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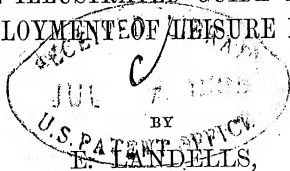




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# THE BOY'S OWN TOY-MAKER:

A PRACTICAL ILLUSTRATED GUIDE TO THE USEFUL  
EMPLOYMENT OF LEISURE HOURS.



AUTHOR OF "HOME PASTIME; OR, THE CHILD'S OWN TOY-MAKER,"  
"THE GIRL'S OWN TOY-MAKER," ETC.

EIGHTEENTH THOUSAND, REVISED AND ENLARGED.

WITH UPWARDS OF TWO HUNDRED ENGRAVINGS.



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GRIFFITH AND FARRAN,  
SUCCESSORS TO NEWBERRY AND HARRIS,  
CORNER OF ST. PAUL'S CHURCHYARD, LONDON.  
E. P. DUTTON & CO., NEW YORK.

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## PREFACE.

THIS is a boy's book in which the author has tried with his pen and pencil, to teach some useful things for the pleasant time of play hours. It is a plain book, which he hopes will be easily understood by any boy old enough to be trusted with such common tools as a penknife or a pair of scissors, and still be equally suited for the pastime of those who, of riper age, aspire to manlier amusement.

It is commonly supposed that the trade of the toy-maker is a frivolous pursuit that has no right to be classed in the useful labours of life; and grave men have shaken their heads at the poor toy-maker, not because he often and justly may be blamed for a great deal of childish work, but by reason that his labours can only end in the amusement of children. The author thinks differently, and would even venture to hint, that if the maker of toys would follow the good example of those for whom he makes them, and go to school to learn, his trade would stand higher amongst the useful and dignified callings, and he himself might perhaps in time be joined as a helper to the schoolmaster. He will become less frivolous the more that grave men look kindly on the labours that

endeavour to unite instruction with the amusements of the juvenile circle. Ours is an attempt in this direction, and not an aimless one at book-making.

Many of our young friends have no doubt heard their parents join in the lament that has been made by some clever men on the general want of knowledge of "common things." Grown men who could talk with Virgil or Homer in their own tongues, are ignorant of many things of every-day life, which very little children are now taught in play and learn with scarcely an effort. It must not be imagined that we think lightly of the graver labours of the school hours when boys come to learn Greek and Latin, and the other branches of knowledge so necessary to fit them to take a place in society as educated men; we would only illustrate the aim of this little book as a teacher for the play hours by putting a question: Who would be the more useful person of two cast on Robinson Crusoe's desert island—the man who could only speak Greek and Latin, or the boy who, in hour of need, would erect a little hut or even construct a boat from the lessons learnt in play hours?

The boyish days of many of the great men who have enlightened the world by their discoveries and inventions have been remarkable for the practical bias their minds have taken. James Watt when a boy first discerned the power of steam by watching the

spout of a common tea-kettle. The great Sir Isaac Newton was the first to introduce the paper kite, when a little school-boy at Grantham. George Stephenson, who in our own day has done such great things for human progress, was in boyhood always making lilliputian mills and clay engines in a small stream that ran by his father's cottage. Whoever would be a great inventor to the benefit of humanity, must begin to learn common things in very early life; for so vast is the accumulation of knowledge, heaped up by ages, and the inventive industry of mankind, that if the task of learning be deferred until the business of life, with its thousand cares and distractions, begins, knowledge cannot ripen enough even when a long one ends for the harvest of that one ambition which youth and men may own without reproach—to be great in usefulness in their generation, to their country, and to their kind.

All children in a degree love to construct, and this surely points to a most practical means of conveying instruction when you provide amusement. The boy engaged in making a toy-house becomes half an architect in the knowledge acquired of the names and uses of forms and materials which, without a model, he could hardly comprehend. He who forms a tiny boat or cutter, and rigs it himself, acquires a familiarity with every rope and spar that belongs to the vessel;

he acquires information which, without going so far as the island desert, may any day of life be of valuable service to him who inhabits an island home. Knowledge is power; the more practical it is the more powerful will it be for our good and for that of our fellow-beings, and it is hoped that our young readers will have reason to remember with a kindly regard among the thousand common circumstances of life, the instruction imparted in these pages.

---

## PREFACE TO SECOND EDITION.

THE favourable manner in which this little work has been noticed by the Press, and the patronage it has already received from the Public, has been so great as to call for a second edition within two months of the first publication. The Author cannot but feel flattered that his efforts to amuse the rising generation, whilst conveying sound practical information in an easy and pleasing manner, has been crowned with complete success. Having carefully revised the present edition, it is now confidently submitted to the world; the Publishers feeling assured that it will continue to receive the patronage and support of both parents and children.

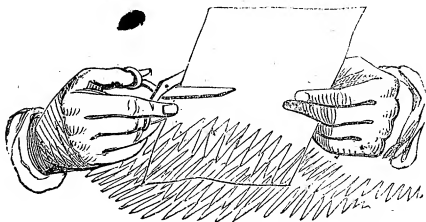
## PREFACE TO THE TENTH EDITION.

TAKING advantage of the opportunity afforded by the preparation of a new edition, the whole book has been subjected to further careful revision, the article on Golfing has been corrected, and a glossary of the technical terms used in the game is now given for the first time. The papers on Angling and Boats have been revised and practically re-written by Mr. J. Harrington Keene, the author of "The Practical Fisherman," and Mr. Jas. E. Walton, the author of "Model Yachts," respectively; and in order to provide somewhat more instructive amusement for leisure hours, an article on Scientific Toys, by Mr. Thomas Dunman, has been added.

*August, 1881.*

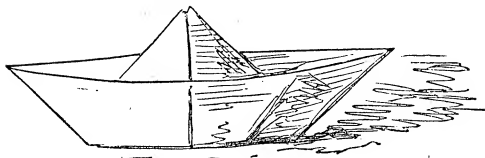
THE  
BOY'S OWN TOY-MAKER.

Paper Toys.



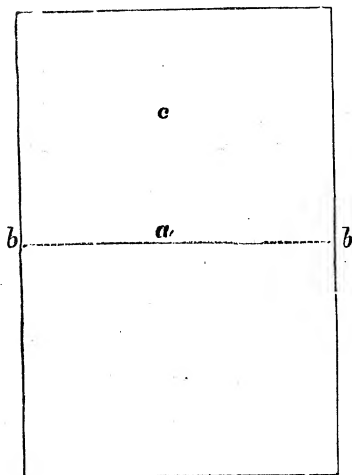
AN endless source of amusement may be obtained by the use of the common scissors and a piece of paper. Forms of every variety can be cut out in this way; figures, animals, birds, trees, and other objects can be imitated, so that with a little practice the eye becomes familiar with the shape of each, and, as it is very quickly done, it is little or no tax on the patience of the juvenile operator. It has also the advantage of being inexpensive, as the materials cost little or nothing; old newspapers or any waste pieces of paper will do to practice upon, and toys can be made in great variety for the amusement of your young friends in the long winter evenings.

## PAPER BOAT. No. 1.



CUT a piece of white writing paper, but not of

FIG. 1.



too stiff a quality, six inches by four (fig. 1); fold it to the dotted line *a*, making exactly one half when folded to *c*; then the corners *b b* are to meet in the centre (fig. 2); turn down the two sides *d*, forming the dotted lines *e*, take the two sides between each finger and thumb, in the left hand, and with the right pull it



FIG. 2.

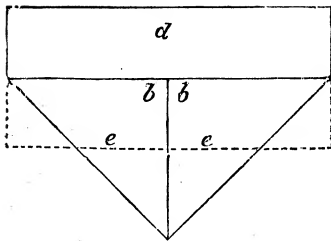
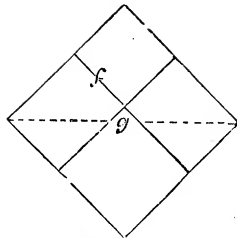


FIG. 3.



out until it forms fig. 3, taking care to turn over the corners at dotted line *e*; turn down the two top lines to dotted line *g*, pull out the sides again, as before, to make fig. 4; *a a* being pulled out as before described, taking care not to press the inside, it will form the boat, fig. 5.

FIG. 4.

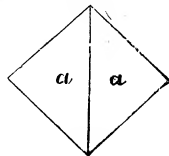
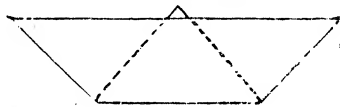
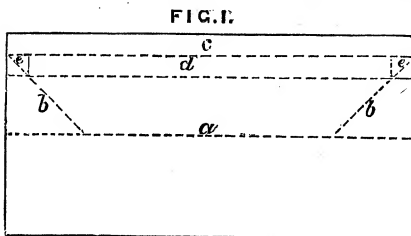


FIG. 5.



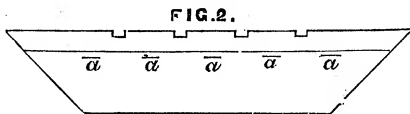
## PAPER BOAT. No. 2.

TAKE a piece of writing or cartridge paper the size

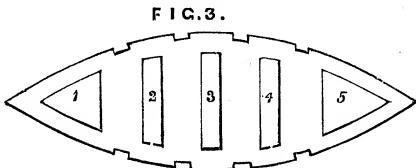


of a double square, fold it in the middle lengthways (fig. 1), turn up the two corners to dotted lines  $b\ b$  and turn down the

two upper edges from  $c$  to the remaining dotted line  $d$ , doubling in the ends  $e\ e$  to form fig. 2 ; before opening it out



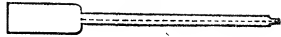
pierce five small notches for the seats  $a$ , at equal distances, and between these again cut out the small square places for the rowlocks for the oars. Open out the inside, and form the seats (fig. 3) of pieces of card-



board or stiff paper to fit the shape of the boat, the two end ones being made to fill up the corners.

*The Oars* (fig. 4). Fold a piece of paper the length of the bottom of the boat, five times, cut out the shape, double over to the dotted line, which will give the oar greater firmness, and also improve the shape.

FIG. 4.



To imitate water, take a long slip of paper, and folding it eight times (fig. 5), cut out the centre piece, crumple up the paper altogether, and open out in a line the

FIG. 5.



places for the boat to rest upon.

*The Men* (fig. 6). Fold a piece of paper five times, about half the length of the boat, cut it out to shape, beginning at the foot on the right, cutting continuously on to the left. When finished, bend from dotted lines to sitting posture, arms brought forward, and hands turned down to hold the oars.

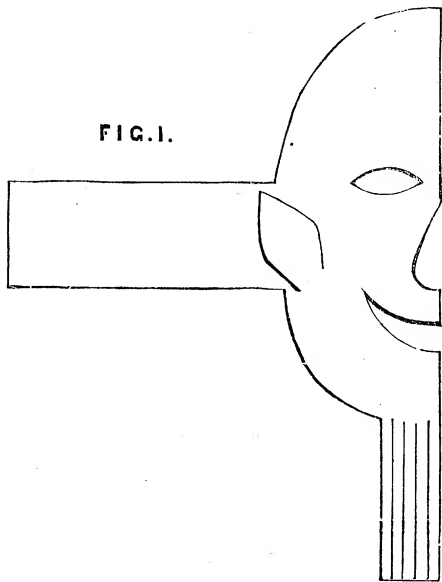
FIG. 6.



Having completed your cutting out, and placed your boat upright, fix your men one on each seat at opposite sides to each other. Place an oar in the rowlock again opposite to each man, and fixing an oar in like manner in each man's hands, your boat with its crew will be complete.

