned so well by Geometrical outline, that the building being raised on it, is not found lacking or defective in anything: so that truly it reflects the first design imagined and conceived in the mind, as much for the defences high and low.

....two points, which not being followed in the art of fortification can lead to loss and damage...the first is that they take guard against certain scum who usurp and call themselves by the name of Engineers, stealing the honour -- as much as it is in them -- of true Architects, not being furnished but with a mask of know-

1. I.e. the princes.

2. Not clearly stated but given by implication as those that can be used on bad sites for these lesser ends.

3. I.e. his property.

4. "le principal fondement": at once the basis and ground of the design in relevant drawings; and the physical footings to that pattern on which the rest of the structure is built.

5. The fundamental process of design, the conceiving and imagining of the finished object in all its complexity, in the mind, as understood by Pasino.

6. "The magistrates", i.e. princes and kings etc. referred to in the elision.

7. Reading "autant".

que d'vn masque de scauoir, d'vne mer de paroles, d'vn abysme comblé & fardé de persuasions, & d'vne presumption de vaillans & experimentez soldats¹....Et faut qu'ils entendēt, q̄ la difference entre l'architecte & le soldat n'est pas petite. Car l'vn (qui est l'Architecte) pour estre tel comme il en porte le nom, il faut qu'il soit muni de plusieurs sciences², lesquelles ne se peuuent acquerir que par peine & travail de l'estude continual, & par vne longueur de temps accompagnée de la pratique militaire. Quant au soldat, sa science est naturelle, & est par luy acquise par vne assiduele frequentation des guerres, & maniemant des armes, formant en son esprit vn certain iugement des ruses & finesses que la pratique continuelle & experience luy fait apprendre³; tellement que pour vser de quelque comparison propre; il faudra dire que tous les deux scauent bien manier les armes⁴; mais l'vn a l'art de les forger telles qu'il cognoist estre necessaires pour la defence de tous, & l'autre n'a que l'vsage seulement⁵. Ce qui sera prins de bonne part de tous soldats generalement: car ie ne veux pas ici maintenir que celui qui sera bon soldat, ne puisse estre dit bon Ingenieur & Architecte: car nul ne peut paruenir à ce degré, s'il n'a les deux⁶; mais ce sera quand il aura mis peine de conioindre & marier la pratique avec la science, sans laquelle cest art, comme i'ay dit au commencement de ce traitté, ne peut subsister.

ledge, a sea of words, an abyss full and loaded with prejudices, and of a presumption of (being) valiant and experienced soldiers¹....And they ought to understand that, the difference between the architect and the soldier is not little. Because the one -- who is the Architect -- to be such as to bear that name, it is needful that he should be armed with many sciences², which cannot be acquired but through the pain and toil of continual study, and by a great length of time accompanied by military practice. In regard to the soldier, his science is natural, and is acquired by him through an assiduous frequentation of wars, and handling of arms, forming in his mind a certain judgement of ploys and tricks which continual practice and experience make him learn. In such manner, to use some proper comparison, it needs to be said that both the two know well how to handle arms, but the one has the art of creating what he knows to be necessary for the defence of all, and the other has nothing but usage alone. This should be taken in good part by all soldiers generally: because I do not wish to maintain here that he who will be a good soldier cannot be called a good Engineer and Architect: because no one can reach to that degree if he has not the two; but that will be when he has taken pain to join and marry practice with science, without which this art, as I have said at the beginning of this treatise, cannot exist.

1. The contrast here is not a simple one where the people calling themselves engineers attempt to take over the job which is properly the Architect's. Pasino partly seems to feel that those who have only some poor quality experience are likely to call themselves Engineers, but he did not feel that this was a poor kind of activity in comparison with Architecture (see below 1. 30/31.), rather it was the whole dependence on practice that he attacked.

2. The very common Vitruvian idea.

3. In part Pasino by describing the soldiers' science as "natural" seems to be thinking in terms of motor skills in "maniemant des armes". But, below, he seems to be thinking of this as involving a more organisational type of skill as in making use of a fortification.

4. Actual handling of the sword would hardly be a central part of the Architect's skill, though he might be able to do so, but managing artillery certainly would be.

5. The contrast between design and use of a fortification.

6. "The two" referred to here seems not to be "Engineer and Architect" (these have rather become united), but rather the soldier's skill and the Architect as indicated below.

p. 90....mon intention n'estoit d'escrire toutes & chacunes les depēdences & circonstances de cest Art, & veer de repetition des choses contenuës es escrits de plusieurs qui en ont fait des gros & grands volumes: mais seulement mettre en auant & moſtrer aucunes fautes fort preiudiciables, lesquelles nous auons commises en nos fortifications iusques a present....

...my intention is not to write of each and every consideration and circumstance of this art, and to make repetition of the things contained in the writings of many who have in it made great and large volumes, but only to put forward and show some very detrimental faults which we have committed in our fortifications up to the present....

ANTONIO LUPICINI

Emendazione del Calendario (1st. ed. 1578)

Bibliography: Firenze 1578;¹ Fiorenza 1580.

Description:² Title page: Breve Discorso d'Antonio Lupicini Sopra la riduzione dell'anno & emendazione del Calendario. Fiorenza 1550.; 8 unpaginated folios, 6½" x 4" text; at end: Di Firenze li 27. di Maggio 1578.

Begin: HAVENDOMI Vostra Serenissima Altezza comandato, che io dica il parer mio sopra il nuouo modo di emendare il Calendario, il quale è stato proposto al Sommo Pontefice dall'Eccellente M. Luigi Giglio Mathematico.

Dedicated to Francesco Medici Gran Duca di Toscana. Signore & padrone suo.³

Nuove Verghe Astronomiche (1582)⁴

General description: 54 pages. 4½" x 6½" text. A number of illustrations in the text.

Contents:

Title page: DISCORSO/ SOPRA LA FABRICA,/ E VSO DELLE NUOVE/ Verghe Astronomiche/ DI ANTONIO LUPICINI,/ AL SERENISSIMO ARCIDUCA/ ERNESTO, IN FIORENZA M.D.LXXXII./ Apresso Giorgio Marescotti.

This is a little book about surveying and some instruments to be used for this purpose.

Final page: F. Dionysius Constacciarus Inquisitor Generalis florentiae, & Florentini Domini facultatem imprimendi concedit. Die 11 Decembris 1581.

Colophon: In Firenze, Nella Stamperia di Giorgio Marescotti MDLXXXII.

Nuove Verghe Astronomiche: Texts

p. 5. SONO le Matematiche, non solo diletteuoli, ma vtilissime alle attioni Mathematics is not only delightful, but the most useful in human activities,

1. RICCARDI (1899)

2. Of the 1580 edition.

3. Only known edition.

4. The dedication from Florence 15 nov. 1581.

humane, e sono tante chiare, e manifeste le loro operationi, che i più saui hanno detto, che elle sono nel primo grado di certezza. Queste ci fan stoccar con mano i corsi de Cieli, e saluare tutti l'apparenze che in essi si comprendano. Con questa possiamo in terra pigliare lunghezze, larghezza, altezze, e profondità, e possiamo per queste riquadrare tutte le superficie e corpi, e cauare la radice de quadri, e de cubi, e ritrouare i pesi di qual si voglia grauezza, & infinite altre cose, le quali essendo bene osseruate si risoluano infallibilmente. Ma la maggior parte di queste operationi non si possano fare senza il mezzo degli strumenti matematici, fra quali io ritrouo molto gioueuoli le nuoue Verghe astronomiche fondate nella Teorema prima del sesto d'Euclide, e verificate nelle quarta del sesto di detto Euclide.

and its operations are so clear and manifest, that the wisest have said, that they are of the highest degree of certainty. It explores the tracks in the heavens, and saves all the appearances that in them are embraced. We can with this on earth, take lengths, breadths, heights, and depths, and square all areas, and bodies, and extract roots of squares and cubes, and discover the weight of whatever heavyness, and many other things, which being well observed, are determined infallibly. But the greater part of these operations can not be done without the means of mathematical instruments, amongst which I find very helpful the new astronomical instruments founded on the first theorem of the 6th. (book) of Euclid, and verified by the 4th, of the 6th. (book) of the said Euclid.

Architettura Militare (1st. ed. 1582)

Bibliography: Firenze 1582; Turin 1585¹; with Lanteri and Zanchi Venetia 1601.

General description: A slight work. 6½" x 4½" text. 88 pages -- lacking 33/40. 4 painterly style illustrations of sites of full page size. 1 pull out plan showing a hexagonal fortification.

Contents:

p. 1: Title page: ARCHITETTURA/ MILITARE/ Con altri Auuertimenti appartenenti/ alla Guerra,/ DI ANTONIO LVPICINI,/ Al Sereniss. Don FRANCESCO Medici/ Gran Duca di Toscana./ IN FIRENZA M.D.LXXXII/ Apresso Giorgio Marescotti.

p. 3/5: Dedication to "Francesco Medici Gran Duca di Toscana, Signore, e Padron mio singularissimo". Dated from Florence 25 Jan. 1581.

p. 7: Verse by Raffaello Borghini in praise of Lupicini.²

p. 8: Ditto by Bernardo Davanzati.

p. 9/10: A benigni lettori.

p. 11/72: Book I:

p. 11/31: Cap I: After a few pages of introductory remarks, this section deals with a fortification in a flat countryside, subject to sapping, having a good quantity of houses, situated in good air, and having sufficient drinking water, and so on. Very many details are discussed one after the other with little organisation.

p. 41/51: Cap. II: Discussion of a river site.

1. AYALA (1854)

2. Includes "In questi scritti trouerete a pieno/ Distinti in cinque Siti le difese,/....del buon LVPICINO/ Il Saper, la Virtù, l'Ingegno, e l'Arte/

p. 53/58: Discussion of a river site with two heights that sweetly descend to the river.

p. 58/62: Cap. IV: A city subject to attack from the sea.

p. 64/71: Cap. V: An island site.

p. 73/88: (Book II): Discorso Militare: Dedicated to Signor Francesco de Conti di Mantauto. This section is concerned mainly with artillery. The qualifications of the captain of artillery, the transport of artillery along with something about provisioning. Dated Florence 8 June 1578. The last part is a separate section (p. 84/88) concerning the profile of the fosse about which

Lupicini's prince had started a debate. Dated from Florence 29 Jan. 1576.

Last page: F. Dionysius Constacciarus Heretice prauitatis Inquisitor Generalis Florentie & Florentini Domini facultatem imprimendi concedit Die 11 Decembris MDLXXXI.

Colophon: IN FIORENZA Nella Stamperia di Giorgio Marescotti MDLXXXII.

Architettura Militare (1582): Texts

p. 4:comprese nell'Architettura Militare tutte l'attioni della guerra, e di quelle essendo, a'tempi nostri, in gran parte rimutate, & in tanta eccellenza cresciute, che poche fortificatione sono state assalite, che si non sieno potute defendera....

....Military Architecture containing all the activitites of war, which being in our time to a great extent altered, and to such excellence increased, that few fortifications that are assaulted, can be defended.

p. 11. E COMVNE opinione che l'arte del fortificare non sia trouate per altro, se non perche i pochi si possono difendere da i molti, e che la difesa sia cauta dalla offesa, la quale offesa, la quale offesa è cresciuta in tanta eccellenza che noi veggiamo niuna cosa esser fatta con l'arte, che con l'arte istessa non si sia potuta disfere....de'quali tutte concorrano i montuosi esser i migliori....Ma perche la maggior parte de'Principi hanno le loro Città in luoghi piani, e sottoposte à molte imperfettioni....Per questa cagione il prudente Principe prima che metta mano alla sua fortificatione, considererà molto bene quali sieno le forze sue, e quali sieno le forze de suoi nimici....⁴

It is the common view that the art of fortification is found to be nothing other, if not that a few can defend themselves against many, and that defence is drawn from the attack, which attack has increased to such excellence that we see that nothing can be made with art which that self same art can not undo....from which all concur that mountainous (sites) are the best....But because most Princes have their cities in flat places, subject to many imperfections....For this reason the prudent prince before he puts his hand to his fortifications will consider thoroughly what is his force and what is that of his enemy....⁴

1. I.e. it is from the understanding of attack that the methods of defence are drawn.

2. This indication of a continuing interaction between attack and defence is one of the few in the literature, which tended to neglect this factor.

3. Many of the other treatise writers did not follow this view, but this sort of detail does not seem to have worried Lupicini.

4. This whole passage takes a very realistic stance in comparison to some of the other treatise writers' sentiments. As for example Pasino when he insisted that the Prince should have 'the best' solutions, whatever the cost, and ignoring his means.

p. 14.la qual forma tutti concludono, che quella, che più si accosta alla circolare, sia la più perfetta per essere figura più capace che l'altre, e perche gli angoli de baluardi vengano più ottusi, i quali così ottusi cagionano molta sicurtà alla muraglia, e danno più capacità di piazza nel baluardo, che non fanno gli angoli acuti.....¹

p. 43.se io m'harò à difendere.. e mi ritrovi in fortificatione fiancata alla moderna, non mi bisognerà tanto numero di forze da difendermi quanto de sopra è detto; perche mi varrò di quei vantaggi, e astutie di stratagemme ne soldati poco esercitati, che essendo esercitati sarebbero di nulla valore.² Per tanto certe sorte di cose bisogna risouerle, con maturo consiglio più che con regola, che si possa dare in qual si voglia particolare discorso pertinente all'architettura militare. Ma si possano bene ascrivere molte regole, e auuertimenti ne sopradetti discorsi,³ i quali saranno sempre gioueuoli à vn valoroso difensore, e particolarmente per chiarire alcune imperfettioni che nuocano alle fortezze.....

p. 75. Perciò se il Capitano sarà perito nelle Mathematiche discipline, che son gioueuoli à tutti i capi della guerra, potrà sempre con facili strumenti de discosto venire in cognizione di qual si voglia sito, con tutto che non si possa andare alle base. Onde potrà poi nel consiglio con certezza dimostrare qual de varij pareri sia il migliore nel risolvere la batteria...
instrumenti, i quali tutti son fondati negli elementi d'Euclide, nondimeno gli usano più per vna certa pratica, che per scienza....

....which form all conclude, that that, which nearer approaches to a circle is the more perfect in being a more capacious figure than any other, and because the angles of the bastions come out more obtuse, which causes much security to the wall, and gives more space in plan of the bastions, which acute angles do not....¹

....if I had to defend myself...and found myself in fortifications flanked in modern (style), I would not need as much a number of forces to defend, as is said above; because I will value these advantages, and tricks of strategy, by inexperienced soldiers being practised, to be of no esteem.² In as much as this certain sort of thing it is necessary to resolve, with mature council more than with method, that can be given in whatever particular discourse relevant to military architecture. But if many rules and notices can truly be written in the above said discourses,³ they will always be helpful to a valorous defender, and particularly to clarify any imperfections that damage the fortress.....

Because if the Captain will be experienced in the mathematical disciplines that are helpful to all leaders in war, he can always with handy instruments from any distance come to know whatever site, even if one can not reach the place. Whence he will be able in council then with certainty to demonstrate which of the different opinions is best in resolving the battery...(using) instruments that are all founded on the elements of Euclid, nevertheless (which) are used more by a certain practice than by science.....

1. Very much the standard view.

2. Lupicini is considering the case where he is defending with good soldiers, and the attackers are poor quality troops.

3. I.e. rules that cover all sorts of cases.

p. 77.quanto nel Capitan Generale dell'artiglierie la sua prudenza accompagnata dalle scienze delle Matematiche discipline....egli eseguisca il carico suo perfettamente...

....in as much as in the Captain general of artillery his prudence is accompanied with the science of the mathematical disciplines....he executes his charge perfectly....

Discorsi Militari (1st. ed. 1587)

Bibliography: Firenze 1587; with Lanteri and Zanchi Venetia 1601.

General description:¹ This is a dense little treatise, 6½" x 3½" text. 84 pages. No illustrations except for one tiny little marginal diagram.

Contents:

Title page: DISCORSI/ MILITARI/ D'ANTONIO/ LUPICINI,/ Sopra l'espugnazione d'alcuni siti/ CON LICENZA DE' SIGNORI SUPERIORI./ IN FIERENZE./ Nella Stamparia di Bartolommeo Sermartelli./ MDLXXXVII.

Dedicated to "Don Ferdinando Medici, Cardinale, e Gran Duca di Toscana".

Dated from Florence 15 Nov. 1587.

This work consists of 30 separate chapters each of which discusses the ways of laying siege to a different type of site.² Most of the places considered are places flanked in modern style, but a significant number are concerned with ancient style structures. Each example is distinguished by a good deal of detail, whether on a plain, on a river, in the mountains, and so on, with the length of the walls given as so many miles and the attacking and defending forces defined as so many infantry and so many cavalry, along with other details. Lupicini in each case gives many details about practical aspects of siege warfare: the employment of trenches, gabions, movable trenches, mining and so on. He mentions incidents from the ancient writers quite frequently, and Caesar and Archimedes figure strongly here.

Discorsi Militari (1587): Texts

p. 23. Mi potrebbe rispondere alcuno poco instrutto nelle leue, e nell'altre azioni matematiche, che le dette invenzioni sono facili da discorrere, come nel metterle in atto apportano tanto difficoltà.....e'matematici non sarà difficile a intender e mettere in atto.

Someone little instructed in the lever and in other mathematical operations, could answer me that the said inventions are easy to discuss, but in putting into action just as difficult... (but) to mathematicians it will not be difficult to understand and put into effect.

1. Of the first edition.

2. Cap. 1, for example, "Primo sito del primo stato, che si presuppone in piano, sottoposto alla zeppa, e fiancato all'antica." In a forward Lupicini explained "In questi discorsi dell'offese si dirà dell'espugnazione di trenta siti, differenti l'vno dall'altro e diuisi in dieci stati." (p. 4.)

JACOPO ACONCIODe Methodo (1st. ed., 1558)¹

Description: A small work, of 138 pages 2½" x 4½" text; in which method is discussed very much by way of Aristotelian concepts such as the four causes.
Title page: IACOBI ACON-/TII TRIDENTINI DE/ METHODO, HOC EST/ DE RE-/cta
 inuestigandarum tradendarumq̄ scientiarum ratione./ BASILEA/ PER PETRVM
 PERNAM/M.D.LVIII.

Texts

p. 5.apud omnes, qui tantum iudicioall those, who do not utterly
 prorsus nō carent, in confesso sit nullā lack sufficient judgement, acknow-
 artē nullamq̄ scientiam, nisi diligenti ledge no art or science, if not with
 ac certa quandā methodo³ adhibita, uel a careful and secure method³ applied
 stradi, rectē posse, uel percipi.... can be treated or understood rightly...

p. 12.neque eīnem persuadere sibino one ought to be persuaded that
 debet quisquam, artem se ulla rectē any art can be rightly understood if
 posse intelligere, nisi usus access- practice is not at hand,⁴ and if ex-
 erit,⁴ & nisi experimēta perspicua experience does not render clear and
 reddant preceptorū, atque efficaciam. powerfully, its rules.

p. 15.Nam cū artium utilitas non For the utility of the arts does not
 ex earum cognitione, sed usu constet: consist in knowledge of them but in
 necesseq̄ sit, si quidem arte aliqua uti (their) application. It is necessary,
 uelis, eius tibi praecepta esse in if indeed in any art you wish that
 promptu, non secus atque literarū you have its rules at hand, no diff-
 elementa scribere aut legere uolēti: erently as the elements of letters,
 diligenter uidetur in tradendis art- wishing to write or read, it is
 ibus uerbositas omnia fugiēda. clearly seen in discussing the arts
 all verbosity be shunned.

1. For bibliography see KÜHLER (1927).

2. 1558 edition.

3. p. 8, "Multa sanē de methodo pluribus in locis scripta reliquit Aristot. & precipue in .I. lib de partib. animalum."

4. "accedo" = to approach, come near.

GABRIELLO BUSCAInstruttione de' Bombardieri (1st. ed. 1584)Bibliography:¹ Carmagnola 1584*²; Torino 1598.³General description:⁴ 88 pages. 7 $\frac{1}{4}$ " x 5" text. Some diagrams in the text.Contents:

Title page: INSTRVTTIONE/ DE' BOMBARDIERI/ DEL SIG. GABRIEL BUSCA/ MILANESE./
 CONTENENTE: VN BREVE/ trattato delle cose più vtile à sapersi/ per tale eser-
 citio./ IN TORINO,/ Apresso Gio. Dominico Tarino/ M.D.XCVIII./ Con Licenza de'
 Superiori.

A discursive work on many practical topics connected with gunnery. Geometric ballistics is not dealt with.

Instruttione de' Bombardieri (1598): Texts

p. 3. RICERCATO con molta istanza da alcuni Artiglieri, & da altri amici miei; di volergli partecipare alcune cose da me osseruate intorno all pratica de'tiri, & all'vso dell'Artiglieria; & ridurli come in vna somma, le cose più importanti dell'arte loro....vna brieve, & facile instruttione; la quale possa seruire come di guida à coloro che di esercitarsi nell'arte del Bombardiero disidrano.....Percioche quest'arte tutta nelle operationi consiste; i discorsi che intorno vi si fanno sono poco meno che souerchi, se non sono indirizzati all'operare, & à gli effetti. Et però non aspettino i Lettori di trouare in questo picciol trattato quei lunghi discorsi che alcuni fanno de mouimenti delle palle, & de mouimenti naturali, & violenti.⁵ Ne meno attendino nuouimodi, & nuoue dimostrationi di misurare;⁶ ne altre cose appartenenti à Geometri; & à

Requested with much importunity by some artillerists and other friends of mine, they wishing to participate in some things by me observed relative to the practice of firing, and of the use of artillery; and to reduce to a whole the most important things of their art.....(so I give) a short and easy instruction that can serve as a guide to those who wish to practise the art of the Bombardier...because this art consists wholly in operations, the discourses that are made concerning it, are little less than superfluous, if they are not directed towards actions and towards effects. Therefore let the reader not expect to find in this little treatise those long discussions that some make on the motion of the shot, and of motions natural and violent.⁵ No less to expect new methods and new demonstrations in measurement,⁶ nor other things of the concern of

1. AYALA (1854) gives earlier editions as Venetia, 1545, 1554, 1559. COLKLE (1900) follows Ayala. However these editions are accepted by more thorough writers particularly RICCARDI (1893). They do not figure in IUX AUR, and the first two at the very least, are far too early with Busca's date of birth c. 1540.

2. NUC.

3. With the next work here, in a uniform edition.

4. Of the 1598 edition.

5. Busca may have been thinking of Tartaglia here, but it is likely he was thinking also of Benedetti, who had joined the Duke of Savoy's court at Turin in 1567, where Busca found employment a little later, and who addressed some ideas to Busca. (See BENEDETTI (1585) p. 271)

6. I.e. in surveying.

gli Aritmetici. Perche solo di quelle cose che ad instituire, & ammaestrare vn Artigliero, & renderlo perito in cotale arte mi sono perse più conuenienti, ho preso a trattare. Ne sono io del parere di coloro, i quali vogliono che egli sia Geometra, & Matematico; & conueniali saper misurare tutte le lontanze, gli interualli, l'altezza, & le profundità de' luoghi, oue l'ire c'è impedito. Percioche; anzi a l'Architetto militare, & al Capitano dell'Artiglieria, che al semplice Bombardieri si richieggono; si come anchora al semplice soldato, che sappia porre vna battaglia, ne alloggiare vn'esercito non è di bisogno; ma che solo sappia tenere le ordinanze, & bene le armi sue a tempo, e luogo adoperare gli si conuiene. Troppo di rado auerrà che cotali scienze si accozzino insieme col trauglio di quest'arte: che tutta di sudori, & di fatiche è ripiena, & quelle nell'otio, & nella quiete siedono. Sarà certo da esserne da più stimato colui che ne sarà possessore; ma io non per questo reputo che da escludere sieno dalla scuola de' buoni Artiglieri: come Platone dalla sue ne gli scacciava gli inesperti dalla Geometria. Et per quello che ad esso si appartenga del conoscere le lontanze sarà a bastanza se con vn certo giudicio preso da lunga pratica quelle potrà stimare; senza che con matematici strumenti ne cerchi la certa, & risoluta dimostrazione.

Geometers and Arithmeticians. Because only those thing which teach and instruct an Artillerist and make him expert in this art which appear useful to me have I undertaken to treat of. Neither am I of the opinion of those that wish he should be a Geometer and Mathematician; and that it belongs to him to know how to measure all distances, intervals, heights and depths of places where the way is blocked. Because rather they are required by the Military Architect and the Captain of artillery, than by the simple bombardier, as likewise further to the simple soldier, to whom to know how to set a battalion or encamp an army, is not needed, but only to keep rank with arms well to time, and to take his proper place. Too rarely will such sciences be joined together with labour in this art, which is full of sweat and toil, and the other of ease and quiet. He will certainly be of more esteem who will possess such, but I do not by this deem he should be excluded from being of the school of good Artillerists, as Plato expelled from him, those inexpert in Geometry. And for that which concerns knowing distances, it will be sufficient to be able to judge with a certain skill got with long practice that can estimate, without that (practice) with mathematical instruments in searching the map and worked out demonstrations.

1. I.e. the artillerist.

2. I.e. to triangulate when distances can not be measured off directly.

Della Espugnatione et Difesa delle Fortezze (1st. ed. 1585)

Bibliography: Turino 1585; Turino 1598¹; Germans tra. Frankfurt 1619.²

General description³: Quite a long discursive treatise. (viii) + 259 pages. 7 $\frac{1}{4}$ " x 3 $\frac{3}{4}$ " text. A fair number of painterly engravings often of a double page spread, included.

Contents:

p. (1): Title page: DELLA/ ESPVGNATIONE/ ET DIFESA DELLE/ FORTEZZE./ DI GABRIELLO BVSCA MILANESE,/ Libre due./ IN TVRINO,/ Nella Stamperia dell'herede di Nicolò Beuilacqua./ M D LXXXV./ Con licenza de'Superiori.

p. (iii/iv): Dedication "Al Serenissimo. Sigor. Carlo Emanuele Per Gratio di Dio Duca di Savoia & mio Signore". Dated, "Di Borgo in Brescia il primo di Gennaio, 1581".

p. (v/viii): Table of chapters.

p. 1/178: Book I: "Delle espugnatione delle fortezze". This is a general discursive treatment of many problems of attack in siege warfare, the use of artillery, trenching, machines for assault, mining and so on.

p. 179/256: Book II: "Della difesa delle fortezza". This section concerns the conduct of the besieged under attack rather than discussions relevant to construction. It also includes many topics discursively dealt with, such as provisioning, the use of defensive guns, etc.

Colophon. In Turino, Nella Stamperia dell'herede di Nicolò Beuilacqua, MDLXXXV.

Delle Espugnationi et Difesa delle Fortezze (1585): Texts

p. 4.ilquale di tale arte & professione⁴ si vorrà chiamare legittimo possessore, sia primieramente ornato di tutte quelle parti, che all'Architetto militare si conuengono, & particolarmente infra tutte posseda la pratica del conoscere le lontananza altezze, profondità, & interualli de' luoghi inaccessibili: & habbia famigliar, & molto in pratica l'uso di più instrumenti Matematici, & sopra gli altri de'diottrici⁵, insieme con l'uso del boggolo: senza le cui cognitione in molte cose gli conuerrà ire à tentone, & incerto.

....who of such art and profession⁴ would be named a legitimate possessor, should firstly be equipped with all the parts, that belong to the military architect, and especially among all others having the practice of knowing distances, heights, depths and intervals between inaccessible places: and should have a familiarity and much practice in the use of many mathematical instruments, above all the art of the quadrant⁶, together with the use of the magnetic compass, without which knowledge many things will proceed gropingly and uncertainly.

....conciosiacosa che se di quella non haurà molta isperienza, senza dubbio egli commetterà molti errori, dannosi

....because if he does not have a good deal of experience of that, without doubt he will commit many

1. PROMIS (1871) stated this edition did not exist, but the H.M. for example possesses a copy. Promis also denied the existence of the editions of 1545, 54, 59, of this work. But these are the editions of the last work dealt with here, quoted by Ayala, and no doubt spurious.

2. After RUMPF (1824).

3. Of the first edition.

4. Gunnery.

5. FLORIO (1611) "Diottra, a certaine quadrate or geometrical instrument."

"Diottrica arte, and arte that by an instrument teacheth the distances and aspects of the Starres". GK DZ IT gives a quotation from Ignazio DANTE (1578) suggesting the equivalence of the "diottra" to the astrolabe.

6. The functioning of artillery.

non pure à quelli, che alle batterie attendono ma ancora à tutti il rimanenti dell'esercito....Ma chi senza il lume di queste arti, & scienze, & senza la guida, & scorta dell'isperienza, si porrà à tante impresa, si troverà in grandissimo labirinto di confusione, & d'errore....

Ma conciosiacosa che fuor di modo breve è la vita nostra, & à molti mancano le occasioni commode di ritrouarsi in tutti i luoghi, per apprendere per isperienza la cognitione di tante cose, la continua lettione delle più famose historie, & i commentari....rendendolo pronto, & sagace alla resolutione delle più aspre, & difficili imprese.

p. 7. CON molto honorata contesa fra belli ingegni longamente si è dubitato, s'era possibile di farsi vna fortezza con tale ragione, & intendimento, che à nessuna quantunque grandissima forza giamai fosse per cedere; ma del tutto inespugnabile, & inuincibile fosse giudicata. A conseguire questo importantissimo fine, due principali mezi fra molti altri erano posti innanzi; cioè la Natura, & l'Arte: perche alcuni col vigore dell'arte sola in qualunque luogo si volesse, ciò credendo di poter ottenere varie forme, & varie maniere di fortificare inuestigaron. Quindi nacquero tante varietà d'ordini nelle fabbriche: quali sono de'beloardi, cauaglieri, piattaforme... & tante altre parti... nell'opere di molti si vedi. Altri dall'isperienza istessa auertiti, molte fiata l'arte venire dall'arte souerchiata: & alle forze maggiori, le più deboli non potere per lungo tempo contrastare. Et nessuna cosa in questi tempi, & à questi artificij, & modi d'espugnare

errors, dangerous not only to those who manage the battery, but to the rest of the army also...But who without the light of these arts and sciences, and without the guide, and council of experience sets himself to such undertakings, will be found in the greatest labyrinth of confusion and error....

But in as much that, apart from the shortness of our lives, and that many lack handy opportunities of discovery in all places, to learn through experience the knowledge of such things, the continual reading of the most famous histories and the commentators... renders him ready and quick to the resolution of the more stubborn and difficult undertakings.

With much honourable debate between the very skilled, a long time has it been doubted if it were possible to make a fortress with such a method and understanding, that to no force, however great, would it yield, but to all it would be judged totally impregnable and invincible. To achieve this most important end, two main means amongst many others were put forward: by nature and by art, because some with the force of art alone, in whatever place was desired which allowed of being able to to achieve varied forms and styles of fortification, they investigated. Hence were born such varieties of orders in the structure that are of bastions, cavaliers, piattaforme....and such other parts....as can be seen in many works. Others from experience itself warn that many times art comes from art surpassed, and to the greater force, the weaker can not long oppose. And nothing in these times, to these tricks and ways of capture, can be said to be sufficiently prepared and

1. Force.

2. Nature and art among many others. Busca seems to be thinking of strength by art as the same kind of thing as strength through a cavalier or through a bastion, rather than, as the more over reaching concept it was conceived of by other writers. This is not untypical of a kind of rough and ready aspect found in his thought.

3. Busca seems to mean that the capture of a fortress allows the understanding of its defects and hence progress is made in the art by correcting those mistakes.

potersi dire à bastanza riparata, & forte istimarono ciò non si potere recare à fine, se la qualità del sito con naturale fortezza non rendeva molta comodità, à conseguire l'intento loro. Con le quale naturale fortezza del sito, da artificiosa, & industriosa mano aiutata affermano portersi dare questa fortezza per forza d'arme inespugnabili. Per queste cagione molti fecero elezione di siti sopra i più releuati colli...l'orme imitando de gli antichi.....

p. 9. Ma tanto gli vni, come gli altri in varie maniere di fortificare non solo in quanto forma s'appartiene: ma anchora in quanto alla materia s'immaginarono: Et così alcuni più dell'altre le fortezze fatte di terra, & di piote de prati, & di fascinate verdi lodarono. Altri le mura grosse, & sode con buonissima calcina volsero fabricare.

p. 10. Ma delle forme i più moderni riputarono la triangolare; & la quadrata poco vtile alle fortificationi, & le imperfettissime de tutti...onde lodarono la forma pentagonale...Ma à tanta loro inuentioni, & riparationi hanno gli offensori trouato il modo di opporsi, et la maniera d'espugnarle.

p. 11.il Tartaglia, il Castrioto, Domenico Mora, & dopo questi l'Alghisi di Carpi, & molti altri sia stato affermato, che col mezo della forma quadrata in sito piano poteuasi fare questa fortezza inespugnabile: vedesi nondimeno, che essi sono in non picciolo errore.

strong they esteem, which cannot reach this end, if the quality of the site with natural strength does not give much convenience to the achievement of their intention. Which natural strength of the site, aided by skilful and industrious hands they affirm can give this fortress impregnability by force of arms. For this reason many chose sites on the higher hills...imitating the fashion of the ancients.

But in the one, as much as in the other different ways of fortifying, not only is the form concerned, but further how the material is conceived; and thus some more than others praised fortresses made of earth, and of turves of grass, and of green faggots. Others walls great and solid with the best mortar, wish to build.

But of the forms more modern, the triangle and the square, they esteem little useful to fortification and the most imperfect of all...whereby they praise the pentagonal form...But to such discoveries of theirs, and defences, have the attackers found the method of opposition, and the method of capture....

...Tartaglia, Castriotto, Domenico Mora, and after these Alghisi da Carpi, and many others affirmed, that by means of the form alone in a flat site can this fortress be made impregnable. It is seen nevertheless that these are in no little error.

1. This section comes from Cap. I "Se può darsi la fortezza inespugnabile per forze d'arme".

2. Busca follows a common pattern of listing different opinions about different kinds of sites. But the emphasis he gives suggests that the views of this passage are most to his liking. He did not give the disadvantage of hilly sites that one cannot choose the most desired form there, although he did give this for sites in the sea and marshes.

3. I.e. by nature or by art.

4. For the usual reason of the pointedness of the bastions.

5. Lit. repairs, but not in the technical sense as given by Castriotto and others (see above p.62) rather in the sense of putting something into good condition.

p. 12. Percioche proprio della natura delle cose di qua giù è, nessuna potere essere compita, & perfetta: ma tutte alle imperfetioni, et mancamenti sottogiacciono.

Because belonging to the nature of things here below, nothing can be complete and perfect, but all are subject to imperfections and defects.

p. 87. La fortezza naturale del luogo nasce dalla qualità del sito, doue si ritroua, come sopra monti, ò colli.... Quelle che per artificio sono fatte forti, può auenire in due modi. L'vno per la materia, come sono mura grosse, grossi, & grand terrapieni, fosse larghe, & profonde. L'altro è per cagione delle forma, la quale molte volte più importa, che non fa la materia: come nelle bene formate fortezze si può conoscere. Ma lasciando di ragionare al present delle forme, nostro proponimento hora è di discorrere intorno alle materie.....

The natural strength of a place arises from the quality of the site, where it is found, as on mountains, hills.... Those that are made strong through artifice can occur in two ways, One by material, as are great walls, thick and large terrepleins large and deep ditches. The others by reason of the form, which is many times more important, than the material, as in well formed fortresses can be recognised. But leaving for the present the discussion of form, we propose now to discuss the subject of the material..

Architettura Militare (1st. ed. 1601)

Bibliography: Milano 1601; Milano 1619.

General description: A long large work, perhaps best described as rambling, in terms of the wide range of subjects dealt with, many of doubtful relevance to contemporary practice, "handled in an over-detailed way." 7½" x 5" text. (xii) + 299 pages. A number of rather nice pull out illustrations and some full page wood cuts, but the work is by no means overloaded with illustrations. It contains only one of the three books which were intended to make up the full treatise. The titles of the chapters of the other two intended books, on field fortification and mechanics, are given at the end.

Contents:

p. (i): Title page: DELLA/ ARCHITETTURA/ MILITARE/ Di Gabriello Busca Milanese./ PRIMO LIBRO./ CON PRIVILEGIO./ IN MILANO, M.DCI./ Apresso Girolamo Bordone, & Pietro Martire Locarni compagni./ Con licenze de Superiori.

p. (ii): "APPROBATIO Imprimendi, diuulgandique potestatem fecerunt: F. VICENTIVS AQVENSIS Vicar. M.R.P. Inquisit. Mediol. ALEXANDER MONETA, pro Illustriss. Card. Archiepisc. ANTONIVS POGGIVS. pro Excellentissimo Senatu".

p. (iii/iv): Dedication to "Il Signor Don Giovan Fernandez di Velasco....."

1. In fact at no place in this treatise does form serve as a major topic of general discussion.

2. PROMIS (1871) expressed doubts about this edition but it is well authenticated, and many copies are known.

3. Of the 1st. edition.

4. MARINI (1810) expressing a very different view wrote "il libro publicato è scritto con metodo, con chiarezza, e con varia erudizione tanto di arte, che di storia antica e moderna." But when one has a chapter for instance "Come soleuano gli Antichi fondare i loro edifici, & quali cerimonie, & osseruatione fossero in uso appresso di loro" (Cap. XXXII) and another on "Trophies" (Cap. LXXVI) it is difficult to see what purpose the use of the ancient examples was intended to serve. As to method, the work tries to cover such a wide range of topics that the reader is left wondering which aspects are intended to be of the most significance.

5. One of the best illustrations is a plain copy of a part of one of Specklin's illustrations, between pages 274 & 5.

Presidente del Real Consiglio d'Italia mio Signore". Dated from Milan 1st. Jan. 1601.

p. (ix/x): Table of chapters of Book I.

p. (xi/xii): A lettori.

p. 1/286:¹ The body of the text. Busca spent a good deal of time on what for others would be preliminary matters, before beginning to deal in chapter 34 (p. 123) with "Della forma delle forttezze." Amongst these preliminary topics is included much discussion of cases from the ancient world; the position of the fortress within the kingdom; various ways of capture; different kinds of sites; and so on. Chapters 34/43 (p. 123/142) concern the trace of the fortification. Then follows discussion on various parts of the fortress -- bastions, curtains, and so on, of a very practical nature, and this type of discussion forms the main mass of the remaining part of the book.

p. 287/299: Chapter headings for the two further books.

Architettura Militare (1601): Texts

p. (xi). Liberato per alcun tempo de
trauagli, & dalle fatiche della guerra;
nelle quali per molti anni era stato
continuamente occupato; nessuna cosa
shò hauato più à cuore, che di compire
alla promessa da me fatta ne' libri
della Spugnatione, & Difesa delle
fortezze; di partecipare à studiosi
alcuni miei scritti delle Architettura
Militare.

Freed for some time from work and the
labours of war, in which for many
years I have been continually occup-
ied, nothing have I had more to heart
than to fulfill the promise made by
me in the book of the capture and
defence of fortresses, to share with
some studius individuals my writings
on Military Architecture.

p. 6.non sono da stimarsi degni
del nome di tanto rara professione,
coloro, i quali confidatisi in un
poco di certa pratica roza, senza l'
saluto delle ottime scienze ardiscono
uaparsi tante honore; così come quegli
ancora, i quali senza alcuna sperienza
di tante cose, che vi fanno di mestiero
per qualche studio fatto nelle camere
in sù i libri, & in sù le fatiche d'
altri arrogamente questo nome vog-
liono attribuirsi. Che siccome non
può ragioneuolmente chiamarsi Archi-
tetto che sin da più teneri anni di
grado in grado salendo nō si sia per
tutte le parti, come dice Vitruuio
essercitato, & con longo, & continuo
uso, & studio non si sarà acquistata
l'esperienza; tanto meno in questo

...they are not to be esteemed worthy
of this rare profession, those who
rely on a little of some rough pract-
ice, without the aid of the best scie-
nce, and dare to usurp such honour.
As well those further, who without
any experience of such things, that
give mastery of it, by some study made
in their chamber on the books and deeds
of others, arrogantly would that this
name be attributed to them. Because one
cannot reasonably be called an Architect
without from ones youth ascending
from degree to degree, if not
being practised in all parts,
as Vitruvius says, and with long and
continuous use, and study will not
acquire experience; so much the

1. The whole published work.

in questa parte dell'Architettura Militare, la quale assai più che tutte l'altre hassi da stimare, & tenere in conto.¹

p. 6. E però all'Architetto Militare oltre allo studio di tante scienze & arti, che vi fanno di mestierio, & all'hauer con diligenza le altrui opere considerate, & osservate: & a molte fabbriche esser stato assistente; & esaminare le perfettioni, & i mancamenti....

p. 7. Non che io presumi come altri d'insegnare a fare vna Fortezza inespugnabile; che ciò sarebbe contraddire alla natura delle cose.....

p. 52. E Stata diuisa tutta l'Architettura da migliori Autori in tre parti principali. Nella edificatoria, sotto la qua le ogni sorte di fabrica di Edifici comprendeuano. Nelle Gnomonica, la quale conteneua la ragione dell'ombre, & de stili conforme alle ragioni del Cielo. Et nell'arte del fare le machine; che da molti, e detta Meccanica.....La edificatoria in due parti si diuide l'vna delle quali la positione delle publiche opera considera. L'altra la ragione de priuati edifici contiene. La consideratione de publici edifici, e di nuouo in tre parti distinta; la prima delle quali alla positura delle mura delle Città, & d'altri luoghi, delle porte, & delle Torri.....L'altra la costruzione de sacri Templi....L'ultima la dispositione de publici edifici all'vso publico destinati, quali sono le Terme, i Teatri, i Potrici, & altri tali contiene. Sono adunque le fortezze vna sorte di publici edificij contenente le muraglie, le porte, & Torri delle Città, & d'altri luoghi: come sono le Roche, i Castelli,

less in this part of Military Architecture, which much more than all the others has to be esteemed and taken into account.¹

Therefore to the military Architect, besides the study of such sciences and arts which make one a master, and of having with diligence considered and observed the works of others, and to having been an assistant on many works, and examined their perfections and defects....

It is not that I presume to teach how to make a fortress impregnable, which would contradict the nature of things...

The whole of Architecture is divided by the best authors into 3 main parts.² Into building, under which the building of all sorts of structures is understood. Into 'gnomics' which contains the account of shadows, and of styles conforming to the regions of the sky. And into making of machines, which by many is called Mechanics.... Building is divided into two parts, one which considers the position of public buildings. The other contains the method of private structures. The consideration of public buildings is further distinguished in 3 parts: the first of the location of the walls of the city and other places, of gates and towers....the second the construction of sacred temples..The last concerns the disposition of public building dedicated to the public use, which are Baths, Theaters, Porticos³ and others such. Fortresses then are one sort of public building consisting in the walls, gates and towers of the city, and of other places; like Rocca's, Castles, and those fortresses

1. I.e. in that part of architecture which fortification comprises, in which practical knowledge of machines and particularly artillery is very necessary.

2. Vitruvius Bk. I, Cap. 3, after whom this whole passage follows.

3. This is Busca simply parroting Vitruvius.

& quelle fortezze ch'hora noi chiamiamo *we today call Citadelles.*
citadelle.

p. 105. TUTTI gli edifici i quali con ragione si fanno consistono in fabbrica, & in discorso. La fabbrica è la ordinata compositione, & costruzione delle materie dalla quale, ne risulta l'edificio. Il discorso rende ragione dell'inventione della dispositione, & compartimento di esso. Per mostrare tutte queste cose avanti, che dar principio all'edificare, si ne fa il disegno. Questi, cō proportionate misure¹ rappresenta in picciola forma quale l'edificio habbia da essere. Sarà adunque il disegno, vn'ordinato & regolato concetto dell'animo, & vna Idea rappresentata con linee, & angoli. Questa Idea in tre parti consiste. La prima dicesi pianta, ò radice. La seconda elevatione, ò alzato. La terza profilo come a dire in piano in faccia, & da lati....Ma perche la prospettiva per mostrar molte cose in piccolo spacio seguendo l'effetto della vista accorcia le cose lunghe, & allunga le breui, inalza le basse, & abbassa le alte, & poche lassa, ò rappresenta con la loro propria misura, hanno stimato molti, & con ragione, che punto non si confaccia con la vera Idea dello edificio, la quale ne deve render certi, & delle parti d'ogni particolare, & minima misura, che in quella sia comparita. Et però si sono alcun pensato, che si habbia da intendere del modello rappresentante con proportionate misure, tutte tre dimensioni dell'altezza,

All buildings which are made with method involve construction and discussion. The construction is the ordained composition, and fabrication of the materials from which the building results. Discourse gives the rules of the invention of the arrangement and its different parts. In order to show all these things before beginning to build the design is made. This, with proportionate measure¹ represents in a small form what the structure will have to be. The design therefore will be an ordered and regulated concept of the mind, and an Idea represented with lines and angles. This Idea consists of 3 parts, the first is called the plan or foundation;² the second the elevation or 'up-right platt';³ the third the profile, so as to say a plan facing and from the side....But because perspective,⁴ to show many things in a small space following the effect of vision, shortens long things and lengthens the short, raises the low, and lowers the high, and little leaves or represents with its proper measure, many have considered, and with reason, that it agrees at no point with the true idea of the building, which ought to be rendered with certainty, and in every part in detail to the smallest measure into which it is divided. Further some have thought, one has to understand from models represented, with proportionate measure, all three dimensions, of height, breadth and

1. I.e. the scale of the drawing.

2. Lit. root.

3. Lit "alazo" = a raising up. The description 'upright platt' is not infrequently found in English building sources of the period (see LULVIN () p.106). The idea being much the same as that expressed here, 'platt' being the English term for plan at the time. The term 'elevation' of course follows much the same pattern of course.

4. This of course in no way figured in Vitruvius in anything like as strong a form.

5. FLORIO (1611) in fact gives "Idea" as "the Idea, figure or forme of anything conceived in the imagination", emphasising the visual analogy rather than any abstract Platonic notion.

larghezza, & lunghezza de gli edifiij. Ma del modello, non pare che si possa intendere, perche egli rapresenta tutte tre le parti, et le altre due souerchie ssarebbono. Però lasciando il discorrere sopra questo.....¹

p. 136. LE altre forme de più angoli, & più lati, come è la Ottogona, nonagola, & le altre consequentemente non sono più buone per Citadelle, ò per Castelli: ma per Città, & per luoghi molti grandi da fortificarsi, perche lo spatio di dentro, ne diuene amp- lissimo, & troppo più capace, che non sconuiene per vna fortezza; nelle quale non habbia da habitarui oltri'che soldati, & artefici, & operari che per la fortezza sono necessarij.

p. 137. Io mi sono persuaso, che gli studiosi di questa professione² debbiano prima hauer gustato i principiij delle Matematiche, onde io era per passarli auanti, senza far mentione, come si possono ritrouare in vn dato cerchio, non solo le figure regolari ma molte altre...

p. 249. Non tanto ristrette saranno le regole, & le misure volendosi fortificare vna Città grande, ò altro luogo habitato da molto popolo, come se à fare si hauesse vna fortezza in luogo non habitato, & senza edifici. Percioche si come in questa si ricercano tutte le perfettioni, & delle grandezza iragioneuole, & delle equalità, & bontà de lati, & de gli angoli della figura....

length of the building. But the model does not seem to be able to teach, because it represents all three parts (together), and the other two would be superfluous. Therefore leaving the discussion of this....¹

The other forms of more angles and more sides, as in the Octagon, nonagon, and others following, are not very good for citadelles or castles, but for cities and very large places to fortify, because the space within becomes of the greatest, and much more spacious which does not belong in a fortress in which do not have to live any, apart from soldiers, artisans, and labourers, that are necessary to the fortress.

I am persuaded, that the studios of this profession² ought first to have tasted the beginnings of Mathematics, which I passed by previously, without making mention, as for example, how can be found in a given circle not only the regular figures, but many others..

Not so much constrained will be the rule and measure, wishing to fortify a great City or other place inhabited by many people, than if one would have a fortress in an uninhabited place and without buildings. Because in this are found all the perfections and great orderlyness and equality, and goodness of sides, and of the angles of the figure....

1. Busca's idea seems to be here that the model in presenting all three dimensions together, in order to measure in one, the other two get in the way, so to speak. His approach here is rather odd as it was on perspective. There, his view was that one could not take dimensions from a perspective drawing. This of course is not strictly true, but to do so is an extremely awkward business, and perspective drawings are not really suited to this purpose, as likewise neither are models. But Busca refused to express his views in any simple instrumental form, and insisted a kind of 'unreality' of representation was involved. His remarks then had the cast of a debate about 'true knowledge' rather than about the mere utility of the techniques involved.

2. Military architecture.

EUGENIO GENTILINIInstruizione de Bombardieri (1st. ed. 1592).

Bibliography: Venetia 1592; Venetia 1598; Venetia 1606; Venetia 1626; Turri 1641.¹

General description: Typical gunners manual. (viii) + 126 pages. 6½" x 4" text. Title page: "Instruizione de bombardieri di Eugenio Gentilini da Este, Que si contiene l'essamine usata dello Strenuo Zaccharia Schiavina, L'Aggiunta, che Copiosamente dichiara, quanto nell'Estamina si comprende: Et un Discorso intorno alle fortezze...." Separate title pages provided for the "Aggiunta... all'essamine" and the "Discorso intorno alle fortezze". Continuous pagination. Some wood cuts in text. The section on fortification occupies a mere 26 pages (101/126), of which the final ten are more concerned with surveying relative to fortification, rather than fortification itself. A number of diagrams of parts of the enceinte of a fortress are given. The treatment is fairly elementary and discussed fortification with a good deal of emphasis on the use of artillery in both attack and defence.

Instruizione de Bombardieri (1592): Texts

p. (iii). QVANTA conoscenza io tengo intorno all'vso dell'Artigliaria, l'ho acquistata con lunga pratica da me diligentemente osservate, mentre che fin da primi anni sono stato su'l mare, & il più del tempo ho seruito la Sereniss. Repub.

What knowledge I have concerning the use of Artillery, I have acquired with long practice by me diligently observed, while from the first years I was at sea, and most of the time I have served with the most Serene Republic (of Venice)....

p. (v).aggiungo anco a maggior sua⁴ perfettione alcuni ben vttili auuertimenti intorno alle fortezze, i quali io come appartenenti all'artigliero appresi già in alcuni ragionamenti del Capitan Marino mio fratello, fedel ingegnere della Sereniss. Republica.

...I add then for its⁴ greater perfection, some very useful notices concerning fortification, which I, as belonging to the artillery, learnt previously in some discussions with Captain Marino my brother, faithful engineer to Venice.

p. 1.appartiene al Bombardiero, bisogna hauer buon'occhio, & esser presto di mano; & saper conoscere l'Artigliaria ricca dalla pouera, per sapere dar poluere tanta che possa resistere ogni qualità di pezzi d'Artigliarie: & saper conoscere la poluere grossa dalla fine.....

...it belongs to the Bombardier to need to have good eyes, and to be ready of hand, and to know how to recognise Artillery fully charged with powder, to know how to select as much powder as any piece of artillery can resist; and to know how to recognise coarse powder from fine....

1. A good deal is rewritten in this edition and more material has been added. The title page begins here "Instruizione di artiglieri".

2. RICCARDI (1893)

3. For a more complete description of the title page see *ibid.* Dedication dated from Venice 5 May 1592.

4. I.e. the book's.

p. 109. Cap.¹Eugenio se io uolessi ad una dichiararui le diuerse ragioni in materia di metter in difesa alcuna fortezza, ui teneria troppo a tedio, smassime per le diuersità delli siti, li quali non essendo alla presenza, mal'atte sono le ragioni a dichiararui, nondimeno ui farò uedere con le istesse misure sopra dette un'altro modo di fortificatione, laqual ueniria a cinger vn gran sito, quando non uolessimo far il beloardi troppo acuti...

Instruizioni de Artigliare (1598): Texts

f. (via).Si che volendo esser Capo Mastro è ancora necessario esser intrepido di core, con hauer cognitione di misure Geometriche per saper tuor vna distanza longa, alta, & profonda secondo le occurenze che vi fusse, a tal che se bisogna saper quante oncie si sò in vn piede, e quanti piedi è il passo, & quanti passa è vn miglio, & quello che vuol significare il liuello e ponto bianca in linea dritta, & linea curua, e la perpendicolare, la visual, la mezarua, l'estremo ponto, & saper adoperar le squadre, & vguagliar le grande con le picciole, e tirando l'Artiglieria alla longa, quanto importa usar diligenza con esse square, & saper la distanza maggiore che può tirar ogni sorte di Artigliaria.....

f. 82a. Ma se così hauerà cauallieri eminenti, potrà benissimo diffendere.³
....

Cap.¹Eugenio, if I wished to discuss with you the diuers reasons of the subject of putting a fortress in defence, it would continue too tediously, particularly through the diuersity of the sites, which not being present, the(ir) rules are badly suited to discussion, nevertheless I will make you see with the above said measure, another way of fortifying, which will enclose a large site, when we would not wish to make the bastions too acute....

....He who would be a Master Captain (of artillery) should be further intrepid of heart and have knowledge of Geometrical measurment, to know how to take distances of length, height, and depth, according to their occurance; and such that he knows how many inches in a foot, how many feet in a pace, a and how many paces to a mile, and what signifies the level and point blank in right line, and curved line, and the perpendicular, the horizon, the mean point, the extreme point, and to know how to use the square,² to compare small with large, and to fire Artillery at a distance, how much the importance of using dilligence with this square,² and to know the greatest distance which any sort of Artillery can fire.....

But if it will have high cavaliers, it is able to defend to the greatest.³
....

1. Eugenio's brother Capt. Marino
2. Gunner's quadrant.
3. A fortress with nearby hills.

G I O V A N N I S C A L ADelle Fortificazioni Matematiche (1st. ed. 1596)

Bibliography: Roma 1596*¹; Roma 1627².

Description:³ A finely produced work consisting wholly of engravings. After an introduction by the editor, there follows 50 sheets, almost entirely, each of a different design of a bastion in plan and perspective, in two engravings each $6\frac{1}{4}$ " x $4\frac{1}{2}$ ". 11 sheets of engravings follow, 3 double page spreads, some of whole fortresses, one showing Civita Vecchia.⁴ The technique of the plans throughout involves a good deal of manipulative geometry, using lines that seem to have no particular physical interpretation.⁵ Many of the plates, including those after the first 50, which apparently were additional to the first edition, have the inscription "Joannes Scala Mathematic. Inuentor"; or the like.

Geometria Prattica⁶ (1st. ed. 1599)

Bibliography: Roma 1599; Roma 1603;⁷ Roma 1623*¹; Roma 1624; Roma 1628*¹; Roma 1667*¹; Roma 1772*¹.

Description:⁸ Title page: "Geometria Prattica....Da Giouanni Pomodoro Venetiano Mathematico eccellentissimo descritta et Dichiarata da Giouanni Scala Mathematico...Opera non meno Vtile che necessaria, a'Misuratori de terreni, di fabbriche, et altri similli, ma'in'oltre ancora a, Geografi, Cosmografi, Architetti Ciuile, et Militari, a'Bombardieri, Soldati priuati, a'Capitani, Mastri di Campo, et a'qual si Voglia altra persona Virtuosa."⁹ After the preliminary sections, this work consists of 44 numbered engraved sheets of diagrams $7\frac{1}{2}$ " x $10\frac{1}{2}$ " each matched by a page of commentary. These are followed by 7 sheets in the same manner, by Scala. A good deal of the work is concerned with surveying, but general mensuration problems are considered also, and some sheets are concerned with recreational geometry.¹⁰

1. RICCARDI (1893)

2. Title Delle fortificationi Di Giovanni Scala mathematico. This is an enlarged edition.

3. Of the 1627 edition.

4. This copy B.M. 59.e.13. appears to be less complete than the copy seen by Riccardi, who lists plates of Macerta and Rocella not in this copy.

5. They do not represent lines of fire for example.

6. This work was only edited and completed by Scala.

7. In this version the colophon has the printer and date of the first edition. A new dedication by Giovanni Martinelli, the printer noted on the new title page, was added, and Pietro Pomodoro's, and Scala's preliminary remarks were omitted.

8. Of the first edition.

9. The genesis of the work is explained by Pietro Pomodoro brother to Giouanni in a dedication thus: "quanto la GEOMETRIA sia necessaria all'vso humano, & principalmente all' essercitio Militare, se per l'vfficio dell' Ingegniero nelle Machine, nelle fortezze, & nelle fabbriche ciuili, come ancora à Capitani, Condottieri di esserciti, & altre persone virtuose; mi son disposto mandare alla Stampa vn'opera di Geometria Prattica, composto già da mio fratello M. Giouanni Pomodoro, & hora da M. Giouanni Scala alla sua vera letitione ridotta"; and by Scala thus: "M. Pietro Pomodoro fratello del detto M. Giouanni, hauesse fatto, & facesse diligenza in cercare qualche persona virtuosa, che vi volesse por le mano & farui il compimento di cio che mancaua (in Giovanni's notes which he left when he died....." (A i lettori)

10. Puzzles to amuse rather than proofs of theories, or useful results.

BUONAIUTO LORINIDelle Fortificationi (1st. ed. 1596) [10] [11A] [12] [13]

Bibliography:¹ Venetia 1596/7; Venetia 1609;² 1659;³ German trs. 1607 Frankfurt am Mayn; 1621 ditto.⁴

General description:⁵ A large elaborate work. 10 $\frac{3}{4}$ " x 6 $\frac{3}{4}$ " text. (xiv) + 219 pages. A good many illustrations in the text with a number covering two pages. In some sections more space is taken up by the illustrations than by the text.

Contents:

- p. (i): Title page: DELLE/ FORTIFICATIONI/ DI BUONAIUTA LORINI,/ NOBILE FIORENTINO,/ Libre Cinque./ NE'QUALI SI MOSTRA CON LE PIV/ facili regole la Scienza con la Pratica, di Fortificare le/ Città, & altri luoghi sopra diuersi siti./ CON TUTTI GLI AVVERTIMENTI, CHE PER/ intelligenza di tal materia possono occorrere./ Et il particolar sogetto di ciascun Libro si dimostra nel rouerscio di questa Carta./ NVOVAMENTE DATE IN LVCE./ Con Priuilegio./ IN VENETIA,/ Apresso Gio. Antonio Rampazetto. MDXVI.
- p. (ii): Contents: "Nel Primo, si tratta della Scienza con le regole, e ragioni da formare tutte le piante delle fortezze. e ridurle à perfetto fine. Nel Seconda, si mostra la Pratica con che si deue fabricare la fortezza....Nel terzo, si notano le diuersità de siti....Nel Quatro, si dichiara la diuersità de'siti...Nel quinto, & vltimo si insegnano le Scienze Mechaniche...."
- p. (iii/iv): Dedication to Vincenzo Gonzaga, dated Venice 28 Oct. 1596.
- p. (v/vi): A lettori.
- p. (vii/xii): Table of chapters.
- p. (xiv): Engraved portrait of Lorini.

1. AYALA (1534) states that the first edition which he had seen was of 1592. The first edition is however of 1596. It was in that year printed in only a few copies with different dedications each for a particular prince. The dedication of the B.M. copy C. 66.h.6 to Vincenzo Gonzaga, Duke of Mantova states "havendone fatto Stampare alquanti libri, per dispensarli solo à Prencipi Christiani". But the next year the book was more widely distributed, according to Lorini, because of fear of plagiarism. (Dedication to Ferdinand I, see PROMIS (1874)). These later copies have 1597 on the title page although the colophon reads the same still. PROMIS (1874) prints a letter of Lorini to the secretary to the Grand Duke at Florence of the 27th. May 1595 which states "Inquanto al non dar fuori l'opera di già fatta sopra la fortificationj, questo è un passo assai più cattivo de qual di Mala mocca, considerato 15 anni di tempo speso e non per utile ma si ben per honore, sendomi afaticato in tutto 30 anni doppo lesere stato in fiandra et haver del continuo trattone con huomini intendenti". It looks therefore as if pressure for limited distribution was brought to bear on Lorini, rather than this being his own idea. RICCARDI (1893) one in the bib. Palatina da Modena, dedicated to Alfonso II d'Este. TIRABOSCHI (1791) notes a letter in the archives from Lorini dated 16th. Nov. sending the work to Duke Alfonso II. POGGIALI (1813) noted the copy to Ferdinando I Gr, Duke of Tuscany. All the 1596 copies seem to have the same date of the 28th. Oct. on their different dedications, as has this last quoted work which is to be distinguished from the 1597 edition also dedicated to Ferdinand I, but with a different dedication dated 5 June 1597. See PROMIS (1874). The 1597 version with a dedication to Venice dated 12 March is held by the Bodleian. N.U.C. lists a copy in the New York Public Library which may be a copy of one of the 1596 versions.

2. With the addition of a sixth book, which included discussion of measures to be taken in defence, and surveying, and instruments to be used in this.

3. After AYALA (1534). 4. N.U.C.

5. Of the first edition B.M. copy C. 66.h.6.

p. 1/104: Book I:

p. 1/7: Cap. I: Geometrical instructions.

p. 7/11: Cap. II: Basic setting out of an octagonal fortress with the measures to be used.

p. 12/15: Cap. III/V: 7, 6, 5, bastioned fortresses.

p. 15/31: Cap. VI/XI: The bastion, flanks, foundations, scarping, profiles.

p. 32/34: Cap. XII: Perspective.

p. 34/44: Cap. XIII/XVI: Various parts of the fortress discussed in detail.

p. 45/51: Cap. XVII/XVIII: 8 and 9 bastion fortresses.

p. 52/104: Dialogue of the author with a count discussing many practical matters relating to siege warfare, along with details of structures.

p. 105/136: Book II: Practical topics, including the setting out of the fortress, time of construction, details of trades involved in construction.

Artillery and barracks discussed.

p. 137/153: Book III: Different styles of fortification, including star shaped forts. A villa on a bastion trace.

p. 154/170: Book IV: Fortresses on different sites, and practical details, discussed.

p. 171/219: Book V: Machines discussed including an introductory section on the theory of machines.

Colophon: IN VENETIA, Apresso Gio. Antonio Rampazetto. MDXCVI

Delle Fortificationi (1596): Texts

p. (iii).in me venne desiderio ne'primi anni della mia gioventù di applicarmi à gli studij delle Matematiche, & à quella parte del mestiero della guerra, che è propria dell' Ingegier Militare. Et acciò più facilmente io venisse à conseguire il mio fine, che era di potere con la fatica, e con l'industria apportare qualche beneficio à Prencipi; Giudicai esser necessario di conguingere con gli studij, la pratica, per laquale volsi veder la Fiandra, & altri paesi, & particolarmente notare quei successi, che alla militia si appartengono: con le varie opinioni che sentiuo proporre per fortificare, & dipoi l' opere che veniuano fatte: oue viddi tanta diuersità, che facilmente si sarebbe potuto credere, che l'arte del fortificare non hauesse alcun fondamento dimostrabile, & che vna opera di

....the desire came to me in the first years of my youth to apply myself to the study of Mathematics, and to that part of the business of war, which belongs to the Military Engineer. And so that I would come more easily to achieve my aim, which was to be able with labour and industry, to bring some benefit to Princes, I judged it to be necessary to join with study, practice, for which I was minded to see Flanders and other countries, and specially to note those events which concerned military affairs together with the different opinions I would hear put forward on fortification, and afterwards the work that would come to be made. Where I saw such diversity, that it would be easy to believe that the art of fortification does not have any demonstrable foundation, and that a work of such importance

1. From the dedication to Vincenzo Gonzago.

tanta importanza venisse fatta à caso. Ma fatto poi dall'esperienza de successi accorto (e massime dall'espugnationi fatte da forza potenti) viddi le cause per le quali ne dipendevano tanti disordini, che principalmente erano, per non si far le difese conformi all'offese, & alla materia, e natura del sito. Et sendomi con la lunga pratica del far fabricar fortezze certificato, potersi con facilissime dimostrazioni, & regole, mostrare come si debbono ordinare, & ridurre à ottimo fine queste opere?¹.....

isp. (v): HAVENDO più volte frà me stesso considerato l'ordine maraviglioso della Natura, e chiaramente veduto non esser creata cosa alcuna imperfetta,² anzi tutte (conformi al genere suo) perfettissime, & affine di apportar comodo, & vtile all'huomo, ilquale essendo fattura, & imagine di Dio, e per così dire, fratello della Natura, e padre dell'Arte, mi son mosso à credere che quegli sia del tutto obligato ad imitare essa Natura, e con l'Arte far tutte l'Opera sue buone, e prima ad honore di Dio nostro Signore, e poi à beneficio del prossimo.³....coloro, i quali faranno selectione delle più nobili arti, e profetiteuoli al confortio humano, saranno degni di maggior honore. Et se frà tutte l'arti, e scienze (lasciando le sacre lettere) la disciplina Militare tiene il primo luogo,

comes out haphazardly.¹ But afterwards made wise by the experience of events -- and especially of the captures made by strong forces -- I saw the causes on which depended such disorders, which were principally that the defence is not made to conform to the attack, and to the material and nature of the site. And being qualified by long practice in the construction of fortresses, it is possible with easy demonstrations and rules, to show how this work ought to be arranged and reduced to its best end.².....

Having many times inwardly considered the marvellous order of Nature and clearly seen nothing imperfect to have been created,² rather -- in conformity to its type -- each the most perfect, and to the purpose to bring ease and utility to man, who, being creation and conception of God is, so to speak, brother of Nature and father of the Arts, I am moved to believe that he is in everything obliged to imitate this Nature, and with art to make all his works good, and firstly to the honour of God our Lord, and then to the benefit of his neighbour.³..(and) those who will make choice of the arts more noble and profitable to human kind, will be worthy of great honour. And if amongst all the Arts and sciences -- excepting sacred letters -- military sciences : hold the first place

1. Lit. 'to the case', that is ad hoc, in contrast to in conformity to a general rule, rather than carelessly in each case.

2. Having assumed there ought to be a (general) rule or method in fortification, and not finding it, Lorini then looked for a possible reason for this, rather than allowing any mere 'empirical evidence' provide him with reasons for changing that preconception. But in many ways, particularly in saying that the defence ought to conform to the attack, he expressed not a great deal more than a tautology.

3. Cf. Busca above p.114 for a diametrically opposite opinion.

4. This passage seems to function more to get the reader in the right mood, rather than as an expression of a definite opinion. -- Were wild beasts and hail and snow, suited to bring ease and utility to man? Lorini thus rather loosely focuses on God's ability to create things perfectly, which is then paralleled by man in his (lessor) creations.

si potrà co'l mezo di questa ascendere
 à tutti i maggiore honori....E douendo
 sopra questa parte del mestiero della
 guerra (cioè saper conoscere i siti, e
 quelli fortificare) esser fondata la
 presente Opera, doueranno tutti quelli,
 i quali à tal professione si vorranno
 dedicare, hauer non poca intelligenza,
 e pratica delle offese, che da esso¹
 nemico potranno riceuere: però che da
 intelligenza tale deue dependere la
 pratica più sicura, e reale strada,
 che osseruar si possa par determinare,
 e con buon'ordine fabricare il corpo
 della fortezza.....sendo la scienza
 del fortificare fondata sopra termini
 dimostrabili....laquale scienza fu
 non solo da gli antichi Romani, ma
 poi da gli altri Principi potenti
 non poco apprezzata....Confermando
 anco l'istesso Vitruuio nel primo
 Libro della sua Architettura, cioè
 con quanta diligenza fussero queste
 fabriche ordinate, & essequite;
 seguendo poi l'istesso Autore le regole
 della Architettura ciuile....nella
 quale Architettura molti poi esser-
 citatisi....& hanno con le loro opere
 ridotta tale scienza all'ultimo grado
 di bellezza². Ma dell'Architettura
 Militare par che pochi siano stati
 quelli, i quali habbino voluto, ò
 saputo osseruar la predetta regola,
 cioè dalle offese cauare le defese,
 essendo questo forse auenuto per non
 hauer così dilettato il tuono dell'
 artiglieria, con le rouina delle mine

p. 1. ⁴ESSENDO la Geometrie non solo
 vtile, ma necessaria, per esser come
 fondamento di tutte le nostre oper-
 ationi, elle si deue perciò molto
 stimare douendosi massimamente co'l
 meza di esse dar principio à quanto s'
 è proposto di trattare nelli seguenti
 Libri, atteso che senza tal mezo saria

with its means one can ascend to all
 the highest honours.....And having in
 this part of the business of war --
 that is to know how to recognise sites
 and to fortify them -- to be founded
 the present work, all those who would
 dedicate themselves to this profession,
 ought to have no little knowledge of,
 and practice in, attack, that from this¹
 enemy they can receive, because on
 such knowledge ought to depend the
 most secure practice, and royal road,
 which it can be observed to determine,
 and with good order to construct, the
 body of the fortress....the science
 of fortification being founded on
 demonstrable ends...which science was,
 not only by the ancient Romans, but
 afterwards by other powerful princes,
 not little appreciated²....Vitruvius
 further confirms this in the 1st book
 of his Architecture, that is, with how
 much diligence were these structures
 arranged and executed; the same author
 following then the rules of Civil
 Architecture....in which architecture
 many then practised....and have, with
 their works, reduced this science to
 the highest level of beauty³. But in
 Military Architecture, because few
 having been those who have wished or
 know how to observe the above said
 rule, that is that from the attack
 to draw out the defence, this having
 occurred perhaps because they did not so
 much delight in the sound of Artillery
 and the ruin of mines....

⁴Geometry being not only useful, but
 necessary, in being as the foundation
 of all our operations, it ought to be
 for this greatly esteemed, especially as
 with its means has to be given
 the foundation to what is prop-
 osed to treat of in the following
 books, in regard to which, without

1. Merely, previously mentioned.

2. In the edition Lorini suggested their structure demonstrated their depend-
 ence on demonstrable ends. (But see above p.123, n.2) because thier approach
 to structures "conforme all'offese che à que'tempi veniuano fatte".

3. That is using the orders to make beautiful buildings.

4. This is the opening section of Book 1, and Lorini's introduction to his
 elementary instruction in geometry.

impossibile potere essequire, nè l' meno ben'intendere alcun cosa, poi che anco li Calzolai, & gli essecutori de' più bassi essercitij sono necessitati di formare, & intendere i lineamenti, con che debbono rappresentare quelle superficie, e forme, che vogliono fare: e tanto più s'aspetta sapere à quelli, che desiderano dedicarsi à opera reali, e molto più degne, come sono le fortificationi.... Però che da questa scienza² dependono li più chiare, e facili demonstrationi, che occorrerà fare, potendosi con esse, non solo rappresentate realmente tutte le cose create dalla natura, ma anco quelle che vorremo co' l' valore, & artificio del nostra ingegno ritrouare; & à quelle aggiungere, ò diminuire, e giudicar le sue perfettioni, ò imperfettioni, si come fussero fatte reali, che senza tal mezo si tratteria dell' impossibile il poter'insegnare, nè mostrare alcuna cosa nell'esser suo,⁴ si come diffusamenti si dirà, quando tratteremo dal disegno, che va con l'istesse scienza; e douendosi ragionare di tal principio, si mostrerà li corpi formati da semplici linee, conforme però à quanta giudicheremo poter seruire per intelligenza di quello, che si douerà trattare nella presente Opera, per esser questo principio delle Matematiche scienze, causa principale di arriuare à tutti le maggiori, & più occulte intelligentie della natura.⁵ E pero trateremo qui solo di tre cose; cioè del punto, della linea, & delle superficie.

such means, it would be impossible to be able to execute, or even to truly understand anything, since even shoemakers and the artificers of the baser trades, are forced to shape and take heed of the outlines with which they have to represent the surfaces and shapes that they would make,¹ and so much more are expected to know those, who will wish to be committed to works, royal, and much more worthy, as are fortifications.... Because on this science depend the most clear and easy demonstrations that will happen to be made, it being possible with this not only to represent truly all things created of nature,³ but also those, we would with the worthyness and artfulness of our skill, discover, and to these to add to or to diminish, and to judge of their perfections or imperfections, as if they were actually made, which, without such means of treatment, it would be impossible to be able to indicate or to show anything in its being, as will be stated in detail when we will treat of design, which proceeds with this science; and having to discuss from such a beginning, bodies will be shown formed by simple lines, conforming therefore to what we will judge to be able to serve for the understanding of that which has to be dealt with in this present work, because this is the foundation of the Mathematical sciences, the main cause of arriving at all the greater and more secret understandings of nature. And therefore we will treat here of only 3 things, the point, the line, the surface.

¹. This is extremely contentious. In the sense in which Lorini used the term 'Geometry' as of a sophisticated discipline with its own autonomous rules and standards, (he started off his geometrical section with "Definitions I, II, III, and so on) shoemakers and the like had nothing to do with it.

². Geometry.

³. A highly ideological statement this, that is more a definition of a proposed course of action in representing objects, than an empirical claim -- the objects of anatomical representations are extremely poorly handled by simplistic geometric techniques, if they can be so represented at all, in any useful sense.

⁴. "nè mostrare alcuna cosa nell'esser suo", again a highly ideological claim.

⁵. The neo-Platonists would surely have agreed here. It is interesting to note that Lorini's argument had the form that geometry is the beginning and key to mathematics which (as we all know) is the key to the secrets of nature.

p. 7. SOGLIONO esser le regole di non poco giovamente a tutti, per il molto beneficio, che da esse si trahe, e massime da'principianti nelle Fortificationi, con liquali presuppongo al presente ragionare; perche da quelle si viene a possedere il vero fondamento della scienza, & insieme a tener memoria delle parti più notabili, che si ricercano nell'operare; Et concorrendoci la diletatione, si verrà ad apprendere detta scienza, con quella maggior facilità, che si possa desiderare, e particolarmente nel comporre, e descriuere le seguenti piante: atteso che dipendendo queste da'lineamenti, e compartimenti di circoli, sempre, che si saprà la proportione di vna sola di esse piante di Fortezza, ouera corpo di baluardo, si potranno sapere tutte le altre, che occorreranno farsi; accrescendole, o sminuendole secondo il bisogno, come al suo luogo si dirà. Et prima proporremo voler formar vna pianta d'vna Fortezza di lati eguali...Et hauendo stabilito (come s'è detto) la misura....

p. 18.fianchi, doue debbono stare l'artiglierie; poi che come parte da molta importanza non ci si vserà mai tanta diligenza, che basti, essendo questi gli occhi del baluardo, che è capo del corpo della Fortezza, peroche perdendogli, o restando impediti, non potrebbe scoprire il nemico per offenderlo, & tenerlo lontana: onde potrassi assomigliare, essa Fortezza al corpo humano, che formato proportionatamente con li membri gagliardi hauerà sempre molta forza nel difendersi; e però s'intenderà il baluardo come capo, li fianchi come occhi, le piazze delle artiglierie, come braccia, le cortine

Usually rules are of no little benefit to all, through the great benefit which from such is drawn, and especially by beginners in fortification, who are presupposed for the present discussion. Because from these one comes to possess, the true foundation of the science, and also to keep a memory of the parts most notable which are found in the work and along with the pleasure will come understanding of the said sciences with the greatest ease that can be desired, and particularly in the composition and description of the following plans; considering that these depend on outlines and divisions of circles, so that always, if will be known the proportion of only one of these plans of a fortress, or body of a bastion, all the others can be known that need to be made, increased or diminished according to the need, as will be said in its place. And first we assume we want to form a plan of a fortress of equal sides....And having established the measure -- as it is said....

...(the) flanks where the artillery ought to stand, since as the part of the greatest importance, never is used such diligence there which would suffice, these being the eyes of the bastion which is head of the body of the Fortress, because lost or remaining obstructed, the enemy can not be discovered to be attacked, and to be kept at a distance, whereby can be compared this Fortress to the human body, which, formed proportionately, with robust members, will always have great strength in defence; and therefore the bastion will be understood as the head, the flanks as the eyes, the places of the artillery as arms, the

1. This is not too clear. To make a bigger fortress one does not scale up from a smaller one. Lorini seems to be conflating abstract geometric form, which is scale free, with the fortress and its parts, which is not altogether so, even if one thinks in terms of the length of the defence as the variable.
2. Artillery reaches out from its casemates somewhat like arms. A common 16th century notion in this context.

come corpo capace da contenere in se tutte le parti interiori, & necessarie per mantenersi, & in vitimo le sortite saranno le gambe...esso corpo, ci doueremo gouernare non solo con la ragione, & proportione delle materie; ma con l'esperienza delle offese....Nondimeno l'huomo sauo deue sempre pigliare la buona parte, e senza passione alcuna lasciarsi guidare non dall'vsanze ma sì bene dalla ragione.

p. 32. PERCHE spesso volte suole auenire di formare i disegni delle Fortezze, o d'altra cosa in prospettiu, scacciò mostrino le parti dell'opera come stanno, ouero come debbono stare, sarà necessario sapere al manco la pratica di quella prospettiu più commune, che basti per essequire quanto s'è proposto, e particolarmente per l'introductione del disegno: il quale non solo è vtile, ma molto necessario, sì in questa professione del fortificare, come anco in tutte le altre, doue però ciascuno essi doueria affaticare per impararlo: atteso che da esso ne dipende la vera intelligetia di tutti le cose: potendosi con questo mostrare quella maggior perfettione, che possa hauere nell'ingegno dell'huomo, sì nell'imitare l'opere marauigliose fatte dalla Natura, e dall'Arte, come anco per mostrare à tutti, e far'intendere ogni suo concetto. E però il disegno è di tanto valore, che chi ben lo possiede potrà con verità dire, esserli molto facile l'essequire perfettamente tutte l'opere, che proporrà voler fare. Perche con questo non solo si mostrano tutte le inuentioni, e fondamenti di esse (approuando il bene, & emendando il male). Ma si rappresentano i siti de' paesi, cioè la terra, & il mare, e quanto essa Natura, & Arte habbino operato, e del tutto sopra vna semplice

curtains as a spacious body to contain in it all the parts, interior and necessary to sustain it, and lastly the exits will be the legs...this body we ought to govern not only with reason, and proportion in the matter, but with experience of attack...Nevertheless the wise man ought always to take the best part, and without any passion, allowing himself to be guided not by usage, but as well by reason.

