THE SECOND BOOKE,

Teaching moſt plainly, and withall moſt exactly, the compoſing of all manner of Fire-works for Triumph and Recreation.

By *I. B.*

LONDON,
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While it's easy to find humor in comparing this book to the materials that are available to us today, I feel that a bit of respect is to be accorded to the author. It's amazing to see that items that Bate described and illustrated nearly four-hundred years ago are easily recognized as being the ancestors of fireworks that we use today. Mortars and aerial shells, line pigeons, Catherine wheels, bottle rockets….this guy was building this stuff before the Fourth of July was even dreamed of.
I made this document available so that people might learn a little bit more about the history of their hobby, and maybe, they'll learn something they didn't know before.

Thank you, Mr. Bate.

To the Reader.

COurteous Reader, there hath a diſtance been occaſioned ſince the inception of this work, by reaſon of the occurrence of certaine Authours, that contrary unto my knowledge had laboured ſo fully herein; but after conſideration had (that for the moſt part they were but tranſlations) I thought it might bee no leſſe lawfull and commendable for mee than for others, to communicate unto ſuch as are yet deſirous of further information, that wherein I haue beſtowed both coſt and paines. Notwithſtanding, I haue ſo uſed the matter, as that I might not derogate from the eſtimation had of others to increaſe mine owne. Read it throughly, iudge indifferently, and if thou likeſt it, practiſe conſiderately. If thou art ignorant herein, I am

ſure it will inſtruct thee, and though well experienced (which perhaps thou art) I make no queſtion, but that thou mayſt finde ſomewhat which thou haſt not heard of before; So farewell.

Your Wellwiller

I. B.

Of Fire-workes.

I Haue euer found (in conference with diuers deſirous of inſtruction in any Art or Science whatſoeuer) that the ſumme and chiefeſt end of all hath been, to know the reaſons and cauſes of thoſe things they were deſirous to be informed in. Wherefore I thought good, before I came to the matter it ſelfe, to ſet down ſome few Præcognita or Principles (as I may ſo call them) whereby ſuch as are ingenious, upon occaſion, may informe themſelues, if they ſtand in doubt of the cauſe of any thing that is hereafter taught.

Certayne Præcognita or Principles, wherein are contayned the cauſes and reaſons of that which is taught in this Booke.

1 THe foure Elements, Fire, Ayre, Earth, and Water, are the *prima principia* (I meane the materialls) whereof euery ſublunary body is compoſed, and into the which it is at laſt diſſolued.

2 Euery thing finding a diſſolution of thoſe *naturæ catenæ*, that is, meanes whereby their *principia* are connected, and ioyned together, their lighter parts aſcend upward,

ward, and theſe that are more groſſe and heauy, doe the contrary.

3 It is impoſſible for one and the ſelfe ſame body to poſſeſſe at one time two places; It followeth therefore, that a denſe body rarified, and made thin, eyther by actuall or potentiall fire, requireth a greater quantity of room to be conteyned in, then it did before. Hence it is, that if you lay your hand upon a glaſſe, hauing a ſtraight mouth reuerſt into a diſh of water, it rarifieth the ayre contayned therein, and makes it breake out thorough the water in bubbles. Alſo, that gunpowder incloſed in the barrell of a gun, being rarified by fire, applied unto the touch-hole, it ſeeketh a greater quantity of roome, and therefore forceth the bullet out of the barrell. This is called violent motion.

4 According unto the ſtrength and quantity of a denſe body rarified, and according unto the forme and length of its incloſure, it forceth its compreſſer further or neerer at hand.

Thus much ſhall ſuffice to haue ſpoken concerning the *Præcognita:* Now I will paſſe *ad majora, & ad magis neceſſaria:* to wit, thoſe neceſſary Inſtruments, and ſeuerall ſorts of Ingredients, that ought to be had in readines.

As for the inſtruments they are theſe; Morters and Peſtles, Serces, alſo ſeuerall ſorts of Formers, Paper, Parchment, Canuas, Whipcord, ſtrong binding thread, Glew, Roſin, Pitch, with diuers veſſells meet to contayne and mingle your compoſitions in. The ingredients likewiſe are chiefly theſe, Saltpeter, Rochpeter, Sulpher, Charcoale, good Gunpowder, Filings of ſteele, oyle of Peter, and Spirit of wine.

Inſtructions

Inſtructions for chuſing your ingredients.

SAltpeter is very good, if that being layd upon a board, and fire put to, it riſe with a flamed ventoſous exhalation, rayſing no ſcum, nor leauing no pearle, but onely a blacke ſpecke burnt into the boord.

The beſt brimſtone, is quick brimſtone, or **line** ſulphur, and that ſort is beſt that breaketh whiteſt; if this cannot be gotten, take of the whiteſt yellow brimſtone.

The beſt Coales for uſe are the ſallow, willow, hazel and beech; onely ſee they be well burnt. Euery of theſe ingredients muſt be powdred finely and ſearſed.

All kindes of gunpowder are made of theſe ingredients impoſed, or incorporated with vineger, or aquavitæ, and afterward grayned by art: The Saltpeter is the Soul, the Sulphur the Life, and the Coales the Body of it. The beſt ſort of powder may be diſtinguiſhed from others, by theſe ſignes:

1 If it be bright and incline to a blewiſh colour.

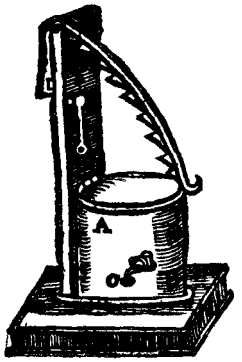
2 If in the handling it proue not moyſt but auoydeth quickely.

3 If being fired, it flaſh quickly, and leaue no dregs nor ſetlings behinde it.

A deuice to try the ſtrength of diuers ſorts of Gunpowder.

IF ſo be you haue at any time diuers ſorts of Gunpowder, and it is your deſire to know which of them is the ſtrongeſt, then you muſt prepare a box, as A, B, being foure inches high, and about two inches wide, hauing a lid

lid ioynted unto it. The box ought to be made of iron, braſſe, or copper, and to bee faſtned unto a good thick plank, and to haue a touch-hole at the bottom, as O, and that end of the box where the hinge of the lid is, there muſt ſtand up from the box a peece of iron or braſſe, in length anſwerable unto the lid of the box: this peece of iron muſt haue a hole quite through it, towards the top, and a ſpring, as, A, G, muſt bee ſcrewed or riueted, ſo that the one end may couer the ſayd hole. On the top of all this iron, or braſſe that ſtandeth up from the box, there muſt bee ioynted a peece of iron (made as you ſee in the figure) the hinder part of which is bent downward, and entreth the hole that the ſpring couereth; the other part reſteth upon the lid of the box. Open this box lid, and put in a quantity of powder, and then ſhut the lid down, and put fire to the touch-hole at the bottom, and the powder in the box being fired, will blow the box lid up the notches more or leſſe, according as the ſtrength of the powder is. ſo by firing the ſame quantity of diuers kindes of powders at ſeuerall times, you may know which is the ſtrongeſt. Now perhaps it will bee expected that I ſhould ſpeak of the making of Saltpeter, Gunpowder, Coales, with the refining of Sulphur: but becauſe they are ſo commonly to bee had, and to bee bought at better rates than I know they can bee made by any that intend it for their priuate uſe, I haue forborne it: There are diuers I am ſure that would willingly bee in action:



action : I haue thought fitting therefore to ſet downe the collection of naturall Saltpeter, which is a kinde of white excreſcence growing upon ſtone-wals, and (as I haue ſeene great ſtore) in the arches of ſtone-bridges. Firſt therefore gather this white excreſcence, and adde unto it Quick lyme, and Aſhes, mingle them, and put them into a halfe-tub that hath a hole to draw the liquor out at; then put into this halfe-tub warm water, and let it ſtand untill all the peter be diſſolued; let it then drain out at the hole by little and little, and if the liquor be not cleere, double a brown paper, and put it within a tunnell, and ſtraine the liquor through it. Then boyle it and ſcum it untill it bee ready to congeale, neither too hard, nor yet too tender: then take it from the fire, and put it into ſhallow veſſels, either of earth or braſſe; ſet them in a cold place two or three dayes, and it will ſhoot into iſicles, and this is called Rochpeter. Thus much for the ingredients. Now I am come unto the Formers, the number whereof I cannot certainly determine, becauſe it dependeth upon the variety of each particular perſons inuention. Now that I may formally proceed, I will firſt make ſome diſtinction of each kinde in generall; and then I will ſpeak of euery particular contained in each generall. Fire-works are of 3 ſorts.

1 Such as operate in the ayre, as Rockets, Serpents, Raining fire, Stars, Petards, Dragons, Fire-drakes, Feinds, Gyronels, or Fire-wheeles, Balloons.