## COMIC PAPER MASK.

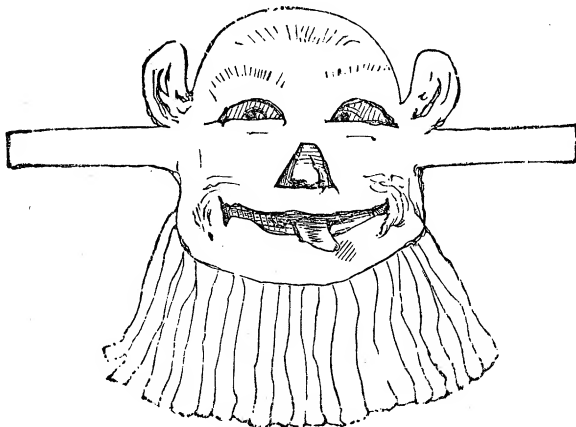
THIS is a highly amusing toy, and can be easily made out of an old newspaper ; if coloured, the effect will be much improved, and made exceedingly funny. This, however, can be better done with a sheet of cartridge paper, about a foot and a half square ; having



folded it double (fig. 1). cut out the eyes, nose, and

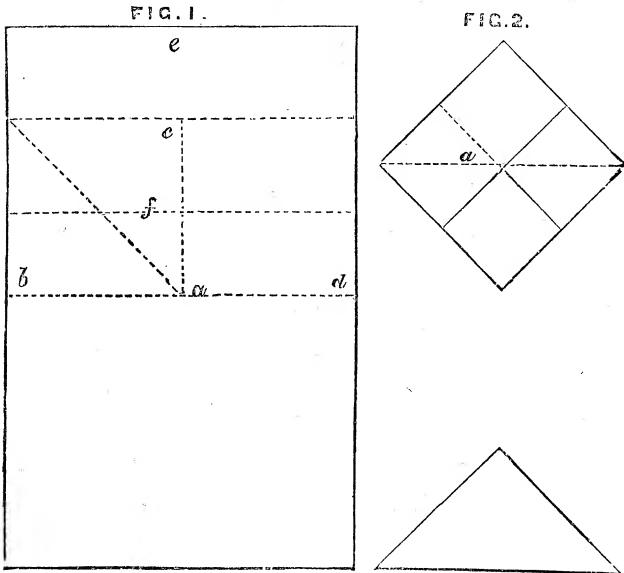
mouth, and round the ear; for the beard, fold the bottom portion four or five times, and cut it in long slips, open out, fix the two long side ends round the head, and by rolling the eyes, and moving the tongue about from side to side, you will find it give a most comic and grotesque appearance.

FIG. 2.



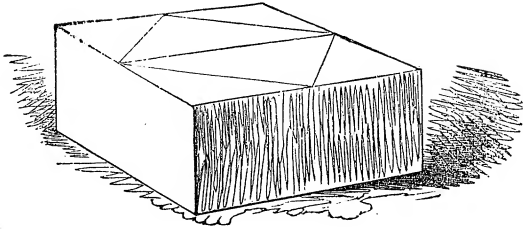
## PYRAMIDICAL HAT.

TAKE a piece of paper the size of two squares (fig. 1), double it to dotted line *a*, turn the corner *b* to *c*, and the corner *d* the same way to the other side; then turn down the piece *e* to the dotted line *f*, and



pull it out to a diamond shape (fig. 2), taking care to fold the corners nicely under each other; turn down the top piece to the dotted line *a*, and the hat will be finished.

## PAPER BOX.



TAKE a piece of paper about six inches square, fold it to dotted lines in fig. 1, after this the four corners meet in the centre (fig. 2), which will give the square as dotted lines, each fold to be firmly pressed; then at each turn fold again to the corners the centre of the outside dotted lines, to form fig. 3. Fold the corners again to

FIG. 1.

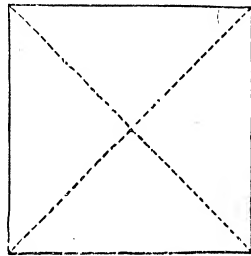


FIG. 2.

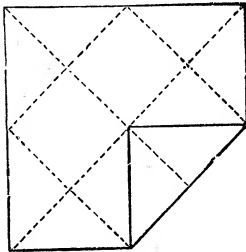


FIG. 3.

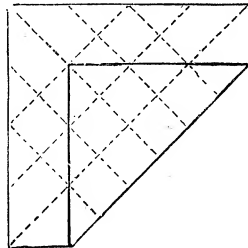
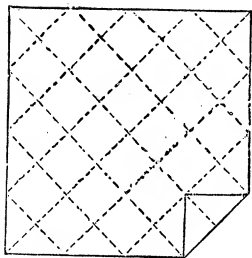


FIG. 4.



the outer dotted line (fig. 4); cut out the pieces marked 1, 2, 3, 4, 5, 7, and 8: cut through all the black lines, being very careful not to touch the dotted lines. Fold over the corners to form fig. 6, insert this in the opposite sides of the box *a, a*, these again being inserted into *b b*, insert again *c* into *d*, and again into *f* will form the box, fig. 7.

FIG. 5.

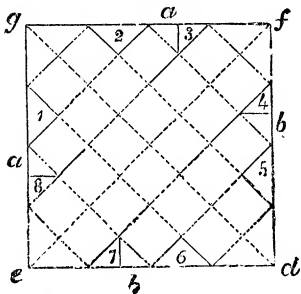


FIG. 6.



FIG. 7.





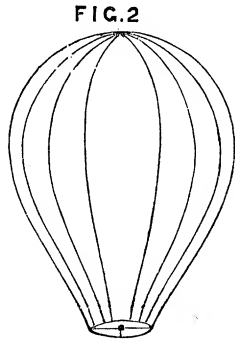
## FIRE BALLOON.

PROCURE a few sheets of well woven tissue paper, and cut out the gores (fig. 1); paste these carefully together, making in all fourteen strips; look carefully over the surface, and see that there is no slit or hole left. Fig. 2: cut the bottom end equally off all round, take a piece of thin wire and make it to a circle the size of the neck of the balloon, then have two cross pieces a little bent in the middle to hold a piece of soft cotton, which must afterwards be dipped in spirits of wine, the circular wire



being then pasted on to the bottom of the balloon.

To inflate the balloon, some one must hold it up by the top, and having thoroughly saturated your piece of cotton, place in the centre of the wires and set fire to it, being very careful not to set fire to the balloon; when the air is well heated within, the balloon will rise to a great height, and in a dark night will have a very fine effect.



## PARACHUTE.

A SQUARE piece of paper folded four times will form fig. 1; then with a pair of sharp scissors cut out to dotted line, pierce a hole through all, open out, and having placed threads through each hole, tie them all round, and bring the remaining ends of the threads down to a point, to which attach a piece of cork or paper as a balance; the air getting under them, they sometimes ascend to a great height.



FIG. 2.

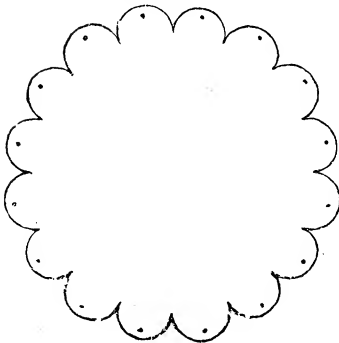
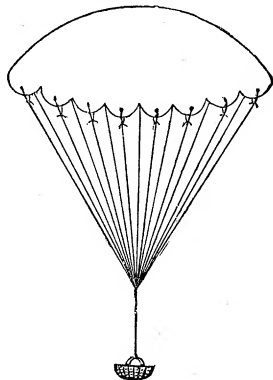


FIG. 3.



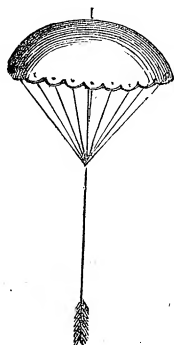
## ARROW PARACHUTE.

THIS is an admirable contrivance to raise the parachute up in the air. We have already described the most common way of making them. There is, however a difficulty at all times in getting them to ascend; but by the means hereafter detailed that obstacle is entirely removed.

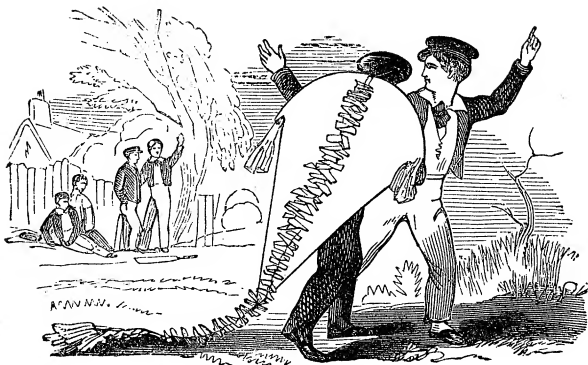
To make one you must procure a piece of thin, coloured paper, and cut out the form of the parachute (*see* page 12); then taking or making an arrow, rather long in the shaft



(*see* page 94), cut a small hole at the top of the paper, insert it over the end of the arrow, and fix it there with a little gum or paste, about an inch from the top; attach pieces of thread to the extreme corners of the paper, and tie them together about half way up the shaft of the arrow, and when completed it will resemble a parasol or umbrella closed. When shot up with a common bow, it will ascend a great height, and in coming down again it will open out, and sail away to a great distance.



## KITE



KITE-FLYING is a most popular game with all boys. It is highly exhilarating and ought to be encouraged by every means, as a healthful and innocent recreation. We are indebted, it is said, to the Chinese for this invention, and to this day it is one of their most popular pastimes. The kites sold in shops are made to sell, but are not necessarily warranted to fly; any boy, however, by following our directions, will be able to make one that will

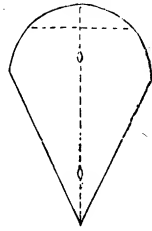
## FIRST KITE.

Take a common sheet of writing paper, double it  
 down the centre, and cut out



fig. 1; prick out two small  
 holes for the belly-band, open  
 out, and bend outwards the  
 top part to dotted line (fig. 2);  
 to fix the belly-band, tie a  
 knob or small piece of paper  
 to each end of the thread at

FIG. 2.



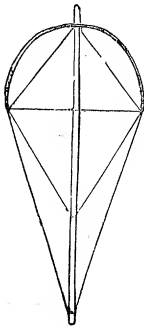
the back of the kite, to prevent it running through  
 the holes. As this is only a small kite, strong thread  
 will be found the best to make the tail of, as well as  
 to fly it with; the tail ought to be about fifteen times  
 the length of the kite, and one piece of paper at the  
 extreme end will be sufficient to steady it;\* care must  
 be taken to tie the thread to the right place on the  
 belly-band, as a great deal of the success of its flying  
 will depend upon this.

## SECOND KITE.

Kites made with a lath and bow can be made to  
 any size, by pasting two or more sheets of paper

\* If the wind is strong, more weights must be attached to  
 the tail.

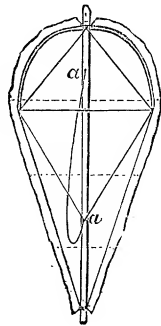
together; an old newspaper will answer the purpose as well as anything, unless you wish to colour it afterwards, in which case it ought to be white; but first you must procure a straight lath of deal, the width and the thickness of course must depend upon the size; shape it to a point at the top, notch a small piece on each side about an inch from the top, and also at the bottom, the former to tie the hoop to, and the latter the string, to paste the side and ends of the paper over.



