THE

Sea-Gunner:

Shewing the

PRACTICAL PART OF GUNNERY,

As it is uſed at SEA.

AND,

As an Introduction thereto, there is Exhibited two Compendiums, one of Vulgar, the other of Decimal ARITHMETICK, With neceſſary Tables relating to that ART.

To which is added

An APPENDIX,

Shewing the Uſe of a Proportional Scale, for the ready working of any Queſtion in Gunnery.

And the Uſe of the Sea-Gunners Rule, of an excellent Contrivance; containing an Epitome of the Art of Gunnery in it ſelf.

Compoſed by [redacted] SBEERR, Senior.

LONDON:
Printed by H. Clark for the Author, and are to ſold by him at the Hermitage in Wapping, 1691.

THE PREFACE TO THE READER.

Courteous Reader,

HAving observed for several Years, that there hath been a great want of a Piece of Sea-Gunnery, that has been principally adapted for Sea-Service, in a Treatise by it self; (for those Books that were Extant, were chiefly intended for Land Service;) and at this time most of them being out of Print, I judg'd this a fit opportunity for the publishing this small Treatise, hoping it will be gratefully accepted by our Sea-Gunners.

And in regard that those who would be Students in that Art, ought (in some competent measure) to be acquainted with Arithmetick; for the sake of such, I have exhibited two Compendiums thereof, one in Vulgar, and the other in Decimal Arithmetick, as a necessary preparation for the working those Questions that are incident to that Art.

And for the eaſe of ſuch as are not fully acquainted therewith, I have furniſhed them with a Proportional Scale, whereby they may perform all the Operations that are uſeful in Gunnery; as alſo, to extract the Square and Cube-Roots, and how to perform the ſame by Logarithms, and by Gunter's-Scale.

To which I have added ſeveral neceſſary Tables uſeful in Gunnery, *with proper Queſtions and their Anſwers, and uſeful Obſervations and Inſtructions,*

And for the better accompliſhing the Deſign of this Book, I have conſulted with the beſt approved Authors, that have written on this Subject.

Alſo at the end of this Treatiſe, I have preſented you with a ſmall Tract as an Appendix, particularly of the uſe of the Proportional Scale; and of the uſe of a Rule of a new contrivance, fit for the Pocket, that hath upon it, an Epitome of the Practical part of Gunnery *in it ſelf, which I call the* Sea-Gunner's Rule: *All which I ſubmit to the favourable conſtruction of the Judicious,*

And reſt your Friend to ſerve you,

John Seller.

A Table

A

TABLE

Of the Principal Matters contained in this Book.

The TABLE.

In the Appendix.

THE

CHAP. VI.

Of the Different Fortifications of moſt Pieces of Ordnance.

THere are Three Degrees uſed in Fortifying each ſort of Ordnance, both Cannons and Culverings.

Firſt, Such as are ordinarily Fortified are called *Legitimate Pieces.*

Secondly, Such whoſe Fortification is leſſened, are therefore called *Baſtard Pieces.*

Thirdly, Thoſe that are Extraordinary Pieces, are called *Double Fortified.*

The Fortification is reckoned by the thickneſs of the Metal at the Touch-hole, at the Trunnions, and at the Muzzle, in proportion to the Diameter of the Bore.

The Cannons double Fortified, have full one Diameter of the Bore, in thickneſs of Metal

Metal at the Touch-hole, and $\frac{1}{7}$ at the Trunnions, and in their Muzzle $\frac{1}{12}$.

The Leſſened Cannons have at their Touch-hole $\frac{1}{8}$ or $\frac{1}{9}$ of the Diameter of their Bore, in thickneſs of Metal, and $\frac{1}{9}$ at the Trunnions, and $\frac{1}{12}$ at the Muzzle.

The Ordinary Fortified Cannons have $\frac{1}{7}$ at the Touch-hole, $\frac{1}{8}$ at the Trunnions, and $\frac{1}{10}$ at the Muzzle.

All the Double Fortified Culverings, and all Leſſer Pieces of that kind have 1 Diameter, and $\frac{1}{7}$ at the Touch-hole, $\frac{1}{8}$ at the Trunnions, and $\frac{1}{10}$ at the Muzzle.

The Ordinnary Fortified Culverings are Fortified every way as your Double Fortified Cannons; and the Leſſened Culverings as the Ordinary Cannons in all points.

CHAP.

CHAP. VII.

How much Powder is fit for Proof, and what for Action for any Piece of Ordnance.

FOR Cannons ' of the weight of the Iron Shot for Proof, but for Service, half the weight of the Shot is enough, eſpecially for Iron Ordnance, which will not endure ſo much Powder as Braſs Guns by one quarter.

For Culverings their whole weight of their Shot for proof, and for Service ², for the Saker and Falcon ' of the weight of their Shot.

And for Leſſer Pieces, the whole weight of the Shot may be uſed in Service, till they grow hot, for then you muſt abate by diſcretion.

For proof theſe Leſſer Pieces, you may take one, and ; of the weight of the Shot, therein alſo muſt be reſpect had to the ſtrength and goodneſs of the Powder, which is to be ordinary Corn Powder.

To make Ladles to Load your Guns with.

THe Ladles ought to be ſo proportioned for every Gun, that Two Ladles full of Powder may Charge the Piece; which in General Terms is thus.

The breadth of all Ladles are to be Two Diameters of the Shot, that ſo a Third may be left open for the Powder to fall freely out of the Ladle, when you turn it bottom upwards; the length of the Ladles muſt be ſomewhat different, according as the Piece is Fortified.

For Double Fortified Cannons, the length of the Ladle may be Two Diameters and One half of their Shot, beſides ſo much as is neceſſary to faſten it to the Head of the Ladle-Staff, which will require One Diameter more of Plate; (but this is not reckoned to the length of the Ladle, becauſe it holds no Powder. For Ordinary Can-

nons the Ladle muſt not exceed Two Diameters of their Shot in length.

For Culverings and Demy-Culverings, the Ladle may be Three Diameters of their Shot, and Three and a half for Leſſer Guns to load them at Twice.

If you would load them at once, you muſt double the length of the Ladle.

☞ *Obſerve this for a General Rule, that a Ladle Nine Balls in length, and Two Balls in breadth, will hold the juſt weight of the Shot in Powder.*

But note, that Iron Ordnance muſt have but Three Quarters of the Charge of Braſs Ordnance.

CHAP.

CHAP. VIII.

To know what Bullet is fit to be uſed for any Gun.

IT is convenient that the Bullet be ſomewhat leſs than the Bore of the Gun; that it may have vent in the Diſcharge, and not ſtick and break the Piece.

Now ſome think one Quarter of an Inch leſs than the Bore, will ſerve for all Guns, but this vent is too little for a Cannon, and too much for a Falcon.

It is more Rational and Artificial to divide the Bore of the Gun into Twenty equal parts, and let the Diameter of the Bullet be Nineteen of thoſe parts, according to which proportion the Table aforegoing, in page 137 is Calculated.

To make Cartridges, Moulds and Formers for any ſort of Ordnance.

THe matter of which Cartridges a made, are either Canvas or Paper Royal, either of which being prepared, take the height of the Bore of the Piece, and let the piece of Cloth or Paper be Three times the Diameter of the Bore or Chamber of the Piece for the Breadth, and for the length according as your Piece is; (that is to ſay,) for the Cannon the length of the Cartridge muſt be Three Diameters, in the length for Culverins, Saker, Falcons, *&c.* Four Diameters, leaving at the top or bottom one Diameter more for the bottom of the Cartridge, cutting each ſide ſomewhat larger for the ſewing and glewing them together, having a due reſpect for the augmenting or diminiſhing of your Powder, according to the goodneſs or badneſs thereof, and to the extraordinary over-heating of your Piece; and according to what you are to have your Cartridges made, you muſt have a Former of Wood turned to the height of the Shot, and a convenient length longer than the Cartridge

tridge; before you paſte or glew your Paper on the former, firſt tallow it, ſo will the Canvaſs or Paper ſlip off without ſtarting or tearing; if you make Cartridges for Taper-bored Guns, your former muſt be accordingly tapered; if you make your Cartridges of Canvaſs, allow one Inch for the Seams, but of Paper ½ of an Inch, more than your 3 Diameters for paſting; when your Cartridges are upon the former, having a bottom ready fitted, you muſt paſt the bottom cloſe and hard round about, then let them be well dryed, and mark every one with black or red Lead, or Ink, how high they ought to be filled: And if you have no Scales nor Weights, theſe Diameters of Bullets make a reaſonable Charge; for the Cannon two and a quarter, for the Culvering 3, and for the Saker 3 and a half, for the leſſer Pieces 3 and a quarter of the Diameter of the Bullet, and let ſome want of their weight againſt the time they are over-hot, or elſe you endanger your ſelf and others.

CHAP. IX.

Containing certain

THEOREMS IN GUNNERY.

THEOREM I.

THere are Three material cauſes of the greater violence of any Shot made out of a great Gun, *viz.* the Powder, the Piece, and the weight of the Bullet.

THEOREM II.

Powder is compounded of Three Principles or Elements, Salt-Petre, Sulphur and Coal, whereof it is that which cauſeth the greater violence.

THEOREM III.

Although Salt-Petre be indeed the only and moſt material cauſe of the violence, and that Powder is made more forcible, wherein is the greater quantity of Petre; and of thoſe forementioned Ingredients, there is a certain proportion to be uſed, as to render it the moſt fit for Service upon ſeveral conſiderations; of which more hereafter.