2 Such as operate upon the earth, as Crackers, Trunks, Lanterns, Lights, Tumbling bals, Sauciſſons, Towers, Caſtles, Pyramids, Clubs, Lances, Targets.

3 Such as burn in or on the water, as Rockets, Dolphins, Ships, Tumbling bals.

Part of either of the three kindes are ſimple, and part are compounded; part alſo are fixed, and part moueable. Firſt I will treat of the diuers compoſitions, and then of the Formers, Coffins, and manner of compoſing euery of them.

Of the diuers compoſitions of fire workes.

FIrſt of the compoſitions of fire workes, for the ayre; and therein firſt I will ſpeake of the compoſitions for rockets, becauſe that all moueable fireworkes haue their motion from the force of them accordingly applied.

Compoſitions for Rockets of all ſizes, according unto the preſcription of the noted Profeſſors, as Mr Malthus, Mr Norton, *and the French Authour,* Des recreationes Mathematiques.

A Compoſition for Rockets of one ounce.

TAke of gunpowder, ſaltpeter and charcoale, of each one ounce and a halfe, mingle them together, and it is done. Note heere, as I told you before, that all your ingredients ought to be firſt powdred by themſelues, and afterwards mixed very well together.

A

A Compoſition for Rockets of two and three ounces.

TAke of gunpowder fowre ounces and a halfe, ſaltpeter one ounce, mixe them together.

A Compoſition for Rockets of foure ounces.

TAke of gunpowder fowre pounds, ſaltpeter one pound, charcoale fowre ounces, mingle them together.

A Compoſition for Rockets of fowre ounces.

TAke of gunpowder fowre poundes, ſaltpeter one pound, charcoale fowre ounces, brimſtone halfe an ounce, mingle them together.

A Compoſition for all middle ſized Rockets.

TAke of gunpowder one pound, two ounces of charcoales, mingle them.

A Compoſition for Rockets of five or ſix ounces.

TAke of gunpowder two pound fiue ounces, of ſaltpeter halfe a pound, of charcoale ſix ounces, of brimſtone and yron ſcales, of each two ounces, mingle them.

A Compoſition for Rockets often or twelve ounces.

TAke of gunpowder one pound and one ounce, ſaltpeter fowre ounces, brimſtone three ounces and a halfe, charcoale one ounce, mingle them.

A Compoſition for Rockets of one pound, or two.

TAke of ſaltpeter twelue ounces, gunpowder twenty ounces, and charcoale three ounces, quicke brimſtone and ſcales of yron, of each one ounce, mingle them.

A Compoſition for Rockets of eight, nine and tenne pounds.

TAke ſaltpeter eight pounds, charcoale two pounds twelue ounces, brimſtone one pound fowre ounces. Note that no practitioner (how exact ſoeuer) ought to relie upon a receipt, but firſt to trie one rocket, and if that be too weake adde more gunpowder, if it be too ſtrong let him adde more charcoale untill hee finde them flie according unto his deſire. Note that the charcoale is only to mitigate the violence of the powder, and to make the tayle of the rocket appeare more beautifull. Note alſo that the ſmaller the rockets be, they need the quicker receipts, and that in great rockets, there needeth not any gunpowder at all.

The

The Compoſition for middle ſized Rockets may ſerve for Serpents, and for rayning fire, or elſe the receipt for Rockets on the ground, which followeth heereafter.

Compoſitions for Starres.

TAke ſaltpeter one pound, brimſtone halfe a pound, gunpowder fowre ounces, this muſt be bound up in paper or little ragges, and afterwards primed.

Another receipt for Starres.

TAke of ſaltpeter one pound, gunpowder and brimſton of each halfe a pound; theſe muſt be mixed together, and of them make a paſte, with a ſufficient quantity of oile of peter, or elſe of fayre water; of this paſte you ſhall make little balles, and roll them in drie gunpowder duſt; then drie them, and keepe them for your occaſions.

Another.

Take a quarter of a pinte of *aqua vitæ*, and diſſolue therein one ounce, and a halfe of camphire, and dip therin cotten bumbaſt, and afterwards roule it up into little balles; afterwards rowle them in powder of quick brimſtone, and reſerue them for uſe.

Another receipt for Starres, whereof you may make fiends and divers apparitions according unto your fancie.

Take gum dragant, put it into an yron pan, and roſt it in the embers; then powder it, and diſſolve it afterwards in *aqua vitæ*, and it will become a jellie, then ſtraine it; diſſolve alſo camphire in other *aqua vitæ*. Mixe both theſe diſſolutions together, and ſprinkle therein this following powder.

Take ſaltpeter one pound, brimſtone halfe a pound, gunpowder three pound, charcoale halfe a pound; when you have mingled and ſtirred them well together, mixe them well with the aforeſayd jelly, and then make it into little balles, or into what faſhion elſe you pleaſe, then cool them in gunpowder duſt, and keepe them for uſe.

Compoſitions for receipts of fireworkes, that operate upon the earth.

FOr Rockets there needeth onely gunpowder finely beaten and ſearced.

Likewiſe for all the other ſorts, ſearced gunpowder will ſerue, which may be abated, or alayed with charcoal duſt at your pleaſure.

Compoſitions for fireworkes that burne upon, or in the water.

A Receipt for Rockets that burne upon the water.

TAke of ſaltpeter one pound, brimſtone halfe a pound, gunpowder halfe a pound, charcoales two ounces. This compoſition will make the Rockets appeare with a great fiery tayle. If you deſire to have it burne cleare, then take of ſaltpeter one pound, three ounces of gunnepowder, brimſtone halfe a pound.

A Receipt of a compoſition that will burne, and feed upon the water.

TAke maſticke halfe a pound, white Frankincenſe, gum ſandrake, quickelime, brimſtone, bitumen, camphire, and gunpowder, of each one pound and a halfe, roſin one pound, ſaltpeter fowre pounds and a halfe, mixe them all together.

A Receipt of a compoſition that will burne under water.

Take brimſtone one pound, gunpowder nine ounces, refined ſaltpeter one pound and a halfe, camphire beaten with Sulphur, and Quickſilver; mixe them well together with oyle of peter, or linſeed oyle boyled, untill it will ſcald a feather. Fill a canvas ball with this compoſition, arme it, and ballaſt it with lead at the bottome, make the vent at the top, fire it well and caſt it into the water, and it will fume and boyle up ſlowly.

A

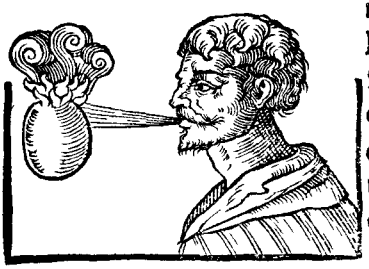
A Receipt of a Compoſition that will kindle with the water.

Take of oyle of Tile one pound, Linſeed oyle three pounds, oyle of the yelks of egges one pound, new quick lime eight pounds, brimſtone two pounds, camphire fowr ounces, bitumen two ounces; mingle all together.

Another.

Take of Roch peter one pound, flowre of brimſtone nine ounces, coales of rotten wood ſix ounces, camphire one ounce and a halfe, oyle of egges, and oyle of Tile enough to make the mixture into a paſte.

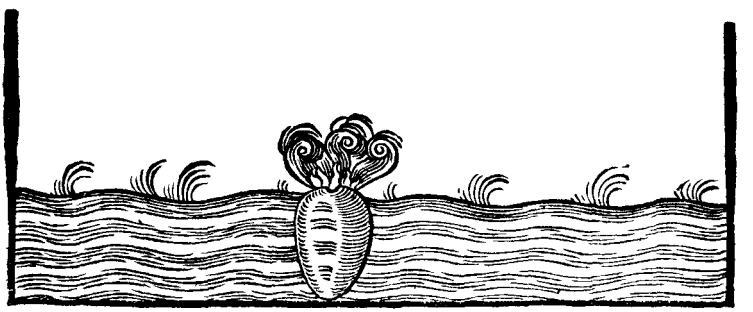
Or take callamita one pound, ſal niter and aſphaltum, of each fowre ounces, quicke brimſtone three ounces, liquid varniſh ſixe ounces; make them all into a paſte. Put eyther of theſe compoſitions into a pot wherein is quick lime, ſo that the lime come round about the paſt; then lute it faſt, binde it cloſe with wires, and ſet it in a limekill a whole baking time, and it will become a ſtone that any moyſture will kindle.



If you make a little hole in the top of an egge, and let out all the meat, and fill the ſhell with the following powder,

powder, and ſtop the hole with wax, and caſt it into a running water, it will break out into a fire.

Take of ſalt-niter, brimſtone, and quick lyme, of each a like quantity, mix them.



How to make ſtouple, or prepare cotten-week to prime your fire-works with.