*The Bow.* This can be made of cane, but the best thing is a hoop. Thin it down to about the thickness of a common cane, balance it on your finger, and then fix it at that point to the top of the lath with string, having cut a small notch at each end of the hoop, fix the string therein, and carry it down to the lower end of the lath, tie it there, and again continue the string up to the opposite side of the hoop, but before fixing with a knot, be sure that your skeleton is equally balanced on both sides—this done, secure the knot, and carry the string to the opposite end of the bow, taking one turn round the lath in its way; from this point carry on the string to the top of the

lath, and again to the opposite corner of the bow, fixing it there in a knot, and continue the string a little more than half way down the lath; after securing it, again carry up the string to the other corner of the bow; fix it also, and the framework of your kite will be completed.

*To paper the Kite.* Having pasted your paper to the size you require, lay the frame upon it, and with a pair of scissors cut about an inch outside of all to the shape; afterwards paste the outer portion all round, and fix it first over the bow, and then down each side; allow it to dry, and then drill out two holes for the belly-band—the upper one should be about one-fifth of the length of the kite from the top, and the other rather more than the same distance above its extremity.



*The Belly-band.* Insert the end of a piece of string into each of the holes *a a*, and tie them in knots on the back part of the lath, taking great care not to make it too full or too narrow. The next important thing is to fix the string to the belly-band, and when this is done you next put on the

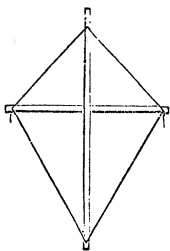
*Twil.* This should be about fifteen or sixteen

times the length of the kite; slips of doubled paper about four or five inches long must be tied to it by noose knots, about four inches apart from each other, with a little larger one or a tassel at the end.

*Wings* may be attached to each corner of the bow, but they do not at all improve its flying capabilities. They are made of pieces of paper folded together, and cut up from the bottom in strips.

### THE CLOTH KITE

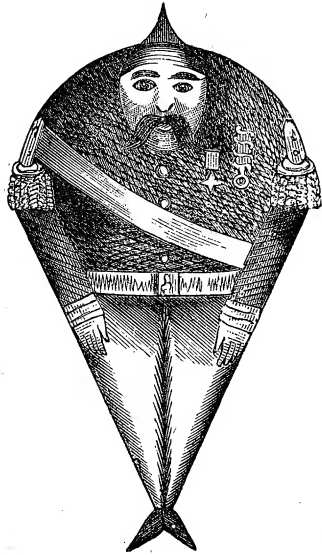
Has some advantages over one made of paper, as not being so soon spoiled by the wet. Calico or silk is sometimes used, but the best material is very thingutta percha cloth. The frame is made of two cross pieces placed at right angles to each other, and secured with string from corner to corner, over which the material is sewn, and fastened by quilting along the string. When finished, the whole may be detached from the laths, and these being separated can be easily packed away in a portable compass.





## THE OFFICER KITE.

Toy-makers generally paint their kites with a few daubs of red or blue, without the least attempt at design; but if you wish to paint your kite, here is an officer that will answer your purpose. It must be all dashed in very boldly, for when the kite is far up, very small work upon it would be entirely lost; the coat may be painted red or blue, the face full crimson, and the epaulettes, &c., yellow, or gold tinsel, if you happen to have any.



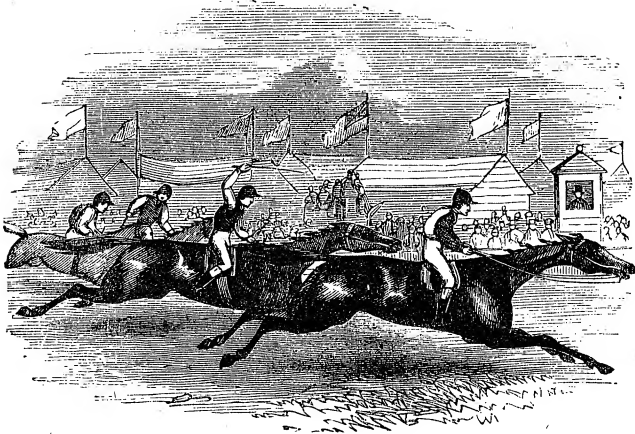
NOTE.—The thickness of the string to be used will of course depend upon the size of your kite.

## Cardboard Toys.

LIKE paper toys, cardboard is a material by which almost anything can be imitated; but as it is more expensive than paper, it will require a little more care, so that what is cut out should be done with a purpose, that it may not be cut to waste. Outside objects are most conveniently cut out with a pair of stout scissors, holding the card as already described for paper cuttings; the smaller pieces inside, such as windows of a house, &c., are better accomplished with a sharp-pointed penknife, and a flat ruler; a parallel ruler with a brass edge is the best, but any other straight line that you can hold firm on the card with the left hand will answer the purpose. When any portion is cut out with a penknife, it ought to be done upon a piece of flat board, to prevent cutting the table. Cardboard has many advantages over paper; solid objects can be formed and put together, specimens of which, with others, we propose giving; but as the Publishers of this book have already issued a useful and instructive work\* on the subject, we refer our young friends to it for further information, should it be required.

\* Home Pastime; or, The Child's Own Toy-maker.

## THE RACE.

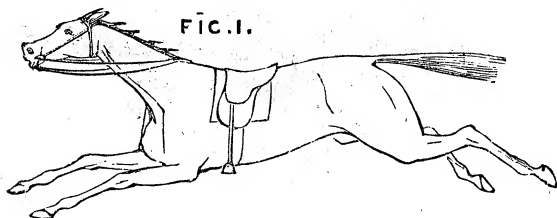


CUTTING out objects in cardboard may be done to any extent, according to the skill and ingenuity of the maker : such as a farm-yard, with its pigs, cows, poultry, &c. ; a circus ; or, in fact, almost anything can be successfully imitated with the common scissors and cardboard. We shall only give two examples in this style—a Race, and a Fox Hunt—and other objects will afterwards suggest themselves.

It will be as well not to attempt too much in the

first essay, but confine yourself to three horses and riders. The outlines may be drawn out in pencil, but with a little practice you will soon be able to cut them out by the eye at once.

The manner horses run at full speed is so much alike, that one position will do very well for all your horses; the head and neck well forward, the ears back, the tail a little erect, and all the legs well stretched out. Cut out with a pair of short stout



scissors, commencing at the outer hind foot, continuously round till finished, making the feet and legs as carefully as possible.

Having cut out the horses, you can prick out the form of the saddle and saddle-cloth with the point of a pin, as well as the eye and nose of the horse, and the part of the bridle on the horses' heads; or if you prefer colouring them, you can do so, making one horse brown, another black, and the other chestnut;

the rein may be put through the mouth of the horse with a needle, and formed of brown thread.

*The Jockeys* in racing, like the position of the horses, are also much alike; they sit with their knees close to the saddle, the body a little forward, and mostly with both hands holding the bridle (fig. 2);

FIG. 2.



this attitude will do for the first and third riders. Cut out, beginning at the heel of the foot on the right hand side, and round to shape, taking care not to cut further between the legs than the dotted line, which will make him sit his horse properly.

*The Second Jockey* may be represented whipping his horse, his right hand raised up, and the other holding the bridle (fig. 3). Having cut out as before described, if you wish to paint them, you can make No. 1, black cap and red jacket; No. 2, blue and yellow striped jacket and blue cap; No. 3, yellow body, blue sleeves, and black cap.

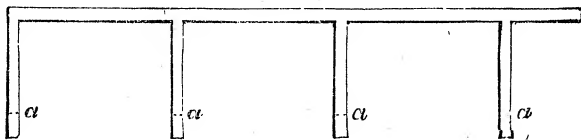
FIG. 3.



Having so far completed the race, you can try the effect on the table by placing the men on the horses, but if you wish to make a more finished job of your work, you must procure a piece of flat board, and cut out the

*Rails* (fig. 4). Take a strip of cardboard about half the height of the men, and cut out with a pen-knife and scissors, and by joining the ends together, make it to any extent you think proper; to fix them

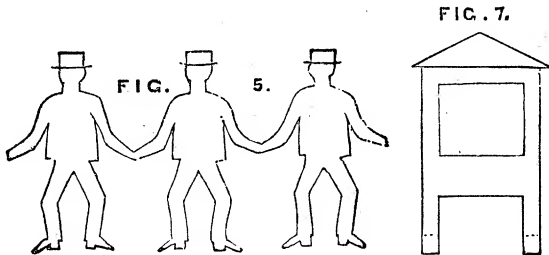
FIG. 4.



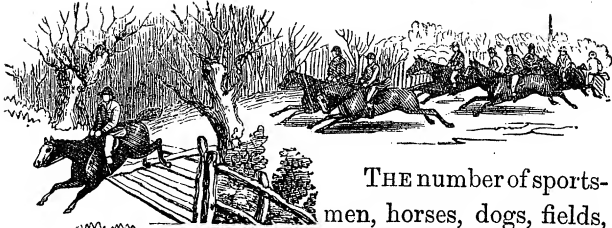
you must split the ends to the dotted lines *a*, and separating them will make them stand upright.

*The Spectators.* Fold a piece of paper four times the size you require your men, and cut out as before described in fig. 2; open out, and place them outside the railings in rows (fig. 5).

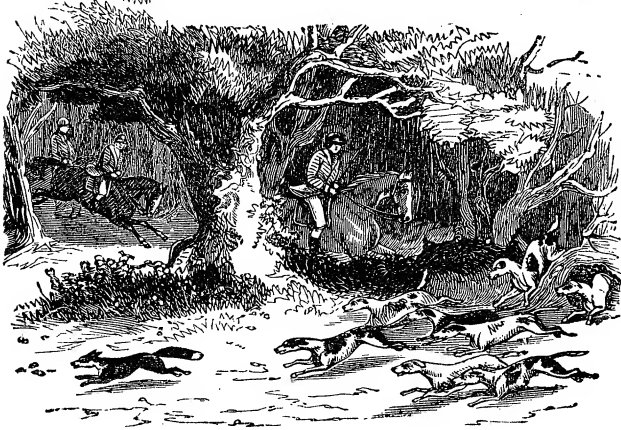
*The Winning-post,* or stand, can be made of cardboard (fig. 7), and made to stand the same as the rails (fig. 4); place a paper man inside.



## THE FOX HUNT.

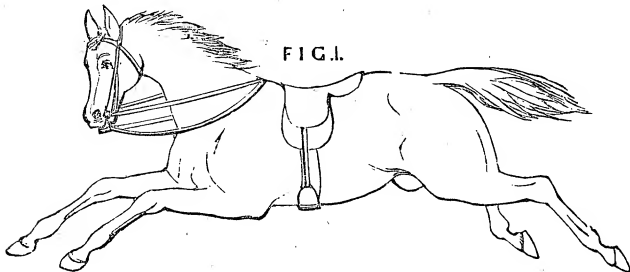


THE number of sports-  
men, horses, dogs, fields,  
trees, gates, &c., can be carried out  
to an unlimited extent, according to  
the skill and perseverance of the artist.

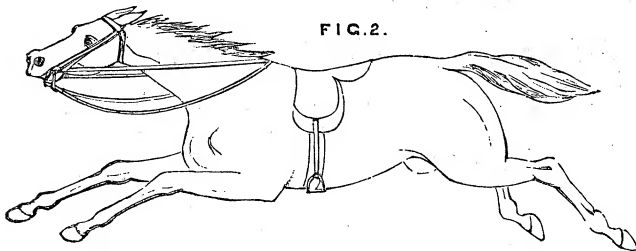


As it is in nature with a real fox hunt, the more that is in it the more the excitement and pleasure, so with your toy hunt, the more you make the better yourself and friends will be satisfied and pleased with the exhibition.

