FORTIFICATION
OR
ARCHITECTVRE
MILITARY.

Vnfolding the principall
mysteries thereof, in the reso-
lution of sundry Questions
and Problemes.

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By R. N.

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thus the lines betweene the ſtakes *G F.* and *K L.* doe limn the fronts, the lines from the ſtakes *F N.* and *L O.* the flankes, the lines betweene the ſtakes *N C.* and *B O.* the Gorge lines, and from *O.* to *N.* the curtaine, and in like ſort you may proceede, with all the other ſides of this hexagon, and ſo of any other figure.

Sundry other wayes for lyning out a Fort, might be preſcribed, which he that is exerciſed in Geometricall menſurations, will of himſelfe eaſily conceive.

But before you begin to breake ground, examine all the parts which you have thus ſtaked out, by the other meaſures ſet downe in the tables of the fifth chapter, or by the parts calculated, as we have before ſhewed, and conſider all diligently a weeke or more, if time will permit, that ſo if any thing may be amended, it may bee done before you proceed any further.

The Inſtrument fitteſt for lyning out a Fort is the *Theodelite,* or ſome other inſtrument of that nature, the limbe thereof being divided into degrees, and every degree ſubdivided into 6. 10. 12. 20. 30. or 60. parts, that ſo you may readily count the minutes. The diameter of your Theodelite may be two foote or more, eſpecially if it be of wood, but they are commonly made much leſſe, and the degrees in them, as alſo in ſemicircles, quadrants, and the like, ſubdivided by diagonals, the intermediate circles of thoſe diagonalls, being equally diſtant one from another, which is erronious, eſpecially if the inſtrument be ſmall, the ſpaces great, and the diagonall broad: and becauſe this errour is very common, and not touched by any ſo farre as I know, it will not bee altogether impertinent in this

place

place to ſhew how by plaine triangles it may bē re-
formed.

To ſubdivide the degrees, or other parts of the Theodelite,
ſemicircle, quadrant, or other circumference, by a dia-
gonall ſcale.

Let *A B.* be the ſemidiameter of the outermoſt circle
A F. the ſemidiamiter of the innermoſt, and I would di-
vide the arch *B C.* or the
angle *B A C.* into two
equall parts, by the di-
agonall *B F.* there is re-
quired the ſemidiame-
ter of the intermediatē
circle, cutting the dia-
gonall *B F.* ſo as the
parts of it may ſubtend
equall angles at *A.* di-
vide the arch *B C.* into
two equall parts in the
point *E.* and draw the
right linē *A E.* which
interſects the diagonall
B F. in the point *D.* then
doe the parts of the dia-
gonall line *B D.* and *D F.* ſubtend equall angles, namely
B A D. and *D A F.* if therefore on the center *A.* and
diſtance *A D.* there be a circle deſcribed it will cut the
diagonall *B F.* as is required.

But to finde this diſtancē or ſemidiameter *A D.* by thē
Doctrine of triangles, firſt having determined the