Take cotten-week, ſuch as the Chandlers uſe for candles, double it ſix or ſeuen times double, and wet it throughly in ſaltpeter water, or aqua vitæ, wherein ſome camphire hath been diſſolued, or, for want of either, in faire water; cut it into diuers peeces, rowle it in mealed gunpowder, or powder and ſulphur; then dry them in the Sun, and reſerue them in a box where they may lie ſtraight, to prime Starres, Rockets, or any other fire-works.

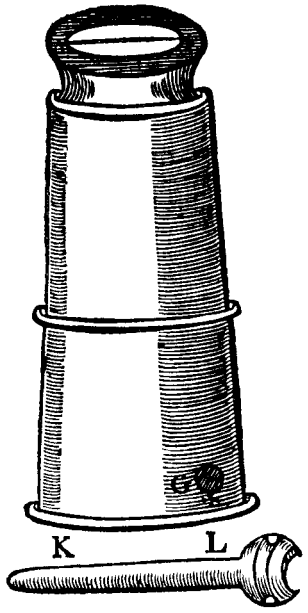
How to know the true time, that any quantity of fired Gun-match that ſhall doe an exployt at a time deſired.

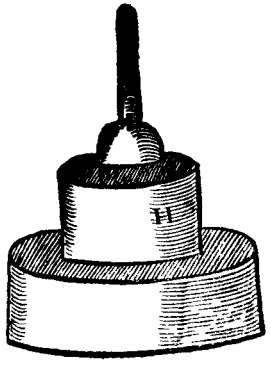
TAke common gun-match, rub, or beat the ſame a little againſt a poſt to ſoften it; then either dip the ſame in ſalt peter water, and drie it againe in the Sunne, or elſe rub it in a little powder and brimſtone beaten very ſmall, and made liquid with a little *aqua vitæ*, and dried afterwards; trie firſt how long one yard of match thus prepared will burne, which ſuppoſe to be a quarter of an howr, then fowre yards will be a iuſt howre. Take therefore as much of this match as will burne ſo long as you will haue it to be ere your worke ſhould fire, binde the one end unto your worke, lay looſe powder under, and about it lay the reſt of the match in hollow, or turning ſo that one part of it touch not another, and then fire it.

A Water called Aqua Ardens.

TAke old red wine, put it into a glaſed veſſell, and put into it of orpment one pound, quicke ſulphur halfe a pound, quicke lime a quarter of a pound; mingle them very well, and afterwards diſtill them in a roſewater ſtill: a cloth being wet in this water will burne like a candle, and will not be quenched with water.

The Formers are inſtruments wherewith the coffins for the fireworkes are made and formed, whereof in order; and firſt for Rockets that operate in the ayre. The Formers for Rockets conſiſt of two parts, repreſented by the two next figures following, the uppermoſt whereof repre-



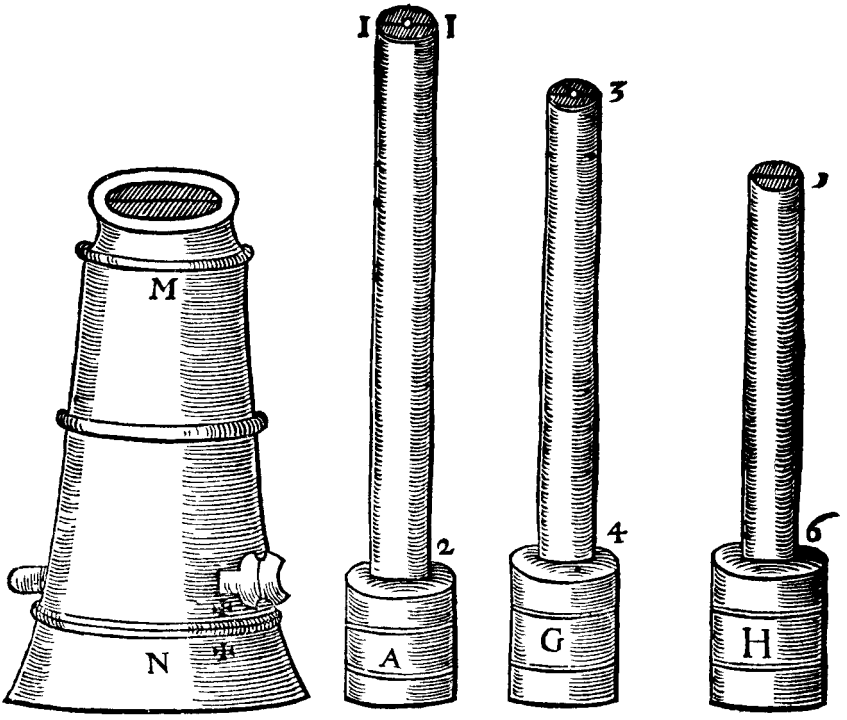


repreſenteth the body of the Former, which muſt bee made of Maple, Walnut tree, or of other cloſe & well ſeaſoned wood, ſeven inches, wanting halfe a quarter in length, turned equally, and exactly hollow quite through, the diameter of whoſe hollowneſſe, repreſented by the line at the top marked at each end with a, c, muſt bee one inch and a quarter; the breech of the former is repreſented by the loweſt figure, the upper part wherof, muſt be made to enter the body of the Former; the height of the whole breech, beſide the broach is 3 inches and a halfe; it entreth the body of the Former, one inch and three quarters; the top of it muſt be made like a halfe nutmeg, in the midſt whereof (as

Mr. *Malthus* and *des recreationes Mathematiques)* there muſt bee faſtned an yron broach two inches and a halfe long: then put the breech into the body, and pierce them both quite through as the figures doe repreſent at G and H; then make a pin as K, L, to pinne them both together, which muſt bee made to take out at pleaſure: then marke both the body and breech neere the ſaid hole with this * or any other marke, that you may thereby know how to fit them afterwards.

The

The next figure marked with M, N, doeth expreſſe both the parts of the Former pinned together; unto this Former there muſt be made one Rowler expreſſed by the figure A; alſo two rammers expreſſed by the figures G H; they muſt all of them be turned very even and ſmooth;

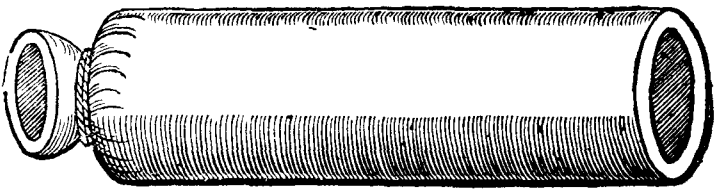


let the diameter of the thickneſſe of the rowler expreſſed by the line on the top marked I I, be three quarters of an inch, let it be eight inches long from I, to 2, and have a hole bored in the very midſt of the end, ſo wide and ſo

deep, that all the broach of the former may enter the ſame : this is to rowle the coffin of paper and upon. The firſt rammer noted with the figure G, muſt bee ſeuen inches and a halfe long, from 3 to 4, and haue a hole at the end of it, as the rowler had ; this rammer is to ram the compoſition into the former (hauing the coffin in it) untill it bee rayſed aboue the broach. The ſecond rammer noted with the figure H, muſt be fiue inches and three quarter long from 5 to *6*, and it muſt haue no hole at the top as the other had ; it ſerueth to ram the compoſition into the coffin, when it is once rayſed aboue the broach. The diameter of the thickneſſe of theſe two rammers muſt be a thought leſſe than the diameter of the rowler, to the end they may not hurt the coffin, being driuen in. Now to make the coffins you muſt take paper, parchment, or ſtrong canuaſſe, rowle it hard upon the rowler, ſo often untill it will go ſtiffe into the body of the Former : then thruſt it rowler and all through the ſayd hollow body of the Former ; put then the broach of the formers breech into the hole of the rowler, and with a peece of ſtrong packthred choake the coffin within halfe an inch of the rowlers end (which you may do beſt, and with moſt eaſe, if you firſt dip the end of the coffin into fayre water, ſo that it may be wet quite through) after you haue choaked the coffin, you muſt thruſt the breech of the former, the coffin alſo with the rowler in it, up into the body of the former : then pin the breech faſt to the body of the former with the pin, and on the rowler giue one ſtroak or two with a mallet lightly, then unpin the breech, and with the rowler thruſt the coffin out of the bottom of the former, lay it by untill the end be dry. Thus you may at leiſure times make diuers coffins ready

to

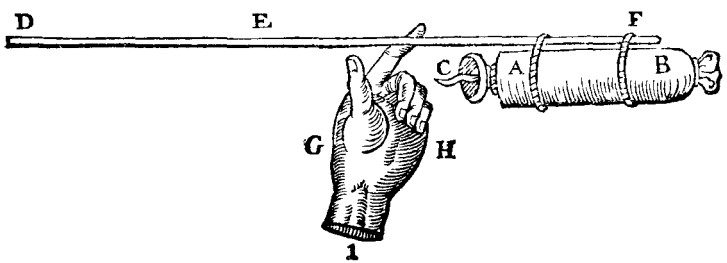
to uſe upon any occaſion. The following figure expreſſeth an empty coffin.