*Horse running* (fig. 1). This is the most common



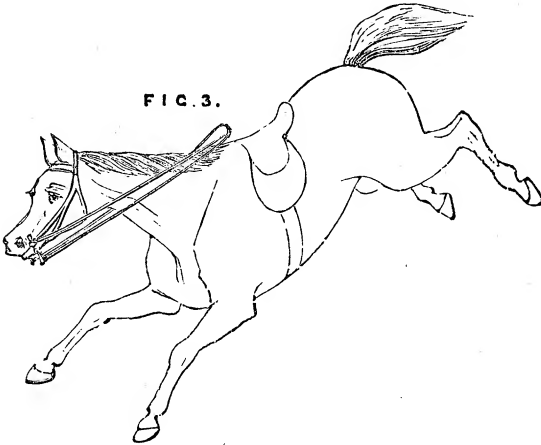
position for a horse galloping, and you will therefore require more of this than any other; it can be varied



a little by making the heads of some a little more forward (fig. 2). Of these two positions you will require



to cut out, according to the following directions, from eight to twelve :—Take a piece of cardboard, and commencing by cutting out, beginning with the right hind leg, and round continuously till completed, taking care to make the feet and legs as good a shape as possible. The eye, saddle, saddle-cloth, and bridle on the head may be pricked out with a pin, and when all are completed they will make a very good set as they are ; but if you wish to make your hunt more finished, you may colour some of your horses brown, others black, chestnut, &c. ; the saddle-cloth inside blue, the



saddles light brown, and the bridles can be made of thread. The two positions of horses already described

will do for almost all kinds of straight or field running, but you will require some in the act of leaping over gates, hedges, &c., when both your horses and men will require a different attitude.

*Leaping* (fig. 3). This is a very good position for a horse in the act of leaping; it must be cut out as described in fig. 1 and 2, and you had better cut out four or five like it.

*Huntsman* (fig. 4). To make a rider for your horses which you have cut out as fig. 1, the most natural attitude will be for the huntsman to be holding his horse with both hands, the body a little forward, and the knees firmly sticking to the saddle. If painted, all the coats must be red, cap and boots black, tops yellow, and neckties light blue.

FIG. 4.



FIG. 5.



*First Huntsman* (fig. 5). The whipper-in or huntsman may be a little in advance of all the others, and

even before some of the dogs; he should be represented in the act of cheering them on, his left hand erect, holding his horn (trumpet), and the other holding the bridle. You will, however, only require one figure in this position, riding a galloping horse (fig. 1).

*Rider* (fig. 6). This attitude is for your leaping horses (fig. 3); he is holding his horse well up to assist it over the gate or fence; you will also require four or five in this position.

*The Fox* (fig. 10). The same previous remarks we have already made respecting the running of horses will also apply to the fox and dogs, for they vary but little in their action; there is, however, a marked difference in the head and tail of Reynard, which must be carefully attended to.



FIG. 6.



FIG. 10



FIG. 7.

*The Hounds* (fig. 7). The one we have illustrated is the most natural, and of this you will require at least ten or twelve; if coloured they must be either

black and white, or brown and white, in patches of every kind.

*Hounds* (fig. 8). This position will give a little variety to the pack, but as he does not look so thoroughly up to his work, you will not require so many, say five or six. If you wish to represent nothing but a straight run, you would not require any other attitudes for your dogs, but you will want to give spirit to your hunt, to see some of them jumping and scrambling over hedges and ditches; here is another attitude:

FIG. 8.



FIG. 9.



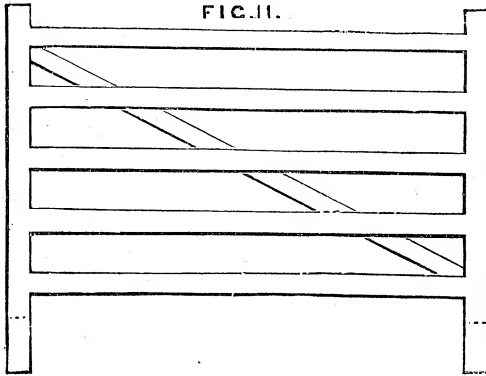
*Jumping* (fig. 9). Of this you will not require more than three or four.

Having cut out and coloured all as before described, you now begin to prepare your ground, which must be composed of fields, hedges, gates, trees, &c.

A piece of thin deal, about two feet long by six or eight inches broad, will make the best stand, the inequalities of the ground may be made up of pieces of paper, cardboard, or bits of decayed twigs of trees, sand, moss, &c., and fixed with a little gum.

*Gates* (fig. 11). These must be cut out of card-

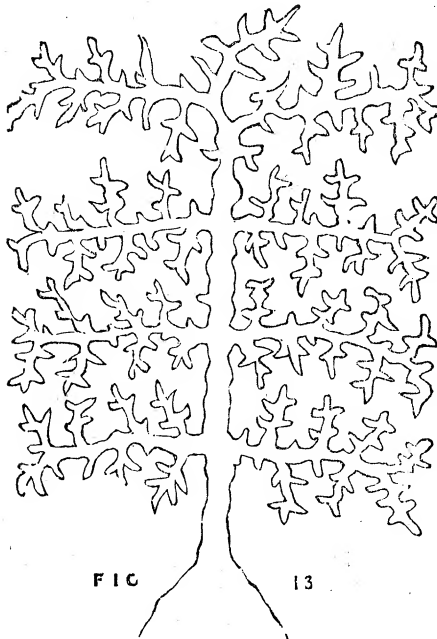
board, and they will not require painting; they are made to stand by splitting the cardboard up to the dotted lines, and fixing the ends with gum or paste. Cut out not less than three of these.



*Hedges.* Procure if possible some green paper; fold it together about four or five times, and cut out to the form of fig. 13; they must be a little higher than the gates. Commence cutting out from the right hand side, holding the paper firmly between the finger and thumb in the left hand; when completed, twist the various cuttings together, and you will have a good imitation of a hedge; you can vary the sizes a little.

*Trees.* (fig. 13). These are also cut out of green

paper, and in the same manner as the hedges, only



FIG

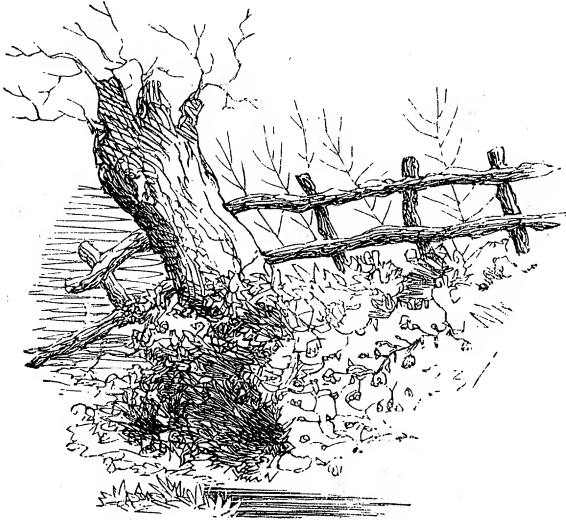
13

much larger and of various sizes, also leaving more length for the trunks, and giving more shape to the outline; they must also vary in size and form. The trunks may be supported by twisting a piece of paper round the five cuttings, and fixing them to the ground with gum or paste.

A village church, cottage, or farm may be represented in the distance, according to the taste and talent of the artist. It will not be necessary to make your horses, dogs, or fox fixtures, so that you may enjoy a fresh hunt as often as you have leisure.

Old railings, stumps of trees, and other objects,

may be made of twigs, roots, and small branches of natural trees ; broken pieces of ground may be formed



by a combination of all, with the addition of pieces of stone and moss, or such other things as may suggest themselves to the taste and fancy of the maker.

## THE THAUMATROPE.

THIS is a very pretty philosophical toy ; its name is derived from two Greek words, one of which signifies *wonder*, and the other *to turn*. It is founded upon the well-known principle in optics, that an impression made on the retina of the eye lasts for a short time after the object which produced it has been withdrawn. When you have made one you will understand it better than by any written description.

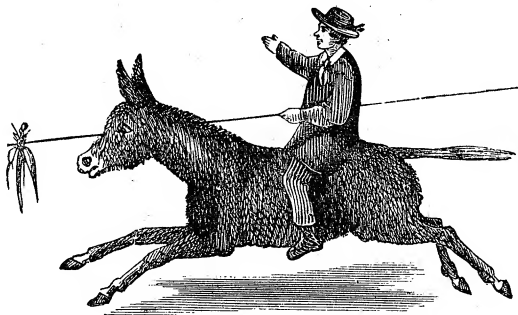


FIG. I.

*The Boy and the Donkey.*—Take a common card or piece of cardboard, say five inches by three ; on one side of it sketch a donkey running, and paint it black



with Indian ink, with a lighter wash for the ground (fig. 3); and in like manner draw and paint a boy in a sitting position, on the reverse side of the card, as shewn in the cut (fig. 2). Fasten two pieces of thread,

FIG. 2.

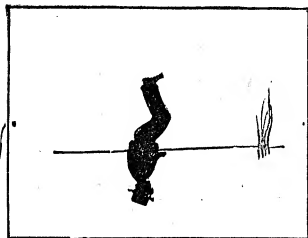


FIG. 3.



one on each side, at opposite points in the centre of the card; take these between the fore-finger and thumb in each hand, twirl them round, which will make the card quickly revolve, and the boy will appear to be riding upon the donkey, as in fig. 1.

A rat in a trap, a bird in a cage, a cricketer and bat, and numerous other subjects may be produced upon the same principle.

## CARD RACKS.

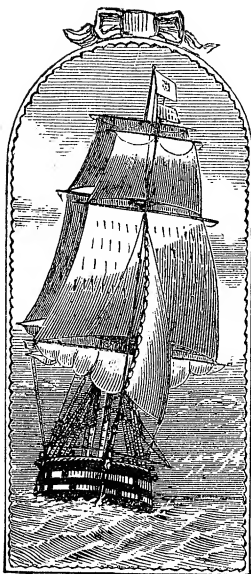


FIG. 1.

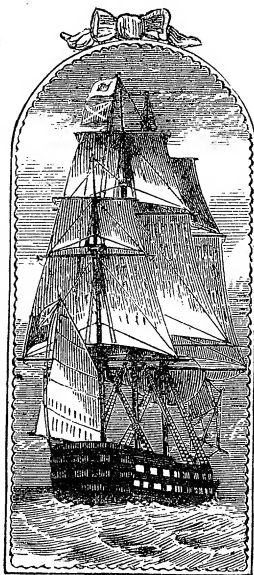
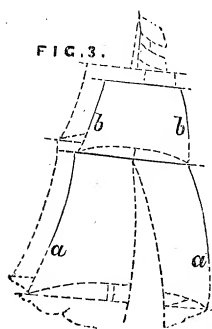


FIG. 2.

IF these are carefully made and neatly coloured, they will make something better than mere toys; they will serve as appropriate presents to distant friends, or as ornaments to decorate your own room. They will

be also useful to hold any loose cards, or letters, if hung up on each side of the mantel-piece.

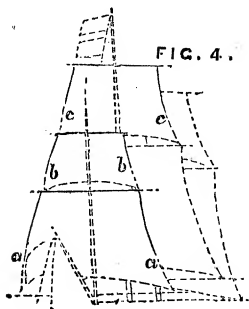
*Front View of a Ship* (fig. 1). Take a piece of clean cardboard about twelve inches high by five broad, copy the outline carefully in pencil, and commence colouring the upper portion of the sky light blue, leaving the lights; mix a little Indian red and darker red for the clouds. With the same colours lay in the distant sea, making it a little greener towards the front. The shadows on the sails can be washed in with sepia, and the sails with raw umber, mixed with



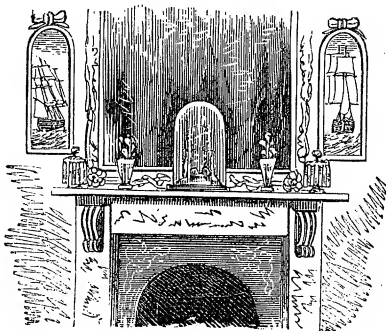
a little yellow ochre. The hull must be a wash of lamp-black and a little Indian red, and the bottom of the ship copper colour, the flags red and blue, the yards black, and the ropes and rigging touched in with sepia. When these are finished, cut out carefully on a flat board the fore-top-sail (fig. 3), along the top of the yard and down the sides to *a a*, and in the same manner the fore-top-gallant sail to *b b*, being careful not to cut the dotted lines.