Because very often it is customary to happen to form the designs of fortresses or other things in perspective, so as to show the parts of the work as they exist, or as they ought to be, it will be necessary to know at least the practice of that perspective more common, which suffices for the execution of as much as is proposed, and especially for the introduction of the design, which is not only useful, but very necessary in this profession of fortification, as also in all the others, wherein then everyone ought to labour to learn it, because on this depends the true understanding of all things: it being possible with this to show that greatest perfection that it is possible for human skill to have, in imitating the marvellous works made by nature, and by art, as also to show to all, and make understood, all his conception. And therefore 'design' is of such value that he who truly possess it, can truly say, that it is very easy to execute perfectly all the work that he will put forward for accomplishment. Because with this, not only are shown all the inventions, and the foundations of these -- approving the good, and emending the bad -- but are represented the sites of countries, that is the land and the sea, and in as much as Nature and Art have operated, and all on a simple sheet

1. Because one can run away through them, presumably, a rather weak analogy.
2. Of others opinions which often differ as Lorini has just pointed out.
3. See below p. 129.

carta se ne fa la sua apparente dim-
 ostratione, come realmente sta, ò douerà
 stare. Potendosi ancora vedere quanto
 esso disegno sia non sole vtile, ma
 necessario, e particolarmente nell'
 esplicare, e fare intendere essi nostri
 concetti, come per essemplio sarebbe, se
 si volesse con le semplici parole
 rappresentare, e dare ad intendere la
 fabbrica di vna Città fatte, ò d'altra
 cosa da farsi, si tratterebbe dell'
 impossibile non solo, che potessero
 esser giudicate le sue perfettioni, &
 imperfettioni, ma ne anco conosciuta
 sia sua propria forma, come all'incontro
 si fa mostrandola in disegno fatte con
 le misure. Et però si deue imparare à
 disegnare, perche (come hò detto) il
 disegno è molto vtile in tutte le
 professioni, & massime à quelli, che
 debbono comandare, e fare essequire
 opere grandi; Et per impararlo non
 si potrà ricorrere al miglior maestro,
 quanto che sia la Natura, perche con
 l'osservatione di essa si vedranno
 osseruati tutti quelli marauigliosi
 effetti, che si possono con l'Arte
 usare, si ne' compartimenti, e line-
 amenti mirabilmente fatti in tutti i
 corpi, & in ogni genere, come nelle
 diuersità de' colori, & ombre causate
 dalla più, o manco riflessione del
 Sole, doue che eccellente Maestro
 vien tenuto quello, che solo li sa
 imitare. E volendo essequir questo
 giouerà molto la diletatione dell'
 operare, con l'applicatione della
 volontà, perche da questa succederà la
 pratica della mano; laquale obedirà a
 all'intelletto, doue si potrà con la
 lunghezza di essa pratica sempre per-
 uenir a quel grado di eccellenza, che
 molti con tal mezo hanno fatto, con
 l'acquistare (doppo le ricchezze, &
 honori in vita) vn'eterna memoria di
 nomi loro. Ma bene dico alli soldati
 (a' quali pretendo parlare) non eser
 necessario l'imparare questa scienza

is made its clear display, as it really
 is or ought to be. It can be further
 seen how much this 'design' is not only
 useful but necessary and especially in
 expounding and making understood those
 concepts of ours, as for example would
 be if it would be represented with sim-
 ple words, and give to be understood
 the construction of a city or other
 thing, which to treat of would be impos-
 sible, not only to judge of its perfect-
 ions and imperfections, but further to
 recognise its proper form which is to
 the contrary in a design to scale is
 made clear. And therefore design
 ought to be learnt, because -- as I
 have said -- design is very useful in
 all the professions and especially
 to those who are obliged to be in
 charge of, and to bring to success,
 great works. And in order to learn it,
 one can not have recourse to a
 better master, in as much as this is
 Nature, because with the observation
 of this will be seen in detail all
 those marvellous effects, which can be
 with Art employed, as in the divisions

and outlines admirably made in all the
 bodies, and in every kind, as in the
 the shadows caused by more, or by less,
 reflection of the Sun, whereby the
 excellent master comes to achieve
 what he alone knows how to imitate.
 And wishing to execute this, the
 delight of the work helps greatly,
 with the application of the will, becau-
 se from this will follow the practice
 of the hand, which will obey the int-
 ellect, whereby one is able with lengthy-
 ness of this practice, always to attain
 that level of excellence, which many
 with such means have done, with the
 acquisition -- after riches and hon-
 ours in life -- an eternal memory of
 their name. But truly I say to the
 soldiers -- to whom I intend to talk --
 it is not necessary to learn this

del disegno, così per eccellenza; ma si bene non esserne ignoranti, perche propongo non gli habbia à occorrere l'hauere à competere con li secreti dell'Arte nel formar le statue, e valersi de gli scurci cauati dalle lontane prospettive;¹ ma bene deue sapere disegnare con lineamenti quali si voglia fabrica, e strumento, che nelle attioni della guerra si possa vsare, e saper mettere in carta vn sito, ouer paese proportionatamente con le sue misure, cioè imitare li monti, e'l piano, e li fiumi co'l mare, e scogli, e quegli ombreggiare con quelle istessa diligenza, che si vede operare dalle ombre causate dal Sole, come s'è detto; E quanto in ciò sarà maggiore la sua intelligenza, tanto più li sarà facile l'ascendere virtuosamente à que' gradi, che desidera. E chi disprezzarà, e farà poca stima della intelligenza del disegno, con dire, che è fattura da Meccanici,² e da gente di bassa conditione, dico senza alcun dubbio, questi tali essere in grand'errore, e per conseguenza poter mancare de perfettioni nel comandare; perche chi non saprà fare vn disegno, non lo saprà ne anco bene intendere; si che hauendo per via di disegno da riconoscere vn sito, ouer far fabricare vna fortezza, bisognerà pure non sapendo, che si rapporti à chi lo sa, & in cambio di comandare, obedire à vn meccanico; delche se ne parlerà a suo luogo. E però il disegno è necessario à tutti, e particolarmente a' Signori grandi; de' quali pure ancora molti osseruano quella così lodeuole vsanza de' nostri antichi, nel fare imparare à disegnare i loro figliuoli. Tal che

science of design so well, but it is good not to be ignorant (in it) because I assume that they should not have to face having to compete with the initiated of the Art in forming statues, and to be good at shading, got out of distant perspective.¹ But ought to know well how to design with outlines what it is wished to make, and instruments which in the activities of war can be used, and to know how to put in a map, a site or country, proportionately with its measure, that is to imitate the mountains, and the planes, and the rivers with the sea and rocks, and those to shade in with that same fineness which is seen to operate in shadows caused by the sun, as is said; and as much in this will be the greater his understanding, as much more will it be easy to him to ascend virtuously to that level which he will desire. And who will condemn and will little esteem the understanding of design, saying, that it is the labour of mechanics,² and of men of low condition, I say (that), without any doubt, these such are in great error, and in consequence may lack of perfection in comand, because he who will not know how to make a design, he will further not know how to understand it well; so that having by way of a design to recognise a site, or to construct a fortress, it will be necessary, not being fully skilled, that he should have recourse to who does understand it, and instead of commanding, to obey a mechanic, who will discuss it in his place. And therefore 'design' is necessary to all, especially to great lords, who further again observe that so praiseworthy usage of our ancestors in making their sons learn design. Such

1. This is slightly obscure, "distant perspective" is presumably vanishing point perspective.

2. During the 16th. century mechanics were concerned with making and maintaining machines and were of course in no way concerned with 'mechanics' in its modern sense, as for example O.E.D. gives "that department of applied mathematics which treats of motion and tendencies to motion". The topic of the simple theory of machines, which was often discussed during the period, was known in fact, as Lorini had it in his heading to Bk. V, as "le scienze delle Meccaniche". (The title of the work by Drake and Drabkin "Mechanics in the 16th. century" is anachronistic, and totally misleading.) Equally the 'mechanical arts' were contrasted with the free or 'liberal' arts.

tutti i più gran Capitani, e Duchi, e gli istessi Imperatori hanno posseduta questa scienza....¹

that all the greatest Captains, Dukes and the Emperor himself have possessed this science.....¹

p. 48. QUELLI, che vogliono fabricar fortezze debbono hauerne prima tanta pratica, e scienza che facilissimamente possino formarsi nell'idea tutte le sue parti, auanti, che faccino l'opera, e quelle chiaramente vedere e considerare si come vedesse l'opera fatta reale....

Those who would construct fortresses ought first to have such practice and science, that easily can be formed the idea in all its parts before they should make the work, and these clearly see and consider as if would be seen the work actually made...

p. 52.²Count: DAPOI, che per conuentione di già fatta dobbiamo ragionare delle Fortificationi, à me pare necessario, che diamo principio con qualche buon'ordine, cominciando da'primi principij, per arriuare a quel fine... Ma vorrei per maggior mia intelligenza due cose da voi, cioè la facilità delle dimostrationi; e che non vi riserbiate alcuna nuoua inuentione, sotto pretesto di secreto, che meriti stare occulto (ilche non conuiene tra amici) oltre che non hò anco fede alcuna in que'tali, che dicono voler far gran cose, e dipoi tacciono il modo, per non iscoprire l'inuentione, ouera per dar più riputatione alle loro opinioni....AV.: In quanto al suo primo desiderio d'intorno alla facilità delle dimostrationi crederò di sodisfarla; perche le voglio far vedere vn Libro, che de già hò scritto, sopra questa materia, doue con ordine (al parer mio) assai facile, hò trattato de'primi principij per *insino a quel fine, che più hò giudicato necessario....In quanto poi al trattare de'secreti non occorre, che la dubiti punto, perche mai ho stabilita alcuna cosa che prima non l'habbia conferita, e disputata con altri, per certificarmi del solito inganno della propria affectione..Ct...Ma vi prego..me dichirate... per mia sodisfattione le cause di donde succedono tante, e così diuerse opinioni nel formare esse fortezze; perche oltre

²Ct.: Since, by agreement already made that we ought to discuss fortification, it seems to me necessary, that we make a start with such good order, starting from first principles to arrive at that end (desired).....But I would for my greater understanding, two things of you, that is ease of demonstration; and that you do not reserve to yourself any new invention, under pretext of secrecy, that it deserves to be kept hidden, which is not meet between friends; besides which I have no faith in any in the like that say they wish to do great things and then are silent on the means, so as not to uncover the invention, or, to give more reputation to their opinion.....Au.: In as much as to your first desire concerning ease of demonstration, I believe you will be satisfied, because I would wish you to see a book that I have already written upon this subject, where, in orderly fashion -- in my view -- very easily, I have treated from first principles up to that end which further I have judged necessary...In as much then that the treatment of secrets does not occur, doubt you not, because I have never established anything which I have not first conferred and disputed on with others, to guarantee myself against the common error or personal apppection...Ct...But I beg you to tell me for my greater satisfaction why arises so many and

1. Lorini went on to mention Charles V and 'cosmography'; and Cosimo Medici and the 'science of design' -- 'Carlo V...che intendono co'l disegno la Cosmographia....'

2. From the dialogue between a count and the author.

il non hauer mai trouato Autore alcuno che ne habbia scritto, ilquale si conformi con gli altri; nè anco hò visto alcuna fortezza, alla quale non venga sfatte infinite oppositione; E quello, che più mi apporta marauiglia è, che sentendone disputare, vedo esser pochi quelli, che concorrino in vn'istessa opinione. E per ciò da molti è stato detto, questa non essere scienza per non hauer suoi fondamenti certi, e demonstrabili, come hanno le altre; ma che il tutto venga terminato sopra le mal fondate opinioni de gli inuentori.

AV: ... questa è scienza fondata come sono tutte l'altre sopra suoi termini reali, demonstrabili, i quali pur sono facili, e noti, come più auanti lo dirò. E primo intorno alla diuersità delle opinioni de gli Scrittori, che dice hauer letto, non è marauiglia, che tal lettura le apporti confusione nelle mente, poi che la maggior parte di essi hanno scritto diuersamente quello c'hanno inteso da altri, senza fondamento di scienza, ò pratica.¹ Non sapendo io trouare, che alcuno di essi habbia mai fatte fabricar fortezze, e che con la esperienza ne possa addurre quelle ragioni, che gli si conuengono. Nondimeno la lor fatica non può se non giouare, pur che l'accorto lettore sappia tra le molte loro opinioni fare elezione delle migliore. In quanto poi alle discordanze fatte da quelli, che ne vogliono disputare, & che non si confrontano di opinioni; questo dipende dalle cause sudette, cioè pochi di essi intendono le ragioni, e massime quegli, che manco sanno, sogliono esser gli più ostinati, si come il più delle volte sono coloro c'hanno qualche autorità; perche andando gli disputanti a guisa de gli orbi, che cercano la strada, non è gran fatto, se trauiano, perche vendendola caminerebbono liberamente² a quel fine, che

and such diverse opinions in shaping these Fortresses. Because, besides that I have never found one author who has written on it, who agrees with the others, nor further have I seen any fortress which does not come to be made without endless contradictions. And that which brings me more amazement is, that hearing disputes I see to be few those who concur in the one same opinion. And because by many it has been said, that this is not science through not having its foundations certain and demonstrable, as have the others, but that it is all concluded on the badly founded opinions of the inventors.... Au.: (I say) that this science is founded like all the others on its own ends, real and demonstrable, which are truly easy, and noted, as I will say to you below. And first concerning the diversity of the opinions of the writers, that you say you have read, it is no wonder, that such reading brings you confusion of the mind, because the greatest part of these have written variously of what they have understood from others, without a foundation of science or practice.¹ I, can not discover any of these have ever constructed fortresses, or can with experience adduce these reasons which belong to them. Nevertheless their work can not but help, if only that the wise reader will know how, among the many of their opinions, to chose the best. As to then the disagreements made by these who wish to dispute and are not agreed in opinion, this depends on the above said cause, that is few of these understand the rules, and especially those, that know less, usually are the most obstinate, as often are those who have some authority, because the disputants proceeding in the way of the blind, who search for the route, it is not a great thing if they go astray, because, it happening that they would travel freely² to that

1. This is rather odd. Such a writer as Castriotto clearly wrote from experience. But perhaps the notion is that even then he could not give the proper reasons.
2. The key notion here seems to be "liberamente", that is without the constraint that a proper knowledge of actual events brings.

la ragione, e la natura delle materie ne mostra; poi che conforme a'siti, & offese, che ne fa il nemico, si debbono formare le fortezze, e non sopra alle imaginationi concette nell'animo, ouero fondate sopra all'esperienza di qualche caso seguito in vn'espugnatione, che non si deue addur per regola, stante le diuersita delle occasioni di estisiti, e materia.¹ Co:....desidero, che discorriamo alquanto d'intorno al fondamento della scienza, con proportionarle a qualche altra approuate: acciò si venga a mostrare più chiaramente le cause di dette contraddittioni

.....AV: Se noi douemo trattare della compartione dell'altre scienze a questa del fortificare, per certo non si potrà ritrouare la più simile quanto sia quella della Medicina, perche l'vna con l'altre pare, che molto si confaccia in tutte le cose. Adesso, che volendo il Fisico medicare, e sanare l'indispositione del nostro corpo, è necessario, che prima conosca la natura della complessione², e dipoi quella dell'humor superfluo, che ha causata il male, & insieme sapergli applicare quelle sorti di medicamenti, che per natura saranno contrarij al detto humore, per temperarlo; si che esso corpo venga a liberarsi da essa sua indispositione. Così nel fortificare si deue sempre preporre che il sito sia il corpo amalato, sendo sempre con qualche imperfettione, alla quale si deuno applicare i medicamenti.

¶ Prima considerare alla sua complessione, cioè se sarà sasso, ò terra,

end, which reason and the nature of the subject in it shows; since conforming to the site and attack which the enemy makes on it, the fortress ought to be formed, and not on the fantasies conceived in the mind, nor founded upon the experience of some chance occurring in a capture, which ought not to be adduced as a rule, given the diversity of the site and material.¹ Co:....I wish that we should discuss something about the foundation of the science by comparing it to some approved other one, so that the cause of the said contradictions comes to be more clearly shown....Au.: If we have to treat of the comparison of an other science to that of fortification, for sure one more similar to it than medicine cannot be discovered, for the one to the other seems very comparable in all things. Concerning which, the Physician desiring to treat and cure the sickness of our body, it is necessary that he first knows the nature of the complexion² and then that of the excessive humour, which has caused the ill, and also knows how to apply those sorts of remedies³ which will by nature be contrary to the said humour, to moderate it, so that the body becomes liberated from its indisposition. Thus in fortification it ought ever to be assumed that the site should be a sick body, being always with such imperfections, to which the remedies ought to be applied. And first to consider its complexion, whether it will be rock or earth, and being of rock it

1. The principle Lorini indicates here that single cases can not be considered to indicate general rules, is sound enough. But he rather leaves out the problem of how, given experience of a good many cases, one selects out of all the complex events of a siege just those features that are to be considered to lead to legitimate general rules. His attitude was to say that this was something one found with experience, but this rather begs the question.

2. I.e. constitution. Lorini here uses the vocabulary and ideas of the medical tradition of his period to good effect. The cast of these ideas in fact enabled him to make a quite extensive analogy between fortification and medicine, which would have been very much more difficult if he had been faced with modern medical ideas, such as the germ theory of disease, for example.

3. Lit. medicines.

& essendo di sasso sarà assai robusto, e facile con ogni semplice medicamento a conseruarlo gagliardo. Ma se di terra esposta alla Zappa sarà all'opposito per natura molto debile, e facile a ricevere il male, si che trasmutando le considerationi, che deve hauere il Medico in quelle, che debbe hauere vn'Ingegnare militare, nel riconoscere le imperfettioni del sito, si potrà (senza alcun dubbio) applicare così potenti medicamenti, che facciano al corpo della Fortezza tanto di beneficio, che sia bastevole a conseruarlo. E però dalle cose narrate concluderemo, che questa di cui trattiamo, sia non pur facoltà, come la medicina,¹ ma Scienza, & Arte; perche ella è facoltà in quanto che dipende ogni sua perfettione in atto, de varij accidenti della guerra, e de diuersi siti, in cui ci bisogna fondar esse Fortezze. Scienza è senza dubbio, hauendo i suoi fondamenti, & ogni formal perfettione dalle Mathematiche, lequali pure sono scienze conosciute per le sue certe demonstrationi. Di modo, che mentr'ella insegna, è Scienza; mentre poi con certe, e determinate regole, ne propone il fine indubitato di fortificare, e difender vn sito, ella è Arte.² E passando poi all'atto pratico, nel trouar molte difficoltà della materia con lequale si opera, diuen facoltà.³

will be very robust, and easily with any simple treatment, conserved strongly. But if of earth, exposed to the sap, it will on the contrary be by nature very weak and vulnerable to sickness, so that translating the considerations which the Physician ought to have, into those which a Military Engineer ought to have, to survey the imperfections of the site, he will be able -- without any doubt -- to apply such strong treatments as should do to the body of the Fortress such benefit that is sufficient to conserve it. And therefore from the things related, we will conclude that this which we treat, is not purely a skill, like medicine,¹ but Science and Art, because it is a skill in as much that all its perfections in action depend on the various accidents of war and of different sites, on which it is necessary to found these fortresses. Science it is, without a doubt, having its foundations and all the formal perfections of Mathematics which are absolutely science, known through their certain demonstrations. So that whilst it teaches it is science, while then with certain and definite rules it puts forward the true end of fortifying, and defending a site, it is Art.² And passing then to practical action in considering many difficulties in the subject with which it works, it becomes a skill.³

p. 55 AV.la Fortezza può in quattro modi ricuere offesa dal suo nemico. Et prima con la ZAPPA. Secondo con le Batterie; terzo co'l lungo Assedio;

Au.:the Fortress can receive the attack of its enemy in four ways. The first is with the sap; the second by battery; thirdly by long siege; fourth

1. "facoltà", lit. 'faculty, power, ability' (FLOHIO (1611)). Lorini above has just referred to medicine as a science, so this seems slightly odd; equally it ignores the very sophisticated theories of medicine, such as that of the humours which he has just referred to. However it is clear that what he was doing was to take a highly respected and long established discipline -- medicine -- and saying, look at this 'science', see that fortification is very much on a par with it; but, -- now focusing on the more empirical aspects of medicine -- fortification is not so much like medicine, rather it is superior to it, for it is based on mathematics with the certainty and perfection that brings, while medicine is really only a matter of skill in practice.

2. Lorini here takes the certain and determinate rules of 'science' and quite blatantly asserts that these belong in fortification in so far as it is an Art, without any apparent justification.

3. Note Lorini's distinction between 'art' and 'science'.

quarto & vltimo, per via di tradimenti. Fra lequeli offese due sole sono le maggiori, cioè Zappa, e Batterie: ma lo piu tremenda sarà la zappa....¹

sp. 56. CO.non ostante la comparatione fatta da voi della scienza del medicare, possiamo con piu reale similitudine comparare questa del fortificare al giuoco de gli Scacchi....²

sp. 59. AV. ...Et volendo offendere il nemico che stia fuori della fossa... ouera nell fossa coperto con trincieresi doueranno operare le palle, & hauendo in detta fossa a tirare a gli huomini, e massime ne gli assalti per la batterie, si essequira co'sacchetti, ouero lanterne³ fatte di rete, di filo di ferro ben serrate, pieni di palle da moschetto.....

sp. 61.⁴ AV. Quando che per offendere il nemico i difensori non potessero usare altro, che la semplici palle, ouera lanterne, o catene, ella hauerebbe qualche ragione per esser la palla molto fallace⁵, e le catene, e lanterne, inutili per la distanza, stante l'impedimento, e contrasto⁶, che gli fa l'aria. Ma douera sapere, che solo si deue stimare l'offesa della palla nel passare trincieri, e disfar machine. Et per offender molti, si deue.... tirare con sacchetti pieni di palle di piombo per il manco di due oncie di peso....da dodici insino a diciotto libbre di palla....

p. 70. CO.Inquanto poi all'altezza del terrapieno, che segue sopra la detta muraglia⁷, e piano del sito; dico non si douer far cosi alto, nè con stante scarpa, perche sua altezza ne cause, che i tiri dell'artiglierie

and last by way of treason. Amongst which attacks, two alone are the greatest, that is the sap and battery: but the very greatest will be the sap....¹

Co.notwithstanding the comparison made by you to the science of medicine, we can with more real versimilitude compare fortification with the playing of chess....²

Au.: ...And wishing to attack the enemy that is outside the fosse...or in the fosse covered with trenches... round shot ought to be employed, and having in the said fosse to fire at men and especially in the attack by battery, it will be achieved with little bags or 'grenades'³ made of a net of strands of iron well closed, full of musket balls.....

⁴Au.: When, through the attack of the enemy, the defenders can not use other than the simple ball, or 'grenade', or chains, they can have such (poor) effects through the ball being very erratic⁵, and the chains and 'grenades' useless because of the distance, given the resistance and impedance⁶ that the air makes to it. But it ought to be known that the attack of the ball ought to be esteemed only to penetrate trenches and to dismantle machines. And to attack many one ought....to fire with little sacks full of balls of lead of at least 2 ounces weight....from 12 to 18 pounds the shot.....

Co.:as to the height of the terreplein, that follows from the said wall⁷ and plane of the site, I say it ought not to be made so high nor with so great a scarp, because its height results in that the fire of

1. Lorini went on to explain that sapping covered all those activities dependent on the spade. Mining he included as one of 5 types of sapping.

2. Lorini did not directly refute this point.

3. FLORIO (1611), "Lanterne...amongst Gunners it is a case of wood, into which they put stones or any hail-shot."

4. In response to the Count's contention that he had often seen defensive artillery to be ineffective.

5. Lit. fallacious, false, deceitful. The verb 'fallare' having the sense of to err, be mistaken.

6. Lit. a withstanding, a contention, a strife. (FLORIO (1611)).

7. Of the counterscarp.

vanno di ficco¹, e si restringon le piazze, e quello che molto importa, è che la detta grande scarpa potria apportare comoda salita al nemico per montarci sopra, & impadronirsi della Fortezza. AV. Douendo sopra le tre oppositioni fatte da lei rispondere, le dirò primo, che le altezze delle piazze, ouer terrapieni delle Fortezze, stanno sempre bene, sì per coprire le strade, e case di dentro, come ancora per dispensare la materia, che si cauerà della fosse.....Circa poi al tirar di ficco per la detta sua altezza, questo vien fatto con molto beneficio della difesa: atteso, che le piazze da alto debbono, non solo coprire le parti interiori della Fortezza, ma da presso, e da lontano scoprire per fianco, e per fronte il suo nemico; benchè coperto dall'altezza delle trinciere, e per ciò fare vengono molto lodati i cavalieri....

p. 97. CO...proporrò sito piano con piccioli baluardetti, e lontani l'vno dall'altro....AV. Queste sono infirmità, che pure hanno i remedij....quanto che hauerà sito dentro capace di far piazze, e ritirate comode....Il suo remedio sarà allargare, e profundare la fosse quanto si potrà, e con quella terra far dentro la Fortezza le piazze grandi con alte, & grosse difese; e particolarmente sopra ciascun cortina fabricare due cavalieri più vicini alla muraglia, che si può....E tanto questi cavalieri saranno più grandi, e con gran piazza di dentro, saranno sempre più vtile....

pp. 103. AV.questa scienza, e pratica è tutta fondata sopra le forme de'alti, e delle offese, che può fare il nemico; perche se ella si potesse insegnare perfettamente con le regole generali, come si fanno tutte le altre, ne auerrebbe, che di nobilissima che è,

the artillery is depressed¹, and the casemates are constrained, and what is very important is that the said great scarp can support an easy ascent of the enemy which mounts it, and becomes master of the Fortress. Au: Having to make answer to these three criticisms, I say of it first that the height of the planterplein of the Fortress, is always good, in order to cover the streets and houses within, as also to use up the material which is excavated from the fosse....Concerning then the depressed fire, through the said height, this brings with it much benefit to the defence in that the upper platform, ought not only to cover the interior parts of the fortress, but nearer, and more distantly uncover the enemy by flank and by the front, although covered by the height of the trenches, and through this the cavaliers comes much to be praised....

Co. ... I propose a flat site with little bulwarks and distant one from the other ...Au...These are weaknesses which I truly have the answer for...in as far as it will have a place within sufficient to make platforms and retranchments ...Its remedy will be to increase and deepen the fosse as much as possible, and with this earth make within the fortress great platforms with high and strong defences, and especially on every curtain to make two cavaliers approaching the wall as much as can be ...And as much as these cavaliers will be larger, and with great places within, they will be always more useful...

Au.:this science and practice is all founded upon the form of sites and of the attacks that the enemy can make. Because if it were possible to teach perfectly with general rules, as are done all the others², it would be that the nobility that is, through

1. GR DIZ II. gives from Tensini (1524 Venice) l. p. 44, "In tiro che viene d'alto al basso detto da fico"
2. Sciences.

per essere posseduta da pochi, non se ne tenerebbe molto conto, sendo intesa da molti.¹ Ma perche altra scienza non si troua, che come questa, debba dipendere dall'acutezza del intelletto dall'huomo, nell'antuedere quello, che puo fare l'ingegno, e la forza d'infiniti altri, per la difesa delle Città, e de gli stati.²...chi vorrà essere buono Ingegnere Militare, e perfetto soldato, non gli sarà bisogno (doppo la fatica fatta di esso studio) andarsi à Dottorare à Padoa, nè à Bologna, ma doue si fa guerra, e si difendono, & espugnano le fortezze.....

p. 105.³ E però hauendo noi nel precedente primo Libro trattato a bastanza di que'principij, che per scienza si debbono intendere per saper ben ordinare, e formare in disegno le piante delle fortezze, al presente per compimento di quanto si desidera, tratteremo della pratica, con laquale s'ha deue ben fortificare....perche volendo ornarsi del titolo d'Ingegnere Militare è necessario non solo di hauer la scienza, ma la pratica....Et però sarà bene hauere anco notitia di tutti gli essercitij appartenenti alla fabrica, o almeno non esserne ignorante ma non già dico, che si debbon far manualmente, ma si bene sapere le cause....

...douendo comandare a' muratori e necessario sapere la natura delle calcine e sabbioni..

being possessed by few, would not be held of much account, being understood by many.¹ But because science is found to be nothing other than this, that it ought to depend on the acuteness of the human intellect, in foreseeing what skill and strength of innumerable others can do, in the defence of the city and states.².....who wishes to be a good Military Engineer, and perfect soldier, he will not need -- after the labour done in this study -- to go to take his Doctor's degree at Padua or at Bologna, but where the war is made and to defend themselves and capture fortresses....

³Therefore we having in the preceding book dealt sufficiently with the foundations that by science ought to be understood to know how to order and form well in design the plan of the fortress, at this time in completion as far as is desired, we will treat of practice with which fortification ought to be well done.... Because wishing to be adorned with the title of Military Engineer it is necessary not only to have science, but practice (also)..Therefore it will be well to have further knowledge of all the trades relevant to building, or at least not to be ignorant therein, but not so soon I say, that one ought to perform manually, but rather to know the causes...having to command masons it is necessary to know the nature of lime and gravel...

1. Elitest considerations determining the epistemological response.
2. This is highly ambiguous and might be read in a number of ways.
3. Bk. I. This section comes from the beginning of Bk. III.

GIOVANNI BATTISTA BELLUZZIDe Fabricar Fortezze (1st. ed. 1598)Bibliography: Venetia 1598.¹General description: (iv) + 116 pages 10 $\frac{1}{2}$ " x 7" text.Contents:

- p. (i): Title page: NVOVA/ INVENTIONE/ DE FABRICAR FORTEZZE,/ DI VARIE FORME,/ IN QVALQVNQUE SITO/ di piano, di monte, in acqua, con diuersi disegni,/ ET VN TRATTATO DEL MODO,/ che si hà da osseruare in esse,/ CON LE 9VE MISVHE, ET ORDINE DI LEVAR/ le piante, tanto in fortezze reali, quanto non reali./ Di Giouan Battista Belici./ CON VN DISCORSO IN FINE INTORNO AL PRESIDAR,/ e guardar esse fortezza, e quanto fa bisogno per il lor mantenimento./ All'illusterrissimo e Genorosissimo Signore il Signor Filippo Ludouico,/ Conte d'Hanauu, de Rinnegh. Signor in Mentzenberg./ IN VENETIA,/ Appresso Tomaso Baglioni. MDXCVIII.
- p. (iii/iv): Dedication to the Count of Hanau by Tomaso Baglioni, dated Venice 20 Jan. 1598.
- p. 1/34: This section is divided into chapters on fairly standard practical topics relevant to fortification. Included is for instance a discussion on the earth to be used for making bastions. The illustrations to go with this section are lacking. The places where they were intended to go are indicated, often by means of a short description of the nature of the intended figure.
- p. 36/116: This later portion of the treatise contains a good number of illustrations of ideal plans and of actual sites, together with gadgets for use in surveying, methods of making mines and so on. The text is rather a random collection of discussions, generally fairly close allied to the illustrations, with no chapter headings. This section seems to have been the work of Gian Tommaso Scala.²

1. Different copies of this work vary in that the title pages of some read "Appresso Roberto Meietti" *, (see RICCARDI (1893), 2nd. Add. Ser.) while others give the name of the editor Tomaso Baglioni as given above, which version is considered throughout. AYALA (1854) noted references to other editions of 1602 and 1708, but did not believe they existed.

2. There seems to be a good deal of confusion about the make up of this work. PROMIS (1841) in part from examination of Belluzzi's manuscripts suggested that a large part of the work as printed was interpolated, and not by this author. Undoubtedly there is a great difference between the sections before and after page 34. Further Belluzzi's diary now available (see ELIDI (1907)) indicates that he could not have written at least some of the later parts due to the contradiction in biographical information. (In the treatise p. 45 the author states he was in Hungary in 1537, while the diary shows he was actually in Italy.) Promis (ibid) attributed these later sections of the printed treatise to Mellone; and this attribution has been continually repeated by later authors, as for example RICCARDI (1893); ELIDI (1907), p.24; MAGGIOROTI (1933/9), II, p. 24; and DE LA CROIX (1963) lists under 'Melloni', Particelli e fragmenti, which is the title to the later sections of this treatise, with its date of 1598. Yet PROMIS (1874) under Mellone and (1871) under Gian Tommaso Scala (not to be confused with Giovanni Scala) recanted on this attribution. Having seen a manuscript, discovered by Ayala, clearly written by Scala, he was quite definite that at least the section p. 34/108 of the printed treatise was by this same author. This view has been accepted here as having to stand until a further collation of the manuscripts with the printed work can take place, particularly as the ideas in this section of the work are very similar to those of the sections of text by this author published by RUSCELLI (1560).

De Fabricar Fortezza (1598): Texts

p. 1.la fortificatione, della quale s'ha da perlar, non è altro, che lasciar gli huomini per vantaggio di sito da chi li volesse offender, & sper questa ragione fa di bisogno hauer intelligentia grandissima di siti, & delle figure di essi misuramento, & de'modi di offendere, l'una delle qual cose v'insegna il mestier della guerra; l'altra si acquista mediante le mathematiche. Percioche il considerer la figura d'un luogo, se egli è tondo, è quadro, è d'altra più composta, & intrigata figura, non è altro, che hauer auertenza alle linee, & angoli che d'ogni intorno la chiudono; Et così anchora il leuar¹ delle piante, & il scompartir di quelle, che il tutto si fa per forza di linee, & angoli, & altri suoi scompartimenti, che tutta questa è propria consideratione del Geometra. Ma quando si dice, questa linea è tante misure, ouera che si consideri le spese, la quantità della materia, & delli huomini, è questo fa bisogno della scientia d'numeri....La intention nostra dunque, è assicurar gl' huomininon in qualunque modo, ma solamente con il pigliar vantaggio di sito....Et queste tre cose principalmente hauemo da considerer nella fortificatione, perche ciascuna di quelle secondo la varietà sua puo assai variar quella: se queste sono, l'armi nimiche; l'Armi di quel che si uole assicurar², e la positua del sito, doue s'habbi da far essa fortificatione.

p. 2. Prima diremo qualche cosa delle conditioni, che si ricercano all' Ingegneri, accioche non si pensasse ognuno senza durar fatica, & senza studio alcuno, poter farse capo di queste tanto degna, & vtil'arte, come

....fortification, which has to be discussed, is nothing else but what allows men through the advantage of the site (to defend himself) against whoever wishes to attack them, and for this reason it is necessary to have the greatest understanding of sites and of their figures by measurement, and of methods of attack, the one which thing the business of war teaches you, (while) the other is aquired by way of mathematics. Because the consideration of the shape of a place, if it is round or square, or otherwise more a composite and intricate figure, is nothing else but to have information of the lines and angles which all concern the closure. And thus further to take¹ the plan and its divisions, which all is done by means of lines and angles and their other its division; which is all done by means of lines and angles and their other divisions, which all belong to the consideration of Geometry. But when it is said, this line is of such a measure, or that cost should be considered, the quantity of material or men, to these is needed the science of numbers.... Our intention therefore, is to secure men.....not in whatsoever way, but purely by taking advantage of the siteAnd these three things principally we had to consider in fortification, because every one of these according to its type can vary much: and these are, the arms of the enemy: the arms of those whose security is desired²; and the layout of the site where this fortification has to be made.

First we will say something of the conditions which are sought of Engineers so that it should not be thought by anyone that without hard labour and without any study, it is possible to make a master of this so worthy and

1. "Leuare", commonly used as 'to raise' but often used in the sense of to take as here.

2. Not so much in quantity as in type in accord with contemporary practice.

si uede tutto il giorno a cascarcon gran danno e vergogna di coloro, che à si fatte persone rimettono il carico delle cose sue. Secondariamente parleremo del modo di leuar piante de siti, qual di quanta importanza sia, lo giudicherà ogn'uno che leggerà queste nostre cose. Dapoi insegneremo compartirle, pigliando li modi da **stiri dell'Artiglieria.....**

ALLI ingeneri, che vorranno ordinare, & terminare le fortificationi, sarà de bisogno esser instrutti delle cose della guerra, & delle Mathematiche, massimamente di quella parte, che serua alla Architettura. Delle cose della guerra, perche conosciuta l'offension d'un luogo, possa con rimedi piu facili fortificarlo, & difenderlo: **ma** qual parte sarà chiamata speculatiua, che contiene in se molte belle qualità da poter specular quelle cose, che alla giornata possino interuenire; perche buona parte dell'ationi delle guerre posson in questi casi auenire, le quali, quando dall'Ingegneri non fosser conosciute, maleamente possono dar rimedi che vagliano, di questa speculatiua ne vorria esser ornato **sciaschun** Prencipe, & gentilhuomo, al qual s'aspetta il commandar, & finalmente ogni soldato, che bramasse venire a gradi honorati.....& chiunque sarà di questa speculatiua bene instrutto, ò per dote di natura o per esperienza di guerra, potrà facilmente ordinare qualunque luogo gli verrà à proposito. Delle Mathematiche deue l'ingegner saper ben quella parte che **si** conuiene all'Architettura; come seria l'operation delli strumenti, & specialmente quelli da leuar piante; **ma** la pratica delsesto, e del regolo appresso per la cognitione della mat-
eria tutta; la calculatione delle spese necessarie, del tempo, & delli

useful art, as is seen everyday to occur¹ with great danger and shame to those, who are persons charged with these things. Secondly we will talk of the method of taking plans of sits, which is of such importance as will judge everyone who studies in this our subject. Afterwards we will teach to set out², taking the method of fire of the Artillery....

Engineers who would order and ground the ends³ of fortification will be needful of being instructed in the subject of war, and of Mathematics, especially in that part which serves Architecture. The subject of war, because knowing the attack on a place, it can more easily with remedies be fortified and defended; which part will be named speculative, which contains in itself many beautiful qualities in being able to contemplate those things, which can daily happen; because a good part of the actions of war can in these cases arise, which, when they are not known to the Engineer, the remedies they desire can be defective; in which speculation should wish to be adorned every Prince and gentleman, who expects to command, and finally every soldier who covets to reach to an honoured degree.... and whoever will be well instructed in these speculations, or by natural wisdom, or through experience of war, can easily order whatever place will be suitable. Of mathematics the Engineer ought to know well that part which belongs to Architecture, as will be the operations of the instruments, and especially those for taking plans; the use of the compass, and the rule learnt through the knowledge of the whole subject: the calculation of the necessary costs, the time and men,

1. Lit. to fall.

2. Lit. to divide, distribute, but used also with a particular sense of with a particular order or measure. See GK DZ II "Distribuire collocando secondo certo ordine o misure".

3. See 1.p.41 for a discussion of the notion of "termini"

huomini, e molt'altre cose & queste chiameremo operative, le quali per esser membro dell'Architettura sarà bastanti nella fortificatione. Ma quando anchora fusse buon Architetto, sarà meglio; benché la più degna parte dell'Architettura consista nelli ornamenti, quali alle fortificationi servono poco, & più presto ha di bisogno di schiettezza, & di sodezza da poter durar, & resistar, che d'alcuna sorte de ornamenti come sarà hauer per esperienza l'ordine de fondamenti in più modi, de potersene valer in ciaschun luogo, doue il bisogno ricercasse: sapere ancora l'ordine di lieuar piante, & misurarle, & ancor scompartirle secondo l'intelligentia dello speculativo, & hauer qualche cognitione delle figure, delle linee, & delli Angoli....

....Ma perche sono rari quelli huomini quali sono dotati della speculativa, & dell'operativa insieme, io stimo esser cosa conveniente, per voler adurre a perfectione una fortificatione, che il speculativo sia soldato, qual per esperienza di guerra sappi bene speculare, quanto sia il bisogno occorrente. L'altro operativo sia un buon Capitano maestro di muratori, qual habbia qualche buon principio dell'Architettura, & che nell'operar sia bene esperto, anchora che il speculativo ha bisogno dell'operativo, e l'operativo del speculativo, come cose diuise, & particolari a ciaschun di loro; ma ne casi occorrenti e di bisogno congiungerle insieme con molto destrezza, & accorgimento, perche la descrizione il più delle volte ingannerà hor l'uno hor l'altro, ch'il speculativo presumendosi dell'operativo, & l'operativo presumendosi del speculativo, sarà causa d'infiniti errori, si come alla giornata

and many other things -- and these we will name operative, which being part of Architecture, will be sufficient in fortification. But when further he would be a good Architect, he should do better; however the more worthy part of Architecture consists in ornaments, which serve fortification little, and he has the sooner the need of plainness and toughness, to be able to last and resist -- rather than any kind of ornament -- as he should have through experience the method of foundations in different ways, that he can make use of them in every place where the business requires it.¹ To know also the method of taking plans and to measure them, and also to set out on them according to the understanding of speculation, and to have such knowledge of figures and lines and angles....

....But because such men are rare, who are wise in speculation and in operation as well, I believe it to be a thing convenient, in wishing to bring to perfection a fortification, that the theorist should be a soldier, who through experience of war knows well how to speculate, in as much as the need occurs. The other, the practitioner should be a good master mason, who has some good foundation in Architecture, and in the work is expert, further that the theorist has need of practice, and the practitioner of theory as different things, and special to themselves, but in actual cases it is necessary to join them together with much dexterity and care, because description most of the time will deceive now the one, now the other; so that the theorist presuming to be the practitioner, and the practitioner presuming to be a theorist,² will be the cause of innumerable errors, as daily

1. Obscure. The general sense seems clear enough. Foundations where ornaments are not used have the sorts of qualities relevant to fortification.

2. It is impossible here to catch the flavour in English of the way 'speculativo' and 'operativo' work in this section.

se ne posson notar molti. Ma se pur sia
alcuno che hauesse voglia di professor
generalmente in l'vna e l'altra parte,
in prima uada alla guerre; & cerchi de
conoscer bene, quali siano l'offese, &
difese con l'altre cose appartenenti
a questo. Poi a tempi di pace de saper
bene i ueri principij delle Mathematiche,
& del Architettura, essercitandosi con-
tinuamente nel disegno.

p. 8. ...tutti quelli che vorranno far
professione di questa scientia¹, che
imparino, & se essercitino nella Math-
ematica, nella Architettura, e nel
mistero della guerra, o vero al tempo
di pace con soldati pratici di scorrere,
e longamente ragionare, essercitare
la mano al disegnar di pratica, che
giouera mirabilmente.

p. 34. QUANTO alle figure delle fort-
ificationi parlando in genere hauendole
a far di nouo, & che non si sia oblig-
ato a siti strani, cioe montuosi; o
precipitosi ma che si potesse tener
perfetta in qual luogo si fosse. Uicemo
che del quadrato in su tutte le forme
di quanti piu lati & angoli saranno
tanto piu gagliarde, & di bella apparen-
za uerrano, & dentro haurà maggior
spatio. Il quadro anchor lui ha bella
forma, breue, & di meno spesa, & di
poca guardia², ma li sui Beloardi
bisogna sieno acuti, & che per questo
haueranno dentro poco spatia, & anco
meglio si potranno offendere; ma la
forma pentagonale cioe di cinque lati
sara meglio assai, & cosi quelle di
sei, di sette, e d'otto o piu meglio
sarrano...ma perche spesse volte

can be much noted. But if it shall be
that anyone should have the wish to
embrace generally in the one and the
other part, first he should go to the
war and search to know what are attack
and defence, with the other things
relevant to these. Afterwards in times
of peace to know well the true princip-
als of Mathematics and Architecture,
practising continually in design.

...all those who will wish to make a
profession of this science¹ (should)
learn and be practised in Mathematics
and Architecture and in the business
of war, or truly in time of peace with
practised soldiers to run over and
lengthily discuss, to exercise their
hand at design in practice, which will
aid astonishingly.

As to the figure of the fortification
talking of the type having to be made
anew, and that is is not constrained
by an inconvenient site, that is mount-
enous or precipitous, but which can
hold perfectly what place they should
be; we say the square, of all
the forms of how many more sides or
angles will come out much more robust
and with a beautiful appearance and
within will have greater space. The
square further has a beautiful form,
briefly and at less cost, and of less
guard², but its bastions nec-
essarily are acute, and for this will
have little space within them and
thus they can be easily attacked. |
But the pentagonal form that is of 5
sides will be much better, and those
of 6, 7 and 8 or more will be better
(again)...but because often

1. I.e. fortification.
2. Garrison.

occorre di farue figure di ristretti
 come Rocco, o Castelli a questo si
 deue auuertir di non far troppo guardia,
 impero la forma quadata starà bene, ma
 smeglio sera quella di cinque lati
 quanto all'esser piu forte, & nõ ui si
 sia il rispetto dalla troppo spesa, &
 la troppo guardia....

occurs the making of restricted shapes,
 as in Strongholds and Castles, and in
 this one ought to warn against making
 too great a guard, therefore the
 square does well, but better will be
 that of five sides, as being stronger,
 and it should not to you in this respect
 cost too much, and (need) too much
 guard....

FRANCESCO DI MARCHI

Della Architettura Militare (1599)

Bibliography: Brescia 1599;² Roma 1810.^{2,3} [14] [15] [16]

General description:⁴ A large elaborate production. 12½" x 8½" text. (vi) + 44 folios + pages 45/279 + pages 1/22, + 161 high quality engraving in pages 45/279 not included in the foliation, and most frequently of a double page spread, of 16½" x 10½" single page size.

Contents:

f. (1a): Title page: DELLA/ ARCHITETTURA/ MILITARE,/ DEL CAPITANIO FRANCESCO/ DE'MARCHI BOLOGNESE,/ GENTIL'HVOMO ROMANO,/ LIBRE TRE./ NELLI QUALI SI DESCRIV-
 ONO LI VERI MODI,/ del fortificare, che si vsa a'tempi moderni./ CON VN BREVE,
 ET VTILE TRATTATO,/ Nel quale si dimostrano li modi del fabricar l'Artigliaria,
 & la pratica da adoperarla,/ de quelli che hanno carico di essa./ OPERA
 NOVAMENTE DATA IN LVCE./ IN BRESCIA, MDXCIX./ Apresso Comino Presegni. Ad
 istanza di Gasparo dall'Oglio./ CON LINCEZA DE'SUPERIORI.

1. This edition appeared in a number of different versions, some having ded-
 icatory letters, to Venice or to Vincenzo Gonzaga (dated 1600), and some not.
 Some carry the name of a different printer and the date 1603. RICCARDI (1893).
 Versions without dedications only have been used here, of which there was more
 than one issue. (B.M. Cat.)
2. A very elaborate edition with commentary, text, and a new version of the
 text, and new drawings, by Luigi Marini.
3. Hans Van Schille published a work Form und weis zu bawen...Maniere de bien
 bastir... at Antwerp in 1580, containing engravings of fortresses without text,
 many of which were taken from Marchi's treatise. MARINI (1810) suggested 11 were
 straight copies from Marchi's designs. At least in a number of cases it is clear
 this was the case, particularly in one case where Marchi showed a fortress and
 then in the empty part of the page within the circuit of this fortress, gave
 other designs. (Marchi's design no. 10.) Van Schille's version of this plate [7], [14]
 clearly involved a misunderstanding because he attempted to integrate the
 different parts of the plate, and make into a single fortress what were independ-
 ent designs. Marchi's text makes this independance clear, so it is probable that
 Van Schille never saw the text and had only acces to some of Marchi's designs,
 which Marchi himself explained he handed around to his friends. (Op. cit. f. 44b.)
4. B.M. 61.g.11.
5. Book IV, begins a new pagination.

f. (iia/b): Table of the measure of fortifications.

f. (iiaa): Different measures.

f. (iiib/via): Table of chapters.

f. (vib): A letteri.

f. 1a/44a: Books I/II: This is essentially an introductory section in which many diverse problems relating to fortification are discussed. It is not so much a continuous text as a collection of notes on various topics relevant to the art. It is difficult even to see any great significance in the division into two books.

f. 44b/page 279: Book III: This section comprises the main body of the work and is organised around the 161 engravings, the text being divided generally into chapters each relating to one engraving. The discussion is often not a great deal more than a simple verbal description of the main features of the design shown to which it relates, although sometimes more extended discussion takes place on general points in the art, or on particular sites and sieges. The engravings are almost entirely of designs of plans of fortresses using the pointed bastion trace. They often tend not so much to emphasise the geometry of the trace, as to show many different possible lines of fire. Many of the designs are simply paper projects, not infrequently rather over-elaborate in nature, but some contemporary sites and structures are included. There is little organisation in the presentation of the designs from one to the next, each being presented rather as it comes to hand.¹

p. 1/22: Book III: Some practical remarks on gunnery.

Della Architettura Militare (1599): Texts

f. (vib). Dilettandomi dell Architettura Militare, non ho voluto mancare, Lettori, de non mostrauì la figura di alcuni miei Disegni, del modo di fortificare, così di Terra, come di Pietra, mostrandouì figure non più viste, ma tutte, ò la maggior parte trouate di nuouo da me, & volendo accompagnare li detti Disegni con il parer mio in iscritto, parlando sempre come Soldato.

.....

f. 1a. NON è dubbio, che è necessario a chi vuole fortificare con ragione, intendere la Cosmografia, per saper conoscere, & repartire l'ara della fabbrica, come dice Vitruuio in più luoghi. Questa scienza leuerà grandissima fatica a chi hauerà da piantare

Delighting in Military Architecture, I have not wished to be lacking, readers, of not showing you the figure of some of my designs in the way of fortification, as much of Earth as of Stone, showing you figures not already seen, but all, or the greater part found newly by me, and wishing to accompany the said Designs with my opinions in writing, talking always as a soldier

.....

There is no doubt that it is necessary to who wishes to fortify with reason, to understand Surveying², in order to know how to recognise and to set out³ the area⁴ of the building, as Vitruvius says in many places. This science removes the very great labour of whoever

1. This no doubt stems from the way the book grew up over a long period, as Marchi continually added to and revised his notes, as can be seen from the many different dates mentioned in the text. See also PROMIS (1863).

2. See below p. 152, n. 4. 3. See above p. 139, n. 2.

4. FLORIO (1611) ara = aia = a court yard or plot of ground designed for any building.

habitationi, & fortificationi. Ancora bisogna precedere il saper pigliar le misure con instrumenti, senza hauer ad andarui a misurar con misure, ouero passeggiare, questo seruirà a gran breuità di tempo....Ancora non potrà mai saper fortificar con ragione, se non haurà cognitione dell'Arteglia: ma dico hauerne esperienza, & non di uddita d'altrui. Perche vi sono molti che parlano d'Artigliaria, per informatione, & non per pratica, nè esperienza, che a questi tali non do troppo credito; perche prima, che io adoperarsi Arteglia m'erano datte da intendere molte cose, le quali con le esperienza ho trouate tutto il contrario.....

f. 1b.³ LE Fortezze non sono altro, che oricetto di habitatori, le quali consistono in tre cose, cioè ne gli animi de gli Huomini, in la natura del Sito, & in l'aiutare con l'Arte.....

f. 2a. SARÀ bellissima, & fortissima la Fortezza fatta in piano....le Fortezze ne i Monti hāno l'aria sempre più purificata, la vista più bella, & producono huomini più robusti....⁴

f. 2b. Adonque la proportione, che si può dare al cinto della Città, & all'habitatione sarà al proposito il sito piano.

f. 18a. FRÀ tutti li siti, che si possono eleggere per fortificar, quello sarà più perfetto, & capace de gli altri c'hauerà figura Circolaria.

f. 19a. NEL fare li Bellouardi à tutte le fortezze bisogna alle volte gouernarsi secondo il sito....

will have to plan¹ houses, and fortifications. Further it necessarily precedes the knowledge of taking measurements with instruments without having to go to measure with the yardstick, or to pace out: this serves to great brevity of time....Further it will never be possible to know how to fortify with reason, if one will not have knowledge of Artillery, but I say having experience of it, and not heard from others. Because there are many who talk of Artillery, for knowledge, and not for practice, or experience, but to these such I do not give much credence, because when first I was employed at Artillery I was given to understand many things, which with experience I have found to the contrary...

Fortresses are nothing but what receive the inhabitants, which consist in three things, that is the spirit of the men, in the nature of the site, and in the the aid of art....

It will be most beautiful and strong the Fortress made in the plain...Fortresses in the mountains have air always more pure, the views more beautiful and produce more robust men...⁴

Therefore the proportion, which can be given to the enceinte of the city and to the houses will be suitable in a site on a plane....

Amongst all the sites that can be chosen for fortification, that will be more perfect and spacious than others which will have a circular figure.

In making the bastions, in all fortresses, sometimes it is necessary to be governed according to the site....

1. Lit. to plant.

2. I.e., for understanding, in a contemplative way. Marchi was probably thinking of l'artaglia here.

3. MARINI (1810) in his revised text, vol. 2, p. 2. gave quite differently "Le fortezze altro non sono che un ostacolo o naturale o artificiale contro la forza dell'assalitore."

4. Part of Marchi's rather Vitruvian approach to sites. The relevance of beautiful views is difficult to see. On the other hand good observation would be to the point.

f. 21a. LI Parapetti...se li fò alti più d'vn huomo sarrano securi dalla vista de nemici.....mà non potranno gl' Archibusieri tirare fuori di là dal sfosse.....

The parapets...if I make them higher than a man, they will be safe from the view of the enemy....but the Archibusers will not be able to fire out from here into the fosse....

f. 22a. Nella guerra di Fiorenza fu difeso il Campanile di San Miniato doue vi fù tirato più di sei milla tiri, & per tale armatura di balle di Lana, le palle dell'Arteglia non potero rouinare detta Torre.¹

In the war of Florence the Campanile of San Miniato was defended where was fired more that six thousand shots, and through such armour of balls of wool the shot of the Artillery was not able to ruin the said tower.¹

f. 26a. L'Architettura militare...nō tanto trà l'altre scienze e gioconda: ma per dignitate la principale...li Principi di hoggidi che si diletmano dell' arte del guereggiare...doueriano cercar di vedere il fatte de gl' Antiche e Moderni, & porsi à memoria li fatti loro per poterli imitare nell' opera buone.....

Military Architecture...is not so much among all the other sciences pleasing,² but in worth the first...the princes of today who delight in the art of warfare...ought to search to observe the deeds of the Ancients and Moderne, and put themselves in memory of their deeds in order to be able to imitate them in good work...

.....perche quest'opera mia tratta di Fortificationi vi ramētarò alcuni siti fatti dalla natura, alcuni aiutati dall' arte, con alcuni fatti de gl'antichi huomini di guerra & di sciēza...nessuno possa giudicar'altrui se non è eccellente & della medesima professione, nō tato in la Theorica: ma ancora nella pratica & esperiēza, senza laquale nō habbia posta in essecutione, come sarebbe dire vno ch'hauesse nauigato vn'anno per mare, e se fosse trouato nelli naufragi più ne saperà che nō quella c'harà studiato molt'anni in terra, senza hauer vistò nè il mare nè nauili
.....ti dico che la suprēma specie di pazia, è quādo vn'huomo altro nō hà che vna sciēza in se, & presume di voler insegnar à chi hà di quell'arte esperiēza, certo che è gran differenza della scienza che in quest'arte della guerra hanno li Letterati, dall' esperiēza c'hanno gl'huomini di guerra esperimētati più volte....

.....because this work of mine treats of fortification I will remind you of some sites made by nature, some aided by art, with some made by the ancient men of war and of science....no one can judge another if he is not excellent and of the same profession, not so much in theory, but also in practice and experience, without which it can not be put into execution, so as to say, one who had navigated a year by sea, and if he were found in shipwrecks, more in it will he know than if he that will have studied many years on land, without having seen ships or the sea...I say to you that the greatest kind of folly, is when another man has only science and presumes to teach who of this art has experience, truly there is a great difference between the science which in this art of war have the literary men, from the experience which have men of war undergone many times...

1. The siege of Florence in 1530, see Lupicini.

2. The root notion here is of play. The general idea is of those sciences which one delights in, that is rather of contemplative knowledge; but there is something slightly derogative in the use of the word 'gioconda', which tends to contrast playful activities with serious ones.

....i Greci fecero Athene Città famosissima, le qual fu madre delle sett' Arti liberali.

f. 27b.l'arte de che noi vogliamo parlare sarà l'Architettura, doue si conuerria dichiarare il principio, e fine dell'Architetto, & Architettura Militare doue chi vorà dichiarare queste due cose non sarà poco, ma così breuemente ne toccherà, parte secōdo il giudicio mio, & de altri valent' huomini. Ogni vitio, & ogni virtù si comprende dalla cognitione dell'intelletto, la quale consiste in due cose, l'vna è che si conosca l'importanza d'apprendere più vn'habito, che vn'altro, doue non è da marauigliarse, se alcuni non fanno profitto nelle scienze, in la virtù è l'altra che non così di leggero s'acquista li bellinomi, ne di leggero esser annominate per chiari nomi chiamati, per il che l'huomo aueduto praticarà con gli huomini eccellēti per vestirsi di buoni habiti, & non darsi ad intendere quello, che veramente gli non sà, & vuole mostrare di sapere.⁴ Di tre sorti di intelletto vi è, alcuni non lasciano l'intelletto più al vero, che al falso,⁵ com'è la opinione, il sospetto, la credulità, altri volgono la mente humana dal vero è di ferme al falso, come alcuni huomini falsi disposti al vero di modo alcuno, che egli non si può alla falsità. Questo mal'habito si chiamata ignoranza praua. La terza maniera di habito è quella, che auezza l'intelletto al vero, di modo che ello non se puote alla falsità, nè all'errore riuolgere,⁶ per alcun via, degna veramente e preciosa maniera, come è quella, che leua l'instabilità da l'openione, scaccia le tenebre dall'ignoranza, & induce la certezza, la schiarezza, e la fermezza del vero. Ma perche il vero in le cose diuersamente

....the Greeks made Athens a famous City, which was the mother of the seven liberal arts...

....the art about which we wish to talk will be Architecture, wherefore it will be meet to discuss the foundation and end of the Architect and Military Architecture -- which two things to discuss will not be a little thing, but thus I will briefly touch on it, partly according to my judgment and partly of other valiant men.^{1,2} Every vice and every virtue, is understood in relation to the knowledge of the intellect, which consists of 2 things, the one is that the importance of learning more one habit than an other, should be understood, whereby it is not strange, if some do not make profit in science (and) in virtue; and the other, that since not lightly are good names acquired, nor the unknown by known names named,³ wherefore the discerning man will practice with excellent men, to be clothed with good habits, and not to give to understand that which truly he does not know, and wishes to show understanding of.⁴ There are 3 sorts of intellect: some do not open the intellect more to the truth, than to the false,⁵ as is opinion, supposition, credulity; others turn the human mind from the truth and lock it on the false as some men evilly disposed to the truth in any manner, that they will not have it but that it is false. This bad habit is termed depraved ignorance. The 3rd. manner of disposition is that, that the intellect should have to the truth in the way that it can not to the false or to error revolve⁶ in any manner, a truly worthy and precious manner, as it is that which removes instability of opinions, chasing out the darkness of ignorance, and inducing certainty and clearness, and the stability of truth. But because truth is diversely found in

1. MARINI's (1810) version makes Marchi say rather that he writes in line with (uniformandomi) other writers.

2. All the following section to p. 151 below is very similar to, and in places follows word for word with BARBARO's (1556) commentary on the introduction of Vitruvius. The greater clarity and sophistication of Barbaro's version, together with the sort of ideas being discussed, make it almost indubitable that Marchi was following Barbaro (or some common source) rather than the other way round.

3. I.e. one can only make ones name with difficulty.

4. Barbaro here carefully made a distinction between the habits of the will and of the intellect, which Marchi omitted.

5. Barbaro had "but yield (piegare) to the false".

6. Barbaro, "twist it (torcono) firmly to the false".

si troua, però molti sono gli habiti de gl'intelletti. Dico adonque, che in la verità vi è vn'habito primo, nominato scienza, che è la conclusione, il secondo è detto intelletto, che è habito de i Principi, & delle proue ritiene il nome della potenza dell'anima, nella quale la doue è intelletto, nominato da Filosofi. Il terzo habito, è detto Sapienza che è pronto e sottile cognitione delle proue alle conclusioni applicate, come è la cuma della diuina intelligenza, passerà per entro il mezo d'ogni cosa, così à vn'risuegliamento dell'intelletto abituato in molte scienze in se ritroua il vero. Gli sopradetti habiti sono dell'intelletto, circa al vero necessario, cioè circa il vero che non può stare altrimenti, del che la regola delle prime è nominata Prudenza; la regola della secondo è dette Arte, che è habito regolatore dell'opera, che ricerca alcuna materia esteriore, si come dalla prima sono chiamati prudenti i Giudici & Rettori; così dalla secondo sono dette Architetti, Soldati, Agricoltori, Fabri, e finalmente Artefici. Nasce ogni Arte della esperienza.....Esperienza non è altro, che notitia nata da molte raccordanze de simiglianti cose alli sensi humani, per le quali ricordanze, l'huomo giudica ad vn'istesso modo. L'esempio, in conoscere vna cosa vi concorre prima il senso, dapoi la memoria, & de più

things, therefore many are the habits of the intellect. I say therefore¹ that in the truth there is a first disposition, named science, which is the conclusion;² the second is called intellect, which is the disposition of the principles, and of the proof (which) retains the name of power of mind, in which there is intellect so termed by the Philosophers.³ The 3rd. disposition is called wisdom which is quick and subtle recognition of the proof to the conclusions applied, as is the sharpness of the diuine intellect passing into the heart of everything, thus to an awakening of the intellect habituated in many sciences in which is found the truth.⁴ The above said dispositions are of the intellect concerned with necessary truth, that is concerned with truth that cannot be otherwise, from which the rule of the first is called prudence, the rule of the second is called Art, which is the disposition to regulate the work which concerns any external matter, so that from the first are called wise the Judges and Rhetors, those of the second are called Architects, Soldiers, Agriculturalists, Smiths, and lastly mechanics.⁵ Every Art is born of experience...Experience is no other than information born of many recollections of similar things to the human senses, through which recollections man judges in a selfsame way. For example in recognising a thing the sense first contributes, afterwards the memory

1. Barbaro here explained that one habit of the mind was to truth which necessarily occurs, and another to that which is contingent, and clearly indicated that it was necessary truth that he was discussing below. By omitting this point Marchi seemed to imply that he was speaking of truth in toto.

2. Marchi here describes truth in terms of the model of a Euclidian proof in geometry. Science is then what grasps the truth; and truth is what is given in the last line of the proof, where Q.E.D. is written, and hence in the conclusion. The habit described by Marchi is then in searching for such conclusions, which in fact form science. BARBARO (1556) "...scienze, che è habito di conclusione per uera & necessaria proua acquistato".

3. This second habit of Marchi's on the Euclidian model, is knowing the proofs of the conclusions from first principles, and the habit of cultivating them.

4. Marchi's third disposition seems to be a seeing into the heart of a matter by a quick assessment of the true conclusions and their relevant proof. God's intelligence in these terms then, is simply a matter of his knowing such. Euclidi type proofs.

MAHINI (1810), Vol. II, p. 61/2, gives here "il prima dicesi apprensione, ed è quello, col quale uno si figura nella mente la cosa; il secondo è quello, che propriamente chiamasi intelletto, col quale si discerna il buono dal cattivo della cosa medesima; il terzo è ciò, che dicesi sapienza, cioè il saper dedurre legitime conseguenze da quanto si è compreso colle forza dall'intelletto. Tutti questi atti, che nell' uomo sono divisi, si uniscono in uno solo nella Diuina, in cui non hanno luogo successioni d'idea, ma tutto è unico, ed eterno.", which is very little to do with the text given.

5. Marchi got into rather a tangle here and Barbaro's explanation was much more coherent. Prudence and moderation, which judges and speakers have, regulate the will. Art regulates external activities.

la comparatione della ricordata cosa. Hauendo l'huomo per via di sensi compreso, che ha conferito à questo & à quello, ricordandosi di tali effetti, &ne causa vna summa de vniuersale propositione; però cō il mezzo della memoria traria le propositioni vniuersali le quali sono principio dell'arte. Adonque sarà simile all'orme de gli animali, che dimostrano doue sia passata la fiera, si come l'orme sono principio di trouare ogni sorte d'animali, nè però son parte de gl'animali; però che gli animali non sono composti di orme; scosì la esperienza è di trouar l'Arte. La differenza, che è tra l'Esperienza e l'Arte, si venirà a considerare in questo modo. Certo è che quanto all'operare, non è dall'Arte all'Esperienza differenza: perche circa alle cose particolari, ma quanto alle forza & efficacia dell'operare, gli esperti faranno effetti maggiori, e con più ragione, che non faranno quelli della esperienza. Questi sono quelli, che hanno la ragione vniuersale della cosa; però spesso auuiene chel'Artefice inesperto pecca; non sarà però perche nō habbia la ragione e regola: ma sarà per non hauere operato più volte, e questo si dice quelli che hāno la scienza, senza l'esperienza della pratica, de qui nasce il prouerbio che la esperienze, è madre della virtù. E più presto sarà pronto l'Architetto esperimento, che non sarà il letterato in fatti: ma poi che si verrà alla vera ragione, il letterato il sarà toccar con mano, che piu presto li venga fatto le fabbriche per pratica, che con ragione. La doue la ragione vuole, che prima si cerchi la scienza che la pratica, poi l'hauere studiato porlo in pratica, che l'vna con l'altra possedono il tutto della fabrica: però l'

and then the comparison with the remembered thing. Man, by way of the senses having understood what is given to this and to that, such effects being recalled, by reason of a total of universal propositions. Therefore with the means of the memory will be drawn out the universal propositions which are the beginnings of Art. Therefore it will be similar to the tracks of animals, which demonstrate where the beast has passed, so that the tracks are the beginnings of discovering every sort of animal, but are not part of the animal because animals are not composed of tracks: thus experience is to find the Art. The difference between experience and Art comes to be considered in this way. Truly in as much as it concerns the worker, Art and Experience are not different because concerning particular things, but as much to the strength and efficacy of the worker, the experts will do greater effect, and with more reason, than will those of no experience. These are those who have the universal reason of the thing -- therefore, although it often happens that the inexpert Artisan goes wrong, it will not be because he shall not have the reason and rule, but it will be through not having worked many times -- and this is said of those -- who have science without experience of practice, from which is born the proverb that experience is the mother of virtue. And sooner will be ready the experienced Architect, than will be the literary man in deeds, but if one wish the true reason, the literary man will have it so that more quickly will the building be made in practice than with reason. Where the reason is desired, first is sought science rather than practice, then having studied to put it into practice, that the one with the other contains the whole of construction.

1. Experiences are like the tracks of animals, they point to the rule, but as much as the tracks are not the animal, neither does experience add up to a rule, which is of a different nature. Experience thus serves to find the rules of the art, although it is quite different from it. BARBARO (1556) "l'esperienza e principio di ritrouar le Arte".

Artifice potrà insegnare, & fare altri in se stesso il l'Arte; ma lo esperto nõ così, & se bene e'l mostra ad altri, però non è atto a darne conto nè ragione, per vera regola non hauendo l'arte. Oltre che il senso suo non s'estēderà alla perfezione della regola e ragione. L'esperienza è quando l'huomo dice, voler prouar' alcuna cosa, questa ragione è fonte a fiume. Se vede, che la esperienza serue più all'arte, che alla inuentione, la quale è la parte dell'artificio. Il nascimento dall'arte nel principio, è come sono li fiume, che nell'loro principij sono debili, poi vengono maggiori, pigliano forza: così fa l'Arte, quanto più va innanzi di ragione ha da pigliare miglior forza, però il primi inuentori hanno poco lume delle cose, de qui nasce, che lo studio della Inuentione è più nobile dell'Arte manuale, & perche gl'inuētori non possegono molto vniversali proportioni delle cose per le quali l'Arte s'ingagliardisca, perche tēpo non hāno di fare l'esperienza, per la breuità della vita: ma lasciando à quelli che seguono le cose da loro trouate scemano le fatiche di quelli, come penso, che haurò fatto io nel fortificare, e agumētano l'arte à quelli che opereranno dappoi gli inuentori delle cose, e che sia la verità, molti sono quelli, che operano, e pochi sono gli inuentori delle cose, che non se ne trouano fatte da altri, e però sono de grande laudi gli inuentori delle cose, che hanno trouato li principij, senza risparmio di fatica. In questa scienza li conuiene di molte altre in essa, prima la Grammatica, la Rhetorica, la Logica, e la Geometria, La Musica, l'Astrologia, l'Arismetica, però bisogna saper ancora da quelle Arti, che sono alla comodità alli corpi humani, come è il nauicare, l'Arte militare, l'Arte del fabricare, l'Agricoltura, la Medicina, la Pittura, la Scoltura, &

Therefore the artificer can teach and and make others like himself in the Art, but the expert not so, and if he shows it well to others, then he is not suited to give any account or reason, not having the art through a true rule. Besides which his understanding does not extend to the perfection of rule and reason. Experience is when a man says, to wish to prove something, this cause is source and stream. It is seen that experience attends more to art than to invention, which is the part of the skillful. The birth of art in the beginning is as are the rivers which in their beginnings are weak, afterwards they become greater, and take force: Thus, does Art, in so far as, as much as it goes forward the more reason it has to take more force, therefore the first inventors have little light on things, from which arises, that the study of Invention is the most noble of the manual arts, and because the inventors do not possess many universal propositions of things through which the Art becomes strong, because they have no time to make experiments², through the shortness of life: but leaving to those that follow, their discoveries, they diminish the labour of those, as I think I have done in fortification, and augment the art, for those who will work after the inventors of the things, and what is true, many are those that work and few are the inventors of things, which are not found made by others, and therefore are of great worth the inventors of things who have found the beginnings without sparing their labours. In this science belongs much else, first Grammer, Rhetoric, Logic and Geometry, Music, Astronomy, Arithmetic. It is necessary to know also those Arts which are useful to the human body, as is navigation, the Military art, the art of building, Agriculture, Medicine, Painting, Sculpture, and other things similar to these, that all haue

1. Marchi's account here is by no means clear. BARBARO (1556) gave a much clearer version. All that was at issue was the idea that one can achieve a certain amount in practice, but having theory of the subject is much better.
2. Experiment/experience being of a very similar meaning during the period.

& altre cose somiglianti à queste, che tutte hanno del grande, e senza le dette Arti, come disse Platone, è vile, e abietto.¹....Bella cosa, è il supporre la ragione e dimostrare la scienza per pratica, quella è la dottrina: il giudicare questo non è concesso se non alli saui, e prudenti: perche il vero giudicio guida la cosa conosciuta, & per questa ragione si dà la sentenza, e dimostra, che cō ragione si sia giudicato & operato l' Architettura. Però le resolutioni delli dubi, e le inuentioni delli secreti, e gli verità delle cose in quella scienza cōtenuti, come fa il seme a produr il frutto, però quelle opere che non saranno vtili alla humana vita non meritano esser nominate Arti. Il desiderio di quelli che leuano la mente alle considerationi delle cose, cercano la occasione d'esse, riguardando da longi con la verità, ascendono alla fatica dell'operare. Sono ancora molti, che poco si curano, anzi danno biasimo alli studiosi, questi tali sono huomini folli, fuori di ragione, questi tali si deueno lasciare da parte. Bella cosa è il potere giudicare, & approuare l'opera come atto di virtù superiore verso l'inferiori, nondimeno pochi sono quelli, che si diano alla fatica, pochi vogliono adoperarsi, & uscire della stanza dell'otio, e però non fanno, nè possono fare giudicio con ragione, e non peruengono al fine dell' opera dell'Architettura. Bisogna dunque affaticarsi con la mente, e discorrere, & affaticare manualmente in certi termini per le opere fatte da altri, e quello della imaginatiua & il discorso come capo, le fabbrica come madre dell'Architettura; però quelli che voranno seguire questa opera sarà necessario in longo, e frequentato studio in più scienze & arti manuali. Ogni compositione ha d'hauere la mira del fine, come ha colui, che hauerà l'arco testo in mano, che mira di

similar to these, that all have greatness, and without the said Arts, as Plato said, it is vile and abject....¹ A beautiful thing it is to surmise the reason and to demonstrate the science by practice, that is learning: the judgement of this is not conceded if not to the wise and prudent: because the true judgement guides the thing known, and for this reason, is given the opinion and demonstration that with reason is Architecture judged and operated. Therefore the resolution of the doubts and inventions of the initiated, and the truth of the subject in that science contained, as does the seed produce the fruit. Therefore those works which will not be useful to human life do not merit to be named Arts. The desire of those who raise the mind to the consideration of these things, searching the occurrence of these, viewing from afar with the truth, they ascend to the labour of the workers. There are also many that little care, rather give blame to the studios— -- these are foolish men, without reason, these such ought to be left apart. A beautiful thing it is to be able to judge and approve the work as fitting to superior virtue against inferior. Nevertheless, few are those who would be given to labour, few wishing to be employed and to go out of their chamber of leisure, and therefore they do not, nor can not make judgement with reason, and do not achieve the aim of the work of Architecture. It is needful therefore to labour with the mind, and discuss, and to labour manually within certain limits through the work done by others, and that of the imagination and discussion as the head, and construction like the mother of architecture. Therefore those who wish to pursue this work it will be necessary to long and frequently study in many sciences and manual arts. Every composition has to have the aim of the end, as he that will have the bow bent² in his hand, who aims to put

1. The elision is again concerned with the Architect's need to be skilled in a large number of disciplines, after Vitruvius.
2. Lit. stretched.

la faetta nel fine doue lui la vuole tirare, così ne auiene all'Architetta, che darà principio alla fabbrica, che bisogna, chi egli habbia cura con studio al principio dell'opera, e mezzo e fine, che con le lettere, & numeri, e desegni, e modelli indirizzerà la mira al fine dell'opera. Però nõ e concordanza maggiore, che quella, che è tra'l principio e l'fine. Volendo dunque fabricare bisogna conoscere il fine, doue è necessario lo studio fermo à quelle tre parti, cioè al principio, al mezzo, al fine. E per questo bisogna fare vn'habito di assuefatione, la quale è la spessa frequentata operatione della virtù forza dell'animo, altrimenti l'artificio non peruenirà al fine. Però questa via è quella, che conduce il buono Architetto à perfettione, secondo Marco Vitruuio.

f. 28b.il Discorso è padre dell' Architettura.

sp. 279. Porta questa cosa del fortificare tanta consideratione con essa, che per me non mi posso contentare, ne acquietarmi l'animo d'hauere scritto à bastanza, ma perche tutte le cose che hanno principio hanno fine, io cominciarò a tacerne, e fermarmi di dissegnare, e di scriuere della fortificatione, solo per potere dare questa mia opera alla Majestà del Re Filippo Catolico di Spagna.....

the arrow in the point where he wishes to fire, thus it happens in Architecture that who will give beginning to the building, it is necessary that he should have care with study of the foundation of the work, of the middle and of the end, that with reading and number and designs and models, he will direct his aim to the goal of the work. Thus there is no greater agreement than that which is between the beginning and the end. Wishing therefore to build, the end needs to be known, wherefor is necessary the study set in these 3 parts, that is the beginning the middle and the end. And for this it is needful to make a habit of the custom which is the very frequent employment of the virtuous strength of the spirit, otherwise the skill does not come to the goal. Therefore this life is that which leads the good architect to perfection according to Vitruvius.

....discourse is the father of Architecture.

This subject of fortification carries so many considerations with it, that I am not able to be contented nor acquit my spirit of having written sufficiently; but because all thing that have beginning have end, I will begin to be silent and finish with designing and writing of fortification, only so as to be able to give this work of mine to Phillip his Catholic Majesty of Spain.....

Gian Tommaso Scala (da Venezia)¹: Texts

2. .i Principi, che dando tal assunto ad vno Architetto, si mette a far cose, che non son di suo mestiero,³ nè tampoco ne ha giuditio, nè vuole accettar niun fidel ricordo, che gli possa appresentare un perito soldato, che con lunga experientia, sudore, et vigile abbia appresa l'arte dell'offendere, & del difendere. nè questo solo, ma il piu delle volte non lo vogliono vedere, se non se gli appresenta un grandissimo bisogno, & questo vitio regna per l' auaritia loro. Ma per fuggire il tedio, che apporta il lungo ragionare, ui dirò sotto breuita queste annotationi, che si hanno da tenere. Prima bisogna auer cognitione delle forme, ilche per geometria, & lunga pratica s'impara. secondo poi si conoscerà il sito, & cioche se gli appartiene per guardarlo, & difenderlo....Et auendo sempre auuertenza d'accomodarti al sito, non vi essendo in questo la piu ferma regola, che'l giudicio del predetto soldato. Che non lo studio di Vitruuio, di Leon Battista, of di altro Architetto, Geometra, o Cosmografo con le lor dottrine non s' impara il modo di combattere, & difese, che s'usa 'oggi, con la scientia, che si ha a trouar nel soldato, & grande experienza, esser astuto, animoso, & conoscer tutto quello che lo nemico possa antiuedere per offenderti, & in ogni fortuna esser ricco de partiti, stener sempre il nemico lontano, et

.....Princes, giving such charge to an Architect, who is set to do things which are not of his business,³ much less of his judgement, nor wishes to accept any faithful opinion, that to him can present an expert soldier, who with long experience, sweat, and care, has learnt of the art of attack and defence, nor this alone, but the most of the times they will not want to see him, if he does not present unto him a great need, and this fault rules through their avarice. But to escape boredom, which long discussion brings, these points I will say to you briefly, that have to be held. First is is necessary to have knowledge of the forms, which by geometry and long practice are learnt; secondly then, will be known, the site and that which appertains to it, to guard and defend it....And having always attention to your accommodating to the site, there not being in this the most steady rule, according to the judgement of the above said soldier. That with the study of Vitruvius, of Alberti, or other architect, geometer, or surveyor⁴ with their doctrines, is not learnt the way of attack and defence, which is used today, with the science which has to be discovered by the soldier, and great experience; to be shrewd, courageous, and to recognise all that the enemy can plan in attacking you, and at every chance to be well supplied with resolution, to keep always the enemy at a distance

1. This Scala came from a lowly station and practised the trade of a soldier, and as an engineer, in many countries abroad. (Presumptuously and unwarrantably playing on the reputation Italians had abroad for being skilled in this profession, according to PROMIS (1871), who included Locatelli with him among the "assassini ed falliti d'Italia".) He served in France, England, Hungary, Scotland as well as in Italy. He made a model of the castle of Anacona in 1523; a design and model of Novi in 1536; and in 1550 was concerned with the port of Monaco. (See AYALA (1869))

Sections from his m.s. treatise, discovered by Ayala, were published in Girolamo Ruscelli's Precetti della militia moderna (Venetia 1568) and in De Fabrica Fortezze, published under Belluzzi's name in 1598. (See above p. 137 n. 2.)

2. From Ruscelli's work, op. cit, f. 39b/40b.

3. I.e. the charge of designing fortresses.

4. "Cosmografo" FLORIO (1611) "a describer of the world", thus one who maps it out and hence here where what are relevant are limited areas, a surveyor.

quando t'è appresso non aver paura. & la sua Geometria¹ è conoscer ogni minimo vantaggio, & saper star sempre a cavalieri del tuo nemico, perche la furia, l'empito de cannoni....faranno perdere la sua dottrina al soldato, ma si bene al Matematico, al Cosmografo, & al Geometra. Non nego però, che queste scienze non sieno buone, & da esser abbracciate, ma dico, che al soldato è necessario saper l'esperienza.....

3....la scienza del soldato è di saper pigliar partito quando si troua col suo nemico in campagna a fronte, accommodarsi al sito, & saper pigliar il unataggio, far forti doue un sito si trauesse debile, & se fosse sforzato a fermarsi, non potendo far altrimenti, combattere...questa disciplina non s'impara nè in Bologna, nè in Padua, ne in Perugia, nè sopra i libri, ma si bene doue si combatte, & conoscessi chiaramente, che l'huomo d'arme quando abbassa la lancia, non ricerca l'arte di Matematica, nè l'archibusiero di Geometria, nè il Capitano quando ordina la battaglia per combattere in campagna, o sforzare una fortezza cerca termini di Cosmografia. però la parte dell'offese, & delle difese si deuno considerare alle parti della militia, & non ad altri, & per esempio vedi la città di Fiorenza, ordinata, & ridotta al suo fine da Antonio san Gallo, famosissimo Architetto; mirate quanti difetti patisce.....

5....la intelligenza di tal fortificatione deue esser propria del soldato, & non dell'Ingegniero, o Architetto. Perche se chi non intende la ragione di fortificare, manco saprà quelle d'offese.

and when near to you not to have fear, and his Geometry¹ is to recognise every least advantage and to know how to always remain bravely to your enemy, because the fury (and) violence of the cannons (and the like)...will make the soldier lose his theory, but as much the Mathematician, Surveyor and Geometer. I do not deny however, that these sciences are not good and to be embraced, but I say, that it is necessary to the soldier to know practice....

...the science of the soldier is to know how to take resolution when he finds himself with his enemy in the field to the front, to accommodate to the position and to know how to take the advantage, to make strong where a site is found weak, and if he would be forced to close, not being able to do otherwise, to fight.. and this discipline is not learnt, neither in Bologna, nor in Padua, nor in Perugia, nor from books, in any way so well as where combat is; and to know clearly, that the man of arms when he lowers the lance, does not seek the art of Mathematics, nor the archibusier Geometry, nor the Captain when he arrays the battalion for combat in the field, or to force a fortress, does he search the goals of surveying. Thus the subject of attack and of defence ought to be considered as parts of the military art, and not of others, and for example, look at the city of Florence, organised and reduced to its end by Antonio da Sangallo, the most famous architect: behold how many defects it suffers....

...the understanding of such fortifications ought to be the property of the soldier and not of the Engineer or Architect, because he who does not understand the method of attack, the less will he know those of fortification.

1. I.e. the soldier's Geometry, that is the science or skill he possesses equivalent to the possession of a knowledge of geometry.