THEOREM IV.

Although Powder is the principal and efficient cauſe of the Force and violence of any Shot, yet ſuch due conſideration ought to be had to the proportions therein uſed in the Art of Gunnery, as giving more or leſs than the due proportion, it may diminiſh the force of the Shot.

THEOREM V.

There is ſuch a convenient weight to be found of the Bullet, in reſpect of the Powder and Piece, as the Bullets Metals being heavier or lighter than that weight, ſhall rather hinder than farther the violence of the range of the Shot.

THEOREM VI.

There is ſuch a convenient Proportion to be found for the Length of every Piece to its Bore, or the Diameter of the Bullet, in reſpect of the Powder and weight of the Ball; as either increaſing or diminiſhing that Proportion, it ſhall abate or hinder the violence of the Shot.

THEOREM VII.

Beſides theſe three moſt material Cauſes of violence, the ſeveral Randoms or different Mountures of Pieces will cauſe a great Alteration, not only in the far ſhooting of all Pieces, but alſo of their violent Battery.

THE-

THEOREM VIII.

Beſides theſe aforementioned, there are many other accidental Alterations which may happen, (eſpecially at Sea,) ſometimes by reaſon of the Wind, the Rarity or Condenſation of the Air, the heating or cooling of the Piece; The different charging by ramming the Powder faſt or looſe, by cloſe or looſe lying of the Bullet; By the unequal recoil of the Piece, or by reaſon of the Ship being upon a Tack, and the Gun ſtanding on the wind-ward or Lee-ward ſide of the Ship, or by the uneven lying of the Piece in the Carriage, with divers ſuch like Accidents, whereof no certain Rules can be preſcribed to reduce thoſe uncertain Differences to any certain Proportions: but all theſe by Practice, Experience and a good judgment are to be performed.

THEOREM IX.

Any Piece being mounted 90 degrees above the Horizon directly to the Zenith, the violent Motion, (being in that ſituation directly oppoſite to the Natural) carries the Bullet in a perfect right-line directly upward, till the form of the violence is

is ſpent, and the natural Motion gotten the victory; then doth the Bullet return down again by the ſame perpendicular Line.

THEOREM X.

But if any Piece is diſcharged upon any Angle of Mounture; although the violent Motion contend to carry the Bullet directly by the Diagonal Line, yet as the natural Motion prevails, it conſtrains it to a Curvity; and in theſe two Motions is made that mixt Compouud or Helical Curvity. And here note, that although the laſt declining Line of the Bullets Circuit ſeemeth to approach ſomewhat to the Nature of a right Line; yet it is indeed Helical, and mixt ſo long as there remaineth any part of the violent motion; but after that is ſpent, then his motion is abſolutely perpendicular to the Horizon.

From whence may be collected this Corrolary, That any Piece being mounted to any degree of Random, ſhall make the Horizontal range proportional to the Degree of Elevation, of which you have a Reſemblance in the Annexed Scheme, Plate I.

Any Piece therefore diſcharged at any Mounture or Random, firſt throweth forth her

her Bullet directly to a certain diſtance, called the Point-blank Range, and then afterward maketh a Curve, or declining Arch, and laſtly finiſheth in a direct Line, or nigh inclining towards it; therefore the farther any Piece ſhooteth in her direct Line (commonly called Point-blank) the more force ſhe hath in the Execution; and the more ponderous the Bullet is, the more it ſhaketh in battery, although it pierceth not ſo deep.

THEOREM XI.

The utmoſt Random of any Piece of Ordnance, is generally judged to be at 45 Degrees of Elevation; and if you mount your Piece to a greater Angle, the Random of the Bullet will be ſhorter; and to know the right Range of moſt Pieces, you may ſee in this annexed Table, as the Title may inform you, where you may ſee the Horizontal Range or Point-blank, and the utmoſt Random of each reſpective Piece, the latter being commonly ten times the diſtance of the right Ranges.

And

And for the Right Ranges and Random to ſeveral Degrees of Mounture, you may note theſe enſuing Tables, which is meaſured by Paces, 5 Foot to a Pace.

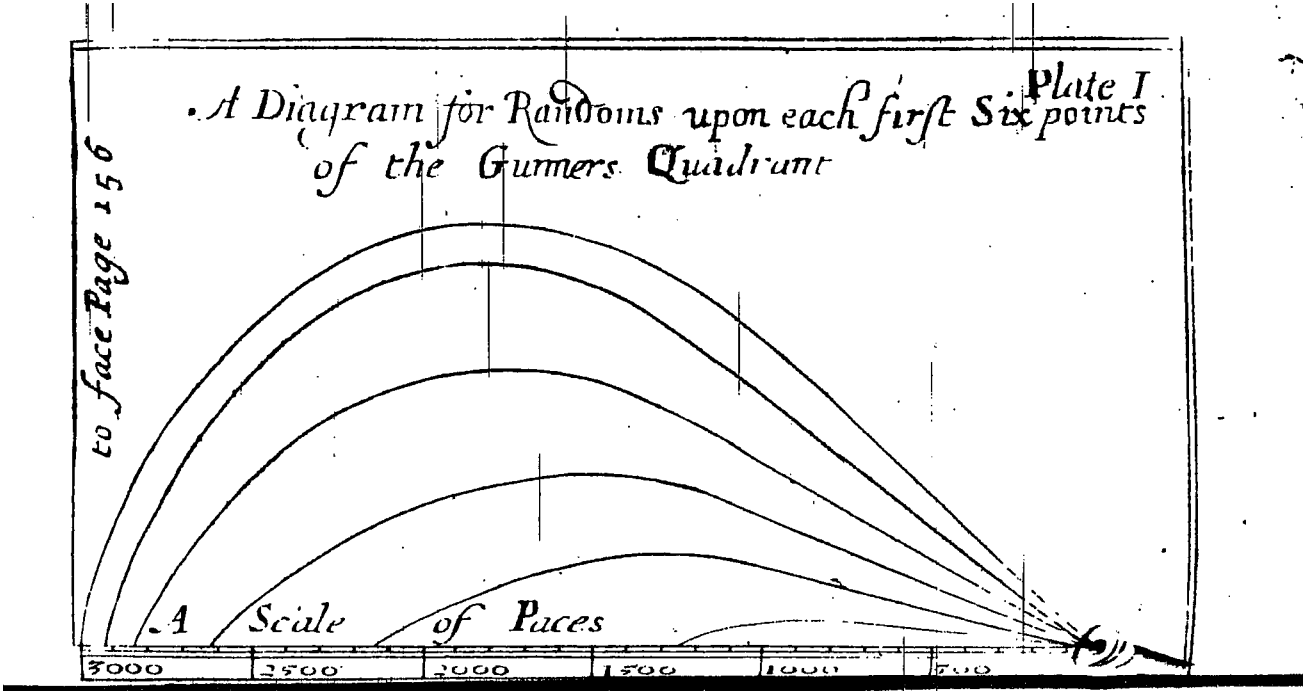
A Table of Right Ranges or Point-blanks at ſeveral Degrees of Mounture.

The Degrees of Mounture.	Right Ranges.
0	19
1	209
2	227
3	244
4	261
5	278
6	285
7	302
8	320
9	337
10	354
20	454
30	693
40	855
50	1000
60	1140
70	1220
80	1300
90	1350

A Table of Randoms at ſeveral Degrees of Mounture.

The Degrees of Mounture.	Right Randoms.
0	192
1	289
2	404
3	510
4	610
5	712
6	828
7	934
8	1044
9	1129
10	1214
20	1917
30	2185
40	2289
50	2283
60	1792
70	1214
80	1300
90	0000

CHAP.


A Diagram for Randoms upon each first Six points of the Gunners Quadrant
Plate I
to face Page 156
A Scale of Paces
3000
2500
2000
1500
1000
500

CHAP. X.

Neceſſary Inſtructions for a Sea-Gunner.

1. THE Firſt thing is, that when a Gunner cometh into a new Ship, that he diligently and carefully meaſure his Guns, to know they are full fortified, be reinforced or leſſened in Metal.

2. Then he muſt with a Ladle and Spunge, draw and make clean all his Guns within, that there may be no old Powder, Stones, Iron, or any thing that may do harm.

3. That he ſearch all the Guns within, to ſee if they are taper Chamber'd, or true bored, or whether they be Crack'd, Flaw'd, or Honey-comb'd within; and finding what Ball ſhe ſhoots, to mark the Weight of the Ball over the Port; that thereby he may ſee

ſee the Mark or Number upon the Carriage and Caſe; ſo that in time of ſervice they may not go wrong.

4. The Guns being dimenſioned and clean as aforeſaid, take half a Ladle of Powder for every Gnn, and blow them off, ſpunge them well; and finding them clean, you may load them with their reſpective Cartridges and Powder, they being ramm'd home with a ſtrait Wadd after it.

Then let the Ball role home to the Wadd, and ſet a Wadd cloſe home to the Ball, that the Ball may not roul out with the motion and tumbling of the Ship.

Then muſt you Tomkin that Piece at the Muzzle, with a wooden Tomkin, which you muſt tallow round about, to preſerve the Powder from wetting.

Likewiſe make a little Tapon of Ockam for the Touch-hole, which muſt be tallowed alſo, to prevent any wet coming to the Powder that way; then let your leaden Apron be put over it; then make your Piece faſt, as occaſion preſents.