In the same manner as before described for drawing and colouring fig. 1, proceed to finish fig. 2; the only

difference to be attended to particularly is in cutting out the sails, which must be as follows ; cut out in the



same manner as fig. 1 the mizen-topsail to fig. 4, and the mizen-top-gallant sail, also the main-top-gallant sail to *c c*. When this is finished paste on or gum a thin strip of gold-edged paper round the outside of all, and finish with a bow of coloured ribbon at the top of each.



## PAIR OF STEPS.

TAKE a piece of cardboard, and draw out the pattern in outline, say one third larger than fig. 1, and commence first by cutting out the small holes for the steps with a sharp pointed penknife, and in the same way the squares inside; the outside can be cut out with the scissors. Having cut out the shape, cut *half* through the card on the dotted lines, and bend over first for the top, and afterwards for the two sides.

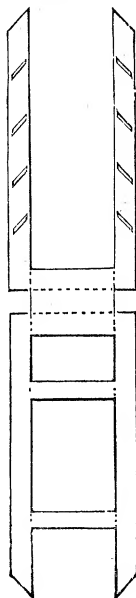
*The Steps.*—Cut out four pieces of card the shape of fig. 2, also one third

FIG. 2.



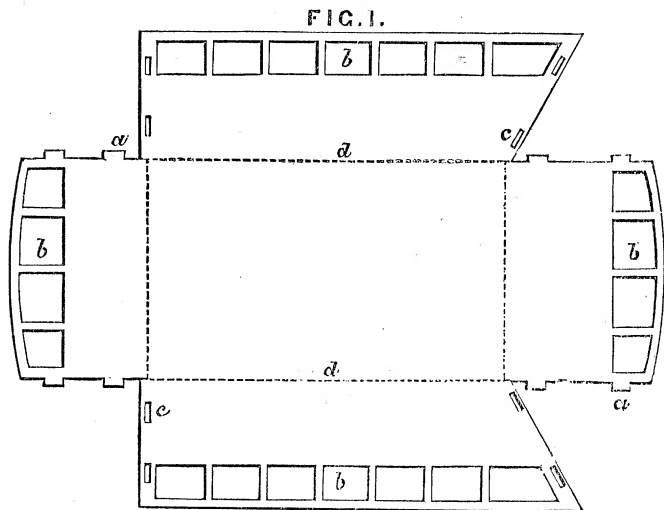
larger than pattern; having done so, insert the narrow ends into their respective holes, and you have a pair of neat little steps.

FIG. 1



## HORSE AND CART

DRAW out on a piece of cardboard, one third larger than the pattern\* (fig. 1), and cut out the outside,

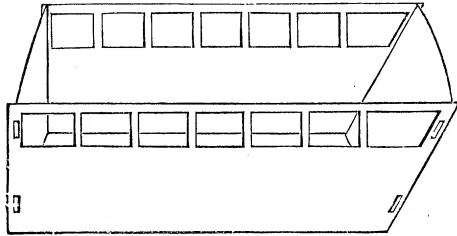


taking care to leave the small projecting pieces on the end and front, *a*; afterwards with the point of a pen-knife cut out between the rails on each side, *b*, and also very carefully the four small holes on each side, *c*; next cut half through the dotted lines, *d*, and bend

\* All the other parts must be in the same proportion.

over the sides and ends, to form the body of the cart

FIG. 2.



(fig. 2), by inserting the projecting parts, *a*, into the small holes, *c*.

*The Shafts* (fig. 3).—Cut out to shape, and with

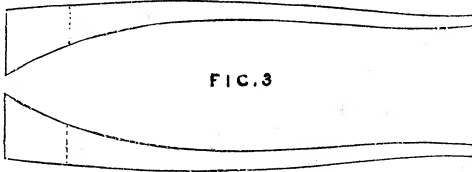
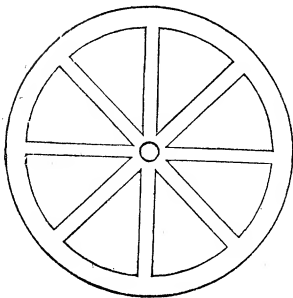


FIG. 4.

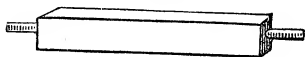


a little gum or paste fix them on to the bottom front of the cart, to the dotted line.

*The Wheels* (fig. 4).—These must be drawn out first with a pencil. The outsides can be cut out

with the scissors, but the insides must be done with the penknife.

*Axle-tree.*—Get a piece of wood and cut it to the shape (fig. 5), and with gum or paste fix it across the middle of the bottom of the



cart (fig. 1); when it is perfectly dry put on the wheels, and to keep them on, you can cut out a small cap (fig. 6); the hole in this should be made first, and the outside cut round with scissors.

FIG. 6.



Your cart being now completed, you will no doubt want a horse for it (fig. 7). This had better

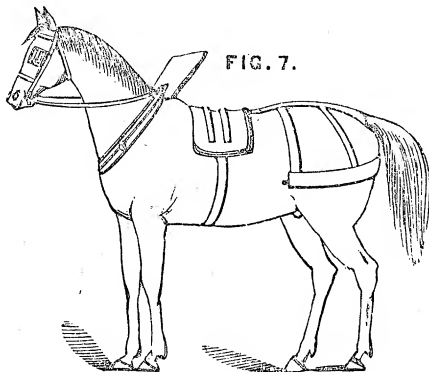
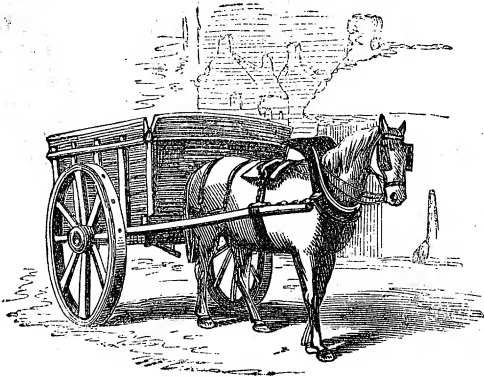


FIG. 7.

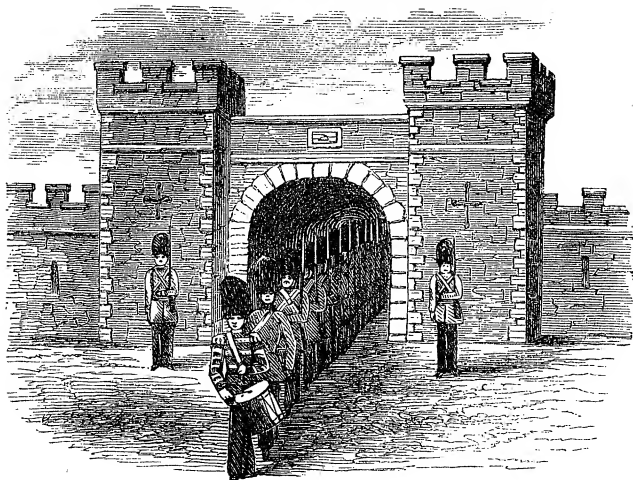
also be drawn out first with a pencil, the harness put in with pen and ink, or the whole, as well as your



cart, coloured according to your fancy. Having cut out the horse, by dividing the legs a little he will stand firmly, and by fixing a piece of thread to each of the shafts, and over the horse's back, you will find it support the cart; you may also make the bridle of thread.

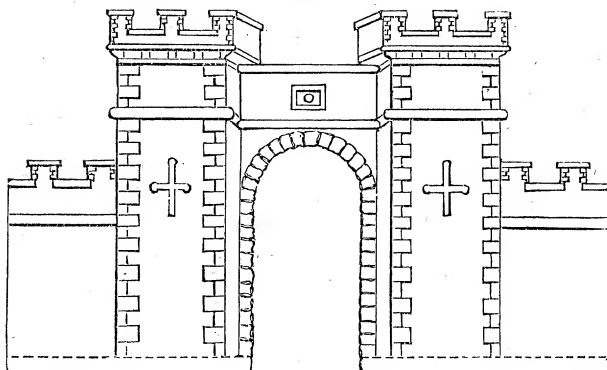


## SOLDIERS MARCHING OUT OF A FORT.



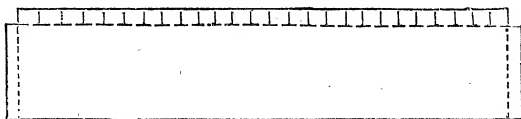
DRAW out in pencil on cardboard the outside of the fort, and colour it in imitation of stone-work. When completed to your satisfaction, cut out the outline with a pair of scissors, and the loopholes and gateway with a penknife, to the form of fig. 1; cut half through the dotted line at the bottom, and turn over to make the support.

FIG. 1.



*The Entrance.* This is also made of cardboard, and coloured in imitation of stone-work inside, but with a shadow over the whole, to give a better effect. When done, cut out to the pattern of fig. 2, and cut

FIG. 2.



half through the dotted lines; the end turned will make the stand, the black lines being cut entirely, and the end bent over from the dotted line; bend over to the form of the gate, and paste the side of it on to the inside of the gateway.

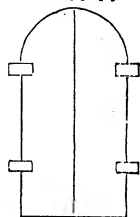
*The Door* (fig. 3). This must also be drawn on cardboard, and coloured in imitation of old oak ; being

FIG. 3.



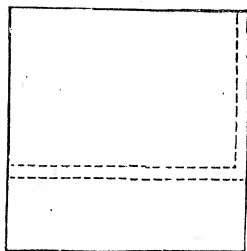
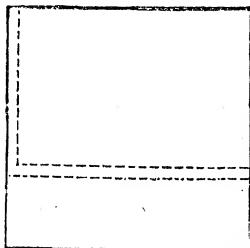
done the exact size of space left open behind the gateway ; cut out with a pair of scissors, and divide the door up the centre. Cut four slips of paper to form the hinges, and bending them in the centre, paste

FIG. 4.



or gum one half of each to the outside of the gateway, and the other to the door ; when dry the doors will conveniently open and shut.

A *Stand* for the whole may be also made of cardboard, painted stone colour, to which you can paste the slip of the front, back, and sides on to the dotted line of fig. 5.

FIG.  
5

It has long been a common amusement with boys to

cut out soldiers and fix them in various positions, but we believe this is the first time that any attempt has been made to put them in motion. They must be first drawn upon cardboard, and coloured as neatly as possible.

*Drummer* (fig. 6). He may be a little shorter than

FIG. 6.



the others, and the coat is the only difference in his dress, having a few white bands round the arms and down the body; coat, red, trousers, dark grey, and black cap.

*The Officer* (fig. 7) must be about the same height as the soldiers, a sword in his hand instead of a gun, and only one belt over the left shoulder, red coat, and trousers the same as the others.

FIG. 7.



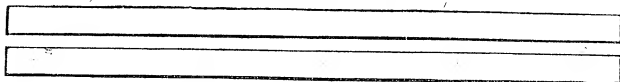
FIG. 8.