2. Or, to be familiar with experience (of war).

3. Ruscelli, op. cit. f.40b.

4. And remains today, of course, of great reputation in the field of fortification.

5. Ruscelli op. cit. f. 55a.

6. Assuming there has been a reversal between these last clauses, to give the usual sentiment.

ESSENDO stato ricercato se questa scientia de fortificar puo esser insegnata da vno ad vn altro, dico de no per non si trouar fine ne fermezza alcuna; perche il fortificar moderno è cauato dall'industria del modo o costume di combatter, estendosi cauato per causa dell'artegliaria il fianchizare, qual nasce dell'industria del huomo per esserli stato il bisogno causato dal sito, non sicurandosi, che quello che ha fatto in vn loco serui in vn altro se li siti non sono eguali, è quasi impossibile trouar doi siti & che tutti doi sijno ad vn modo concordi.... & per questa tal uarieta dico che non si puo fermamente ammaestrar alcuno.... & non vi essendo fermezza meno vi puo esser scientia... se mi direte colui è Dottor ha letto, quell'altro è Giometra; & quell'altro Cosmografo dico queste esser tutte parole perche chi non impara con la vita in proprio fatto cioe con l'esser stato alla guerra non potrà far cosa buona. Se di nouo direte colui dissegna bene vi dico, che buona cose è star in vna camera perche sopra vna carta l'huomo puo far quello che vuole, & io farò cose sopra vna carta, che saranno molto lodate, & di sorte, che mai si potranno metter in effetto pche il disegno inganna, & puo mostrar il falso³ però il dissegнар nō è il primo importante vero è che è necessario p poter mostrar al principio li effetti, che hanno da far li tiri, & le diffese, & le distantie, ve ne sono molti nondimeno, che fanno li disegni, & poi non li fanno dar essecutione, ma è ben vero che questi tali si potranno seruir in quanto del far l'opera di Maestri muratori valent'huomeni, che conosceranno le comodità, che vorrà quel opera,

It having been inquired if this science of fortification can be taught by one to another. I say no, because no established end is found, because modern fortification is drawn out of the endeavours of the method or custom of combat, being drawn from the matter of the flanking artillery, which is born of the endeavour of men through there having been the need caused by the site, it is not safe that that which he has made in one place serves in another, if the sites are not alike, and it is almost impossible to find two sites and that both are even in one way agreed.... and through this variety I say there can not be any firmly masterful.... and there not being any firmness the less can there be science....

and if you will say to me that one man has read his Doctor's degree, and that another is a Geometer, and another a Surveyor, I say these to be all words because those² who do not learn with the life of personal deeds, that is having been to the wars, are not able to make the thing well. If again you will say he designs well, I say to you, how good a thing it is to remain in a study, because a man on paper can make what he would, and I will make things on paper that will be much praised, and of a kind that never could be put into effect because the design deceives, and can show the false³, therefore design is not of the first importance; true, it is necessary in order to be able to show the roots of the effects, which the firing has to do, and the defence and the distance -- there are many nevertheless, that make designs, and afterwards they can not⁴ execute them; but it is very true that these such will be able to serve in as much as master masons do the work, valiant men who will know the commodity that would

1. From De Fabrica Fortezze (1598) published under Belluzzi's name, p. 88.

2. I.e. the scholars.

3. This argument might be considered to be defective in that, it is not legitimate to fault design as an activity, because on occasion it can be misleading, and all that is required is that it is ensured that on any particular occasion this is not the case. But, one can represent impossible objects, and it is only through experience of actual objects that such representations can be judged. Thus design conceived of as merely or essentially an activity involving simply the manipulation of lines in a drawing, is defective. Thus there is quite a serious point here beneath a good deal of bombast.

4. Taking "fanno" as "posonno", if this is not simply meant to be understood.

nel far delli pedamenti, & nel operar della fabrica, il muratore però non farà altro se non quello li sarà mostrato dal disseggnator; ma se il disseggnatore, & muratore non intendono quello che importa la difesa, & non conoscano quello, che li possono far il nemici, & che commodade può hauer l'inimico...
 ...parlando de disseggni in carta dico che mai vn Principe douria creder à disseggni, ma farsi far li modeli, & ditti modeli sopra il sito farli corregger, da huomini di guerra, lasciando Architetti, & Dottori da banda, & dimandar consiglio à quelli delli quali lui si uolesse seruir quando facesse bisogno di diffender tal fortezze....

be wished in that work, in making the footings, and in the work of construction; the mason therefore will not do anything which he will not be shown by the designer, but if the designer and mason do not understand that which concerns defence, and do not know what the enemy can do, and what commodity can have the enemy (things will be awry) ...talking of design on paper, I say that a Prince ought never to believe the designs, but should have models made, and the said model upon the site to be corrected by men of war, leaving Architects and Doctors aside, and request council of those by whom he would wish to be served when the defence of such fortresses is needed....

1. According to HALE (1970) p. 524. During the construction of the Fortezza da Basso at Florence in the 1530s Nanni Unghero wrote to Antonio de Sangallo saying "that he had had to have a model made as the Duke could not visualize it from the drawings; he says "It is all very well to talk, but I don't follow it" ".

ALBRECHT DÜRERUnderweysung der messung (1st. ed. 1525)

Bibliography: Nürnberg 1525; Nürnberg 1538; Arnhem 1604*¹; Latin translation Lutetiae Parisorum 1532*²; Lutetiae 1532; Parisiis 1534; Paris*³; Nürnberg 1538*⁴; Arnhem 1605*⁵; A new German version München 1908*⁶; Berlin 1908*⁷; Fac. of the 1st. ed. Zürich 1966; Zürich 1969*. An English version of the section on the formation of letters New York 1917.

*General description: A large format well produced work with many illustrative diagrams and drawings. 89 unpaginated folios. 9"x 6" text. The work is concerned with ruler and compass constructions in many areas.

Contents:

Sg. Aia: Title page: Vnderweysung/ der messung/ mit dem zirckel vn̄ richtscheynt/ in Linien ebenen vn̄d gantzen corporen/ durch Albrecht Dürer zůsamen getzogē/ vnd zů nuss allē kunstlieb habenden mit zů gehörigen figuren/ in truck gebracht/ im jar. M.D. XXv. Mit begnadung Kayserlicher im end eyngeliebter Freyheytt damit sich ein yglicher vor schaden zů hůten wyss rc.

Sg. Aib: Dedication to Willibald Pirckheimer.

Sg. Aiiia/Aiiii: Preliminary geometrical descriptions.

Sg. Aiiib/Dvib: (Bk. I) Different curves.

Sg. Eia/Fvib: Bk. II: Plane figures including the generation of some of the regular solids from a plane sheet.³

Sg. Gia/Miia: Bk. III:

Sg. Gia/Iiia: Solids, including a good deal on architectural features.

Sg. Iiiib/Kia: Mainly on sundials.

Sg. Kib/Miia: Geometric setting out of letters.

Sg. Miiib/Qiia: Bk. IV: Sg. Miiib/Diia: Mainly more regular solids developed from a plane sheet.

Sg. Oiiib/Qiia: Shadows cast, by perspective techniques.

Colophon: Gedruck zu Nůrenberg. Im. 1525. Jar.

Underweysung der messung (1525): Texts

Sg. Aib.⁴....man hat byssher in vnsern deutschen landen/ vil geschickter jungen/ zů der kůnst der mallery gethon/ die man an allen grundt vn̄d alleyn auss einem táglichen brauch gelert hat/ sind die selben also im vnuerstand wie eyn wylder vnbeschnytener baum auff erwachsen/ Wie wol etlich auss inen durch stetig ũbung eyn freye hand erlangt/ also das sie jre werck gewaltiglich aber vnbedecklich/ vn̄d alleyn nach jrem wolgefalle

....up till now in our German land many skilful youths have been taught the art of painting, without any ground and all learnt from daily practice. They have thus developed in ignorance like a wild unpruned tree, even though some of them from continual practice have acquired a free hand, so that all their work has been powerfully but impudently done, and only according to

1. After Max STECK, Dürers Gestaltlehre der Mathematik und der bildenden Kůnst (Halle 1948).

2. Of the first edition.

3. Sg. Eia "Nach dem jch hie forē angetzeigt hab/wie man etlich linien ziehen soll/ will ich nun wie ich im anfang gemelt/ an die planos oder ebenen komen."

4. From the dedication.

gemacht haben/ So aber die verstand-
igen maler vnd rechte künster/ solchs
vnbesunen werck gesehen/ haben sie
vnd nit vnbillich diser leüt blind-
theyt gelacht/ die weyl einem rechten
verstand nichts vnangenemer zü sehen
ist/ dan falscheyt im gemel/ vnange-
sehen ob auch das mit allem fleiss
gemalt wirdet/ Das aber solche maler
wolgefallen in jren yrthumben gehabt/
ist alleyn vrsach gewest/ das sie die
kunst der messung nit gelernet haben/
an die keyn rechter werckman werdē
oder seyn kan/ Das aber jr meyster
schuld gewest die solche kunst selbs
nit gekündt haben. Die weyl aber die
der recht grundt ist aller mallerey/
hab ich mir fürgenomen allen künst-
begyrigen jungen/ eyn anfang zü-
stellen/ vnd vrsach zügeben damit
sie sich der messunge zirckels vnd
richtscheyt/ vnderwinden vnd darauss
die rechten warheyte erkennen vnd vor
augen sehen mögen/ damit sie nit
alleyn zü künsten begirig werden/
sonder auch zu eynem rechten vnd
grösseren verstandt komen mögen/

....Demnach hoff ich disz meyn
fürnemen vnd vnderweysung/ werde kein
verstandiger dadelen/ die weyl es
auss einer gutten meynugn vnd allen
künstbegyrigen zü güt geschicht/ vnd
auch nicht alleyn den maleren/ sonder
Goldschmidten Bildhaweren Steynmetzen
Schreyneren vnd allen den so sich des
mess gebrauchen dienstlich seyn mag/...

Zu Befestigung der Stett, Schloss, und Flecken (1st. ed. 1527)⁵

Bibliography: Nurenberg 1527⁴; Nurnberg 1530*⁵; Nurnberg 1538*⁶; Arnhem 1603*⁶.
Latin version Parisiis 1535⁷. A modernised German version Berlin 1823*⁶. French
version Paris 1870⁸. Fac. of the 1st. 1527 ed. Unterschneidheim 1969. do Dietikon-
Zurich 1971; of the 2nd. Farnborough 1972.

their taste. Thus when the informed
painter and true artist, sees such
unconsidered work, they have -- and
not unreasonably -- ridiculed these
workers blindness, because to a true
understanding nothing is so unpleas-
ant to see as falseness in painting
unnoticed, although painted with the
greatest diligence. That further
such painters have taken pleasure in
their errors is for the only reason
that they have not learnt the art of
measurement⁴ without which no man is
or can be a true worker, that however
was their master's fault who did not
themselves know such art.

Because therefore it is the true
ground to all painting I have under-
taken for all youths desirous of art,
to set out a beginning and to give a
ground, that they undertake measure-
ment with compass and ruler, and
therefore the right truth recognise
and see before their eyes, that they
are not only desirous of art, but also
to a true and greater understanding
can come.

...Whereby I hope this my undertaking
and instruction will not be blamed
for little understanding because it
comes from a good intention and to
bring all art lovers to a good skill,
and also not only to painters, but
goldsmiths, sculptors, stonemasons,
joiners, and that all who use the rule
may be served...

1. That is geometrical measurement and setting out.

2. Or grasp.

3. or "yardstick".

4. There were at least two editions in this year and a number of variants are known among the copies of the first. See JAEGGLI (1971) for a discussion of these early editions and variants.

5. These last editions are quoted in many older bibliographies, and for example by BIDDLE (1972). They are however very rare and JAEGGLI (1971) suggests they are variants of the second edition.

6. After JAEGGLI (1971).

7. De Urbibus, Arcibus, Castellisque condendis, ac muniendis rationes aliquot praesenti bellorum necessitati accommodatissimae.

8. Instruction sur la fortification trs. A RATHEAU.

General description:¹ 37 sides with printed text 6" x 8". The work contains a number of pull out sheets up to twice and more the page size containing illustrations of a good quality. There are 10 of these large illustrations with further diagrams and illustrations within the text.

Contents:

Sg. Aia: Title page: Etliche vnderricht/ zu befestigung der Statt/ Schloss/ vnd flecken.

Sg. Aib: Dedication to "herrn Ferdinanden/ zu Hungern vnd Beheim Konigen...." over Durer's name.

Sg. Aia: Section I (i): Introductory remarks.

Sg. Aia/Ciib: Section I (ii): Some 11 pages of text which gives the design of a bastion with a round face to be set at the angle of an existing town wall. More than one such to be used where necessary. The setting out plan shows a honeycomb type structure and the thickness of some of the internal walls are determined by geometrical diagrams. The section is accompanied by a large number of pull out drawings giving plans of the structure at various levels, and vertical cross-sections and elevations. The text gives a good deal of detail about the dimensions of various parts of the structure, and about such things as mantelets, access stairs, ventilation and so on.

Sg. Ciia/Cvb: Section I (iii): A short section of 2+pages of text with one of drawings showing another way of constructing a bastion in the same situation as that of the previous section. The work possesses a continuous gallery around the curve front face of the bastion forming casemates, which is backed up by a solid earth platform.

Sg. Cvia/Dia: Section I (iv): One page of text and 2 plans and an elevation. This is about another version of the same type of structure to be built when money is tight. The structure is of a similar nature to that of the first on a smaller scale.

Sg. Dia/Eia: Section II: 10 pages of text with 2 pull out plans. This section is concerned with the design of a strong castle and all its relevant appurtenances. The castle is set out as a square in the centre of the whole fortification with space around it to house the king's servitors and tradesmen, so forming a town. The whole fortification is surrounded by a series of ditches in a square plan. The innermost smallest ditch has 8 casemates firing along the ditch; the next ditch has 12 similar casemates and a series of embrasures at 50ft. intervals cover the bottom of the ditches in addition. A good deal of detail is given as to how the houses are placed around the castle.

Sg. Eia/Fia: Section III: Some 5 pages of text with 2 pull out drawings concerning a round fort or blockhouse. The structure is made up of a series of heavy concentric rings. An inner masonry ring contains living quarters surrounding an inner court. This structure is surrounded by a ditch, a bank, and then a further ditch. Casemates cover the bottoms of the ditches. The inner ring is designed to have defensive artillery firing from its upper surface. The site of this blockhouse is between a mountain and the sea or other area of water.

Sg. Fib/Fia: Section IV: One page plus of text and a section through the works. This passage is concerned with protecting older defences which are no longer suitable in the face of artillery. The town is surrounded by an earth bank and ditch outside the medieval style wall. The upper face of the bank above general ground level is set at a shallow slope and stone faced to

1. Of the second edition of 1527.

2. These divisions are not in the original text but are here given for reference purposes

withstand artillery. Casemates are placed in the bottom of the ditch every 200ft.

Sq. Fiia/b: Section V: $\frac{1}{2}$ page of text with a drawing of a gun and carriage.

Sg. Fiib: Closing remarks.

Colophon: Gedrückt zu Nürnberg nach der gepürt Christi. Anno. M.CCCCC.XXVII.

In dem monat² October.

Etliche underricht zu befestigung der Stett, schloss und flecken (1527 2nd. ed.):

Texts

¹Die weil sich nun zu dregt das E. Mt.
 etlich steet vñnd flecken zu befestig-
 en verchsafft hat/ bin ich verursacht
 meinen geringen verstandt derhalb an
 zuzeygen/ ob E. Mt. gefellig sein wolt/
 etwas darauss ab zunemen/ Dann ich dar
 für halt/ ob mein anzeygen nit an allen
 orten angenommen werd/ müg dennoch züm
 teil was nutz daraus entspringen/
 nit alleyn E. Mt. sonder auch andern
 Fürsten/ herrn/ vñnd stetten/ sie sich
 geren vor gewalt vñ vñpilliger bed-
 rangung schützen wolten....

Sg. Aia. Nach dem sich ist pey vnsern
 szeytē fil fremder sach begeben/ ge-
 dunckt mich von nöten sein zū bedenck-
 en/ wie befestigung gepaut/ darauss
 sich König/ Fursten/ Herrn/ vñd Stett/
 veruaren möchten/ nit allein das ein
 Christ/ vor dem andern beschütztet/
 sonder auch die lender so dem Türken
 gelegen sind/ sich vor des selben
 gewalt vñ geschoss erretten möchten.
 Hab ich mir für genommen/ ein kleyne
 szanzeygung zu thon/ wie en solch gepau
 auff zurichten were/ doch auff ver-
 besserung der verstandigen die sich
 auch der krieg gebraucht/ vñd der so
 vil gesehen/ vñd erfahren haben.

Erstlich ist mein gut beduncken/ das
 man kein gepau darauff man starcke
 geschos legeren wil/ mit gestrackten
 oder auffrechten mauren sol auffüren/
 Dañ so man ein stück puchsen sechse
 achte oder zehene daran lest geen/
 schlahen sich die mauer in der mitte

Now that your majesty has decided to
 fortify some towns and villages I am
 caused to set forth my little under-
 standing therein -- if it please your
 majesty -- to observe something there-
 on. But in this I hold, if my ideas
 are not adopted³ in every place, per-
 haps usefulness will arise from some
 part, not only for your Majesty but
 also to other Princes, Lords and
 Towns, who would gladly be protected
 from power and unfair harassment.

Because in our time many strange⁴ things
 occur, I thought it necessary to
 consider fortification building, so
 that Kings, Princes, Lords and towns
 can make defence, not only that one
 Christian from another is protected,
 but also that the lands neighbouring
 the Turks, can be saved from the same
 power and shot. (So) I have undertaken
 to make a little treatise⁵ on how
 such buildings should be erected;
 yet for its improvment (are) those of
 understanding in this and who also
 have used the wars and much seen and
 experienced.

Firstly it is my considered opinion
 that no building where heavy shots
 will be about, should be built with
 straight or vertical walls. If so
 when a piece, 6, 8 or 10 shots lets go,
 striking the wall in the

1. The first edition may be distinguished here by its giving "manat".
 2. From the dedication.
 3. HULSIUS (1607) "abnemen = abmercken, observer, coniecturer".
 4. I.e. strange new things.
 5. Lit. advertisement, declaration.

ein/ sie seyen als dick sie wöllen/ so man dann zum andern vnd dritten mal her wider kömmt vnd anklopfft/ felt der last oben herauss/ vnd ie schwerer der pau vnd last ist/ ie ee das geschicht.

An etlichen orten da die leut nit bey gelt sind/ oder die eil vnd not das erheischt/ machen sie grosse schütten/ verschrancken vnd vergraben die/ vnd weren sich kecklich darauss/ das ist vast gut/ Davon wil ich aber hie nit schreiben/ dan die Kriegsleut wissen solchs wol zumachen/ auch erlernē es die teglich so die kriege not dar zu dringt/ wan man aber solcher gepu nit mer bedarff/ lest man sie gewonlich zerreytern/ dan niemandt hat darnach acht darauff. Aber in eyner treslichen zestat/ oder achtparem schlos/ da die mauren/ thürn/ vnd ob das sein mag gefüetert gräben vmsich haben/ da sol man solche befestigung auch mauren/ vñ dem andern gebeu gemes machen/ auff das so man der zu seyner zeyt nit bedarff/ das die dannocht verhafft beleyben/ pis zu eyner andern zeit/ darumb müssen solch mauren vest gepaut werden/ Vnd ob man sagen wolt es wurde vil costē/ so gedencck man an die Künig in Egipten welche grossen costen an die Pyramides gelegt haben/ d' doch nicht nütz geweest ist/ so doch dieser costen seer nütz ist/ haben die herrn vil armer leut/ die man sunst mit dem almussen erhalten muss/ den geb man taglon für jer arbeit so dörfen sie nit petteln/ vnd werden destminder zu auffrur bewegt/ Es ist auch pesser ein herr verpau ein gross gelt auff dzer beleyben müge/ dann das er in eyner gehe von seinem feind vberilet/ vnd auss seinem land vertriben würde/ wie das einiglicher geringes verstandes leichtlich abzunemen hat.

Ob aber etlich sagen wolten/ es wer nicht nott solch dick gemeurer zu machen sie solchs hernach angezeygt

middle, no matter how thick it will be, then when a 2nd. or 3rd. (salvo) further comes and strikes, the weight above falls outwards, and as heavy and weighty as the wall is the more so.

In some places where the people have no money, or haste and necessity requires it, are made great banks, pallissaded and ditched, that defend it strongly thereby, and that is very good. But on that I will further not write, for the warriors know well such to make, and learn it daily as the needs of war press; but when then such structures are no longer required, left, they generally break down, so that nobody esteems them. But in an important town or significant castle which has walls and towers, and if it can have a reveted ditch around it, then such should also be fortified in masonry, and the other structures conformably made, so that if in its time it is not needed it will afterwards remain defensible till another time, wherefor such masonry must be strongly built. And if it is said what will it cost, then consider what great cost the kings in Egypt laid out on the pyramids, which knew no use, yet this cost is very useful. The lords have many poorfolk that otherwise must receive alms, then giving them daily for this work, then they do not go about begging, and will be less moved to rebel. It is also better that a sovereign spends much money in building that he can remain, than in an attempt of his enemy he is precipitated,¹ and expelled out of his land -- and that any of small understanding can easily grasp.

If however some will say it is not necessary to make such thick masonry walls as are hereafter indicated,

1. JAEGLI (1971) gives "als das er in einem Kampfe von seinem Feind überunden".

ist/ vnd man möcht geringer gepew mit weniger costung gleich so vest pauen/ wer solches warhafftig anzeygt/ dem mag man folgen/ Ich sag aber/ wer für sorg vnd einfallen pauen wil/ der sol noch sterker gepew machen dann ich hernach anzeyg/ daß es thut pey disem herten anklopffen/ das ietz in krigs laufften vor augenn ist alles not/ Ich wil mich auch mit diser schrift nit so künstlich machen/ das ich die hoch geachten werkleut vnd die es for können pauen wöllerem/ Aber die so solcher gepew nit genugsam vnterricht sind vnd doch zü zeyten zü pauen vberkommen/ wil ich ermanen/ das sie ire gepew im auffreissen wol betrachten/ Doch ist keyner verpunden mir zu folgen/ sonder er mag sich seines gut bedenckens vnd gefallens prauchen.

Wer nun pauen wil/ der betracht erstlich die gelegne örten der statmauren/ darauss sich am füglichsten zü weren ist/ so man dann an der selben stat meer dan ein pastey bedarff/ auff das man mit dem geschos zü sammen reychen möge/ setz man sie an die ort da man am minsten beschossen may werden/ Vnd der pau werdt gesetzt auff festen grund/ es sey auff fels/ lebendig² ertlich oder pfäl/ Vnd for der pastey herumb/ werde der gefüttert statgraben erwytert/ das auff das wenigst zweyhundert schuch weyt/ zwischen dem selben vnd der pastey vnden im dem grund sey/ so ferr es anders die gelegenheyt desselben ortes leyden wil/ vnd man mach in fünff vnd funfftzig schuch tiff/ in disen graben mach man noch ein kleinen gefütterten graben/ achzehen schuch weyt/ vnd zwelff schuch tiff/ zü negst vnden ander pastey/ vor den streychweren zü ringe herumb/ von eyner seyten der statmuer an die anderen/ Auff das so man in den graben fiel/ nit so bald zü dem schiessglöchern köme/ Aber die pastey soll for der statmauren ein

and that lesser buildings with smaller cost can be made just as strongly built. If this were truly said then one could follow it. I say however, who will build through fear of invasion, should build yet stronger than I have hereafter indicated rather, than be struck by this injury, that any warrior can clearly see is very necessary.

I will also not make these writing at such a high level as for highly esteemed workmen to know how to build. But for such as are not sufficiently instructed and yet are overcome by the time to build, I will encourage, that their buildings in design are well considered. Nevertheless no one is bound to follow me without employing his own considered opinions and pleasure.

He who would build, first examines the site of the town wall, where it is most convenient to defend. If the same town needs more than one bastion, so that the guns can reach each other they are set in such places where the least shots can do so. And the structures should be on firm ground, as on rock, living earth, or on piles. And around the bastion the reveted town ditch is widened to at least 200 feet wide, between it and the bastion under the ground (level), as much as the occasion of the place allows, and it is made 55 feet deep. In this ditch is made a further small reveted ditch, 18 feet wide and 12 feet deep, beside the opposite bastion so as to circle around the flank defences from one side of the town wall to the other, so that when one drops down in the (main) fosse one can not come up directly to the gunports. However the bastion should from the town wall

1. The bastions should be set at a distance in accord with the range of the smallest guns to be used in defence.
2. "lebendig" ? The latin version (Paris 1535) has "argillose". RATHEAU (1870) gave "ordinaire". JAEGGLI (1971) gave "gewachsen". Presumably just good ground as against swampy or unsafe surfaces.
3. Opposite the countercarp.
4. Or casemates.

zimliche weyten hinauss in den stat-
graben tretten/ wie hernach volgt/
Auch werd die bastay also gesetzt/ das
man sich zü beyden seiten so wol weren
smöge als fur sich/ kan man sie auch
machen hintersich darauss zü weren/
ist destbesser/ Ich red ietz von truck-
nen statgraben/ wo man aber diffe
wasser greben mag haben/ ist forteyl-
phafftiger.

Sg. Die. SÜ ein herr weyt vnd wolge-
legne land/ vnd die wal hat nach seinen
willen ein fest schloss² zupauen....
Erstlich sol ein eben fruchtbar land
darzu erwelt werden/ vnd dise ebne sol
gegen mitternacht ein hoch holtz gepirig
haben.....Vnnd diss schloss³ sol gesetzt
werden ein kle ne meyl weyt von dem
gepyrg auff der ebne gegen mittag.....
Diss schloss sol gantz in die fierung
gepaut werden/ doch sollen die euss-
ersten eck/yetlichs mit einer lini
sechs hundert schüch lang....Dise
fierung sol ein grosse weyten haben/
von wegen der eussern weeren/ die vil
fürsich nemen/ darumb sol ein seyten
vō diser eussersten fierung/ wo die
eck nicht abgeschnitten werden/
vngeuerlich biss in vier tausent/
dreyhundert schüch lenge haben.⁴
Dise fierung des schloss sol vber
ort gesetzt werden/ von der vier
wind sterck wegen/ auff das sich die
and den ecken leychtlich abstossen.

Sg. Dib. Aber die teylung inwendig des
schloss/ sol also gemacht werden/ in

travel a reasonable distance into
the ditch as here follows. Also the
bastion is set so that it can be
defended from both sides as well as
in front, and if it can be defended
behind it is better again. I
speak here of a dry town ditch, when
a deep wet ditch can be had, it is
advantageous.

If a lord with a wide and well-lying
land has the choice of building a
strong castle² to his desire....
Firstly should a flat fruitful land
be chosen, and this plain shall to
the north have a high wooded mountain
.....And this castle³ shall be set a
little mile from the mountain in the
plain to the south....This castle
should be completely built in a square,
yet the outer points each with a line
600 feet long (trimmed)⁴.....This
square should have a great space, by
reason of the outer defences, that
takes a good deal of consideration,
whereby shall one side of this outer
square where the points are not trimmed,
have fully up to 4300 feet in length.⁴

This square of the castle should be
set in place, from the four strong wind
directions, so that they are on the
corners easily worn down.

However the division of the inside of
the castle should be made thus: the

1. I.e. bevelled off. See below.

2. JAEGGLI (1971) p. 93, 'modernises' "schloss" into "residence".

3. Here the last author p. 93, 'modernises' "schloss" into "town" ! (See below #5.)

4. I.e. ignoring the bevelled off corner.

5. JAEGGLI (1971) gives "Die Einteilung des inneren Raums soll folgende sein". This author in his modern rendition of these sections distorts the sense of the passages by transforming "schloss" as noted, or by use of a circumlocution with a similar effect. This completely distorts Dürer's text. Dürer continually used the term "schloss" to cover the complete castle and town surrounding it. This author's intention seems to have been to make Dürer's text sound as if it were much more concerned with town planning in the modern sense than it really was, in order to emphasise Dürer's contribution to this field. ("Dürer webt hier sein Vorstellung von idealen Stadt hinein." (Op. cit. p. 117)) Yet clearly Dürer conceived the problem was to provide a strong fortification and residence for the king or prince, and his design centered around this, although a town was necessary to the whole. As Dürer himself explained (op. cit Sg. Dib) "So nun des Königs hauss nach der leer Vitruuij oder ander verstendiger werkleut gemacht ist/ denn mach mann ausserbald desselben grabens ein gefierten platz.. ..auff disen platz sollen wonen des Königs Rätte/ diener vnd handwerker...." His view was thus of a town and castle very medieval in conception, and not of the organisation of the urban space as an abstract into which various structures might or might not be fitted.

der mit sol das herlich hauss des
Künigs/ auff einen gefierten platz
gestelt werdē/ des ein seyten acht
hundert schüch lang sey/ vnd kein eck
sol an diser fierung abgeschnitten
werden. Wie aber ein sollich Küniglich
hauss gepaut sol werdē/ schreybt
Vitruuius der alt Römer klar....¹

39. Fiib. DAMIT genedigster König vnd
Herr/ wil ich meinem schreyben end
geben/ vnnnd E.M. damit mein vnder-
thenig dienstperkeyt angezeygt haben/
nit der meynung/ das mir in allen
dingen gefolgt sol werden/ dann ich
weyß das auch pessers dan ich anzeygen
kan/ erfunden mag werden/ so sind auch
die gelegenheytt der landt/ des gleych-
en das vermögen der Herrschafft nit
gleych/ derhalb auch die befestigung
mit an allen orten gleych sein
mögen/ aber auss allem
vorgeschehem anzeygen mag so vil ab-
genummen werden/ das an alle ort dienst-
lich sein mag/ man prauch sich des gar
oder zum teyl/ darein sich aber die
verstendigen wol wissen zurichten. Es
ist auch in sundere not zubendencken
das also gepaut werd das die befest-
igung so sie abgedrungen würden/ nit
mer dem feynden nutz sein dann sie die
freund beschützen mögen. Der halb zu
erhaltung solcher befestigung not ist/
gut geschütz/ alle kreigs notturfft/
vnd zu forderst frumme vmd mandliche
leut/ die sich tröstlich weeren dörfen/
dann an die selben ist alle befestigung
vnerhalten/ zu den sich aber ein yet-
licher Fürst vnd Herr nach seiner
gelegenhett weyß zu schicken.

lordly house of the king should be set
in the middle of a square plan of a side
of 800 feet long and the corners of this
square should not be chopped off. Now,
however such a royal residence should
be built the old Roman Vitruvius clearly
wrote.....¹

Here gracious king and lord, will I
give end to my writing and there-
with your Majesty have indicated my
humble servitude, not in the intention
that I should be followed in all things,
for I know others can discuss better
advices than mine. Also the
opportunities of the land, and like-
wise the power of lord's, are not
equal, so that fortifications can
not in every place be the same, but
from all the foregoing ideas can as
much be taken up, as in any place
can be serviceable, using the whole
or a part, on which those who under-
stand such things know well how to
correct. It is also particularly
necessary to consider that such fort-
ifications are built so that if they
are seized, they are not more use to
the enemy than they are in defence of
ones friends. In regard to the preservat-
ion of such a fortification it is necess-
ary that (it have) good guns and all
war necessaries, and above all pious str-
enuous fighters to allow a faith-
ful defence, for of these is every
fortification lost except that each
Prince and lord knows to send them at
his opportunity.

1. It is not very clear what part of Vitruvius Durer may have been referring to here. Vitruvius of course had no specific section on "palaces", rather on temples and theaters. He did write on houses however (Bk. VI, Cap. III/V) and perhaps Durer was thinking of this, but in detail these are rather dwellings on a modest scale. Here however Vitruvius stated that houses should be designed in accordance with the status of the client, and that his general rules of decoration serve in design generally in this field. Thus it is probable that Durer was thinking of Vitruvius's rules of design, particularly for the orders, in these remarks, and their application to form a suitable residence for the prince.

2. Lit. manly, virile.

REINHARD von SOLMS-LICH

Ein gesprech eines alten erfarnen kriegsmans mit einem jungen hauptmans
(1st. ed. 1535)

Bibliography: Meyntz 1535;¹ Koln 1556.

General description:² 9" x 5½" finely printed text. 28 folios. 2 pages of diagrams. 3 pages of tables. 3 pages of illustrations. The majority of the text in dialogue form.

Contents:

- f. 1a.: Title page: Eyn gesprech eynes alten erfarnen kriegsmans vñ baumeysters mit eynem jungen hauptmann: welcher messen eyn vester baw fürzunehmen vñnd mit nütz des herren mög vollenfürt werden. Gedruckt zū Meyntz bei Iuo Schöffern mit Keyserlicher vnd Königlicher Maiestät freihey/ nit nach zūdrucken.
- f. 1b.: Illustration showing a cherub sitting on a sphere, holding a dividers and surrounded by tradesman's tools. Verse inset: "Grandaguuus ego sum tardus ceu primus in Orbe/ Omnia consternens quae iam mihi fata dedere/ Falce mea, ne nunc in me Mauortius heros/ Bella ciet: loca tuta mais haec artibus usus/ Circumfossa iacent, sed tu qui castra moliris/ Valle sub angusta circumdare. Respice quae/ Ordine quo posset fieri. puer ille docebit/ Hoc beo quos genui ingenio, hac uirtute ualebunt."
- * f. IIa: Coat of arms and the date 1534.
- * f. IIb/IIIa: Dedication: "Aller Durchleuchtigster groszmechtichtigster Römischer/ Hungerischer vnd Behemischer König...."
- * f. IIIb/IIIa: Forward.
- * f. IIIb: Illustration showing Micheal Utt and Hans Willig, the two protagonists of the dialogue. An inset shows a rudimentary representation of what might be a scale on a drawing labelled: "Verlängung des kleinen mass stab. 1534 .H.D.:"
- f. Va/XVa: (Pt. I): A dialogue between Michael Ott, an old experienced warrior, and Hans Willig, a young willing learner. The whole section is very general and discursive. No illustrative drawings are given. It is characterised by general apophthegms similar to those of Michael Ott's rhetorical questions.³ The information involved is not a great deal more than one might expect anyone reasonably familiar with contemporary building practices to automatically accept.
- * f. XVb/XXIIIb: (Pt. II): "Eyn vnderricht eynes vestennbaus anzulegen/ vnd auss was grundt das genommen/ geschehen/ vnd wie der im reissen verstanden soll werden." A straight didactic text, which deals with the problems of cubing up a bank, and diagrams are given to aid this. In addition much general advice is given such as that stone-cutting can go on in the winter when the laying of masonry is not possible, and that draught animals should be outspanned at different times according to the seasons, and the like.

1. The first edition of 1535 appears not to have been previously considered in the literature. It does not bear Reinhard's name at any place. Comparison with the second edition, however, which was published under the title of Ein Kurtzer Auszug vñnd vberschlag/ Einen Baw aufzustellen (Koln 1556) shows it to be the same work, this later edition involving some relatively minor changes and the addition of a small amount of material in the final sections. In the later edition Reinhard stated "dieses Gesprech der Architecture/ noch nit in die gemeyn in Truck hab aussgehen lassen/ ist die ursach/ dass solches noch nit/ wie es sein soll/ volngertigt ist" referring to the first edition. The first edition seems in fact to be very rare. A note in the master catalogue (title room) of the B.M. from Benzling the German bibliographer, suggests that only two extant copies are known. JAHNS (1909) noted the reference to the earlier edition in the later version, but did not see a copy.

2. Of the first edition.

3. See below p. 174/3.

f. XXVa/b: Closing remarks.

f. XXVIa/XXVIIb: "In diser nachuolgender figur mag nit alleyn alle multiplication der zal/ sonder auch alle gelider verordnung kriegsvolcke zu ross vnnnd fuß in die gefierten plätz gestellt werden"

Colophon: Gedruckt in der löblichen vnd Churfürstlichen statt Meyntz/ durch Iuonem Schöffer. Vollendet am XXV. tag des monats Novembris/ als man zalt nach der geburt vnsers lieben herren Jesu Christi/ Anno M.D.XXXV. jar.

Eyn Gespräch (1535): Texts

f. I1b. Wiewol aller gnedigster herr/ ich keynen zweiffel hab/ E. Kō. Ma. sei mit geschickten vnd kunstreichen Bawmeystern/ die zu der zeit Weilandt hochlōblichster gedechtnuss Keyser Maximilian zce. als eyne hochberūmpten kriegs fürsten/ dasselb gnūgsamlichen gesehen/ erfarn/ vnd gelert haben/ höchlich vnd wol versehen/ Desshalben dieses mein fürnemen von mir als eynem jungen noch etwas vnerfarnen/ der kunst billichen vnderlassen sein solt. Dieviel ich aber bedenck/ augenscheinlich sihe/ vnd teglich erfarn/ das entweder durch vnerstendig baulent oder aber die jhenigen/ so dass gnūgsamen verstandt haben/ darzu nit gebraucht vnnnd beruffen werden an vil orten vnd enden in der weiten welt mit vnzalbarn kosten/ vil vngeschickte gebew (meinem eynfeltigen verstandt nach) mit grosser mühe auffgericht vnd gemacht werden/ der etlich jren herren/ wo das die noth erfordern solt/ schedlicher dann den feinden sein wurden. Hab ich mir fürgenommen mein eynfeltig gütbeduncken/ wie eyn nützlich vnnnd gebreüchliche werliche befestigung soll gemacht werden/ was auch zuolbringungen derselben biss zu end darzu noth sein wirt/ in eyn kleyne schrift mit sampt eyner veriungen vffreyssungen eynes rechten grundts zu erfassen/ nit darumb/ dass ich mich

Although all gracious lord, I have no doubt, that your Kingly Majesty, with skilful and ingenious building-masters, of the time of the late and very praiseworthy and well remembered emperor Maximilian -- a very famous war leader -- in this has sufficiently seen, experienced and learnt, and greatly and much practised, to consent to ignore such as this my labour, like that of a youth still somewhat inexperienced in the art. At the same time, I conceive, clearly see, and daily experience, that either through uninformed tradesmen, or also that those that have sufficient understanding are not employed or consulted thereon, in many places and far reaches of the wide world, with uncountable cost many poorly constructed buildings -- to my simple understanding -- with great labour, are erected and made, that their lords that have that need should be divided from their enemies. I have (therefore) undertaken, my simple opinions, as to how a useful and ordinarily defensible fortification should be made: what also it is to bring such to the goal that is necessary thereto, in a small brief with everything to a reduced setting out on a true ground, to compose. Not thereby for the reason that I believe

1. Lit. "building workers".

2. Lit. "ends" as in "the far ends of the world" meaning everywhere.

3. I.e. geometrically to scale. "Veriungen", literally to make young. This is very much the vocabulary of the German medieval masons, which they used about the process of reducing a module to arrive at the size of a smaller member using the graphical technique of the revolving square. See SHILBY (1977). "Uffreyssungen" from the root "to divide". Designing is here seen as dividing up the object into its proper parts. A "veriungeten vffreyssungen" is then a design to scale, but not exclusively the design as it appears in a drawing, rather something also of the conception of the object that may be so represented.

dafür acht in solchen sachen vollkommen sein oder das solches durch verstendiger nit gebessert oder nützlicher solt oder möcht an tag gebracht werden/ sonder alleyn darumb allen erfahren baumeystern/ die sonst vil leicht schweigen/ vnd jren verstandt on frucht gemeynes nütz mit jnen inn die ander welt/ weg fürthen jr gemüt vnd hohen verstandt/ durch diss mein dörich fürnemen züberwecken/ dasselb zu bessern/ vnd weit nützlicher an tag zübringen/ damit ich mich des bessern/ vnd weiter lernen möcht/ welches mein fürnemen/ ich aber neimants inn der gantzen welt billicher züschreiben vnd zü überantworten gewist.

f. IIIb. Ich hab auss sonder neygun vnd löft mich bissher züm höchsten obefliessen/ starke vnd veste gebew zü besichtigen/ denen/ so wil ich vermögt/ nach gereyst/ auch gern mit erfahren kriegsleuten darvon geredt/ damit ich mein begir etwas settigen/ vnd derselben eynen verstandt bekomment möcht. Aber warlich bei disen meinen zeiten/ it vil befunden/ die meines achtens/ aber geringen verstands/ voranfang des bewes nottürfftigliche jre fürnemē überadschlagt vnd jren nütz bedact hettē/ das sich dan erscheindt an manchen tapffern gebewen im heiligen Reich un bei ausslendigen Nationen/ welche vngew(in)tliche zü zeit des frids angesehen werden/ vnd doch in der not nit so nützlich vn gebreuchlich sein würden/ wie dan sie geacht werdē/ solche mit güter vnd vnderprechlicher vrsachen möcht werden dargethan. Nun ist je meniglichen wissend/ ayn bau ist ganz leichtlich angefangen/ aber warlich schwerlich/ vnd mit grossem kosten züvolbringen/ der bauen nit versuch hat/ der glaubt nit

I am in such things so accomplished; or that, by those who understand, better or more usefully, it can or should not be expressed, but only because experienced buildingmasters, perhaps otherwise are silent and their understanding, without the fruit of general usefulness, carried away with them into another world their insight and great understanding, through this my ignorant undertaking, these to arouse the same to better and usefully to bring to the light of day, so that I myself can better and further learn, which task of mine I yet know no one in the whole world to truly write on, or to answer.

I have from a particular inclination and spirit hitherto, with the greatest diligence, to the observation of strong and solid buildings attended, as far as could be from travel, and also gladly with experienced warriors thereon spoke, so that my desire could be somewhat satisfied and so that I could obtain an understanding therein. But truly with this my time not found much to my esteem, albeit little knowledge, the beginnings of buildings necessarily have had their undertakings counselled and their use considered; that it appears that many famous buildings in the Holy Empire and in foreign nations, which were regarded in time of peace as impregnable, yet at need were not as useful and suitable as they were esteemed -- such with good and expressed reasons can be proved. Now it is the meanest knowledge (that) a building is very lightly begun, but with difficulty and great cost accomplished. The building has not been attempted I do not believe.

1. Reinhard in fact no where mentions specifically Durer's treatise, and this suggest he did not know it. On the other hand to do things at a reasonable cost was a central preoccupation of Reinhard's (see below p.169, l.13) and this probably should be read as a rejection of Durer's work as being "unbillich" for it is hard to conceive that Reinhard had not at least heard of his ideas, both having been connected with the Emperor's court, although at different times.

2. Defective text.

was auch eynem erfahrenen baumeyster
 mitten im werck tegleich für allerley
 irrungen vnd beschwernussen einfallen/
 den er als der den baw für dem anfangk
 wol vnd notturrfftiglichen beradtsch-
 lagt vnd bedacht hat/ vil leichter
 widerstehen mag/ dan der jhenig der
 vnbedacht auch durch eynen vnerfahrenen
 baumeyster in eil eynen baw fürnimbt.
 Darumb hab ich mir fürgenommen/ eyn
 beuestigung/ wie ich die für nützlich
 vnd bestendig bei mir acht/ zu
 beschreiben/ nit dass alle
 beuestigungen meinem auffreissen nach
 müssen oder sollen gleich nach gemacht
 werden. Diweil die plätz vnd landt-
 schafften vngleich sein/ sonder ob
 eyner gern bawenvolt/ vnd jm vil-
 leicht verstandig vnd erfarn. bau-
 meyster mangeln würden/ dass er selb-
 er mit zusehen/ vnd des eynen zimlich-
 en verstandt haben möcht/ vnd jnen
 erindert was an eym baw zübedencken
 ist/ vnd jnen also weiter nach zü-
 bedencken bewegt/ damit der baw nützlich
 vnd förmlich verbracht/ vnd der
 herrschafft verlost des kostens spott
 vnd hön von erfahrenen leuten/ desselben
 nit leiden/ vnd den vnwillen seiner
 landtschafft gedulden müst/ dan war-
 lich was hülff die herrschafft/ ob als
 dan der baumeyster vmb seine verwar-
 losungen hefftig gestrafft wirt. die-
 weil dardurch die herrschafft jres
 kostens vnd Schadens vnergetzt bleiben/
 desselben erfordert die hohe notturrfft
 dass eyn jeder/ der willens ist eyn
 beuestigung zü bawen/ dass er vor durch
 verstandig vnd erfarn baumeyster
 kriegsguerstendige vnd güter werckleut
 besichtigen lassen die leger vnd alle
 plätz/ darvor vnd darin mit aller
 notturrfft/ vnd alsdan das wol mit
 fleiss nach jrem besehen vnd anschlag
 in visierung mit reissen vnd geschnitt-
 en mostern gestellt werden/ vnd alsdan
 nach aller notturrfft mit güter weil im
 (moster)¹ Alle thurn/ thor/ gräben/
 plätz/ schiesslöcher vnd anders wol-
 bedächtlich züm dickermal besichtige/

in which there was not any experien-
 ced building master daily at the work
 for all the disputes and difficulties
 arising; therefore if the building
 from the beginning gets good and rel-
 evant coucil and consideration, much
 lighter resistance will it make,
 than those inconsidered, or by an inex-
 perienced building master undertaken,
 in a hurry. Therefore it is my intent-
 ion to describe a fortification that
 is to my opinion useful and solid --
 not that all fortifications after my
 design must or should likewise be
 made, for sites and landscapes are
 dissimilar. Apart from which if one wish-
 es to build, and perhaps informed and
 experienced building masters are
 lacking, that he himself must see to
 it, and needs a reasonable under-
 standing of it, and to be reminded
 what it is to plan buildings,
 so that the
 building is usefully and properly
 created; and that the sovereign avoids
 (over) expense, and does not suffer
 ridicule and mockery of experienced
 people; and the difficulties of the
 landscape must be born. Then truly
 what helps the sovereign is, as if the
 building master would be heavily
 punished for his negligence in it.
 Because thereby the sovereign's costs,
 and damages are kept in mind, which
 is a great necessity to who wishes
 to build a fortification, (as also)
 that he allows an experienced and
 warwise building master and good
 workman to examine the site and the
 whole place around and about with all
 relevant necessities and also that
 his surveying and estimation in meas-
 urement with drawings and cross-sections
 models are diligently arranged, and
 then at good leisure all the neces-
 sities in the model (considered): All
 towers, gates, ditches, platforms, gun-
 ports and the rest, carefully

1. I.e. the patron.

2. "moster" appears as the catchword but the next sheet begins "Allen".

vnd eynes jeden gutbedenken heer/
damit die reue im werk nit mit schaden
komme/ dan gar mit leichtem kosten das
müster mag geendert werden/ das doch
so das werck gemacht/ gar seer schwer-
lich zuthun ist. Desshalben hab ich
solchen baue vnd meine fürnemen durch
zwo personen/ nemlich eynen jungen der
noch des bauens nit gantz bericht ist/
vnd doch gern für andern des wissens
haben wolt/ der rathfragt/ vnd eynem
alten erfahren vnd geübten kreigsmann
wollen an tag brengen/ der hoffnung
die verstandigen werden mein fürnemen/
sob ich gleich etwa geirret/ wie ich
selbst es dafür halt/ nit verachten/
sonder vil mehr begerig sein/ die
mängel vnd gebrechen zü bessern/ dan
alle sachen wöllen erstlich durch leer
junger/ wie hie in der figur der mel-
anckolya durch eyn kindt angezeygt
ist/ angefangen/ vnd durch die erfahren
gebessert werden. Vnd damit ich zü
dem anfang meines fürnemens komme/ hab
ich den alten erfahren kreigsmann/
Michel Otten³ genent/ wiewol der vor
etlicher zeit mit todt vershieden ist/
so hab ich doch inn zeit seines lebens
das zümachen mich mit jm vergleichen/
so acht ich in er sei würdig der inn
seinem leben Römischen Keysern vnd
Königen ehrlichen vnd nützlichen
gedient/ vnd bei vil dapffern vnd
guten rathen gewesen/ auch des bauens
vor andern hohen verstandt vnd bericht
gehabt/ dass nach seinem todt/ sein
kunst vnd verstandt vnder seinem
namen an tag gebracht werde. Den jungen
aber die weil er gern lerner/ sich
fragen nit schampt/ vnd willig ist
alle arbeyt vnd mühe auff sich zü laden/
den nenne ich Hans Willig/ vnd nach
dem gedachter Hans willig von seiner
oberkeyt zü eynem baumeyster verordnet
ist/ dass er auch also von ehren oder
nütz wegē wie offt geschicht angenömen
hot/ vnd im handell befindt/ dass im
solch ampt züerwesen an dem verstandt
vnd erfarnheyt vil mangelt/ damit er

as to thickness examined; and
everything well considered here so
that regret in the work with shame
does not arise, then with very
light costs can the model be accomp-
lished: even if the work then made is
very difficult to do. Which I have
undertaken to do for such building
through two persons, namely a youth
that is not yet fully informed about
building, and yet is happy to have
knowledge from others in dialogue; and
an old experienced and practised warrior
who will bring to (the light of) day,
the hope of understanding which is my
task, (and) if alike I somewhat err,
as I myself in that hold; not to crit-
icise without being much more eager,
the faults and mistakes to correct.
Then all reasons will first (be expres-
sed) through the unformed¹ youth as he
in the figure of melancholy as a child
is drawn², at the beginning; and will be
improved through the experienced man.
And so I come to the beginning of my
task. I have the old experienced warrior,
Michel Ott³, named, although for some
time he is passed over into death; yet
I have him still as in his lifetime to
make a comparison with; in this way I
esteem him as worthy just as in his life
he honourably and usefully served the Ro-
man Emperor and King, and for both much
valiant and good council was known, and
also had before others of building a gr-
eat understanding and acquaintance, that
after his death, his art and under-
standing be openly employed under
his name today. The youth however
because he is eager to learn, and not
ashamed to ask questions, and is will-
ing to bear all the work and trouble,
I call Hans Willig, and then this imag-
inary Hans Willing, in his office is
subject to a building master, so that
he too thus of honourable and useful
ways has as often aquired the skill,
and in practice discovered, in this
office to banish from his under-
standing and practice, many faults, so

1. Leer = empty.

2. This is a reference to the frontispiece.

3. Michel Ott was a historical character. Born 1479, in 1503 he was "obriester
feldzugmeister" to Maximilian I. He had a long and distinguished career as
an artilleryist. d. 1532 (?). ALL DEUT BIOG.

dañ sein herrschafft in grossen kosten
nit für vngnad/ spott/ vnd schandt
erlange/

f. Vb. H.W....dañ eynem jungen keyn
schandt ist/ vō alten erfarnen leuten
zūlernen/.....vnd mich was ich in
krieggslauffen gesehen gefragt/ sein
wir etlicher beuestigungen/ als des
Schloss Meylandt beyder Stett Bern und
Ferer zū reden worden/.....dass sein G.
mir zwo geschickte personen/ nemlich
eynem Steynmetzen vnd gūten Maler
woll zūgeben/ mit denen woll ich in
Italien ziehen/ jnen die gebewe/
weeren vnd schiesslöcher augenschein-
lich weisen/ vnd auch darnach eygent-
lich ab Conterfeyen lassen/ damit sein
G. selbs solche beuestigung sehen....

f. Via. M.O. Was ist dañ not mit
solchem kosten inn Italien zūziehen/
dañ wann du gleich alle ding eygent-
lichen besichtigt/ ab conterfeyt/ vnd
in dein gemūt alle befestigungen in
Italien wol gefast hettest/ vnd dān
wider heym zū deinem herrn kömest/ jm
relation vnd die counterfeyung für-
gelest/ vnd er darauss würd spüren/
dass solcher Welscher bau sich zū
seinem fürhaben nit schicken wolt/
wie würstu dañ bestehn/ geschweig was
würden dein missgunner darzū reden/ ist
wol möglich dass du dardurch gnad vnd
achtung bei deinem herrn verlieren
würdest.

H.W. Ich gesteh dass die Welschen
gebaw sich mit meines herrn fürhaben
nit vergleichen/ jedoch vermeynt ich/
wo ich eynen berichten steynmetzen vnd
moler dinnen hett/ die das augen-
scheinlichen sehen/ ich wolt noch
allerley an solchen gebewen finden/
das sich an meines herrn bau auch
schicken würd/ als eyn thurn/ etlich
weeren/ schiesslöcher vnd anders/

that his sovereign is not subjected
to great costs, with ungraciousness
ridicule and shame.

H.W....it is no shame for a youth
to learn from old experienced people
...and I being questioned (about) what
I have seen of warfare, we are to
discuss some fortifications
like the castle of Milan and both
towns of Bern and Ferrara....if your
grace allows me two skilful persons,
namely a stonemason and a good painter,
I will take them with me to Italy and
the buildings, defences and gunports
clearly examine, and further these
truly portray so that your grace is
able to see such fortifications...

M.O. Was it then necessary to go
to Italy with such cost, when you
similarly everything truly examine
from representations, and in your
mind all Italian fortifications have
strongly fixed: and then you come
back home to your lord, your accounts
and representations to read before
him, and he about these would feel
that such Italian buildings are not
fitting to his intentions, you would
then stand dumb about what was your
pride to talk: it is very possible
that thereby you would lose the grace
and esteem of your lord.

H.W. I admit that the Italian build-
ings do not compare with my lord's
intentions, however I believe, when I
have a qualified stonemason and a
painter to attend, that clearly see
these, I will yet discover a variety
of things in such buildings, that will
also be fitting to my lord's building:
for example a tower, some defences,
gunports and other things, which all

1. It is clear that in this passage than Reinhard wanted to emphasise two things. One the value of drawings, and the other that Italian structures might not suit German conditions. But if Hans Willing did not go to Italy it is unclear where he is to get the drawings of structures there. The implication must be that pictures of Italian buildings were widely available in Germany at the time.

welches alles in die meyster wann sie das zuvor nit gesehen haben/ schwerlich zubringen ist.¹

M.O. Deinem anzeygen nach/ so seind die thürn zu Meylandt vast gross vnd dick/ und stehn dieff in dem graben/ vnd ist eyn thurn wol so gross als eyn viertheyl an deines herrn schloss/ darzu so würdestu sie nit versencken können inn den gräben wie zu Meylandt.

H.W. ES ist ja war/ ich wol sie aber nit so gros machen wie zu Meylandt.

M.O. HANs wölstestu die thürn kleyn machen/ so werden sie schwach von mauren vnd stehn frei zu allem geschütz/ das wil sich nit schicken. Nun ich müß dich fragen ob du auch wissest was eyn gut weerlich schiessloch² sei.

f. VIIb.M.O.³müß ich dich fragen ob er auff eyn grosse oder kleyne besatzung gemacht oder geordent sei.

H.W. ICH hab des keyn verstandt was eyn grosse oder kleyne besatzung erfordert dan ich lass mich beduncken/ so weyn Statt oder Schloss grösser sei/ so es eyn grösser besatzung erforder/ weiter weys ich nit zu antworten.

M.O. IA du saget wol in eynem weg davon/ aber in andern weg hör ich wol dass du es nit verstehst/ damit du des eynen verstandt habest war nach ich gefragt hab/ so ist das mein frag. Man kan eyn bau gemachen der vor schiessen verwarth ist/ vnd doch nit weerlich/ das hat eyn verstandt. Ich lass eyn schüdt machen mit eynem graben die nit zu schiessen ist/ vnd hat keyn weer dan alleyn vor schiessen wie gehört/ darhinder gehört eyn grosse starcke macht zú stehen/ ob man schon zu jnen

in the business, if one has not seen them previously are difficult to create.³

M.O. Your report being then that the towers of Milan are very great and thick and stand deep in the ditch, and one tower is as great as four times one of your lord's castle, thereby you can not sink it in the ditch as at Milan.

H.W. It is very true, I will not make it as big as at Milan.

M.O. Hans, if you would make the tower small, then will the masonry be weak, and will stand open to all guns, and it will not suit. Now I must ask you whether you also know what a good defensible gunport⁴ is.

M.O.³I must ask you whether for a great or a small garrison it should be ordered and made.

H.W. I do not understand what requires a large or a small garrison, except that I imagine that the greater a town or fortress is, so is a greater garrison necessary, further I know not how to answer.

M.O. Yes you say well in one way thereon, but in another way I hear clearly that you have not understood it, thus so as you truly understand what I asked, this is my question. A structure can be made that is safe against bombardment,⁴ yet which is not (properly) defensible, that has to be understood. I assume a bank made with a ditch, which is not for shooting and has no defence employed purely for shooting; behind it belongs a great force to be made to save against attacks over the bank, thus they

1. Reinhard here emphasises here the value of personal experience, rather than that got through drawings, and this is not later denied.

2. "Schiessloch" clearly meaning gunport. But the text goes on to discuss the making of a chamber ("kammer") in a solid wall so this term tends to have something of the sense of "casemate". The discussion following points out the difficulty of providing sufficiently large chambers in reasonably sized towers, to house the defensive guns.

3. A "statt baue" is under discussion here.

4. On the other hand this might mean "safe for shooting" in the sense of being able to handle defensive guns. However, the reading given here seems much more likely, not simply from the language, but also because the point Reinhard goes on to make is that in contrast it may not be safe from storm, unless it has an impossibly large garrison. Ryff read it in this sense also, and in his version gave "das man ein tapfferen gewaltigē bau dermassen wol anrichten vnd stellen mag/ das er vor dem Geschütz herauffen/ zimlichen wol verwart/ vnd starck genug sein mag/" RYFF (1547) f. Vb.

Über die schüdt fallen würde/ so
 stehn die inn der besatzung hinder der
 schüdt in der ordnung/ als ob sie im
 felde stünden/ vnd sich schon mit jnen
 schlagen solten/ vnd müssen die so sie
 überfallen wollen ausserhalb der ordnung
 zu jnen lauffen/ das dann vngewöhnlich
 ist zuthun/ darzu gehört dan̄ eyn ge-
 waltiger grosser hauff in die besatzung/
 dann rechen auss solt du hinder eyn
 schüdt die keyn weer hinder jr hot/
 leut zu der weer stellen/ müst du eyn
 an den andern so lang die schüdt ist/
 wie eyn zaun ordnen/ damit ist es nit
 verwarth/ sonder sie müssen auch hinder
 eynander stehn/ glidssweiss wie inn
 eyner ordnung/ also dass sie eyn druck
 leiden können. Nun rechen was eyn
 seitten an der schüdt obgemelter
 massen zu besetzen für eyn volck
 erfordern wöll/ Solt nun an eynem
 andern ort auch dergleichen angefallen
 werden vnd gestürmt/ so will der-
 gleichen versehen sein/ darzu gehört
 auch eyn hauff volcks/ Nun rechen auch
 was fürwacht in die beuestigung vnd
 obs gewegsam sein will/ darumb acht
 ich das für keyn nütze besatzung die
 gehort nit weerlich ist/ sonder mit
 dem grossen hauffen sich weeren müssen.
 Nun will ich dir sagen was eyn weer-
 licher bau ist/ daruor ich es halt/
 vnd nit so eyner grossen besatzung
 bedarff/ Dass ist so eyn schüd oder
 mauer weerē hot vor jr vnd hinder jr
 die zusammen sich weeren vnd die leut
 darinnen verwart seind/ also dass sie
 nit zu überfallen/ noch mit dem ge-
 schütz darauss getrieben werden/ vnd
 dei hinein fallen/ vor solchen weeren
 stehn mogen/ vnd zu jnen mit dem
 geschütz zwerchweiss auss den weeren
 schiessen lassen/ vnd sich zwischen
 den weeren trennen müssen/ das halt
 ich für weerlich besatzung....³

stand as the garrison behind the bank
 in their ranks, as they stand in the
 field, and they all should and must
 be ready with their shots, to the
 attack that proceeds from the outside
 onto their ranks, as is generally done:
 for that there then belongs a great
 powerful host in the garrison. Then
 reckon out that behind a bank that has
 no defence behind it, the men that should
 be placed in defence, (who) must be
 one beside the other as long as the
 bank is, in a straight ranking,¹ which
 is not secure except that another (rank)
 stands behind it, ranked as in an
 array, that they can bear a press.
 Now reckon that one side with its
 bank with the above mentioned numbers
 to occupy it, will require one 'battle'.
 Now should another place likewise be
 attacked and stormed, thus being simil-
 arly organised, to it will be required
 also a mass of men. Now count also the
 guard in the fortification and whether
 it will be sufficient -- from that I
 judge that no fortress is any use
 that is not defensible,² except that
 it is defended by great masses.

Now will I say to you what I hold to
 be a defensible structure and which
 does not need so great a garrison.
 That is that a bank or wall has (flank)
 defenses, before and behind it to
 defend it, and the men within are
 protected, so that they are not
 attacked, except if they are driven
 out by guns and on the inside assault-
 ed, because such a defence can stand,
 and at them can fire guns crosswise
 out from the defensive flanks, and
 must cut up those between the defences
 -- that I hold for a defensible
 garrison....³

1. Lit. "as a fence ordering" i.e. only in a thin line.

2. Not defensible in general, but defensible by being flanked see n. 3, below.

3. This passage causes a great deal of difficulty for the very significant reason that, "weerlich" = "warlike" or "defensible", functions in a very technical sense. That is 'defensible' is being use in the sense of being defended by flanking fire.

This is a clear indication of how common place the notion of defence as dependent on this technique had become by this time.

f. VIIIb. M.O.....Weyst du aber ver-
stehst du dich auch vmb die Artolorei
als vmb aller gattung der büchsen
vermögen/ was eyn jede gattung eyn tag
vñ fort von mauren brechen kan/ mit
dem vnterscheyd an dicken und dünnen
mauren/ eyn jedes besonder hat sein
rechnung vnd mass zu geben.

f. XIa. M.O.....vñnd so er eyn weer
machen muss nach gelegenheyt des platz
do er es besser wisst zumachen vnd
platz halben nit sein kan/ dass er
doch wiss rede un̄ antwort zugeben.
warumb es nit anders hat sein mögen/
so hört sein herr doch wol dass er es
hass versteht. Dann glaub mir so eyner
gleich alle fortheyl vnd geschicklich-
keyt auff dem bawen weyss vñndver-
steht/ so fordert doch alwegen eyn ander
platz oder walstadt eyn andern baw vñnd
art/ dass eyner anders lernen muss/
darumb ist gut dass eyner der sich
bawes vndernimt dass er alle zeit
sich fleissigk mit viesiern überund
was er gemacht das in gleich gut
bedunck/ so soll er sich selbst mit
allem fleiss das widerlegen vnd allen
fel zusuchen üben/ vñ so er eyn fel
daran finden thut/ so soll er sich dan̄
wider bearbeyten den zufürkommen/ also
will stets disse handlung inn disput-
ierung gehandelt werden/ so findt
sich durch die contrarien/ vil das
eyn an das nit wol zufinden ist/ vñnd
ich bleib noch darauss wie ich vor
darvon geredt hab/ dass eyn bawmeister
aber angeber eyns vesten baws not sei
dass er sich des geschütz vnd Artolorei
wol versteh.

f. XIIa. M.O.zweyntzig fragstück..
i Item erstlich die walstadt zube-
sehen ob die lieg dass sie wasser hab/
das nit zu nemen sei.
ii Item ob man muss auff allen seitten
den baw gleich herumb führen/ oder es
auff eyner seitten oder mehr etwan̄

Do you know or understand about Art
artillery and about the capabilities
of all types of guns, and what each
one in a day, can break down of masonry,
the different thickness of thinness
of the wall in each particular case,
having their measure and proportion
given.

M.O.....thus if he would make a
defence it is better to know how to
make it after the opportunities of
the site, and what the site can not
have, that he yet knows how to talk
and answer why it can not be otherwise:
thus his lord hears very well that he
fully understands it. Then I believe
that thus one likewise knows and under-
stands all the advantages and skilfulness
of building, so that always yet another
place or walled town requires another
building and art, that one also must
learn, whereby it is good that one
oneself undertakes building, that
continually with diligence in judging
what he makes that he similarly gets good
familiarity with it. Thus should he
himself with all diligence attempt to
seek all contradictions and faults,
so that if he does find a fault, thus
he then shall work against its occur-
ance. Thus if this treatment is ever
dealt with in debate thus he finds thr-
ough argument much that will not other-
wise be found. And I stand then in
this what I have already said -- that
is, it is necessary for a building
master or designer of a structure to
thoroughly understand Artillery and
guns.¹

M.O. ...twenty (rhetorical) questions..
Item 1: Firstly to observe whether the
walled town lies so it has water that
it can not be taken.
Item 2: Whether must all sides of the
structure be similarly led around or
if one side or more (is) somewhat

1. All this passage tend to be very akward in detail; but the general points
being made about the value of arguments and the need to understand particular
sites and all the details of building thereon, are quite clear.

behelff hab dass solcher sterck nit bedörff/ als durch gemoss oder wasser/ dass man keyn läger dahin kün legen/ od oder das geschütz.

iii Item zübesehen ob es berg vmb sich hab/ die es über höhen/ das es nit daruor züdecken sei.

iiij Item ob man schon eyn seitten vor solchem berg decken möcht/ ob man dan auch möcht über die selbige weeren sehen oder schiessen inn die ander weemauff der ander seiten in rücken.

v Item ob man etwan eym mög zwerch in die weern sehen/ vnnd ob das auch züverdecken sei durch schütten oder blenden.

vj Item so es eyn eben erden bau ist/ ob er gleich eben vnd wol leg/ ob man auch steyn darbei haben kan/ oder nit dergleichen ob man schütten machen wolt/ ob man auch möcht die erden darbei bekommen/ oder ob sie züweit züholen sie/...

f. XIIIa H. W.so bin ich des anbietens dass ich euch getrewlich helffen will vnnd euch der arbeyt über heben/ die ich auff ewer angeben aussrichten kan/ vnnd will also ewern bericht vor mich nemen/ vnnd es mit fleiss bedenken/ mich darinnen üben mit reissen vnd was mich darinnen vnderrichten möcht/ so würd ich zü Gott verhoffen/ wo das ich also möcht eyn jar oder etzlich bei euch sein/ vnd eyn bau sehe vnd helffen machen/ ich wolt es begreifen.....

ff. XIIIb. M.O. Eyn bau angeber ist eyn person der rath gibt wie der bau gemacht sein soll/ vnd von jm geordent mit allem weern/ vnnd warumb eyn jede weer auff sein angeben also gemacht/ vnnd wie die zügebrauchen mit allem dem das darein gehört gemacht werden soll. Züm andern soll eyn angeber wissen alle mass eynem bau zügeben vñ zü ordnen nach gelegenheyt des platz nemlich dass er dem platz wiss zümessen nach aller seiner gelegenheyt/ vnd fürter wiss alle weern darauff züordnen/

assisted that it does not require such strength, as through bog or water that no camp or guns can be set there.

Item 3: To observe whether it has a mountain nearby, that is very high, that it does not cover it.

Item 4: Whether if one side really can be well covered by such a mountain, whether then also this same defence can be seen or shot over into the other defence of the other side, in its rear.

Item 5: Whether someone can see across into the defences, and if also whether it could be covered by banks or mantellets.

Item 6: If the building is on level ground whether it is similarly level and well laid. Also whether stone can be got nearby or if not whether a bank will be made; whether also can earth be obtained nearby, or must it be fetched from a distance...

H.W. ...thus I request that I will truly help you and have you over the work so that I can be corrected by your council, and I will take your advice for my own, and diligently consider it, thereby that I can be instructed with practice in design and what therein I can learn; thus I hope to God, when I can thus for one year or a few be with you, and see and help to make a building, I will understand it....

A building adviser is a person that gives council as to how the building should be made and by him arranged with all defences and why each defence to his advice should be made, and how as needed everything belonging therein should be made. Further an adviser should know how to give advice on all the proportions of a building and how to design according to the opportunity of the place: namely that he knows how to measure the place according to all its circumstances and further knows how to design all defences, as well

auch mit iren massen/ die der platz
leiden kan/ doch auch weerlich vnd
starch weeren/ dass muss er künden
durch den jungen mass stab/ züer-
gungen nach dem grossen platz/ auch
dasselbig augenscheinlich züreissen
vnd fürt züscheiden/ oder züerstechen
lassen/ in das kleyn mass das es durch
den Cirkel schierst auff den kleynen
schneidt oder riss züfinden sie/ wie
man das gross am rechten bau darnach
nemen vnd anlegen soll/...

f. XXIIIb. Ist aber eyn herr der den
bau selbst versehen will/ vnd dorbei
sien kan ist so will dest besser vnd
es geht in warheyte in beisein eyns
herrn ernstlicher und gehorsamlicher zü/
dann wann eyn herr nit darbei ist/ dar-
bei ist aber auch züdencken dass eyn herr there,
besonder eyn grosser herr nit allezeit
bei seinem bau sein kan auss andern
seinen geschafft/ Darumb so ist in
doch eyn baumeyster von nöten/ so
helt eyn herr sein baumeyster doch bei
sein arbeytern gewaltig ob er schon
vnderweill mit etwas fehlet/ vñ das-
selbig nit auss vndrewen oder sein
vortheyl...

with their measurements, that the
site allows. However, also defensible
and strong flankers he must make known
through scale drawings reduced
from the full sized place,
also how to set them out clearly and
explain how to arrange, or let rep-
resent in the small scale that with the
compass alone is discovered in the lit-
tle section on the drawing in accord
with how the large structure truly
from it shall be taken and laid out...¹

However (when) a lord will himself
oversee the building, and can be
there, it will thus be better and in
truth it proceeds more honestly and
obediently in the presence of the
lord, than when the lord is not
there, however it also (should be)
considered that a lord, and espec-
ially a great lord, can not always
be at his building away from his
other business. Then is a building
master needed to help the lord
through his working capability
whenever he sometimes may be absent
so that things are not done disloyally
but to his advantage...²

1. In this passage Reinhard used many words and phrases in a technical sense to do with design, drawing, and arrangement of the building, which all hover around the root notion of cutting, dividing, yet whose precise significance is difficult to elucidate. He appears in many ways to be groping for the right terms rather than using a clearly defined vocabulary or set of concepts, as for example at the beginning of this passage where he tried to define a "bawangeber" as a particular kind of individual and avoided such terms as "Architect" or "baumeyster". Reinhard clearly did want to distinguish between a "bawangeber" and a "baumeyster" yet their skills were very close for at the beginning of the next passage he stated "Ein baumeyster muss sich rechnungen vnd aussmessens verstehn". Reinhard only began to use the term "architect" in the opening sections of his 2nd edition. Ryff on the other hand equated "bawangeber" with "architect".

2. The "baumeyster" here is seen as valuable for his administrative skill rather than for any particular technical skill in design, but that sort of latter activity must have been part of his skill at least because Reinhard had explained earlier that to make the building go "obediently" he had to be able to understand the faults where they arise.

Der Gantzen Architectur (1st. ed. 1547)  

Bibliography: Nürnberg 1547; Nürnberg 1558*;^{1,2}

General description:³ A very large production of some 330 folios. 8½" x 6" text. Profusely illustrated with wood cuts. A good deal of internal division, with many sections, separately paginated. The contents generally consists in translations and redactions of earlier authors.

Contents:

f. (1a): Title page: Der furnembsten/ notwendigsten/ der gantzen Architectur angehörigen Mathematischen vnd Mechanischen kunst/ eygentlicher bericht/ vnd vast klare/ verstandliche vnterrichtung/ zu rechtem verstandt der lehr Vitruuij/ in drey furneme Bücher abgetheilet. Als Der neuen Perspectiua das .I. buch Vom rechten gewissen Geometrischen grund/ alle Regulierte vnd Vnregulierte Körperliche ding/ dessgleichen ein yeden Baw/ vnd desselbigen angehörige glider/ vnd was vns im gesicht furkomen mag/ künstlichen durch mancherley vorthail vnd gerechtigkeit Zirckels vnd Richtscheids/ auff zureissen/ in grundt zu legen/ vnd nach Perspectiuischer art auff zu ziehen/ mit weiterem bericht des grundts der abkurtzung/ oder vermerung aller ding nach verendrung der distantz/ mit erklerung der furnembsten puncten Künstlichen vnd Perspectiuischen Reissens vnd Malens/ verstandt der Farben/ Mit getreuer vnterweisung/ der gantzen Sculptur oder Künstlicher Bildung/ ein yedes ding aus gewissem grund in rechter Proportion vnd Simmetria/ artlichen vñ gerecht zu Formieren vnd Bilden/ durch Schnitzen/ Hawen/ Graben/ Etzen/ Stechen/ Abformen/ Possieren/ Abgiessen vñ Abtrucken/ in aller Handt Zeug/ als Holtz/ Stein/ Marbel/ Metal/ Helffen bein/ Gyps/ Wax/ Giesstandt vñ dergleichen. Mit sonderlichen abtheilung/ der rechten proportion vnd Simmetria Menschliche Körpers/ vnd was weiter zu der Kunst der Perspectiua erfordert werden mag/ alles mit schönen Figuren fur augen gestellet. Weiteren inhalt das II. vnd III. Buchs der Geometrischen Büxenmeisterey/ vnd Geometrischen Messung/ sampt den kurtzen Summarien/ des gantzen begriffs/ der selbigen vnterschiednen theil/ sindestu hernach nechst der Vored. verzeichnet.

Allen Künstlichen Handtwerckern/ Werkmeistern/ Steinmetzen/ Baumeister/ Zeug oder Büxenmeisteren/ Maleren/ Bildhaweren/ Coltschmiden/ Schreineren/ vnd was sich des Zirckels vnd Richtscheids künstlichen gebraucht/ zu sonderlichem nutz vnd vilfeltigen vorthail in Truck verordnet/ Durch Gualtherum H. Riuium Medi. & Math. Dermassen klar vnd verstandlich/ bissher in Truck noch nit aussgangen/ oder gesehen worden. Zu Nürnberg Truckts Johan Petreius. Anno 1547. Mit Keiserlicher vnd Königlicher Maiest. Priuilegio/ in vj Jahren nit nach zu Trucken.

f. (1b): Woodcut of a cherub surrounded by tools; above: "Viuitur ingenio, caetera mortis erunt". Below: "Aurum probatur igni, ingenium uero Mathematicis".

f. (11a/11a): Dedication to "Der Fürsichtigen Erbarn vnd Weisen Herren Bürgermeistern vnd Rath/ der Stadt Nürnberg/ meinen Labietenden vnd Günstigen Herren.

1. N.U.C.

2. For further bibliographical information and notices of other editions (Nürnberg 1572* and 1585*) see BLNZING, Joseph: Walter H. Ryff und sein literarisches Verck: Eine Bibliographie (Hamburg 1959)

3. Of the first edition.

f. (vib): Ballistic design after Tartaglia, a geometric design from the Nova Scientia being superimposed on a picture of the countryside with a gun firing.

f. I/XLII: Bk. I, The New Perspective: Bk. I, General geometrical drawing techniques.

f. I/ LXII: Bk. II, Perspective representation mainly concerned with architectural features.

f. I/XLVII: Bk. III, General discussion on painting and sculpture, including human proportions after Vitruvius.

f. I/LII: Bk. II, Geometric gunnery: Pt. I, Ballistics after Tartaglia with a translations from Nova Scientia and Quesiti et Inventioni.

f. I/XLVII: Fortification:

f. I/XXIV. Pt. (i): A reworking of Reinhard's Eyn Gesprech.

f. XXV/XXIX. Pt. (ii): Translation from Bk. VI of the Quesiti et Inventioni.

f. XXX/XXV. Pt.(iii): A general discussion with respect to the ancient authors.

f. XXXVI/XLVII. Pt. (iv): On arrays after Bk. IV of the Quesiti et Inventioni.

f. I/XLVII: Bk, III: Geometrical measurment: Pt I: Surveying.

f. I/IX: Pt. II: General mensuration.

f. I/XIX: Pt. III: Weights and weighing.

f. I/XI: Pt. IV: Levers, and weight.

Colophon: Haec omnia cum Priuilegio Caes. atq Reg. Maiest. Patreio concessa ad sexennium.