5. The Piece being loaded and faſt, then provide to every Piece 24 Cartridges at leaſt, ready made; that is to ſay, 12 fill'd, and 12 empty.

Likewiſe you muſt be careful, ſo long as the Gunner's Crew are buſie with the Powder,

der, that there be no burning Match or Fire in the Ship; Alſo to lay his Cartridges in Barrels or Cheſts, that when there is occaſion to uſe them, they may be without abuſe.

6. The Gunner muſt ſee that he ſorts his Ball very well, and lay every ſort by themſelves in ſeveral Caſes; and upon every Caſe ſet the Weight of one of the Shot, which is in them.

Alſo you ought to make the Bags for Hail for the Guns above, and fill them with Stones, ſmall Shot, or Pieces of old Iron, which may be a great annoyance to the Enemies Men.

7. If it falls out that any new Ports muſt be cut out in the Ship, you muſt be careful that it be made over a Beam, or as near one as poſſible you can; Alſo that they be not higher or lower than the Ports before; likewiſe that there be room for the Guns to play, becauſe if one Gun be diſmounted, there might be another brought to her place: And obſerve that the Carriage ſtand on her Trucks. The uppermoſt part of the Carriage muſt ſtand in the middle of the Port, up and down, that a Man may lay his Piece as you pleaſe.

8. You muſt be careful that the Powder in the Powder-Room be well covered with

with Hides: And alſo that the Ropes, Rammers, and Spunges be ready at hand. And you muſt not let the Powder be unturned above a Month, becauſe the Salt-Petre will be apt to ſink to the lower part of the Barrel, which would be dangerous to make uſe of that Powder; And you muſt every Month draw your Guns; if you think they have got any wetneſs or moiſture in the Powder; Alſo for fear of the Salt Petre diſſolving, which may prejudice the Piece. You muſt alſo be careful of the Candle and Fire about the Gun Room, and eſpecially the Powder Room, that there may come no diſaſter.

Likewiſe a Gunner muſt keep a good Account of all Materials that belong to the Guns, as Ball, Match, and Powder. What part thereof he ſpends, alſo what remains.

9. A Gunner muſt uſe all diligence before they engage with an Enemy, to ſet a Barrel of Water betwixt every two Guns, that when they have conveniency they may dip the Spunges for the cooling of the Guns, and for fear of Fire remaining in the Piece, which may do hurt.

10. Alſo you muſt be ſure that there be no melted Fire-works done in the Ship, but aſhore; for it is dangerous, and a great hazard to the Ship, and Goods, and Men's Lives may thereby be deſtroyed.

Alſo

Alſo that in time of ſervice, no Fire-works be brought up in the Round-houſe, or great Cabbin, to ſtand, for fear of Shot coming from the Enemy may fire it, and ſo deſtroy the Ship. But rather to have them kept below in the Powder-Room, or Steward-Room, to prevent Danger.

11. Neceſſaries that a Gunner ought to have for his Ordnance, and the quantity thereof according to the Length of the Voyage, the Quantity and Quality of his Guns.

Alſo if you go in a Man of War, or a Merchant-man, then there is difference of Proviſions; only I will here name them all that belong to a Sea Gunner, that he may take ſuch a Proportion of each, as the occaſion may require, and at the End of the Voyage to give an Account what Stores are ſpent, and what there is yet remaining.

Gunners Stores.

Powder and Match.
Round-ſhot of every ſort.
Double-headed Shot.
Cut Iron of a Foot, or a Foot and a half long.

Wooden Tomkins for each ſort of Gun.
Cartridge-Paper and Glew.
Threed, Needles, Twine and Starch.
Mallets, Handſpikes, Rammer-heads.
Worms, Ladles, Spunge-heads, & Spunge-ſtaves, Beds and Quoins of ſeveral ſorts.
Old Shrouds for Breeching, and twice lay'd Stuff for Tackles.
Laſhers, double and ſingle Blocks, new Rope for double Tackles.
Some old Shrouds for Spunges, ſome Lines, Marline, Tarr'd Twine, Port-Ropes.
Moulds for Cartridges for each ſort of Gun, Axle-Trees and Trucks.
Pouch-Barrels and Linſtocks, Crows, Splice-Irons, Primes, Staples and Rings, Tackle-Hooks, Nails, Thimbles, Port-Bands, Sheet-Lead and Leaden-ſhot, old Canvaſs, Scales and Weights.
Lanthorns, Muſcovia-Lights with a large Bottom to put Water in, to prevent danger from the Sparks of the Candle flying upon the Powder-duſt, that may get into the Lanthorn; Dark-Lanthorns, Powder-Meaſures, Sope, Powder-Horns, Priming-Irons, Nippers, Plyers, Moulds to caſt leaden Bullets.

And for Inſtruments ſuch as follow, which every Gunner of a Ship ought to be furniſhed withal.

Callaper

Callaper Compaſſes large and ſmall, for taking the Diameters of the Baſe Ring, Body or Muzzle of a Gun, and the Diameters of Shot.

A New Rule called the Sea-Gunners Rule, whoſe uſe is ſhewed at the End of this Book.

Braſs Heights for Shot.
A Gunners Scale and Quadrant.
Braſs Compaſſes with Steel-points,

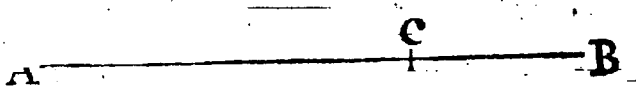
Which Inſtruments, and any other belonging to the Art of Navigation you may be furniſhed with, by *John Seller*, at the *Hermitage* in *Wapping*; with all ſorts of Books, and Maritime Charts, and Atlaſſes, for any of the known Parts of the World.

CHAP. XI.

Shewing an Eaſie way to diſpart a Piece of Ordnance.

FIrſt take the Diameter of the Piece upon the thickeſt Part, at the Breech of the Gun, with a Pair of Callaber Compaſſes, and ſee upon the Quadrant of your Callabers, how many Inches that is; the half of which Diameter take between a Pair of Compaſſes, and put that diſtance off upon a Sheet of Cartridge-Paper, which will make two Points upon the Paper, as A and B; then take the Diameter of the thickeſt part with your Callabers, and ſee how many Inches that Diameter is, And take the half thereof between your Compaſſes, and ſet one Foot in A, and the other Point in C upon the ſaid Line AB, at C.

Then



Then take the Diſtance from C, to B, on the Line, and that is the true Diſpart of the Piece; and if you take a Stick or Straw of that length, and ſet on the Muzzle faſtned with Wax, it will be a true Diſpart for that Piece.

CHAP. XII.

To Level a Piece of Ordnance to ſhoot Point-Blank.

TO ſhoot Point-Blank is to be underſtood, that when the Cylender of the Piece lyeth level with the Horizon, ſo that the Ruler of the Gunners Quadrant being put into the Mouth of the Piece, the Line and Plummet hangeth Perpendicular, then that Piece lyeth in its true Poſition, to ſhoot Point Blank.

And to make a good ſhot at a Mark, within Point-blank reach of the Piece, The Piece lying in that Poſition, as is before ſhewn; then ſet up your Diſpart upon the Muzzle; then if you put your Eye down to the higheſt part of the baſe Ring (as you took the Diameter of) and bring the top of the Diſpart in a right-line, with the Ob-

Object at a Diſtance, that ought to be of the ſame Heighth from the Horizon at your Breech of the Gun and the Diſpart, then is your Sight or viſual Line alſo parallel to the Horizon, and if there be nothing defective in the Piece or Carriage, you will make a good Shot.

But if you intend to elevate your Piece, diſcharge it of ſome of the Quoins at the Breech, and by your Quadrant applyed to the Muzzle, you may elevate the Piece to what Angle you pleaſe; as may be performed by the New Sea Gunners Rule, whoſe Uſe is ſhewn at the latter End of this Book.

CHAP. XIII.

How to ſearch a Piece of Ordnance, to diſcover whether there be any Flaws, Cracks or Hony-combs in the Piece.

IN a clear Sun-ſhiny-day, take a Piece of Looking-glaſs, and reflect the Beams of the Sun into the Cavity of the Piece, by the means of which a clear Light will appear within the Piece, by which you may diſcover any Flaw or Honey-Comb therein.

Another Way.

Take a long Stick with a ſlit at the End of it, and put an End of Candle lighted, and put it into the Cylender, turning the Stick

Stick every way; and you may very well diſcover Flaws or Honey-Combs, if there be any in the Piece.

Another Way to diſcover Cracks.

Immediatly after you have diſcharg'd your Piece, let one be ready with a Tomkin to clap into the Mouth of the Piece, with a Piece of Sheep-skin wrapped about the Muzzle of the Piece, and the ſame time let one ſtop the Touch-hole; and if there be any Crack through the Metal a viſible Smoak will appear.

Another Way.

If you ſtrike a Piece of Ordnance with a ſmart ſtroke, with a Hammer on the Outſide, and if you hear a hoarſe ſound, it is an evident Sign the Piece is not ſound, but there is ſome Crack in it.

But if after every ſtroak with the Hammer you hear a clear ſound, you may certainly conclude the Piece to be ſound.

CHAP.

CHAP. XIV.

How Moulds, Formers and Cartridges are to be made for any ſort of Ordnance.