*Soldiers* (fig. 8) must be represented carrying the gun over the left shoulder, cross belts over the body, and coloured as before described. You will require at least six of these, or as many more as you think proper to make. Having completed the drawings of your figures, cut them out carefully with a pair of scissors, using a penknife for the



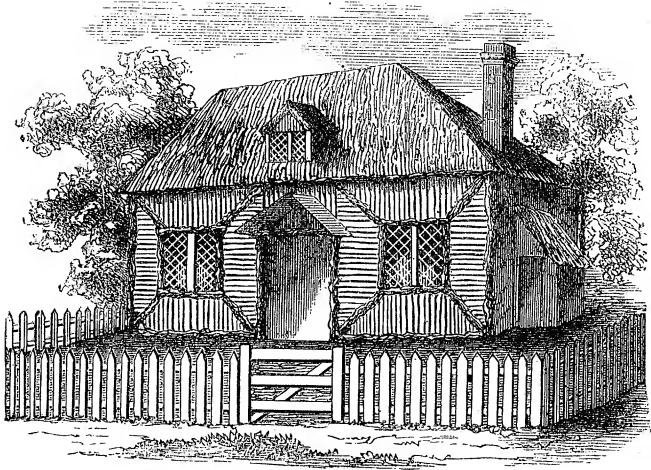
inside portions ; when finished, cut two slips of cardboard long enough to stand all your figures upon, allowing an inch between each figure, and not broader than half an inch (fig. 9) ; turn up the feet of the sol-

FIG. 9.



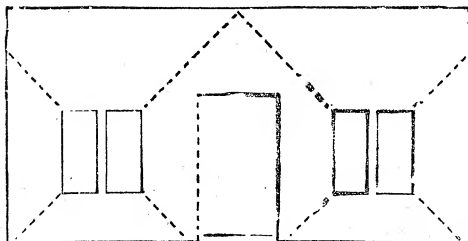
diers to make them stand, and cut several slips of cardboard the shape of fig. 10, and cut half through the middle, and bend **FIG. 10.** over; with a little gum or paste fix the feet  of the soldiers upon fig. 9, one foot on each slip ; and behind the feet fix the piece of card, half to the leg and the other half to the stand, and so on till you have placed them all in regular order ; allow them to stand till perfectly dry, and then, by moving the stand forward right and left, the soldiers will have the appearance of marching. The door of the fort should be kept closed, only opening it just before the soldiers are made to march out. The manner of working the figures being kept as much a secret as possible, and the soldiers really marching will assuredly amuse your juvenile visitors. The cardboard on which your soldiers are fixed ought to be rather stout, and painted a brownish tint, to be as near the colour of the stand as possible.

## RUSTIC COTTAGE.



TAKE a sheet of cardboard about the proportion of twelve inches by six, cut out the windows and round the black lines of the door, and half through the dotted lines, which will allow the door to open and shut (fig. 1); this is for the front of the cottage. For the back, cut out another piece of cardboard in a similar manner and the same size.

FIG. 1.



For the two ends, cut out two pieces of cardboard six inches square (fig. 2).

*The Out-house.* Cut out of cardboard the pattern (fig. 3), and half through the dotted lines, bend over

FIG. 2.

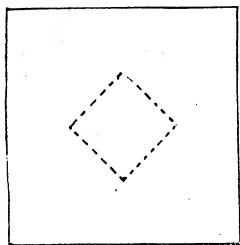
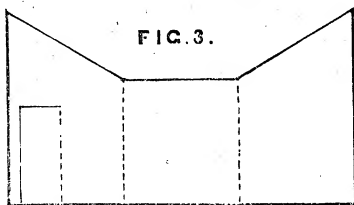


FIG. 3.

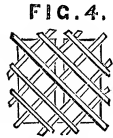


to shape, having first cut out the black lines of the door, and half through the dotted lines, as already described in fig. 1.

*Small squares for Windows* (fig. 1). Cut out several slips of white paper, and paste them over the back

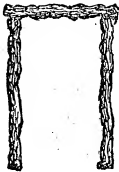
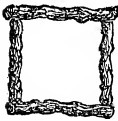


and front windows, according to pattern (fig. 4); pieces of glass can be pasted behind these, and also red or white curtains may be afterwards added, if you wish your cottage to have a completely finished appearance. Tracing paper will make a substitute for the glass if you are not able to procure the real thing.



Before commencing with the wood-work, wash all over the front, back, and sides of the cardboard with a brown colour, to prevent any white work shewing between the interstices.

*The rustic wood-work for the front.* Procure a quantity of small twigs, not thicker than a common quill—they must be quite dry and well seasoned; first cut out pieces to fit the top and bottom of the windows, and afterwards the two sides, and then in the same way the top and sides of the door; and with similar pieces, but a very little thicker, fit to the length of the two sides,

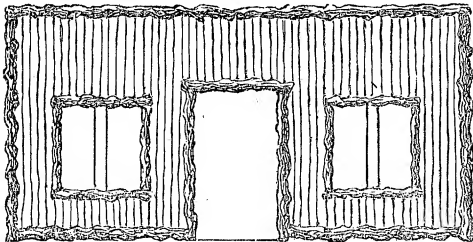


and along the bottom and top, with a small piece in

the centre of the door. Having got them all to the correct size, cut off nearly one half of the under side of all, to allow them to lie flat on the cardboard. Fix the wood-work with glue, and while the front part already described is drying, cut out in a similar manner pieces to fit the windows, door, top, bottom, and sides, for the back, and then glue them on in their respective places.

*Inside of the wood-work.* Cut out several pieces of twigs, taking care that they are not quite so thick as the supports for the door, windows, &c.; split them evenly down the middle, and fitting them first carefully to the pattern, fix them with glue. Continue in like manner till the whole of the front is covered, care being taken that they fit as closely and neatly as possible.

FIG. 5.



ble. The back of the cottage must next be covered in the same manner, unless you wish to save time

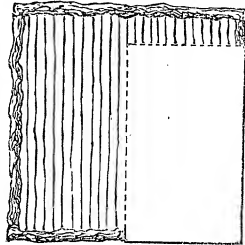
by making all the inside pieces upright (fig. 5), instead of the same pattern as the front.

*The sides or ends of the Cottage.* The end on the left must be commenced by cutting out a frame of twigs first for the sides, and then for top and bottom. Having previously drawn out the shape of a diamond on the cardboard (fig. 2), fix with glue to the top, bottom, and two sides; then cut out small pieces to the shape of the diamond, and fix them across the end, and fill up the remaining portion with uprights.

As the end on the right is partly covered by the out-house, it will not be necessary to cover more than the outer portion with wood-work. It must be done as already described, by fixing a piece along the top and bottom, down the one side, and the upper portion of the right hand side, and fill up with small pieces the inside, all upright (fig. 6).

FIG. 6.

*Wood-work for the Out-house.* Pieces must be first fixed round the door and down the sides of the two ends and back, also along the bottom and top of each, and filled up with uprights in the inside.

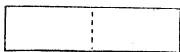


Having completed your wood-work for the front, back, and ends of your cottage, before putting them together, paint the three doors a dark green colour.

To fix the house together, cut four slips of paper five inches by one, double each piece down the middle, and with paste or glue bind the sides and ends together in the inside with the paper; allow it to stand quietly till dry, and then fix to the ground.

*The Stand.* This must be made of millboard, or a thin piece of deal, either of which must be first slightly covered over with a brownish coat of paint; it should be altogether about sixteen inches long by twelve broad. The house, including the out-house, should be placed at equal distances from the ends, and close to the back, leaving room for the garden and railings in front; fix the house with slips of the paper in the inside to the walls and ground, in the same manner as before described for fixing the ends together. The out-house must be next added, and put together by pasting slips of paper to the sides of the house and to the bottom and ground.

*The Porch* over the front door must next be cut out of cardboard (fig. 7); cut half through the dotted line, bend to shape, and fix with glue and thin slips of paper under the porch, and after it is dry, paint it the same colour as the doors.



*The Roof.* First cut out of cardboard the two

ends (figs. 8 and 9), the square hole in fig. 9 being for

FIG. 8.

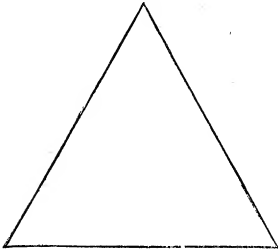


FIG. 9.

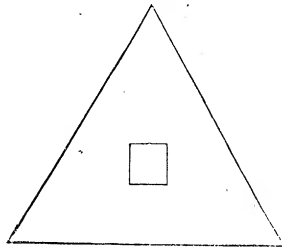
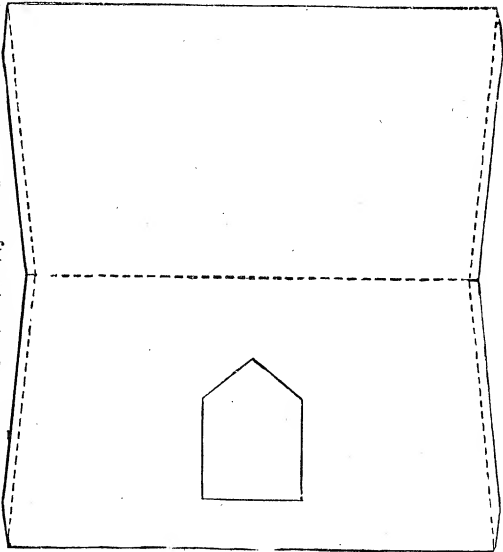


FIG. 10.

the chimney. The front and back to be cut out in one piece (fig. 10), and half through the dotted lines to get the bends; cut out the porch for the window in



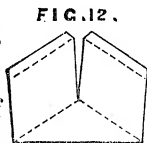
front, and paste the extreme ends on the inside, to which fix the two end pieces.

*Top front Window* (fig. 11). Cut out of cardboard the window to pattern, and half through the dotted lines; the end dotted lines being cut on the back of the card to turn over to the front.

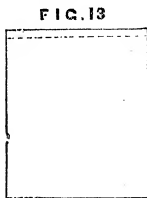


Cut thin slips of paper for the cross sashes, as in the other windows, and paste them on to the back of the window, and afterwards paste in glass or tissue paper, as before described.

*Roof of Window Porch* (fig. 12). Cut out the shape and half through the dotted lines for the front, and at the back to turn upwards the end dotted lines. Fix in the window by pasting the end pieces to the inside of the roof, and fig. 12 to the same on the outside.



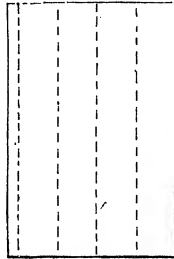
*Roof of Out-house* (fig. 13). Cut out the shape, and half through the dotted line, and fix the piece to the end of the house. The roof may be afterwards painted in imitation of thatch, or actually thatched with hay or moss.



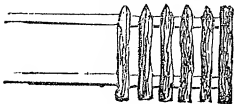
*The Chimney* (fig. 14). Cut out the shape, and

half through the dotted lines; bend over to the square, and fix by pasting lower extremity on the inside. To give finish, and make an imitation stone coping round the top, cut four pieces of wood the size, and fix round. Secure the chimney by pasting it to the end wall inside, before placing on the roof, which will not require fixing; but before the chimney is secured, it ought to be painted in imitation of bricks, with the stone coping at the top.

FIG. 14.



*Railings in front of Cottage.*—These can be made in the same way as the wood-work of the house, by splitting pieces of wood, and glueing them on to two other pieces, the length you require for the front and sides, the end ones being a little thicker; they must be fixed with slips of card behind the supports. The gate in front can be cut out of cardboard. The garden may be composed of moss; and the walks of sand, small shells, &c.



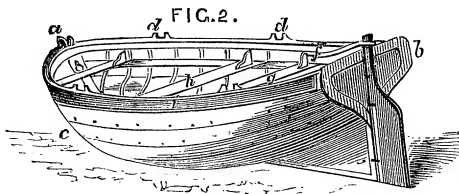
## BOATS.