Der Gantzen Architectur (1547): Texts

f. (iib)². Bin ich aus sonderlicher wolmeinung vnd höchster begirdt/ geneimen nutz vorab/ desgleichen allen/ der scharpffsinnigen Mathematischen künst (souil die selbigen der Architectur angehörig) liebhaberen/ zu dienen/ vnd wilfaren bewegt worden/ dise schwere mühe auff mich zu nemen/ vilgemelte Bücher der Architectur/ nach höchstem vermögen/ meines geringen verstandts/ zu Transferieren vñ in gemeiner/ verstenlicher / Teutscher sprach/ allen kunstliebhaberen/ durch den Truck/ gutwilliglichen mit zu theilen. Diueil aber dise Bücher vom hocheffarnen Vitruuio/ mit solchem grossen verstandt/ vnd trefflicher fursichtigkeit beschriben/ vnd geordnet/ das nit allein alles dasselbig/ was zu rechtem verstandt/ künstliche vnd ordentliche Bawens/ sonder in

I am from a particular well meaning and great desire for the general good especially, similarly³ all lovers of the ingenious Mathematical arts -- in so far as they belong in architecture -- to serve, and being moved to comply, to take this heavy labour from myself, to translate the famous books of Architecture to the best of my ability from my poor understanding, into common understandable German speech, all art lovers, through the printing readily to share it with. Because these books of the greatly practised Vitruvius, written and arranged with such great understanding and excellent care, not everyone knows fully how to rightly understand, carefully and regularly to build, but also

1. This section owed a good deal to Casarini's Vitruvius. (See below)
2. From the dedication.
3. As other ingenious men.

allen andern/ der Architectur angehör-
 igen Mathematischen künsten/ vnd
 Mechanischer erfindung/ notwendig
 erfordert, werden mag/ alles so gar in
 kurtzer summa/ begriffen vnd gefasset/
 das zu besorgen gewest/ das die getreue
 vnterrichtung diser Bücher/ villicht
 den fleissigen erforscheren/ diser
 künstlichen sachen/ etwas dunckel vnd
 schwer/ vnd nit allenthalben verstend-
 lich/ Furnemlichen aber dieweil auch
 etliche ding/ in sonderheit was die
 befestigung Gebew/ vñ scharpffsinnige
 erfindung mancherley Machination¹ des
 Geschützbetrifft/ nach der zeit
 Vitruuij/ doch aus dem ersten grund
 der Architectur erfunden/ Wie dann
 auch weiter andre ding/ durch lang-
 wirigen brauch/ stetige Übung/ fleissig
 nachtrachten/ dergleichen nach
 vilerley Landt sitten/ vnd gebrach/
 geendret/ vnd auch etwan
 gebessert worden/ Zu dem/ das dise
 ding/ furnemlichen der vrsach halb/
 dem Teutschen Leser frembd vnd vnbekant
 sind/ Dieweil bisher bey vns Teuschen
 derselbigen wenig in schriftten gedacht/
 oder aus sattem grund/ gehandelt oder
 tractiert worden/ Bin ich derhalben/
 noch weiter verursach worden/ zu
 müssen zeit/ bey neben meiner fur-
 habenden profession/ der hochlöblichen
 kunst der Medicin/ zu sonderlicher
 ergetzung vnd recreation/ nach dem
 herlichen Exempel/ anderer trefflicher
 Kunstner als Lucas Paccioli, Caesaris
Caesarini, Benedicti Iouij, Boni Mauri,
Guiljelmi Philandri, Sebastiani Serlij,
Petri Nonij, Orontij Finei, Nicolai
Tartaleag, vnd andre mehr....

f. Ia.³ Bm.⁴ Gvnstiger herr vnd freundt/
 nach dem ich euch nun ein gute zeit
 erkant/ vnd ewer gemüt gemercket/ als
 einen sonderlichen fleissigen erfor-
 scher aller guter künsten/ vnd furnem-
 lichen aber deren so der Mathematick

that all of the mathematical parts
 of Architecture and mechancial
 discoveries that may necessarily be
 required, all this in a short summary,
 grasped and fixed that the true inst-
 ruction of these books is acquired,
 which despite the diligent research
 in this artful business is somewhat
 somewhat dark and obscure,
 and not altogether understandable.
 Principally, although in other things,
 but especially concerning fortification
 and the many ingenious discoveries of
 various artifices of shooting, (which)
 arose after the time of Vitruvius,
 yet discovered from the first ground
 of architecture. As also other things
 through lengthy employment, contin-
 uous practice, diligent additions,
 which many lands use and employ, have
 changed, and also somewhat improved.
 So that these things principally for
 this reason are foreign and unknown
 to the German reader. Because up to
 now by us Germans, thus, in writing
 have been little treated, or on sat-
 isfactory grounds handled and dealt
 with. I have thus from the arising of
 the further occasion being free from
 my primary profession of the very praise-
 worthy art of Medicine, to particular pl-
 easure and recreation from the excellent
 example of other good artists, such as
and others more...(studied)

Bm.⁴ Good sir and friend, having known
 you now for a good time, and your
 spirit remarked, as a particularly
 diligent searcher into all good arts,
 and especially of those to which math-
 ematics relate, so that you never yet

1. "Machination" a rather odd form, from the Latin "machinatio" presumably.
2. See Volume I for all these figures. Pacioli p. 169 → ; Caeserini p. 201 ; Philandri p. 204 ; Serlio p. 191 → ; Nunez p. 156 ; Fine p. 117 . Benedict Iouj and Boni Mauri finished getting Caeserini's Vitruvius through the press.
3. Of Pt. III (On fortification) Pt. I. This is based on Reinhard's dialogue but with a good deal of change in emphasis.
4. Baumeyer, equivalent to Reinhard's Hans Willig.

verwandt/ also das jr. bissher kein
 fleiss noch arbeit gesparet/ noch
 einige geferlichkeit euch habt hindren
 lassen/ solchem eweren herlichen fur-
 nemen nachzukomen/ derhalben andre
 frembde Nation besucht/ vnd mit fleiss-
 iger auffmerking durch wandert/ auch
 mancherley sprachen gelernet/ darmit
 in allen solchen guten kunsten euch
 nichts verborgen oder verhalten blibe/
 wie dann ewere vilfeltige schrift
 arbeiten welche jr. zu sonderlicher
 wolfart das gemeinen nutz/ teglichen
 allen fleissigen kunstliebhabenden
 mittheilen/ vnd gutwilliglichen
 zustehen lassen klarlich anzeigen/
 Dardurch ir. dann kein gerings lob/
 nit allein beim gemeinen man/ vnd
 allen auffrichtigen Kunstliebhabern
 verlanght/ sonder auch bey etlichen
 Fürsten vnd mechtigen Herren/ in
 sonderlichem werdt/ wie dann billich/
 gehalten.....Dieweil sein G. allerley
 redt vernomen von den gewaltigen/
 starcken vnd wehrlichen befestigung
 viler Welscher gebew/ welchen er in
 diesen wunderbarlichen seltzamen vnfrid-
 lichen lauffen/ sich gern zum theil
 gebrauchen vnd volgen wolt/ etliche
 Stadt/ Schlösser vnd Flecker/ zu befrid-
 ung seiner vnd seiner vnterthanen/
 vor gewalt vnd vnbilliger bedrangung/
 gern dermassen zu befestigen vnd ver-
 weren/ Vñ wiewol ich mich zu solchem
 ampt zugerings verstandts erkenne/ hat
 mich doch die Ehr. überwunden solches
 anzunemen/ kome derhalben zu euch/
 als meinem Günstigen Herren vnd
 freundt/ gantz vntertheniglichen
 bittend/ mein furnemen zu hören/ vnd
 mir eweren getrewen rath mit zuthellen

.....
 Arch.....Dann du onzweiffel weist/
 vnd auch bey dem berühmtesten vnd
 namhefftigen Architecto Vitruvio ge-
 lesen hast/ wie mancherley kunst vnd
 wissen/ den fleissigen Architecto/
 vnd ansehenden Jungen Baumeistern
 (als du bist) von nöten sein wil/ ich

spared any diligence or labour, or
 have allowed any danger to hinder you,
 from following your noble work, thereto
 having visited other foreign countries
 and with diligent attention travelled
 through them, also sundrie languages
 learnt, so that in all such good arts
 nothing remained hidden or secret from
 you, as then your diverse written works,
 which to the particular welfare of the
 common good, continually you commu-
 nicated to all diligent lovers of the
 arts, and very readily allow to be
 clearly announced to them. Whereby
 you have obtained no little praise,
 not only from the common man and from
 all sincere lovers of the arts, but
 also by some Princes and powerful
 lords, are held, as is fair, remarka-
 ble..... Because your grace under-
 takes to speak variously concerning
 the powerful, strong and defensible
 fortifications many Italians build,
 which in these wonderful strange strife
 filled times, he gladly some parts
 will follow and employ, to give peace
 to him and his subjects, by some
 towns, castles and villages, from
 powerful unjust harassments willingly
 in this wise to fortify and protect.
 And because I, of such an office have
 too little understanding, and yet
 as I have the honour to undertake to
 accomplish this, I come to you as my
 gracious lord and friend, very obed-
 iently to beg you my task to hear,
 and to share your faithful council....

Arch.....Then you doubtless know,
 and in the renowned architect
 Vitruvius have read, how diverse arts
 and disciplines, to the diligent
 Architect and beginning building master
 -- as you are -- will be necessary,
 I pass silently by the wonderful

1. This excess Durer (above p.159) but it is probably too common a sentiment to be considered of any great significance.
2. Architectus, equivalent to Michael Utt in Reinhard's dialogue.

geschweig der wunderbarlichen scharpf-
 fsinnigkeit diser yetzigen Welt/ so
 alle ding vnterstehet auff das höchst
 zu bringen/ vnd zu uberkunsten.^{1,2}...

SBm. DER vrsach halb bin ich zu euch
 komen/ von euch zulerne/ vnd meins
 furnemens vnterwissen zu werden/ dann
 ich ye fur kein vnehr oder schand achte/
 nit allein von alten verstandigen
 leuthen/ sonder von einem yeden/ wie
 gering der sey/ so eins dings besser
 dann ich erfahren/ zu lernen....Als
 mich mein G.H. (wie ich auch vorgesagt)
 zu im gefordert/ vnd allerhandt sachen
 mit mir vnterredet/ vnd befragt/
 sindt wir auch etlicher herlicher/
 gewaltiger vnd fester gebew Welsch-
 landes zu rede worden/ als des gewalt-
 igen mechtigen Schloss Meylandts/ der
 *Stadt Ferrar vnd Bern/ welche gebew
 ich meinem G.H. hoch berüme/ wie dann
 billich/ vnd in der warheit zu rümen
 sindt/....Welches zuuerstehen....Das
 mir geschickte erfarnere personen zugeben
 worden solten/ Maler vnd Steinmetzen/
 mit den selbigen in Italien zu reysen/
 sie gemelten festen Gebew jhnen fur
 augen anzeigen/ mit allen wehren vnd
 Schiesslocherē/ vnd was dañ zu solchen
 gebewen erfordert wirt/ dasselbig alles
 auffe eygentlichst abzureissen/ vnd
 in grundt legen/ vnd hernach das gantz
 Werck Contrafacten lassen/ vnd meinem
 G.H. also fur augen zu legen/ vnd mein
 meinung vnd anschlag darinnen weisen/
 vnd sein rath vnd gut bedunckt dar-
 innen vernemen.

Dann ich weisse das solchs von etlichen
 namhaftten Stedten auch beschehen/
 welche kein geringen Kosten an solche
 ausschickung/ erfarnere/ geschickter
 personen/ in frembde land/ angewendet/
 vnd jre gebew darnach berathschlagt
 vnd angelegt haben/ bin derhalben der
 meinung auch/ das mir solchs zu meinem
 angenommenen befeh vnd furhaben/ nit wen-
 iger nutz vnd vorthellig sein würde.

subtleties of the present world --
 thus to bring all things to the high-
 est understanding, and to the highest
 art.²...

The reason I have come to you (is) to
 learn from you and to be instructed
 in my field, for I esteem it no
 dishonour or shame to learn not
 only from old understanding workers,
 or from any other however modest he be
 who in anything is more experienced
 than I.....Then my good sir -- as I
 have already said -- that you discuss
 with me the required and other reasons,
 and we are to debate also some
 great, powerful and strong Italian
 buildings, as the strong,
 powerful castle of Milan, the towns
 of Ferrara and Bern, which buildings
 my good sir I highly praise as is fair,
 and for defence are lauded....Which to
 understand...if I should be given two sk-
 illed and experienced persons, a painter
 and a stonemason, with them into Italy to
 travel the (above) mentioned strong
 buildings to them to show by sight
 with all their defences and gunports,
 and what is necessary to such buildings,
 the same all truly to represent and
 lay out, so that the whole work
 is pictured

so that my good lord is then able to
 see them and my opinions and pro-
 nouncements thereto to know, and his
 council and opinions thereon to consider

Then I know that also from inspect-
 ing some notable towns on which no
 little cost, clever, experienced, skilful
 persons in foreign lands, was spent,
 and their buildings counselled and
 laid out in that fashion, so that I
 am in that of the opinion that these
 to my task, brief, and project no
 little use and advantage can be.

1. "uberkunsten" to surpass in art.

2. In comparison to Reinhard's version, this opening account of Ryff's, emphasises the value of mathematics as the true ground of the arts, and the significance of Vitruvius, in a way Reinhard never did.

f. IIIa. Bm. Dann als euch wol zu wissen/ sindt diser zeit unsere gemeine Werckmeister vnd Steinmetzen/ solches grobs verstandts/ Diueill si nit allein der Mathematischen/ sonder aller guter künsten vnerfahren/ vnd auch der Geometri vorab (darauff all jr grundt vnd fundamēt stehet) solchen kleinen bericht haben/ das solche ding von jnen in keinen rechten verstandt gebracht werden mögen/ wie verstandtlich vnnd wol man jnen solches furlege....

f. IIIb. Bm.aber mein meinung ist nit/ das solche Thurn also gross...als die zu Meylandt in Schloss stehendt/ heraus an meines Heren Bau ordnen oder machen wolt.

f. IXb.Vitruuio selber/ daher wir den grundt vnd vrsprung haben disen Kunst.¹

f. XIIa. I. Item erstlichen den platz der malstadt mit fleiss zu besehen/ Geometrischer weise aufs eygentlichst zu messen/ vnd aller gelegenheit war zuzunemen/ ob auch Wasser vorhanden das nit zu nemen/ oder abzugraben sey.

f. XIIa....auch was vnterscheid zwischen dem Baumeister vnnd Angeber des Baus. Vnd nenne ich den einen Angeber eins Baus/ der rath gibt/ aus gnugsamen gründtlichen vrsachen/ wie ein solcher Bau furzunemen/ oder gemacht werden sol/ vnnd so ein yeder solcher Bau erstlichen von diesem Angeber/ oder Architecto/ geordnet werden mit allen seinen Wehren.²

f. XXVa.³...die namhafftig Stadt Thurin/bey etlichẽ erfahren Teutschen Kreigsleuthen/ vn̄ erfahren Baumeister-
en/ den namen hat/ als ein vast wehr-

Bm. Then you well know, at this time, our ordinary workmasters and stonemasons are of such crude understanding because not only of Mathematics¹ but also in all good arts and also in Geometrical foundations -- on which stands their whole foundation and base -- have so little instruction that such a thing they can not use with any true understanding, as intelligibly and well as such is put forward...

Bm.but my intention is not that such towers as great as those that stand in the castle of Milan should be ordered or made for my lord's building.

....Vitruvius himself from whom we have the foundation and origination of this art.²

Item I: Firstly the site of the walled town to diligently survey, out of geometrical knowledge truly to measure, and all opportunities of defence to take, whether also water is available that it is not taken or undermined.

....also the difference between the buildingmaster and the building counsellor. And I take for the building counsellor, one who gives counsel, from sufficiently grounded reasons, what particular building should be undertaken or made, and every such building should first by this adviser, or Architect, be arranged with all its defenses.³

⁴...the renowned town of Turin... by some experienced German warriors, and experienced buildingmasters, has the name of a strong, defensible,

1. This is again an emphasis on mathematics quite foreign to Reinhard.

2. Ryff's Vitruvian emphasis.

3. Ryff here equates 'architect' with 'bauangeber'.

which first term Reinhard did not use. Ryff's version of this section that follows, equivalent to Reinhard's above p.173/4 emphasised mathematics again, yet could do so and remain much more faithful to the original text, than at other places.

4. After Tartaglia.

liche/ starke/ veste/ vñ vngewinliche
Stadt/¹ welche wir zu einem exempel
setzen vñnd ordnen wöllen/ zu besserem
verstandt diser vnser folgenden vnter-
richtung.

Aber zu weiterer volführung vnser fur-
habē/ sol erstlichen gemerckt werdē/
das wir setzen/ das ein Stadt vest
sein mag von natur/ das ist aus guter
art/ vñnd geschicklicheit² des orts/
vñnd platzes/ de sie ligt/ vñnd zum
andern/ das auch ein Stadt durch
geschicklicheit vest erbawen werden
mag/ vñd zum dritten/ das etwan ein
Stadt durch sie beide/ vest vñnd wol
bewart sein mag.....Vñd weiter aber
so ein Stadt allein vest erbawet ist/
aus dem verstandt künstlicher vñd
erfarner Baumeister/ mag solche befest-
igung zweyerley gestalt haben/ als das
etwan ein Stadt der stercke halben der
Gebew/ vest vñnd wol bewaret ist/ als
von stercken Gebawen/ vñd so die Mauren
dick/ die Pasteyen gross/ die Gräben
rtieff sindt/ vñd dergleichen/ vñd also
mehr der martery/ solcher Gebew/ dann
jrer form vñnd guten gestalt/ hierin
nach getrachtet worden/ vñd ob wol
solche Gebew ein trefflichen schein
haben/ der stercke/ vñnd vestigkeit/
halten wir sie doch nit fur künstlich.
So aber ein Stadt jrer form/ vñd ge-
stalt halben/ mehr dann aus trefft
vñd stercke der matery/ vest ist/ als
sob die Mauren mit verstandt herumb
geführt sind/ vñnd dermassen geordnet/
das etwan der feinde mehr nachtheils
vñd schadens darvon entpfahet/ daß
von den grossen mechtigen Thürnen/
dicken Mauren/ vñd tieffen Gräben/ ein
solchen Baw achten wir gar fur wehrlich-
en/ der aus rechtem grundt der künst-
lichen Architecture gemach sey.

solid and impregnable town¹ which we
will set as an example and arrange to
the better understanding of this our
following instruction.

But to further the execution of our
intention, it should first be remarked
that we put it, that a town may be
strong from nature, that is from good
art and suitability of the place and
site where it lies, and secondly, a
town also may be strongly built through
skillfulness, and thirdly, that some-
times a town through both may be strong
and very secure...But further when a town
is strongly built only because of the
understanding of the art-full and
experienced buildingmaster, can such
a fortification have two forms, as
that sometimes a town has stren-
gth from the structure being strong
and well secured, as strongly built,
and here the walls are thick, the
bastions large, and the ditches deep,
and the like, and thus more from the
material of its structure, than from its
shape and good form -- as here after
is endeavoured; and although
such a building has an excellent
appearance of strength and powerfulness,
we do not hold it to be art-full.
But if a town from form and shape,
more than from excellence and strength
of the material, is powerful, as when
the walls with understanding are drawn
around, and in such are arranged
that sometimes the enemy encounters
more disadvantage and danger from it,
than from great powerful towers, thick
walls and deep ditches, one such
building we esteem as entirely def-
ensible and constructed from the cor-
rect ground of skilful Architecture.

1. This smuggling in of the opinions of Germans in an essentially Italian text seems rather gratuitous.

2. Ryff's adjectives here give a peculiar impression because they are terms that most characteristically apply to human skills, which skills in fact are to be contrasted with nature's provisions, here.

3. This section after Tartaglia above p.14 was not given by Ryff in dialogue form.

f. XXVla. Vnnd ist also/ nach
meiner meinung/ die erste manier solcher
form oder gestalt/ einer Stadtmauren/
die vest vnd wehrlichen sein sol/
das man sich alle zeit dermassen
befleisse/ die Mauren der Stadtmauer/
oder der Pasteyen/ also zu zurichten/
das der Feindt aus keinen eusseren
Leger/ dieselbig wagrecht treffen mög/
oder beschliessen.

f. XXXVb. Es haben auch die alten
erfahren Baumeister/ vnd Kriegsleuth/
in sonderheit den gebrauch gehabt/
inwendig der Schloß/ ein furnemen/
ghohen/ grossen/ starcken Thurn auff
zu führen/ der nit wol zugewinnē/ wie
dann solcher Thurn noch heutigs tags/
in vilen alten Schloßgeren/ so vor
vil Jahren erbawē worden/ gesehen
wardē. Wie aber weiter zu dem Gebau
der Schloßgeren/ die Porten/ Fall-
brucken/ vnd dergleichen/ was weiter
dazu von noten/ haben wir zum theil
gnugsamlichen in den Büchern
zu Vitruuij gehandelt/ vnnd erkleret/
darumb wir dises orts disen theil von
der erbawung der Stadt vnd Schloßer/
mit iren befestigung Gebawen/ enden
vnd beschliessen wollen.

And it is thus my intention that
the first mode of such a form or
shape of a townwall that should be
strong and defensible, that always be
such wise studied that the masonry
and the town wall or bastion
is so prepared that the enemy cannot,
from any of their camps, shoot or
strike perpendicularly.

It happens also that the old exper-
ienced buildingmasters and warriors
particularly employed inside the
fortress a special high, great, strong,
tower so that it was not easily taken,
which such towers today in many old
castles that were erected many
years before, are seen. However, further
to the building of castles, the gates
drawbridges, and the like, what further
is necessary thereto, we have suffic-
iently dealt with in some parts of
Vitruvius' books, and clarified,
wherby in this place, of this part of
the construction of towns and castles,
with their fortified structures, we
will end and conclude.

LEONARD FRONSPERGERVon Geschütz vnd Feuerwerck (1st. ed. 1557)Bibliography: Frankfurt am Main 1557; Frankfurt am Main 1564.General description: A large format work. 8 $\frac{1}{2}$ " x 5 $\frac{1}{2}$ " text. (vi) + 58 folios.
One illustration of a gunners quadrant.Contents:

f. (1a): Title page: Vonn Geschütz vnd Feuerwerk....Das ander Buch. Vonn erbawung/erhaltung/ besatzung vnd profantierung der wehrlichen Beuestungen/Alles durch Leohnart Fronspergern mit fleiss beschrieben. Mit Keyserlicher Malestat Priuilegio vnd Freihey. M.D.LVII.

f. (11a/111b): Dedication to "Herrn Maximilian König zu Behaim/ Ertzhertzog zu Oestereichmeinem gnedigsten Herrn."

f. (1va/ 1vb): Vorede.

f. 1a /25b: Bk. I: Vonn "Geschütz vnd Feuerwerck: A very general discussion with no details given of gun sizes, or of ranges, or of any ballistics. It is much concerned with the making and supply of powder, the make up and use of gun trains and different kinds of shot, and the like, as well as with the guns necessary to a fortification. The section finishes with a drawing of a gunner's quadrant with three pages of text on this topic.

f. 26a: Title page to Bk. II.

f. 26b/58a: Bk. II: The first section of this book (f. 26/35) is concerned with structures in fortification. The discussion is very general often following Reinhard or Ryff. Discussion included such points as that thick walls do not give good "schliesslochern"; what a "bawangeber" is and his duties; the use of towers, rondelles, and bastions where necessary, and so on. The rest of the book is a rather varied collection of topics. Provisioning of a fortress, preparation for sieges and storm, "Feuerwerken", fire in a fortress, watch and ward, the "Zeughaus", and so on.

Colophon: Gedruckt zu Franckfurt am Main/ Zum eysern huth/ durch Dauidem Zephelium.

Von Geschuss vnd Feuerwerk: Texts

f. (va). Nichts ist so stark/ vest oder veruert/ welche nicht durch das Geschütz vberwunden/ zerbrochen/ auff den boden geschleyfft vnd erobert wurd/ Die starcke Bolwerck/ hohe Schlösser/ woluerwarte beuestigung/ gefüterte meur vnd dieffe graben/ werden oft kümmerlich erhalten. Dann ob gleich etwo ein ort von natur mit wasser/ gemösa/ höhe oder anderer gelegenhey beuestiget ist/ das man

Nothing is so strong, solid or secure, which is not by guns overcome, broken up and razed to the ground, and captured. Strong bulwarks, high castles, well defended fortifications, reveted walls and deep ditches, often get into a bad state. Then even if it is around the place fortified by nature with water, bog, height or other opportunity, that with heavy guns

1. Of the first edition.

2. f. 28b et seq.

3. f. 34b.

mit schwerem geschütz vnd maubrechern/
entweder wassershalb nicht darzu kan/
oder der hohen wäll vnd bolwerck halb/
nicht beschossen werden mag/ vnd also
auff diese gerade weg nichts frucht-
barliche ausszurichten/ So kan man
dannoch dergleichen beuestigungen/ mit
graben/ sprengen/ verbawen/ vnd sonder-
lich mit einwerffung der feuerkugeln
vnd feuerwerck also betragen.....

f. 1a. IN allen künsten so jhemals
durch die Göttlich fürsehung an den
tag gebracht worden/ ist von alter
her ein löblicher gebrauch gewest/ das
man die neuen anfang zuorderest die
ersten anfang erkennen gelert/ welche
bey den lateinischen Prima rudimenta
oder principia genant werden. Nun ist
vnuernaendlich war/ das Salpeter/
schwefel/ koln/ vnd das.....

f. 27a. Es ist auch gut das vor anfang
eines Bawes/ der platz darauff man die
Vesten zubawen willens/ odertlich
ermessen vnd aussgetailt werde/ damit
solche fürgenommene Vesten/ möge mit
den Rundelen/ vnd andern bolwercken/
ordentlich gebawt werden/

f. 27b. Die erst Veste oder wehr wirdt
gebawt durch dei Steinfelsen vnd ge-
mewren/ dieselben sollen lang/ breit/
hoch/ dick/ vnd auch als dann mit auff-
geführten Basteyen/ Bolwercken/ Rundelen/
vnd anderen runden vnd geuerten thürnen/
gebawt werden/ auch solchen sie mit
guten vorthellen vnd schiesslöchern
dermassen gefast sein/ das man sich
darhinder wehren vnd erhalten mag.
Die ander Veste wirdt mit beschüttung
der Erden/ auch mit thämmen oder
bühnen gebawt.....Die dritte Veste
wirdt durch wassergebew....

Darmit man sich/ im fall der noth/ auff
solchen wehrlichegebawen oder Vesten
stattlich erhalten vnd wehren/ auch

and bombards, it can not be come to,
or high walls and bulwarks has that
it cannot be battered and cannot be got
got at directly in a useful way. Then
one can besiege such fortifications
with trenching, mines, overbuilding,
trenching, mines, overbuilding,
and particularly with the throwing of
fireballs and 'fireworks'....

In all arts that ever through god's
providence were invented, there is
from the ancients' a praiseworthy
usage, that the new beginner
first of all learnt to recognise the
first beginnings which by the Latins
were named Prima rudimenta or
Principia. Now it is undoubtedly
true that saltpeter, sulphur, charcole,
and that.....

It is also good that before starting a
building the place where the fortif-
ication will be built, is regularly
measured and setout¹, so that the
fortification undertaken can with
Rondelles and other bulwarks be
regularly built.

The first fortification or defence
is built of rock and masonry, which
should be long, broad, high, thick and
also with projecting bastions, bul-
warks and rondelles and other round
and square towers built, so that it
will be of good advantage, and with
gunports in such fashion well fixed
so that one can defend and be safe
behind it.

The second fortification is built
with banked earth, and with dams and
banks....The third fortification is a
water structure....

Thus one does it in case of need for
such a defensible structure or imp-
osing fortification to preserve and

1. Not, symmetrically built, so much as in an orderly fashion.

das Geschütz sampt denen so darzu
verordnet/ möge platz raum haben.....

f. 30a. Vnd für das erst ist das
Geschütz das best vnd höchste haupt-
stück in einer Beuestigung....Für
das ander stück/ werden die schiess-
löcher vnd streichwehren/ in einer
Besatzung gar nützlich geachtet/ wo
anderst die recht vnd ordentlich
gebawt/ also das sie in allen Rundelen/
Bulwercken/ Basteyen/ Thoren vnd
Thürnen vlessig auff einander vnd
zusamen sagen/...

f. 32b. Item solche Plochhauser sollen
auch in zimlicher grösse vnd höhe sein
...

Kriegsbuch² [19]/[24]

Bibliography: Part I: Franckfurt am Mayn 1571; Pts. II & III: Franckfurt am
Meyn 1573; all 3 parts: Franckfurt am Meyn 1596.

General description:³ In its final form the Kriegsbuch formed a massive
compilation.⁴ 5 1/2" x 9" text. Pt. I. 266 numbered folios; Pt. II, 227 do.; Pt.
III, 362 do. Included are many woodcuts of a rather painterly style, inserted
often to give a pleasant appearance to the work rather than to impart inform-
ation. Also are included many engravings often of a double page spread or larger.

Contents: The contents of this work ranges over an extremely large number of
topics connected with warfare in different ways. A good deal of the discussion
concerned administrative matters of the army, such as provisioning, discipline
and the nature of the various ranks that could be held. Practical gunnery
comes in for a good deal of discussion. Small sections relevant to fortific-
ation appear at various places. The work is characterised by containing a good
deal from earlier publications by Fronsperger, and from the works of other
writers.⁴

1. I.e. that the defensive guns 'speak' properly.

2. This work was very much a compilation with a complex bibliography in itself
as well as in relationship to Fronsperger's earlier publications.

3. 1571/73, and later editions. The 1571/73 edition is specifically referred
to here.

4. JÄHNS (1889) gives a good deal of detail about the make-up of the
Kriegsbuch and its relationship to Fronsperger's earlier writings and pub-
lications, and to the work of other writers.

defend, and also the whole ordered
so that the guns can have space and
room.

And for the first are guns the best
and greatest mainstay of a fortific-
ation.....For the second part gunports
and flank defenses in a garrison are
esteemed as very useful where the
rest is correctly and properly built,
that thus all, Rondelles, Bulwarks,
Bastions, Gates and Towers, diligently
with each other and together speak...¹

Item, such a blockhouse should also
be somewhat great and high.....

Kriegsbuch: Texts

Pt. II, f. XXIIIIa. Item, erstlichen den Platz den Malstatt mit fleiss zubesehen/ Geometrischerweiss auffse eigentlichest zumessen/ vnnnd aller gelegenheyt war zunehmen/ ob auch Wasser vorhanden/ das nicht zunehmen/ oder abzugraben sey.

*.....sol auch der fliessig Architectus vor allen dingen wissen/ dem Bau die rechte mass zugeben vnnnd verordnen/ auch mancherley begriff/ der Malstatt vnnnd gantzen Platz/ also dass er wisse/ mit fliess solchen Platz vnd Hofstatt gantz eigenlichen abzumessen/ Geometrischer weiss/ mit besonderen Instrumenten/ als du solches ein gnugsamen bericht in einem sonderlichen Büchlin/ so von Geometrischen messung/ mit etlichen newerfunden künstlichen Mathematischen Instrumenten.....

Item, firstly to survey the site of the town wall diligently, and to measure it exactly geometrically, and to take all opportunities for defence; if also water is available that it can not be taken or undermined.

....the diligent architect shall know above all other things how to give the building the correct proportion, and to order it, and variously conceive the town wall and the whole place; thus that he knows how to carefully and exactly take measurement of such a place or town, geometrically with special instruments, which is all sufficiently taught in a special book on geometrical measurement, with some newly discovered scientific mathematical instruments.

DANIEL SPECKLIN

Architectura Von Vestungen (1st. ed. 1589) ²⁵/₃₃

Bibliography: Strassburg 1589; Strassburg 1599¹; Dresden 1710².

General description³: A large format densely printed work. It contains many double page engravings of an extremely high quality. 9 $\frac{1}{2}$ " x 5 $\frac{1}{2}$ " text. (viii) + 112 folios. Occasional diagrams in the text. A good deal of the text is organised by means of direct reference to one of the engravings or a part of one.

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1. Lazarus Zetzner, Specklin's brother-in-law, the editor of this edition added his own dedication in place of Specklin's. He also gave marginal notes, and made corrections and additions, many of which, he stated Specklin had wanted to make before he died. Of the publication of the original edition he wrote in this dedication "Daniel Speckle.....in Anno 1589. gegenwertigen Tractat von Vestungen auff anlass vnd beger/ etlicher fürnemmer Herren stands Personen/ lassen offenem Truck ausgehen: Vnd inn massen an vershiedenenOrten er selbst gedenckt/ bedacht gewesen/ nichtallein den widerumb mit der zeit/ mit vilen besondern Manieren/ Arten vnd Visierungen gemehrt vnd verbessert/ Sonder auch noch ein andern Theyl vnd Tractat von Ordnungen in Feld/ mit Schantzen/ Schantzwägen/ Wagenburgē/ Geschütz/ darzu gehörigen Instrumenten vnd dergleichen neuen Inventionen.....(to publish)"
 2. RIJMPF (1824) gave (no. 4853) Dresden 1712; and (no. 4743) Dresden 1705. These are presumably in error and refer to this edition.
 3. Of the 1st. edition.

Contents:

- f. (1a): Title page: Contained in an elaborate architectural style framework: ARCHITECTVRA Von Vestungen. Wie die zu vnsern zeiten mögen erbawen werden/ an Stätten Schloßern/ vñ Clussen/ zu Wasser/ Land/ Berg vñ Thal/ mit ijren Bollwercken/ Caualliren/ Streichen/ Gräben vnd Leuffen/ sampt deren gantzen anhang/ vnd nutzbarkeit/ auch wie die Gegenwehr zu gebrauchen/ was für Geschütz dahin gehörig/ vnnd wie es geordnet/ vnd gebraucht werden soll/ alles auss grund vnd deren Fundamenten. Sampt den Grund Rissen/ Visierungen/ vnd Auffzügen für Augen gestellt. Durch Daniel Speckle/ der Statt Strassburg bestellen Baumeister. Mit Röm: Key: May: Freyheit/ auf zehen Jahr. Gedruckt zu Strassburg/ bei Bernhart Jobin. Im Jar M.D.LXXXIX.
- f. (11a/111a): Dedication to "Herrn Julio Hertzogen zu Braunschweig vnd Lünenburg zu Meinem gnedigster Fürsten vnd Herren." Dated 1st. Feb. at Strassburg by "Daniel Specklin der Statt Strassburg Baumeister".
- f. (111b/viib): Forward. f. (viib): Two dedicatory verses to Specklin.
- f. (viii a/b): Table of chapters.
- f. 1a/68b: Part I: "Von Bawens vornembsten Stucken vnd zugehörungen: Zirckel/ Quadranten vnd andern nothwendigen wissenschafften."
- f. 1a/2b: Cap. I: Preliminary remarks on the knowledge necessary to the architect.
- f. 2b/6a: Cap. II: Rather crude geometrical preliminaries, including surveying using a horizontal circle and compass.
- f. 6a/7a: Cap. III: Security of the works during building. Dimensions given from which the regular polygons can be set out.
- f. 7a/14a: Cap. IV/VIII: Foundations, the construction of the curtain.
- f. 14a: Cap. IX: The yardstick.
- f. 14b/18b: Cap. X: The number of the bastions, with a discussion of their dimensions, and the dimensions between them. All discussed with a good deal of reference to actual structures, particularly the Castel S. Angelo at Rome, and to incidents of 16th. century warfare.
- f. 19a/25a: Cap. XI/XII: Obtuse and acute bastions discussed, again with particular reference to 16th. century structures and incidents.
- f. 25a/26b: Cap. XIII: An important fortress discussed including a complex geometrical layout.
- f. 26b/34b: Cap. XIII/XXVII: Mainly a discussion of the flanking casemates, but with some mention of materials -- wood and stone.
- f. 34b/45b: Cap. XVIII/XXII: Various topics dealt with, parapets, cavaliers, more on the flanking casemates, a plan of part of a fortress given.
- f. 45b/57a: Cap. XXIII/XXVII: Discussion of different kinds of attack.
- f. 57b/64a: Cap. XXVIII/XXIX: General discussion, often relating to different details of fortification.
- f. 64a/68b: Cap. XXX/XXXII: Different types of site.
- f. 69b/90b: Part II: Fortification on slopes and mountains. Includes a long section on Valletta and the siege there. Contains very fine engravings of castles on crags. Shows how many different types of sites, sloping, on mountains or by the sea may be dealt with using the bastion trace.
- f. 91a/112b: Part III: The river in the fortification. Mechanical topics: Bridges, drawbridges, description of artillery, powdermills and the like.

Architectura Von Vestungen: Texts¹

f. (iiib). Die vrsachen/ die mich zu publicierung dieses Wercks bewegt/ seind dise/ Erstlichen dass ein Oberkeit sol vnd mag bawen/ solche auch vor Gott² zu Gemeinem nutz vorstand schuldig ist/ welches etliche gantz verwerffen.

Zum andern muss ich einem Italianer antworten³ (wie auch etlichen seines gleichen) so vnns Teutschen mit grosser verachtung angreifen/ vnd niemande gut genug achten/ denen jr schmehen vnd verachten abzuleinen.

f. (va). Die ander vnd furnebste vrsach/ so mich zur pulication dieses wercks treibt ist/ dass ich einem Italianer so vnns Teutschen nit allein verlacht/ sonder auch bei Fürsten vnd Herren in verachtung vn̄ verdacht zu bringen vnderstaht/ als ob wir Teutschen gantzlichen on sinn vnd Hirn/ vnd ohne vernunft vnd vor kinder gegen dē Italianern zu achten weren/ dan̄ er sich bei etlichen/ ohne scheu hören lasst/ wo er in Teutschland noch jemalen gewesen/ er nie nichts in vnserm thun gesehē no noch gehört hab/ dass wir vn̄ andere jnen solche nit abgestolen hatten/ vn̄ ob schon etliche Meister etwas news herfür bringen/ könne er doch solche nit passieren lassen/ dieweil er solche zu voran in Italia nit mehr gesehen hab/ zu dem hab er sein lebenslang niemalen gehört oder gesehen/ dass die vollen Teutschen etwas news erfunden hatten.

So ist auch sonst ein Niderländer/ der gleichwol etwas bescheidener in der sachen/ aber in jren wercken vn̄

The reasons that I move to publish this work, are these: Firstly that a sovereign should and can build, who also is responsible before God for the care of the public good, which some wholly reject.

Secondly I must one Italian answer -- as also some of his like -- who assaults us Germans with great contempt, and none of us esteems sufficiently, their abuse and condemnation to reject.

The second and principal reason that I am driven to publish this work, is so that no Italian laughs at any of us Germans, even apart from putting Princes and Lords under contempt and derision, as if we Germans wholly lack sense and brain and are without reason, and to be esteem as children in comparison to the Italians, for some unashamedly let it be heard, that he has never seen or heard of anything yet in Germany of our doings that we had not stolen from others, and if truly some Master has something newly discovered, he nevertheless can not allow this has occurred, because he has not yet seen such in Italy, because he has his lifelong nothing seen or heard, that anything new has been discovered in the whole of Germany.

Thus it is also usually with the Netherlanders as well, for all that they are something more modest on

1. From the first edition.

2. This sort of reference in a general way to religious issues is typical of Specklin's style at many points. At the end of his treatise he affixed "Der Gott vertraut/ Hat wol gebaut." (See also below p. 190, n. 1). While there is no reason to question Specklin's sincerity in this sort of sentiment, connections between such, and detailed problems of fortification, were in his text rather tenuous.

3. It is not clear who, if anyone, is referred to specifically here. But the idea that many Italians were highly critical of the work of individuals from other countries is by no means surprising. No doubt Specklin was reacting to a very real attitude coming from, for example, many of the Italian engineers at the Emperor's court. (MAGLIUCCI (1933/9) details the many of those involved.) Perhaps Specklin was thinking of Carlo Theti for whom he worked at Vienna in 1569. (See Biog.)

deren Regln/ seind sie durchaus einig/
 dan sie jre Lineanenten zu den Vestungen
 alle auss der alten Regel ziehen/
 welchs man damheutige tags weit
 besser hat vnd weist/ dass sie aber
 alles ohne grund vnd vrsachen vernich-
 ten vnnnd verwerffen wollen/ darum ich
 ihnen dass gegenpil fürzustellen vnd
 zubeantworten verursacht worden.

Do man sie aber in den hauptsachen
 befragt/ warumb ein bau hoch/ der
 ander nider/ dessgleichen ein Streichen
 offen/ die ander zu/ eine lang die
 ander kuttz gezogen werden/ ist jr
 antwort/ wann einer nit Latein könne/
 so verstehe er solche nit könne auch
 die dauon reden/ vnd damit haben sie
 ijres bedunkens treflich wol getroffen.

So man jnen aber solche auff gut Teutsch
 (welche sie dann wol verstehen) wider-
 legt/ warten sie biss sie allein zu ein-
 em kömen/ so betten sie mann wölle solche
 kunst/ vñ sachen/ in geheim halten/
 besonders gegen den Oberkeiten/ dann
 swañ sie solche in grund ein wenig
 verstehn/ könne hernoch niemands mit
 jhnen/ vil weniger dann mit den
 Kriegsverstendigen/ vber Einkommen/ die
 wissen oft weniger dann die Gantz
 dauon zureden.

Weil aber ich ein solche gründlichen
 weiss/ so steht mir auch billich das
 zu verantworten/ doch wil ich jedes
 (wass die gebaw belangt) an seinem ort
 streulichen Examinieren/ vnd dass jrig vñ
 meinig/ auff dass maniglichen sehen
 vñ spüren sol/ dass die fromen Teutsche
 die sach so wol als sie verstehn vor-
 stellen/ vnd solche also zugleich
 verstendiger zu judicieren vndergeben.

Die schmachwort vnd verachtung aber
 belangende/ will ich in dieser Vord
 verantworten/ vñ Erstlichen/ dass der
 Italianer vorgibt/ dass er in Teutsch-
 land nie nichts gesehen noch gehört/

the subject, but in their work and
 rule they are throughout united that
 the trace of the fortification is all
 from the old rule drawn; which one has
 much better today, which without any
 ground or reason they will destroy
 and reject. Whereby I
 am caused to put forward this refut-
 ation, and to answer them. Then when
 one asks of the main business, why one
 building is designed high, the other
 low, similarly one flank open the other
 closed, one long the other short; their
 answer is that when one does not
 understand Latin, then he can not
 also understand how to discuss it,
 and their opinions are very much
 to the point.²

Thus one who disputes in this in good
 German -- which he well then understands
 -- he awaits only one who comes to him
 to beg him to keep such art and subject
 secret, especially against authority.
 Then when he understands this a little
 in its fundamentals, thereafter no
 one can overcome him, much less the
 warwise that often know less how to
 discuss the whole of it.³

Nevertheless, as I know one such foundat-
 ion, thus it stands to me yet fairly
 this to answer, so I will everything
 -- which belongs to building -- examine
 faithfully in its place, and of an
 opinion at least shall see and
 feel, that the godly Germans, as well
 will understand to put forward
 the subject, and on such also at the
 same time know how to submit judgements.
 The insults and contempt yet involved.
 I will answer in this forward. And
 firstly that the Italians claim, that
 nothing in Germany is ever seen nor
 heard that we have not stolen from

1. Presumably small and distant bastions, with the use of intermediate 'piatta-
 forms'. See below p. 193/4.

2. I.e. If you do not know Latin you are uneducated and not fit to discuss
 the matter, and anyway our ideas are correct.

3. This is slightly obscure, but the value of a good ground is certainly central.
 Specklin's view of the 'warwise' here is probably not much different to what
 he clearly expressed later. See below p. 194.

dass wir de Italianern nit abgestolen haben/ abzuleinē weis ich nit wass sie in Italia habē/ meint er daß die grosse gebäu vnd Vestungen muss man sie fragen/ wo für solche gebawen werden/ dauon sie so grosse Bücher schreiben. Darauff sie nichts anders zu antworten wissen/ daß dass solche für dz grausam geschütz gebawen wordē/ wer hat daß nun dass geschütz erfundē? die Bücher dauon sie schreiben/ war hat dass Trucken erfunden/ kömt es nit von unss Teutschen her? welches zwō jneutiones vñ kunst jetzumal di höchsten in der Welt seind.....¹

f. (vilia). Was nun den Tractat an im selbst belangt/ hab ich dē/ in drey theil abgetheilt/ vnd ein jeden theil so kurtz/ vñ verstendlich/ als jimmer sein hat können verhandlet/ vnd so viel möglich aller frembden wörter mich entschlagen/ vnd allein bey vnserer Teutschen sprach gebliben/ auff dass es ein jeder Teutscher.....verstehen könne....ich im ersten theil handle/ wass zu einem neuen bau gehörig/ vnd ertliche vom Circkel/ quadranten grundlegungē/ fundamenten/ Mauren/ darnach grieff ich zu dē wehren vñ Bulwercken....Im andern theil....kom ich an die hohen halden/ Bühel/ vnd druckene ort/ wie daran/ vnd darauff zu bauen/ dergleichen auff die Berg/ vnd daß widerumb herab an die Flüß vnd See.....Im dritten vnd letzten theil/ handle ich gantz kurtz wie gross vnd kleine Flüß/ durch Stätt vnd Vestungen geleitet vnd geführt.

ff. 1a. EIN Jeder so ein Statt/ Schloss/ Marckt oder andere Vestung zerbawen vorhabens/ muss vorgender drey Puncten wol wissen vnd bericht sein/ auch gute erkantnuss haben/ fürs erst der Mathematica/ demnach der Mechanischen kunst/ als da seind die Handwerker/ Steinmetzen/ Maurer/ Schreiner/ Zimmerleut/

the Italians. I am not ignorant of what they have in Italy, considering the great structures and fortresses, of which one must ask, why such were built on which they write such great books. To which they do not know how to answer but that such were built against the ferocious guns: where now were guns discovered? The books they wrote on this, where was that printing discovered? Did it not come from us Germans here? Which two inventions and arts are now the greatest in all the world....¹

Coming now to the Treatise itself. I have divided it into three parts and in each part shortly and understandably, as far as it can be handled, and as much as possible eliminated all foreign words, and stayed only with our German tongue, so that every German....can understand....In the first part I consider what belongs to any new building, and firstly from the compass and square, to lay out foundations and walls. Thereafter I deal with the (flank) defenses and Bulwarks....In the second part....I come to the high slopes and hills, and narrow places, how therein and thereon to build, similarly for mountains and then further on rivers and the sea....In the third and last part I deal very shortly with how great and little rivers are led and carried through towns and fortifications.

Whoever intends to build a town, castle or market, or other fortification must the following three points well understand and be instructed in and have a good knowledge of: firstly of Mathematics, then of the Mechanical arts as are of the craftsmen, Stone cutters, Masons, Joiners, Carpenters, Smiths,

1. To printing and guns Specklin went on to add the rise of the reformation in Germany as showing the achievements of Germany. Of course all this does little to persuade the reader that German skill in fortification is to be valued.

Schmidt/ Schlosser/ Wagner/ etc.¹ Was in ein Bau gehörig/ So dann auch der Materialien/ als da seind Metal/ Holtz/ Stein vnd andere/ fürs drit der jetzigen Kreigerüstung/ in Schantzen/ Schiessen/ Geschütze/ jner vnd aussserhalb Lande/ zu Wasser zu Berg vnd Thal/ seitemal auss demselben/ die grösse/ hohe/ dicke/ breite vnd gantz stercke des Bawes genommen/ geordnet vnd angelegt werden muss.

So vil dann/ damit es desto bass verstanden werden mag/ die Mathematischen wissenheit belangt/ So muss in vornehmung neuer Vestungen vnd Bawe (dann mit den alten Stätten vnd Schlössern hats seinen weg) alle vnd jede gelegenheit fleissig betrachtet werden/ Ob nämlich das Land gut/ das Erdrich² weisst/ zur nahrung des Menschen vnd Vihes bequem/ eines gesunden Luftts vnd milten himels/ guten geländes/ guter gebaw sey/ gesundes Holtze/Wasserflüsse vnd Bronnen habe/ obs sumpffig oder Mosig/ damit die Wind kein böse Luft/ besonders Sud vnd West oder faule geschmack dahin treiben. Dann ob wol ein Architectus oder Baumeister kein vollkommener Astronomus oder Physica vnd anderer wissenheit ein a³ ausbund haben kan/ so soll er doch inn anlegung neuer/ auch verbesserung alter Baw/ auff das die nutzlich vnd bekömllich erbawen werden mögen....

cf. 1b. Die Grundlegung oder Topographia die verzeichnuss des ortts/ dahin neue Baw man anzulegen gedenckt/ belangende/ Ist dieselbige inn jedem Baw/ das recht Haupt vnd Principle stuck/ dann auss derselbigen alle rathschlag fliessen/ sintemal alle gebaw/ new vnd alt abgemessen/ vnd in den jungen Massstabe aussen/ vnd innen alle...verzeichnet werden muss.

45 In gleichem zu erwehlung der Materialien/ als Stein/ gebrante Stein/

Locksmiths, Cartwrights, etc. which are concerned with building. Then further the materials as Metal, Wood Stone, and the like. Thirdly of the present day armament of forts, shooting guns inside and outside, by water, mountains and valleys because from these the great, high, thick, broad, and whole strength of the building must be taken, ordered and laid out.

As much as to this basic understanding Mathematical science belongs, thus in undertaking new fortifications and buildings -- that with the old towns and castles have their way -- must all and every opportunity be carefully considered. Namely whether the ground is good, the earth rich to the nourishment of man and beasts suitable, a healthy air and mild climate, good land, good structures having healthy woods, watercourses, and wells; whether swampy or marshy, that the wind draws no evil air, particularly from south or west, or foul smells therein. Then although an Architect or Building master can have no perfect knowledge in Astronomy or Physic, and in other sciences, he can have an outline, so that in laying out a new, or improving and old, structure, they can be built usefully and beautifully....

The ground layout or topography relevant to the drawing of the place, in which one thinks to set out a new Building, is in every building the true, head and principal part, from which all council flows, because all building, new and old must be drawn and measured and set out to reduced scale, inside and out.

Likewise to chose the material as stone, burnt stone,² wood and other

1. In a way this is rather Vitruvian in the way that the architect is supposed to have knowledge of all sorts of fields. But in stark contrast to Vitruvius, Specklin insists not on the need for familiarity with the more 'bookish' disciplines, but with many practical crafts.
2. Brick ?.

Holtz vnd andere Materien mehr/ so
gibt die Musica durch erkentnuss deren
Harmonia/ als ein stuck der Mathesi/
* guten verstand vnd erkandtnuss/ dann
alles was klingt/ vnd ein Thon von
sich gibt/ ist allwegen besser/ dann
was keinen/ oder jedoch ein groben/
oder schwachen Thon oder klang hat/
derhalben was kernhaft satt vnd rein
ist/ als Stein/ gebrant Stein/ Holtz/
auch die Metal/ Ertz/ Stahel vnd Eisen
.....¹

f. 2b. Was den Cirkel belangt/ ist
desselben gebrauch vnd hoher nutz
nicht wol auszuzgründen dann ohne
denselbe nichts gemacht ist noch gemacht
werden kan/ Es kan nichts gebawt werden/
es muss sein mass vn Proportion haben/
vnd dieselbig kan durch anders nicht/
dann durch den Cirkel zuwegen gebracht
werden/ durch welches hülff ein jedes
ding inn sein gewiss Corpus gefasst
wird. Darnecht an dem Himmel vnd
alles so daran gehet oder laufft/ ist
alles von Gott den Allmächtigen/ inn
sein Circkelrunde gefasst/ dess gleichen
Sonn vnd Monn/ vnd das Erdrich hat
alles ein Circkelrundes Corpus.

Die weil dann nun der Cirkel, das
älteste Instrument ist, vnd von vnsern
vordern hochgeach worden/ wie er dann
hoch zuachten ist/ ist auch zu vnserer
zeit auss lieb zu demselben/ von sinn-
reichen Leuten derselb sehr gebessert/
vnd in ein geschwinde richtig theylung-

materials, here, music gives, through
understanding harmony, as a part of
mathematics, good understanding and know-
ledge, for when all are sounded, and
give out a tone it is always better than
that which has none, or always a coarse or
a weak, tone or sound, which is
internally full and pure, as in stone,
burnt stone, wood, also Metal, brass,
steel and iron....¹

The compass involves that usage and
great benefit that nothing can be well
set out without, it nor is or can
be made. Nothing can be built but it
must have its size and proportion,
and this can be done in no way but by
way of the use of the compass, through
whose help is everything in its true body
fixed. The six² of the heavens, which
there go or exist are all by Gods
the Almighty in a sphere fixed,
similarly the sun and moon, and the
earth have spherical bodies.

Thus because the compass is the oldest³
Instrument and by those before us
highly esteemed, so it is to be highly
praised. It is also in our time, from
love of it, by ingenious workers
itself much improved, and in a quick
exact dividing is employed.....

1. Specklin seems to mean simply that the material gives out its 'true' tone when it is sounded. His dragging in of 'harmony' as a branch of mathematics here, is rather gratuitous. Of course Vitruvius dealt in some detail with harmony. (Bk. V, Cap. IIII) He equally used much the same notion as Specklin's in the tuning of catapults. But the mathematical approach to harmony was explicitly tied up with the design of theaters and their acoustics, in a rather elegant way, in Vitruvius. In contrast Specklin, attempted, to associate this rather esoteric field of mathematical music with the, certainly useful, but very much rule of thumb craft practice of testing materials by note for their soundness which practice can hardly have been illuminated by any such study.

2. Planets.

3. In the sense of being the most fundamental.

brecht worden.....¹

f. 5a. Will man dann ein Bau/ Statt oder Schloss just inn grundt legen/ vnd verzeichnen/ muss man ein starck Linial/ vnd Messstangen nehmen/ so 10 Schuch....vnd durch 2 Personen halten lassen/ als dann halt man den quadranten...²

When a building or town or castle will be truly on the ground, laid and drawn out, one must take a strong line and measuring rod of 10 feet.... and two people able to hold it, and the square is held....²

f. 6b. Wann dann nun nach gehabter berhatschlagung ein solcher Platz geraumt/ vnd im plano ligt/ so muss im Centro ein stercker Pfal geschlagen werden/ so im Diameter völig eins Schuchs dick ist/ vnd inn der mitten ein grossen eysen Nagel/ so auff 1 1/2 oder 2 Zoll im Diameter dick/ vnd auff anderthalb Schuch lang/ inn den Pfal geschlagen werden/ vnd dann auff 10 Schuch darvon auff Pfälen zwen Schuch hoch Dielen oder saubere Breter im Cirkel auff genagelt/ vnd vom Centro ein runden riss darauff gemacht/ vnd soveit ect oder Bollwerck/ das Castell oder Bau haben soll/ also viel soll es theilung haben.³

Now having considered such a place, spacious and lying in a plane, then must a stronger pile in the centre be driven, that in diameter is fully a foot thick and in its middle a great iron nail, 1 1/2 or 2 inches in diameter thick, and 1 1/2 feet long, driven into the pile, and then 10 feet off from the pile, two feet high, planks or wrought boards in a circle nailed, and around the centre a circle made by a groove: and as many points or Bastions the castle of building shall have, so many should it have.³

f. 17b.³ Es hat aber Key. Carle der V. solche Statt berhatschlagen lassen/ vnd im Jahr 1540 durch M. Frantzen der Statt Antorff Baumeistern/ welcher in kurtzen Jahren noch gelebt/ zubauw angefangen.....Im Jahr 1577...ich Jhnen befragt/ ause was

The Emperor Charles V however allowed such council on the town, and in 1540 through Master Franz, the building-master to the town of Antwerp, which existed a few years later, began to be built....In 1577....I asked him, firstly

1. Specklin seems here to be referring to the actual physical object as being mechanically improved, as well as to improvements in its use. In modern English there tends to be a distinction in this context between a compass -- that is an instrument typically provided with a pencil or pen, for scribing a circle; and a dividers, which is similar but with two metal points and which is typically used for setting to, and transferring a particular dimension. Of course this second type of instrument can equally be used for scribing a circle, by scratching and indenting the relevant surface. It was this second type of instrument that was so used both in this period and earlier, and that was referred to when a compass was mentioned, by Specklin and the like. But Specklin's first copperplate (after f. 2) gave some very nice illustrations of the instrument he was concerned with, which in fact was a set of tools consisting of two arms which crossed at a junction to give a pair of opening legs on either side of the junction, the different instruments he showed each having a different ratio between the lengths of the pairs of legs on opposite sides of their pivot. The ratio between the openings of the legs on one side of the pivot to the opening of those on the other was then constant for each instrument, but varied from instrument to instrument to give the ratios 1/2, 1/3, 1/4, 1/5, 1/6, and 1/7, as he indicated in his illustration and confirmed by his text (f. 2a.). (These instruments then as a set were roughly equivalent to what is now known as a proportional compasses, which is in fact only one instrument but with an adjustable pivot to give the same effect.) Clearly these compasses of Specklin's could be used for reducing or increasing drawings, and for dividing lines into the fractions they represented. Thus reducing to a mechanical process, what otherwise would have been more geometrical.
2. Specklin gave a good deal of this sort of practical and low level description here and below.
3. A discussion on the enceinte of Antwerp.

ursachen er erstlichen die Bollwerck also weit vñ einander gelegt an der Statt....Darauff er mir antwort/ dass Key. Carle der V. als man die Statt gberahtschlagt het/ an solchem schuldig sey gewesen/ daß er d'Keyser....durch an weisung etlicher Obersten.... beredt were. Da aber M. Frantz gegenpart heilte.....

* Auss des Keyzers/ auch deren Obristen Rathschlagungen/ ist dieser bau also fort gangen/ darum darff man nit allwegen dem Baumeister die schuldt geben/ wañ ein ding nicht recht wirdt/ dann

* Potentaten vñ Oberkeiten/ sich offft selbs vberreden/ wañ sie Kriegsverstendige hören/ auch etwan Landtstreiffer/ die sich vieler künst ausstun.

for what reason he laid out the bastions of the town so far apart...On which he answered me that as the Emperor Charles V was the one who advised on the town he should be held to blame and the Emperor was counselled by some of his captains....On this however Master Franz held the contrary....(but) from the advice of the Emperor and also of his Captain counsellors

this building went forward, whereby one does not always hold the Architect responsible, when something is not right, rather great lords and those in authority who themselves are often persuaded, when they hear a warwise man, or sometimes an armyman, which despoils much art.

PAUL IVE

The Practise of Fortification (1589)

Bibliography: London 1589.

General description: A very slight treatise. 5½" x 3½" text. (iii) + 40 pages. Some illustrations in the text and pull out illustrations.

Contents:

p. (i): Title page: THE/ PRACTISE/ of Fortification:/ Wherein is shewed the manner of/ fortifying in all sorts of scituations, with / the considerations to be used in delining,/ and making of royal frontiers, Skon-/ces, and renfor- cing ofould/ walled Townes./ Compiled in a most easie, and compendious method,/ by Paul Iue. Gent./ Imprinted at London by Thomas Urwin, for Thomas/ Man, and Toby Cooke. 1589.

p. (iii/iv): Dedication to Sir William Brooke.

p. 1/6: Cap. 1/2: Locations of fortresses and their sites.

p. 6/27: Cap. 3: p. 6/13: The standard way of laying out the pointed bastion, and the dimensions to be used.

p. 14/27: Different parts of the structure individually discussed.

p. 29/34: Cap. 4: Earth fortifications.

p. 35/40: Cap. 5: Fortification of old walled towns.

The Practise of Fortification: Texts

p. 2. WHO so shall fortifie in playne ground, may make the fort he pretendeth of what forme or figure he will, and therefore he may with lesse compasse of

1. I.e. against the Emperor and his counsellors that the bastions should be distant.

2. Specklin argues here, roughly, that one should not keep a dog and bark oneself. If someone employs an architect, the advice of the architect as the expert should be listened to even against the views of very experienced generals and other counsellors of state: if one does not one is only too likely to make some bad mistakes.

3. Only edition known. fcs. Amsterdam 1968; England 1972 ed. BIDDLE, M (Greg International Publishers). DNB however notes a 1599 edition.

4. I.e. fortresses

will enclose a more superficies of ground, then where that scope may not be had. Also it may be the perfecter, because the angles that do happen in it, may be made the flatter or sharper.¹

p. 6. IN the delineation of a Fort that shall serue for a royall frontier,² the figure triangular is not to be vsed at all, nor the quadrant, but only in those watrie grounds where it can not be approached, neither is the cynqueangle to be chosen for any perfection that is in y figure, for this purpose (although that many good Forts are made in that forme of the Casteil of Antwerpe, the citadell of Turyne and others) but rather for sparing of charges in building and mainteing the fort, for the exteriour angles of the bulwarks placed vpon the angles of those figures, do fall out sharpe, and therefore are weake to resist a batterie, and hard to be defended, but in other figures they become flatter.....All which being considered, lyne out the Fort you pretend, if nothing do hinder the deliniation, not that any part may be less approachable then other with equall sides and angles; but if any part may be better assured of the scituation then the rest, on that side lay out the longer sides and sharper angles, or both, to the intent the other part more easie to be approached, may be the more defenceable:³ yet heerein there must be a foresight, that the Fort may fall out as circular as possible it may....

p. 8. But to returne to the practise of the deliniation, being vpon the ground to be fortified, take good view where it were necessarie the bulwarks which are the chiefest and royalest defences should be placed....And where you determine to place a Bulwarke, there set downe a stake, and stretch a lyne betwixt stake and stake, and with a Spade make a little cut along the lyne....

p. 12. And when you haue thus lined out the fort and his ditch....for the angles of the Bulwarkes begin a newe riüiew, to see if any thing, either in the placing of delining might be amended. For if any fault should be escaped, it were now time to amend it before any ground bee broken: which the Duke of Alua and the Marques Vitell considering, caused the Castle of Antwerpe after the first marking to be delined a newe in māy parts, correcting their first escaped negligences and errors. (Here note, that in this busines the opinion of the Souldier who hath had experience of the defence, and offence, is to be preferred before the opinion of the Geometrician,⁴ or Mason, who are inexpert, of the practises than an enemy may put in execution)....⁵

p. 35. For that the Townes enclosed with weake walles of stone, and defended with small, square, or round towres, are insufficient to abide the mallice and offence that an enemy at this day may put in practise, the Cannon being an engine of much more force then any before it inuented. To resist whose violence, other meane cannot be giuen, then to rampier those walles within, and make greater and royaller defences without....

1. I've is a bit peculiar here. He stated quite reasonably that on a flat free ground one may choose whatever shape one wants and hence make it the best shape. But, it was common coin that this involved making the bastions more obtuse, hence his remark that they may be made 'flatter or sharper' is slightly odd.

2. Or fortress.

3. I've very rapidly drifts here from consideration of the ideal trace, to its adjustment in practice.

4. Designer or architect.

5. Cf. Specklin above p.193/4 where the specialist designer is shown to be right and errors to arise when such high figures take their own counsel.

Problematum Geometricorum (1st. ed. 1583)^{*1}: Texts

p. 3. GEOMETRIAE, mediusfidius, vtilitas magna, imo vero necessitas. Et vero, quid tandem non illi feremus acceptum? Ponamus nobis ante oculos pauca quaedam ex multis, sine quibus certè neque commodè, neque omnino benè viuatur. An non hinc domicilia, an non & vrbes? an non vestes, omnisque suppellex? an non omnia cum pacis tum belli instrumenta?

De Weeghdaet (1st. ed. 1586)²: Texts

p. 3. GHELICT onnutte cost vvaer, een groote stercke grondt te legghen, die een svvaer ghesticht draghen can, sonder eintlick eenich ghebau daerop te vvillen brenghen: Alsoo is de speigheling inde beghinselen der consten verloren arbeydt, daer t'einde totte daet niet en strict, Ghelijck oock na de natuerlicke oirden, dien grondt voor t'opperghebau gaedt, alsoo dese speigheling voor huer daet.

p. 68....³Wy de Weeghconst....een vrye Wisconst ghenoeemt hebben....dat haer wetenschap den menschen daeren bouen seer nut is, soo wordense met recht vrye consten ghenoeemt....nadien de sekerheyte in haer bestaende, de gheuisheyte van d'ander Constent verre te bouen gaet, soo wordense billichlick daer beneuen, Wisconsten gheheeten. T'selue is om der ghelijcke redenen vande Weeghconst oock te oirdeelen.....Voorts dat sy duer haer uysterste beghinselen, in sulcken gheuisheyte bestaat als die, soo seel sy om haer ghemene reden, een besonder vrye Wisconst ghenoeemt worden.

Geometry, U God, is of the greatest usefulness--on the contrary-- a true necessity. And in fact, what, in the end, do we not get from it. Let us remember what few things out of many without which certainly neither ease nor the good life is lived. Are not from it homes and towns?; and clothe/s and all furniture?; and instruments for both peace and war?

Similarly as it a useless cost, to lay a great strong foundation, that can suffice for a heavy structure, without in the end wishing to bring up on it any heavy structure, thus theory in the elements of the arts, is lost labour if its end is not directed towards practice. Similarly also in the order of nature, as the ground preceds the superstructure, thus theory goes before practice.

...(why) we have called 'the art of weighing' a liberal Art....(Now concerning arithmetic and goemetry) because men's knowledge of them is very useful, thus are they rightly called liberal arts.....(and) since the certainty inherent in them far exceeds that of other arts, thus they are legitimately called (true) Arts also. The same for similar reasons can be said of the Art of weighing...Further because in its fundamental principles is the same certainty as exists in them, thus for this common reason, is it named a particular liberal (branch) of mathematics.

1. At Antwerp. Date after VAN DE VELLE (1948). For further details and bibliography see the same. STEVIN (1955/66) Vol. IIA p. 134/5.

2. At Leyden by Plantin. STEVIN (1955/66) Vol. I p. 287 on. This work appeared as part of a uniform edition with Beghinselen der Weeghconst and the work from which the next section comes.

3. Of the first edition.

4. Marginal note "Theoria".

5. Marginal note "Effectum".

6. From De Beghinselen des Waterwichts "Anhang" Cap. III. STEVIN (1955/66) Vol. I. p. 514.

p. 69. DE gheleerden maken oderscheyt
tusschen Wisconstich ende Werckelick
beweys: T'welck niet sonder reden en
is, want dat is ghemeen over allen,
soock grondelick d'oirsaeck verclarende,
dit besonder allenlick op t'ghegheuen,
sonder kennis der reden waerom dat also
gheschiet.

The learned make a distinction between
mathematical and mechanical proofs,
which is not without reason, because
the first is general over all (cases)
and further clarifies fundamental
reasons, the latter to the particular
given case only, without knowledge of
the reason why it happens thus.

Der Sterckenbouwing (1st. ed 1594)*

Bibliography: Leyden 1594*³; Amstelredam 1624*⁴. German translation Franckfort am
Mayn 1608*⁵; Franekfort. am Mayn 1624. French version Leyde 1634.

General description: (vii) + 91 pages. A good many diagrams in the text. Illustration of a bastion; of a front of two bastions with curtain; and a full plan of a hexagonal fortress.

Contents:

p. (i): Title page: DE STERCKENBOUWING, / Beschreuen / door / SIMON STEVIN / van Brugghe, / TOT LEYDEN, / By François van Ravelenghien, / M.D.XCIV.

p. (ii/v): Dedication to "Ionker Hendrick van Brienem".

p. (vi/vii): 'The Argument', on the structure of the work.

p. 1/7 Cap. I: Definitions.

p. 7/27: Cap. II: A hexagonal fortress, with details, particularly of the bastions, and its various dimensions, along with the production of the necessary drawings, discussed.

p. 27/32: Cap. III: Setting out the actual fortress.

p. 33/34: Cap. IV: Setting out of the regular fortresses of other number of sides, full size and to scale.

p. 35/39: Cap. V: On the need for the pointed bastion.

p. 39/71: Cap. VI: Many points of detail of the structure and the different solutions that can be adopted, with regard to regular fortresses.

p. 71/91: Cap. VII: Irregular fortresses; their various problems, and the disadvantages and advantages of different sites.

De Sterckenbouwing (1594): Texts

p. (ii). DE stercken dese tijts, welck- The fortresses of these times, which
men stercken noemen mach, te waten (truly) can be named strong, that is,

1. Marginal note "Mechanicam".

2. This is rather odd. A proof, for example, of the construction of the pentagon, may apply to that particular case only, yet give reasons and show why it must be so, in contrast to any mechanical (approximate) solution which does not. Proof and generality are distinct and independent notions, although Euclidean proofs tend to apply to general types of triangles, and this was possibly what Stevin was thinking of. If such proofs are then contrasted with special triangles with numerical values attributable to their variables, which can be 'solved' by reference to sine tables, for example, one gets an idea of what Stevin may have been after.

3. STEVIN (1955/66) Vol. IV, p. 38/231.

4. VAN DE VELDE (1948).

5. Irs. Levinus Hulsius.

6. Stevin began this chapter by admitting that men have different tastes in building fortresses, as in other areas, but he stated "in the building of fortresses the architects ideas are not so wholly different but that by natural feeling (natuerlick ghevoelen) they have something in common, some scope that they aim at, so that who so repugns (sulx dat hy die t'selve teghenstaet) is thought to strive against common feeling", and then went on to give the standard historical justification of the pointed bastion, as this inevitable universality.

7. From STEVIN (1955/66) Vol. IV, as all the sections below.

die door¹ wisconstich beleyt, met sicht-
stralen² opt meeste voordeel gheteyckent
worden.....

p. (iii)....de Aristotelisten beftelick
ghenouch vande Dirden straden, maer
metter daet weynich Oirdens ghebruyckten
.....Ramus meining van dies tot een
* goet einde streckte.....hebbe my
Euclides (die ick acht int stuck des
Oirdens, onder de ouden wat besonders
te wesen) in ettlicke punten wel laten
bevallen....⁴

p. (iv)....mijn meyning altijd was,
dat der Spiegheleers spiegelhingen,
* tot voordering van der Doenders daden
connen strecken.....

p. 7. WANTMEN de sterckten al veroir-
dent moet hebben....eermen ant bouwen
comt....soo ist inde ghebruijck, dat-
men van te vooren verscheyden formen
teeckent, na gheleghentheyte der plaets,
ende den eysch van allen omstandighen,
op dat de personen die daer af te spre-
ken hebben, deur soodanighe formen mal-
scander wel verstaen meughen, ende
eintlick het beste daer af besluyten.
Dese formen worden ghemaect op
tweederley wijze, eerst int platte op
papier, daer na lichamelick van
poteerde, was, hout, of ander stof,
eintlick comten tottet eyghen ghebou.
Om welcke natuerlicke oirden hier oock
te volghen, soo nemen wy eerst voor
de teyckening van een volcommen⁷ ses-
ghouckighe evesijdeghe sterckte, int
ront bescrivelick, sonder ons te be-
commeren, niet eenich belet, achterdeel
of voordeel van onligghende hoogden,
laegden, Zeeen of marasschen.....

40p. 22. WANT de voorgaende grontteijck-
enighe alleenlick bethoont der stercken
ghestalt int ansien van langde en

1. Marginal note "Mathematicam operationem radus visualibus".

2. STEVIN (1955/64) translates "sichtstralen" as "auxiliary lines" yet the root meaning is clearly here: sight, beams or rays. Clearly the sightlines of the defensive guns, in other words in accord with the notion of flanking fire, which thought is completely missing from "auxiliary lines", as his marginal note emphasised.

3. Just previously, Stevin gave a marginal note against "Oirdens" of "Methodi".

4. Stevin here in his dedication to Lord Hendrick van Brienen explained that part of his reason for publishing his work was to show the method he had learnt from the dedicatee ("te toonen des Oirdens die ick van V.E. doen sy haer met my inde Wisconsten oeffende, gheleert heb...") who held such opinions. How laterally he should be taken here, in view of dedications of the period tend- ing to impute very great abilities to their dedicatees, is rather unclear.

5. Marginal note "Theoricum theoriae".

6. Marginal note "Practicorum effecta".

7. Marginal note "Hexagonum castrum aequilaterum circulus inscriptibile".

those by mathematical methods with
sight-lines² to the best advantage
drawn.....

....the Aristotelians disputed viol-
ently enough on Method, but in the
matter of practice employed little
method.....Ramus' opinion on this was
directed to a good end....(but) I have
been by Euclid -- whom I consider in
point of method, amongst the ancients,
particularly apt -- in several points
greatly satisfied.....⁴

....my opinion always was that the
theories of the theoreticians, can
direct the regulation of practioners
arts.

Fortresses must be designed...before
the building is undertaken...thus it
is the custom, that first the different
forms are drawn, according to the
opportunity of the place, so that every-
thing concerning it, all the people who
have to speak of it, can well understand
it through such figures, so that further
the best thereon is resolved. These
figures can be made in two ways.

Firstly in a plan on paper, then in
a model of potters earth, wax, wood,
or other material and finally one comes
to the actual building. Which natural
order here to follow I take first the
design of a regular evensided hexagonal
fortress, described in a circle, with-
out being troubled by any hindrance,
disadvantage or advantage of nearby
heights, or low grounds, sea or marsh
.....

Because the foregoing ground plan
only shows the figure of the fortress
in respect of length and breath and

breede, ende dat de¹spieghelinghe vande gheleghenthey in hoochde of diepte tot volcomen kennis seer noodich is, soo sullen wy nu ande verheven teyckeninghe commen; om den sin van welcke wat breeder uijt te legghen, soo neem ick dat ein lichamelicke stercke, doorsneden wort met een²oneindelick plat door t'³middel tusschen twee bolwercken (sulcx is de gebruijck van doen byde⁴Wisconstnaers, die alsoo hemelen ende eerde doorsnien, om te vinden wat inde ene staet)....

p. 27....ons nemende datter te bouwen sy op plat even landt, een sterckte... van⁵evesijdich seshouck int rondt beschriuelick, elcke sijde lanck 1000 voeten: welcke form by anderen ghemeenelick gheteyckent wort deur t'⁶behulp eens⁶platcloots....Maer om op⁷corter tijt, ende met minder moeyte alles volmaecter te hebben, soo soude ick (volghende de ghemeene regel, welcke inhoudt dat de grootste⁷wisconstighe reetschappen de sekerste sijn) daer toe nemen twee evelanghe coorden, elck van 1000 voetē.....

p. 34. Ghenomen dan datmen begheert ein vijf houck, hebbende elcke sijde van 1000 voeten, vraghe hoe lanck dander coorde sal moeten sijn, die de halfmiddellijn beteekent, om effen uijt te commen? Men sal sien in een⁸boochtafel, wat⁸reden de⁸halfmiddellijn xheeft teghen de peze ghetrocken ondet den booch lanck wesende een vijfde deel des rondts, dat is een hooch van 72⁹trappen, ende wort bevonden van 1000000 tot 11755704....comt voor⁹begeerde lengde van dander coorde 805 voten $7 \frac{9529272}{11755704}$ duym.....

p. 55...soo de viant sonder¹⁰muerbrake de groote gordine met leeren bestormt, in sulcken gevalle schietmen uijt de

because speculation on the opportunity of height and depth is very necessary for the fullest knowledge, we will now come to the raised representation¹¹ concerning the meaning of which, to better explain, I take it that a solid fortress, is cut through with an infinite plane through the middle between two bastions -- as is the practice of mathematicians that thus cut through heaven and earth to find what is the section....

...we assume a fortress to be built on a flat even plane....equilateraly hexagonal in a circle described, each side 1000 ft. long, which figure by others is generally laid out with the aid of an astrolabe (or the like)... But to have it in less time with less labour all well made, I would -- following the general rule, which has it that the greatest mathematical instruments are the surest¹² -- thereto, take two equal ropes, each 1000 foot (long)....

Assuming that a pentagon is desired having each side of 1000 feet, then how long should be the rope that represents the radius, to give a good fit? One must look in a table of sines, what is the ratio of the radius to a cord drawn under an arc that is one fifth part of the circle, that is an arc of 72 degrees, and it will be found of 10,000,000 to 11, 755,704....the desired length of the rope comes to 805ft.

$7 \frac{9529272}{11755704}$ inches....

....if the enemy without a breach, storms the great curtain with ladders, in such circumstances one shoots from

1. Marginal note "Contemplatio".

2. I.e. elevations roughly, but including sections.

3. Marginal note "Plen infinito".

4. Marginal note "Mathematicos".

5. Marginal note "AEquilaterale hexagono circulo inscriptibile".

6. Marginal note "Planisphaerij seu Astralabij".

7. Marginal note "Mathematica Instrumenta".

8. Stevin seems to mean here not merely physical instruments, or gadgets, but also intellectual devices, for here he describes setting out a hexagonal fortress by means of equilateral triangles, using ropes.

9. Marginal note "Tablum Sinuum".

10. Marginal note "Rationem".

11. Marginal note "Semidiameter".

12. Marginal note "Graduum".

13. Marginal note "Brecke".

strijckhoucken met keyen ende keten-
gheschot, t'welck groeter moort der
vianden doet....

p. 88.¹de² Boumeester en can de
sform niet kiesen diet hem belieft,
maer moet hem na da gheleghenthey
ghewoughen, nemende meer plaets dan hy
van doen heeft, ofte min dan hem
behouft.

the flank, with stones and chain shot,
which do great murder to the enemy...

¹....The architect can not choose the
figure that pleases him, but must
adapt according to the situation,
taking in more space than he would,
or less than is needful to him.

Wisconstige Ghedachtenissen (1st. ed. 1605/8)³

no⁴Soo is de stof des⁵ Zeeschrifts
een der besonder oirsaken gheuveest,
die hem⁶ track totte begheerte en oeffen-
ing der⁷ Visconsten: Sulx dat hy deur-
sien heeft al het oirboirste en diep-
sinnichste dat van die stof mijns
uuetens gehandelt uvert.

Thus the subject of hydrography was
one of the particular causes that at-
tracted him to the desire to practise
in Mathematics. Such that he consid-
ered all the most useful and ingenious
things that to my knowledge have been
said on the subject.

⁸ANGESIEN ervaringen de sekerste
gront sijn.....daermen ghemeene reghelen
uty treckt, om tot kennis aer saken te
wcommen, en dat ons deur deser landen
grote seylagen, bequamer middel ont-
moet d'ander te vooren gheuveest is,
om te geraken tot veel gheuvisse ervar-
inghen der eyghenschappen van ebb en
vloed: So heeft my tottet bevoorderen
van sulcx, oirboir ghedocht van dese
stof een⁹ Spiegeling te beschrijven,
ghegront ten deele op ervaringhen die-
men nu heeft, ten deele op stelling
die de natuedlicke redenlijck formich
schijnt....Angaende ymant decken mocht,
dattet van my voor t'uytgeven van desen
vougheucker uvaer gheuveest, sulcke
dingen eerst sekerlick ondersocht te
ghebben, of doen ondersoucken: Hier op
segh ich....heeft my dit de bequaemste
uwech ghedocht, om op corten tijt veel
bescheyt en sekerheyt te krijgen.....

Since experience is the surest ground
....from which to draw out general
rules, in order for knowledge to come
of things, since we, because of our
countries' great voyaging know better
means than others before, for obtain-
ing many definite experiences of the
properties of ebb and flow: Thus it
seemed to me suitable to further this
to describe a theory of the subject,
grounded in part on experiences now
available, and in part on assumptions
that present the characteristics of
the form of natural reasons....If any-
one should think, that before my
publishing of this treatise, it were
better to have first in this subject
securly researched or have had resear-
ched, on this I say....it appeared to
me the best way in a short time to
acquire much information and certainty
.....

1. Under the disadvantages of hilly sites.

2. Marginal note "Architectus".

3. For bibliography see VAN DER VELDE (1948) Texts from the work along with English translations can be found in STEVIN (1956/66) at various places.

4. STEVIN (1955/66) Vol III, p. 505. Wisconstige Ghedachtenissen Pt. I: Vant Weereltschrift. Sect. (ii): Vant Eertclootschrift, p. 86. Bk. 4 Van de Zeylstraken.

5. Marginal note "Hydrographias".

6. "His Princely Grace as Admiral" = Prince Maurice.

7. Marginal note "Mathematicarum artium".

8. STEVIN (1955/66) Vol. III p. 330. Wisconstige Ghedachtenissen Pt. I, Sect. (ii): Vant Ertclootschrift, p. 178, Bk. 6: Van de Spiegeling der Ebbenvloed.

9. Marginal note "Theoriam".

1.ich segh dat gelijk ymant die in Caert wil brenghen een Lantschap dat noyt caertische wijze gheteychent en was, of daer hem gheen teyckening noch sonderrichting af ter handt ghecommen en is, soude moeten het Landtschap of self dadelich besien, of seker onderrecht hebben vande gene diet dadelick gesien hadden: Alsoo eenen die mede manier des loops der Dwaelders....

...I say that similarly as one that wishes to put a region into a map of which no known map has been drawn, or of which no representation or report is come to hand, should either himself actually inspect the region, or secure reports have from one who had personally seen it. Similarly herein: the nature of the planetary circuits...

2. Ick noem dese wercking wisconstich, tot onderscheyt der wercking ghetrocken uyt ervaringhen int eerste bouck, en hoewelse dickwils deur rekeningen met tafels in geen heele volcommenheynt der getalen en bestaet, gelijk in volcommen wisconstighe wercking vereyscht wort, nochtans anghesien daer is een voet van oneindelicke naerdering, smettet wisconstich groote ghemeenschap hebbende, en de bewijsen ooch wisconstich sijnde, soo schijnet datmense om t'boveschreven onderscheyts wille wisconstich noemen mach.

I call this treatment mathematical to distinguish it from the treatment drawn out of experience, of the first book, although often concerned with reckoning with tables of no complete perfection of accuracy, as in perfect mathematical operations are required. Nevertheless, since there is a basis for infinite approximation, having a great deal in common with mathematics, and the proofs also being mathematical, thus it appears from the outlined distinction it can be called mathematical.....

3. ALSOO sijn VORSTELICKE GHENADE⁴ hem dickwils oeffende in te trecken⁸ grontteyckeninghen, en⁶ stantteyckeninghen van sterckten,....heeft oirboir bevonden hem oock te oeffenen inde derde⁷ afcomet der teckening te uveten⁵ het⁹ verschaeuven of schilderen...om daer deur anderen sijn meyning, alst de saeck vereyscht, lichtelicker te verclaren.....Doch vvant de vercorting⁵ der linien, en verandering der houcken uyster ooghe, of byder gisse toeginck, en heeft hem, hou vvel het sijn oirboir ghebruyck can hebben, daer me niet vernought, maer vullen een voorghestelde⁵ verschaeulicke saeck volcomelick afteyckenen, mit kennis der oirsaken en sijn⁹ vvisconstich bevvijs.

As his princely Grace⁴ often exercised himself in drawing ground plans and elevations of fortresses.....he found it useful to practise also in the third type of drawing, that is in perspective or painting....in this way to easily clarify his meaning to others as the business required.... However because of the shortening of the lines and the alteration of the angles was obtained by sight or guessing, however useful these can be, he was not satisfied but wished any form in a perspective manner truly to draw with knowledge of the causes and their mathematical proof.

1. STEVIN (1955/66) Vol. III, p. 50 Wisconstighe Ghedachtenissen Pt. I: Vant Weerschrift. Sect. (iii): Van den Hemelloopen p. 15, Bk. I.
2. STEVIN (1955/66) Vol III p. 110, Wisconstighe Ghedachtenissen Pt. I, Sect. (iii) p. 118, Bk. II.
3. STEVIN (1955/66) Vol. IIB p. 800; Wisconstighe Ghedachtenissen Pt III: Van der Deursichtighe Bk. I: Vand der Verschaeuwing, p. 4.
4. Prince Maurice.
5. Marginal note "Ichnographias. Plans".
6. Marginal note "Orthographias. Profils".
7. Marginal note "In tertie specie".
8. Marginal note "Scenographia, seu Sciographia".
9. Marginal note "Mathematica demonstratione".

CLAUDE FLAMAND

La Guide des Fortifications (1st. ed. 1597)

Bibliography: Montbeliard 1597.