greateſt
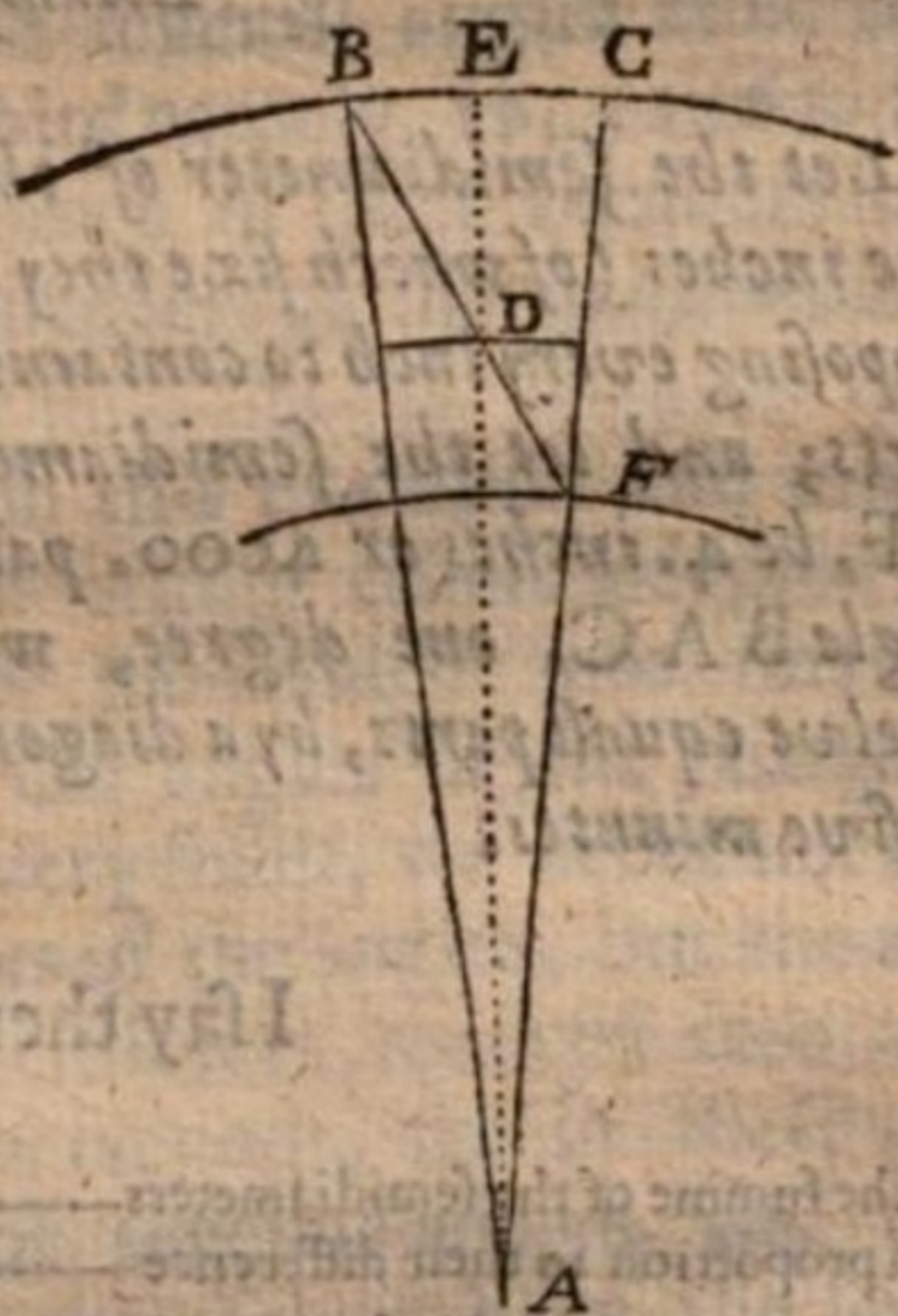
gréatéſt and leaſt ſemidiameters *A B*. and *A F*. and their contained angle *B A F*. we may finde by the tenth caſe of plaine triangles the angle *A B F*. which being known we have in the triangle *A B D*. the ſide *A B*. and the angles *A B D*. and *D A B*. wherefore by the eighth caſe we may finde the ſide *A D*. and ſo you may proceede by the ſayd eighth caſe to finde the ſemidiameters of any other intermediate circles for dividing the angle *B A F*. into as many equall parts as you will.

Example.

Let the ſemidiameter of the outermoſt circle AB. be ſixe inches (of which ſize they are often made in braſſe) and ſuppoſing every inch to containe 1000. parts this is 6000. parts; and let the ſemidiameter of the innermoſt circle A F. be 4. inches or 4000. parts, and the arch B C. or the angle B A C. one degree, which we would divide into twelve equall parts, by a diagonall, ſo that every part may be five minutes.

I ſay then

As the ſumme of the ſemidiameters ————→ *A B.* + *A F.* 10000. 6, 00000.
is in proportion to their difference——————— *A B.* — *A F.* 2000. 3, 30103.
ſo the tang. of the halfe ſumme——————— t. $\frac{1}{2}$. F. + B. 89.d. 36. 12, 05914.
to the tangent of an angle ——— ——————— t. 87. 36.'6. 11, 36017.
which ſubſtracted there remaines——————— *A B F*. 1 d. 59'. 54".

And ſeeing the angle B A C. *is* 1. deg. *or* 60. *minutes and it is required to divide it into twelve parts, every part will be* 5. *minutes, wherefore ſuppoſing the angle* B A D. *to repreſent that angle of* 5. *minutes, and* A B D. 1. deg.

59. *minutes* 54". *the sum of them is* —— 2. d. 64. 54".
the complement of the angle B D A. *to* 180. *deg. which so*
encreaseth for every twelfth part 5. *minutes.*

I say then

As the sine of the angle——————— s. B D E. 2. d. 64.54". 1,43980.
to the greateſt ſemidiameter ————————— A B. 6000. parts. 3,77815.
ſo the ſine of the angle at B. ————————— s. B. 1. d. 59. 54". 8,54246.
to the firſt and leſſer ſemidiameter ——————————— 5760. 3,76041.

And thus we might proceede to finde all the other
ſemidiameters, by adding to the complements arith-
meticall of the ſines of the ſeverall angles at *D.* the
ſumme of the ſecond and third namely 12, 32061. ſo
ſhall you have the logarithmes of theſe numbers fol-
lowing, being the ſemidiameters of the intermediate
circles.