REVISED BY JAMES E. WALTON.

IN the following pages an attempt is made to show how to construct and rig model boats of various kinds; if the reader wishes to learn how to build, rig, and *sail* a *self-acting* model yacht, he is recommended to procure "Model Yachts and Model Yacht Sailing,"\* by Mr. James E. Walton, V.M.Y.C.



Before commencing to build or cut out a boat, it will be as well to become acquainted with its com-



- |                  |                       |
|------------------|-----------------------|
| a. Cutwater.     | e. Thwarts, or Seats. |
| b. Stern.        | f. Tiller.            |
| c. Bow.          | g. Sternsheets.       |
| d. Rowlocks.     | h. Midship-thwart.    |
| i. Wale-streaks. |                       |

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\* Griffith and Farran, St. Paul's Churchyard. Price 2s. 6d.

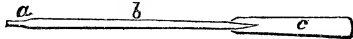


ponent parts, but it must first be observed that ships' boats, or those used on the sea, are much higher and stronger than those used on rivers only. Here we have a ship's long boat.

In wager boats there is a board fixed across the boat, for the feet of the rower, called a *Stretcher*.

Boats with two rowlocks opposite each other are called *sculling boats*, and are propelled by a pair of light oars called *sculls*; when the rowlocks are not opposite each other it is called a *pair-oared boat*; if with two in the middle, opposite each other, it is called a *randan*; when there are four rowlocks, none of which are opposite each other, it is called a *four-oared boat*; and so on, up to ten.

FIG. 3.



SCULL, OR OAR.

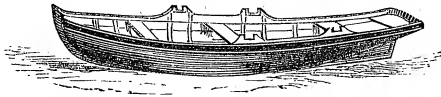
- a. Handle.                      b. Loom, or Shoulder.  
c. Wash, or Blade.

A scull is a small oar used with one hand, and requiring a pair, as is the case with oars—one being placed in the rowlocks on each side. Oars are used with both hands, and a pair-oared boat of course requires two oarsmen, and so on. The *strokesman* is the rower nearest the stern; the *bowman* the one

nearest the bow; and the *coxswain* the one who steers the boat. The painter is a rope fixed to the inside of the bow to fasten the boat to the shore. Having become acquainted with the various parts of a boat, we shall now give directions how to make one or two, and afterwards illustrate the different kinds of boats, and their style of rigging, &c.

#### TO MAKE A SMALL PLEASURE BOAT.

FIG. 4.



Having procured a small piece of soft deal, perfectly free from knots, say seven inches long, by two inches wide and one and

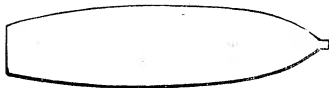
FIG 5



a half inch deep; mark out with a pencil the keel, stem,

and stern, and with a knife cut along each side and

FIG. 6.



down the stern; gradually cut away the corners to make the shape of upper portion, and then

cut away the sides, making fig. 7 the bottom of the boat, and afterwards finish off the stern (fig. 8).

FIG. 7.

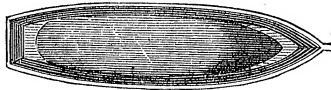


FIG. 8.



Having completed the outside work, you next scoop out the inside with a small gouge (fig. 9), leaving a small ridge to rest the seats upon; the stern must project a little above the gunwale, and the sides must have a slight sheer.

FIG. 9.



Cut out the rowlocks, and your boat will be ready for the seats (fig. 10).

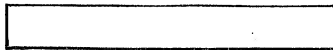
FIG. 10.



Cut out five pieces of wood about the breadth of fig. 11, and fix one in the centre and the two others at each end; the one at the bow filling up the corner. Drill or bore a small hole through the middle

FIG. 11

of the second seat for the mast, and opposite



it a corresponding hole in the bottom of the boat, and with a little sand-paper polish up the whole.

A little strip of lead, the length and breadth of the

keel, should be nailed on, to keep the boat upright; 3 oz. or 4 oz. weight would be sufficient.

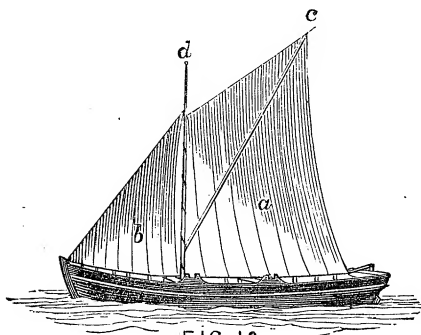


FIG. 12

*Sails and Rigging.* A boat of this description may have one or two sails: *a* is called the spritsail, *b* the foresail, *c* spritsail boom, *d* the mast. The

ropes which hold in the sails are called the main-sheet and the fore-sheet.

*The Rudder* (fig. 13). Cut out a small piece of wood to the size; take a small pin, and having cut it in two, bend it to this shape, and stick the sharp point into the upper part

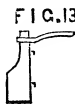


FIG. 14. of the rudder. Cut another pin in two, double it, and drive the two points into the upper part of the stern of the boat, fitting the hinge

of the rudder into it. A small hole may be FIG. 15 made through the lower part of the stern of the boat, and opposite it also in the rudder, through which a thread may be tied to keep it in its place.



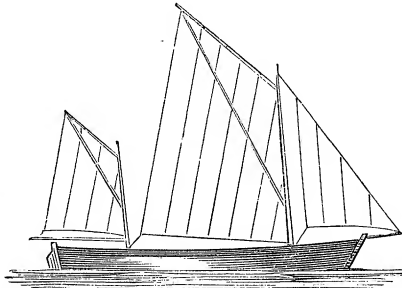
The thick end of a pin, bent a little, will make a very good substitute for a tiller.

*To paint your Boat.* The whole should first have a priming of white or lead-colour, and when this is dry, paint the inside green, the seats and sides of the boat black, and the bottom green, and then you will have a very nice pleasure-boat.

There are various styles of rigging adapted to sailing boats; but the one illustrated in fig. 12 can be most easily made by juvenile sailors, being simple to manage, and not more liable to capsizes than when a boom is used to extend the sail.

The different parts of the coast have all their favourite kinds of rig.

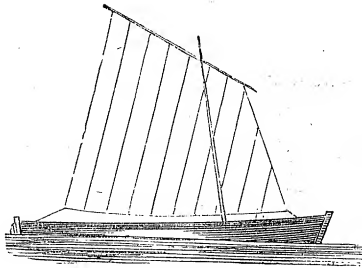
The watermen about Portsmouth use a kind of deep wherry, rigged with two spritsails and a jib; they sail very fast, and go



out to the ships at Spithead in all kinds of weather.

Ships' boats, and those used by the coast-guard have a *lugsail*, or as it is sometimes called, a *squaresail*; it

is more difficult to manage than the spritsail, and

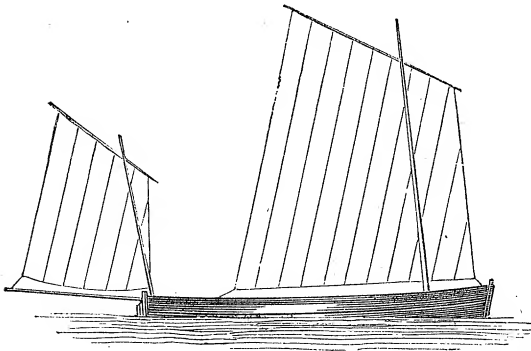


LUGSAIL.

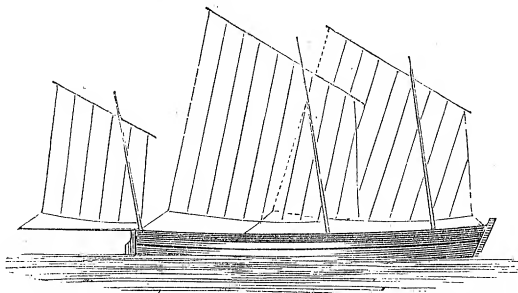
ought therefore to be only used in the hands of experienced sailors.

Boats on a large scale, rigged with two or more sails of this kind, are much used by the fishermen about the coast at Margate, Deal, &c. In the hands of skilful seamen they are excellent sea-boats, and their fine manly crews have saved the life of many a shipwrecked mariner.

BOAT WITH TWO LUGSAILS.



Having noticed the various characteristics of different boats, we shall continue the subject to the



making of a yacht, and the rigging and sailing of the various classes of vessels.

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### CUTTER.

THERE is nothing in which the professional toy-makers have more improved than in their boats and ships. It is not long since the most clumsy and shapeless things were sold in shops and bazaars, generally without form or design ; but within the last few years the trade has so much progressed in this particular branch, that the tiny craft may now be seen in all the best toy-shops, executed in many instances to scale, and perfectly correct in all their proportions. Yachts, schooners, brigs, ships, and even steam-packets, with

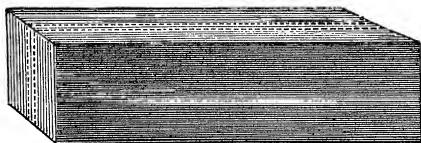
their machinery, can now be purchased complete; but the design of the present work is to teach boys to make their own toys, whereby they will gain both amusement and instruction, and save their money.

The cutter may be called the gentleman's yacht, and with it and the uses of its various parts, every boy would do well to become acquainted, as he will learn practical information that will always be of use to him through life.

To commence, you must procure a nice soft piece of deal, as free from knots or cracks as possible, say about fourteen inches long, by five inches wide, and three inches deep; take a ruler, and make with a pencil two lines along the centre of the bottom for the keel, and up the ends for the stem and stern

(fig. 1), as in the dotted lines; cut along outside these with a sharp

FIG. 1.



knife, to an equal depth of half an inch, then with a

FIG. 2.

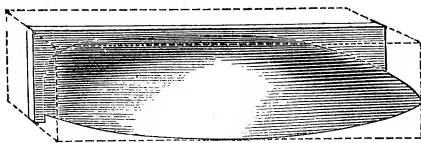
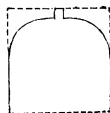


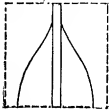
FIG. 3.





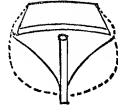
gouge scoop away the wood on both sides, forming the centre or midships first, and gradually cut away to the shape of fig. 2. The midships (fig. 3) being first

FIG. 4.



completed, you work away next to fig. 4 for the bow and stem, and then to fig. 5 for the stern; these latter portions must gra-

FIG. 5.



dually taper down towards the keel; the latter is called the run, and the former the cutwater and entrance; in yachts and clipper ships these are much finer, i. e. sharper than in other vessels. Having cut out the shape to fig. 6, you must now carefully finish off the

FIG. 6.



model, taking care that each side is perfectly true. The stem and stern must

project a little above the gunwale with a slight curve in the centre or midships, to improve the shape.

*The Hold, or Inside* (fig. 7). Scoop out with a

FIG. 7.

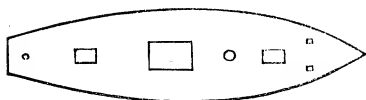


gouge very gradually, first clearing the sides all round, and then you can

hollow out the rougher portions more freely.

*The Deck* (fig. 8) must be cut out of a thin piece of

FIG. 8.



wood to the exact size of your yacht, having previously left a small ledge, as in

the dotted line (fig. 7), for it to rest upon. Having fitted your deck as neatly as possible, before securing it cut out the holes for the fore and after hatchways, companion, rudder, mast, and bitts for the windlass, then paint the inside of the hull, and fix the deck firmly, but without glue; painter's putty is the best to fill up any imperfection.