General description: Small format work. Small diagrams and illustrations in the text. 204 + (xvi) + 227 pages. 5" x 3" text.

Contents:

- p. 1: Title page: LA/ GUIDE DES/ FORTIFICATIONS ET/ CONDUITTE MILITAIRE, DV/ sont contenus sept livres de Mathematic-/que, & Geometrie, contenant ce qu' est/ le plus necessaire pour l'vtilite de/ la vie humaine./ AV ROY,/ Tres-chrestien Roy de France, & de Navarre./ par/ CLAUDE FLAMAND Ingenieur du/ Duc du Vvirtemberg,/ A MONTBELIARD,/ Per IANVES FOILLET. 1597.²
- p. 3/9: Dedication to the French King.
- p. 10/11: Au lecteur.
- p. 12/16: Table of chapters.
- p. 17/47: Bk. I: On 'right lines', concerned with surveying.
- p. 48/204: La guide des fortifications et conduite militaire.
- p. 48/80: Preliminary general remarks about warfare.
- p. 81/184: "La maniere de Fortifier les Villes et Trasser les Forts". Bastion fortifications handled by means of fairly general remarks, dealing with regular and irregular traces. Not a great deal of information about the details of structures given. A number of small plans of regular and irregular fortresses appear in the text.
- p. 184/204: Siege warfare and forming a 'battle' in the field.
- p. (1): New title page: LES/ MATHEMATIC-/QUES ET GEOMETRIE,/ DEPARTES EN SIX LIVRES....1597 Montbeliard.
- p. (iii/vii): Dedication to the "Duc de Vvirtemberg & Teck, Conte de Montbeliard", dated 24 August 1597 at Montbeliard.
- p. (viii/xvi): Definitions, mainly geometrical.
- p. 1/22: Arithmetic.
- p. 23/52: "Le premier livre de geometrie...des progressions & proportions Geometriques".
- p. 53/109: Le second livre des Fractions Geometrique.
- p. 101/145: Le troisieme livre de Geometrie de la mesures des superficies plainnes.
- p. 146/170: Quatriemelivre de Geometrie de lart & pratique d'Arpenter.
- p. 171/200: Cinquieme livre de Geometrie de la mesure des corps solides.
- p. 201/227: Le Sixieme liure de Geometrie....de la proportion des forces mouuant, par le moyen du contrepoix.
- At. end: de Montbeliard, ce 20 iour de moye d'Aost 1597.

1. Les Mathematiques et Geometrie (Montbeliard 1611) by the same author is a further edition somewhat altered, omitting the section on fortification.
2. The title page contains a portrait with, at its sides: "DIEU faict ses secrets paroistre/ à ceux qui l'ont en honneur/ & leur monstre & faict cognoistre/ de son contract le teneur. Psal. XXV."
3. Irregular pagination.

La Guide des Fortifications: Texts

p. 3 Sire outre le grand plaisir & contentement que la diversité des industries, & sciences donne à l'homme, le souverain bien, qu'il en peut recevoir, n'est pas de petite estime entendu mesme, qu'à la recherche d'iceux, sont trouvez les moyes les plus propre & vtilies, pour les affaires de la vie humaine: ce que nous voyons par mescrit, que les nobles anticques, n'ont jamais m'esprisé les arts & sciences, & principalement les grands Roys, Princes, & Potentaux, lesquels de tout temps sont esté curieux à recercher les sciences & industries, tant pour l'vtilité de leurs affaires, que pour le cõtentement, & plaisir qu'ils prennent d'en avoir la cognoissance. Car c'est le propre, & la vertu de l'homme seul, de rechercher la cause de toute chose: ce que par industrie & diligence, il a trouué la science de tout Art: par son esprit il a recerche, & descouvert l'essence, nature & ressort, de ce qui est contenu en tout l'univers: encores son esprit est bien monté plus haut. Car il a penetré iusques aux cieus, & a comprins le cours, & reuolutiõ du Soleil, de la Lune, des Estoilles, des Astres.....Or le profit qui reuiët, de quelque chose excellente, est le principal, qui induit les hommes, tant à recercher la cognoissance des sciences, que la iouissance d'icelles, principalement es Mathematicques, & Geometries, où sont contenus tant de secrets innombrables, qu'elles contiennent en elles: tellement que l'on peut asseurement dire, que les beaux effects qui pro- uiennent des sciences nobles, notamment des Mathematicques & Geometrie, sont comme les appuis de la vie humaine. Car c'est la vray & seul science qui enseigne toute discipline & industrie, pour la conduite de tout art, &

Sire, besides the great pleasure and contentment which the diversity of industries and sciences gives to man, the sovereign good, which he can receive, is not of little value, understanding that from the research of these are found the most proper and useful means for the affairs of human life: whereby we see written, that the nobles of old never scorned the arts and sciences, and especially the great Kings, Princes and Potentates, who at all times have been curious to inquire into the sciences and industries, as much for the utility of their affairs, as for the contentment and pleasure they took in having knowledge. Because it is the property and virtue of man alone to search the cause of everything, so that with labour and effort he has found the science of all art: by his spirit he has researched and discovered the essence, nature and scope of that which is contained in all the universe: further his spirit is truly raised on high, because he has penetrated to the sky and has understood the course and revolution of the sun, of the moon, of the stars, of the heavenly bodies.....Now the profit which returns from such an excellent thing, is the main (reason) which induces men as much to research the knowledge of the sciences, as much as their pleasure in them, mainly in Mathematics and Geometry, where are contained so many innumerable secrets, that they contain in them, in such wise that it can be assuredly said that the beautiful effects that result from the noble sciences, notably from Mathematics and Geometry, it is the support of human life. Because this is the true and only science which teaches all discipline and industry, for the

1. from the 1st. edition.

2. 1st. pagination.

3. This, at the very least seems highly exaggerated, if not totally false. Dionysius of Syracuse might be considered one for whom this was true, but, as a rule, in any period, it is difficult to accept Flamand's view except as true in the vaguest most general way.

principalement pour l'assurance d'icelle, contre la violence & impetuosité des armes....l'experience a monstre de tout temps, que les affaires, tant civile, que guerriers, estans conduites par mesures & proportions, ont eu ordinairement leur deliberation plus assuree, & l'execution plus heureuse, ayant ainsi leur affaire accomplie comme il est expedient, ont tousiours l'avantage, par dessus toute autre force esgaree, & sans mesure, & comme par la bonne discipline, & cognoissance des choses naturelles, on trouve les moyens les plus propre & utiles, tant pour l'enrichissement de la paix, que pour la conseruation & deffence contre toute impetuositè, & violence de guerre....

10p. 10. AYant des ma cognoissance, tousiours esté diligent & affectionné à rechercher les sciences & industries en plusieurs, & diuers lieux, où i'ay tousiours honoré & chery les amateurs d'icelles: d'autant que la vertue de l'homme prouient de la connoissance & verité qu'il a des choses naturelles, & des fausses, & pour la bonne affection que ie porte aux homes vertueux desireux des sciences, i'ay dressé ce petit traitté, de ce que i'ay peu reconnoistre par experience, & pratique tant des fortifications, que de la conduite militaire, & des Mathematiques & Geometrie.....

p. 17. Pour bien excerser l'art & pratique de fortifier, comme aussi de tout se qui se mesure il est necessaire, d'entendre ou scauoir, les dimensions des lignes droittes, desquelles depend toutes sortes de mesurage, pour mesurer, & scauoir les distances....comme aussi pour tracer tout plan, tant des fortifications qu'autre.....

conduct of all art, and in the first place for their assurance against the violence and force of arms...experience has shown in all times that affairs as much civil as military-being conducted by measure and proportion have generally had their consideration more assured and their execution more happy, having thus their business regulated as is useful, having always the advantage over all other force, astray and without measure, because by the good discipline and understanding of natural things, is found the means most proper and useful as much to enrich the country in peace as to secure and defend against all impetuosity and violence of war...

I, having from the age of reason, always been diligent and desirous to inquire into the sciences and industries in many and diverse places, where I have always honoured and cherished the lovers of these, in as much as that virtue in man results from the understanding and truth which he has of natural things, and of the false: and from the good affection that I carry to virtuous men desirous of the sciences, I have organised this little treatise of that which I have become a little familiar with, by experience and practice, as much of fortifications as of military conduct, and of Mathematics and Geometry.

In order to properly exercise the art and practice of fortification, as also of all that is measured, it is necessary to understand or know, the dimensioning of right lines, on which depends all sorts of measurements, to measure and know the distance....as also to trace each plan, as much in fortification as in other things....

1. Flamand could hardly have put more strongly his basic belief in the effectiveness of mathematics. 2. i.e. efficacy, power. 3. HUGUET (1925), v. Dimension -- "action de mesurer". Thus geometrical measurement.

p. 49.la necessite contraint de
rechercher les plus propre pour se
prevaloir & garantir contre l'inclemence
& furie des guerres, quand elles sur-
viennent, & combien que la prattique
enseigne les moyens plus propres pour
tel exercice, ce que l'on ne peut pas
quelque fois concevoir, on y consomme
beaucoup de temps, si elle n'est aydee
par enseignements familiers, de l'
experience ordinaire. Car la prattique
militaire ne se termine qu'avec grande
prudence, art & industrie....à ceux qui
ne sont praticquez en tel art, c'est
bein prevoir par raison, & s'appuyer
sur quelque regle d'experience, sans
s'arrester à autre inventions impract-
icables...C'est pourquoy ie me suis del-
ibere de mostrer la prattique par raison,
& experience, la maniere de se fortifier

...necessity forces the most fitting re-
search to be availed of to protect
against the inclemency and fury of
war, when this occurs, and as much
that practice teaches the means most
suitable for this practice, something
which can not sometimes be conceived,
without spending a great deal of time,
if it is not aided by familiar teach-
ings and common experience. Because
military practice is not grounded but
with great prudence, art and under-
standing....(and) for those who are
not very practised in this art, it is
well to foresee by reason and depend
on some rule of experience, without
stopping at other impracticable inventions
...This is why I have decided to show
by reason the practice and experience
of fortifying oneself.

p. 201. LE plus vtile & la plus grande
commodite des affaires humains, dep-
endent des forces mouuantes, parceque
presque toutes choses sont conduites,
& guidees par mouvement, ce qu'est biẽ
necessaire à toutes gens d'estats, de
scauoir ou entendre quelque peu des
maniments, & proportions des forces
mouuantes, qu'est l'une des principales
parties, & la plus exquises & indust-
rieuse des mathematicques & Geometrie,
encore que ce soit le plus ignoré &
caché à ceux qui n'entendent les
mathematicques pour son obscurité, &
pour la subiection des trois prop-
ortions, que sont coincincte ensemble,
qu'est la force, le temps, & le contre-
poix, & c'est qui à enseigné aux
anciens une infinité d'inventions, qui
nous sont à ceste heure, les plus
propres & vtilles, pour les affaires de
la vie humaine, & le moyen de trouver
les inventions pour l'vtilité de tous
arts & sciences....

The most useful and the greatest ease
in human affairs, depends on moving
forces because nearly all things are
conducted and guided by movement, so
that it is very necessary to all men
of estate, to know or understand a
little something of the managment and
proportion of moving forces which is
one of the principle parts and the
most exquisite and industrious of math-
ematics and geometry, further which
would be the most unknown and hidden
to those who do not understand math-
ematics because of its difficulty,
and through the domination of the
three proportions which are joined
together, that is, the force, the time,
and the counterweight, and it is these
which taught the ancients an infinity
of inventions, which are to us at this
hour, the most proper and useful, for
the affairs of human life and the means
of finding the inventions of utility
in all arts and sciences....

1. Of the second pagination.

2. Flamand refers here to the lever, and the counterweight is really the moment, although he was not really clear about the difference.

p.202..combien que plusieurs se sôt travailléz, & ont estimé qu'il se pouvoit faire vn mouvement, qui seroit perpetuel, c'est à dire, qui mouueroit sans gl'ayde du contrepoix, & que l'on luy pourroit dōner quelque grande force, ce que l'on pourroit faire, si ainsi estoit. Mais l'ignorance qu'ils ont de ce qui est vray & naturel, c'est ce qui les fait esblouir, en ceste opiniō la fantastique, & sans raison. Tout leur but & attente est appuyee sur leur imagination ou resuerie trompeuse qui les deçoit. Car quant ils sont entréz en ce labirinte de folie & outre-cuidence accōparee à la pierre philosophale, ils ne s'en peuuent retirer, en fasson que ce soit: & à vray dire, c'est vn mouvement perpetuel & sans fin, qui les travaille incessamment, parce ce qu'il n'y a point de bout n'y de fin, leur esprit qui est tant embrouillé en ceste opinion, qu'ils ont de parfaire telle oeuvre les pousse, & les enfōce tousiours de plus en auant, tantost il faut vne piece d'vnd sort, tātost vne d'vne autre, plus vne piece rompt, ou il faut vn resort, ou il faut refaire vne autre piece, ou il en faut faire plusieurs, l'vne est trop petite, ou l'autre trop grande: puis il ont opinion, qu'il faut vne piece d'vne sorte, & vne autre d'vne autre, ou trop de dents en vne roue, ou peu en vne autre, l'vn des arbres est trop petit, l'autre est trop gros, ou il faut la machine plus grande, ou plus courte, & sont tellement aveuglez en ces fantasies la insensibles, qu'ils les met en vn cōtinuel travail sans bout n'y fin. Combien que telles gens lesquels sont sollicitéz par la curiosité de leur esprit de rechercher les choses le plus propre pour ayder à la vie humaine, mais aussi, ceux qui se sentēt auoir l'esprit agile, ne se doiuent point enfourner dans vn labirinte de tant de secrets inconnus, qui ne scauent l'issue, sans discretion & bon iugement pour les guider: encores

....in as much that many have worked and have believed that it is possible to make a movement which would be perpetual, that is to say, which would move, without the aid of the counterweight, and to which one could give as great force, as one would, it being thus. But the ignorance which they have of that which is true and natural, is that which dazzles them with this opinion, fantastic and without reason, All their intention and expectation is based on their imagination or fancies which decoy them. Because when they are entered in this labyrinth of folly and presumptuousness, like to the philosophers stone, they can not withdraw from doing what they would, and true to say, it is a movement perpetual and without end, which they work at unceasingly, because, there being nothing to their end or aim, their spirit, which is so much tangled in this opinion that they have to perfect this work, pushes and drives them always the further forward: sometimes it needs a piece of one sort, sometimes one of another, then one piece breaks, or there ought to be a spring; or another piece must be remade, or it ought to be made larger, the one is too small, or the other too big; then they have the opinion that a piece of one sort is needed, another of another, or too many teeth on a wheel, or too few on another; one of the axles is too small, the other is too big, or the machine ought to be larger or shorter, and they are such wise blind in these fanciful fantasies that they set to a continual work without aim or end. In as much that such men who are drawn by the curiosity of their spirit to inquire into the things the most proper to aid human life, but also, those who feel they have a quick spirit, ought never to take in hand such a labyrinth of such unknown secrets whose results they do not know, without due care and good judgement to guide them.

qu'ils presument & mettent en auant toutes les inuentions dequoy l'on se sert à present n'ont pas esté de tout temps, & qu'elles sont esté trouuees par tel moyen, ce que ie confesse estre vray. Mais depuis duex mille ans ença, du temps d'Aristote, & d'Archimedes, & d'autres depuis n'ôt iamais sceu entendre, n'y cōprendre tel mouuement sans fin, comme aussi de la quadrature du cercle, du feu sans fin, & de la pierre philosophale, & ont estimé ces quatre choses impossibles, cela leur doit seruir de regle, pour s'arrester aux choses possibles, & fuir les impossibles, cōbien qu'ils dient que le mouuement perpetuel, est vn beau secret * & qui peut estre, l'aduoue que c'est vn grand secret, veu q̄ personne ne la encore descouuri, mais quelle folie pourroit estre plus euidente, que de croire que les hōmes avec leur industrie, puisse faire, ce que la nature ne peut faire parfait, ou de dōner esprit & vie à vne chose morte.... I'estime qu'il est autant possible, de faire vn mouuement perpetuel, cōme transporter les monts S. Bernard iusques en Espagne....

Further they who presume and put forward that all the inventions which have arisen up to the present, have not been for all time, and that they have been found by such means, which I confess to be true. But for 2,000 years from the time of Aristotle and of Archimedes, and others since, it has never been known to be understood or comprehended such movement without end, as also the squaring of the circle, fire without end, and the philosophers stone, and these 4 things have been considered impossible so that they ought to serve them as the rule, for stopping at things possible and fleeing the impossible. In as much as that they say that perpetual motion is a beautiful secret, and which can be, I avow that it is a great secret, seeing that no one has ever discovered it, but what folly can be more obvious, than of believing that men with their industry can make that which nature can not make perfect, or give spirit and life to a dead thing...I believe that it is as much possible to make a perpetual motion, as to transport the mountains of St. Bernard to Spain....

AMBROISE BACHOT

Le Gouvernail (1598)¹ [34] [35]

General description: A work very much dependent on its high quality engraved designs. (vi) + 44 pages + 70 pages of engravings unpaginated. The early section with text has a good many diagrams and good quality woodcuts, and 4 full page engravings. 10 1/2" x 7 1/2" text. The engravings vary in size, occasionally of a double page spread, often of single page 10" x 7", and sometimes of a collection of 3 or 4 impressions c. 2 1/2" x 3 1/2" in size, a few include engraved text rather than designs.

Contents:

p. (1): Title page: LE/ GOUVERNAIL/ D'AMBROISE BACHOT/ CAPITAINE INGENIEVR/ DU ROY./ Le quel conduira le curieux de Geo-/metrie en perspective dedans l'ar-/

1. An earlier version entitled Le Timon was published at Paris in 1587* with less material particularly in the fortification plates. See M.T. Gnudi in RAMELLI (1976). A copy of this work is also to be found in the Bibliotheque Sainte-Genevieve Paris.

chitecture des fortifications, machines de guerre & plusieurs autres/ particularitez y contenues./ Imprime à Melun souz/ L'auter./ Et s'en trouuera ainsi en son logis rue de/ seine du fauxbourg S. Germain des/ Prez, à la croix blanche à Paris/ M.D.IIC.

p. (iii): Dedication to "Monseigneur de la Grange le Roy Conseiller du Roy et Son conseil d'Etat, et Gouverneur pour sa Maesté es villes & Chateaux de Melun."

p. (v): Engraved plate including verse: "Je sers MON ROY, ie vis en esperance/ Le Roy me tient, en la Grange enfferme:/ Dedans Melun, ou ie me suis arme:/ D'un mien labour pour seruir a la France."

p. 1/2: "A la Bande Guerriere."

p. 3/4: Introductory section "le subject de mon intention".

p. 5/12: Geometrical constructions and the basis of Bachot's perspective.

p. 13/44: The remainder of the text is more concerned to illustrate Bachot's perspective techniques than anything else, although it starts with a short section showing the layout of the pointed bastion in standard fashion. Many of the illustrations show basically only a bastion and its details, though occasionally two bastions with their curtain appear, and a pentagonal fortress is given in full in a number of cases.

The plates: The first 19 (after the section with text) are mainly concerned with representation of the pointed bastion trace in perspective: a few show a simple geometrical trace. Then come 19 pages of engravings nearly all with 4 small impressions concerned with geometrical constructions. Then 5 pages on surveying. 2 on the ellipse with a compass for drawing that figure. 4 on vanishing point perspective. The last 22 are on gadgets or machines many connected with warfare but others of a more general technological interest. Many of these are a clear steal from Rammeli.¹

Le Gouvernail (1598): Texts

p. 1. POVRANT que l'affection et naturelle inclination que j'ai toujours eue aux sciences Mathematiques (amy Lecteur) m'a constraint non seulement de rechercher les plus rares ouvrages des plus doctes personnages d'icelles disciplines: Mais aussi m'a grandement incité à hanter les plus signalez hommes de nostre age; et ad'auantage, parce que les preceptes, discours, et propositions des disciplines, se comprennent beaucoup mieux quand on les voit rapporter et s'appliquer à quelque usage....ce qu'un Guerrier doit scauoir & entendre, qui est la cognoissance des fortifications: et pour ce il m'a semblé fort expedient deuit que de représenter par

In as much that the liking and natural inclination that I have always had for the Mathematical sciences—dear reader—has compelled me not only to inquire into the most rare works of the wisest persons of these disciplines. But also I have been greatly encouraged to frequent the most notable men of our age, and to advantage, because the precepts, discussions, and propositions of the (sa) disciplines, are much better understood when one sees them connected with and applied to some usage....that which a good soldier ought to know and understand, that is the understanding of fortifications; and because it seems to me very useful, before representing by the traces --

1. See GNUDI (1976).

les traces, l'art de les tresbien construire, de sommairement l'advertiser des choses plus generales & principales qui le peuvent conduire à la claire intelligence d'icelles. Premierement il est tresutile qu'il aye la cognoissance des nombres & des lignes, c'est à dire, qu'il soit aucunement instruit en l'intelligence de l'Arithmetique & de la Geometrie: & en apres pour le regard des corps solides & esleuez desdites fortifications, il doit bien entendre la Perspective, & d'avantage faut qu'il aye plusieurs considerations des lieux que l'on doit fortifier, eu esgard à la diverse situation d'iceux, tant pour le regard des moyens, commoditez, & incommoditez qu'ils ont de la nature des lieux, comme aussi pour le regard de leur qualitez.... Parquoy ie diray seulement que le Guerrier qui vouldra bien entendre sa profession, apres s'estre founny desdites trois disciplines, doit tant pour deffendre la place, comme pour l'assallir, se faire vaincre vn combat du dedans au dehors, & au contraire du dehors au dedans.... que luy recognu tous les avantages que la forme de la situation du lieu luy peut donner.

P. 2.esquelles traces et desseins nostre Guerrier doit finalement avec grande consideration cognoistre vn effect admirable sur le subiet de l'Architecture des fortifications lequel est tel, la Perspective ne doit en rien changer la forme et dimension du plan Geometrique, à celle fin que lon puisse tousiours mesurer quand il en sera besoing. Ce qui ne se peut faire ny observer par la reigle de la Perspective, que se conduit avec vn point principal et deux tiers points. Ceste maniere dont il est question, de la quelle nous auons use pour représenter les desseins des fortifications est

the art of good construction -- to allude summarily to things more general and fundamental which conduce to the clear understanding of these. Firstly it is very useful that he has the knowledge of numbers and lines, that is to say, that he ought to be somewhat instructed in the understanding of Arithmetic and Geometry and afterwards with regard to solid bodies and the raising of the said fortifications, he ought to well understand Perspective, and it is advantageous if he should have many ideas about places which have to be fortified, in regard to their diverse situations, as much for the regard of the means, suitability and unsuitability, which are of the nature of the place as also in regard to their qualities.... Whereby I will say only that the Warrior who would truly understand his profession, after being provided with the three said disciplines, ought, as much to defend a place as to assault it, to have fought from inside to without, and on the contrary from outside to within.... that he recognises all the advantages that the form of the site of the place can give him.

...in which traces and designs our soldier ought finally to recognise with great attention an admirable effect in the subject of the Architecture of fortifications, which is thus: Perspective ought not to change in any way the form and dimensions of the Geometric plan, to the end that one can always measure from it where it will be needed. This can not be done or observed by the rule of Perspective, that is organised by a principal point and two third points. This manner that is at issue, which we have used to represent the designs of the fortifications is very familiar and

fort familiere et facile à entendre: le faict d'icelle ne gist qu'à tirer les lignes perpendiculaires, les hauteurs ou profondeurs au dessus ou au dessous ledit plan, le quel represente la superficie de la terre, et assembler les dites lignes dessus et dessous, avec lignes parallels....¹

p. 3. En ce discours reconnoistrez le subject de mon intention, pour vous conduire et adresser parmy les guerrieres mathematiques, en Geometrie & Perspective, avec l'ordre des ombrages, ensemble la metode de paruenir à la connoissance des fortifications, instruments, & machines de Guerre, & autre parties.

D'AVTANT qu'en toute chose le bon ordre doit estre en recommandation pour autant qu'elle nous adresse & conduit à la claire intellegence de nos affections, parquoy il m'a semblé bon suyuant mon intention, de vous adresser le stil de plusieurs belles pratiques, par paruenir par la Theorique, à la construction des fortifications, & pour ce regard i'ay prins, comme il m'a semblé conuenable, mon subject sur la figure du Pentagone, d'autant qu'elle est vne figure assez delectable,³ & aussi que celui qui scaura & aura la connoissance de la fortification sur le plan dudict Pentagone, il ne pourra estre accusé qu'il n'aye prompte connoissance sur quelque proposition qui luy puisse estre faicte, & ne luy soit facile, pour le regard desdictes fortifications, & pour le regard du stil & ordre, i'ay commencé par Geometrie, comme fondement & appuy de nostre Perspective, par laquelle pourrez represente l'idee de vos conceptions en l'art des fortifications, & en apres pour les corps esleuez est de besoin de contenter l'oeil par les diuerses ombrages par lesquelles

easy to understand, the making of which does not lie but in drawing perpendicular lines to the heights or depths above or below the said plan, which represents the surface of the earth, and joining the said lines above and below, with parallel lines.....¹

In this discussion you will find the subject of my intention to guide and direct you in the company of Mathematical warriors, in Geometry and Perspective, with the arrangement of shadows, together with the method of arriving at the knowledge of fortification, instruments and machines of war, and other things.

In as much that in all things a good discipline ought to be in a recommendation such that it guides and directs us to the clear understanding of our desires: thus it seems good to me, following my intention, to direct you to the method of many beautiful practices, in order to arrive by Theory, at the construction of fortifications, and in this regard I have taken, as it seems to me convenient, as my subject, the figure of the Pentagon, in as much as it is a very pleasing figure,³ and also that whoever will know and have understood fortification on the plan of the said Pentagon, it will not be possible to accuse him of not having a ready understanding of whatever proposition can be made to him, and it should be easy to him; in regard to the said fortifications, and in regard to the method and arrangement, I have begun with Geometry as the foundation and support of our perspective, by which can be represented the proposal of your conception in the art of fortification, and afterwards for the solid bodies⁴ it is necessary to please the eye by the various shadows

1. Bachot illustrates the process thus (p. 10)



2. This first paragraph is the section heading, (capitalization omitted).

3. Although Bachot here seems to imply that the figure of the pentagon is in itself a very nice figure, undoubtedly he was influenced by the popularity of this form among fortification writers.

4. Lit. 'raised bodies'. In other words bodies developed upwards from the plan trace into 3 dimensional objects.

l'œil se contente de pouvoir discerner le but de ses intentions.

p. 3. Et de là pour s'acheminer à la construction des fortifications, & de la pratique d' icelle, j'ay pris la plus familiere demonstration qu'il m'a esté possible, pour vous conduire sans confusion (pourveu que la patience vous accompagne) & cognoistrez qu'en suyuant nostre ordre, vous entrerez de traict à traict, & peu à peu en la totale intelligence de la Theorique & pratique desdictes fortifications, par l'augmentation & amplification de nos desseings, où sont representees nos conceptions. Et de là comme d'un piussant fondemēt, faisons suyre par ordre plusieurs diuerses & notables inuentions, lesquelles n'auons voulu pour le present desduire & discourir par le menu,¹ attendu que tout ainsi que la nature ayāt sa matiere disposee, ne produit iamais la chose avec sa perfection: Car cōme l'on voit en obseruant les choses naturelles soudain qu'elles sont produittes, elle ne cesse iamais selon tous ces moyēs, de les esleuer en leur plus grande perfection, semblablement les entendemens cōtemplatifs, selon l'occurance, besoing & necessitē, à l'imitation d'icelle comparant les choses, les vnes aux autres, produisent de là plusieurs inuentions, lesquelles bien souuent mettent en auant ainsi simplement representees par leurs euidentes traces, sans autre long discours.

which the eye pleases him in being able to discover the aim of his intentions.

And in order to proceed to the construction of fortifications, and their practice, I have taken the most familiar demonstration that has been possible to me, to guide you without confusion -- provided you have patience -- and you will find that in following our method you will enter bit by bit, and little by little, into the full understanding of the Theory and practice of the said fortifications, by the increase and amplification of our designs where are represented our conceptions. And from there as a strong foundation, we will add in their place many various and notable inventions, which we have not wished for the present to describe or discuss in detail,¹ considering that all that nature of its material has arranged, it has never yet produced the thing in perfection. Because, as can be seen in natural things, as soon as they are produced, they do not cease according to all their means to raise themselves to their greatest perfection, similarly contemplative undertakings according to the opportunity, need and necessity, in imitation of this, comparing things the one with the other, produce in this way many inventions, which very often they put forward thus through simple representation of their clear trace with other long discussion.

1. HULSIUS (1607) "narrer par le menu" = "Von stück zu stück erzählen".

CRISTÓBAL DE ROJASTeórica Y Practica de Fortificacion (1598)Bibliography: Madrid 1598;¹General description: Boldly printed work. (iv) + 106 folios. 9" x 5½" text.
Many diagrams in the text.Contents:

- f. (ia): Title page: TEORICA/ Y PRATICA/ de fortificacion, confor/me las medidas y defen-/sas destes tiempos, re-/partida en tres/partes. / POR EL CAPITAN/ Christoual/ de Rojas, Ingeniero/ del Rey nuestro señor/ DIRIGIDA AL/ Principe nuestro señor/ Don Felipe III./ CON PRIVILEGIO./ En Madrid, Por Luis Sanchez/ Año 1598.
- f. (iia): "Suma del Priuelegio."²
: "Tassa."³
: "Erratas."
- f. (iib): "De Lupericio Leonardo en loor de la obra". Verse in priase of Rojas.
- f. (iiaa): Dedication dated 8 July 1596, "Al Principe nuestro señor don Felipe."⁴
- f. (iibb)/ ?): Prologo.
- f. 1/29b: Part I: After some introductory remarks (Cap. I/IV: f. 1a/4a) this section is almost entirely taken up with elementary geometrical constructions.
- f. 30a/88a: Part II:
f. 30a/35b: Cap. I/II: The layout of bastion style fortresses including the measure of the fortress.
f. 35b/36a: Cap. III: Standard measures discussed with mention of the scale of the drawing.
f. 36b/52b: Cap. IIII/VII: General remarks on fortification and the various members of the fortress, followed by demonstration of regular fortresses from 3 to 7 sides. Irregular and star shaped forts then follow along with a detailed discussion of construction with earth and fascines.
f. 53a/68b: Cap. VIII/XIV: Mensuration.
f. 68b/79a: Cap. XV/XXI: General remarks about details of structures.
f. 79a/88a: Cap. XXII/XXV : Mainly about surveying and sundials.
- f. 88b/106b: Part III:
f. 88b/101b: Intro./Cap. VIII: Practical problems of construction.
f. 101b/106b: Cap. IX/XI: Ordering of squadrons and lodging an army in the field.

Table of contents (1 folio).

1. Only know edition. The work by Rojas Compendio y breve resolucion de fortificacion (Madrid 1613*) often said to be a second edition of this work is, according to MARIÁTEGUI (1880) p. 183/4, a much more elementary work.

2. Penalty for offending against the privilege "cinquãta mil maravedis". Given 3 March 1598 for 10 years.

3. "...tassaron cada vno de los dichos libros en onze reales". Dated 19 June 1598.

4. The copy used here (B.M. 717. k. 14) is defective at this point and contains only the first page of this section, and the next folio is from a totally different work.

Teorica Y Practica de fortificacion (1598): Texts

f. (iiib).la materia de fortificacion, qui contiene este libro, es parte de la milicia tan importante, que sin ella en estos tiempos ningū refato puede conseguirse, y assi con esto se cifra quanto se puede dezir de sus vtilidades (ò hablando mas propriamente) de la necessidad precisa, que ay de que la entiendan los Principes, Capitanes y soldados.....

f. 1a. TRES Cosas han de concurrir en el soldado, ò Ingeniero, que perfectamente quiere tratar la materia de fortificacion. La primera, saber mucha parte de Matematicas: si fuere possible, los seis primeros libros de Euclides, y el vndecimo y duodecimo, porque con ellos absoluerā todas las dudas que se la ofrecierē, assi de medidas, como de proporciones, y para el disponer los planos y fundamētos de los edificios, y medir las fabricas y murallas, pilares, columnas, y las demas figuras: y quando no lo supiere, bastara lo que cerca dello se dize y declara en este tratado, digerido y puesto en terminos claros para instruyrle en lo que para esta materia fuere necessario, si bein la tal inteligencia serā mecanica. La segunda.es, la Arismetica.....La tercera, y mas principal para la fortificacion, es saber reconocer bien el puesto donde se ha de hazer la fortaleza, o castillo. Serā dificil saberlo dar a entender y enseñar el Ingeniero, sino huuiere estado en la guerra en ocasiones, y cerca de algun gran soldado....si le faltare esta experiencia, tendra necessidad de acompañarsi con vn soldado viejo, el dia que huuiere de edificar la forteleza, por muchos respetos: y al contrario, el q̄ fuere solamente soldado, sin Matematicas, ni practica de fabricas, tendra necessidad de acompañarse con el Matematico, y

....the subject of fortification, which this book contains, is a part of warfare of such importance, that without it in these times no effect can be obtained, and as much as it is counted in this so much can be desired its utility, or speaking more exactly, for its necessity to the understanding of Princes, Captains, and soldiers....

Three things have to come together in a Soldier, or Engineer, that wishes to treat perfectly the subject of fortification. First to know a good deal of Mathematics: if it were possible the first six books of Euclid, and the 11th. and 12th., because with these are answered the doubts that arise both of measurement and of proportion, and in order to lay out the plans and foundations of the buildings, and measure the structures and walls, pillars, columns and further figures, and when then this is not possible, sufficient concerning this, what is said and declared in this treatise, directed and put in clear terms to instruct in whatever of the matter would be necessary, even though such undertakings will be mechanical. The second is Arithmetic....The third and most fundamental for fortification is to know how to recognise well the site, where the fortress or castle has to be made. It will be difficult for the Engineer to be instructed and taught without his having been in the wars on occasion and in the company of some great soldiers....if this experience is lacking it is necessary to be accompanied by an old soldier when the fortress has to be built, for many reasons; and on the contrary, anyone who would be only a soldier without Mathematics and practice in building, will have to be accompanied by a Mathematician and

hombre inteligente en la practica: mas el Ingeniero qui tuuiere lo vno y lo otro, dar buena quenta de su fabrica, por saber la razon teorica, y practicamente, que es lo propuesto al principio.

f. 3a.lo primero q̄ ha de aduertir el tal soldado, è Ingeniero al tiẽpo q̄ trate de erigir su fortificaciõ, si *fuere ciudad, laro deara con muchas valuartes, conformandose con el terreno: y si fuere castillo, cõsiderarà bien a aquel puesto, si es fuerte por naturaleza, o por artificio, o por ambas cosas. Por naturaleza lo puede ser, si lo circūda la mar, o està sobre alguna montaña...Por artificio pue de ser fuerte, quando tenga cerca de si alguna plaça fuerte de amigos que socorran a su necesidad. Y en conclusion serà fuerte aquel puesto que no se pudiere minar....

f. 32a.las defensas que en aquel tiempo eran cõ artilleria, se hã reduzido aora a tiro de mosquete, y arcabuz, porque al tiempo que el enemigo ha metido sus trìncheas hasta el bordo de la estrada cubierta....y quiere passar el fosso por el derecho de la esquina del valuarte, y arrimarse à el para picarlo, y hazerle la mina, si estuuiesse la defensa atiro di artilleria, passarian los enemigos vno à vno, casi al descubierta, por ser muy lexos la difensa, porque la pieça de artilleria se sue le tirar poca vezes à vn hõbre solo, y siẽdo la defensa tan larga, como dicho es, se passa al fosso con vna trìnchea muy baxa, que se haze con poca trabajo, y es muy fuerte, por estar poco leuantada de la tierra, y con dificultad la puede batir el artilleria desde la casamata:

man learned in practice; further the Engineer who would have the one and the other, gives good account in his building through knowing the reasons theoretically and practically, that are proposed in the beginning.

....the first thing the soldier or engineer has to observe when he considers the erection of his fortification, if it would be a city, is to surround it with many bastions, conforming to the ground, and if it would be a castle to consider well the site, if it is strong by nature or through skill, or by both. By nature, it can be if it is surrounded by the sea, or is on some mountain....By skill it can be strong when it has around it in some strong place friends that can aid it when necessary. And in conclusion it will be strong that site can not be mined....¹

....the defences that were in that time² that were by artillery, have been reduced now to the range of a musket or arquebus, because when the enemy has pushed his trenches to the edge of the covered way.....and wishes to pass the fosse in the direction of the corner of the bastion to close up on it to use picks on it and make mines, the defence being of the fire of artillery, the enemy passes one by one, almost openly, through the defence being very distant, because a piece of artillery is able to fire only a few times at a single man, and being the defence so great, as is said, the fosse is passed by very low trenches that is made with little work and is very strong, in being little raised above the ground, and with difficulty (only) can be battered by the artillery

1. While Rojas clearly here speaks of the familiar distinction between sites strong by nature or by human skill, he gives a unique personal meaning to the idea. It is difficult to think that he misunderstood such a well known distinction and it seems probable that he simply felt it could be used in whatever way he thought handiest. Italian engineers having worked in Spain for many years (see MATGIOROTTI (1933/9)). In a mss, he stated he had read Tartaglia among others, on artillery. (MARIATEGUI (1980) p. 135). See next note also.

2. He has just indicated 25 years past, and mentioned Alghisi, Busca, Maggi, & Castriotto, Lanteri, Theti and Girolamo Cataneo.

y siendo las defensas à tiro de mosqueta, y arcabuz, no puede passar el enemigo, sino es con trinchea muy alta, y siendo alta, es facil de derribarsela, porque la puede batir bien el cañon de la casamata, y siendo la defensa corta, como dicho es, si el enemigo procurasse de passar vno à vno, los mosqueteros, y arcabuzeros, que estan en la defensa, tiran cō mucha facilidad.....

in the casemate; and the defences being to the fire of a musket and archibus, the enemy can not pass without very high trenches, and being high it is easy to demolish them because they can be battered well with the cannon in the casemates and being the defence short, as is said, if the enemy attempts to pass one by one, the muskets and archibuses, which are in defence, fire very easily at them....

DIEGO GONZÁLEZ DE MEDINA y BARBA

Examen de Fortificación (1st. ed. 1599)

Bibliography: Madrid 1599; Madrid 1609*¹

General description:² A long undivided text mainly in dialogue form. (xii) + 221 pages. Some good quality though small illustrations.

Contents:

- p. (i): EXAMEN/ DE FORTIFICA-/LION, HECHU POR DON/ Diego Gonçales de Medina Barba,/ natural de Burgos./ DIRIGIDO AL REY NVESTRO/ Señor don Felipe III./ CON PRIVILEGIO,/ IN MADRID,/ En la Imprenta del Licenciado Varez de Castro/ Año de M.D.XC.IX. años.
- p. (ii): Coat of arms.
- p. (iii): Verse in praise of the author, by Luperçi Leonardo.
- p. (iv): "Errata", dated 11 June 1599.
- p. "Tassa", dated 16 June 1599.³
- p. (v): "Al lector".
- p. (vi/viii): Dedication dated 24 November 1598 at Madrid.
- p. (ix/xi): Privilege dated 22 Jan. 1599 at Madrid.⁴
- p. (xii): "Apouacion de Francisco de Valencia, Baylio de Lora, del Consejo de guerra de su Magestad" dated 11 Jan. 1599 Madrid.⁵
- p. 1/6: General introductory remarks: Only a "just" defence to be considered; nature and value of defence, and of the fortress, and the like, discussed.
- p. 6/13: Advantages and disadvantages of various types of sites.⁶
- p. 13/16: The best form for the fortress and the pointedness of the bastions, considered.

1. MARINI (1910). ENC UNI ILL EUR AMER suggest there were other later editions.
2. Of the first edition taken from a microfilm of a copy belonging to the University of Michigan.

3. "tassarōn cada cuerpo del dicho libro à seys reales en papel, y dieron licencia para que a este precio se pueda vender".

4. For "todos estos reynos de Castilla", for 10 years. Penalty "cincuenta mil maruedis" ; to accuser, ; to the king, ; to the judge who tries the case.

5. "AViendo visto vn libro, que se me cometio por el Consejo Real el examen y censura.....me parece, que se puede y deue imprimir, por ser la materia de que trata muy vtil y prouechosa el conocimiento desta manera de soldadesca para la nacion Española, no obstante otro mas y mejor parecer que el mio, con que se entienda, que di mi opinion no es aprouar en ninguna manera el fortificar los arrabales...."

6. The dialogue between "vn Principe" and "vn Maestro de la profesion" begins with this section.

- p. 16/21: Different members of the fortress named and outlined.
- p. 22/51: Different members of the fortress discussed in detail in terms of size and function and the like.
- p. 51/65: The plan of the fortress. How to set out pentagonal, hexagonal, septagonal and octagonal fortresses.
- p. 66/69: An irregular fortress.
- p. 70/75: Calculating the area contained by the fortress.
- p. 75/78: How the curtain should be best set out.
- p. 78/87: Setting out on site.
- p. 88/221: The remainder of the book consists of the Prince raising a particular problem and the "master" giving a continuous definitive answer. Many problems and 'remedies' are dealt with -- a too pointed bastion, a hill nearby, or in the enceinte, a site on a lake or near a bridge head, the construction of raterate. Included also are short sections on materials, artillery and surveying, and so on.
- 6 pages listing the contents.
- Colophon: EN MADRID, En casa del Licenciado Varez de Castro. Año de M.D.XCIX.¹

Examen de Fortificacion (1599): Texts

- | | |
|--|---|
| <p>p. 8. M.²...deuese de eliger...el sitio llano, por el mejor, que se le podra dar forma que se quisiere, y será mas perfeta.....</p> | <p>...the site on a plain ought to be chosen as the best, in that it can be given the form that is wished, and it will be more perfect...</p> |
| <p>p. 75. M.² .Senõr, verdad es, que la cortina obliqua por el angulo enmedio, tiene mas fuerça contra los golpes de la artilleria.....</p> | <p>.Sire it is true, that the oblique curtain with an angle in the middle is stronger against the blows of the artillery...</p> |

J E A N E R R A R D

La Geometrie et Pratique General (1st. ed. 1594*)³: Texts

- | | |
|--|---|
| <p>p. 3. SIRE, puis que vostre Majesté nous faict esperer, par l'Academia qu' elle a ordonné estre dressee en ceste ville de Paris, de voir resusciter & reuiure les sciences, de long temps mortes en ce Royaume, & quel les Gentile hommes François ont esté contraincts cercher & aller mandier es pays estranges: I'ay pensé que ce ne seroit mal à propos luy dedier maintenant cest oeuvre, combien que petit,</p> | <p>Sire, since your Majesty makes us hope, by the Academy which has been ordered to be prepared in this town of Paris, to see the revivification and renewal of the sciences, for a long time dead in this Kingdom, and because French men of quality have been forced to search and to send out to foreign countries, I have thought that it would not be inappropriate to dedicate to you now this work, no matter how small,</p> |
|--|---|

1. The text finishes "Acabose de escriuir en Madrid a veynte de Abril de 1598. años, por D. Diego Gonçalez de Medina. LAVS DEO."

2. The "Master of the profession".

3. At Paris after LALLEMEND & BUINETTE (1884); 2nd. edition (Paris 1602). A smallish treatise of 96 pages on surveying and mensuration. For later editions see *ibid.* p. 110/111. 2nd. edition used here.

comprenant neantmoins ce qui est de plus beau & plus rare en la Geometrie: Esperant....il sera veu & receu du public &....incitera par sa facilité & brevueté, la Noblesse à rechercher les Mathematiques, vrayes & seules sciences, qui ne proffitent pas seulement durant la paix, mais produisent leurs plus beaux effects en temps de Guerre.¹

nevertheless containing that which is most beautiful and rare in Geometry. Hoping...it will be seen and received by the public....and will incite by its easiness and brevity, the Nobility to investigate in Mathematics, the true and only sciences, which do not bring reward during peace alone, but produce their most beautiful effects in time of war.¹

Les Neuf Premiers livres des Elemens d'Euclide (1st. ed. 1598*): Texts²

10f. 2a. SIRE, Le fauorable accueil qu'il a pleu à vostre Maiesté faire à mes premieres oeuvres Mathematiques, m'oblige & assure tout ensemble de luy presenter ce recent labour, qui apportera peut estre quelque clarté à ces sciences, & quelque desir à vostre Noblesse d'aimer & honorer ce qu'elle void fauorisé & chery de son souuerain Prince. Et si au gouvernement du monde Dieu vse tousiours de quelque trait de Geometrie (comme disoit le diuin Platon:) C'est bein raison, que celuy auquel par vne certaine communication de sa puissance en terre,³ il a commis l'administation du plus beau Royaume qui y soit, se monstre amateur d'une science dont l'usage se remarque au Ciel, & que le Createur mesme de l'usage se remarque au Ciel, & que le Createur mesme de l'Uniuers n'a point desdaigné, puis que (comme dit le Sage) il a créé toutes choses par poids, nombre & mesure. Et certes s'il est plus difficile de mesurer, comme il appartient les choses grandes, la science qui l'apprend est tres-necessaire à ceux que Dieu a esleuez au supreme degre de grandeur.⁴

Sire, the favourable reception which it has pleased your Majesty to make to my first Mathematical works, obliges and assures me altogether in presenting to you this recent labour, which will perhaps bring some clarity to these sciences, and some desire to your Nobility to love and honour that which they see favoured and cherished by their sovereign Prince. And if in the government of the world God uses always some aspect of Geometry -- as the divine Plato said -- it is good reason that he to whom by a certain communication of his power on earth,³ he has committed the administration of the most beautiful kingdom which there is, shows himself the lover of a science whose usage is noted in the sky, and that the creator even of the Universe never scorned, since -- as says the sage -- he has created all things by weight, number and measure. And truly if it is more difficult to measure, as appears with large things, the science which teaches it, is very necessary to those who god has raised to the supreme level of grandeur.....

1. From the dedication dated 1594 to the King.

2. N.U.C. Les six premiers livres..... (Paris 1598). For later editions see LALLEMEND & BOINETTE (1884) p. 110/111. The 1605 enlarged edition used here.

3. Errard was presumably only too happy to be able to show his support, in this contest, for such a notion as the divine right of kings.

4. From dedication dated 1598.

La Fortification reduict en Art (1st. ed. 1600*)¹ [34] / [39]

Bibliography: Paris 1600*²; Paris 1604; Francfort-sur-le-Mein 1604; Francfort sur la mein 1617*²; corrected by A. Errard, Paris 1620/19; and Paris (?) 1619/22; German trans. Franckfurt am Mayn 1604*.³

General description:⁴ Large format work. 12" x 7" text. (iv) + 130 pages. Many good quality engravings, often impressed on the same page with a section of normally printed text.

Contents:

- p. (i): Title page : LA/ FORTIFICATION/ DEMONSTREE ET/ REDVICTE EN ART/ PAR/ I. ERRARD DE BAR-LE-DUC/ Ingenieur du Treschrestien Roy/ de France et de/ Nauarre./ Dediee à sa Majesté./ A Paris./ 1604/ Edition seconde reueue et augmente./ Avec Priuileges./ a la rose blanche rue St Jaques/
- p. (iii/iv): "Au Roy".
- p. 1/2: Preface "A la Noblesse Française".
- p. 2: "Advertissement aux lecteurs".
- : Corrections.
- p. 3/26: Book I: Preliminary matters.
- p. 3/4: Introductory section "Les Axioms, qui sont sentences communes, n'ayer besoin d'aucune demonstration".
- p. 5/22: Cap. I/X: Artillery, Batteries, Munitions of an army, Sieges, Walls, Terraces, Retrenchments, the Fosse, Counterscarpe, Methods of attack.
- p. 23/26: Cap. XI/XII: Qualities of an Engineer and the taking of a plan.
- p. 27: Dedication of Bk. II to "Maximilian de Bethune...Grand maistre de l' Artillery, et Superintendant des fortifications de France".
- p. 29/63: Book II: The pointed bastion trace.
- p. 29/30: Cap. I: The precepts of the system.
- p. 30/52: Cap. II/VIII: Hexagon to Dodecagon, each seperatly discussed.
- p. 53/57: Cap. IX: Other regular figures from 12 to 24 sides.
- p. 58/63: Cap. X/XI: Counterguards and detached works, and retrenchments.
- p. 65/108: Book III: Irregular traces;
- p. 65/66: Cap I: Preliminary remarks.
- p. 66/76: Cap. II/VI: Triangle and square, rectangle, "quarre compose"⁵, pentagon, seperately discussed.
- p. 77/108: Cap. VII/XVII : Mainly concerned with irregular traces and different types of sites.
- p. 109/130: Book IV: Of places commanded.
- 1 page: "Priuilege du Roy."
- 2 pages: "Copie du Priuilege de la Majeste Imperiale."

1. The first edition is often quoted as of 1594. However the dedication of the work is dated January 1600 and a document of 1599 shows the king paying 220 ecus towards its production. LALLEMAND & BOINETIE (1884) p. 157/60.

2. Ibid p. 163/4.

3. N.U.C.

4. Of the Paris 1604 edition.

5. This is a square with doubled bastions at the corners.

La Fortification reduicte en Arte (Paris 1604): Texts

p. 1.la Pratique estant aussi aveugle sans la Theorique, que la Theorique est manchotte sans la Pratique.

....Practice being as blind without theory, as theory is one armed without Practice.

....i'ay osé entreprendre ce que tous les Ingenieurs, iusques à present, n'ont voulu ou osé, au moins n'en paroist-il rien par aucun escrit traitant de ceste science: Car les discours des choses mechaniques ne meritent point ce Titre: n'a estat icy quest(i)on des traits, qui à quelqu'un pourroient réussir à l'adventure: mais de demonstrations Geometriques, qui donnet à tous assurance infallible: Quiconque se fie en ceux-la, ne hazarde moins le salut d'un pays, qu'un autre la vie d'un homme, qu'il commet à un ignorant Empiric, lequel (comme dit Platon) deuroit avoir passé par toutes les maladies & accidents, dont il veut iuger: autrement il ressemble à celui qui peindroit bien la mer, des escueils & des nauures, mais s'il faut venir à l'effet, il ne sçait comment s'y prendre.

....I have ventured to undertake that which all the Engineers up to the present, have not wished or dared, at least there appears nothing written by anyone treating of this science. Because the discussions of mechanical things, in no way merits this title, there being no question here of features which anyone can achieve by chance: but of Geometrical demonstrations, which give to everything infallible assurance. Whoever trusts in those, does not risk less the safety of a country, than another the life of a man, which he commits to an ignorant Empiric, who -- as Plato says -- ought to have passed through all the disorders and accidents, which he wishes to judge. Otherwise he is like one who would paint well the sea, the reefs and ships, but if he would come to action who would not know how to set about it.

p. 2. Ceste seconde edition a esté augmentée de quelque figures & discours necessaires pour l'intelligence plus entiere de cet oeuvre, lesquels en la premiere edition auoient esté omis pour certaines raisons. Et quant au mot d'Art dont nous vsons, souuent il est plus conuenable à nostre propos, que celui de science, d'autant que nous raportons le tout à la pratique, qui est la fin & le but de ceste institution, ne nous contentans de la simple cognoissance par ses causes, qui est le propre de la science, combien que nous n'y proposons rien que ne soit démontré ou ne se puisse démonstrer

This second edition has been enlarged by some figures and discussions necessary to the more complete understanding of this work, which in the first edition were omitted for certain reasons. And with regard to the word 'Art' which we use, often it is more convenient to our purpose than 'science', especially as we relate everything to practice, which is the end and aim of this discipline; we are not content with the mere knowledge of causes, which is the attribute of science, even though we do not propose anything which is not demonstrated, or can not be demonstrated by the

1. I. e. mechanical solutions.

2. The Empiric school of medicine is generally taken to have developed after Plato's time, in reaction to the Dogmatics. See CASTIGLIONI (1947), for example, who suggests it developed 270/220 B.C.

3. In Laus (720) Plato wrote "The slave doctor prescribes what mere experience suggests, as if he had exact knowledge...But the other doctor who is a freeman, attends and practises on freemen; and he carries his enquiries far back, and goes into the nature of the disorder" JOWETT (1964)

4. Advertisement aux lecteurs.

5. What reasons is not very clear.

par les principes des sciences Mathematiques. Que si en quelque lieu nous usons du mot de science; nous entendons une science pratique qui equipolle au terme d'Art, & s'oppose à la science speculative qui n'a autre fin que la cognoissance.¹

p. 10. AVANT que de traicter l'art de la fortification, il ne sera pas inutile de discourir des assiettes des places, des commoditez & incommoditez d'icelles, de la muraille, & de sa matiere: ensemble des terrasses, retranchemens, fosses, & contrescarpes, qui son choses indifferentes, communes à toutes sortes des fortifications, & non de la substance & essence de l'Art: à fin qu'icelles bien entendues, on les puisse approprier & adapter à la fortification, esuyant les preceptes qui seront cy apres enseignez & demonstrez, & que la necessité le requerra.

p. 23 D'AVTANT que de la suffisance & iugement de l'Ingenieur, dépend tout le desseing de la fortress, & que les Roys, Princes & grands Seigneurs, doivent bien & exactement examiner les raisons, pour lesquelles est faicte la fortification de ceste sorte ou de l'autre, il est bien necessaire aussi que l'Ingenieur discoure à propos de toutes les parties de sa science, en sorte qu'il puisse par demonstrations Geometriques (& non mechaniques à la facon des ignorants) faire cognoistre ce qu'il aura conçu pour l'accomplissement de son desseing, lequel se doit toujours rapporter à l'intention du Prince, que veut fortifier selon ses moyens, selon le temps & selon la puissance & force de son enemy....Et pourtant, il est premierement de besoing qu'il cognoisse suffisamment la force de l'artillerie

principles of the Mathematical sciences. Thus if we in any place use the word 'science' we intend a science of practice synonymous with the word 'Art' and opposed to speculative science which has no other end but knowledge.¹

Before we treat of the art of fortification, it will not be without value to discuss the sieges of places, their advantages and disadvantages, their wall and its material; together with terraces, retrenchments, fosses and counterscarps which are things indifferent, common to all sorts of fortification and not of the substance and essence of the Art, in that when these are well understood, one can suit and adapt them to the fortification, following the precepts which will be taught and demonstrated below, and which necessity requires.

In as much as that on the adequacy and judgement of the engineer, depends the whole design of the fortress, and that Kings, Princes and great Lords, ought carefully and exactly to examine the reasons why the fortification is made of one sort or an other, it is very necessary therefore that the Engineer discusses aptly all parts of his science, in the way that he can through Geometrical demonstrations -- and not mechanically in the fashion of the ignorant -- make known that which he will have conceived for the accomplishment of his design, which ought always to relate to the intention of the Prince, who would wish to fortify according to his means, according to the time and power of his enemy.... Nevertheless it is first necessary that he sufficiently recognises the strength of the artillery.....

1. The insertion of this section in the 2nd. edition suggest that Errard may have come under a certain amount of criticism for the way he used the terms 'art' and 'science'.

1. ...Qu'il soit Geometre, tant pour inventer machines, qu'autres instruments seruans à la defense de la place & au travail necessaire, que pour demonst^rer sⁱ l'utilité & profit de ses inventions, auant que les mettre en pratique, & proportionner l'ouvrage à faire, au temps & aux moyens presens, & par ainsi eviter les despences excessives, qui se font le plus souvent mal à propos, faute d'entendre ceste belle science de Geometrie.

That he should be a Geometer as much to invent machines, as other instruments serving the defence of the place and the work necessary, as to demonstrate the usefulness and profit of his inventions before putting them into practice, and to proportion the work to be done to the time and to the means present and by this avoiding excessive expenses, which arise most often to bad effect, lacking the understanding of this beautiful science of Geometry.

p. 29. L'ART de fortification ne consist en autre chose, qu'à cliner ou decliner² les lignes sur lesquelles sont jettez les fondements d'une place, en sorte que l'ennemy l'attaquant en quelque sorte que ce soit, puisse estre veu & offensé, au front & au flanc: ceste sorte d'offension s'appelle flanquer.

The art of fortification does not consist in anything but the inclining and declining² of the lines on which are laid the foundations of a place in such a way that the enemy attacking in whatever way he would, can be seen and attacked, and to the front and by the flank -- this sort of defence is called flanking.

p. 39. EN l'Heptagon l'angle du centre est $51 \frac{3}{7}$: La raison du costé de l'Heptagon au demy-diametre de son cercle, ne se trouve, & pourtant sa description & demonstration en a esté mechanique jusques à present, & n'auons rien de plus precis, que la moitié du costé d'un triangle equilateral, d'escrit au meme cercle, pour le costé du dit Heptagon.

In the heptagon the angle of the centre is $51 \frac{3}{7}$ degrees. The ratio of the side of the Heptagon to the semi-diameter of its circle is not found and therefore its description and demonstration has been mechanical up to the present, and we have nothing more precise than half the side of an equilateral triangle, drawn in the same circle, for the side of the said Heptagon.

p. 66. LE triangle equilateral ne se peut simplement fortifier qu'avec beaucoup d'incommoditez & imperfections qui se trouvent en la construction: ce qui se sera neantmoins selon les maximes de ce liure, peut estre demonst^ré en cest sorte.

The equilateral triangle cannot be fortified ordinarily but with much inconvenience and imperfections that occur in the construction. That which it will be nevertheless, according to the principles of this book, can be demonstrated in this way.

p. 97. ON fait les Citadelles pour les villes, ou les villes pour les Citadelles.

Citadelles are made for towns, or towns for Citadelles.

Les Citadelles pour les villes, comme quand vn Conquerant ayant gagné vne grande ville, veut l'assourer contre .

Citadelles for towns, as when a conquerer having gained a great town, wishes to secure it against the revolt of

1. In this section Errard suggested that the fortification engineer ought also to have had the soldiers' experience of sieges; that he ought to have some experience of commanding people; and also a knowledge of general architecture.
2. I.e. setting them at different angles in the drawing.

la reuolte des habitans & euitier la
dépense d'une si grande garnison que
requiert telle place....¹

On fait les villes pour les Citadelle,
comme quand vn Roy ou Prince a quelque
beau & fort Chasteau ou Citadelle qu'
il desire (pour certaines raisons)
accompagner d'une belle ville: Alors
il fait tailler cest place en plain
drap & en sorte que son chasteau
commande par toute la ville, & rend sa
place capable pour contenir le nombre
de sujets qu'il aura aduisé, logez au
long & au large, tant pour y accommoder
la garnison suffisante à resister aux
efforts de ses ennemis, que pour la
beauté & espace des logis & jardinages
qu'il veut preferer à la dépense & au
temps du travail.

of the inhabitants and avoid the ex-
pense of a garrison as large as the
place requires....One makes the town
for the Citadelle, when a King or Pri-
nce has some beautiful and strong
chateau or Citadelle which he desires
-- for some reason -- to accompany with
a beautiful town. Then he does as he
pleases, and in such a way that his
castle commands all the town and makes
the place capable of containing the
number of subjects which he will have
decided on, lodged at breadth and at
large, as much to accommodate a garrison
sufficient to resist the endeavours of
his enemies, as for beauty and spacious-
ness of lodgings and gardens, which he
would like given the expense and time
of the work.

1. To obviate the need for a garrison which is so large as to be able to hold the town simply by being in it.

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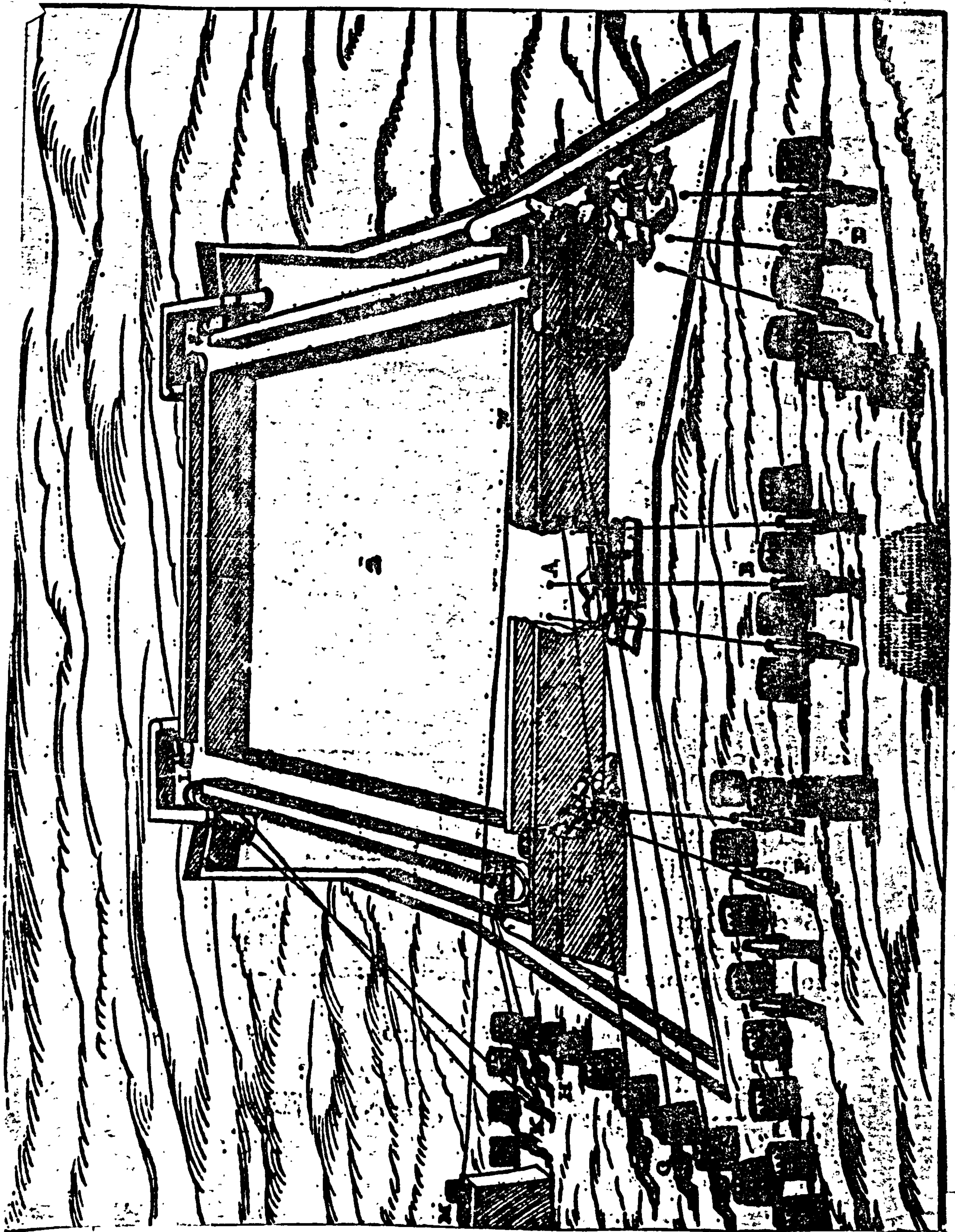


Plate 1. Battery of a square fortress. ZANCHI (1554) p. 39.
Actual size c. 7" x 5".

CAPITULO-

VENTO.

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DECIMASESTA FIGURA.

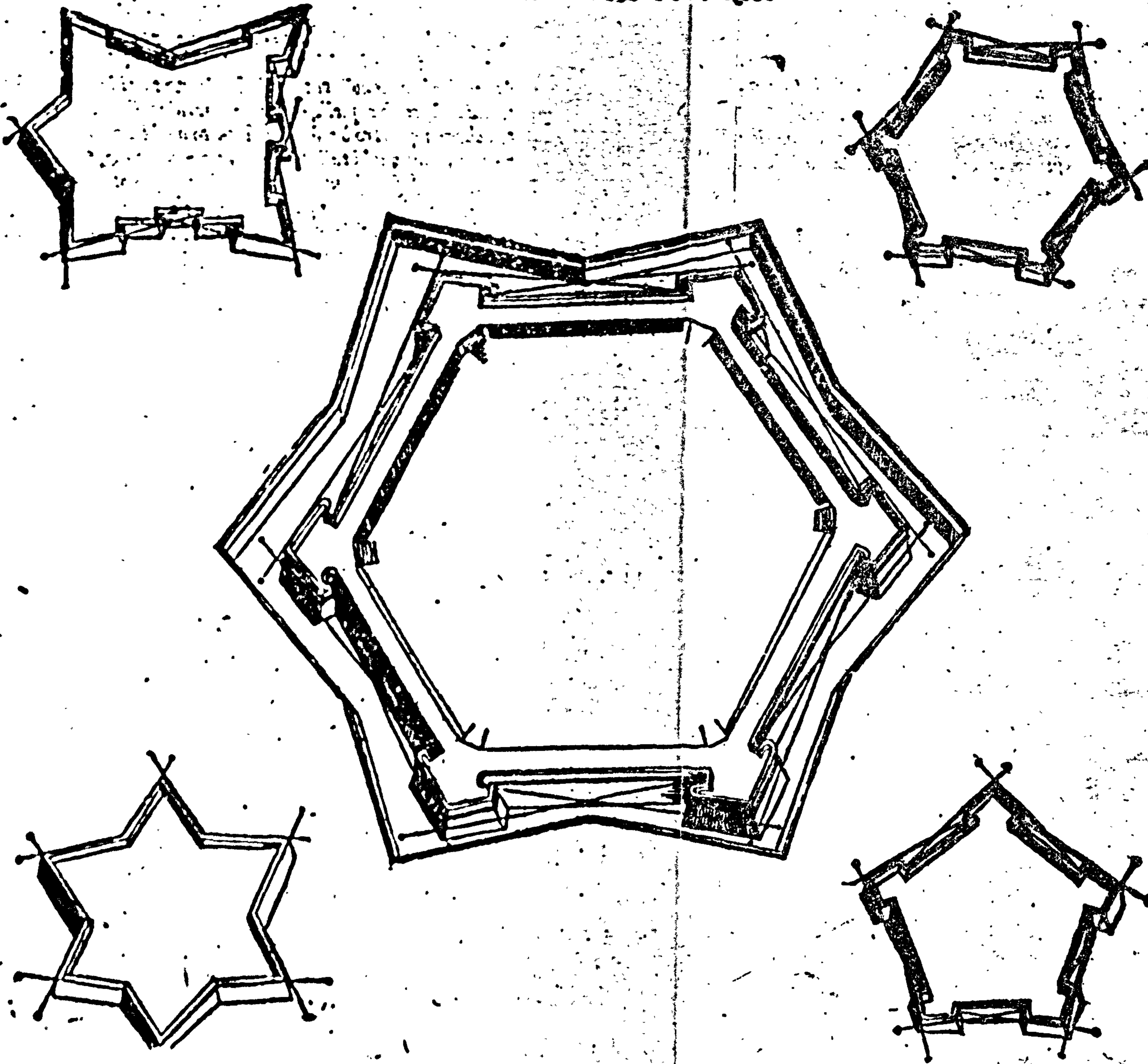


Plate 2. Design in accordance with the principle of no dead ground. Girolamo CATANEO (1564). Approx. full size.

VIGESIMA SECONDA FIGURA.

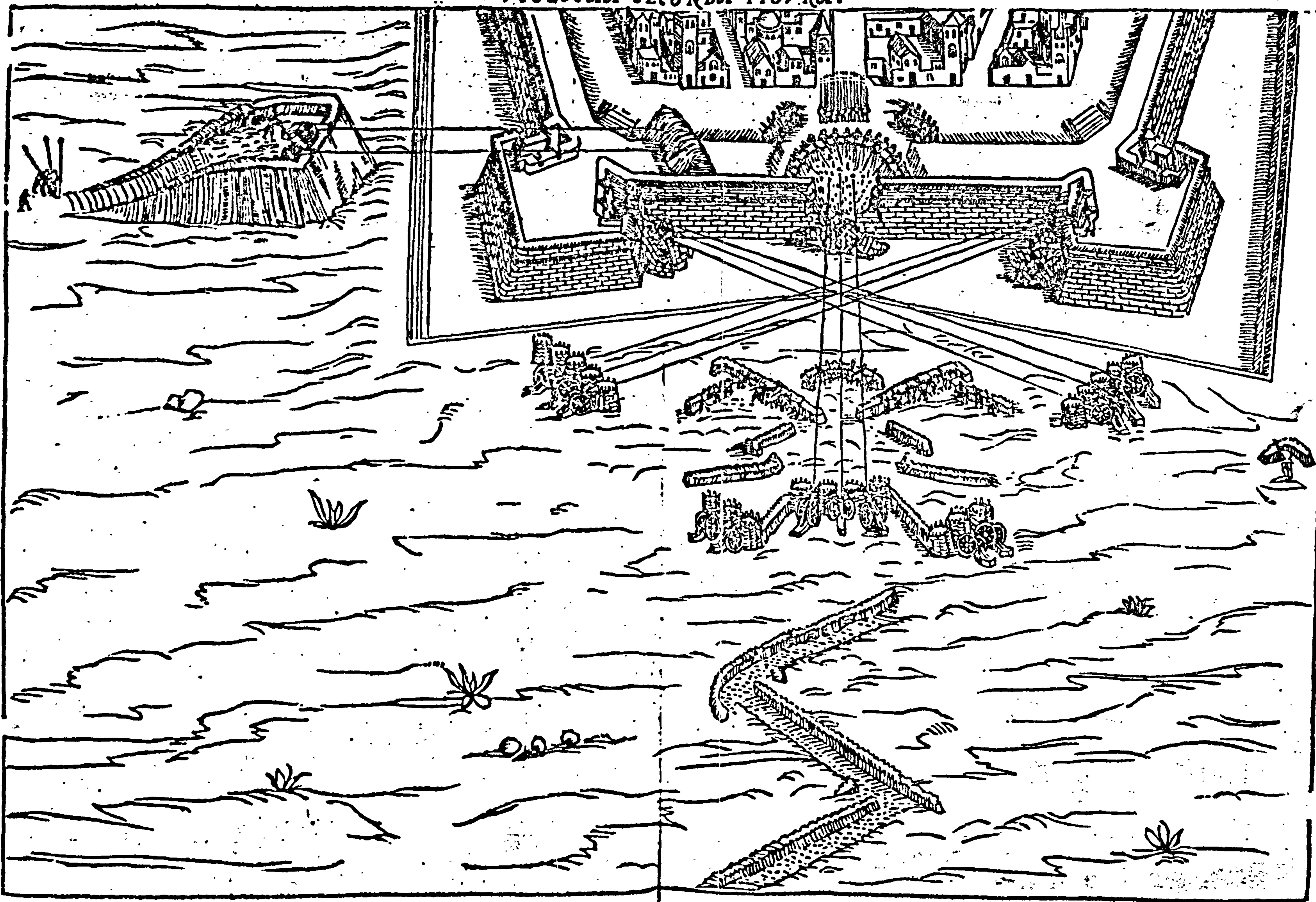


Plate 3. Battery of a fortress. Girolamo CATANEO (1564).
Approx. full size.

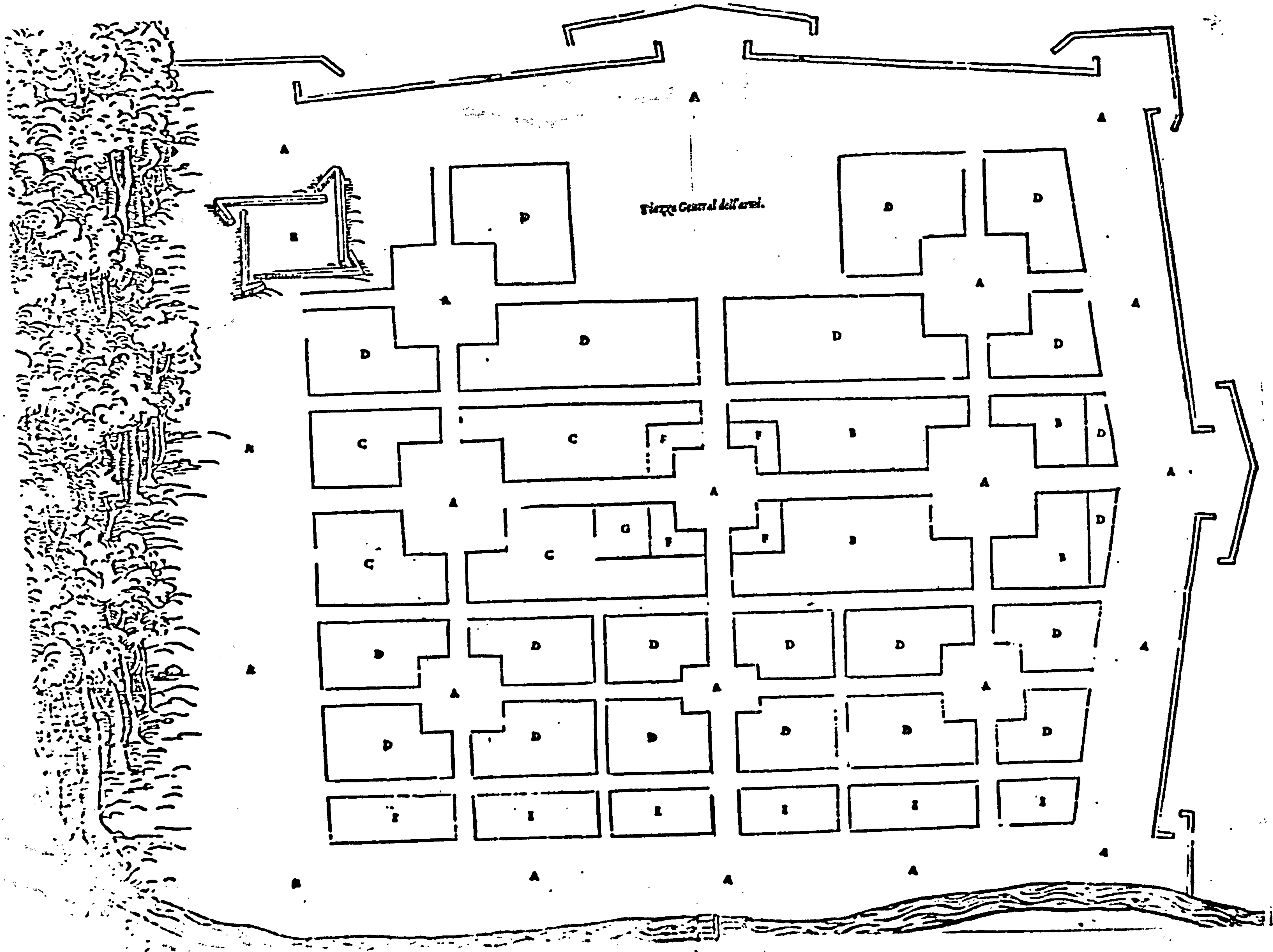


Plate 4. A field fortification. Girolamo Cataneo
Dell'arte militare libri tre (1571). p. 79.
c. 2/3 full size.

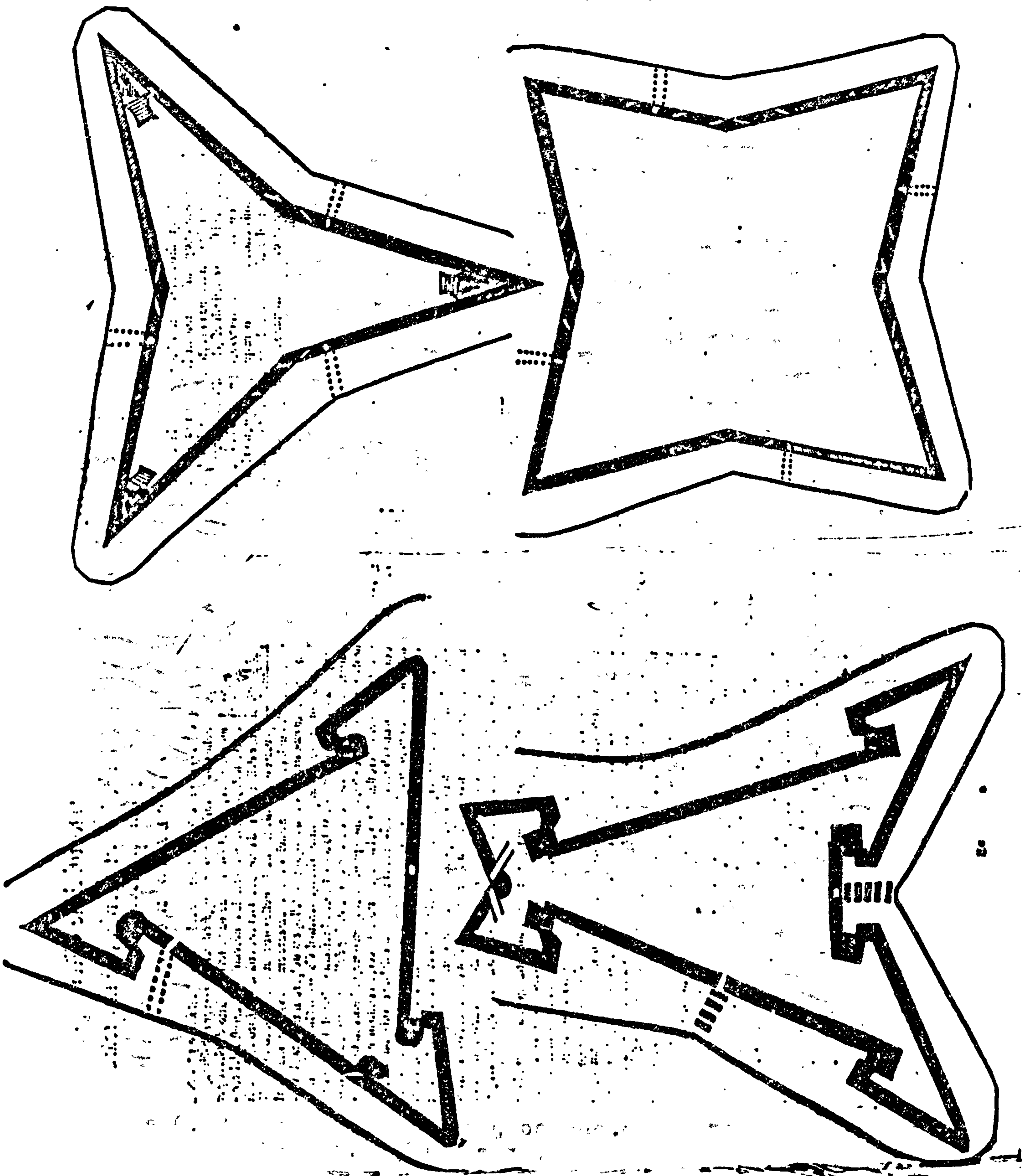


Plate 5. Different traces in accord with the principle of no dead ground. MAGGI (1564) f. 105b & 106a. c. $\frac{1}{2}$ full size.