CArtridges are uſually made of Canvaſs, or Royal Paper; to make them firſt take the heighth of the Bore of the Piece, and allow $\frac{1}{10}$ part of the Diameter for the Vent, and make the breadth of the Cartridges three Diameters of the Chamber of the Piece, beſides the ſewing or paſting, and from the Cannon to the whole Culvering is allowed about two Diameters for the length, from the Culvering to the Minion, the Cartridge is two Diameters and a half, and from the Minion to the Baſe three Diameters.

To

To every ſort of Ordnance you muſt have a Former turn'd to the heighth of the Cartridge, which is ⅞ parts of the Diameter of the Bore, and half an Inch longer than the Cartridge.

Before you paſte the Paper on the Former, tallow it, that the Canvaſs or Paper may ſlip off, without ſtarting or tearing.

If you make your Cartridges for Taper-bored Guns, your Former muſt be Taper'd accordingly; if you make your Cartridges of Canvaſs, allow an Inch for the Seams, but if you make them of Paper, allow ½ of an Inch (more than three Diameters) for the paſting.

When your Cartridges are upon the Former, having a Bottom ready fitted, you muſt paſte the Bottom cloſe and hard round about; then let them be well dried, and mark every one with black or red Lead, or Blacking, how high they ought to be filled; and if you have no Scales nor Weights, theſe Diameters of the Bullets make a reaſonable Charge for a Cannon, 2 and ½ for a Cannon, three Diameters for a Culvering, and 3½ for the Saker; And for the leſſer Pieces 3 and ¼ of the Diameter of the Ball, and let ſome want of their weight againſt the time the Piece may be over-hot, or elſe you may endanger your ſelf and others:

thers: Note that at Sea the Guns are never charged with a Ladle, but with Cartridges.

CHAP. XV.

How much Rope will make Britchings and Tackles for any Piece.

IN Ships that carry Guns, the moſt experienced Gunners take this Rule; look how many Foot your Piece is in length, four times ſo much is the length of your Tackle, and your Britchings twice the length; and if the Ropes are ſuſpected of ſtrength, then you may nail down Quoins to the four Trucks of heavy Guns, that they may have no play; and if Breechings and Tackles ſhould give way in foul Weather, it is beſt immediately to diſmount your Gun; that is the ſureſt way.

SECT.

What Powder is allowed for Proof, and what for Action.

FOR the biggeſt ſort of Pieces, as Cannon, take for Proof ⅔ of the weight of the Iron-ſhot, or for ſervice ½ the weight, for the Culvering almoſt the weight of the Shot for Proof and for Action; for the Saker and Falcon, take for Proof the weight of the Shot, and for Action ½, and for leſſer Pieces the whole Weight of the Shot for ſervice; and for Proof give them one, and ¼ of the Weight of the Ball in Powder.

CHAP.

CHAP. XVI.

How to know what Diameter every Shot muſt be of, to fit any Piece of Ordnance.

DIvide the Bore of the Piece into twenty equal Parts, and one of theſe Parts is ſufficient vent for any Piece, the reſt of the nineteen Parts muſt be the heighth of the Shot: But moſt Gunners now-a-days allow the Shot to be juſt one quarter of an Inch lower than the Bore of the Piece, which rule makes the Shot too big for a Cannon, and too little for a Faulcon; but if the Mouth of the Piece be grown rounder than the reſt of the Cylender within by often ſhooting; to chooſe a Shot for ſuch a Piece, you muſt try

try with ſeveral Rammer-heads, until you find the Diameter of the Bore in that Place where the Shot uſeth to lye in the Piece, and a Shot of one twentieth part lower than that Place, is ſufficient.

Every Gunner ought to try his Piece, whether it be not wider in the Mouth than the reſt of the Chaſe, and then proceed to chuſe his Shot.

To tertiate a Piece of Ordnance.

This word Tertiate is a Term principally uſed by foreign Gunners, meaning thereby only the meaſuring and examining the Fortification of Metals in a Piece, *tertiating*; becauſe it is chiefly to be meaſured and examined in three principal Parts of a Piece, *Viz.* at the Breech, the Trunions and the Mouth: And there are three Differences in Fortification of each ſort of Ordnance, either Cannon or Calverings, for they are either double fortified, ordinary fortified or leſſened, as Legitimate, Baſtard, or extraordinary Pieces: For the Cannon double fortified or re-inforced, hath fully one Diameter of the Bore in Thickneſs of Metal at her Touch-hole, and [illegible] at the Trunions, and [illegible] at her Muzzle; and the ordinary Cannons

nons have $\frac{1}{8}$, at the Chamber $\frac{1}{9}$, at the Trunions $\frac{1}{11}$; The leſſened Cannons have $\frac{1}{8}$ at the Chamber, and $\frac{1}{10}$ at the Trunions, at the Muzzle $\frac{1}{11}$, *&c.*

Now that every Gunner may be aſſured of the Fortitude of any Piece of Ordnance, and ſo may the more ſafely and boldly allow her a due Loading and Proportion of Powder, both for Proof and Service, that ſhe may without danger perform her utmoſt Execution, you may obſerve this following Direction:

As for Example.

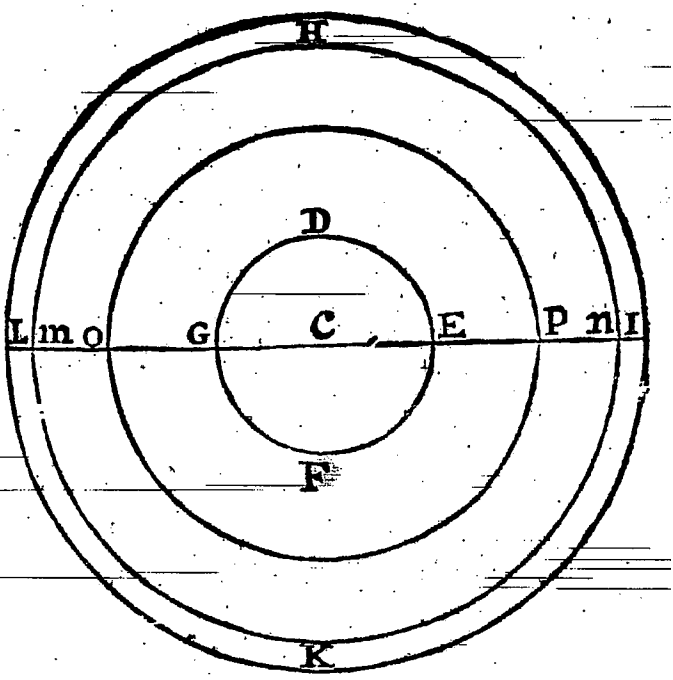
Suppoſe there is a Culvering that ſhooteth an Iron-ſhot of 17 *l.* with 13 *l.* of Corn-Powder, which is $\frac{4}{5}$ of the Weight of the Shot; the Queſtion is, whether ſhe may be able to bear ſo much Powder, and if need were, more which queſtion cannot be well anſwered without examining or tertiating her Metal, which may be thus performed.

Firſt with a Ruler draw a Line upon a Paper or Slate, as you may ſee in the annexed Figure, as the Line AB.

Then with a Pair of Compaſſes with reverſed Points, take the Circumference of the Bore of the Piece, and Meaſure the ſame upon an Inch-Rule.

Then

Then take the ſame Meaſure from any other Scale of equal parts of a competent ſize, and divide that diſtance into two equal parts with your Compaſſes, and having that diſtance in your Compaſſes, ſet one foot in the Point C, and deſcribe the circle D E F G, which circle is equal to the bore of the Piece.



Then with a pair of Calaber Compaſſes, take the Thickneſs or Diameter of the

Metal at the Touch-hole, and Meaſure the ſame upon a rule as before, and take that diſtance between your Compaſſes, and with half that diſtance ſetting one Foot in the point E deſcribe the circle H I K L, which ſhall repreſent the circumference of the Metal at the Touch-hole, ſo that you may take the Compaſſes and Meaſure the Diameter of the bore G E, which is equal to the diſtance of L G or E I which ſhews, that there is one Diameter of Metal round the Concave Cylinder of the Piece; you may therefore be ſure that it is an ordinary fortified Culvering; but to know if it be a Baſtard, or extraordinary Culvering, it cannot be known by the fortification but by the length thereof, being longer than ordinary, it is therefore called an extraordinary Culvering, and being ſhorter than the ordinary, it is therefore called a Baſtard Culvering.

Now this being found to be an ordinary Culvering, ſhe will bear $\frac{4}{5}$ of the weight of her ſhot in Cannon Powder, which is 13 *l.* 9 ounces.

But to be more aſſured of her fortitude, the meaſure of her Metal may be taken at her Trunions and Neck as followeth.

At the corniſhing before her Trunions, with a pair of Caliber Compaſſes, you may

may take the Diameter of the body of her Metal there, as you did before at the Touch-hole, and meaſure the ſame Diameter upon a rule, then take your Compaſſes and from the ſame ſcale as you did uſe before, take that diſtance and divide it in two equal parts, and ſetting one Foot of the Compaſſes in C deſcribe the circle M N, and if found ⅞ of the bore, it is the proportional fortification for an ordinary Culvering, and the like may be done with the Neck which the circle O P doth repreſent, and the diſtance from G to O being ⅞ of the height of her bore, and is the due thickneſs of her Metal, for an ordinary Culvering at her Neck.