Take one of theſe coffins, put it into the Former, and take the compoſition for middle-ſized rockets (mentioned before) and put thereof ſpoonfull after ſpoonfull, untill you haue filled the coffin unto the top of the former, after the putting of euery ſecond ſpoonfull into the coffin, with a mallet giue two or three blowes upon the head of the rammer, that the compoſition may bee well rammed into the coffin : euery third or fourth driuing M. *Norton* wiſheth (if the rockets are to be fired in three or foure dayes) to dip the rammer in gum-dragant, and camphir diſſolued in ſpirit of wine, or good *aquavitæ*: but if it will bee a month before they will bee fired, then dip the rammer in oyle of peter, or liquid varniſh, and linſeed oyle mixed together : If you would haue the rocket to giue a report or blow, then within one diameter of the top, driue a bottom of leather, or ſix or eight double of paper, pierce and prime either of them through in three or foure places, and fill the reſt of the coffin with whole gunpowder; afterwards driue another bottom of leather, and then with ſtrong packthred choak the coffin cloſe unto it: then take the rocket out of the Former, and prime

it

it at the broach-hole with a peece of prepared ſtouple, and binde unto it a ſtraight rod 6 or 7 times the length of the rocket, and ſo heavy, that being put on your finger, it may ballaſt the rocket within two or three diameters of the ſame: mark the following figure, which repreſents a rocket ready made and finiſhed, A, B, the rocket, C, the ſtouple that primeth it, D, E, F, the rod bound unto the rocket with two ſtrings, G, H, I, the hand that poyſeth it.



How to make Serpents.

THe coffins for ſerpents are made of paper rowled nine or ten times upon a rowler not much thicker than a gooſe quill, and about foure inches long. The coffins muſt bee choaked almoſt in the midſt, but ſo that there may bee a little hole, through which one may ſee: the longeſt part of the coffins for Serpents muſt be filled with the compoſition ſpecified before: if you would haue it wamble in the ayre, then choak it not after the compoſition, but if you would haue it wamble, then halfe-choak it, as is demonſtrated by the following figure, the ſhorter end of the coffin muſt bee filled with whole gunpowder,

der, and choaked quite up, as appeareth at B, in the figure M, N, O, which is the figure of a Serpent ready made.

How to make rayning fire.

TAke diuers gooſe quils, and cut off the hollow ends of them, and fill them with the compoſition before mentioned, ſtopping them afterwards with a little wet gunpowder, that the dry compoſition may not fall out.

How to make ſtarres.

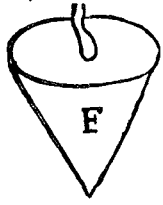
I Haue ſufficiently taught the making of theſe in deſcribing their compoſitions, wherefore I will now onely preſent the figures of them unto your view; A, A, ſignifieth two

that are bound up in paper or cloth, and peirced, and primed with ſtouple: the other two, E, E, ſignifie thoſe that are made up without paper, and need no priming more than the powder or ſulphur duſt that they are rowled in.

How to make Petards.

YOu muſt make the coffins for them either of white yron, or elſe of paper, or parchment rowled upon a

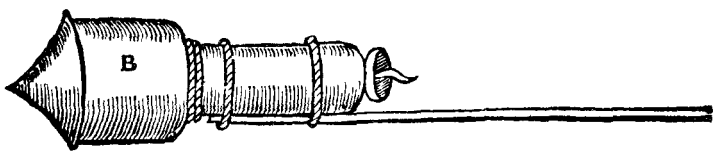
Former for the purpoſe, and afterwards fitted with a couer, which muſt be glewed on: theſe coffins muſt be filled with whole gunpowder, and peirced in the midſt of the broad end, and primed thereat with prepared ſtouple; the paper ones muſt be couered all ouer with glew, and the peirced. The figure of a Petard ready made, and primed, is ſignified by the figure E.



How to make compounded Rockets.

FIrſt you muſt make the Rocket I taught you before; you muſt not choake the end of it, but eyther double downe halfe the coffin, and with the rammer and a maller, give it one or two good blowes: then with a bodkin pierce the paper unto the compoſition, or elſe drive a bottome of leather fitted unto the bore of the Rocket, and pierce it through in two or three places; then pare or cut off the coffin equall thereunto; to this end of the rocket you muſt binde a coffin wider a great deale then the Rocket is; ſtrew into it a little gunpowder duſt, that it may cover the bottome of this coffin, and put therein with their mouthes downeward eyther golden rayne, or ſerpents, or both; alſo ſtarres, or petards; you muſt put ſome gunpowder duſt among theſe; when you have filled the coffin with theſe or ſuch like, cover the top of it with a peece of paper, and paſte upon that a picked crowned paper,

paper, balaſt it with a rod, and it is finiſhed; the figure followeth.

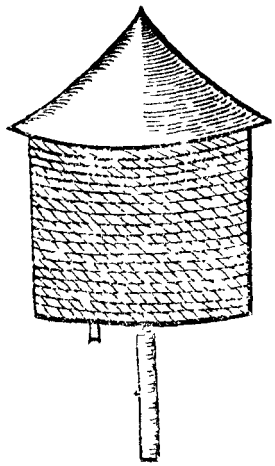


How to make fiends, or fearefull apparitions.

THeſe muſt bee made of the compoſitions for Starres, wrought upon cotton weeke dipped in *aqua vitæ*, wherein camphire hath beene diſſolved, and after what faſhions your fancy doth moſt affect.

How to make fire Boxes.

YOu muſt make the coffins for fire Boxes of paſte-board, rowled upon a Former, of what bigneſſe you liſt; then binde them about with packthread, and glew over the cords; alſo glew bottoms unto them, which muſt be pierced with a bodkin to prime them at. In theſe bo-

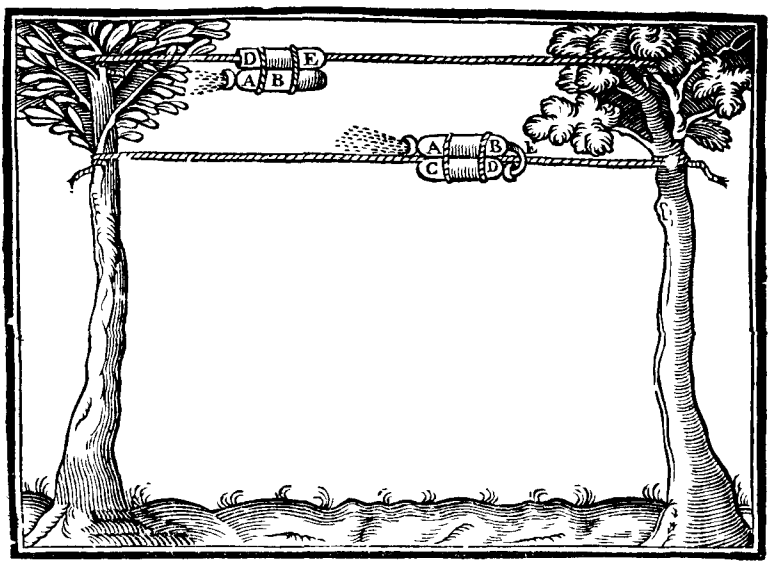


xes you may put golden rayne, ſtarres, ſerpents, petrars, fiends, devils. The tops of theſe fire boxes muſt bee covered with paper as the compound Rockets. Note that you muſt ſtrew gunpowder duſt a pretty thickneſſe on the bottome of the fire-boxes, and prime the hole at the bottome with prepared ſtouple.

How to make Swevels.