But in this example, and much
more in others where a degree or
leſſe is ſubdivided into ſmaller
parts, the angles of the triangles
being very ſmall, we neede not uſe
the ſines of the angles, but the an-
gles themſelves reduced into mi-
nutes or ſeconds, for in theſe the
ſines of ſeverall angles, and the
angles themſelves have the ſame
proportion, without ſenſible diffe-
rence: that is,

As the ſine of ———————— 1. d. 06.
to the ſine of ——————— 0. d. 30.
ſo is ————————————— 66.
to ———————————————— 30.

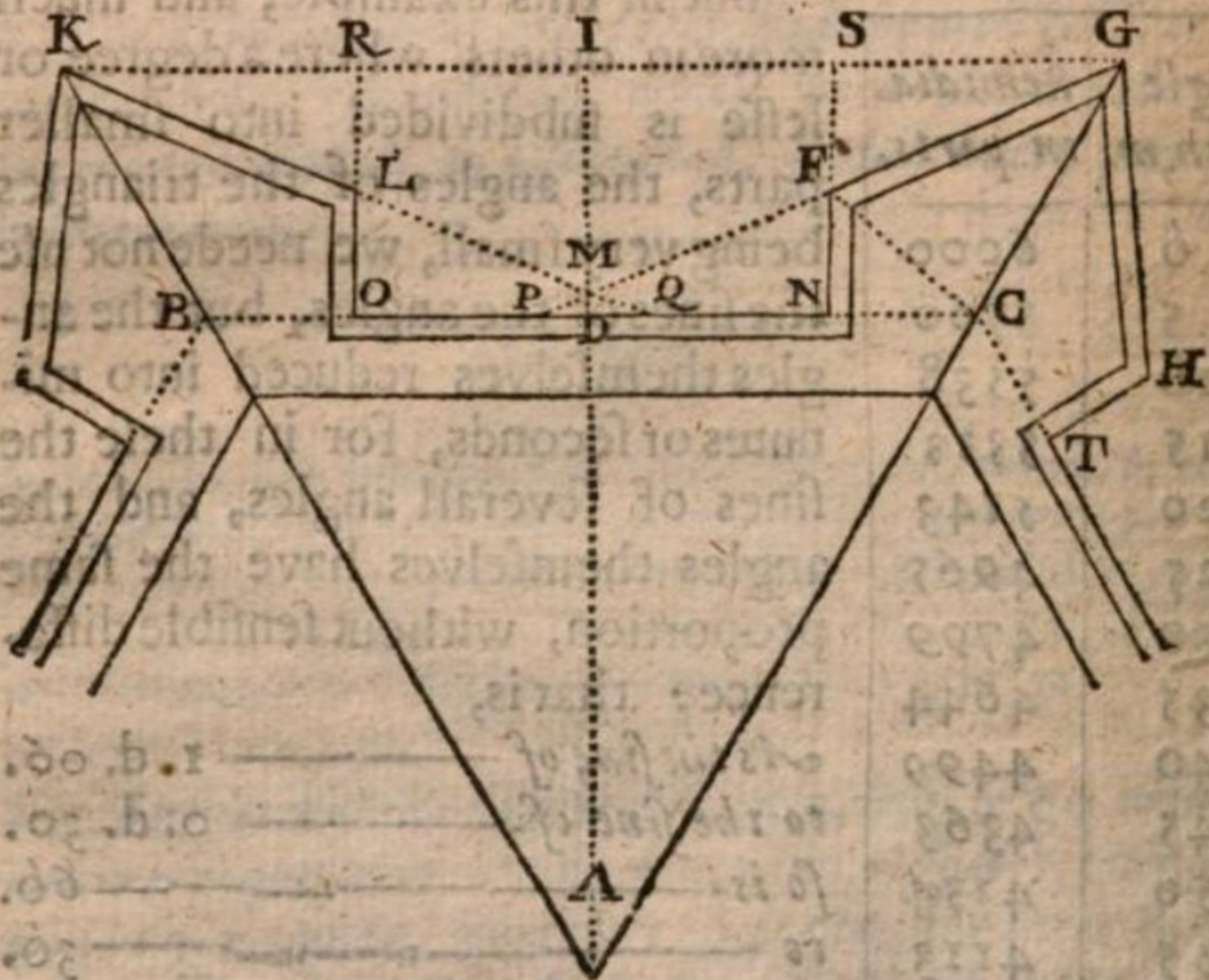| Angle A. in m.	Semidia. in parts.
6	6000
5	5760
10	5538
15	5333
20	5143
25	4965
30	4799
35	4644
40	4499
45	4363
50	4234
55	4113
60	4000

And

And so of others; But this by the way, now we re-
turne from whence we have digressed.

CHAP. VIII.

*Shewing how and in what forme, the Rampire, and Para-
pets are to be raifed, and the Ditch to be funke.*

E have fhewed in the Chapter laft before
going, how to delineate the platforme of a
Fort, and alfo how to ftake out the fame up-
on the ground, we will proceede briefely
to touch the reft.

First then it is to be underftood that that which you
have drawne, as before we have fhewed, namely the