But if in taking the meaſures aforeſaid there had been found at the Touch-hole from G to L (the thickneſs of one Diameter at the bore, and ⅛ more, it would have ſignified that it had been a double fortified or a reinforced Piece, having alſo at the Trunions G M ⅞, and at the Neck G O ⅞ of the height of her bore, then ſhe ſhooting an Iron ſhot of 17 *l.* would have endur'd 17 *l.* of Cannon Corn Powder to be loaded with, and to be fired without danger, and would conveyed the ſhot further than the ordinary could have done upon the like degrees of Mounture.

Contrariwiſe, if the Circles there had been found that from G to L had been but $\frac{7}{8}$ of the height of her bore at the Touch-hole, and at her Trunions but $\frac{3}{4}$ which is G M, and at the Neck from G to O but $\frac{17}{17}$ of the height of the bore, then ſhe would appear to be one of the leſſened or ſlender fortified Culverings, and muſt be allowed but 12 pound 9 ounces of Cannon Corn Powder, to convey her ſhot of 17 *l.* which upon like elevation will not carry a ſhot as far as the ordinary.

In this manner all other Guns are to be meaſured and tertiated only with this allowance withal that the Demy Culvering hath $\frac{1}{4}$, and the Saker $\frac{1}{3}$, and the Falcon $\frac{1}{2}$ more Metal comparatively than the whol Culvering hath.

And if a Piece is found that it is not truly bor'd, you muſt always reckon that the Piece is no otherwiſe fortified than ſhe is found to be, where her Metal is found to be thineſt.

How to make a Shot out of one Ship unto another in any Weather whatſoever.

IN time of ſervice when you are on a diſdain to make a Shot at a Ship, and know not what diſpart will ſerve the Piece, then you muſt take your aim at what part of the Ship you judge to do moſt execution, and look along by the ſide of the Piece, as near as you may at the middle of the Breech unto the middle of the Mouth of the Piece, and ſo place her to the beſt advantage, and quoin up the tayl of the Piece faſt (for that giveth the true height of the mark) Then minding the ſteeridge take your beſt opportunity and give fire, and if the Sea be any thing grown, chooſe your Piece that is neareſt the Main-Maſt and in the lower Teer, if the Ship can keep her Ports open, for there ſhe doth leaſt labour; and when you are to make a Shot at a Ship, you muſt be ſure to have a good Helms-Man that can ſteer ſteady.

And he that giveth level muſt lay his Piece directly with that part of the Ship that he doth mean to ſhoot at. And if the

Enemy be to Leeward of you, then give fire when the Ship doth begin to aſcend or riſe upon a Sea, which is the beſt opportunity that doth preſent.

But if the Enemy is on the weather-gage of you, then wait an opportunity when the Ships do right themſelves; for if you ſhould give fire at the heelding of your Ship, then you would ſhoot over the other Ship; and if the Sea be high, there is no better time to give fire than when your Enemies Ship begins to riſe on the top of a Sea, for then you have a better mark than when ſhe is in the trough of the Sea: All which ſeveral obſervations muſt be managed, with a good judgment and diſcretion of the Gunner.

And he that is at the Helm muſt be Yare-Handed with the Helm, to obſerve the motion of the Enemy, to luff when the Enemy luffs, and to bear up when the Enemy bears up; and it is always good to level the Piece rather under the place you ſhoot at than over.

And if in a fight, if you intend to lay your Enemy aboard then call up your Company either to enter or defend.

And if you are reſolved to enter, then be ſure to level your Baſes or other ſmall Guns ready to diſcharge to the beſt advantage you can at the firſt boarding, at ſuch a

place where his Men have moſt recourſe; and if you can poſſibly, at boarding endeavour to take off his Rudder by a great ſhot, or at his Main Maſt &c.

In what Order to place your great great Guns in Ships.

IT is firſt to be conſidered that the carriage be made in ſuch ſort that the Piece may lie right in the middle of the Port, and that the Trucks or Wheels are not too high, for if they are too high, then it will keep the carriage, that it will not go cloſe to the Ships ſide, ſo that by that means the Gun will not go far enough out of the Port, except the Piece be of a great length; and alſo if the Ships heelds that way, the Trucks will always run cloſe to the Ships ſide, ſo that if you have occaſion to make a ſhot, you ſhall not bring the Trucks off the Ships ſide, but that will run too again; and the Wheel or Trucks being too high, it is not a ſmall thing will ſtay it, but will run over it.

And another inconveniency is, if the Trucks are too high, it will cauſe the Piece to have a greater reverſe or recoyl, therefore

for theſe reaſons it is good to have low Wheels or Trucks to a Gun aboard of a Ship.

The beſt poſition that the Gun can be in is, to place it in the very midſt of the Port, that is to ſay, that the Piece lying level at point blank, and the Ship to be upright without any heelding, that it be as many Inches from the lower ſide of that Port beneath, as it is upon the upper part above; and the deeper or higher the Ports are up and down, it is the better for making of a ſhot, for the heelding of a Ship, whether it be on the Lee or Weather ſide; for if you have occaſion to ſhoot forward or backward, the ſteeridge of the Ship will ſerve the turn.

It is alſo very bad to have the Orlope or Deck too low under the Port, for then the Carriage muſt be made very high, which is very inconvenient in ſeveral reſpects, for in firing the Piece it is apt to overthrow, as alſo in the working and labouring of the Ship in foul weather.

And alſo you have conſideration in placing your Ordinance in a Ship, for the ſhorteſt Ordinance is beſt to be placed out of the Ships ſide, for ſeveral reaſons.

1. For the eaſe of the Ship, for the ſhorter they are the lighter, and if the

Ship

Ship ſhould heel with the bearing of a Sail, then you muſt ſhut the Ports, eſpecially thoſe Guns on the lower deck; then the ſhorter the Piece is, the eaſier it is to be taken in both for the ſhortneſs and weight alſo.

2. In like manner, the ſhorter the Piece lyeth out of the Ships ſide, the leſs it ſhall annoy them in the tackling of the Ships Sails, for if the Piece lyeth far out the Sheets, Tacks or Bowlines, it will be apt to be foul of the Guns.

For your long Guns they are beſt to be placed in the Gun-Room or any place, after on for a Stern-Chaſe, for two Reaſons.

1. The Piece had need to be long, or elſe it will not go far enough out that it may be no annoyance to the works of the Stern that may over-hang, and ſo may blow away the Counter of the Ships Stern.

2. The Pieces that are placed abaft, are required to be long, becauſe of the raking of the Ships Stern from below, ſo that the Carriages cannot come ſo near the Ports as they do by the ſhips ſide, which is more up and down.

Alſo for ſuch like Reaſons as theſe, it is as well required to have long Pieces to be placed forward or in the Fore-Caſtle, &c.

And

And here note that there muſt be regard had to the making of the Carriages, both for Forward-on or After-on for the places of the foremoſt trucks, in taking notice if the Ships ſide do tumble in or out, and alſo the cumbering of the Deck or Orlope; in all theſe caſes it muſt be left to a good judgment and experience, in the convenient placing of Guns in a Ship.

How much Rope will make Breechings and Tackles for Guns.

For the Tackles.

YOU may obſerve this Rule, that as many Feet as your Piece is in length, ſo many Fathom muſt your Rope be.

For the Breechings.

They muſt always be four times the length of the Piece with ſome overplus for faſtning at both ends. If in foul weather your Breechings and Tackles ſhould give way, you have no better way for the preſent to

to prevent danger, than immediately to diſmount the Piece.

It is alſo approved by able Gunners, that the Rammers and Spunges made with ſmall Hawſer ſhould be armed cloſe and hard with ſtrong and twiſted Yarn, from the Rammers end quite to the Spunge, which would much ſtiffen and make it more uſeful and laſting to ram both Wad and Bullet cloſe to the Powder.

Let the head of the Rammers be of good Wood, and the heighth one Diameter, and ; thereof in length, or very little leſs then the heighth of the ſhot next the Staff; it muſt be turned ſmall that a ferril of Braſs may be put thereon, to ſave the head from cleaving; when you ram home the ſhot, the heads muſt be bored ', for the Staff to be put in and faſtned with a Pin through, and the Staff-length a foot more then the concave of the Gun.

CHAP.

CHAP. XVII.

Of Powder.

Several things neceſſary to be known by a Gunner; but eſpecially of Powder.

THE efficient cauſe for expelling the Shot is the Fire that is made of Powder, that is compounded of Salt-Petre, Brimſtone and Charcoal.

The Salt-Petre gives the Blow or Report.

The Sulphur takes Fire, and the Coal rarifies the other two, to make them Fire the better.

Two ſorts of Gun-Powder are commonly in uſe.

One is made of five Parts of Salt-Petre, one of Brimſtone, and one part of Charcoal.

The

The other (being ſtronger) is made of ſix one and one.

That of five one and one is generally uſed for great Guns, the other for Muskets and ſmall Arms.

And it hath been generally obſerved, that forty two pound of Powder of five one and one, is ſtronger than forty five pound of four one and one; and forty pound of ſix one and one works greater effect, than forty two pound of five one and one, although all contain thirty pound of Salt-Petre.

Anciently they made Powder of four one and one; but this Powder by experience being found too weak, is not now in uſe.

That Powder which at this day is received into their Majeſties Magazine at the Tower of *London*, is made of ſix one and one.

To know good Powder.

1. The harder the Corns are in feeling, by ſo much the better it is.

2. When the Powder is of a fair Azure or French Ruſſet colour, is it judged to be a very good ſort and to have all its Ingredients well wrought, and the Petre to be well refined.