SWevels are nothing elſe but Rockets, having inſtead of a rod (to ballaſt them) a little cane bound faſt unto them, where through the rope paſſeth. Note that you muſt be carefull to have your line ſtrong, even & ſmooth, and it muſt be rubd over with ſope that it may not burn. If you would have your Rockets to returne againe, then binde two Rockets together, with the breech of one towards the mouth of the other, and let the ſtouple that primeth the one, enter the breech of the other; both kinds are expreſſed by the figures, the uppermoſt whereof repreſenteth the ſingle one; A B ſignifieth the Rocket; D E, the cane bound unto it, through which a rope paſſeth. The lowermoſt repreſenteth the double Rocket; A B ſignifieth

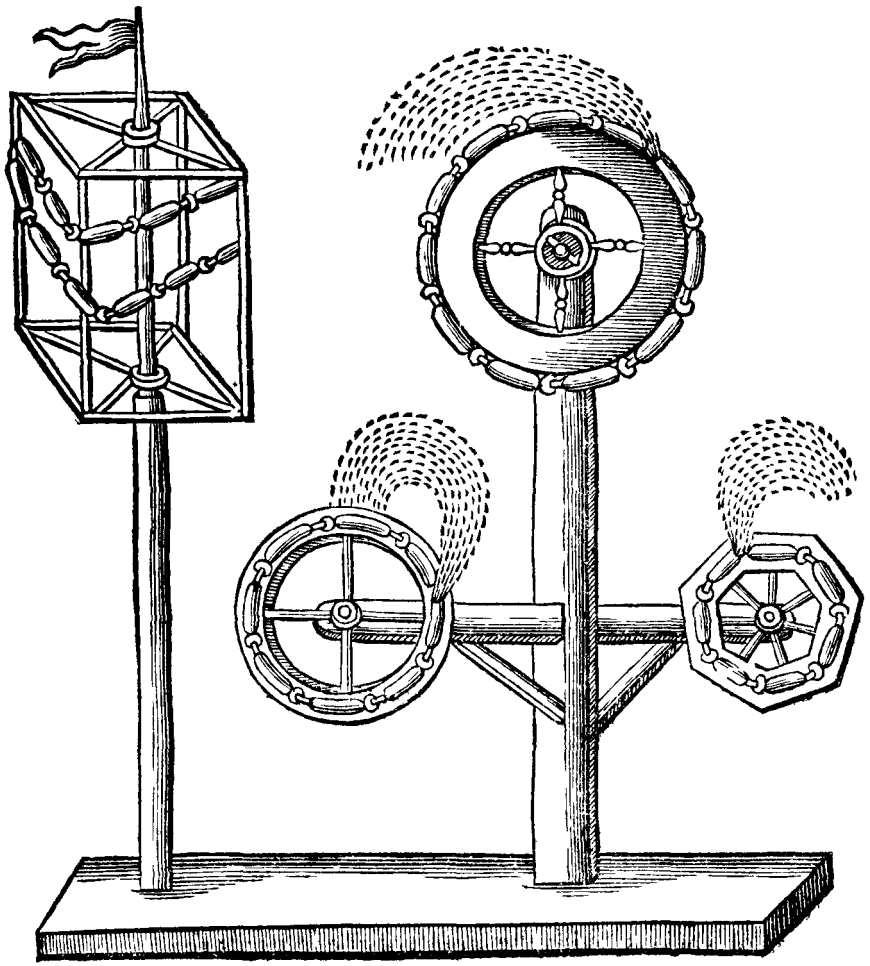
ſignifieth one Rocket, and C D another; E the ſtouple that primeth the one, and entreth the breech of the other;



the cane that the rope paſſeth thorough, is ſuppoſed to be behinde the two Rockets.

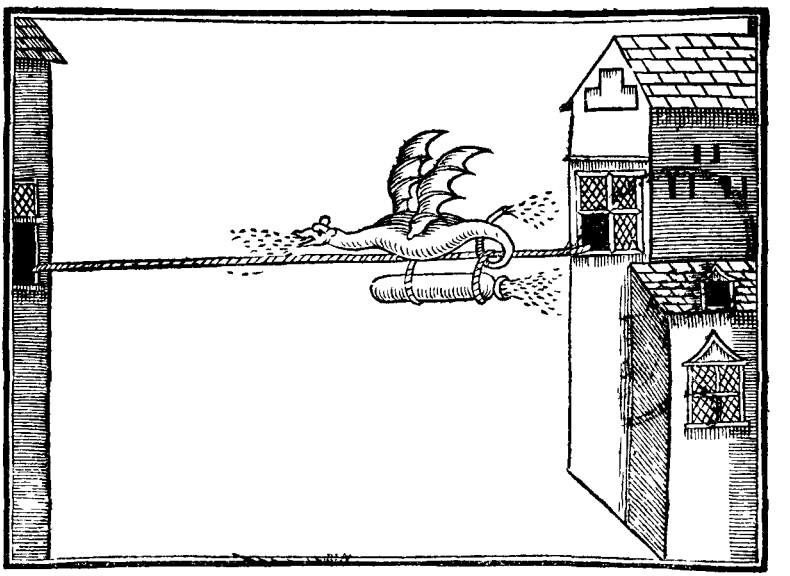
How to make Gironells, or fire wheeles.

THe making of fire wheeles conſiſteth onely in the placing of Rockets, with the mouth of one towards the tayle of another, round about certaine moveable wheels; wherefore I thinke it ſufficient only to deſcribe the diverſity of their faſhions which follow.



How to make flying Dragons.

THe flying Dragon is ſomewhat troubleſome to compoſe; it muſt be made eyther of dry and light wood, or crooked-lane plates, or of thin whalebones covered with Muſcovie glaſſe, and painted over. In the body thereof, there muſt bee a voyde cane to paſſe the rope through; unto the bottome of this cane muſt bee bound one or two large Rockets, according as the bigneſſe and

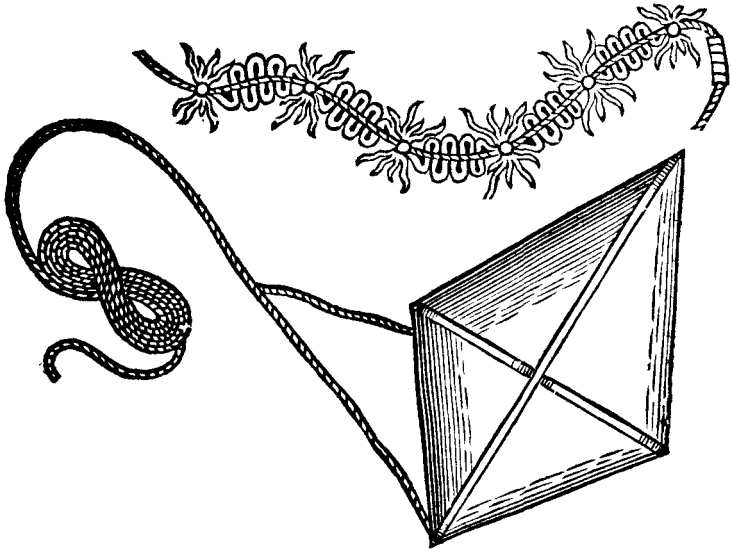


weight of the Dragon ſhall require; the body muſt bee filled with divers petrats, that may conſume it, and a ſparkling receipt muſt be ſo diſpoſed upon it, that being fired, it may burne both at the mouth and at the tayle thereof;

thereof; then hang the wings on in ſuch wiſe, that they may ſhake as the Dragon runnes along the line; you may diſpoſe divers ſmall ſerpents in the wings; marke the figure.

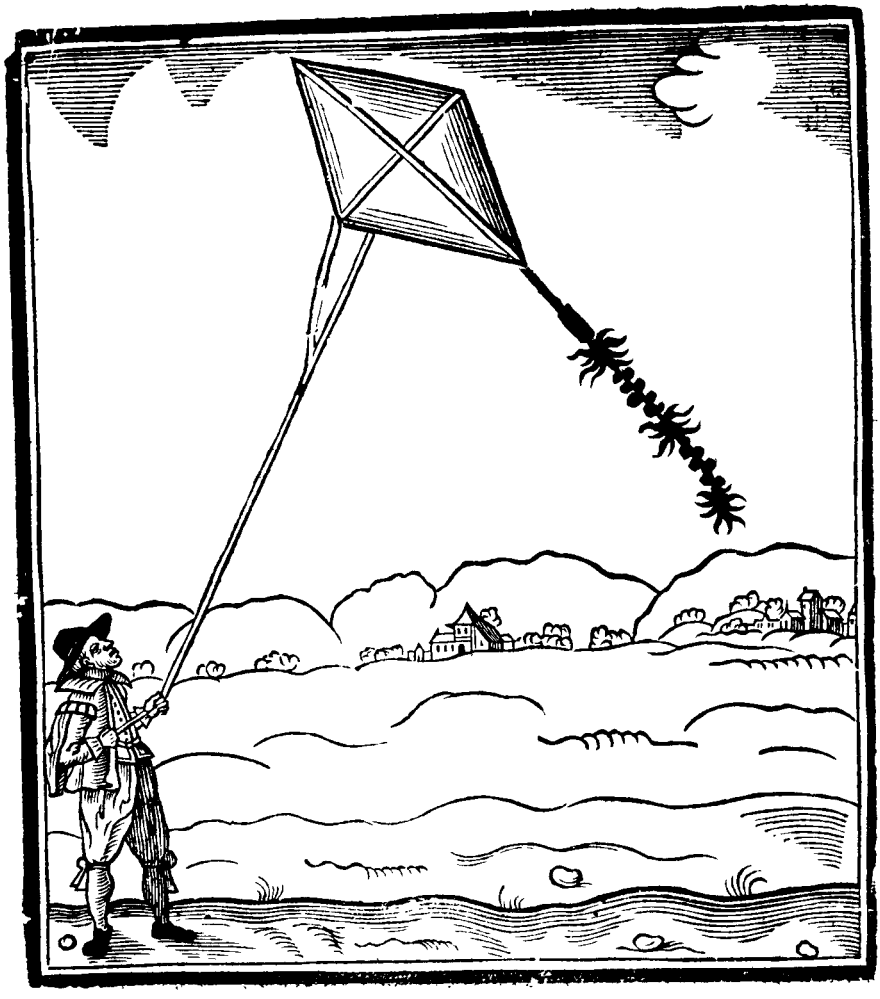
How to make fire Drakes.