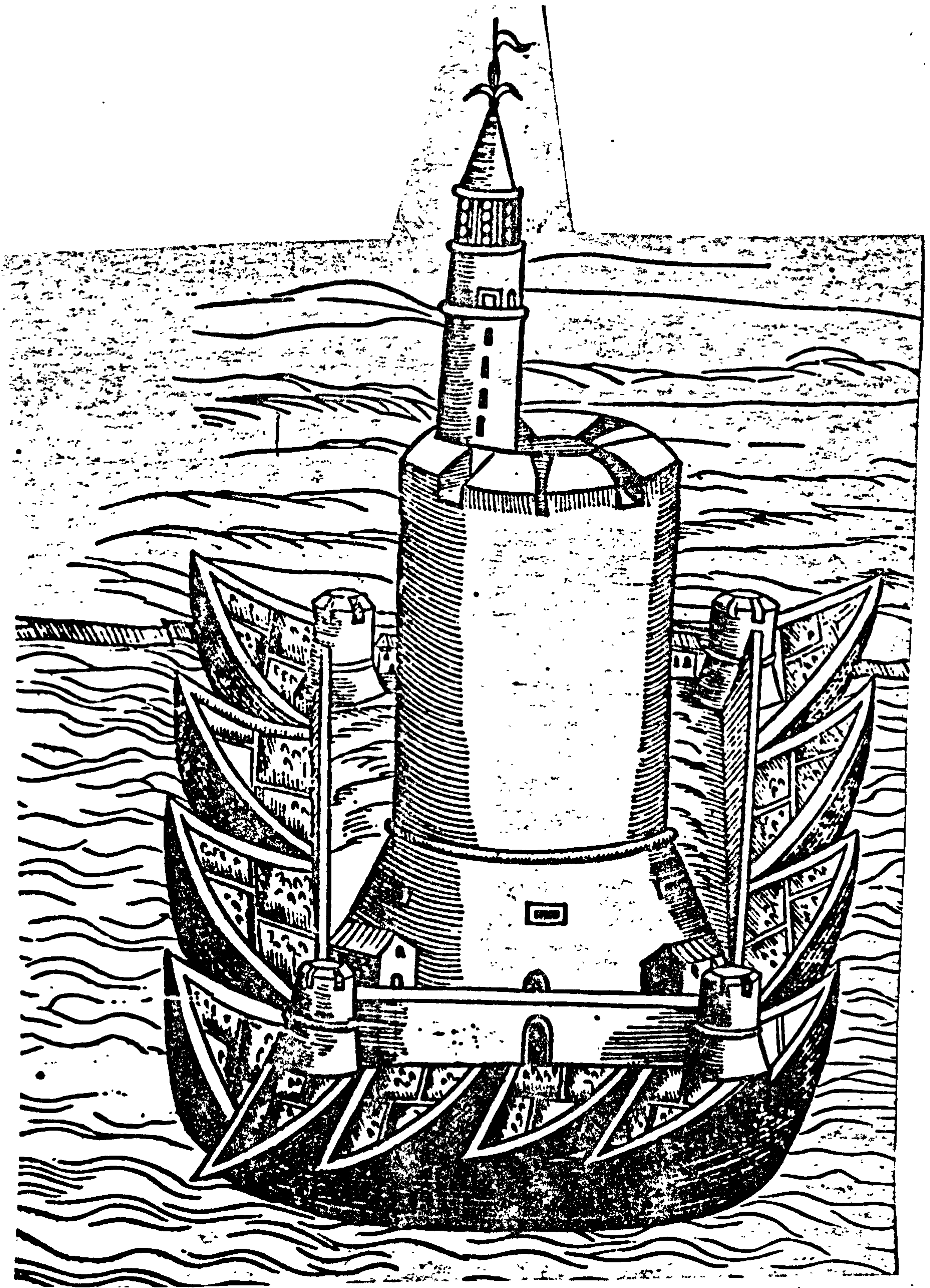


Plate 6. A structure floating on pontoons. MAGGI (1964)
f. 84b. c. $\frac{3}{4}$ full size.

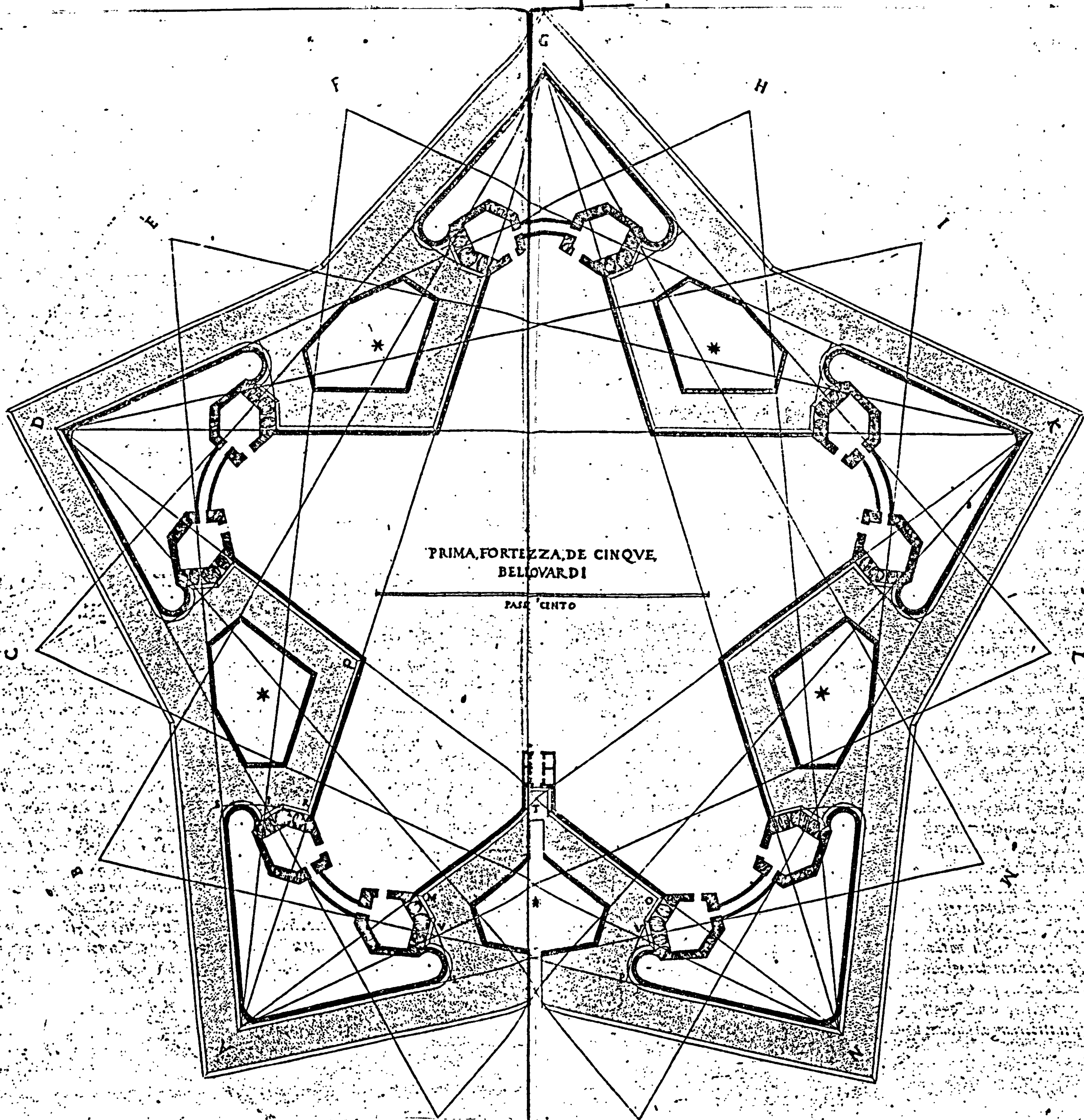


Plate 7. Trace of a pentagonal fortress. ALGHISI (1570)
p. 44/5. c. 2/3 full size.

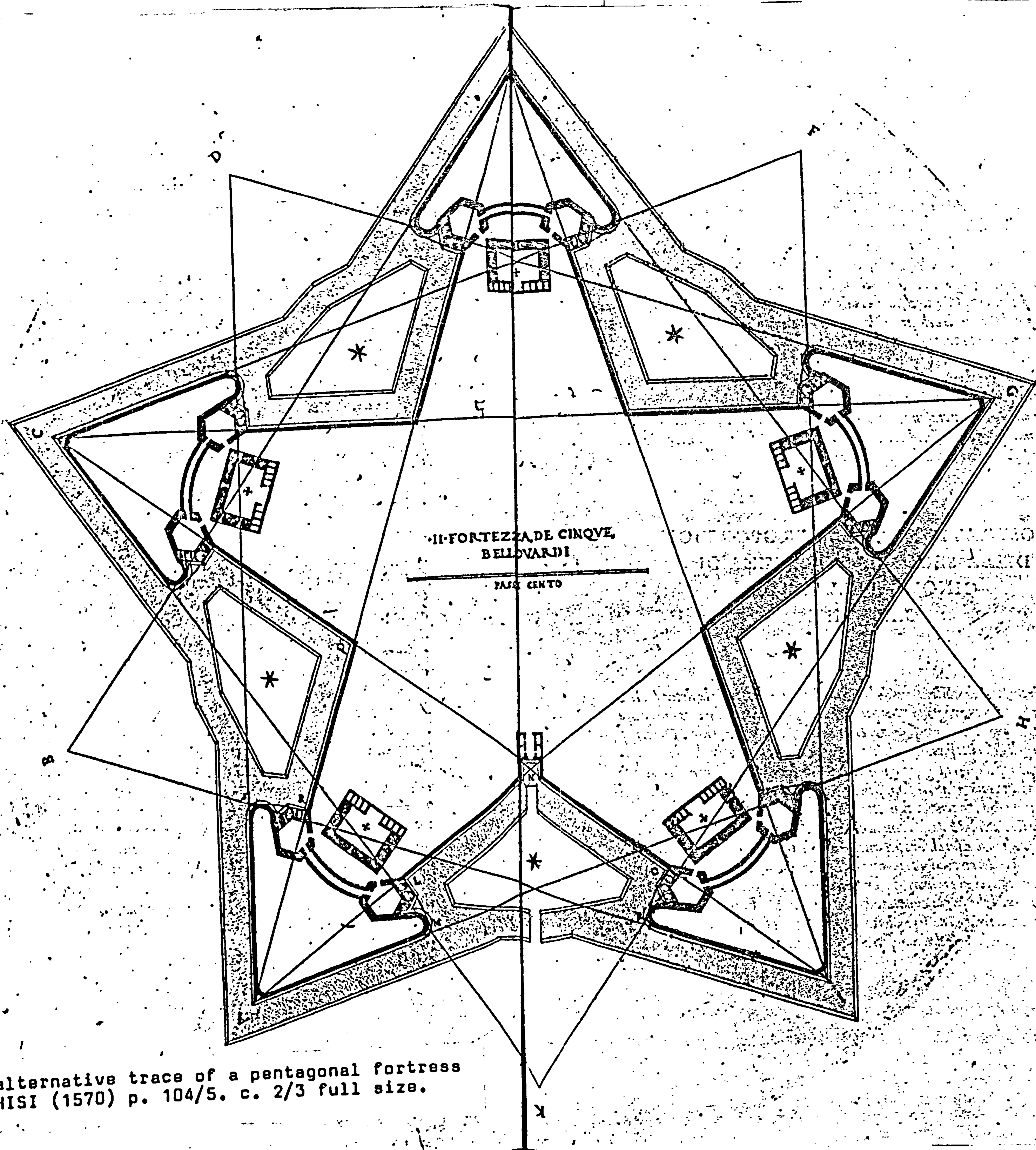


Plate 8. An alternative trace of a pentagonal fortress
 ALGHISI (1570) p. 104/5. c. 2/3 full size.

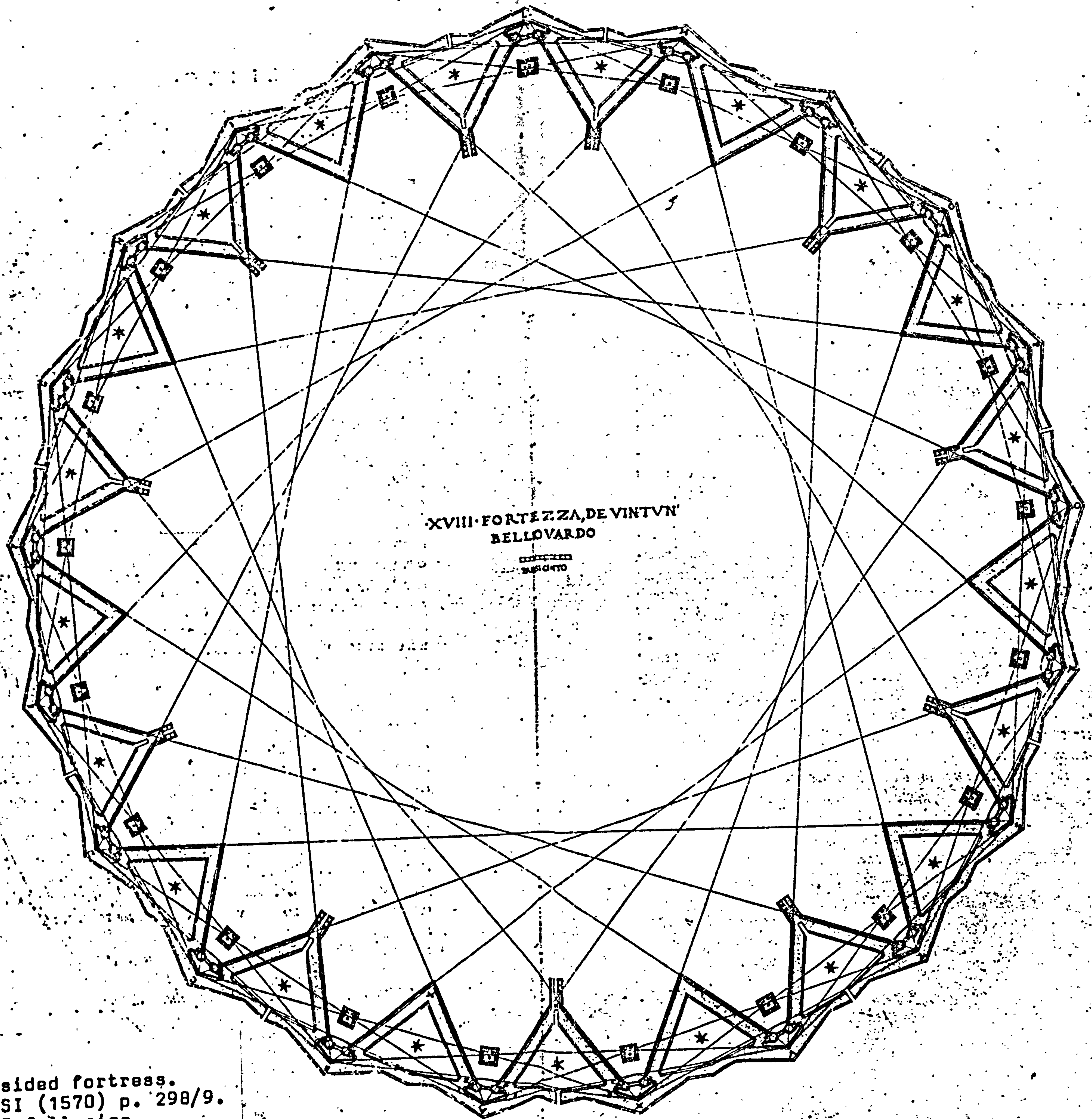
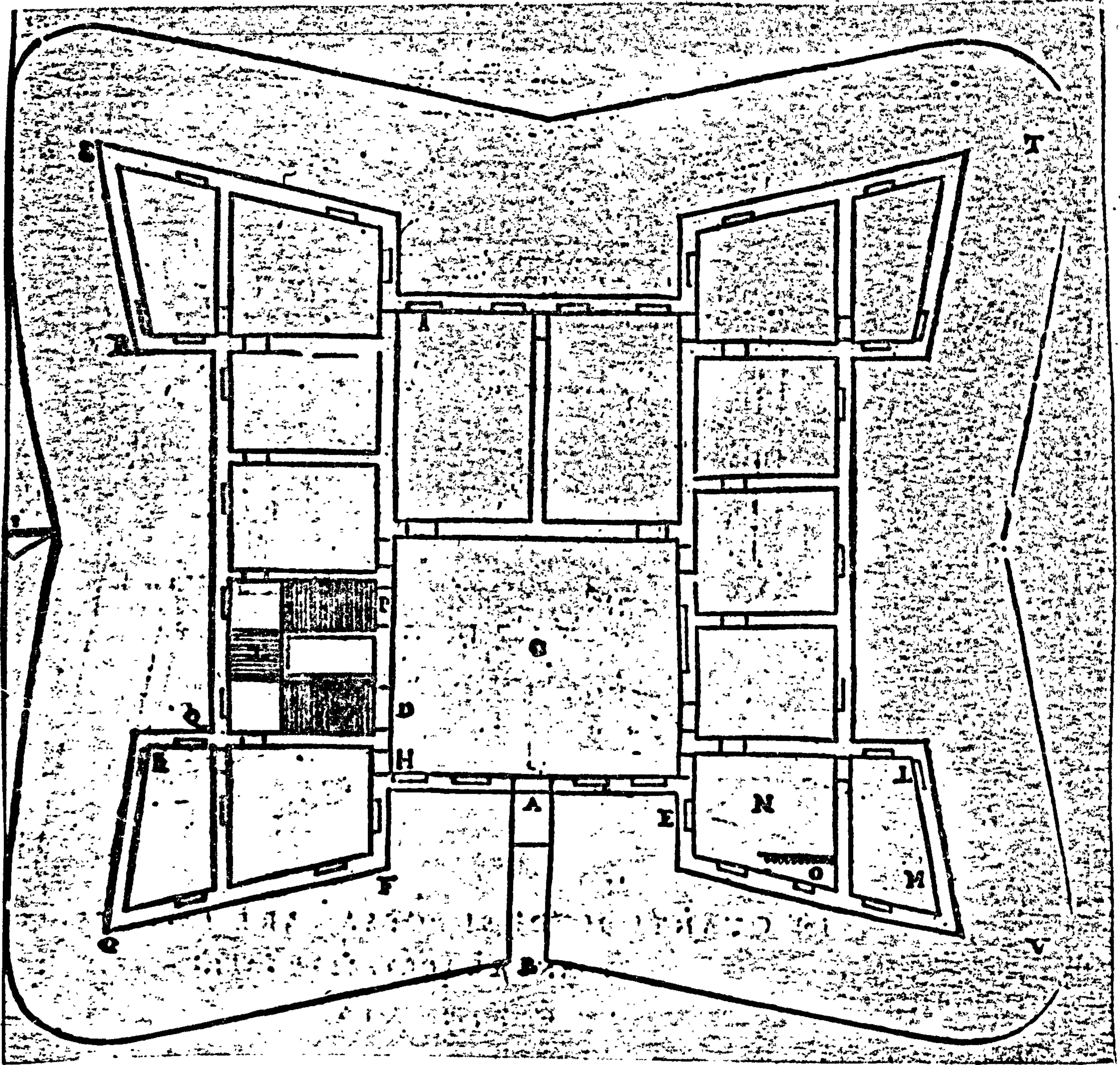


Plate 9. A 21 sided fortress.
ALGHISI (1570) p. 298/9.
c. 2/3 full size.



.. Plate 10. "Case, overo palazzi fatti in fortezza"
LORINI (1609) p. 167. ((1596) p. 151).
Slightly reduced.

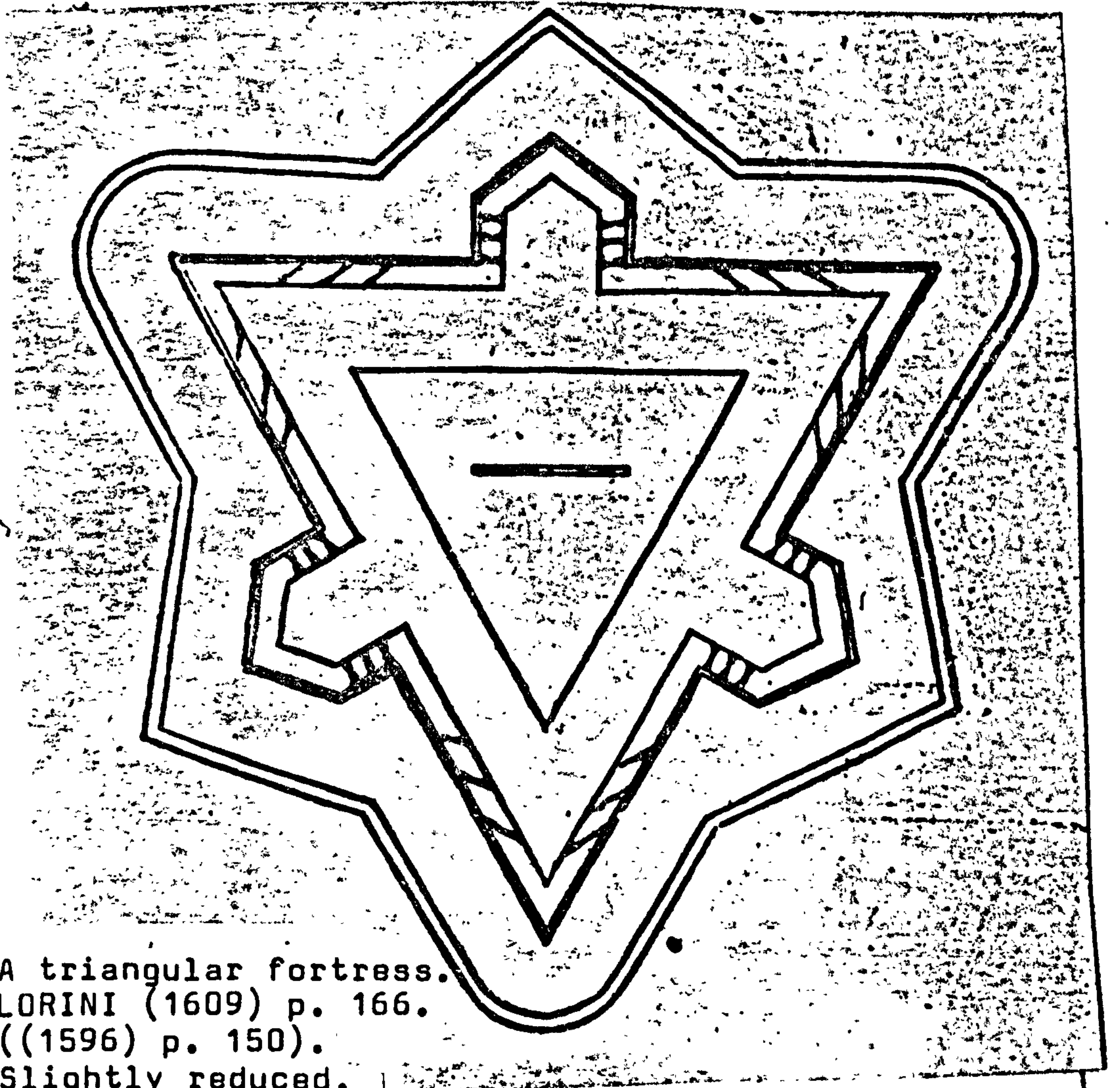


Plate 11A. A triangular fortress.
LORINI (1609) p. 166.
(1596) p. 150).
Slightly reduced.

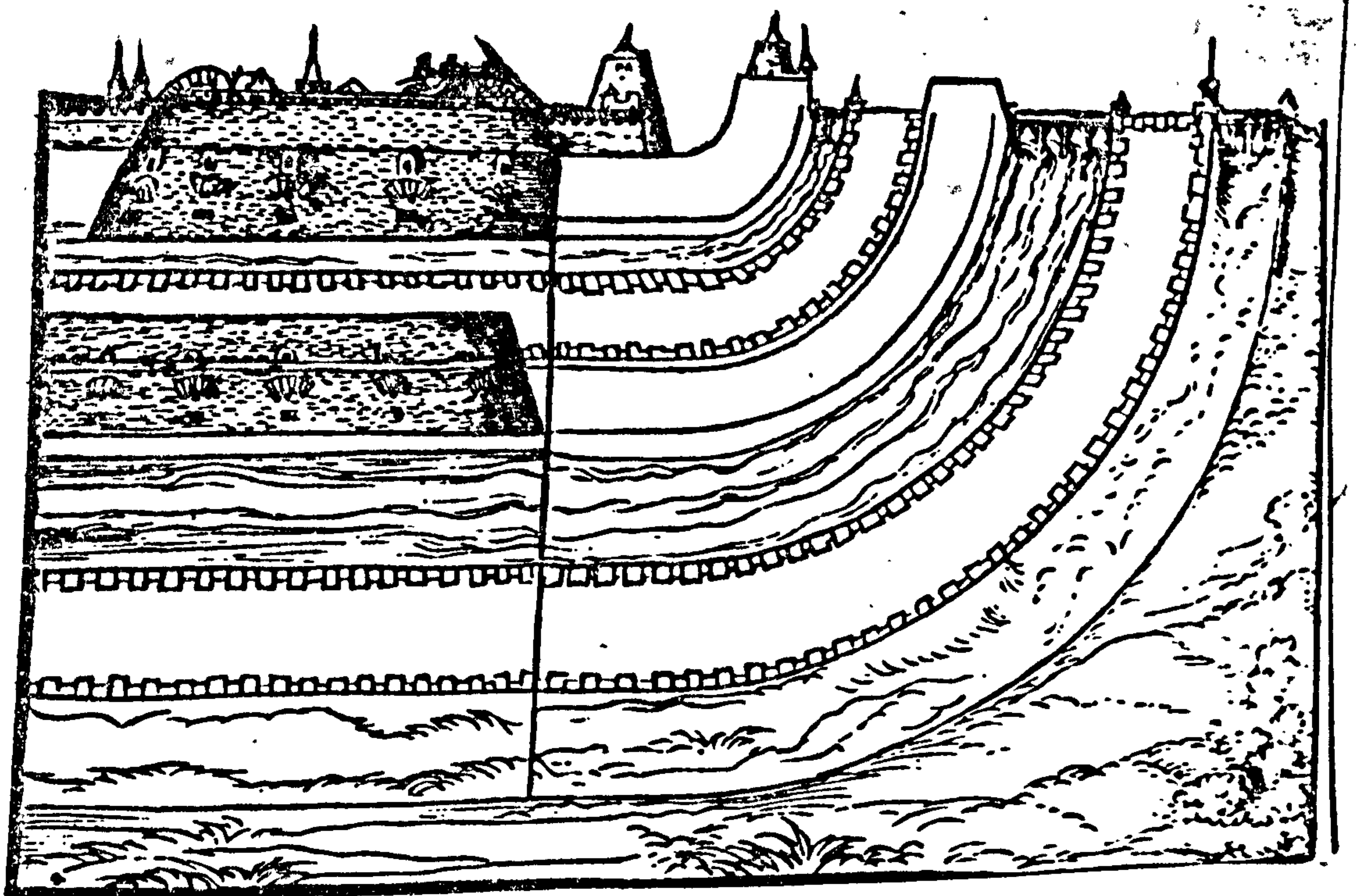


Plate 11B. Defences after Durer. RYFF (1547)
f. XXIIB. Full size.

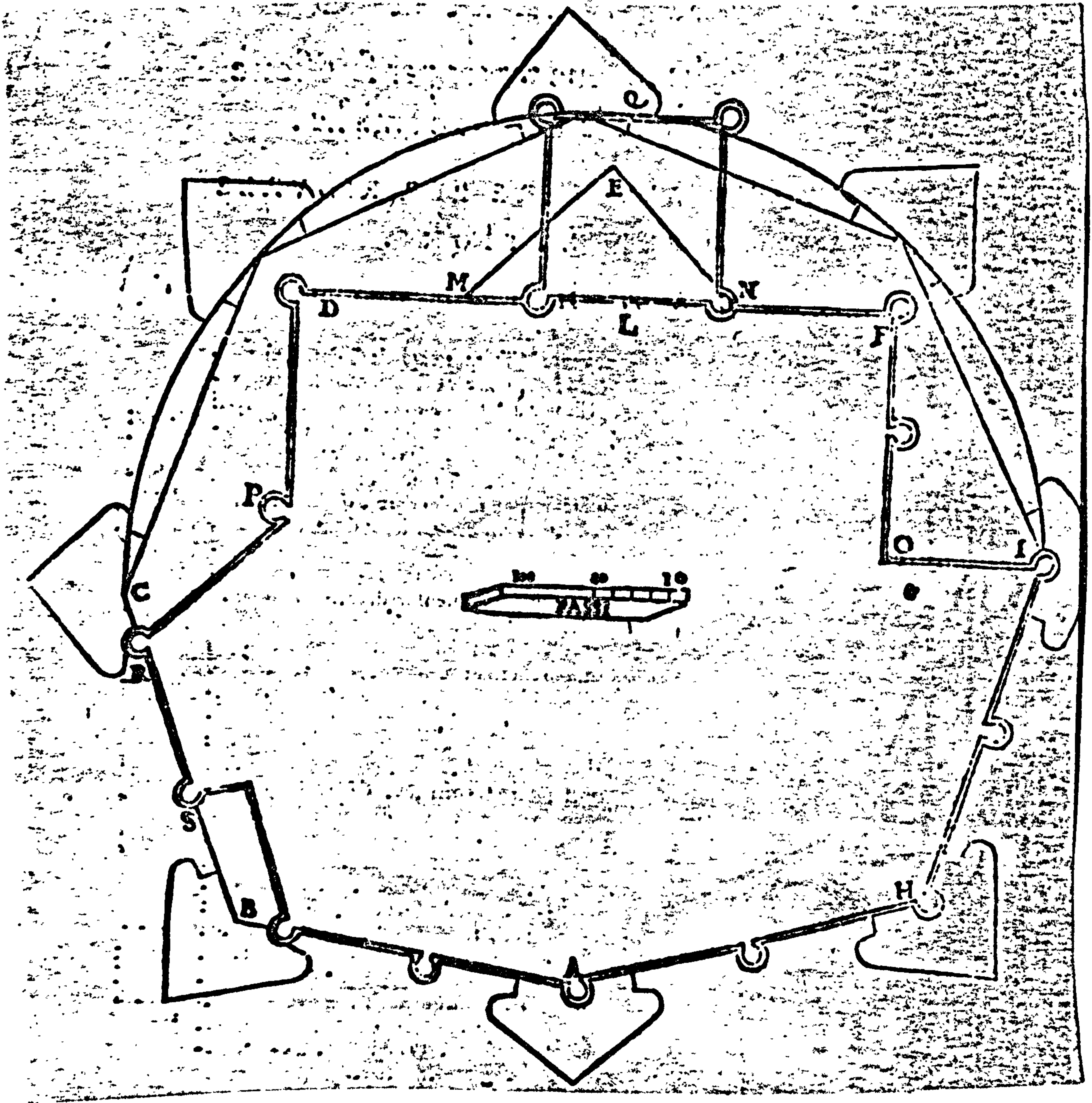


Plate 12. Regularisation of an old enceinte. LORINI (1609) p. 172. ((1596) p. 155). Slightly reduced.

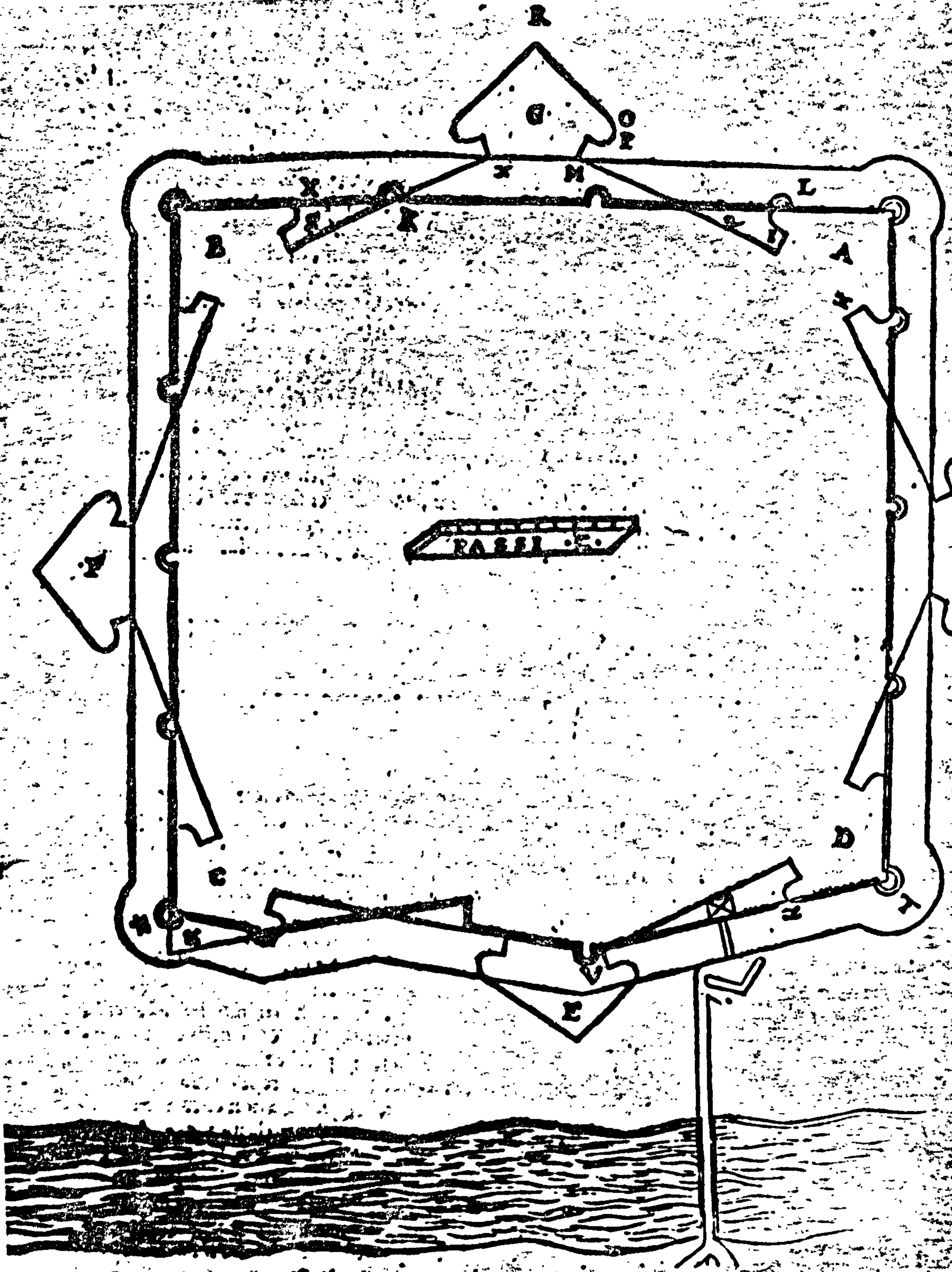
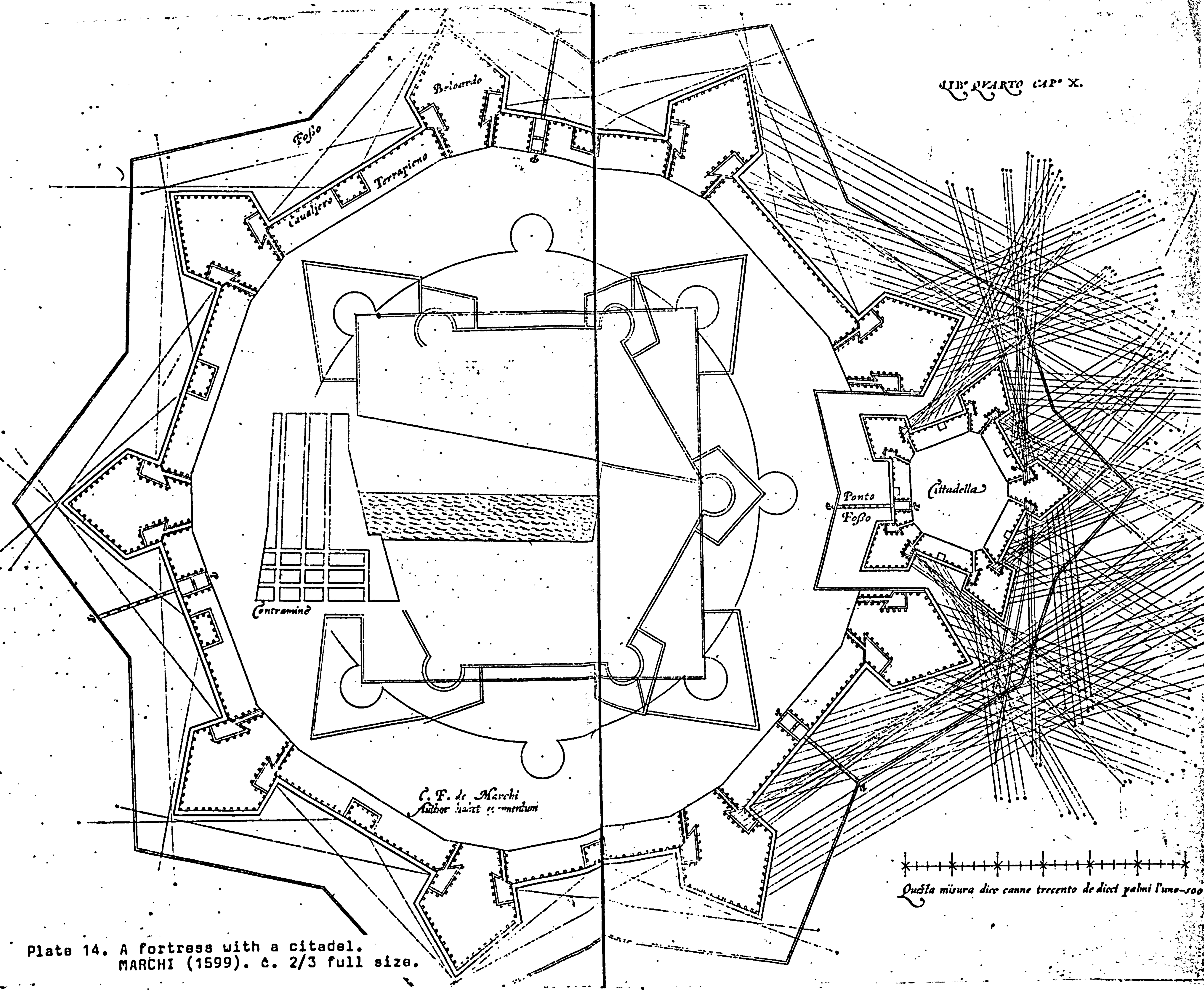


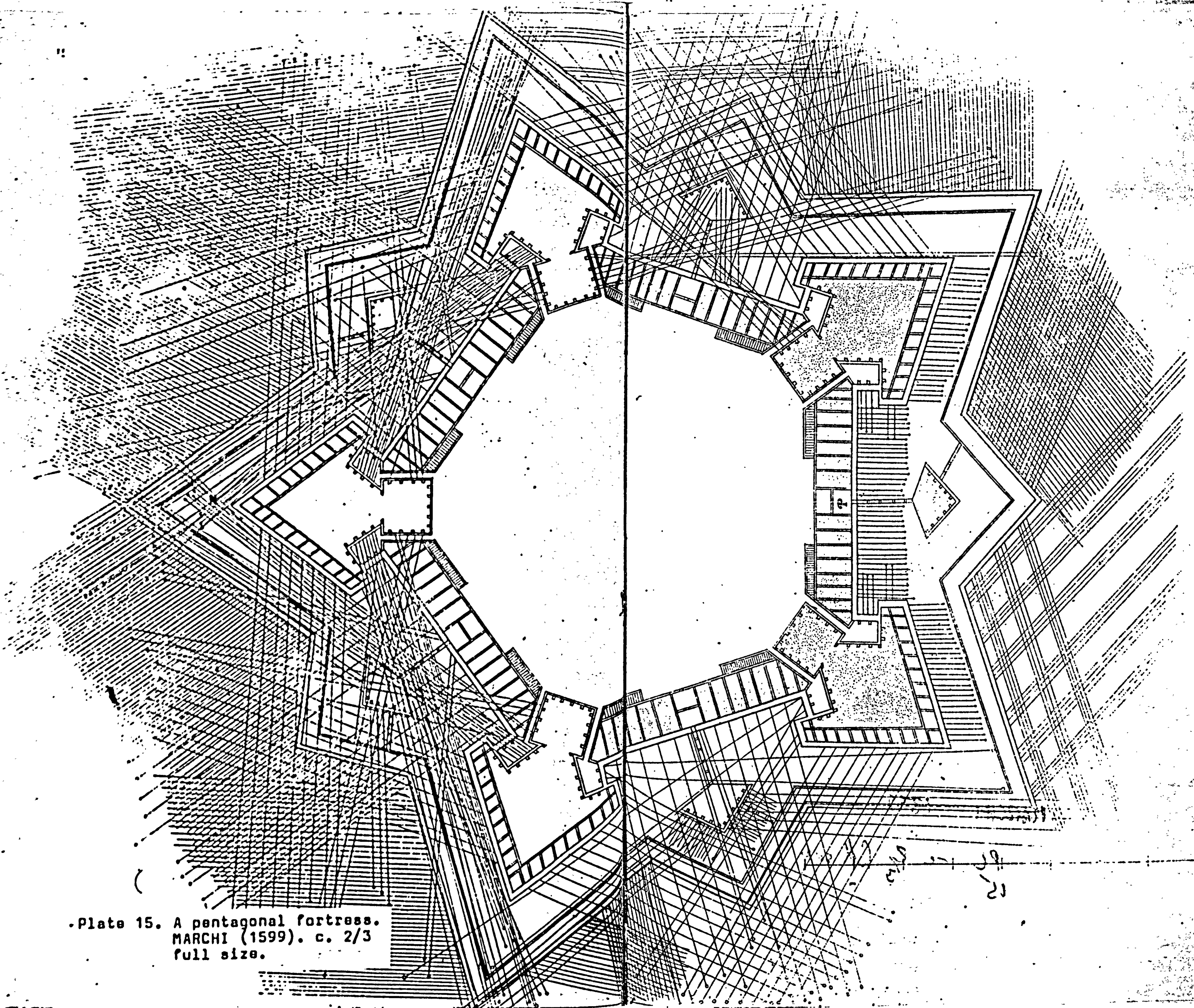
Plate 13. Regularisation of an old enciente. LORINI (1609) p. 174. (Not in (1596)). Slightly reduced.



C. F. de Marchi
Auctor hanc commentum

Quæta misura dice canne trecento de dieci palmi luno-500.

Plate 14. A fortress with a citadel.
MARCHI (1599). c. 2/3 full size.



.Plate 15. A pentagonal fortress.
MARCHI (1599). c. 2/3
full size.

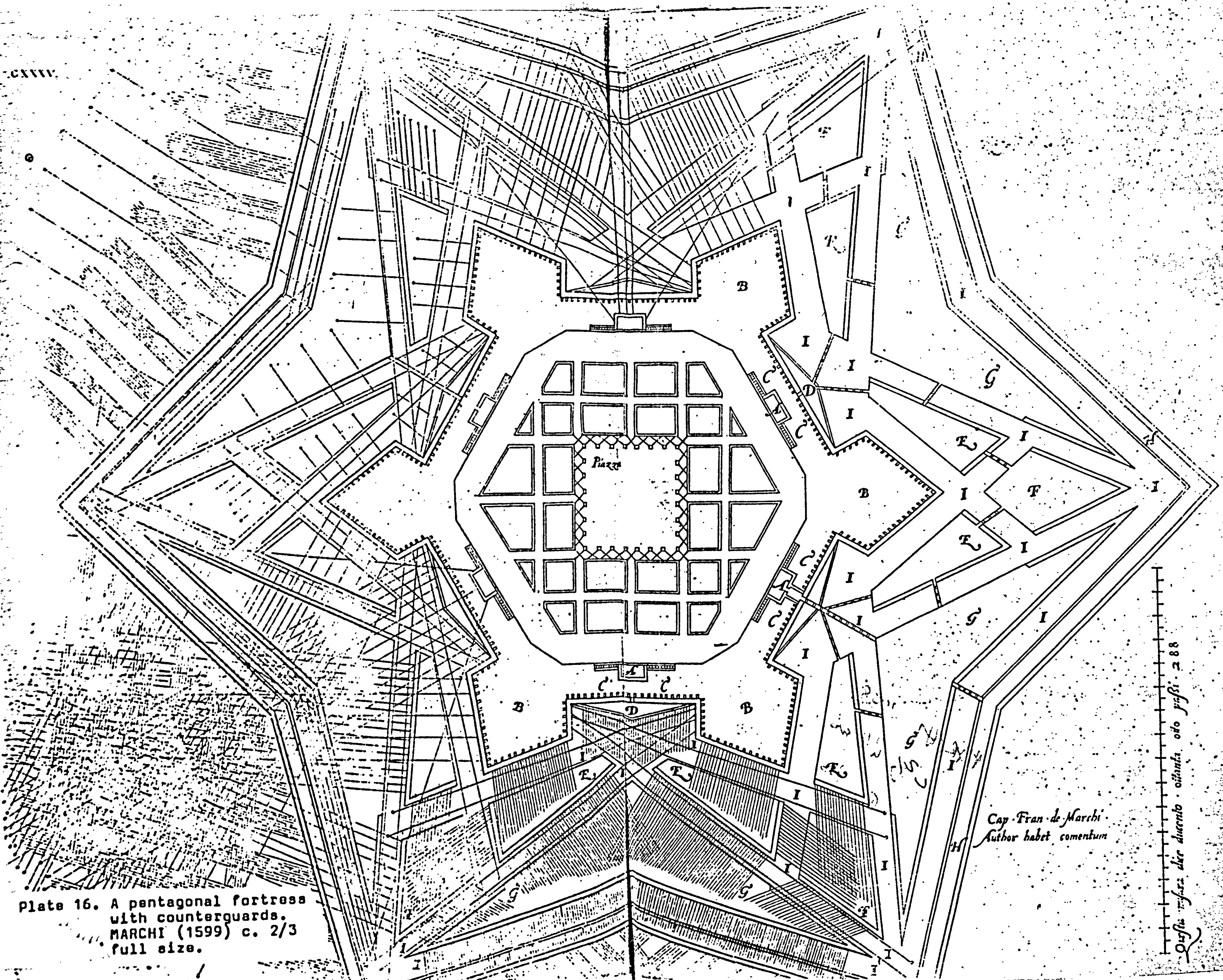


Plate 16. A pentagonal fortress with counterguards. MARCHI (1599) c. 2/3 full size.

Cap. Fran. de Marchi.
 Author habet comentum

Quisq. infra dec. ducento. c. octanta. octo. pass. 288

CXIV

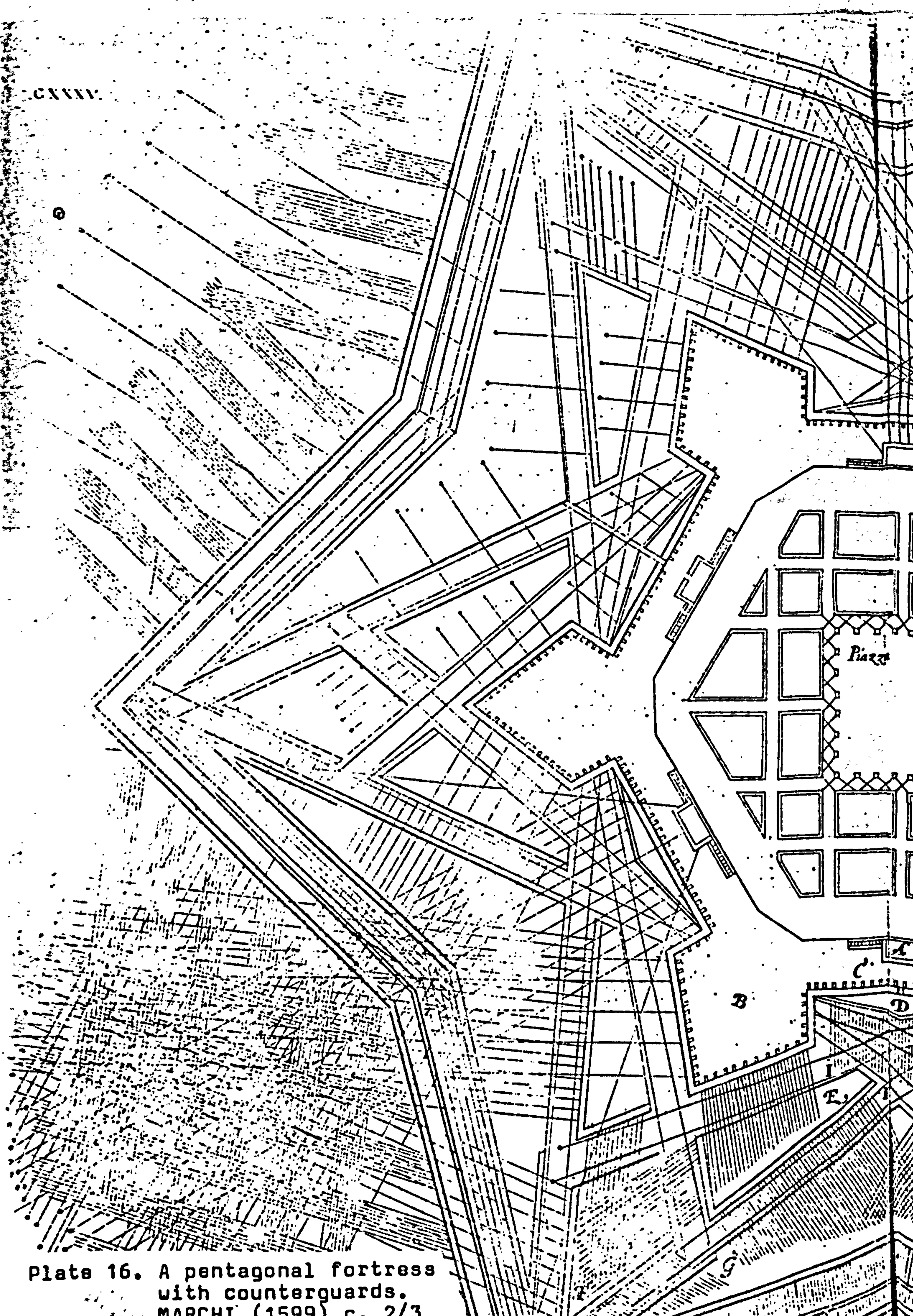
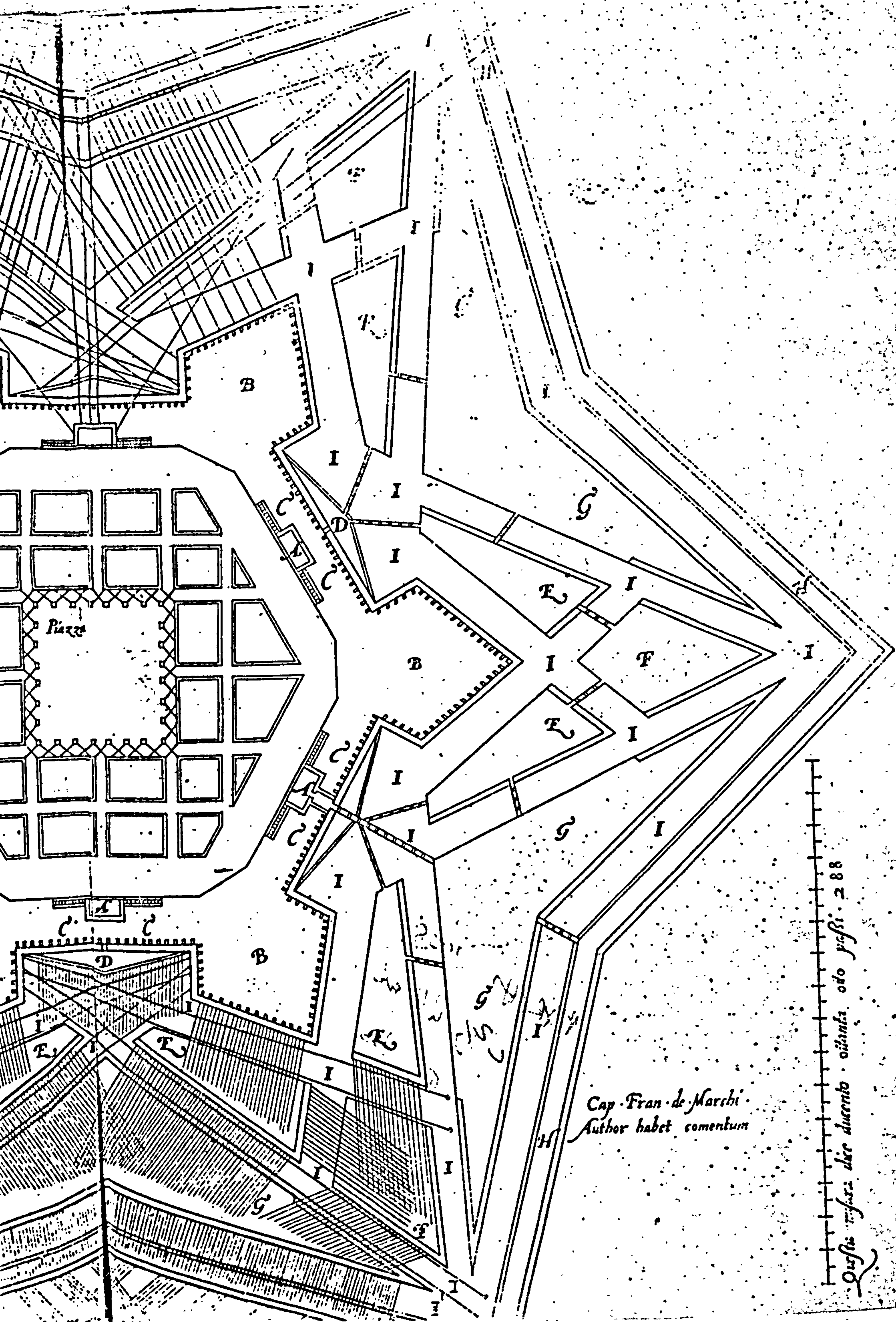


Plate 16. A pentagonal fortress with counterguards. MARCHI (1599) c. 2/3 full size.



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Cap. Fran. de Marchi.
Author habet comentum

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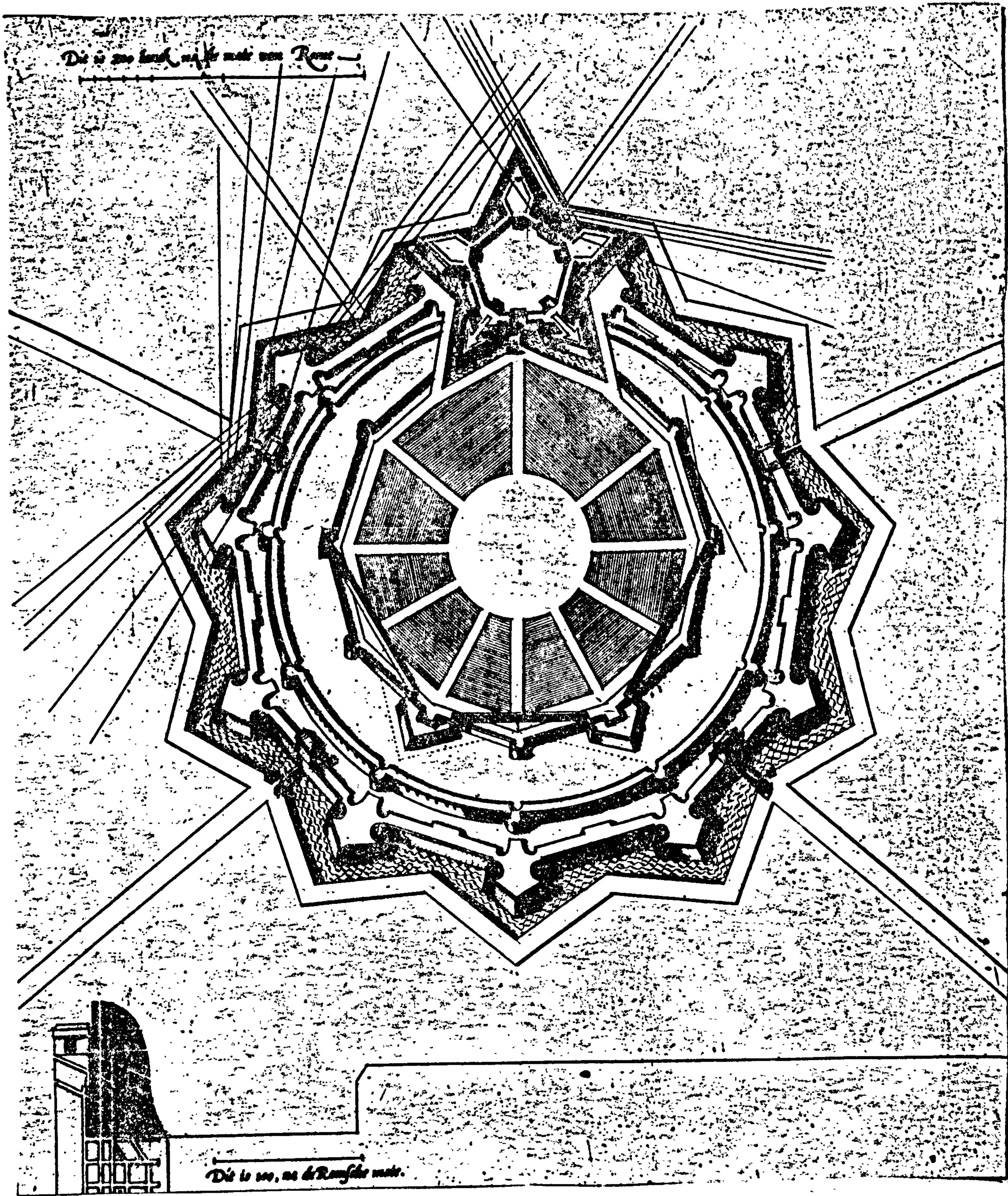


Plate 17. A fortress with a citadel. SCHILLE (1580)

Von Befestigung der Stadt
 Des Namhaftigen Gewaltigen vnd Besten Schloß Mey-
 landt / mit allen Gebewen vnd Wehren / eygentliche
 Contrafactur / wie solchs diser zeit im
 Berck gesehen wirt.



Plate 18. The castle of Milan. RYFF (1547) f. IIa
 of the section on fortification. Slightly
 reduced.

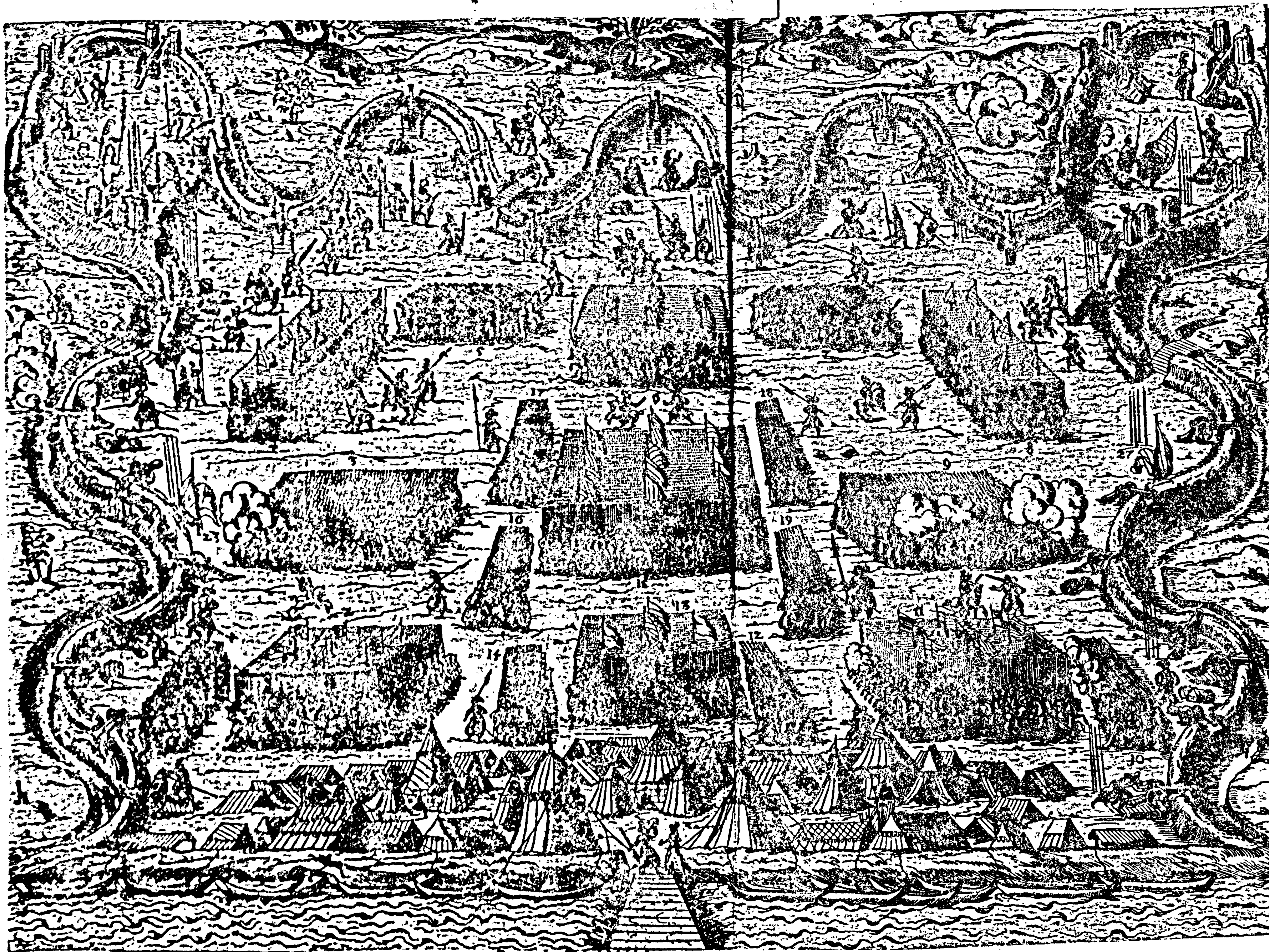


Plate 19. A sinuous field fortification. FRONSPERGER
(1571/3). Between f. CXXVII/VIII. c. 7
full size.

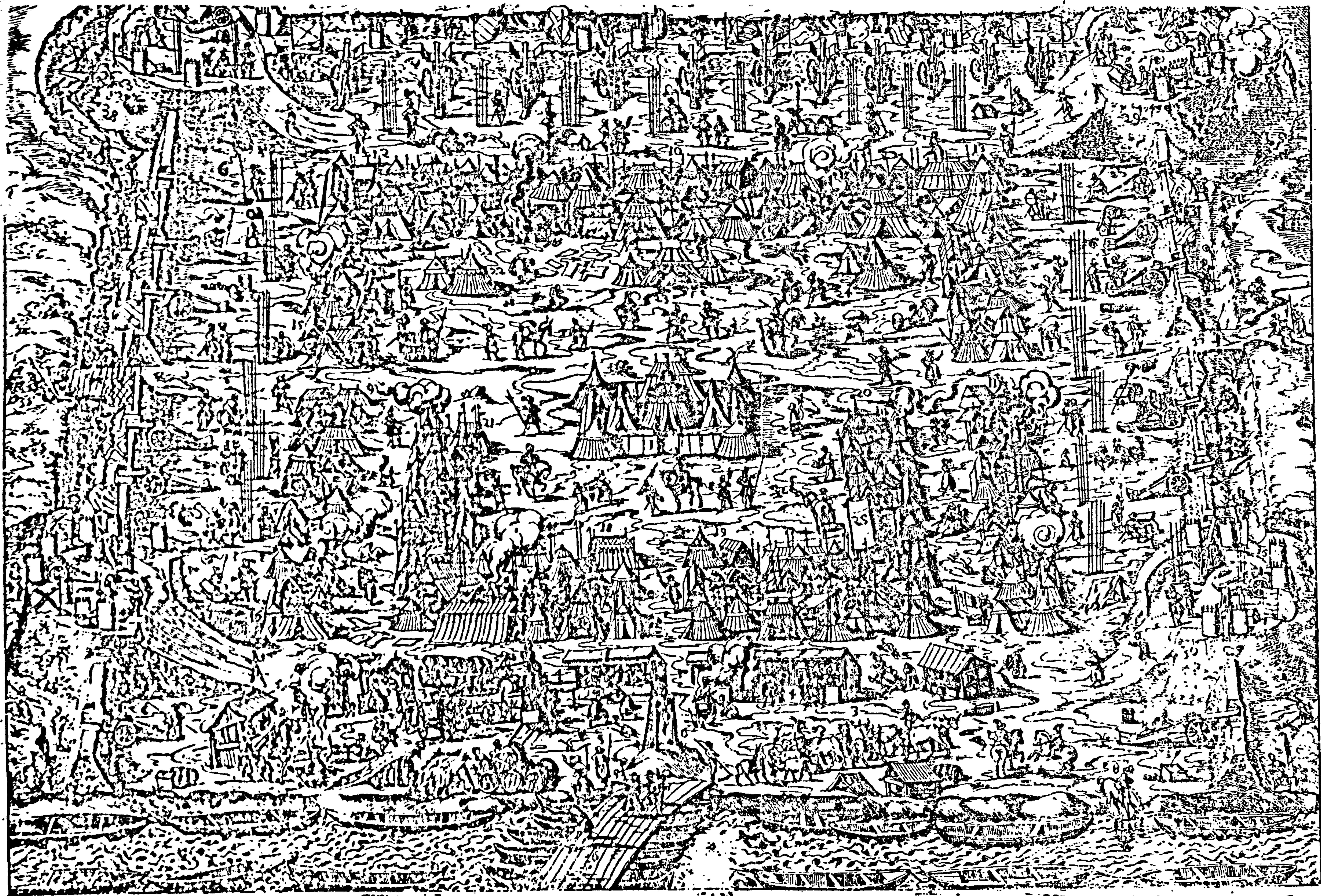
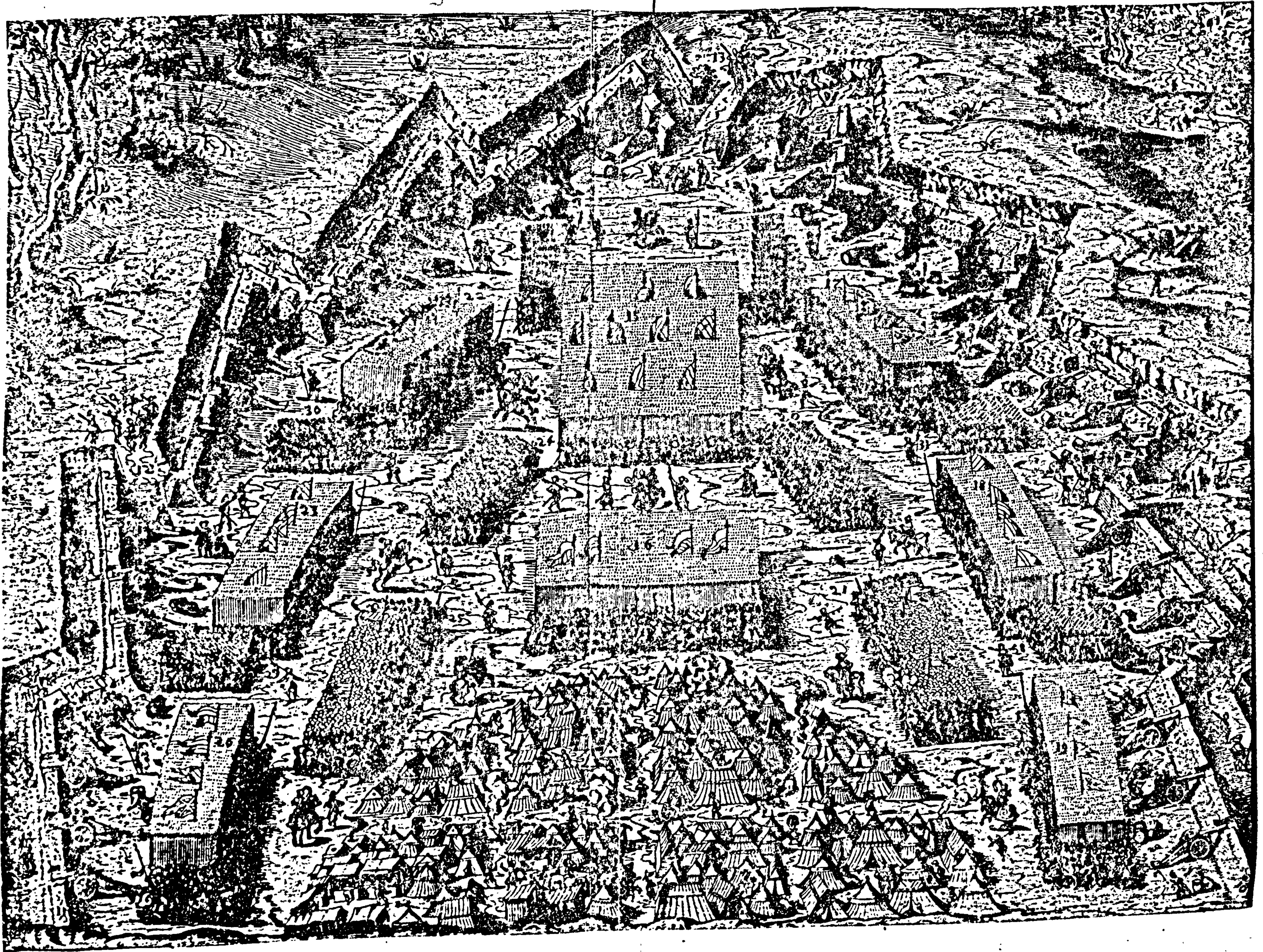


Plate 20. A field fortification with rondells.
FRONSPERGER (1571/4). Between f. CXXIX/
CXXX. c. $\frac{2}{3}$ full size.



21.
Plate 21. A partly flanked field fortress. FRONSPERGER
(1571/3). Between f. CXXX/CXXXI. c. $\frac{3}{4}$ full
size.



Plate 22. Pioneer with a square fortress in the background. FRONSPERGER (1571/3) f. CXLVIA for example. c. 1½ full size.

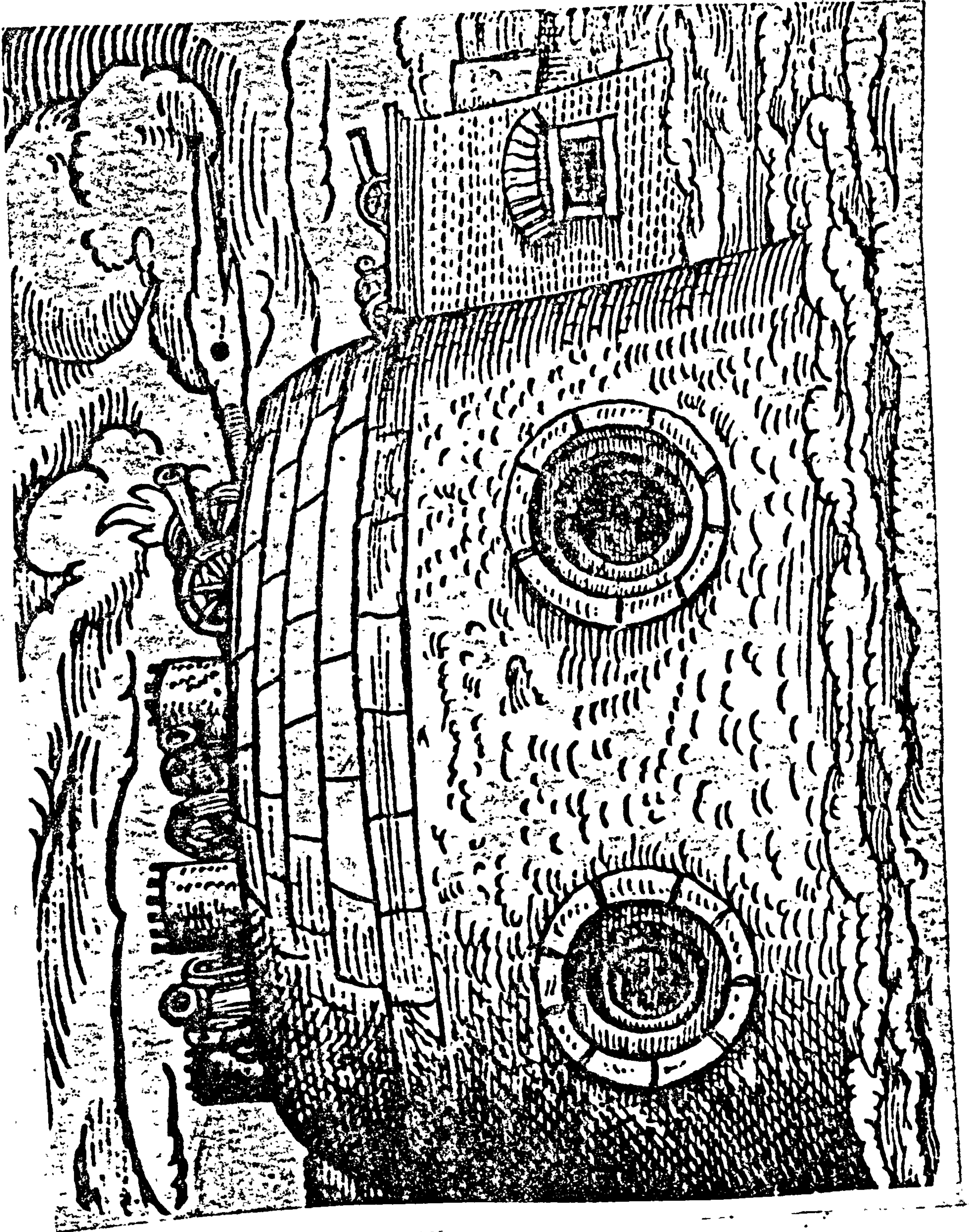


Plate 23. A round bastion. FRONSPERGER (1571/3). Pt. II
XXVIIIb, for example. c. 1½ full size.

in apt

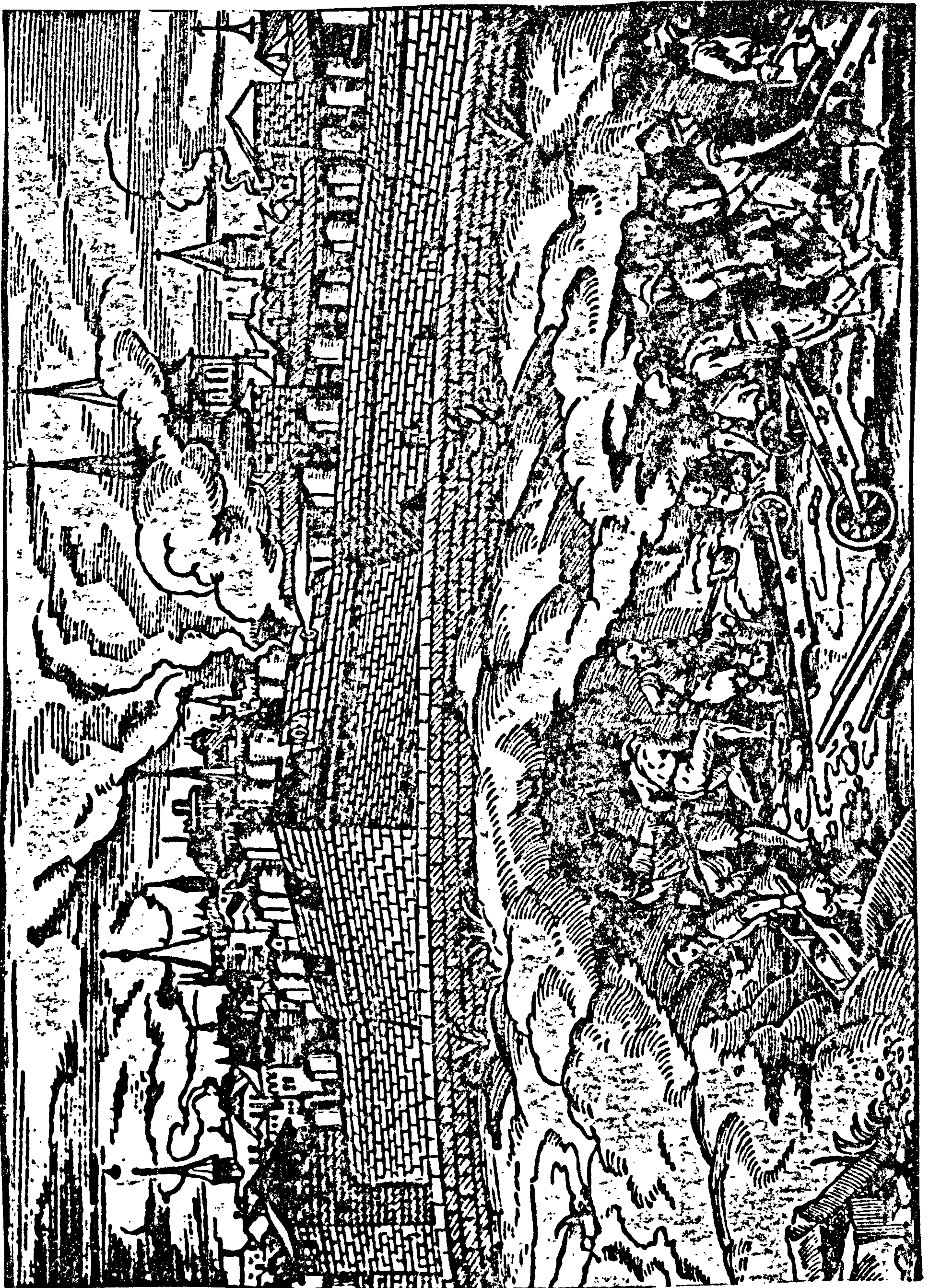


Plate 24. A pointed bastion. FRONSPERGER (1571/3) Pt. II, f. XXIIa. c. 1½ full size.

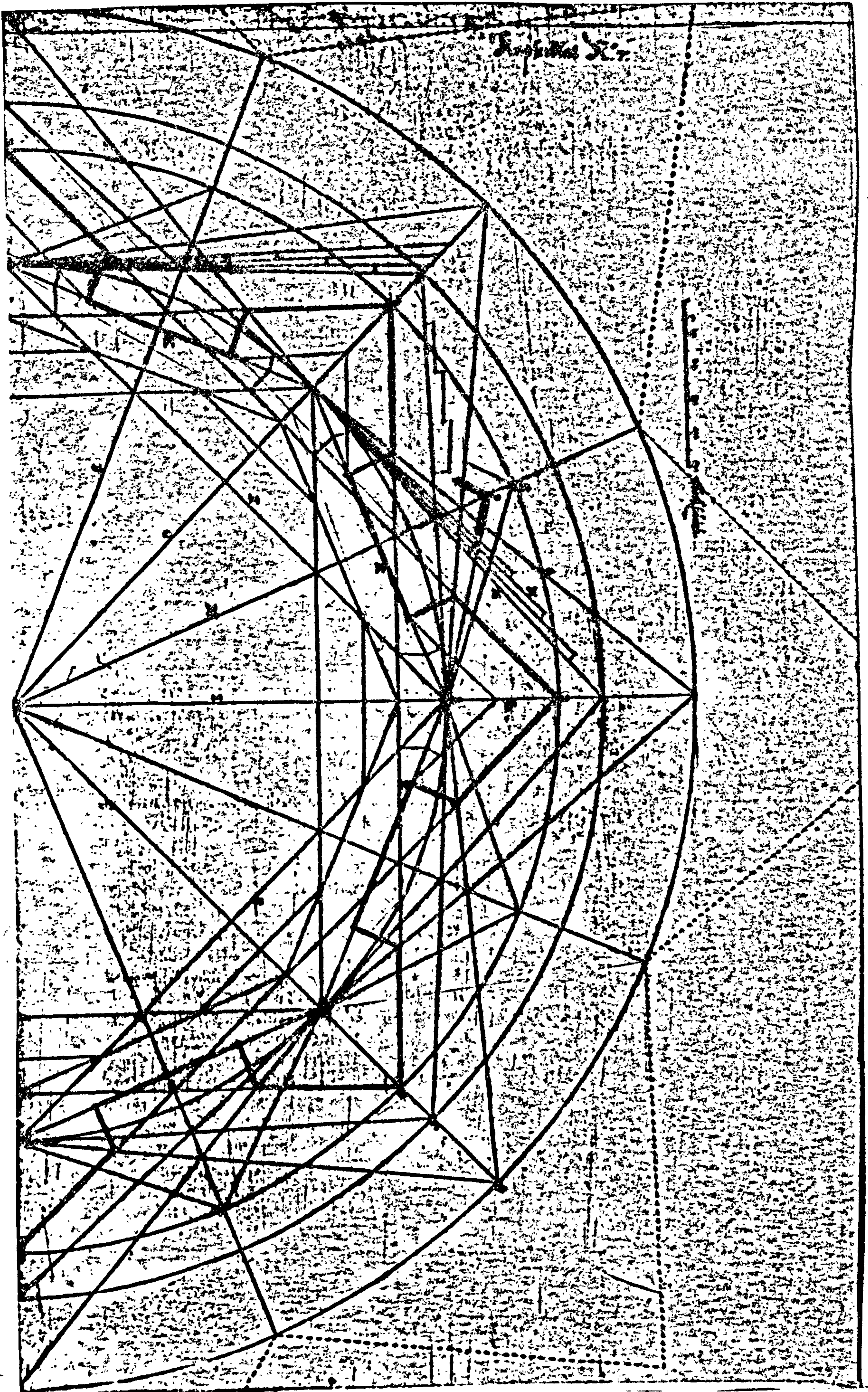


Plate 25. Method of designing the trace of a fortress.
SPECKLIN (1589). Pl. no. 7, l.h. side. c. $\frac{3}{4}$
full size.