3. Lay

3. Lay five or ſix Corns upon a white piece of Paper three fingers diſtance one from another, then fire one, and if the Powder is good they will all fire at once and leave nothing but a white chalky colour on the Paper; neither will the Paper be toucht: But if there remains a groſſneſs of Brimſtone and Petre, it diſcovers the Powder to be bad.

And take this for a general Rule, for a ſign of good Powder; that which gives fire ſooneſt, ſmoaks leaſt, and leaves leaſt ſign behind it, is the beſt ſort of Gun-Powder.

To preſerve Powder from decaying.

To preſerve good Powder, Gunners ought to have that reaſon to keep their Store in as dry a place that can be had in the Ship, and every Fortnight or three Weeks to turn all the Barrels and Cartridges upſide down, ſo that the Petre may be diſperſed to every part alike; for if it ſtands long, the Petre will always deſcend downwards, and if it be not well ſhak d and moved, it will want of its ſtrength at the top, and 1 *l.* at bottom with long ſtanding will be ſtronger then 3 at the top.

To find the Experimental Weight of Powder (Tower-Proof) that is found convenient for Service, to be uſed in Guns of ſeveral Fortifications (or thickneſs) and by conſequence ſtrength of Metal.

TO find the ſtrength of Guns the brief Rule is thus, Firſt find the Diameter of the bore (or Chamber of the Gun) where the ſhot lies, then the true fortified Iron Guns ought to be 11 of thoſe Diameters in the circumference of the Gun at the Touch-hole, 9 at the Trunions, and 7 at the Neck, a little behind the Mouth or Muzzle-ring where the diſpart is ſet.

But Braſs Guns having the ſame weight of Powder are as ſtrong at nine Diameters of the Chamber bore about the Gun at the Touch-hole, and ſeven Diameters at the Trunions, and five at the Neck.

This

This is the Rule of true bored and true fortified Guns; and for thoſe more or leſs fortified, obſerve the Proportions in this following Table.

	Braſs		*Iron*
More Fortified	11 12 5	*Diameters*	13 14
True Fortified	9	*Diameters*	11
Leſs Fortified	8 7 5	*Diameters*	10 9

Weight of Powder for Service is proportioned by the Numbers of Diameters of the Bore about the Gun at the Touch-hole, for ſuch Guns ſo qualified as in the foregoing Table, *viz.* and to load them accordingly.

To know whether the Trunions of any Gun are placed right.

Meaſure the length of the Cylender from the Muzzle to the Britch, and divide the Length by 7, and divide the Quotient by 3, and the Product will ſhew how many the Trunions muſt ſtand from the bottom of the bore of the Piece, and that they ought to be placed ſo that ⅓ of the Piece may be ſeen above the Center of the Trunions.

The

The Practical way of making Gun-Powder.

The Eſſential Ingredients for making Gun-Powder are three, *viz.* Salt-Petre, Brimſtone and Charcoal, and of theſe there are to be three ſeveral quantities and proportions, according to the uſe intended for; and for the beſt Powder that is now made, there is commonly uſed theſe proportions.

Salt-Petre,——4, 5, 6 *Parts.*
Brimſtone,——1 *Part.*
Charcoal,——1 *Part.*

The Cannon Powder hath commonly of Salt-Petre four times ſo much as of Brimſtone and Charcoal, and for Musket Powder it is uſually made five times as much Salt-Petre as of Brimſtone and Coal.

Now having the Proportional quantity of each of theſe Ingredients, put all the Salt-Petre together into a Caldron, and boyl it with ſo much Water as will ſerve to diſſolve it with; being ſo diſſolved, it ought to be waſhed and lay'd upon a clean place; this done, beat the quantity of Coal into duſt, then put this Charcoal duſt being finely bea-

ten into the diſolved Petre, and incorporate them very well together, and as you mingle them, put in by little and little the Sulpher very well beaten; when this mixture of Salt-Petre Brimſtone and Coal are well incorporated, lay it forth to dry a little; when the ſame mixture is ſomewhat dryed and is very well mixed, ſift it well through a Sieve; then caſting Water or Vinegar upon it, corn it, and when you have ſo done, dry it againſt the Fire and the Gun-Powder is made: There are divers ways to grind Gun-Powder; the beſt way is to ſtamp it in Mortars with a Horſe-mill or Water-mill, for the Powder is thereby moſt finely beaten and with leaſt labour; and to know if it be well done, you may with a Knife cut in pieces ſome of this Compoſition, and if it appear all black it is well done, but if any of the Brimſtone or Petre is ſeen, it is not incorporated enough.

The manner to ſift Powder is thus,

Prepare a Sieve with a bottom of thick Vellom or Parchment, made full of round holes, then moyſten the Powder which ſhall be corned with Water, put a little Bowl into the Sieve, then ſift the Powder ſo as the Bowl rowling up and down in the Sieve may break the clods of Powder, and make it by running through the little holes to corn.

To

To Renew and make good again any ſort of Gun-Powder, having loſt its Strength by moiſture, long lying, or by any other means.

Having moiſtned the ſaid Gun-Powder with Vinegar or fair Water, beat it well in a Mortar, then ſift it through a Sieve or fine Searce; for every *l.* of Gun-Powder mingle one Ounce of Salt-Petre that hath been pulveriſed, and when you have ſo done beat and moiſten this mixture again, until by ſo breaking or cutting with a Knife, there is no ſign of Salt-Petre or Brimſtone in it: Alſo corn this Powder when it is incorporated with the Petre, as it ought to be, and you have done.

CHAP.

CHAP. XVIII.

How to make Hand-Granadoes to be Hove by Hand.

THere is good uſe made of Hand-Granadoes in Aſſaults and Boarding of Ships; theſe are made upon a Mould made with Twine, and covered over with Cartridge Paper and Muſket Bullets cut in two, put with Paſt and bits of Paper thick on the out-ſide. After you have doubled the Shells, paſt on ſome at a time, and let it dry, and put ſome more until it be quite full; then dip it in ſcalding Roſſen or Pitch and hang it up and it is for your uſe: But you muſt have the innermoſt end of the Twine left out, and before you pitch it you muſt draw out the Twine and ſtop the hole, and then pitch it.

To load them, fill theſe Shells with Gun-Powder, then make a Fuze of one pound of Gun-Powder and ſix Ounces of Salt-Petre and one of Charcoal, and fill the Fuze; then knock it up to the head within one quarter of an inch, which is only to find it by night.

Stop the reſt of the holes well with ſoft Wax; your firſt Shells muſt be coated with Pitch and Hurds leſt it ſhould break with the fall; and be ſure when you have fired the Fuze, ſuddenly caſt it out of your hand, and it will do good execution.

CHAP. XIX.

How to make Fire-Pots of Clay.

Fire-Pots and Balls to throw out of Mens hands may be made of Potters-Clay with Ears to hang lighted Matches to them; if they light on a hard thing they break and the Matches fire the Powder, and the half Musket Bullets contrived on them, as in the laſt Chapter, diſperſe and do much miſchief.

Their mixture is of Powder, Petre, Sul-

pher, Sal Armoniack of each one pound, and four Ounces of Camphire pounded and ſearced and mixt well together, with hot Pitch, Linſeed Oyl or Oyl of Petre; prove it firſt by burning a ſmall quantity, and if it be too ſlow add more Powder, or if it be too quick then put more Oyl or Roſin, and then it is for your uſe.

SECT. I.

How to make Powder-Cheſts.

You muſt nail two Boards together like the ridge of a Houſe, and prepare one Board longer and broader for the bottom: Between theſe three Boards put a Cartridge of Powder, then make it up like a Sea-Cheſt and fill it with pibble Stones, Nails, Stubbs of old Iron; then nail on the Cover and the ends to the Deck, in ſuch a place as you may fire the Powder underneath through a hole made to put a Piſtol in: Theſe are very uſeful to anoy an Enemy if they board you.

To make Stink-Balls.

Take Gun-Powder 10 *l.* of black Pitch 6 *l.* of Tarr 20 *l.* Salt-Petre 8 *l.* Sulpher Ca-

Calafornia 4 *l.* melt theſe over a ſoft Fire together, and being well melted put 2 *l.* of Cole duſt of the Filings of Horſes Hoofs 6 *l.* Aſſa Fætida 3 *l.* Sagapenum 1 *l.* Spatula Fætida half a *l.* Incorporate them well together and put into this matter ſo prepared old Linnen or Woollen Cloath, or Hemp or Tow as much as will drink up all this matter, and of theſe make them up in Balls of what bigneſs you pleaſe, and being thrown between Decks will be a great annoyance to the Enemy.

CHAP. XX.

The Properties Office, and Duty of a Sea-Gunner.

1. A Gunner ought to be a ſober, wakeful, luſty, patient, prudent and quick Spirited Man; he ought alſo to have a good eye-ſight and a good judgment in the time of ſervice, ſo to plant his Piece to do moſt hurt or execution, either to the Hull or rigging of a Ship, as may be moſt expedient according to the appoinment of the Commander.

2. A Gunner ought to be skilful in Arithmetick and Geometry, in the making of all kind of Artificial Fire-Works, eſpecially for ſervice.

3. A Gunner ought to procure with all his power the Friendſhip and Love of every Perſon, and to take great care of his charge for his own ſafety as well as the Ship and all the Mens lives, by having ſpecial regard unto his Powder Room and to be well ſatisfied in the carefulneſs of thoſe that he doth intruſt to manage the buſineſs there, and to ſee that the Yeoman is careful always to keep a good and large Lanthorn, and to be kept whole, that it may prevent the flying in of the duſt of the Powder, for the neglect of which it hath ſometimes been conjectured that ſome Ships have been blown up and loſt for want of care in the Powder Room.