YOu muſt take a peece of linnen cloth of a yard or more in length; it muſt bee cut after the forme of a pane of glaſſe; faſten two light ſtickes croſſe the ſame, to



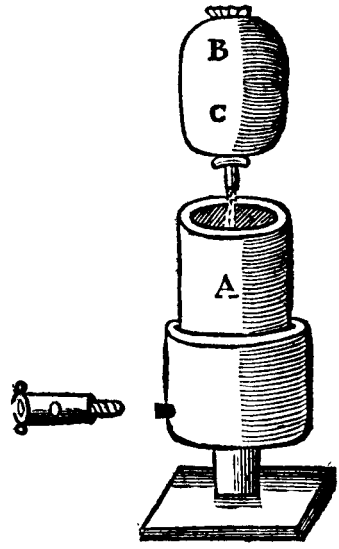
make it ſtand at breadth; then ſmeare it over with linſeed oyle, and liquid varniſh tempered together, or elſe wet it with oyle of peter, and unto the longeſt corner faſten a match

match prepared with ſaltpeter water (as I have taught before) upon which you may faſten divers crackers, or Sauciſſons; betwixt every of which, binde a knot of paper ſhavings, which will make it flie the better; within a quarter of a yard of the cloth, let there bee bound a peece of prepared ſtoupell, the one end whereof, let touch the cloth, and the other enter into the end of a Sauciſſon: then tie a ſmall rope of length ſufficient to rayſe it unto what height you ſhall deſire, and to guide it withall: then fire the match, and rayſe it againſt the winde in an open field; and as the match burneth, it will fire the crackers, and ſauciſſons, which will give divers blowes in the ayre; and when the fire is once come unto the ſtoupell, that will fire the cloth, which will ſhew very ſtrangely and fearefully.



How to make Balloones, alſo the morter Peece to diſcharge them.

THe diameter of the hollowneſſe of the morter Peece muſt be one foot, the longer it is the further it will carry: Let the diameter of the hollowneſſe of the ſacke be the third part of a foot, and halfe a foot deepe: it muſt have a ſquare foot, and a portfire to ſtrew into the bot-



tome of the ſacke on the ſide of it; this portfire is to be made like a cane about three inches long, and have a bottome ſodered unto the inſide of the ſcrew, which bottome muſt be pierced with a ſmall touch-hole. This morter peece may be made of yron, red copper, or for a neede

with paſtbord, armed with cord, and glewed ouer, but the ſack, and foot of it muſt bee made of wood, and the paſtbord morter muſt bee nayled faſt upon it. A Balloone muſt be made of canuaſſe rowlede ght or nine times upon a Former, it muſt bee made ſo, that it will eaſily go into the morter peece ; into this Balloone you may put Rockets, Serpents, Starres, Fiends, Petards, and one or two Sauciſſons to breake the Balloone ; then choak it up with cord, and prime it with a little cane rammed full of a ſlow compoſition ; fill the ſtock of the morter peece full of whole gunpowder, then ſcrew on the portfire, O, then put the Balloone down to the bottom of the morter with the cane that primeth it, downward into the ſtock ; then with tallow or greaſe ſtop the chinks between the Balloone and the morter, and it is ready to bee diſcharged, which you may do by putting fire to the portfire, and while that burneth, retreat out of harmes way.

A, the figure of the morterpeece with its portfire. O, B, C, a Balloone ready made. D, an empty coffin for a Balloone.

Of Fire-works for the earth.

How to make Rockets for the earth.

THe moulds for theſe Rockets for the earth are not made like thoſe for the ayre, becauſe that it is required that theſe ſhould laſt longer, and haue a more gentle motion : obſerue therefore the following directions for the making of them, which may ſerue for all occaſions, without any alteration for bigger or leſſer. Let the diameter

meter of their hollowneſſe bee halfe an inch, let their hollowneſſe be five or ſix inches long, let the rowler for to rowle the coffins on, bee the third part of an inch thick, and let the rammer to charge it bee a thought leſſe, let the breech bee three quarters of an inch long, and let the breech enter halfe an inch into the mould, then fill it with the compoſition proper for it, obſeruing thoſe rules in the ramming it, as you did in ramming rockets for the ayre; when you haue filled it within an inch of the top of the mould, double down a quarter of the coffin, beating it with three or foure ſtrokes of the mallet; then with a bodkin peirce it in two or three places, and then put in the quantity of a piſtoll charge of whole gunpowder, then double down the halfe of the coffin, giuing it a gentle blow or two with the mallet, and with a ſtrong packthred choak the reſt of the coffin, and what remaineth after the coffin is choaked, cut it of, and it is made.

How to make Crackers.

IT is well known, that euery boy can make theſe, therefore I think it will be but labour loſt, to beſtow time to deſcribe their making: only thus much, if you would make a Cracker to giue forty, fifty, a hundred, or two hundred blowes, one after another, then binde ſo many Crackers upon a ſtick, ſo that the end of the one may ioyne to the mouth of the other.

How to make Trunkes.

THeſe you may make of paſte-board, paper, or wood, and of what bigneſſe and length you pleaſe, and ram

them full of the compoſition of Rockets for the earth; if you would have them to change colour, then alter the compoſition that is, put in two or three ſpoonfulls of the compoſition of Rockets for the water, and ramme that in, then put in two or three ſpoonfulls of the compoſition of Rockets for the ayre, and ramme that in, then put in two or three ſpoonfulls of gunpowder duſt, and ramme that in, doe ſo till you have quite filled it then tie a bottome of leather upon it, and pierce it and prime it with ſtoupell; after the ſame manner may you make lanternes and lights.

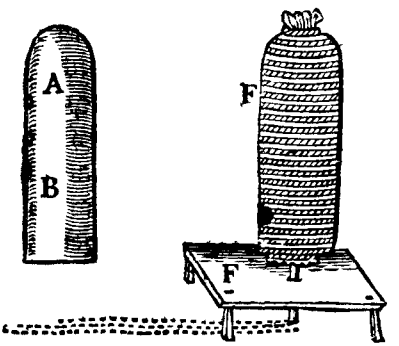
How to make tumbling balls.

MAke a ball of canvas, and faſten in it a double Rocket for the earth; you may ſtuffe the reſt of the ball with a ſlow compoſition of two parts charcoale duſt, and one part of gunpowder duſt, mingled together, and put divers petrards amongſt it.

How to make Sauciſſons.

SAuciſſons are of two ſorts, eyther to be placed upon a frame, or ſuch like, and ſo to bee diſcharged with a trayne of gunpowder, or elſe to bee diſcharged out of the morter-peece. The ſtanding Sauciſſon is thus made; you muſt roll paper or canvas, nine or ten times upon a roller as A, B, and choake the one end of it: fill it then with whole

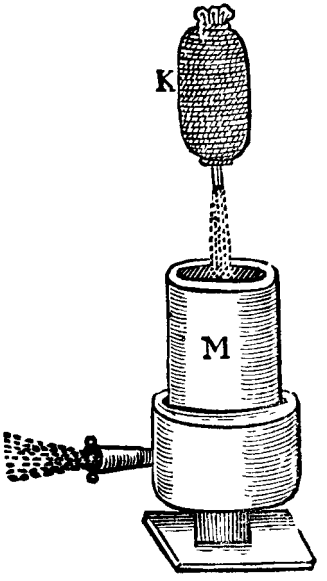
whole gunpowder, and then choake the other end alſo, then cover all the Sauciſſon with cord, and glew it over; then pierce one end of it, and prime it with a quill filled



with gunpowder duſt; place it upon a forme having a a hole for the quill to paſſe thorough; then fire it by a traine of gunpowder layd under the frame, it will give a report like a canon: marke the figure F F.

Hou

How to make the flying Sauciſſon to be delivered out of the morter peece.