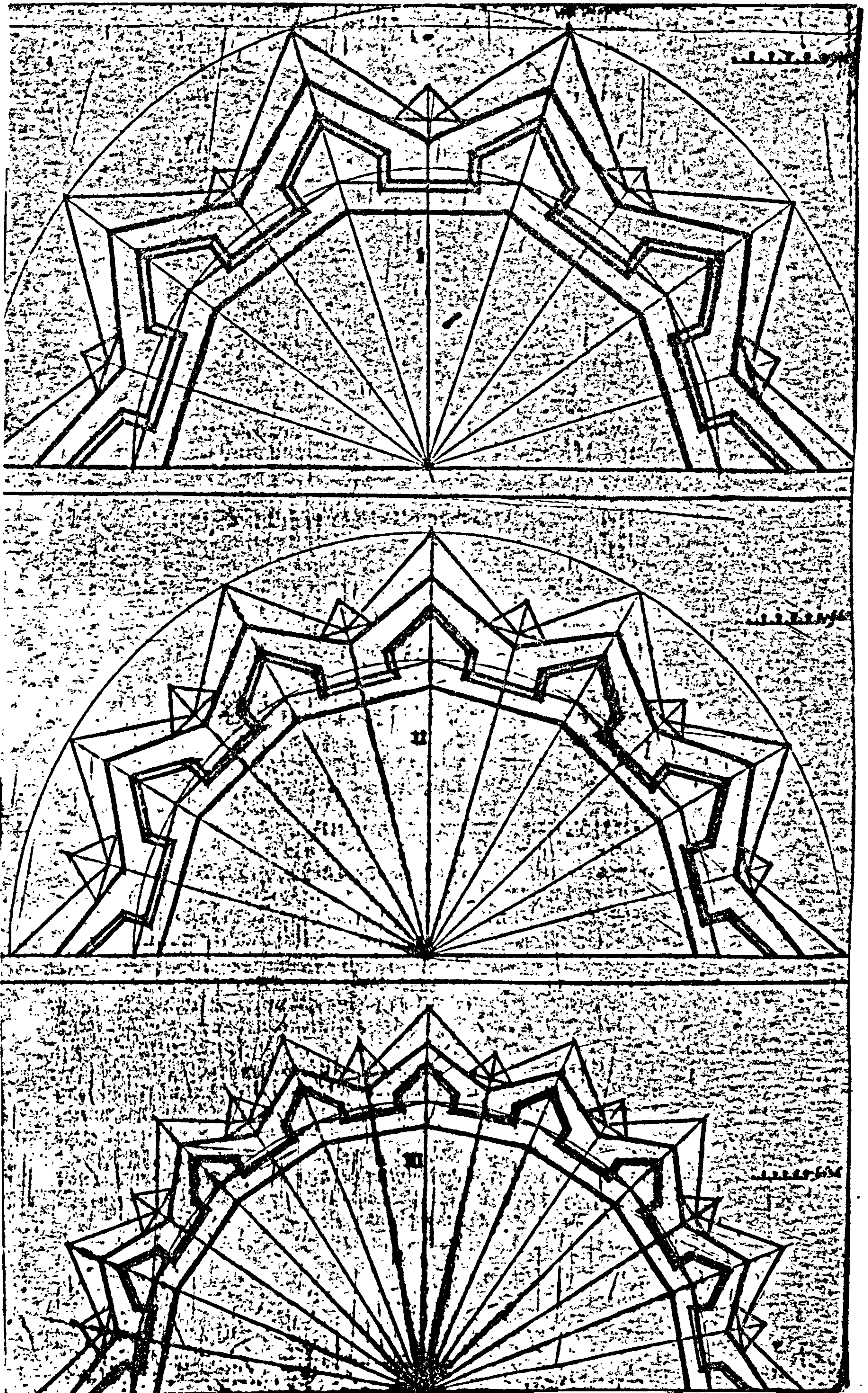


Plate 26. Fortress traces. SPECKLIN (1589) Pl. 7. r.h. side. c. $\frac{3}{4}$ full size.

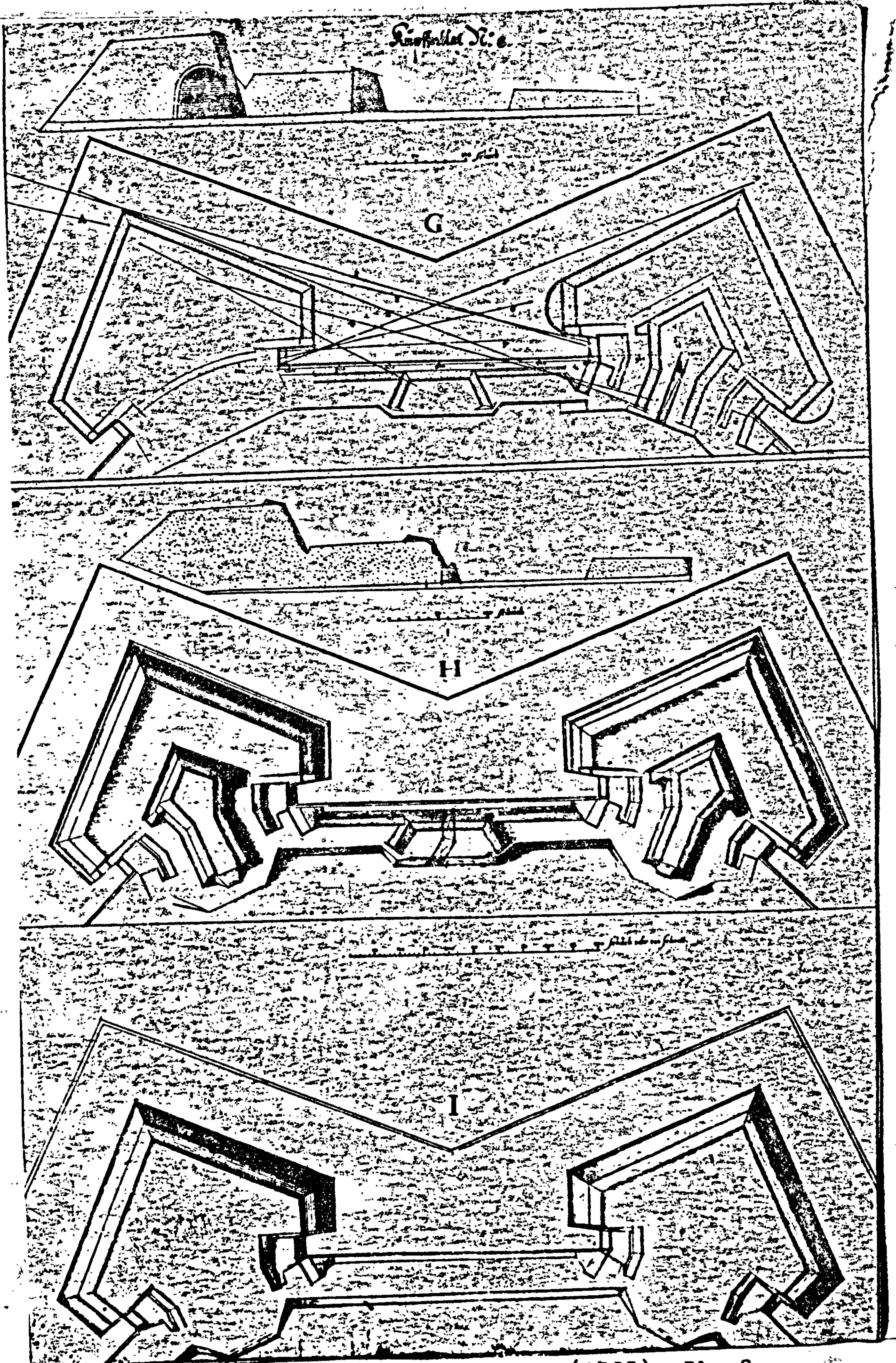


Plate 27. Pairs of bastions. SPECKLIN (1589). Pl. 8.
l.h. side. c. $\frac{3}{4}$ full size.

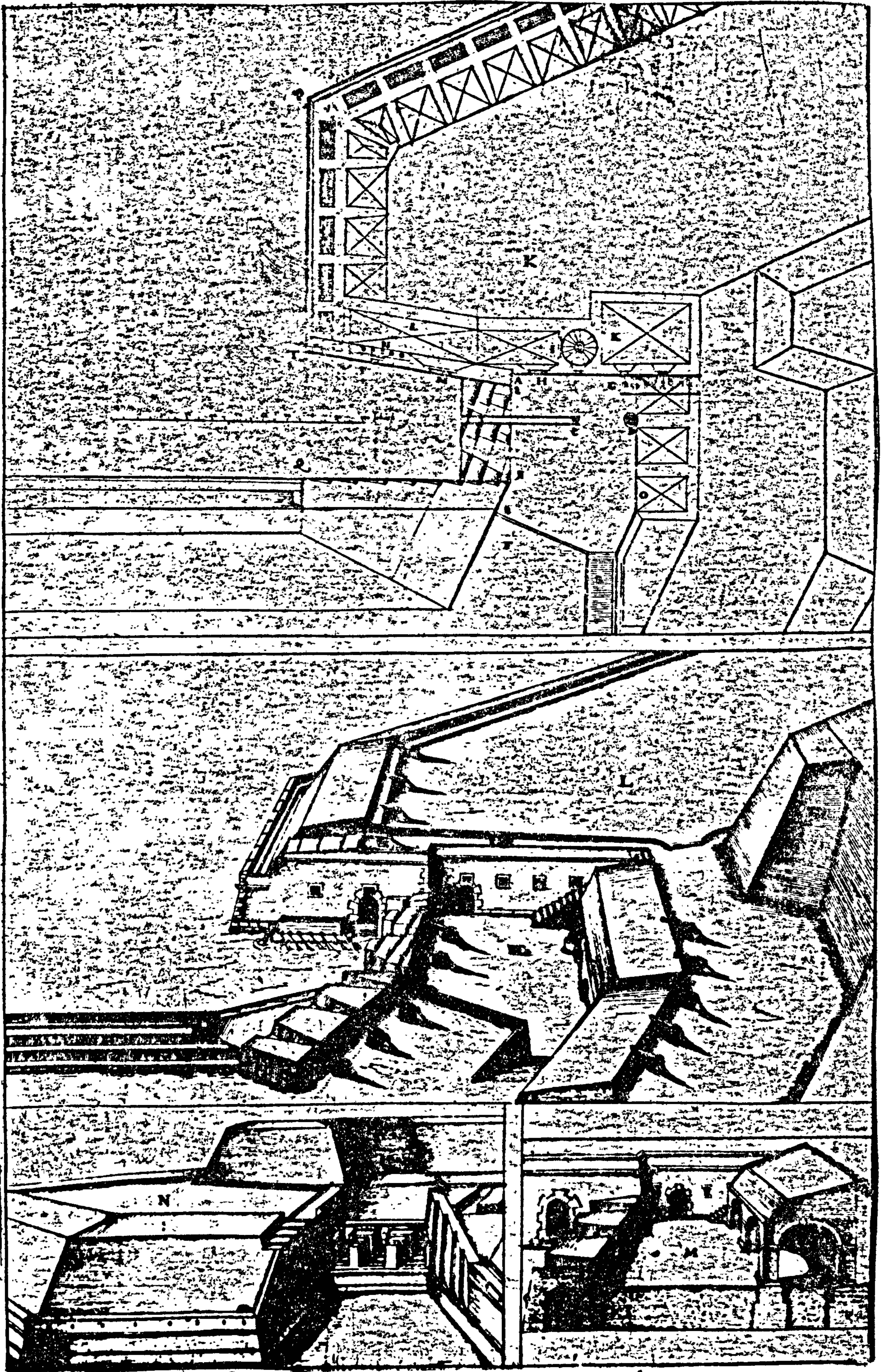


Plate 28. Details of a casemate in the neck of the bastion. SPECKLIN (1589). Pl. 8. r.h. side c. $\frac{3}{4}$ full size.

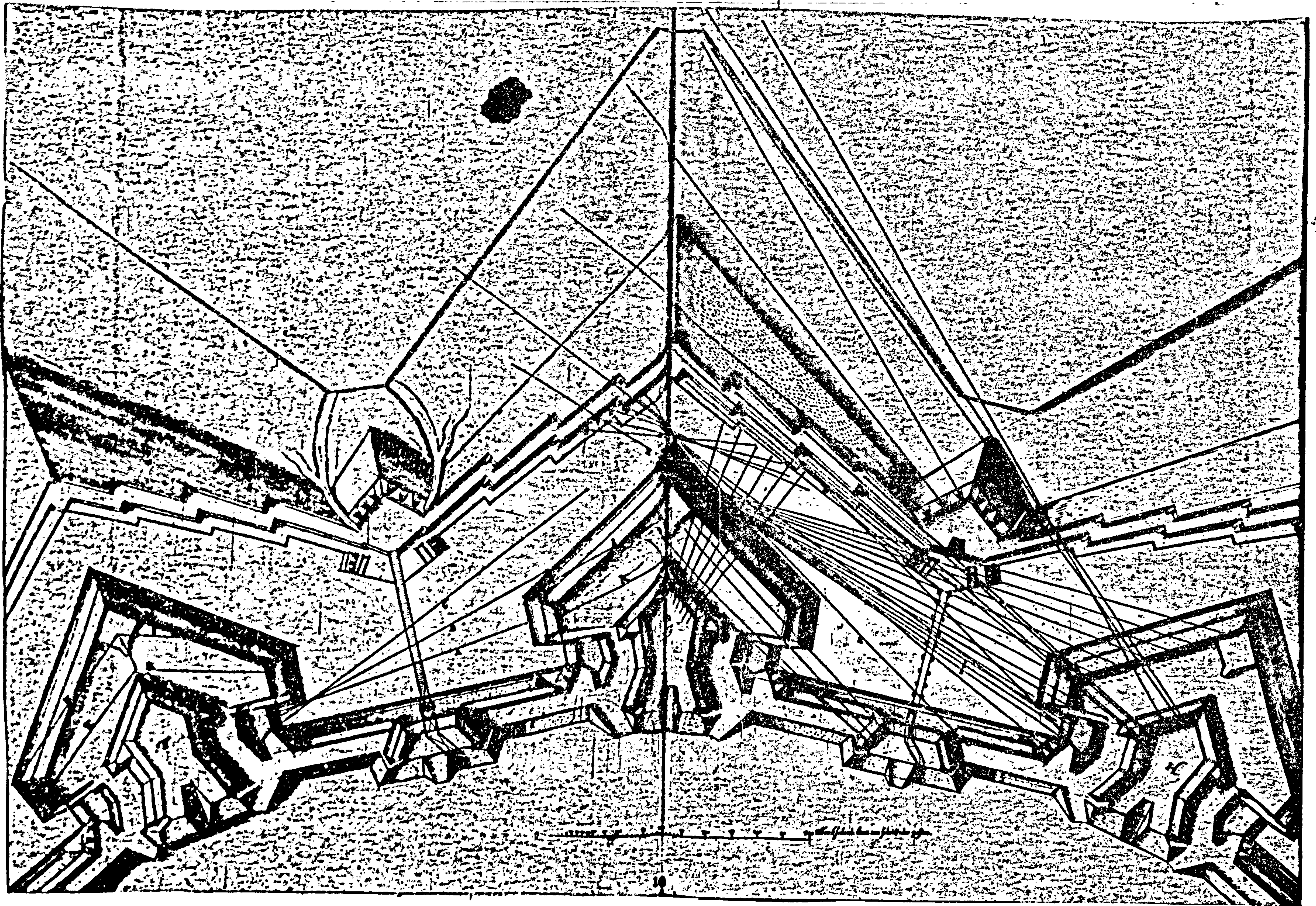


Plate.29. Part of a fortress front. SPECKLIN (1589)
Pl. 10. c. $\frac{3}{4}$ full size.

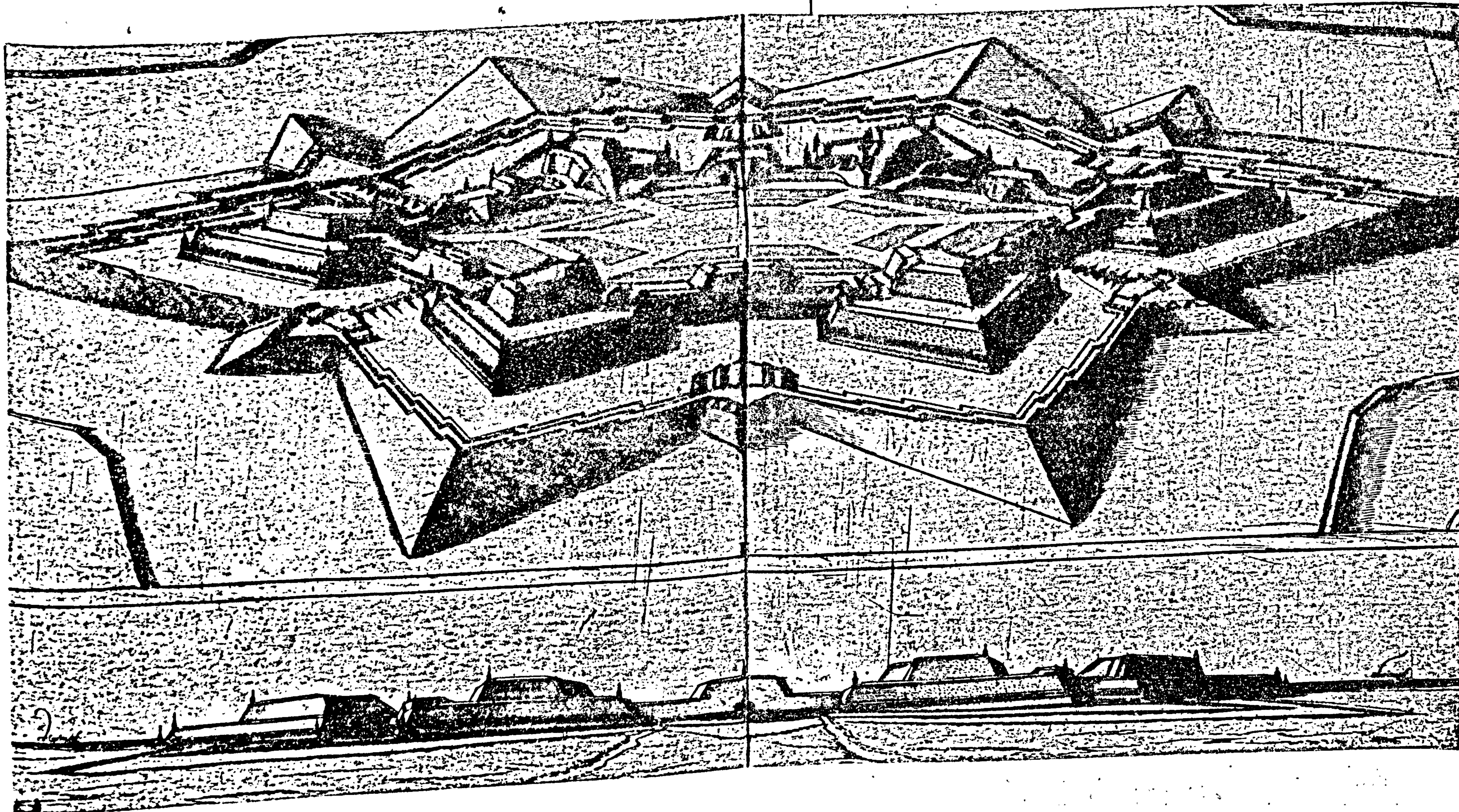


Plate 30. A perspective view of a fortress. SPECKLIN
(1589). Pl. 11. c. $\frac{2}{3}$ full size.

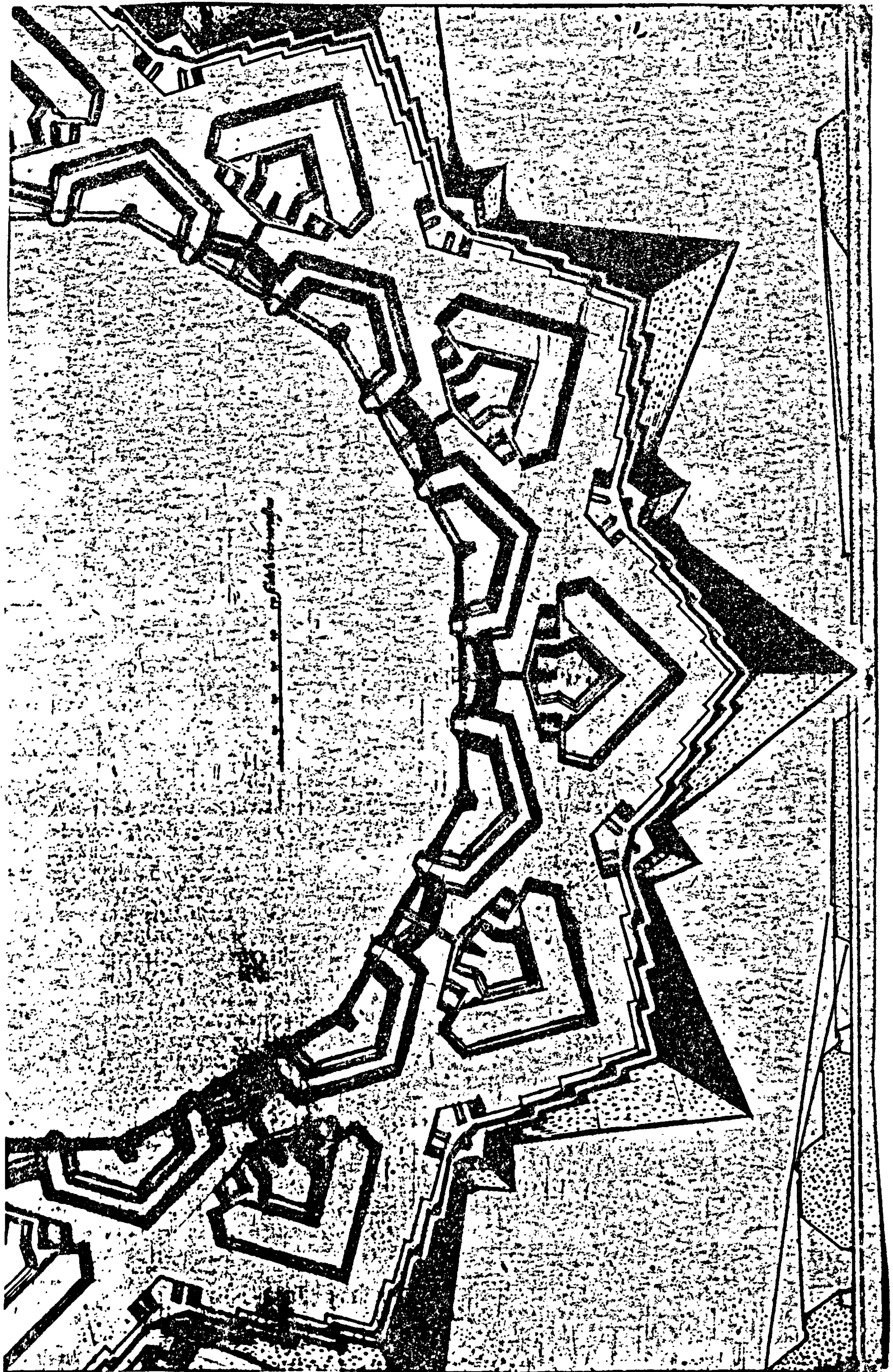


Plate 31. Design of a 12 bastion fortress. SPECKLIN
(1589). Pl. 12, l.h. side. c. $\frac{2}{3}$ full size.

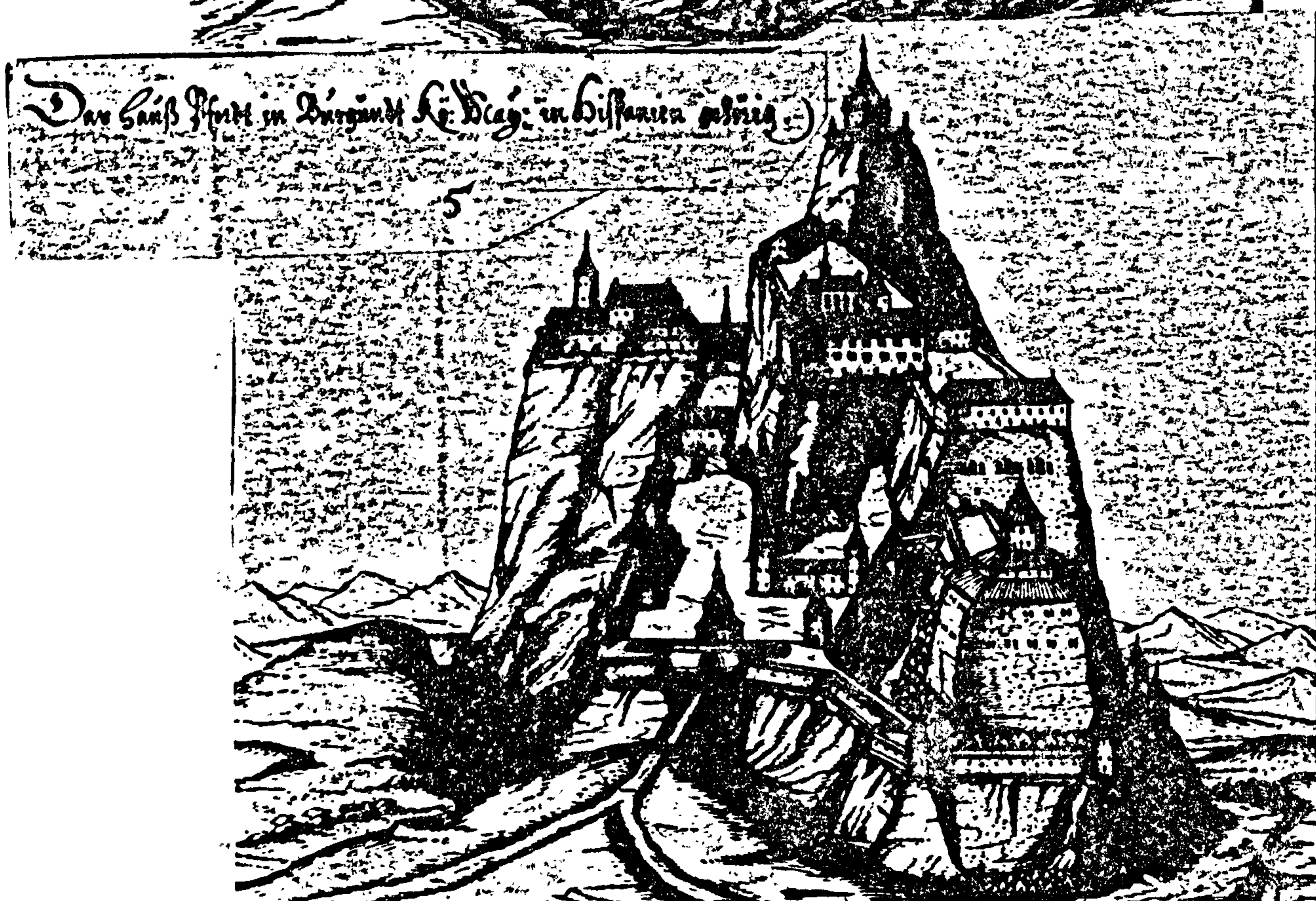
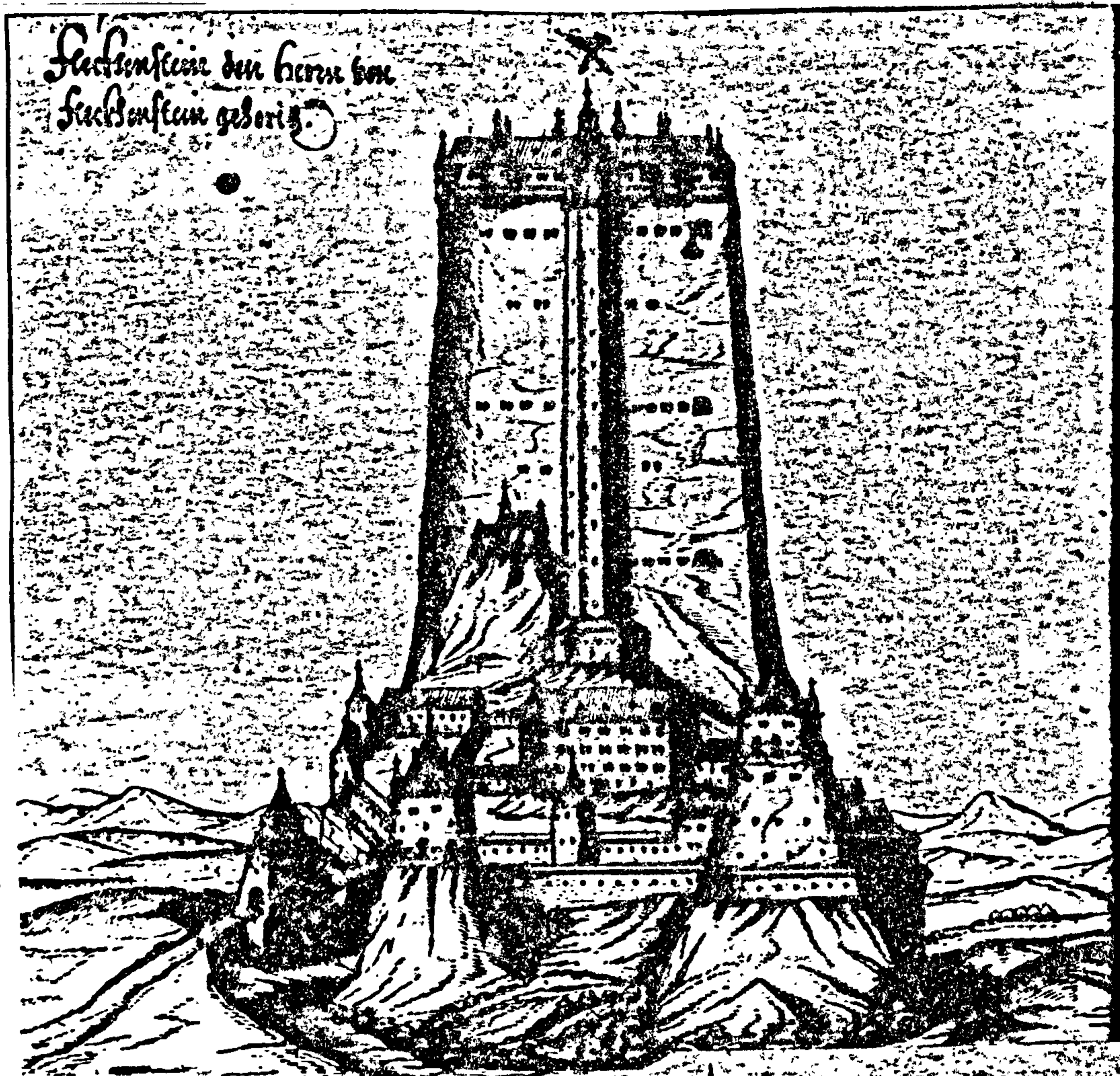
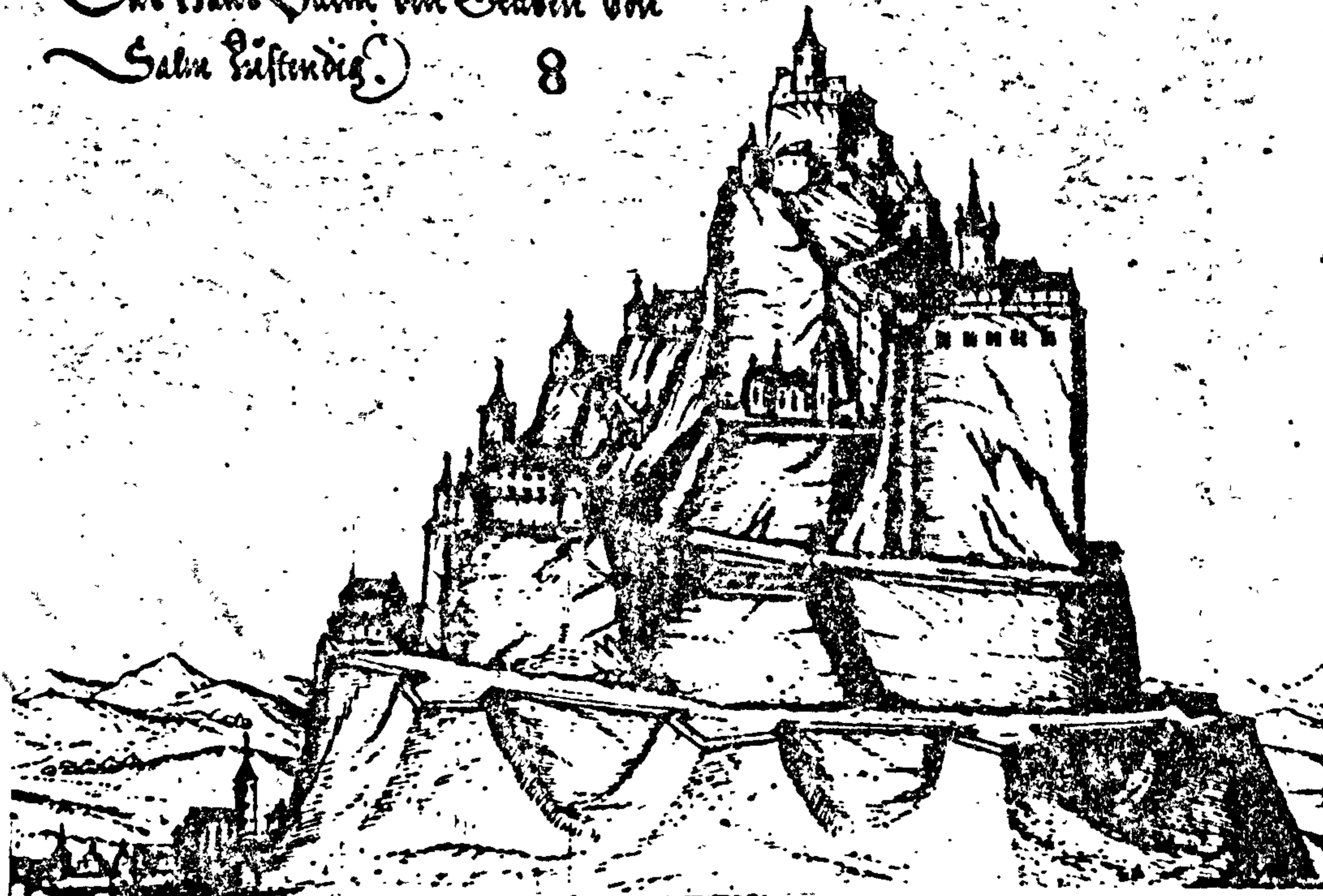


Plate 32. Castle sites. SPECKLIN (1589). Pl. 16. c. 7
full size.

Das Haus Salm im Graben von
Salm Rüstendig. 8



Donnentstein oder Ehrenreiffen am
Stein im Tschel von Geyer gebauet. 2

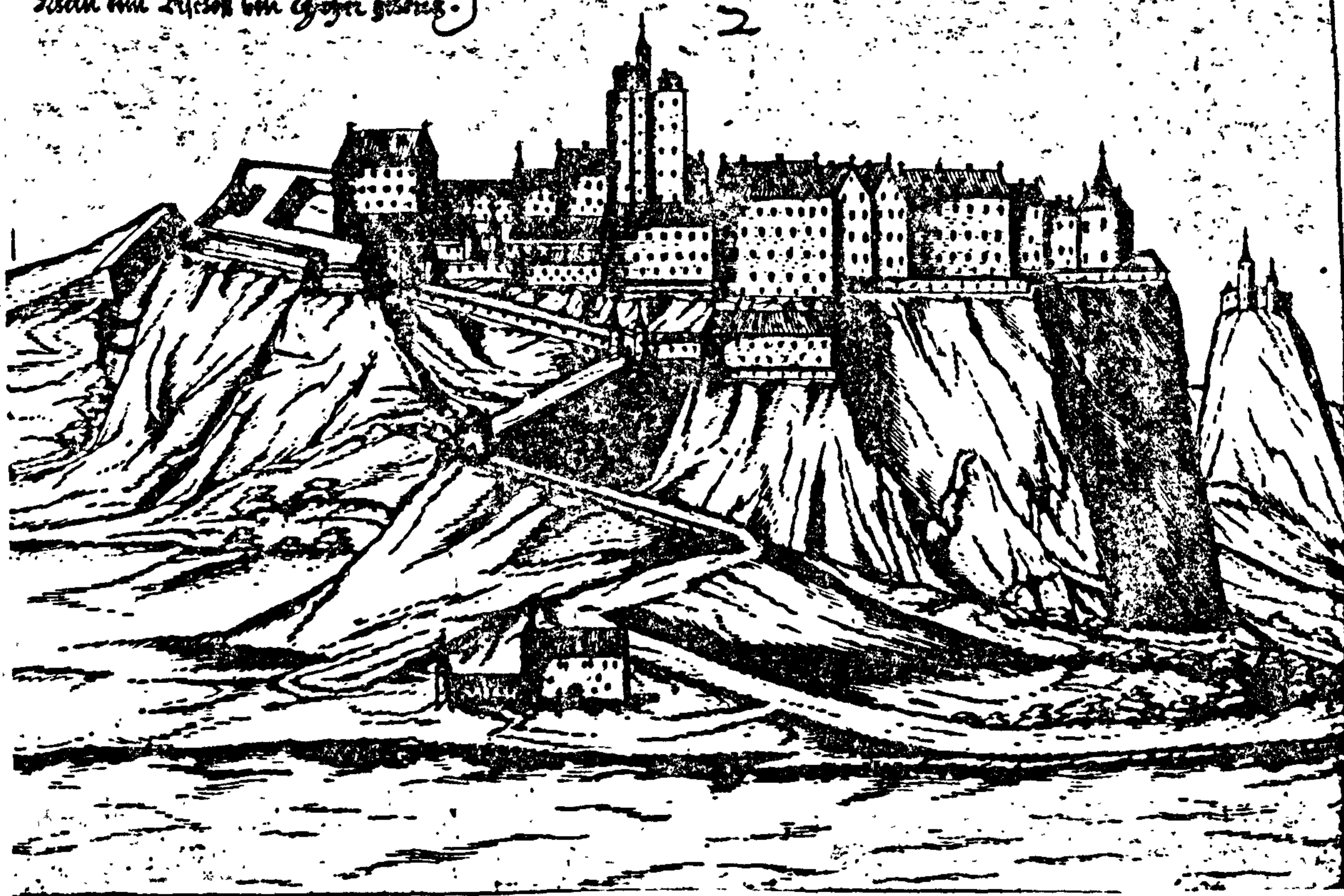


Plate 33. Castle sites. SPECKLIN (1589).Pl. 16 & after
f. 88. c. $\frac{3}{4}$ full size.

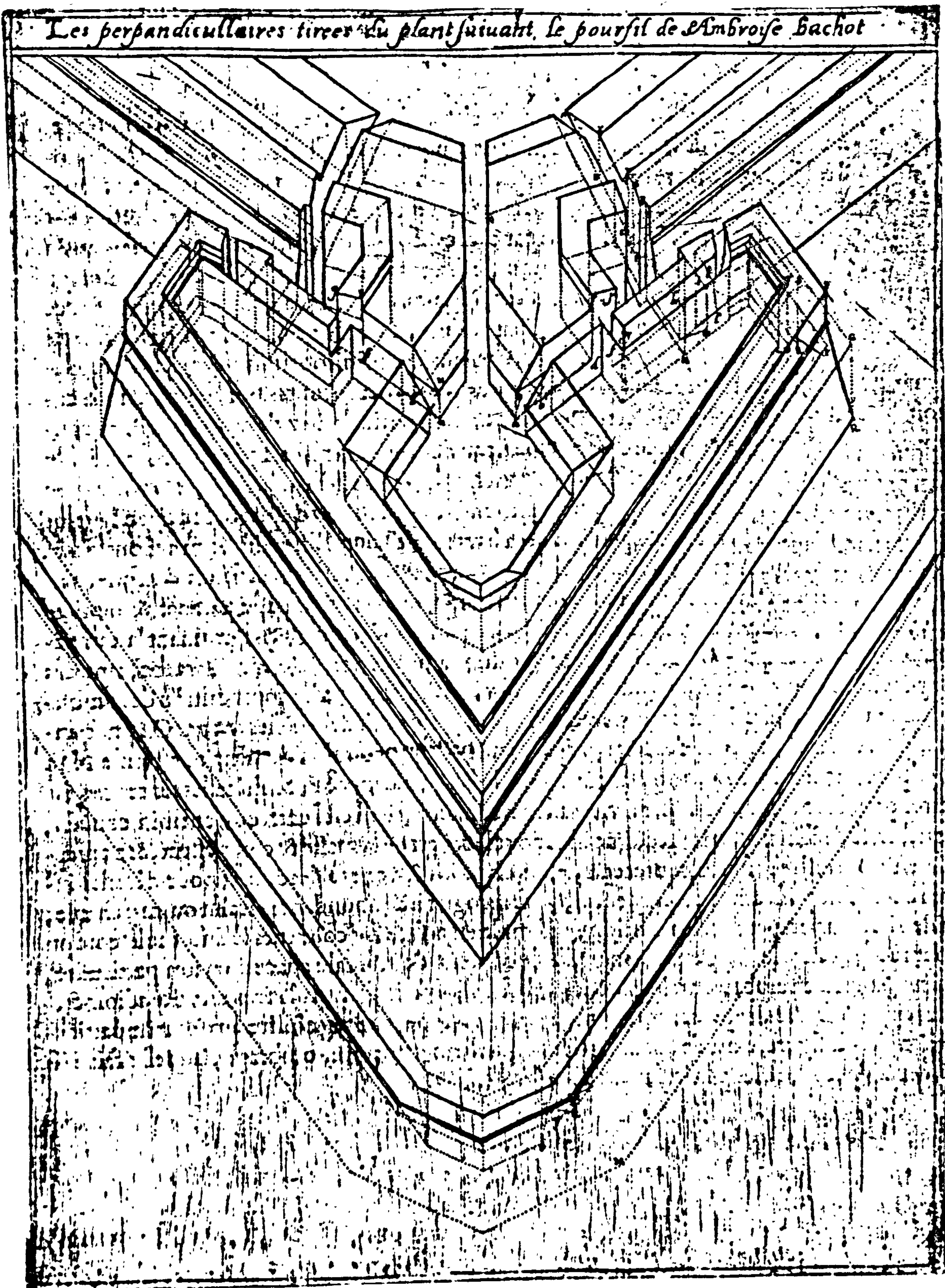


Plate 34. Perspective view of a bastion. BACHOT (1589)
p. 43. c. $\frac{3}{4}$ full size.

Corps elleue Monstran toutes les faces qui ce peuuent voir suivant les regles de nostre perspectiues

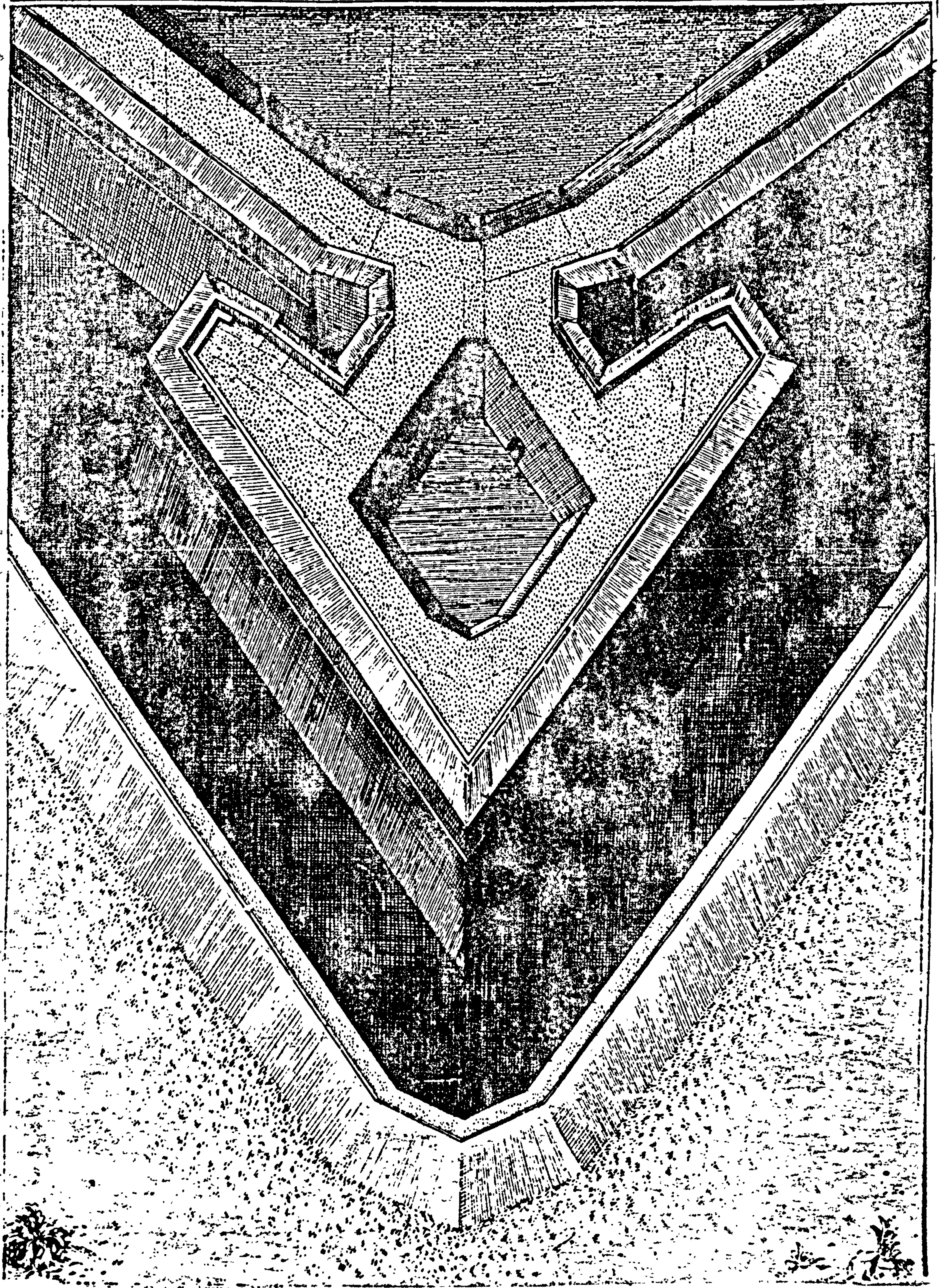


Plate 35. Perspective view of a bastion with shading.
BACHOT (1598), p. 45, c. $\frac{3}{4}$ full size.

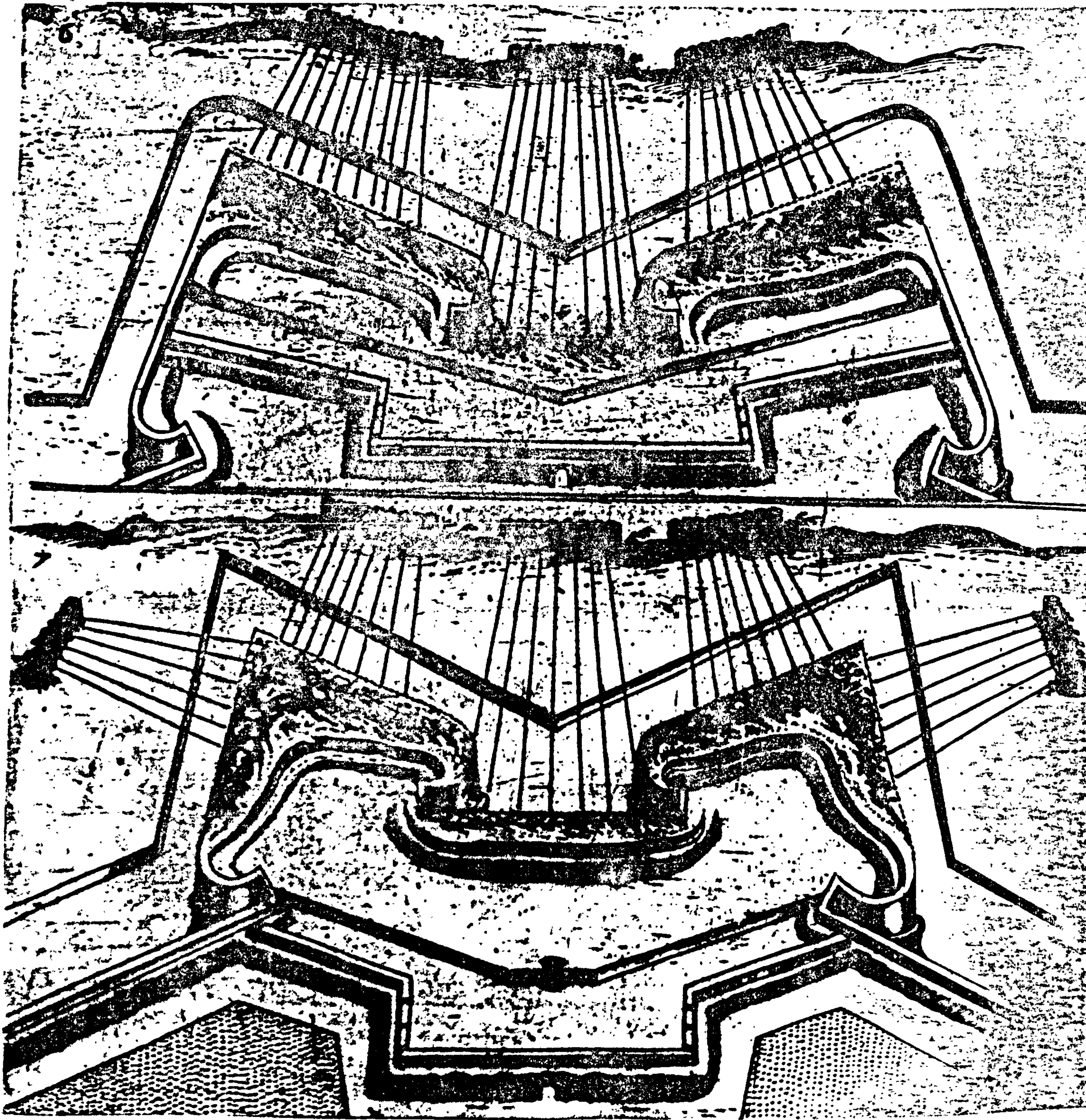


Plate 36. Attack on two bastions of a fortress. ERRARD
(1604 Paris) p. 62. c. $\frac{3}{4}$ full size.

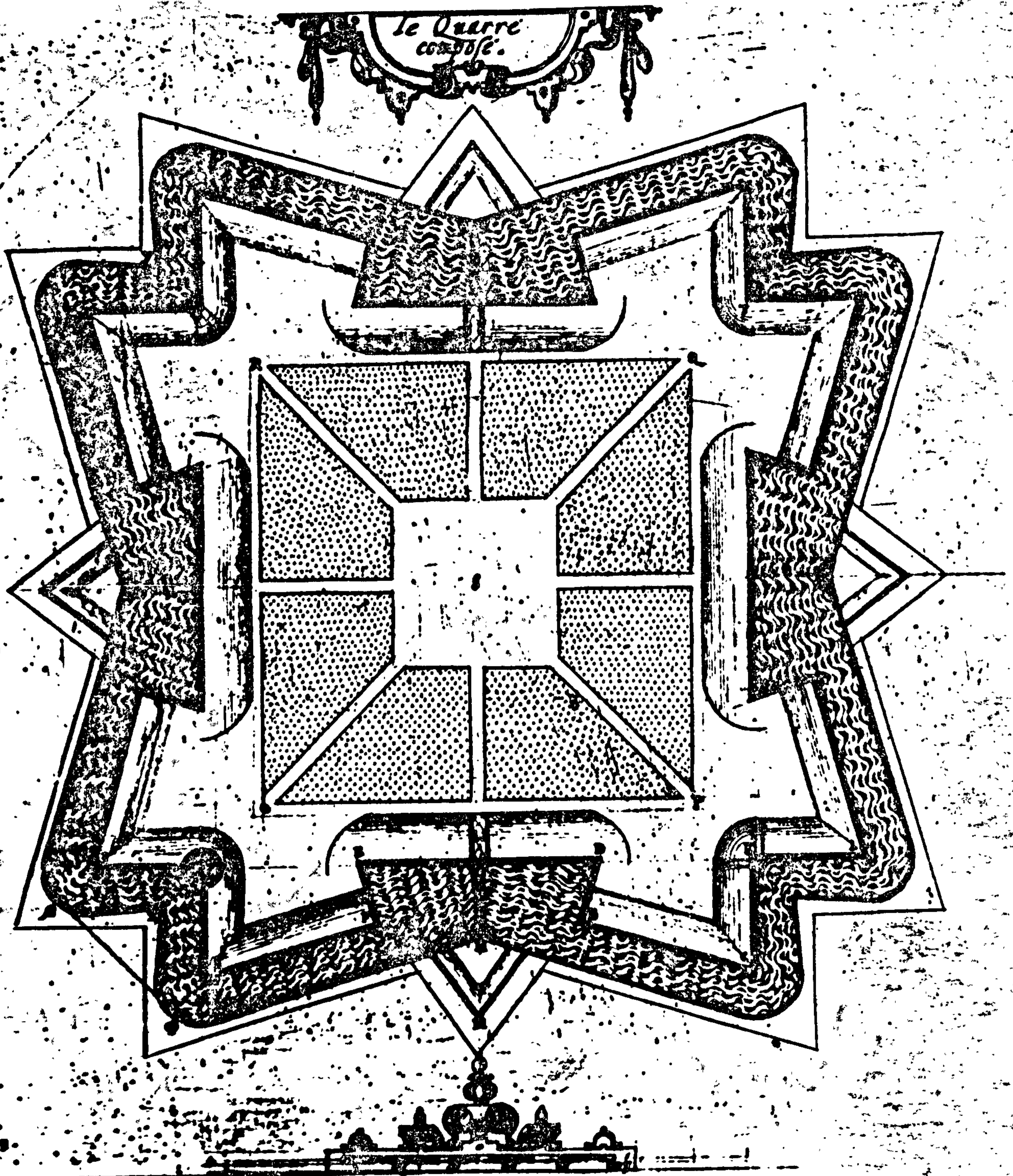


Plate 37. "Quarre compose" ERRARD (1604 Paris) p. 74.
Scale: 3/4 c. 7/8 full size.

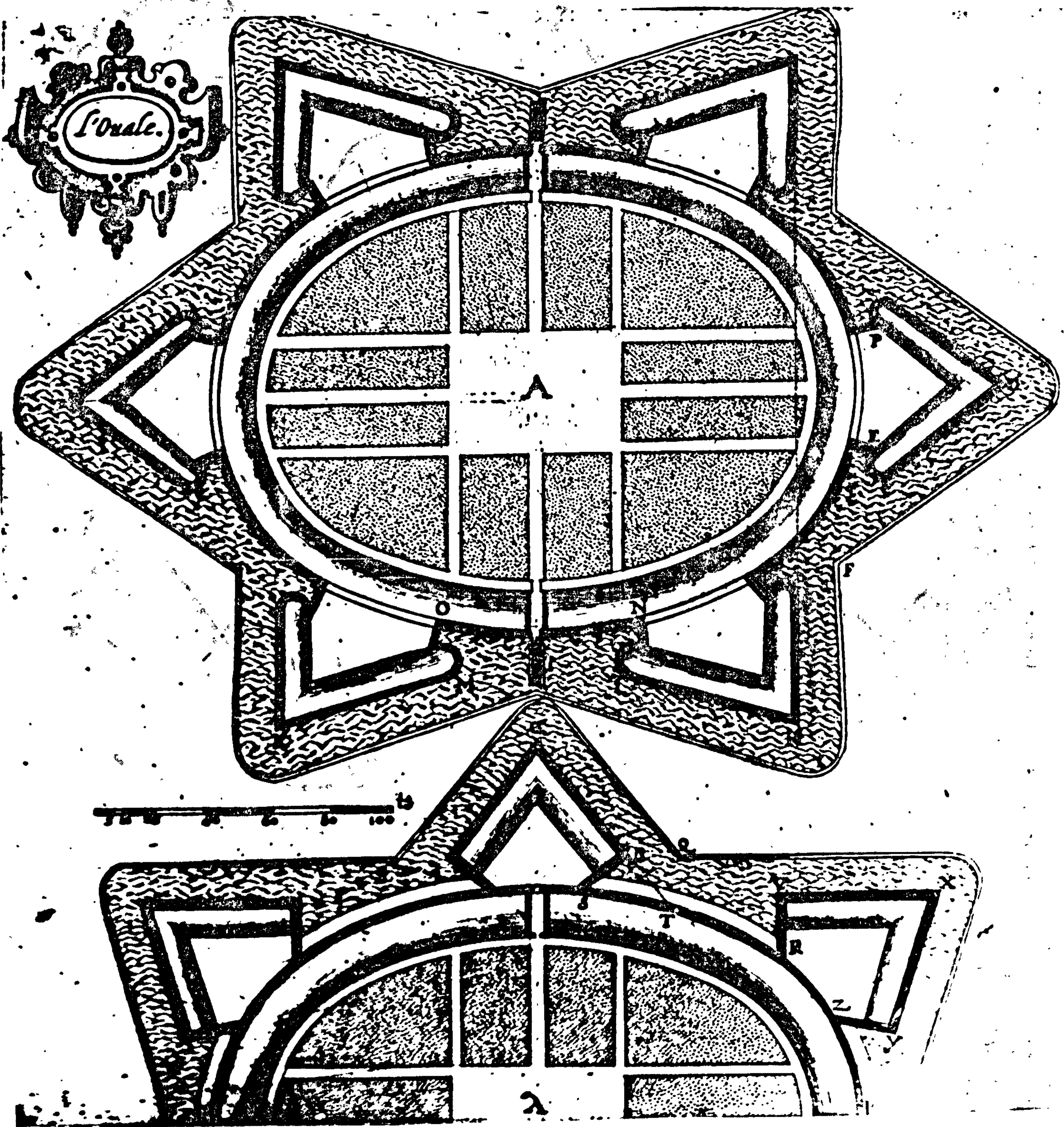


Plate 38. An oval fortress. ERRARD (1604 Paris). p. 38.
c. $\frac{3}{4}$ full size.

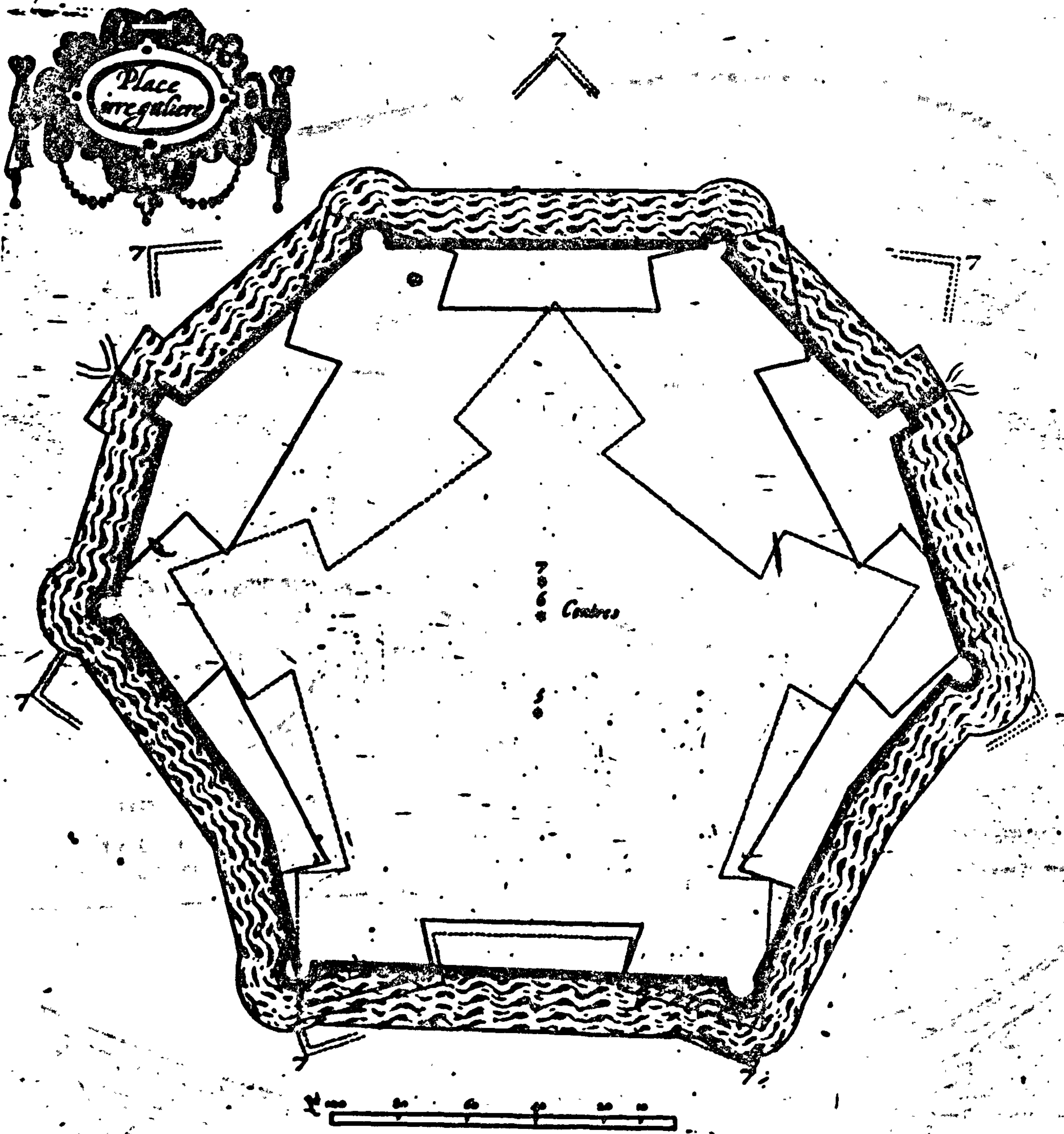


Plate 39. Regularization of an old enceinte. ERRARD
(1604 Paris) p. 89. c. $\frac{3}{4}$ full size.

Figura do aluantamento dos gramminhos.

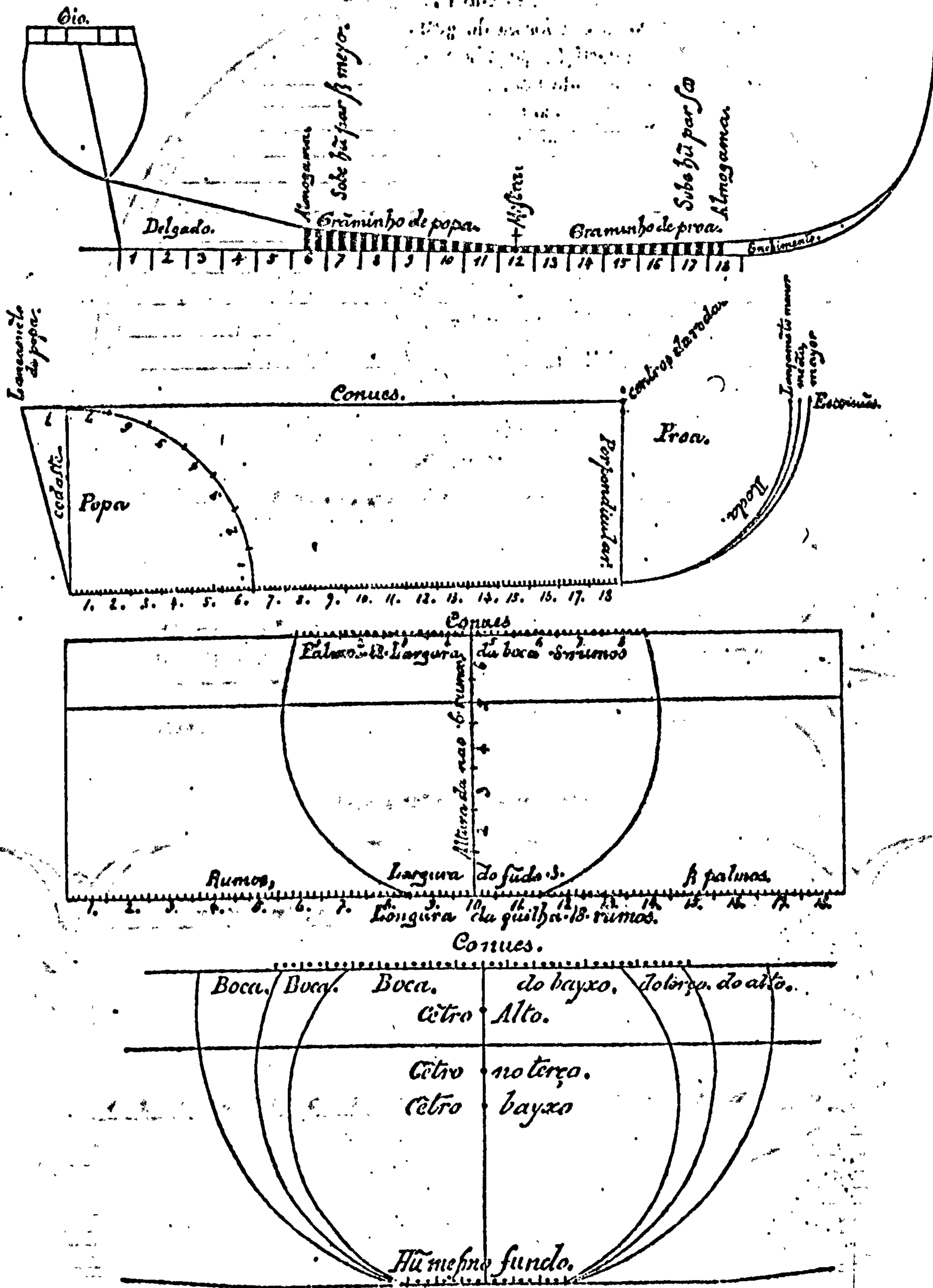
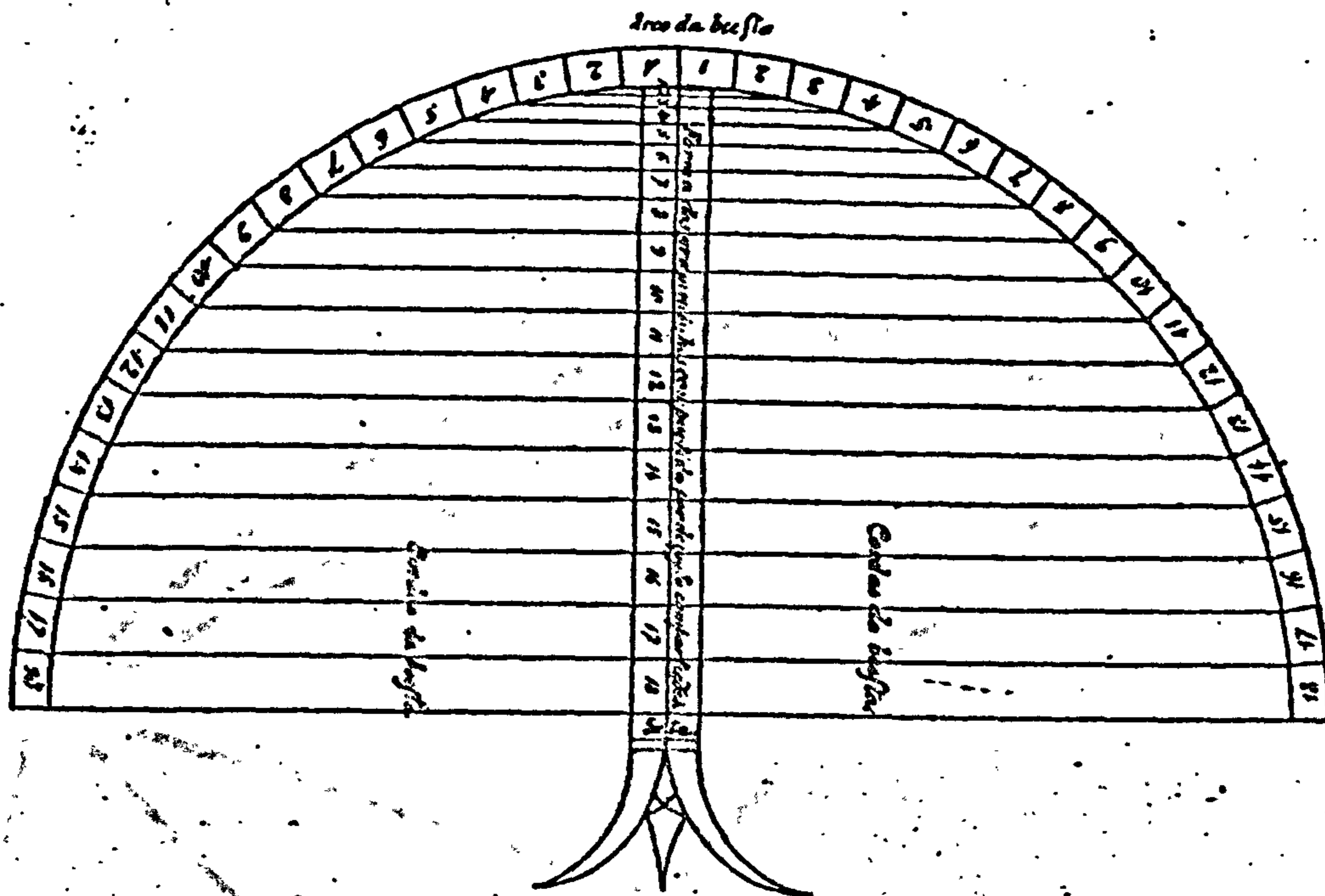


Plate 42. Design of ships. Oliviero's digrams, after LOPES DE MENCONCA (1898).

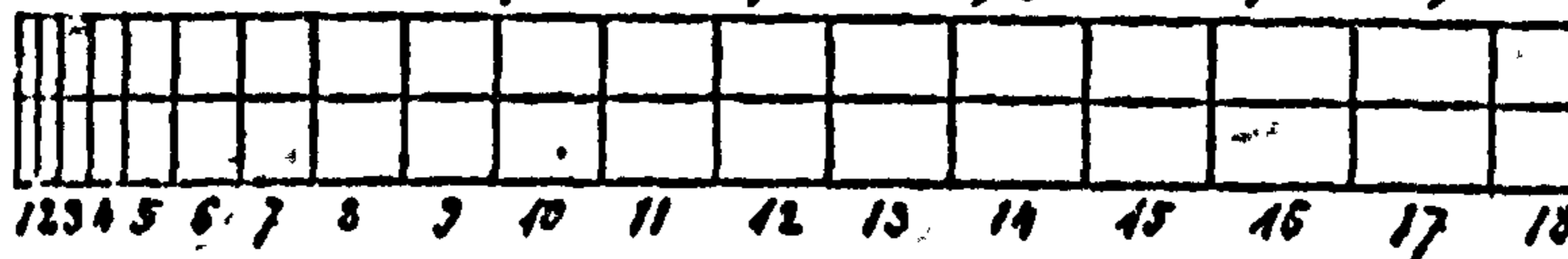
Date of ...

by ...



¶ Esta he a forma dos grammiños tirados pela besta:

Quantidade compartida per dezoyto compartições.



¶ Figura dhã quarta do fundo.

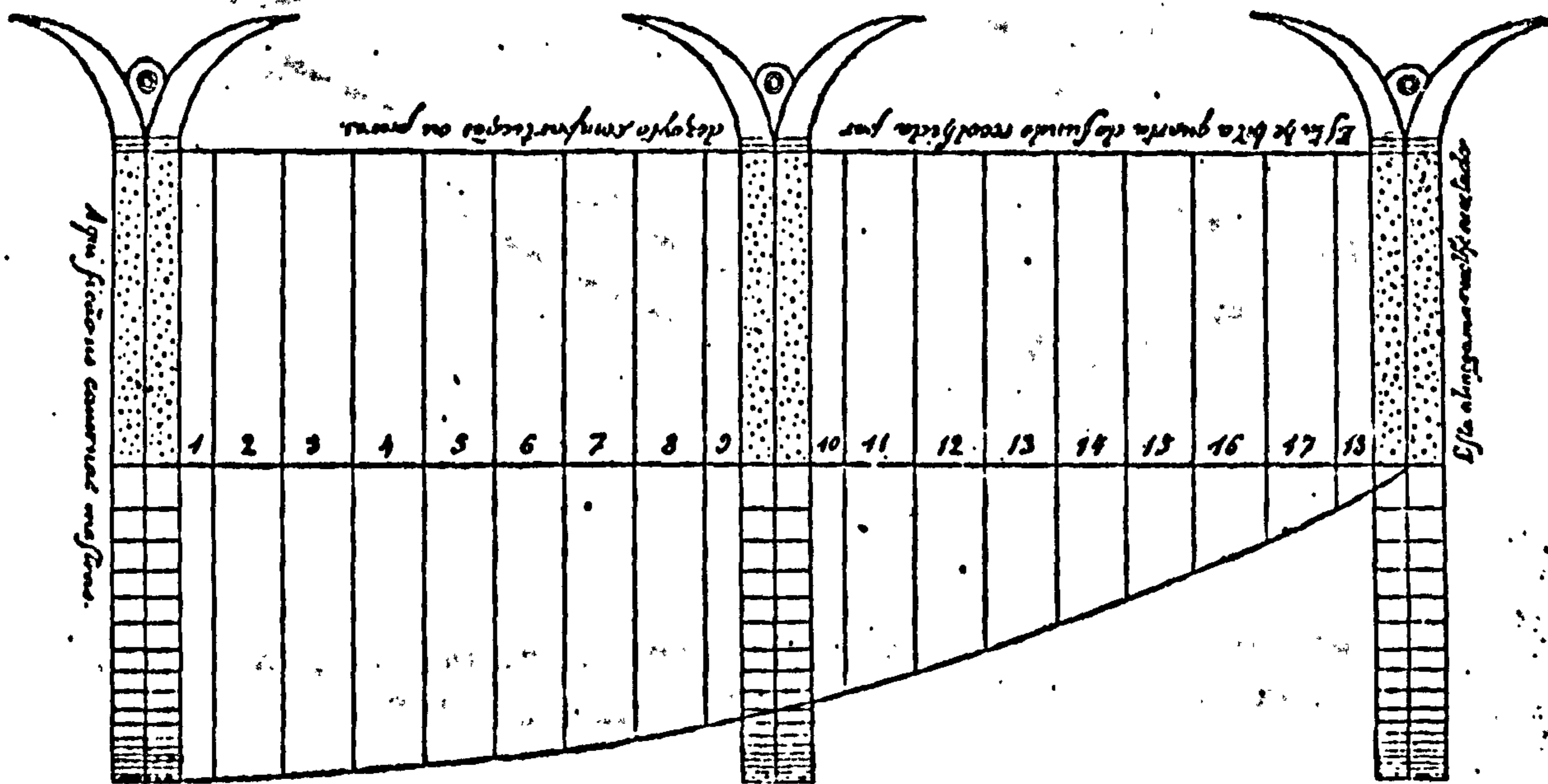


Plate 43. Device for regularising a ships lines by Oliviero, after LOPES DE MENDONÇA (1898).