4. A Gunner ought at the receipt of his charge, to make an Inventory of all ſuch things as ſhall be committed to him, as well to render an account as to conſider the want of ſuch Materials as are neceſſary to the well performance of his duty.

5. A Gunner ought to have his Gun-Room always ready furniſhed with all neceſſaries belonging to his Art, which ought always to be in readineſs, *viz.* Ladles, Rammers,

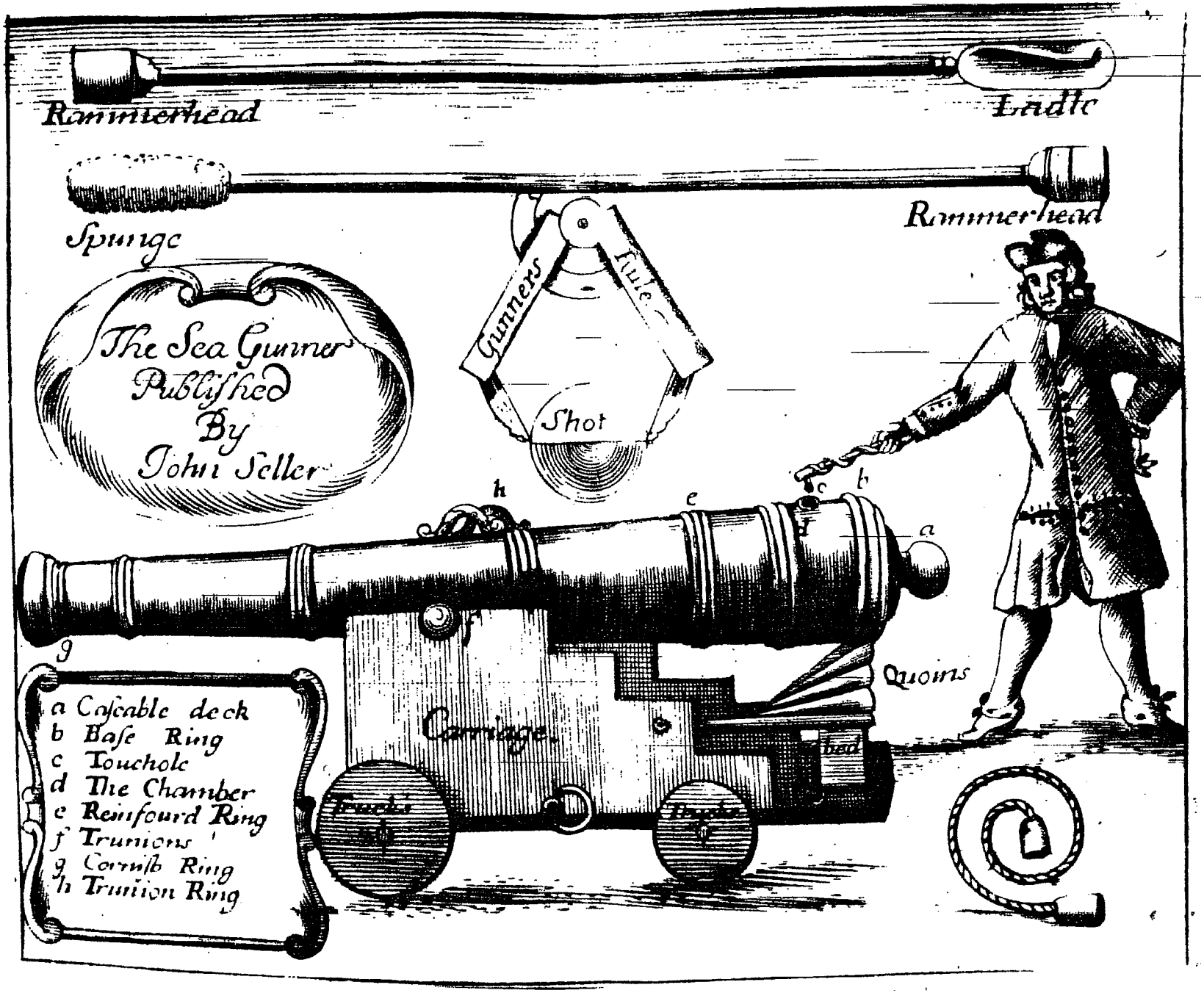
mers, Spunges, Gun-Powder, Balls, Tamkins, Wadds, Chain-ſhot, Croſs-bar-ſhot, Quoins, Crows, Tackles, Breechings, Powder-Horns, Canvaſs, and Paper for Cartridges, Forms for Ladles, Cartridges, Needles and Threed to ſow and bind the Cartridges, Candles, Lanthorns, Handſpikes, Poleaxes, little Hand-Baskets, Glew and Paſt, with a ſufficient Crew of able and expert Seamen, being yare-handed to travers a Piece, to Charge, Diſcharge, Mount, Wadd, Ram, make Clean, Spunge, and Prime and Scoure, and readily to do and perform any thing belonging to the Practical Part of Gunnery.

6. A Gunner ought always to have a Ruler about him, and a pair of Compaſſes, and Callabers to meaſure the heighth and length of every part of his concavity, and the length depth and wideneſs of every Ladle whereby he may know whether his Piece is laden with too much Powder, or is charged with a leſs quantity than it ought to have.

7. A Gunner ought to know the length and weight of all manner of Pieces, and be able to give an account readily how much Powder is a due charge for every Piece, and how many times a Piece may be ſhot off without harm, and how each kind of Piece ſhould be charged with the Powder, Tamkin, Ball and Wadd. 8. A

8. A Gunner alſo muſt be skilful to make Salt-Petre, to refine and ſublime Salt-Petre, to make divers ſorts of Gun-Powder to purifie Brimſtone, to amend any ſort of Powder when it hath loſt its vertue and force, and to know how much Salt-Petre ought to be put to the ſaid unſerviceable Powder, and to make it ſtrong as it was before, and how many times the Salt-Petre that is put into the Powder ought to be refined.