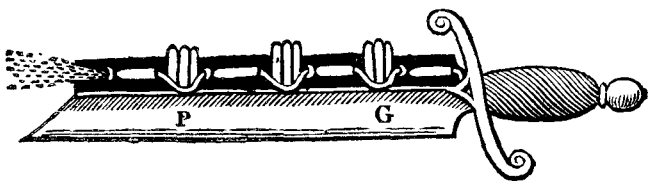


MAke a coffin for this, as you did for the former; firſt, fill it almoſt with whole gunpowder, then put upon that gunpowder duſt, which you muſt ramme hard into the coffin, ſo that it may bee one finger thicke; then choake it cloſe, and arme, and prime it as you did the former. It is repreſented by the figure, K M.

How to make a fire ſword.

YOu muſt make a ſword of woode, having a deepe channell in the backe of it, wherein place firſt a Rocket for the ground; then two or three ſerpents upright; (with their mouthes inward) let the ſtoupell that primeth the

the Rocket come under the mouth of the ſerpents, ſo that being kindled, it may ſet them on fire, and enter the breech of the next rocket, ſo fill the channell quite full



with rockets and ſerpents, binde the rockets faſt into the channell, but the ſerpents muſt be placed ſo, that being once fired, they may fly out of the channell, and it is made: mark the figure G, P.

The deſcription and making of three ſorts of Fire-lances.

TO make the firſt Fire-lance, whoſe figure is noted A, you muſt make a hollow trunk of what length or bigneſſe you pleaſe, either of wood, paper, or paſtbord rowled on a rowler, and armed with ſome cord and glew: firſt put into the bottom of whole gunpowder about one or two fingers thick; then ram upon it a paſtebord peirced with a little hole in the middle, hauing a quill faſtned in it, which quill muſt be filled with a ſlow compoſition, or elſe with gunpowder duſt: this quill muſt ſtand up in the lance two or three inches; then fill the coffin up to the top of the ſaid quill with ſtarres, and ſtrew among the ſtarres ſome gunpowder duſt, then put paſtebord ouer them, having a hole for the quill faſtned in the former bottom of paſtebord to paſſe; then upon this paſtebord

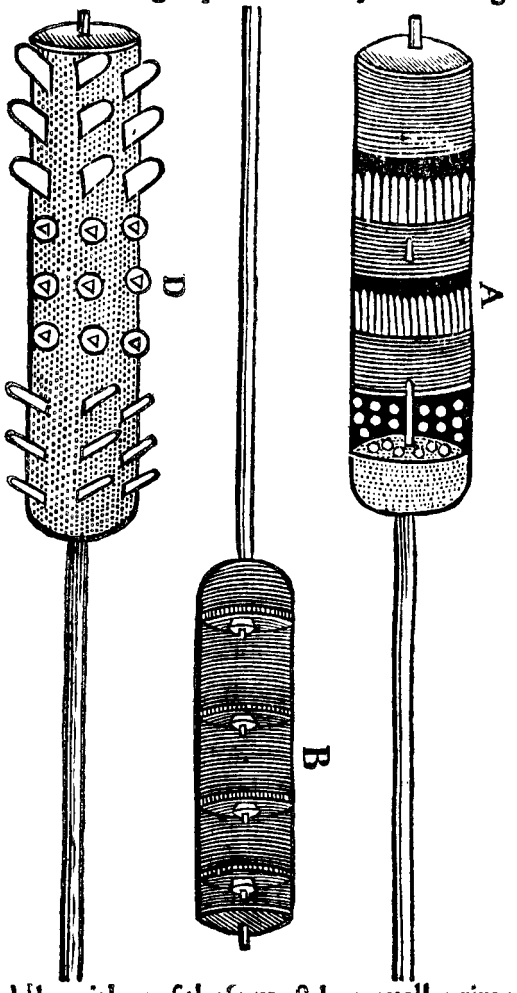
ram gunpowder duſt one or two fingers thick, then put a row of ſerpents in, and in the midſt of the ſerpents put a cane open at both ends, and filled with gunpowder duſt, this cane muſt be ſomewhat longer than the ſerpents, and it muſt paſſe through a paſtebord, which muſt bee put ouer: then put ſome more gunpowder duſt, and ram it in upon it, and upon that put another row of ſerpents, with a cane in the midſt of them filled with a ſlow compoſition, and upon them put gunpowder duſt, or elſe a ſlow compoſition, ramming it in till the lance bee full; then put a paſtebord upon it, and in the midſt of the paſtebord put a little cane filled with a ſlow compoſition, then faſten it upon a ſtaffe of what length you will, and it is made.

To make the ſecond Fire-lance, you muſt prepare a trunk like unto the former, firſt ram in the bottom of it ſome of the compoſition of rockets for the earth about two fingers thick, then put a paſtebord upon it, having a petard faſtned in the middeſt; this paſtebord muſt bee pierced in three or foure places, round about the petard, that thereby the powder that is rammed ouer the paſtebord may take fire: then ram in ſome more compoſition upon the petard, about two or three fingers thick, then another petard, then more compoſition, ſo doing untill you have filled the trunk: then faſten it upon a ſtaffe, and and prime it as you did the former, it is repreſented by the figure noted B.

To make the third Fire-lance you muſt haue a trunk alſo, which muſt bee rammed full of a ſlow compoſition, of two parts charcoale duſt, and one part gunpowder duſt well mixed, prime it as the former, then bore divers holes round about it, from the top to the bottom, into e-

very

very of which holes glew a ſauciſſon, or a ſerpent, or a little ball filled with gunpowder duſt, and having a petard



in the middle: either of theſe muſt bee well primed, and their primed ends muſt be towards the inſide of the lance,

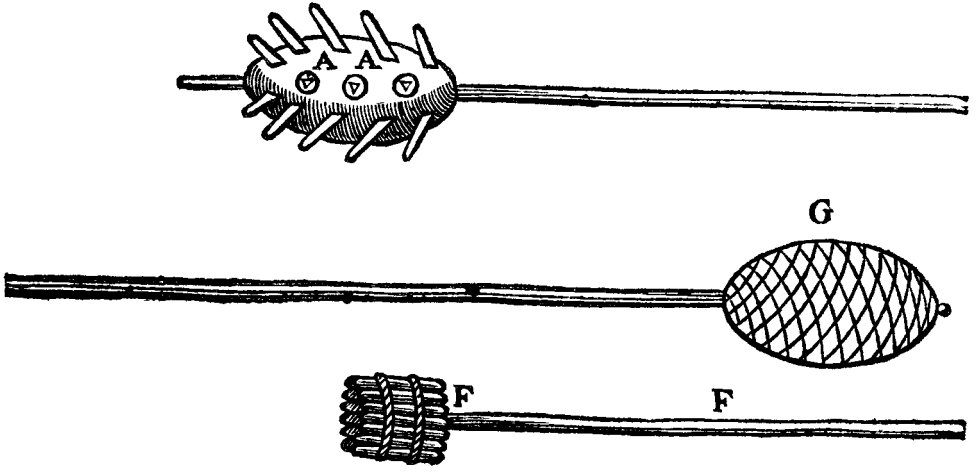
ſo that as the lance burneth downward, it may orderly give fire unto the ſauciſſons, bals, and ſerpents : the figure D repreſenteth a lance having three rowes of ſerpents, three rowes of bals, and three rowes of ſauciſſons, faſtned round about it.

The deſcription and making of two ſorts of Fire-clubs.

TO make the firſt you muſt make an ovall ball of paſte-bord, canvaſſe, or parchment glewed together, which you muſt firſt fill with a ſlow compoſition, ram it in, and then bore divers holes round about it, and put therein ſerpents, fire bals, or what you will : faſten it upon a ſtaffe, and prime it in the top with a cane filled with a ſlow compoſition: this is repreſented by the figure A, A.

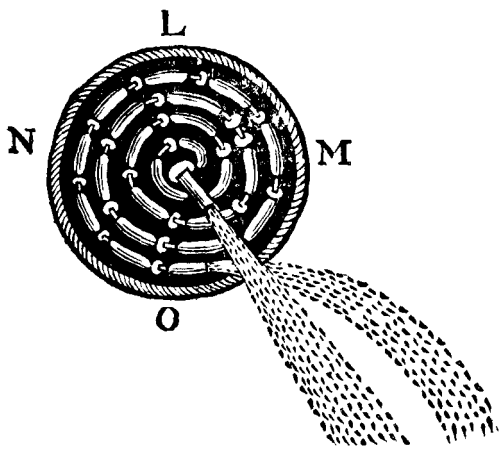
To make the ſecond you muſt fill divers canes open at both ends (and of a foot long, or more, or leſſe, as you think fit) with a ſlow compoſition, and binde them upon a ſtaffe of foure or five foot long ; prime them ſo that one being ended, another may begin : you may prime them with a ſtouple or match (prepared as before) make an oſier basket about it with a hole in the very top to fire it by, and it is done.

The figure F, F, repreſenteth the ſtaffe, with the canes bound upon it. The figure marked G, repreſenteth the ſtaffe having a basket wrought over it.


A
A
G
F
F

How to make a Fire-target.