149

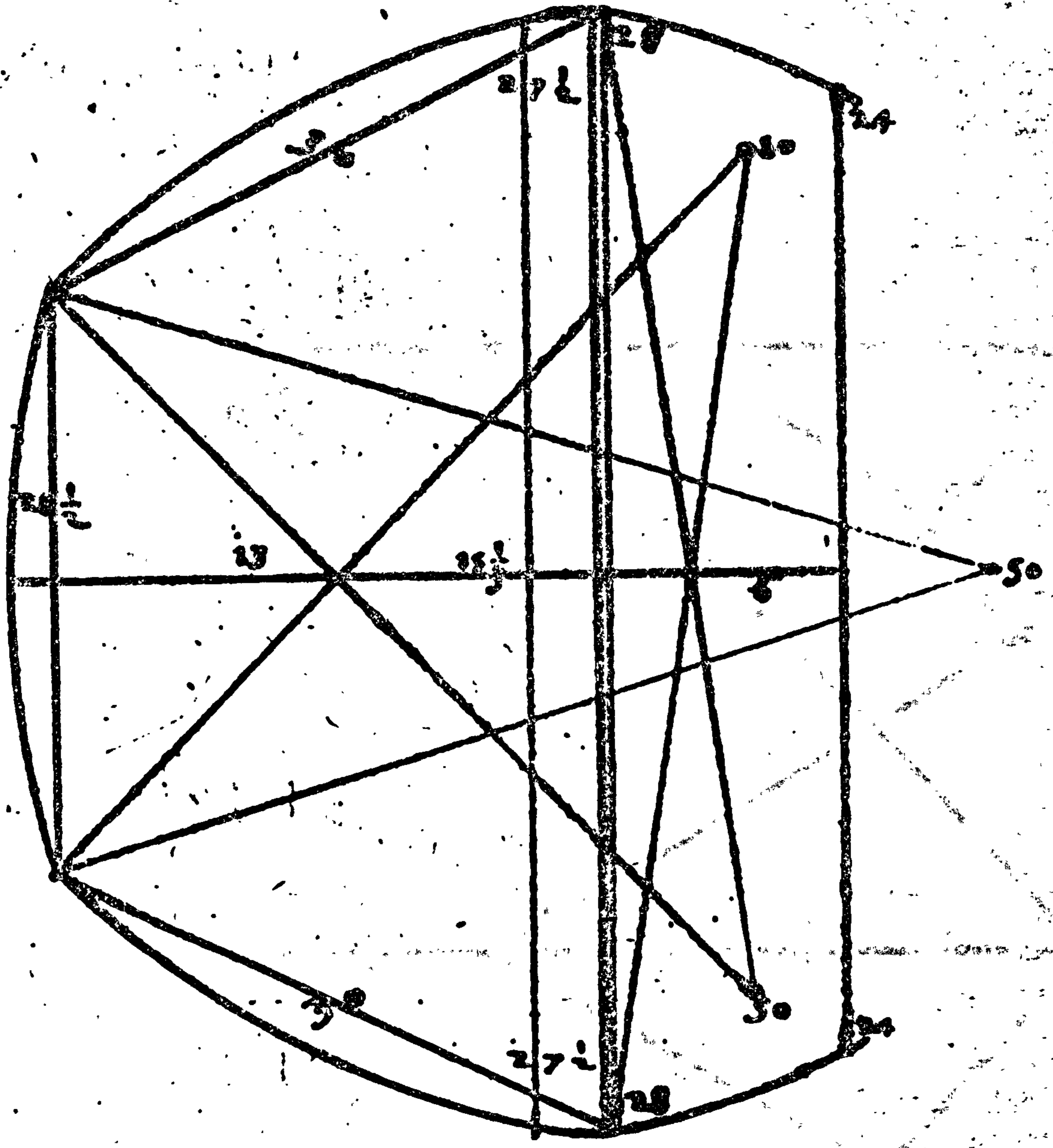
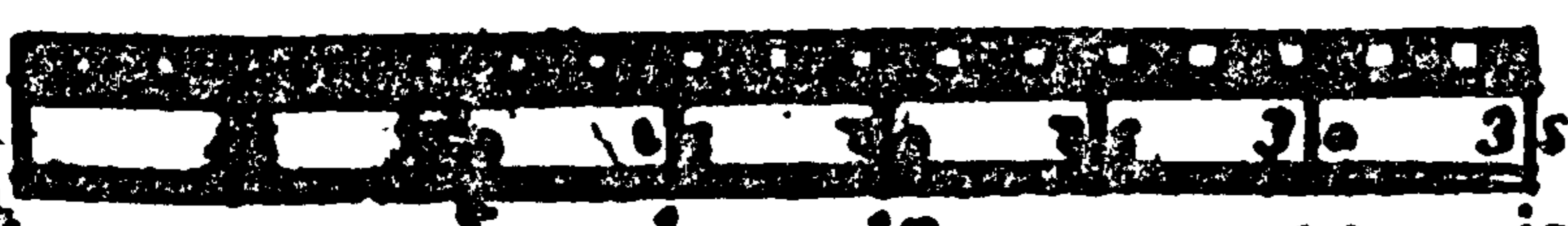


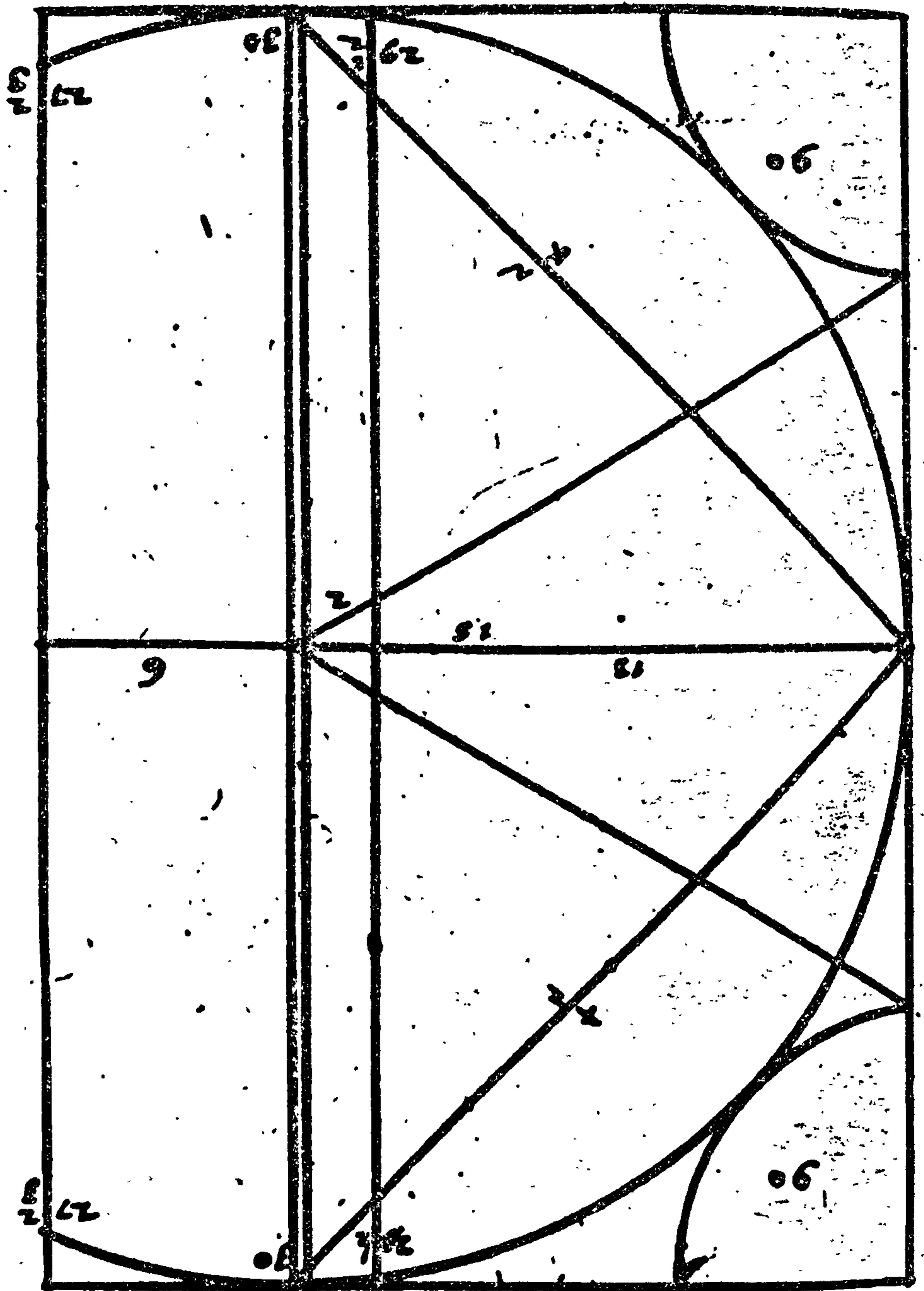
Plate 44. Geometric ship design. George WAYMOUTH
Jewell of Artes f. 149. $1\frac{1}{2}$ full size.



17 1/2 20 15 17 1/2

55.50 of any house or way 03

Plate 45. Geometric ship design. George WAYMOUTH
Jewell of Artes f. 150. $1\frac{1}{2}$ full size.



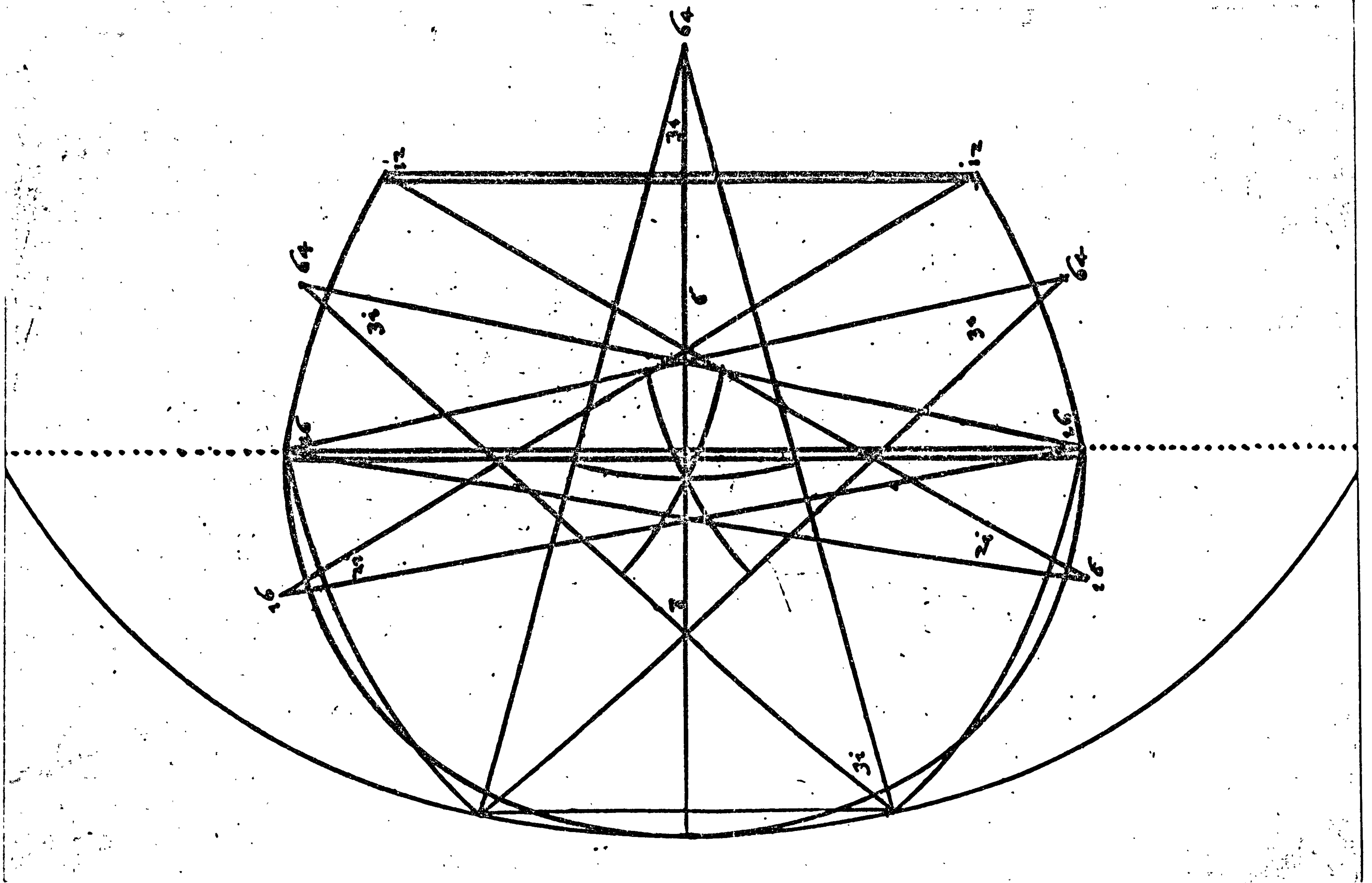


Plate 46. Geometric ship design. George WAYMOUTH
Jewell of Artes f. 152. $1\frac{1}{4}$ full size.

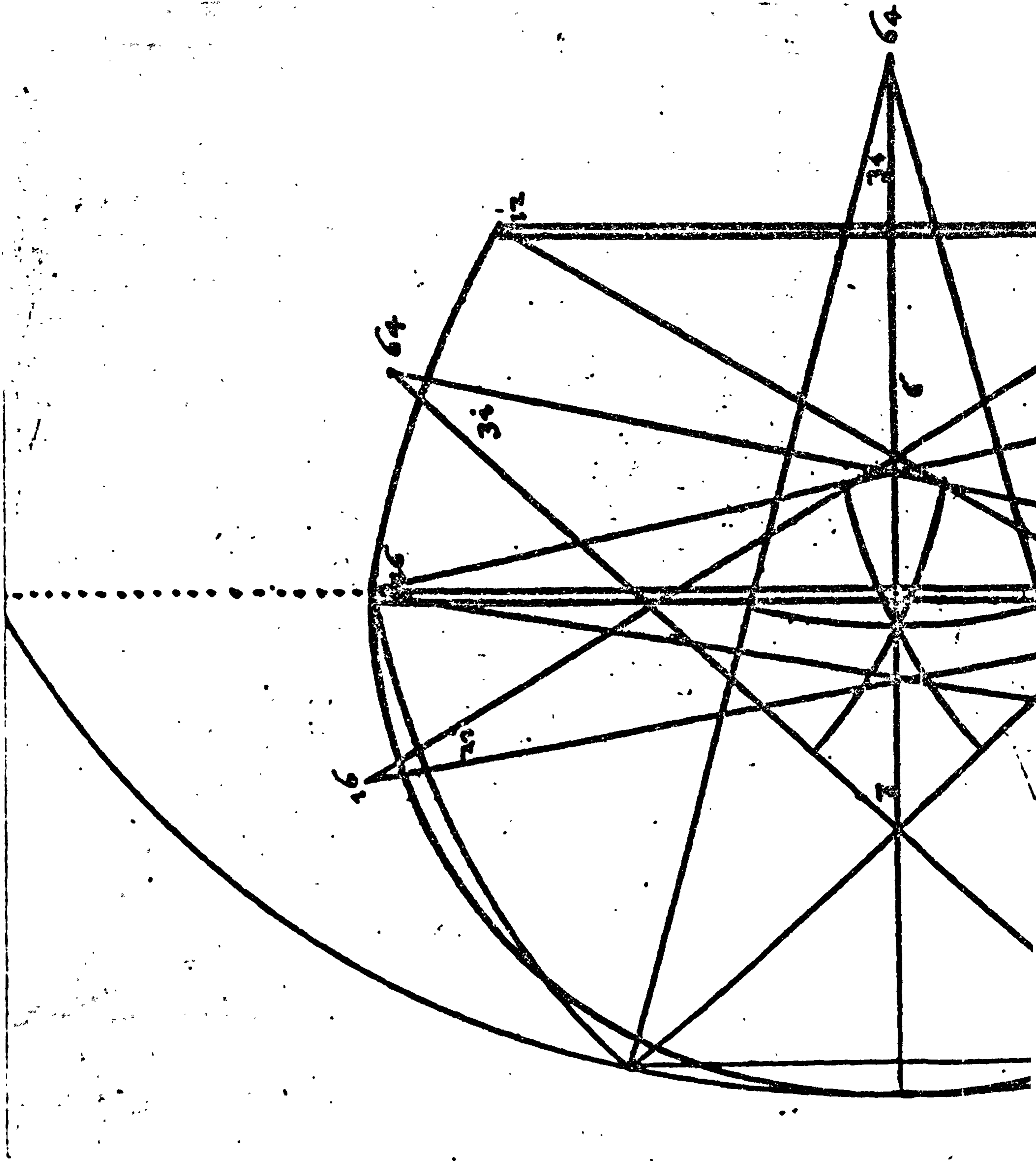
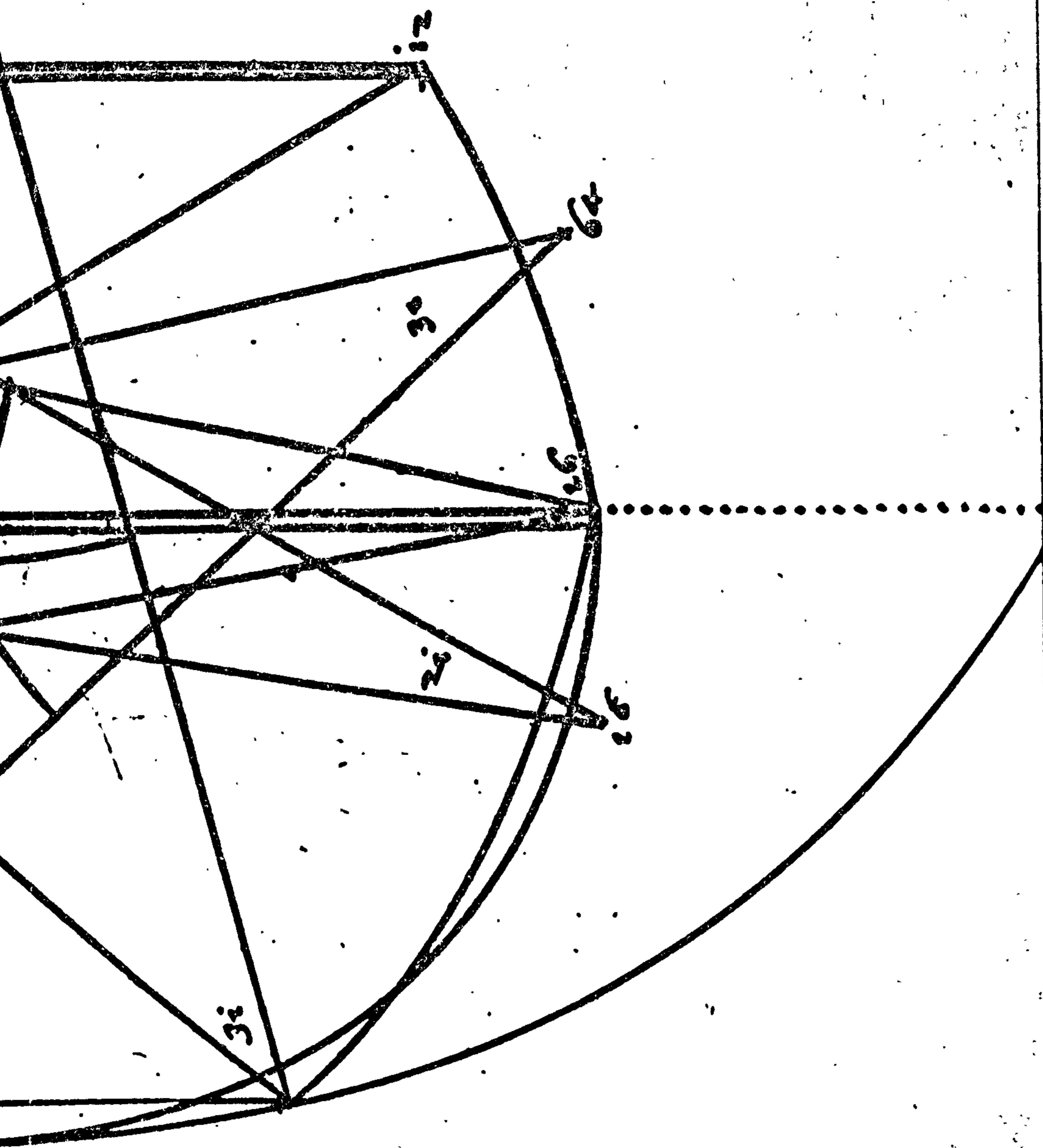


Plate 46. Geometric ship design. George WAYMOUTH
Jewell of Artes f. 152. $1\frac{1}{4}$ full size.



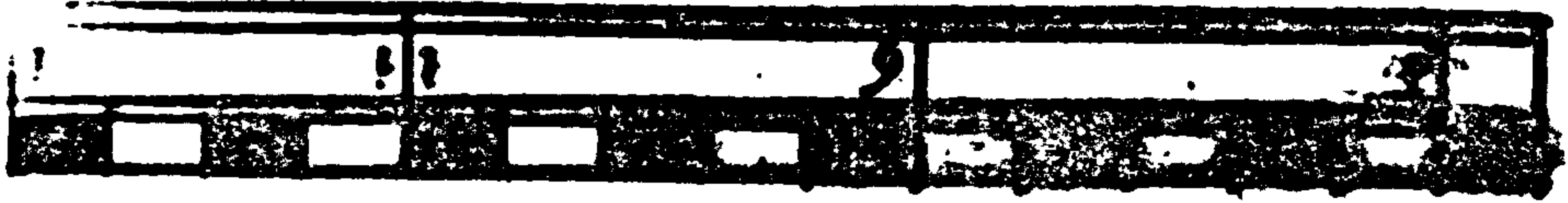
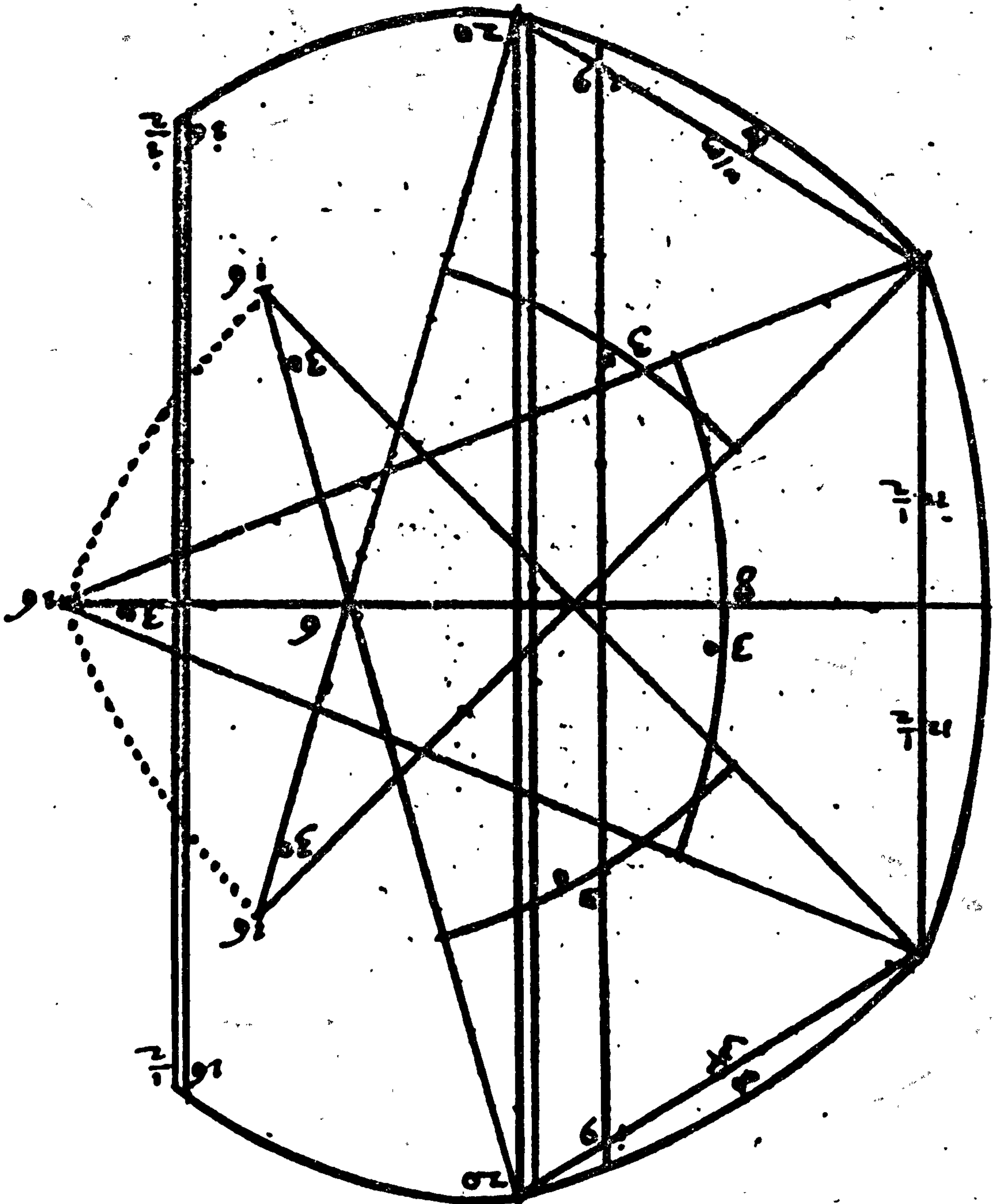


Plate 47. Geometrical ship design. George WAYMOUTH
Jewell of Artes f. 155. $1\frac{1}{2}$ full size.



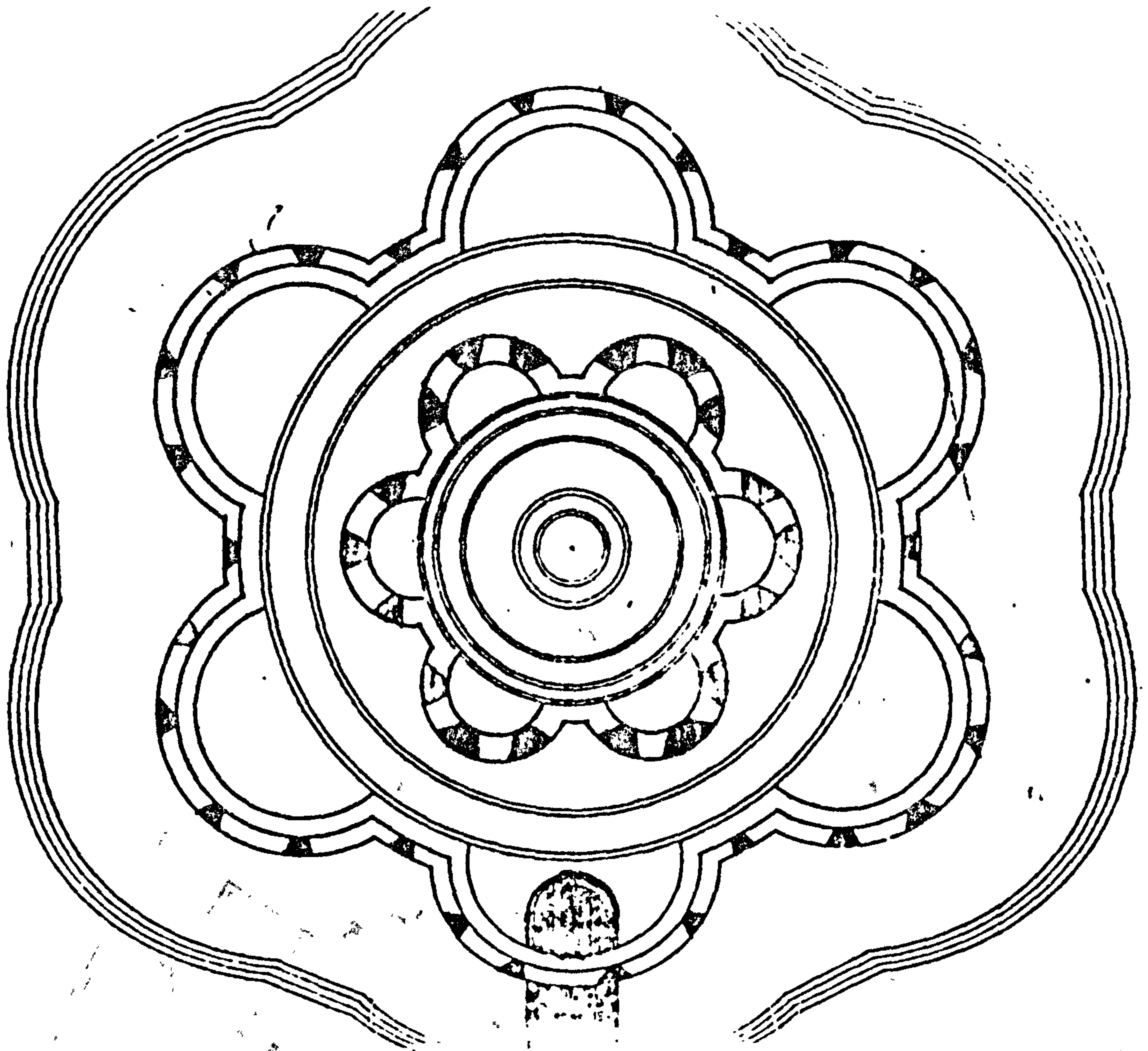
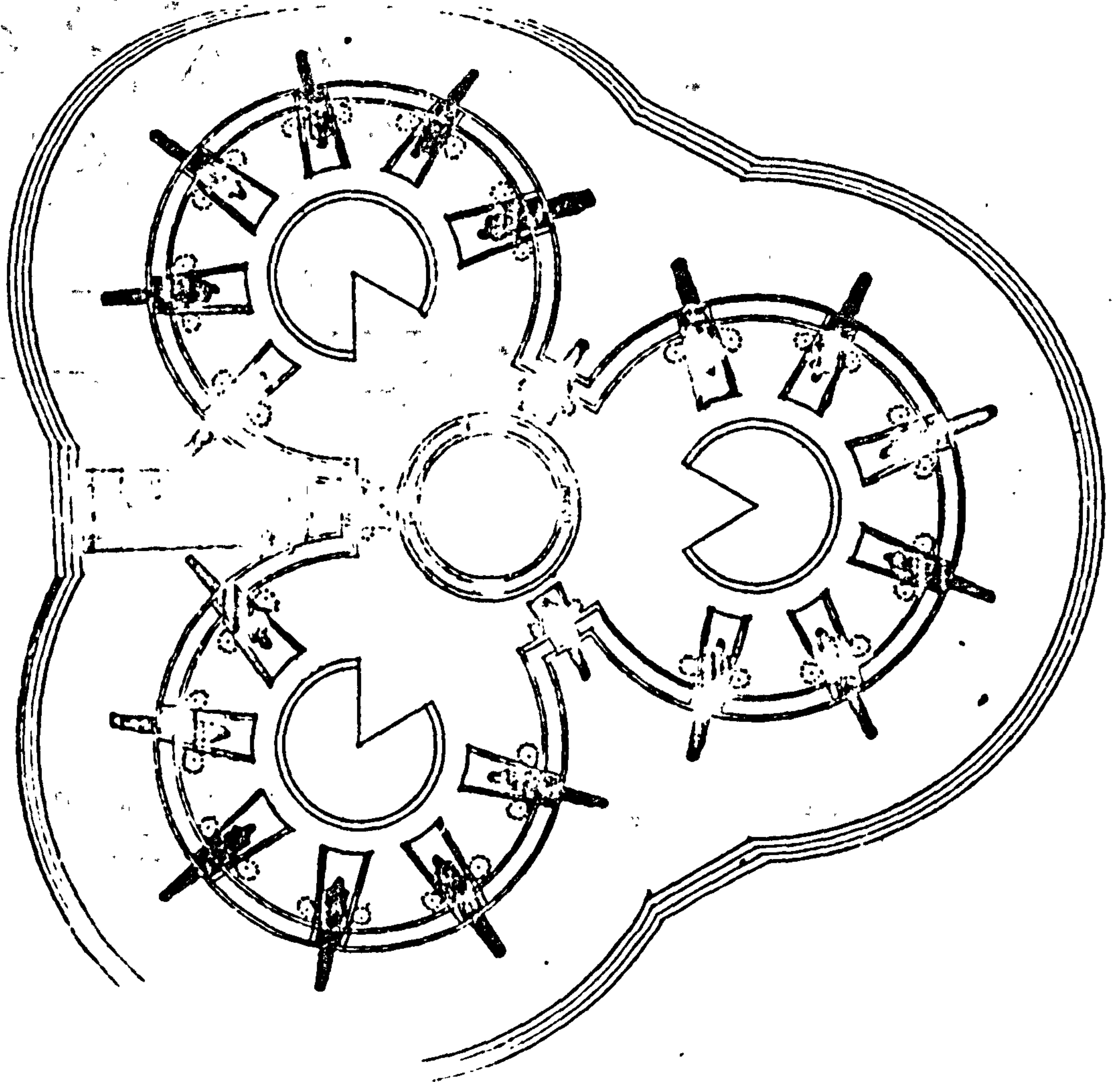


Plate 48. Clover leaf forts. George WAYMOUTH
Jewell of Artes f. 219 & 225. $\frac{3}{4}$ full size.



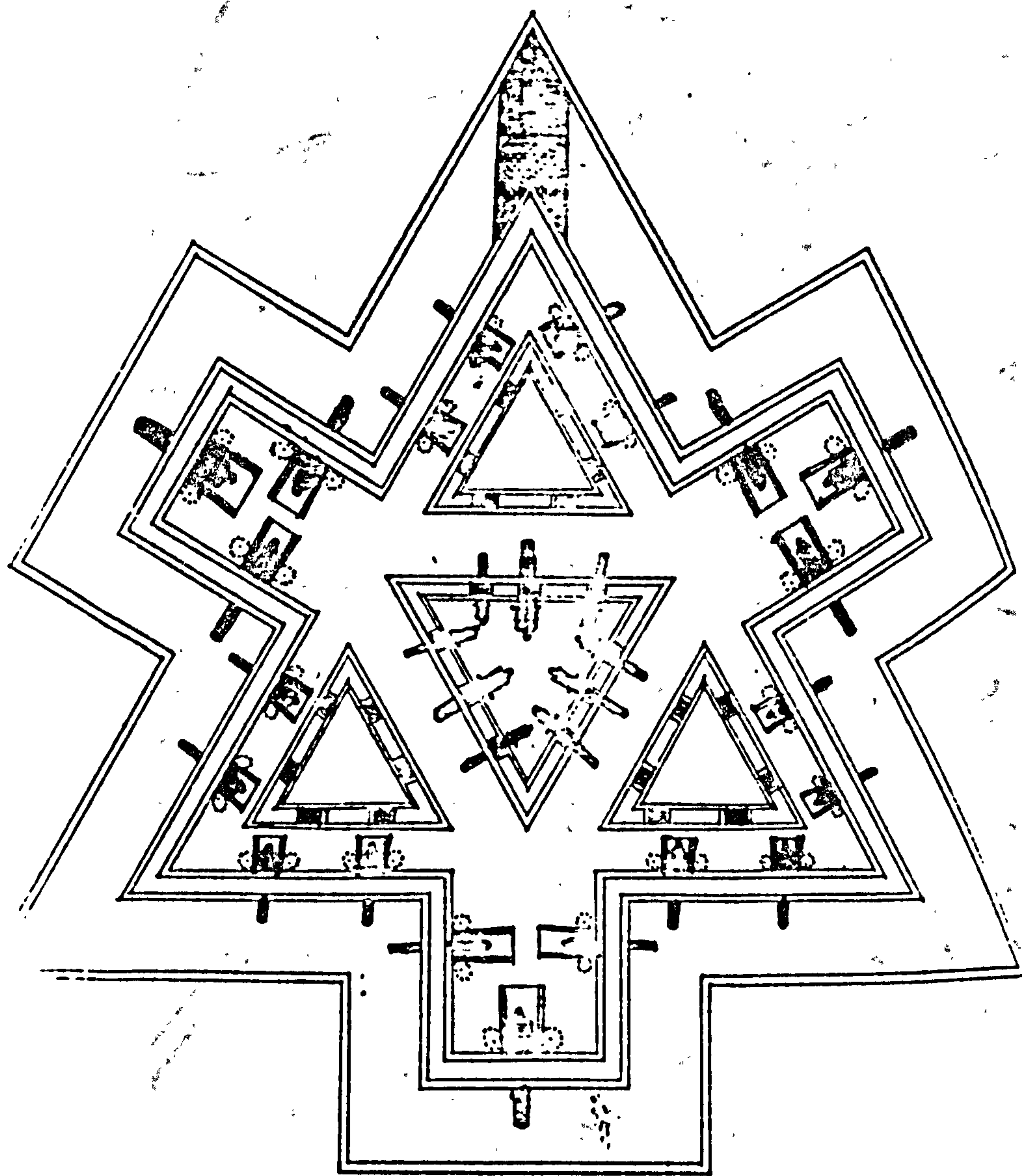


Plate 49. A triangular fort. George WAYMOUTH
Jewell of Artes f. 233. $\frac{3}{4}$ full size.

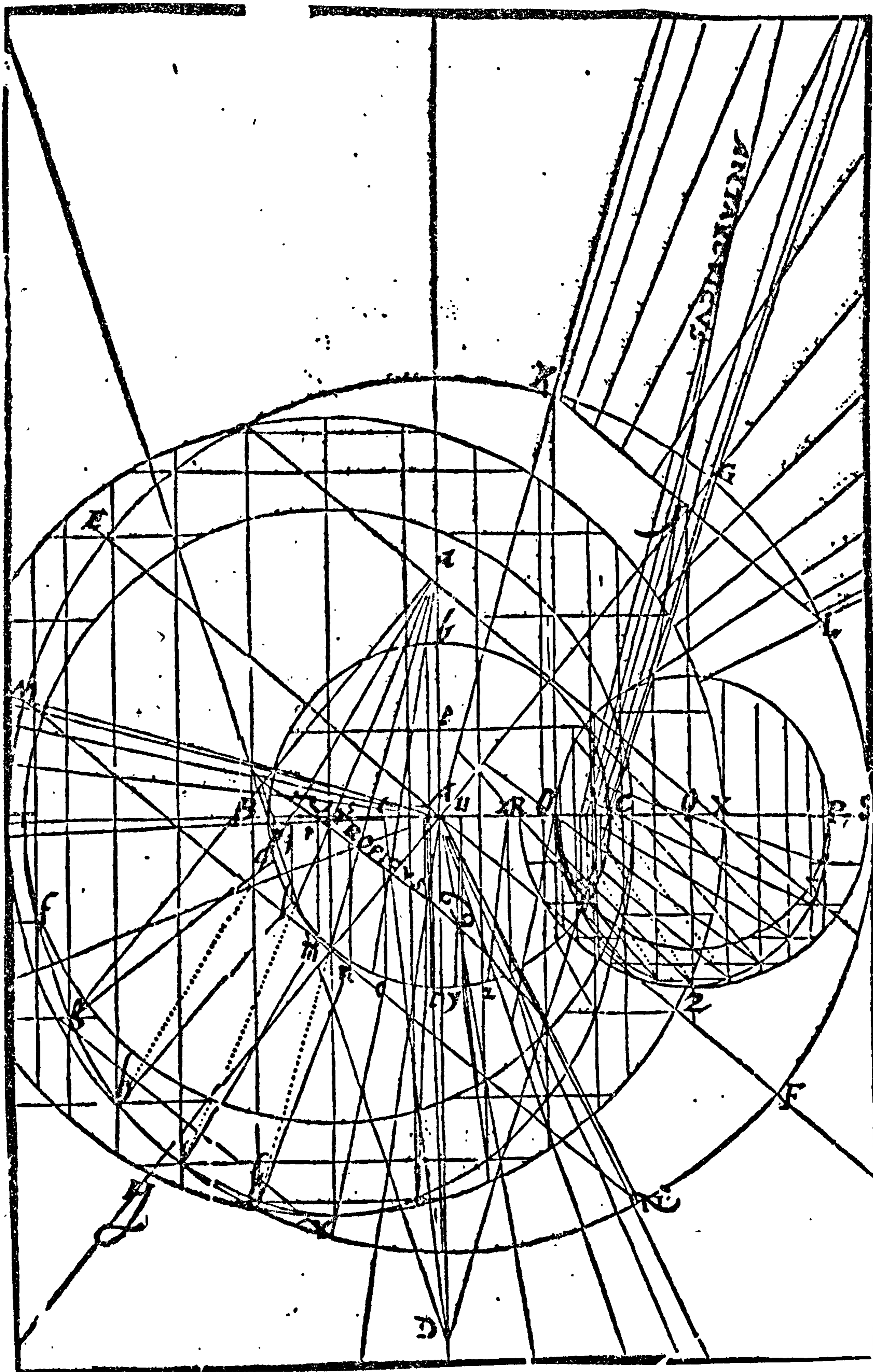
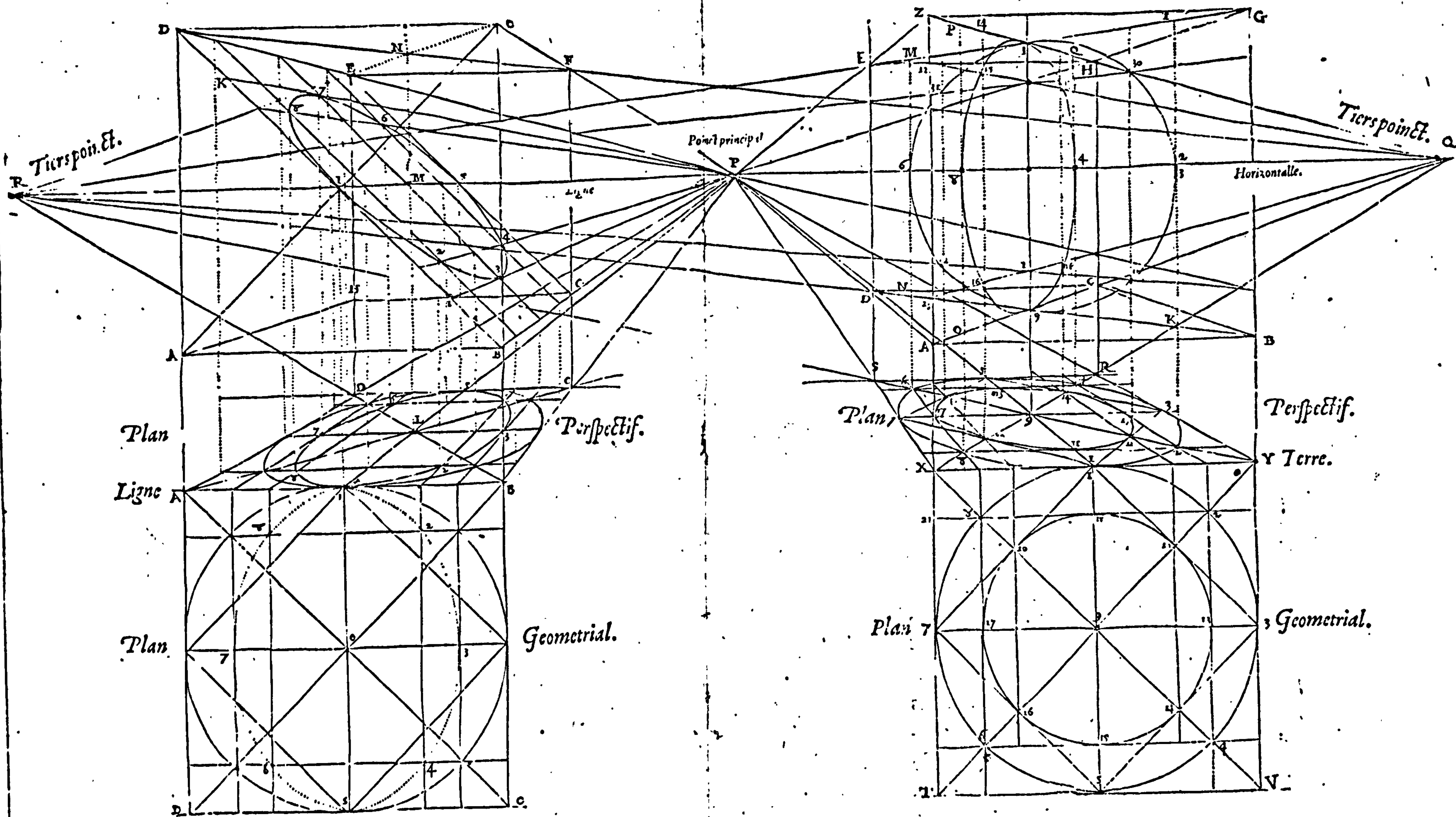


Plate 51. Dialling diagram. SCHÖRNER (1572) f. LXXIa.
Full size.

de Jehan Cousin

Description des Ronds Spheriques, assis sur lignes Diagonales.



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Plate 52. Perspective exercises. COUSIN (1560). Full size.

de Jehan Cousin

Description des Ronds Spheriques, aſſiz ſus lignes Diagon

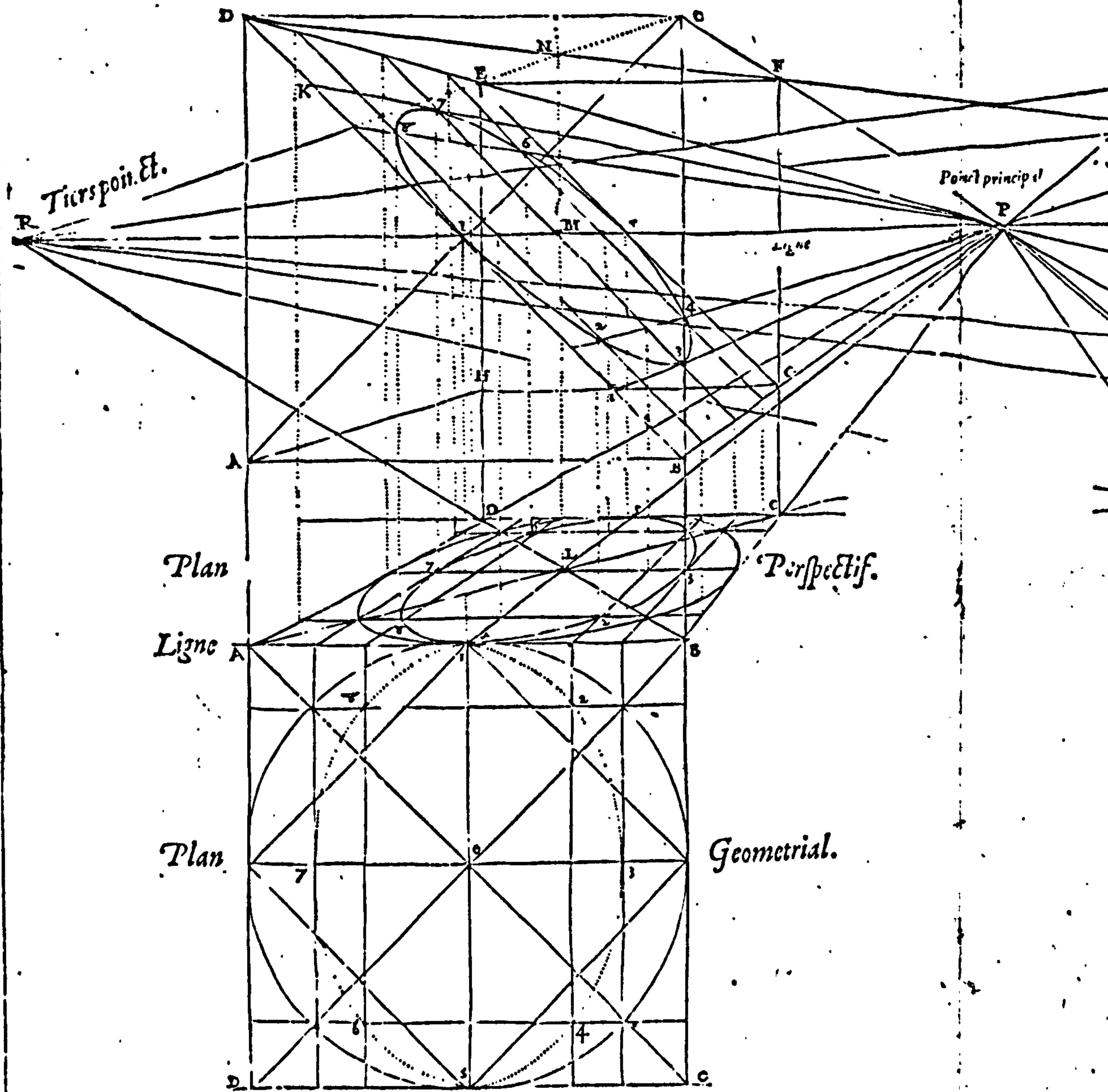
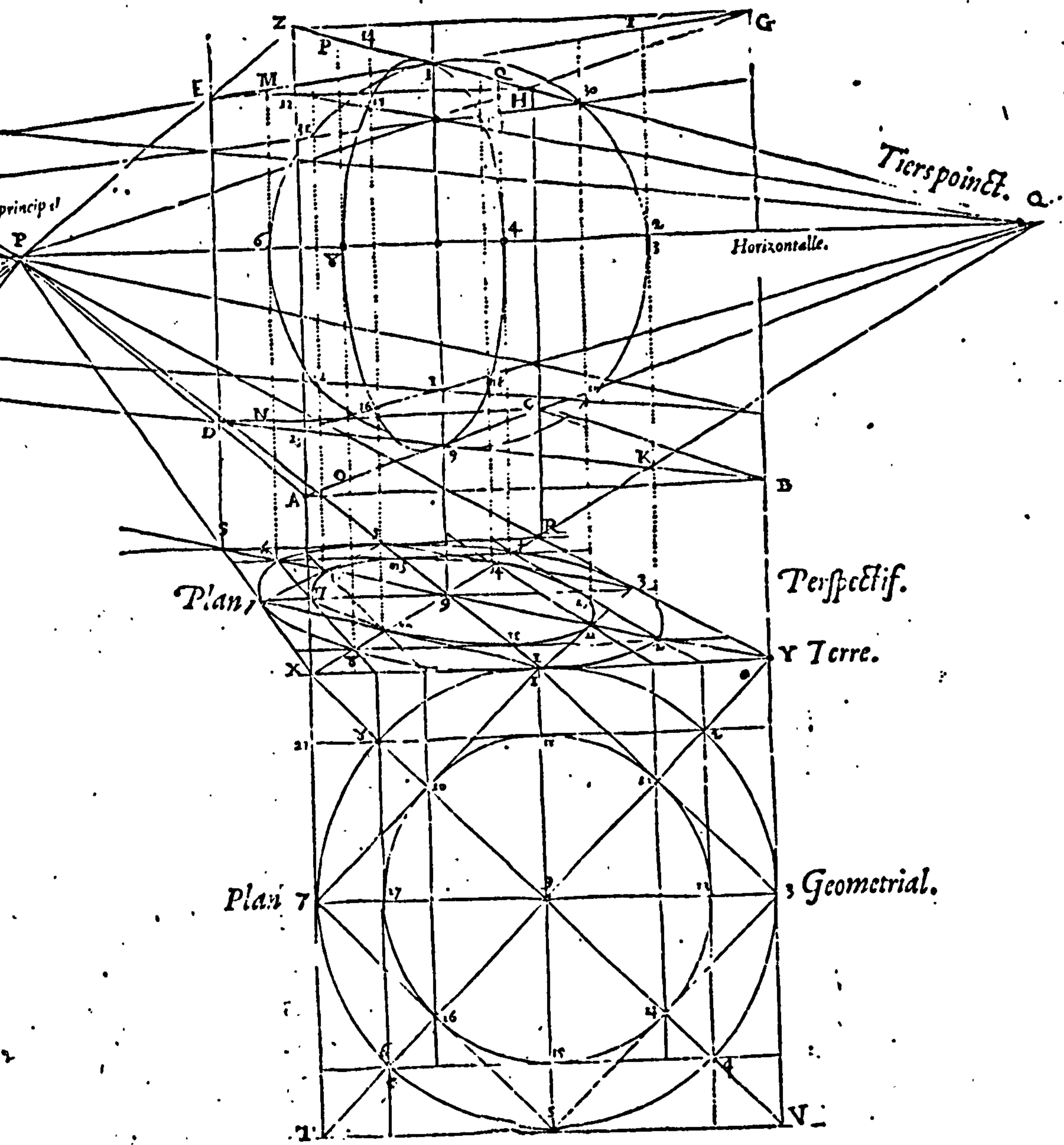


Plate 52. Perspective exercises. COUSIN (1560). Full size.

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nes Diagonales.



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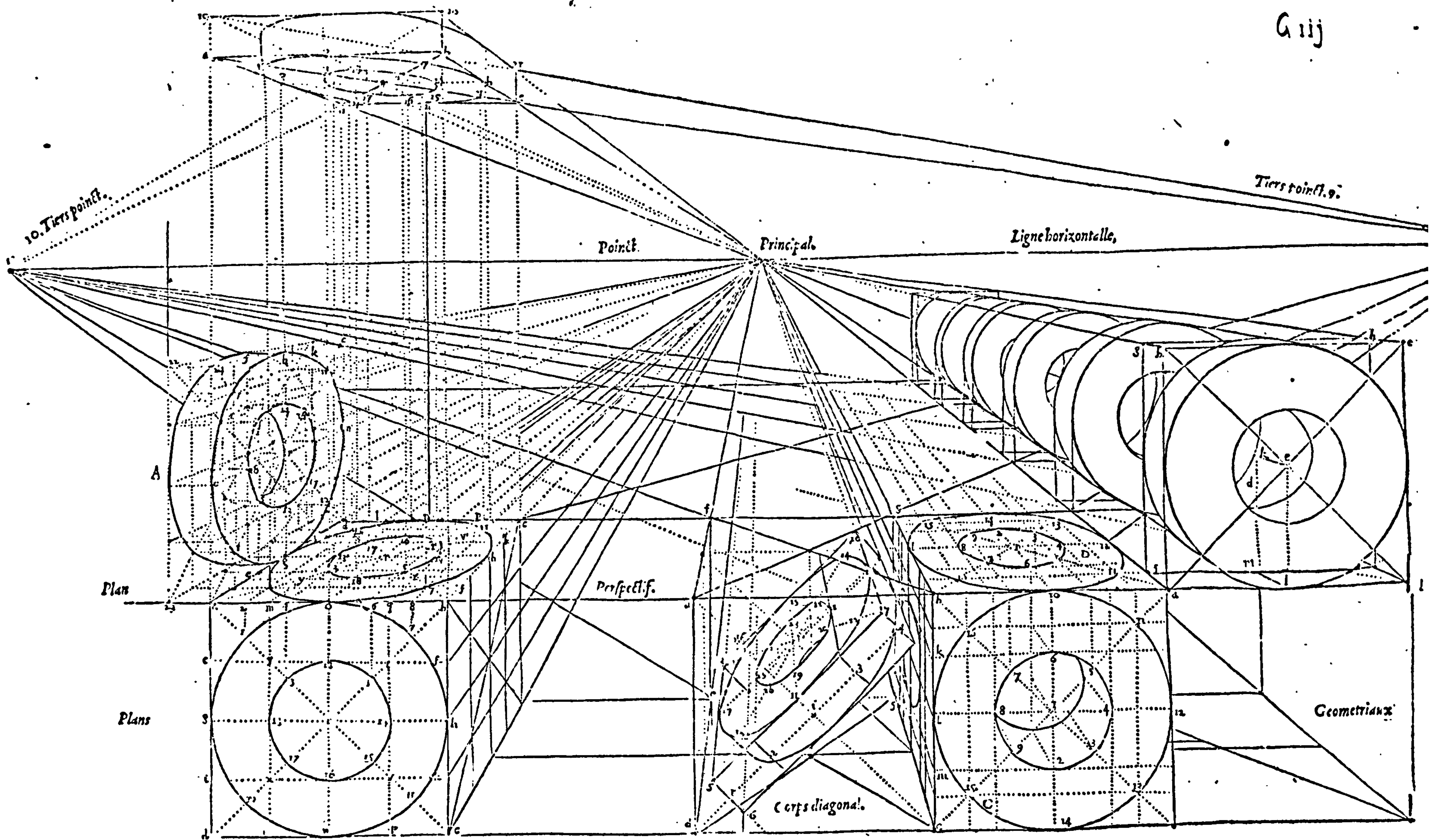


Plate 53. Perspective exercises. COUSIN (1560). Full size.

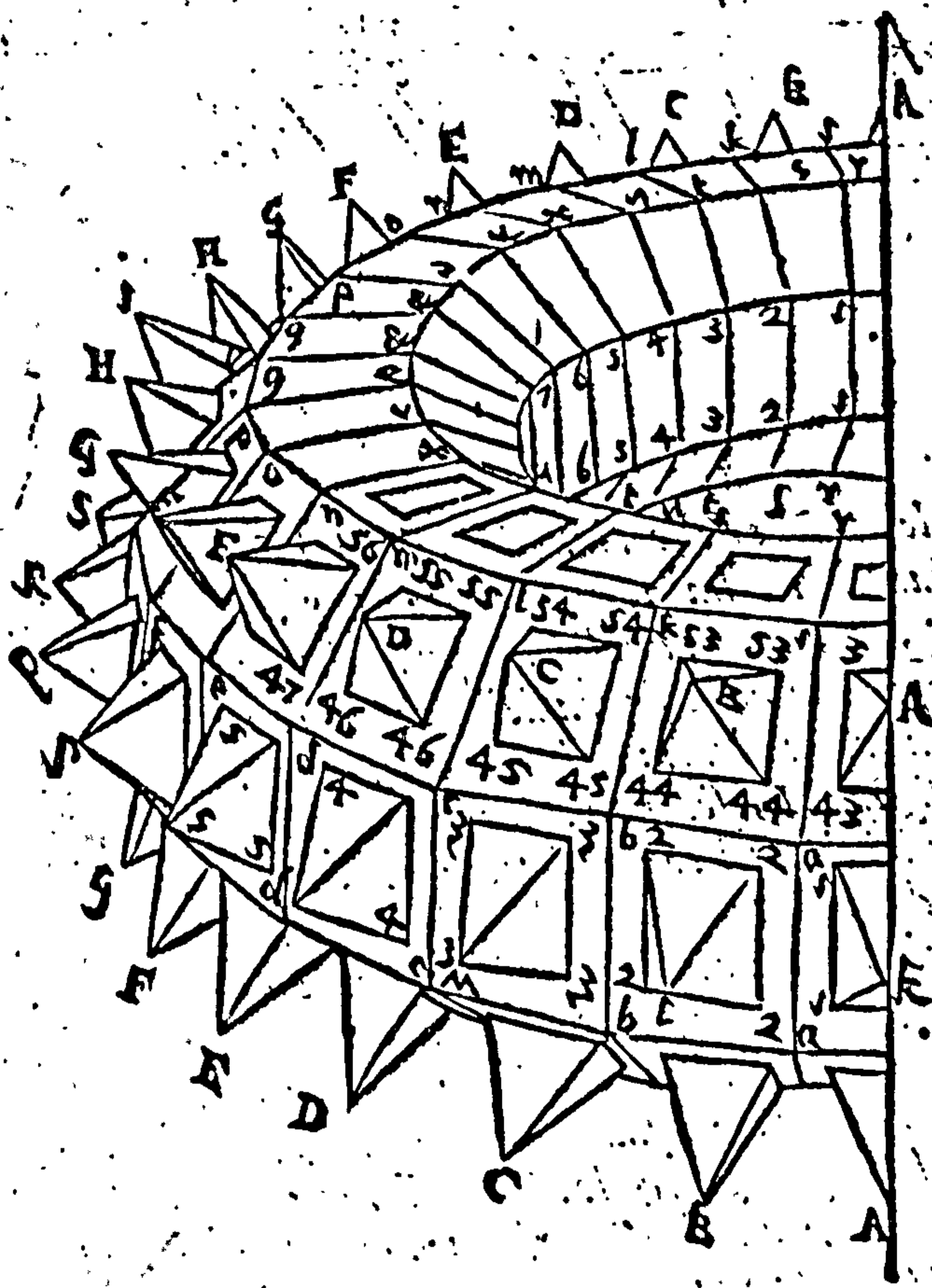
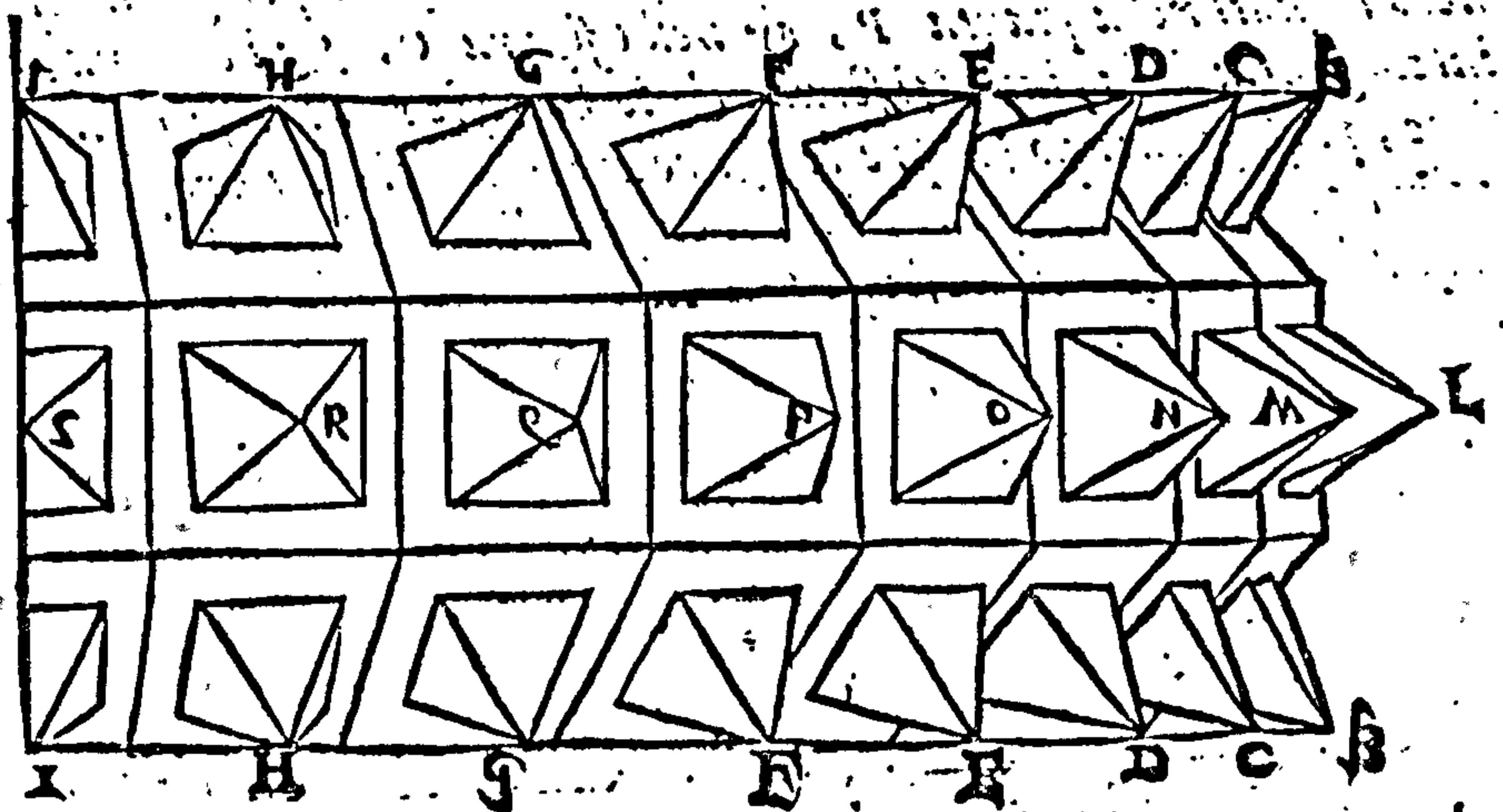


Plate 54. Perspective representation BARBARO (1568). p. 128.
Full size.

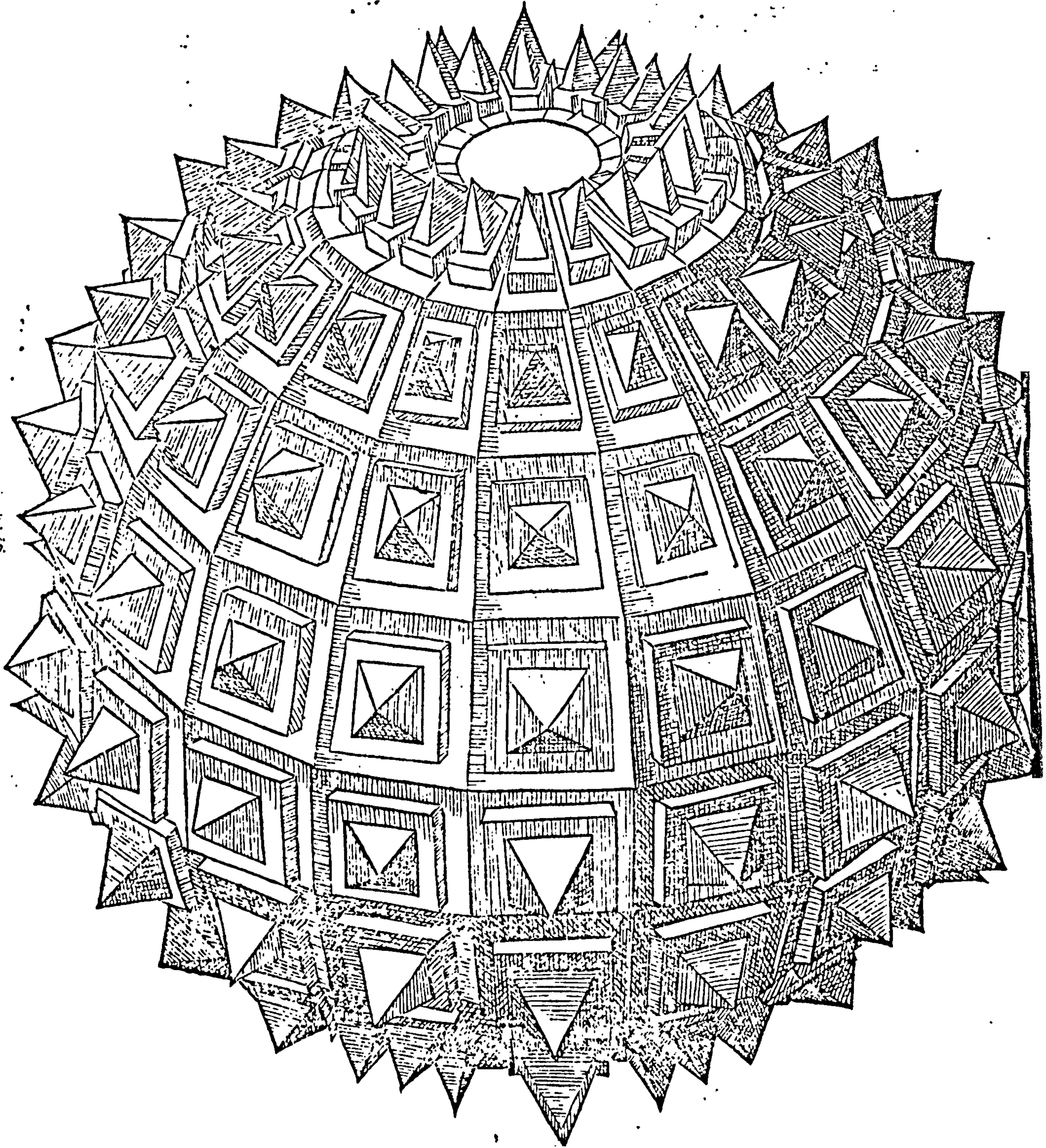


Plate 55. Perspective representation. BARBARO (1568).
Full size.

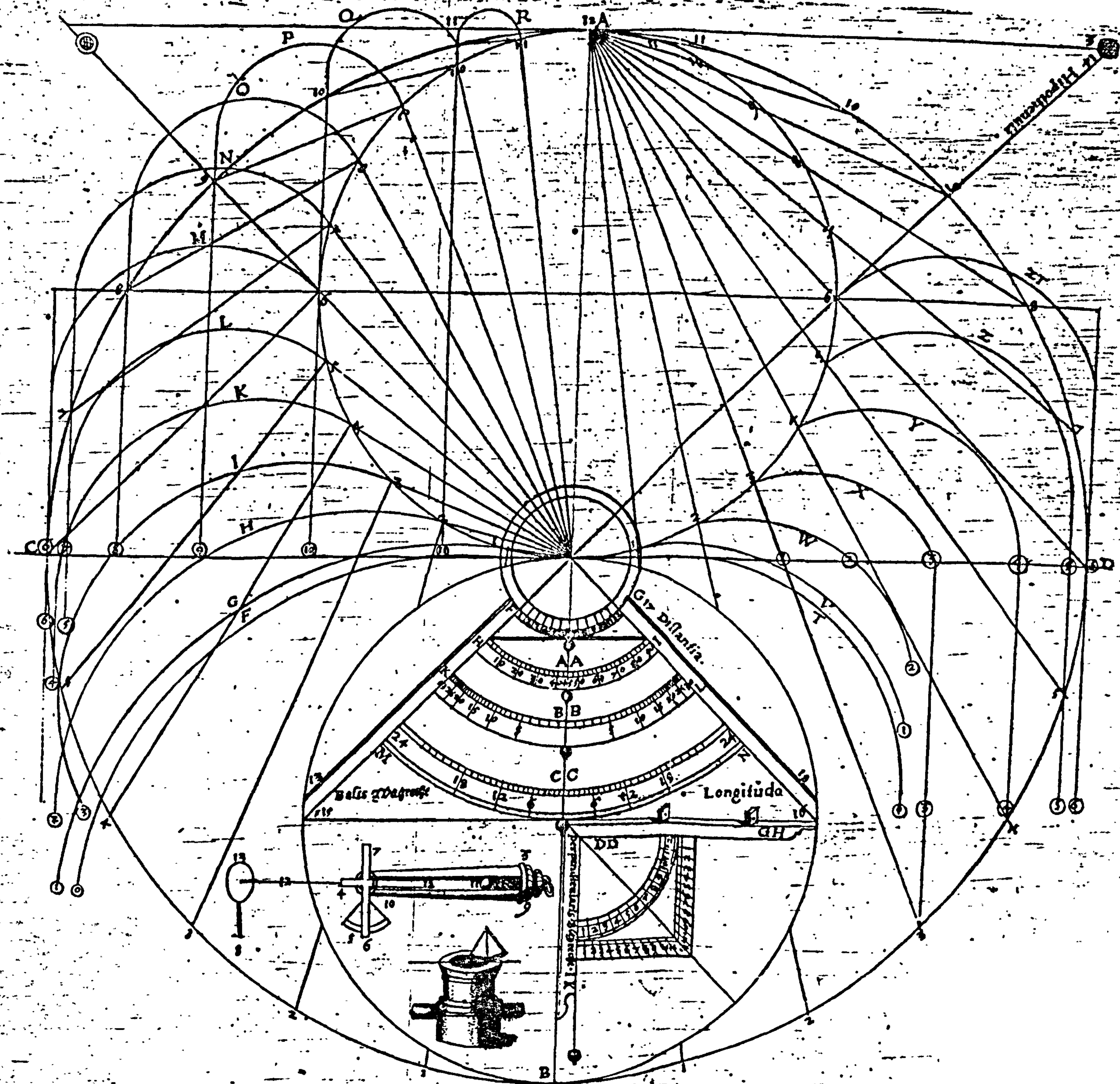


Plate 56. Fronsperger's ballistic diagrams. FRONSPERGER (1571/3) Pt. II between f. CX/CXI. c. $\frac{7}{8}$ full size.

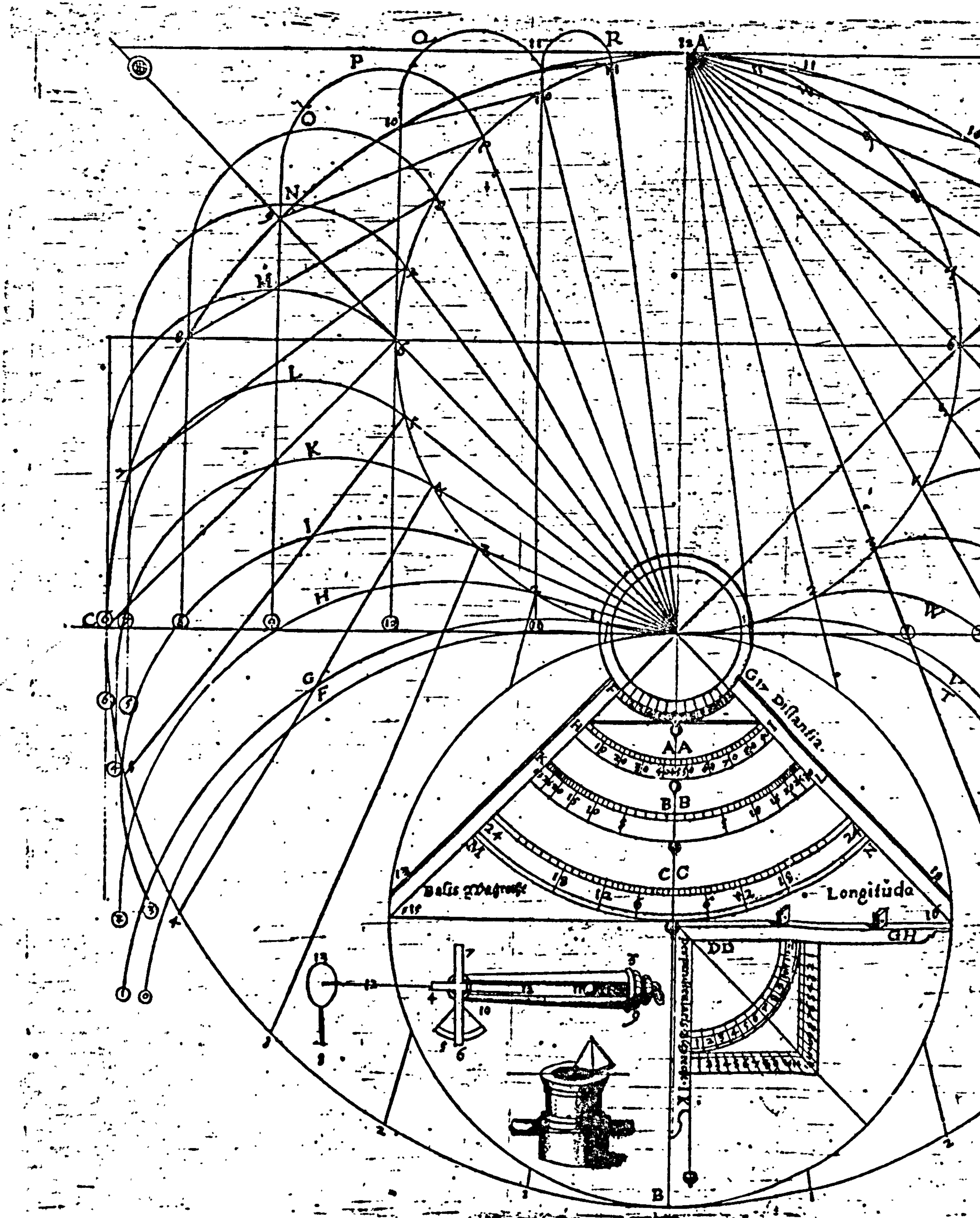
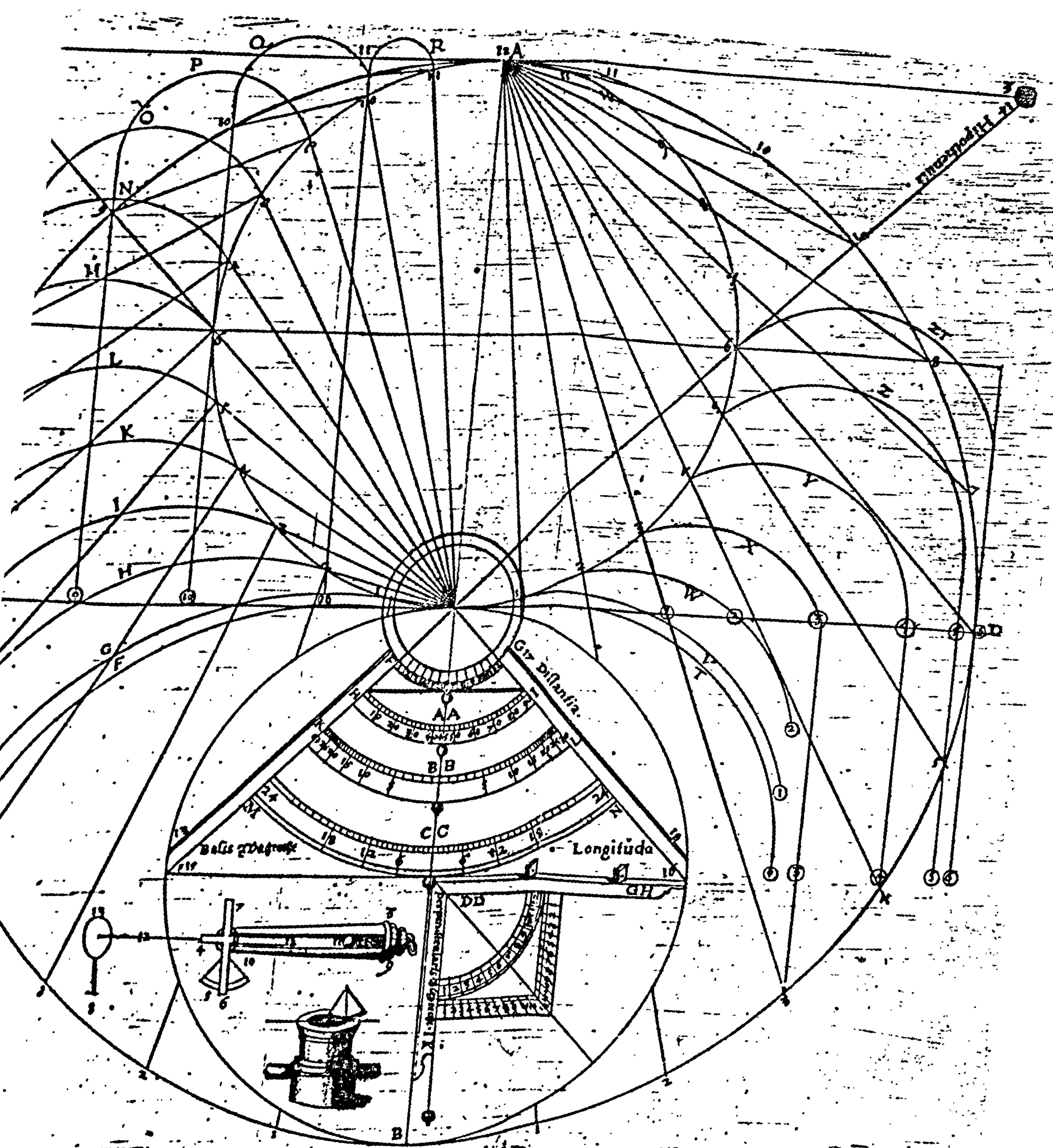


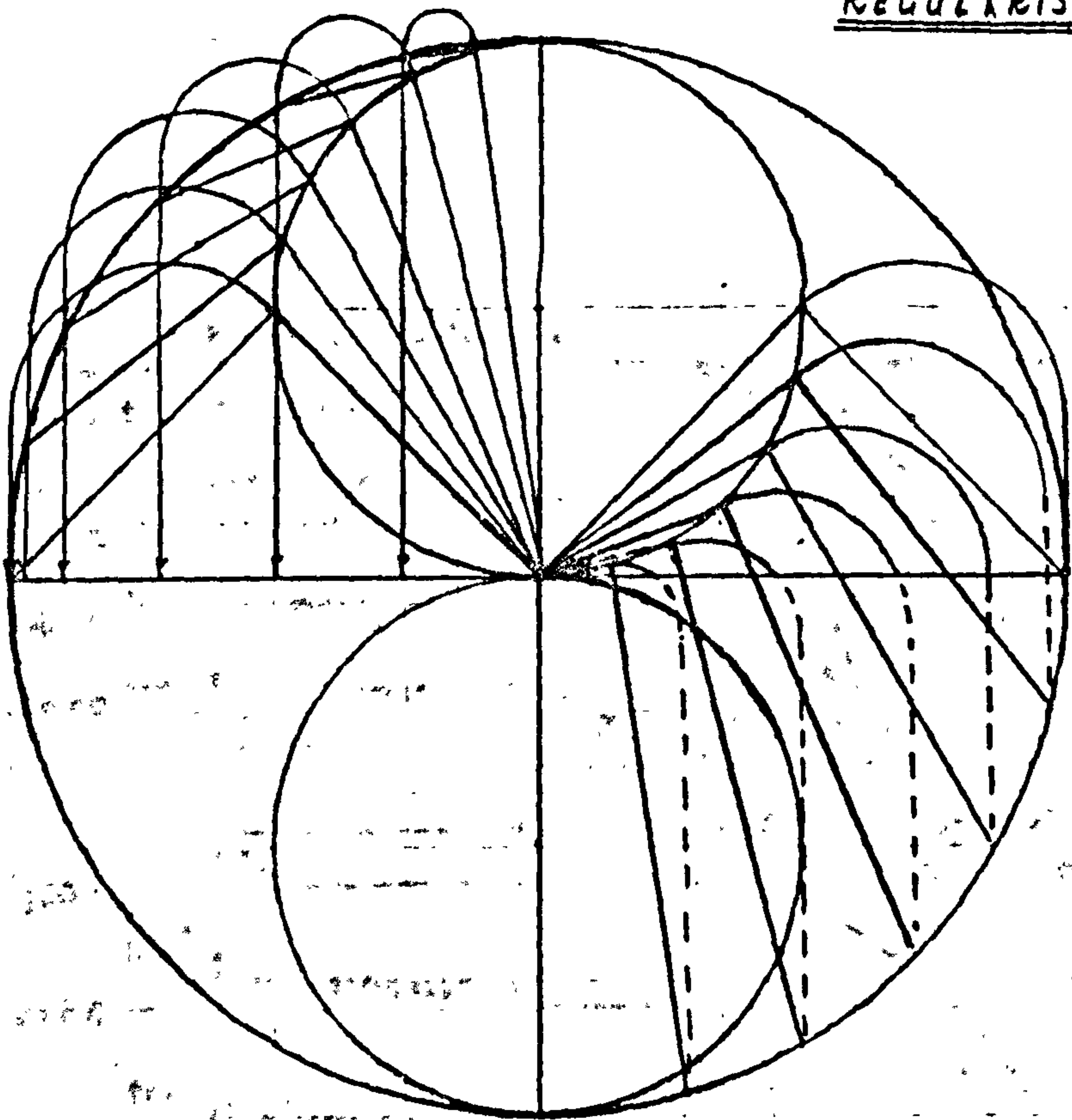
Plate 56. Fronspurger's ballistic diagrams. FRONSPERGER (1571/3) Pt. II between f. CX/CXI. c. $\frac{2}{3}$ full size.



rger's ballistic diagrams. FRONSPERGER
) Pt. II between f. CX/CXI. c. 7 full

FRONSPERGER'S CONSTRUCTION

REGULARISED



AQUILONE'S CONSTRUCTION