9. A Gunner that ſerves at Sea muſt be careful to ſee that all their great Ordance be faſt breeched, and that all the furniture be handſome and in a readineſs as was ſaid before, and that they are circumſpect about their Powder in the time of ſervice, and to have an eſpecial care of the Linſtocks and Candles for fear of their Powder and their Fire-works, and the Oacum, which is very dangerous, and to keep your Pieces (as neer as you can within): And alſo that you keep their Touch-holes clean without any kind of droſs falling in them; and it is good for the Gunner to view his Pieces and to know their perfect diſpart, and to mark it upon the Piece or elſe in a Book or Table, and name every Piece what it is and where ſhe doth lie in the Ship, and note how many inches halfs and quarters of inches the diſpart cometh unto.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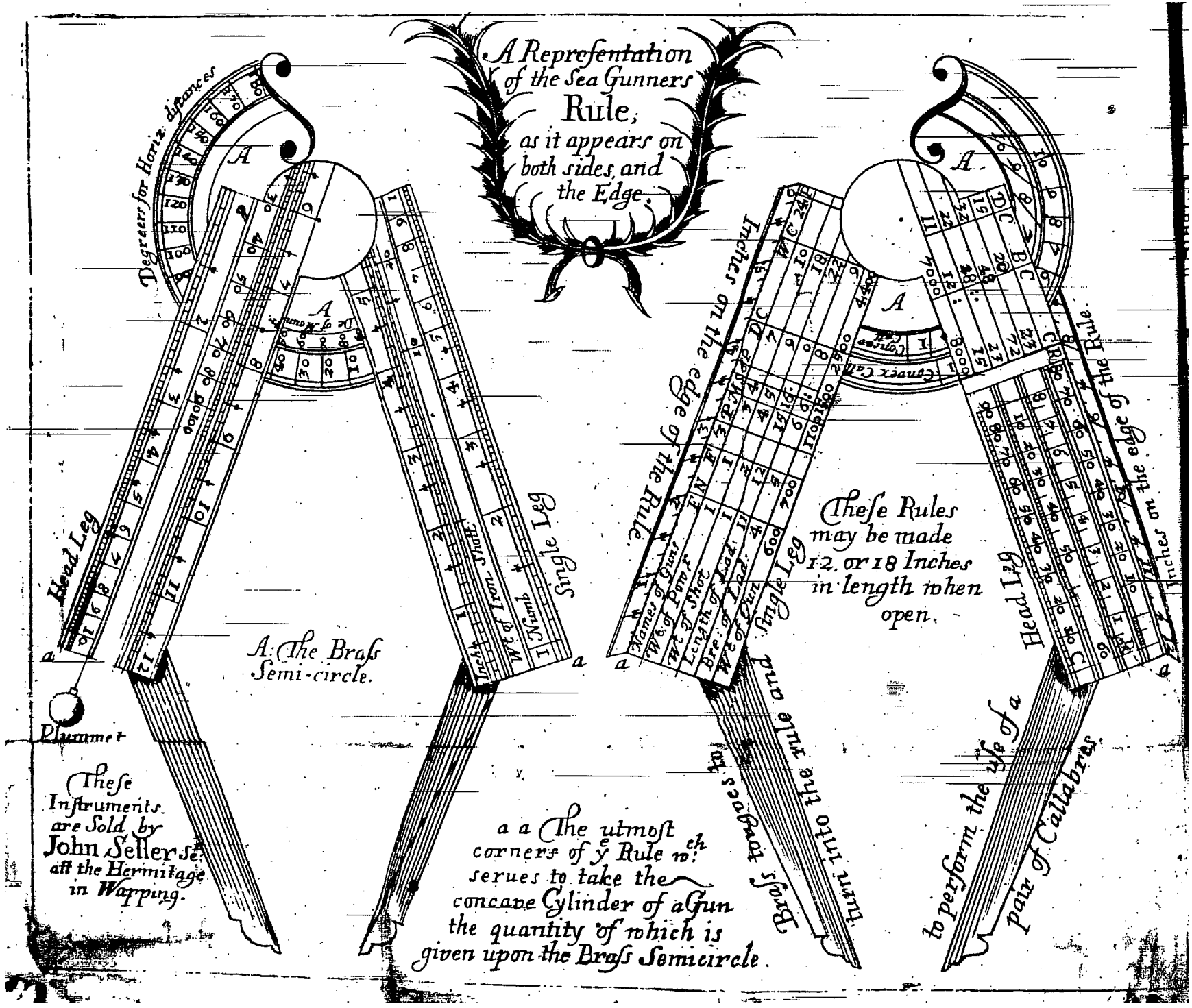
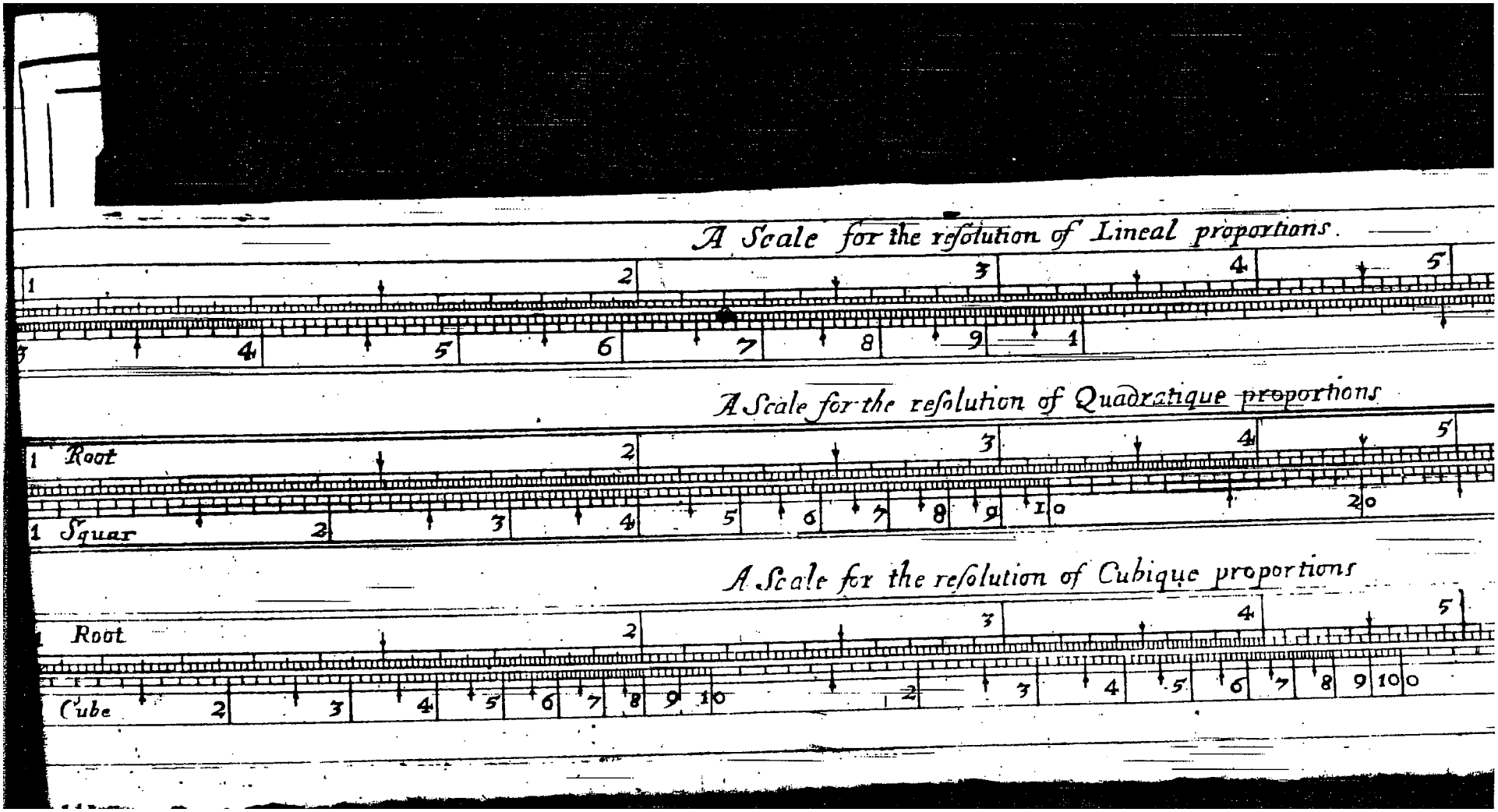
Carriage
Truck
Truck
a Cascable deck
b Base Ring
c Touchole
d The Chamber
e Reinfourd Ring
f Trunions
g Cornish Ring
h Trunion Ring

A Representation of the Sea Gunners Rule, as it appears on both sides, and the Edge.




A Scale for the resolution of Lineal proportions.
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A Scale for the resolution of Quadratique proportions
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A Scale for the resolution of Cubique proportions
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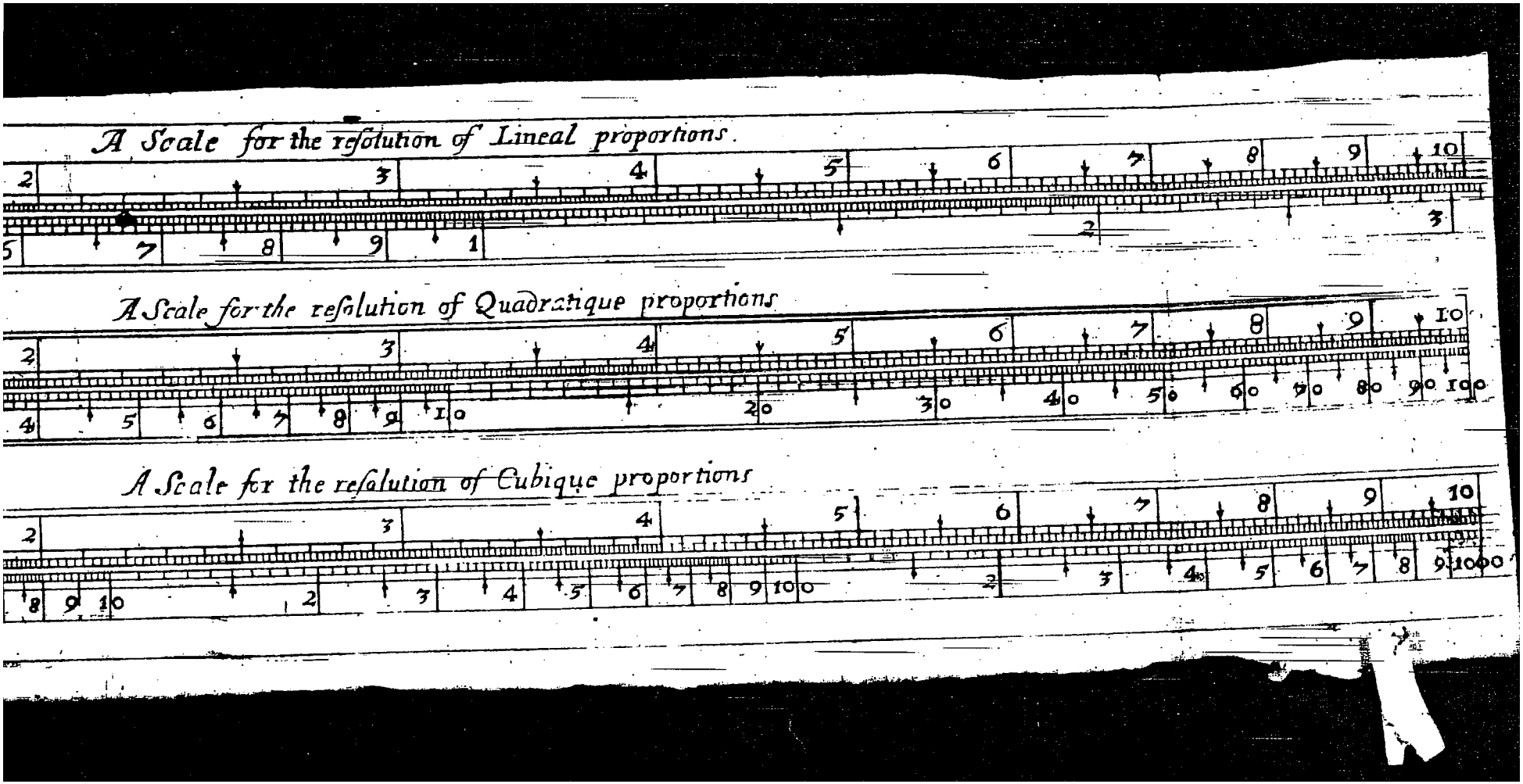
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A Scale for the resolution of Quadratique proportions
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