MAke a Target of oſier twigs, or elſe of light wood, & binde upon it divers canes filled with a very ſlow compoſition: the canes muſt bee open at both ends, and primed with ſtouple, that one may give fire unto ano-



ther: in the midſt of all you may ſet up a large cane alſo, if you pleaſe, which you may fill with the ſame compoſition as you did the others. Mark the figure L, M, N, O.

Of Fire-works for the water.

How to make Rockets for the water.

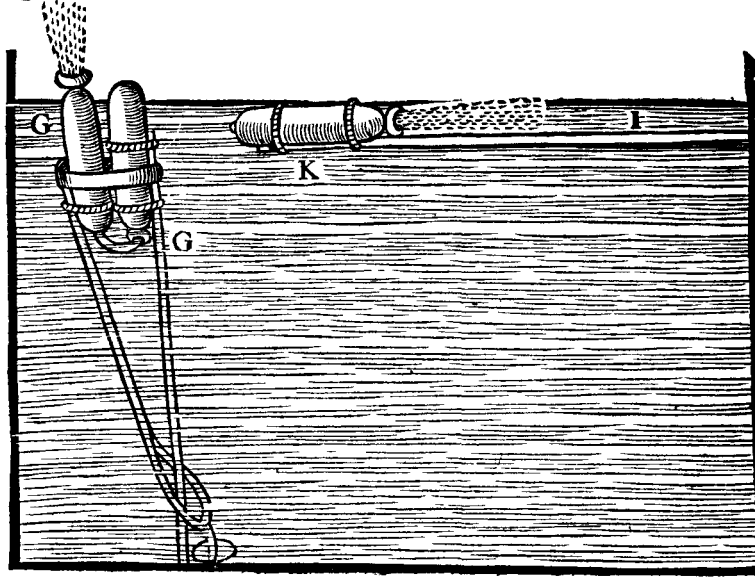
THe diameter of hollowneſſe of the mould for Rockets that ſwim on the water, muſt be one inch, and eight inches

inches long : let the breech enter into the body of the Rocket one inch, and it muſt have no broach at all in it. Let the diameter of the thickneſſe of the rowler bee three quarters of an inch, the rammer muſt be a thought leſſer; then ram it full of the compoſition of Rockets for the water; joyne to the upper end of it a Sauciſſon: then couer it all over with melted pitch, roſin, wax, or tallow, to the end that the water may not ſpoyle the coffins; and to make it float along the water, binde a rod about two foot long, as you did unto the rockets for the ayre: now if you would have the rocket to change his actions, (that is, to ſwim one while above the the water, and one while under the water) then put into it in the filling, one ſpoonfull of compoſition, and ram that in; then one ſpoonfull of whole powder, and ram that in; and then another of compoſition, and after that another of whole gunpowder, ſo do untill you have filled it quite. If you would have it change colour, then ſhift the compoſition divers times, (that is, put in one ſpoonfull of the compoſition of rockets for the water, then another ſpoonfull of the compoſition of rockets for the ayre, or rochpeter and gunpowder mixed) untill you have filled it.

How to make a Rocket that ſhall burne a good while in the water, and then mount up into the ayre.

FIrſt you ſhall make a rocket for the water, and binde unto the lower end a ſtick about two ſoot and a halfe long, having a large hole in the end thereof: then tie unto it (but loofly, ſo that it may eaſily ſlip out) a rocket for the

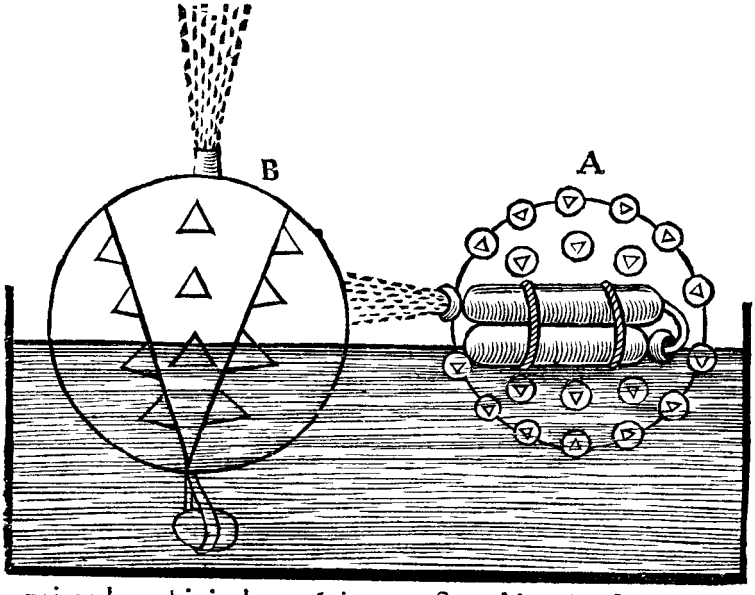
the ayre, and let the ſtouple that primeth for the rocket for the ayre, enter into the breech of the water rocket, then let the end of the rod of the rocket for the ayre enter into the hole of the rod of the rocket for the water : beſmeare then both the rockets with tallow, greaſe, or wax, or any oyle colour that the water may not ſpoyle the coffins of the rockets; then hang a ſtone at the bottom of the ſtick that hath the hole in it, to make it ſink down into the water; then fire the water rocket, and caſt them into the water; the fired rocket will burne in the water, and being conſumed, will giue fire unto the other rocket, which being looſly tyed, will ſlip the bond, and mount up into the ayre. This is repreſented by the figure G, G. The floating rocket mentioned before, is expreſſed by the figure noted I, K.



The

The deſcription and making of two ſorts of fire bals for the water.

FOr to make the firſt, you muſt make a ball of Canvas, about the bigneſſe of a Foot-ball, or bigger if you pleaſe, and faſten in it a double Rocket for the water: if you will, alſo you may ſtuffe the reſt of the ball with the compoſition that will burne under the water, and cut holes in the ſides, and therein faſten other bals, and petrards in them: then cover the ball over with Tallow, Pitch, or painting, except the place where the Rocket is

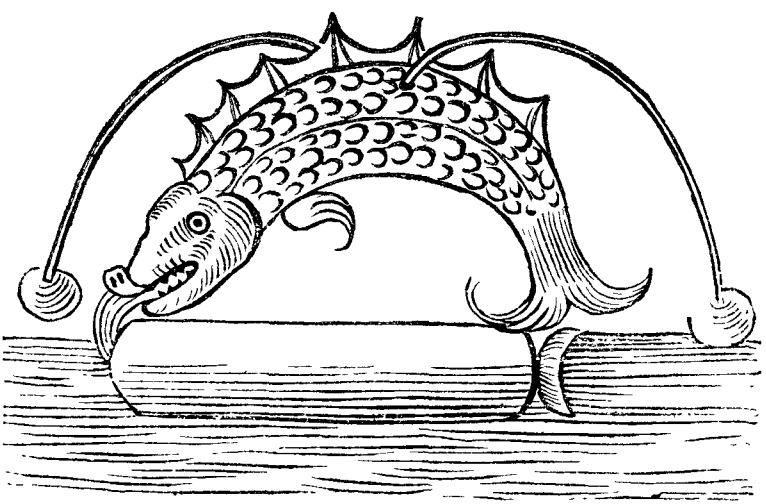


primed, and it is done. It is repreſented by the figure noted with A, and it will tumble up and downe in the water.

To make the ſecond fire-ball, you muſt firſt make a ball of Canvas, Paſteboard, or ſuch like, and cut a wide hole in the top of it, and place in it a channell of Tinne pierced in divers places: fill the channell with the compoſitions of Rockets for the water; againſt every hole thereof, place a petrard: cover it with a cover, pitch it over, and prime it, then ballaſt it with leade, or a ſtone, that the vent may burne upwards, and it is done. It is repreſented by the figure K

How to make a Dolphin.

YOu muſt make the body of it of Paſteboard glued together, fill the body with the compoſition of Rockets



for the water, pierce it in the back with divers little holes, wherein

wherein put Serpents, beſmeare the body all ouer with the following pap: Take gunpowder duſt, foure ounces, camphire, and ſulphur, or brimſtone in powder, of each one ounce, make them into a ſoft pap with oyle of tiles, then binde unto it a large Rocket for the water, which Rocket muſt be armed (as afore) that the water may not hurt it: then ballaſt it with a wyre, hauing at each end a piece of lead of weight ſufficient, and it is done. Marke the figure.

I might haue beene infinite in the deſcribing of ſuch like with Ships, Towres, Caſtles, Piramides. But conſidering that it would but increaſe the price of the booke, and not better your underſtanding: ſince all conſiſt of the former workes, which are ſo plainely deſcribed, as that the moſt ignorant may eaſily conceiue thereof, and (if any whit ingenious) thence contriue others, of what faſhion they liſt.

FINIS.