A lead keel must now be put on, the same length and breadth as your boat keel, but thick enough so as to weigh three-quarters or a pound weight.

*Main-hatchway* (fig. 9), *Fore-hatchway* (fig. 10), *Companion or Binnacle* (fig. 11). Cut out to drawings and

FIG. 9.



FIG. 10.



FIG. 11.

insert the lesser ends of each into their respective holes.

Having now completed the hull of your vessel, take a piece of sand-paper and polish it carefully all over.

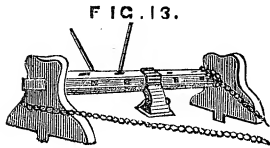
*The Rudder and Tiller* (fig. 12). Cut out to the proper shape and size, placing



FIG. 12.

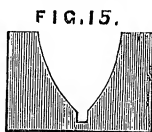
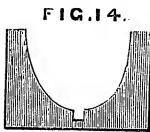
the small end through a hole in the stern; and fix it with a piece of strong thread or small string to the stern-post of your yacht, about one-third from the keel; next insert the tiller into the upper end of the rudder.

*Windlass and Bitts* (fig. 13). Cut out, join together, and fix in the two holes in the fore part of fig. 8. Previous to proceeding with the mast and rigging, you had better first paint the hull with



a priming of lead colour all over, deck, bulwarks, and hull; when dry, paint the inside of the bulwarks, deck, and hatchways, a light stone colour; the bottom to about half way up the sides, copper colour (mix a little of this with the deck colour); and paint the companion, windlass, and the upper sides of the vessel, all black.

Figs. 14 and 15 are two stands cut out of pieces of



wood to the shape of the bottom of your yacht; fix them about one-third from each end, for it to

rest upon.

## THE MASTS.

For the *Main-mast* (fig. 16) get a straight piece of wood, the length of the deck of your yacht, round it carefully, taking care to leave the projecting portions at the masthead. These are called the cheeks. The upper portion of the masts above the cheeks is nearly square, with the edges just turned; a smaller square is left on the top of all, on which is afterwards fixed the cap. The lower end must be fined to a point to fix in the bottom of the vessel.

The *Cap* (fig. 17), in small vessels, is generally made of iron, but in larger ones of wood bound with iron. To make it, get a small piece of tough wood, cut out a round and a square hole nearly close together, and cut to shape.

The *Cross-trees* (fig. 18) are also formed of tough thin pieces of wood, the longest about the length of the breadth of the deck. Large yachts have sometimes two, but mostly only one; they are secured to the top of the tressel-trees, and the shorter cross-piece and fore and aft pieces must be just large enough to fit the masthead, and are a support to the



FIG. 16



FIG. 17.

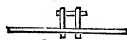


FIG. 18.

*Top-mast* (fig. 19). This is about two-thirds the length of the main-mast, and thinner in proportion, gradually tapering towards the top, on which is fixed a small round truck; there is a small square portion at the bottom, through which passes a small pin or fid, resting upon the tressel-trees; or, better still, through the fore part of the tressel-trees and the heel or bottom end of the top-mast; the top of all is called the truck.

FIG. 19.



*The Bowsprit* (fig. 20) is also quite round, except the part which goes inside the bulwarks, this should be square, and



FIG. 20.

not quite so thick as the main-mast; at the inner end is a small hole, through which passes a pin to fix it to the bitts; altogether it should be about two-thirds the length of the vessel.

*Main-boom* (fig. 21). This also should be about the length of the bowsprit, but much thinner; the inner portion is a half circle, which works round the main-mast; at the outer ends are two blocks, one above and one below.

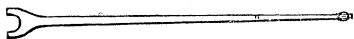


FIG. 21.

*Gaff* (fig. 22). The same shape, only smaller and thinner

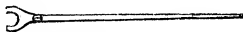


FIG. 22.

in proportion ; three small blocks are fixed on the upper part, and one below at the end.

*The Yard* (fig. 23) is a long thin spar, nearly the length of the main-mast, but not thicker than the top-mast ;



FIG. 23.

there is one block in the upper centre and two below, directly under the one above, and two small holes at each end passing downwards.

*To paint the Mast and Spars.* The main-mast from the bottom of the cheeks must be white upwards, also the lower part of the top-mast, the cap and the cross-trees, and the top-mast head, all the main-boom and gaff, a very small portion of the extreme end of the bowsprit, and all of it that is inside the yacht.

*To fix Mast and Rigging.* Having previously made a small hole in the bottom of the hull, corresponding with the one on deck, insert the lower end of the main-mast and fix it firmly, with a slight inclination backwards, and having made a hole in the front of the bulwarks close to the stem, place in the bowsprit from the inside. In large vessels an iron ring is attached to the stem, through which it also passes on the outside.

## STANDING RIGGING (fig. 24).

These ropes are so called from being generally stationary; they are much thicker than others, being used as supports to the masts: as follows:—

*The Main-Shrouds* (c) is composed of three stout ropes

are much thicker than others, being used as supports to the masts: as follows:—  
*rigging* (or composed of on each side of

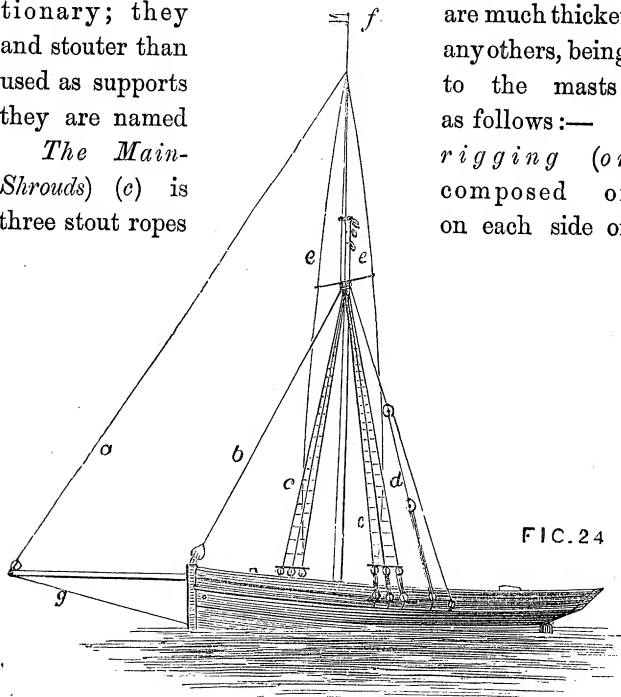


FIG. 24

## STANDING RIGGING.

the mast, passing over the tressel-trees and down

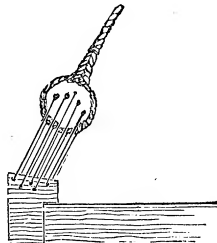
to the sides of the vessel. In large yachts, they pass round large blocks, called "dead-eyes;" these again are tightened by smaller ropes passing through another set of dead-eyes attached by iron hoops to the sides of the yacht.



*Back-stays (d)* are two ropes of the same thickness, and pass round the front of the main-mast to the back of the upper portion of the tressel-trees, half way down. They are made of the same thick rope as the shrouds. One end of the other smaller ropes is hooked to rings on each quarter of the vessel, passing upwards through the blocks above, down again, and round two other double blocks, which are tightened by smaller ropes passing through them to corresponding blocks a little in front of the other ends on each quarter.

*Fore-stay (b).* This is also made of the same stout cord; the upper end passing over the back of the top of the tressel-trees, and the lower end round a large dead-eye, and by smaller ropes attached to the stem of the cutter.

*Top-mast Rigging.* Having fixed the cap on the square of





the main-mast head, insert the thinner end of the top-mast first through the tressel-trees and then through the cap, and fix it by placing a small pin through the tressel-trees and heel, or bottom of the top-mast.

*Preventer Top-mast Back-stays (e e)* secured a little below the top-mast truck; they come down on each side, over the ends of the cross-trees, to dead-eyes on each side of the yacht.

*Fore-top-mast Stay (a)*. This is secured in the same place at the top-mast head as the preventer back-stays, and passes through a block at the end of the bowsprit to the deck.

*The Bob-stay (g)* is a support to the bowsprit, being fixed to the end, coming down to a cleet on one side of the stem, and secured on deck.

*Vane (f)*, fixed on the very top of the mast; it moves round on a spindle, and points to the direction from which the wind blows.

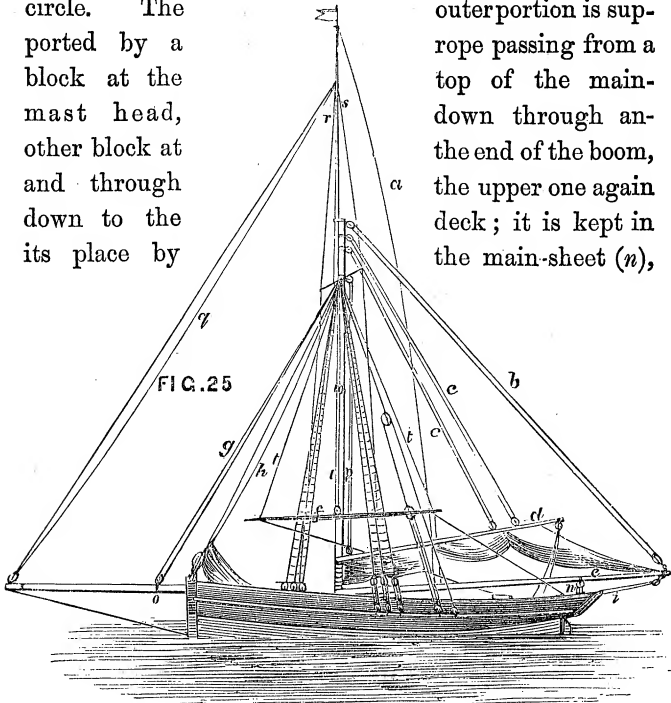
### RUNNING RIGGING (fig. 25).

The names given to ropes or halliards, for hoisting up and down the sails, &c.; they are generally smaller than the standing rigging, and pass through blocks from two to four times each.

*Main-boom (e)*. This is attached to the main-mast

by a small rope passing through each end of the half circle. The ported by a block at the mast head, other block at and through down to the its place by

outerportion is sup- rope passing from a top of the main- down through an- the end of the boom, the upper one again deck ; it is kept in the main-sheet (n),



RUNNING RIGGING.

a rope passing through double blocks, one being attached to the boom, and the other to an iron traveller on deck.

*The Gaff* (d) is also secured to the mast in the

same manner ; but as it is required to hoist the main-sail up and down, it is furnished with a double block near where it joins the mast on the upper side, and two single blocks—one near the centre, and the other between that and the end of the yard ; also a small block at the extreme end downwards.

*The Main-sail Halliards (p)* pass from a double block at the bottom of the main-mast head through another double block in the gaff, and from the upper again to the deck.

*Peak Halliards (c c)*. These hoist up the upper end of the gaff and main-sail ; they first pass from the third block below the head of the main-mast, coming through the inner block on the gaff, up again, and through the same block above, down through the outer block on the gaff, and up again through the second block on the main-mast head.

*Jib Halliards (g)*. A block with a hook is attached to a ring in the upper corner of the jib, through which passes a rope travelling from a block just in front of the cross-trees, and through these to the deck.

*Fore-sail Halliards (h)* are secured to the fore-sail in the same manner as the jib, and also hoisted by two blocks ; the upper one attached just below the cross-trees.

*Jib Top-sail Halliards* (*q*). A single rope passes from the upper corner of the sail through a small block in front of the top-mast head down to the deck.

*Gaff Top-sail Halliards* (*r*) pass through a block in the top of the mast, and down to the deck.

*Half Top-sail Halliards* (*s*) also pass through a hole in the top-mast, or through a small block there, and down to the deck.

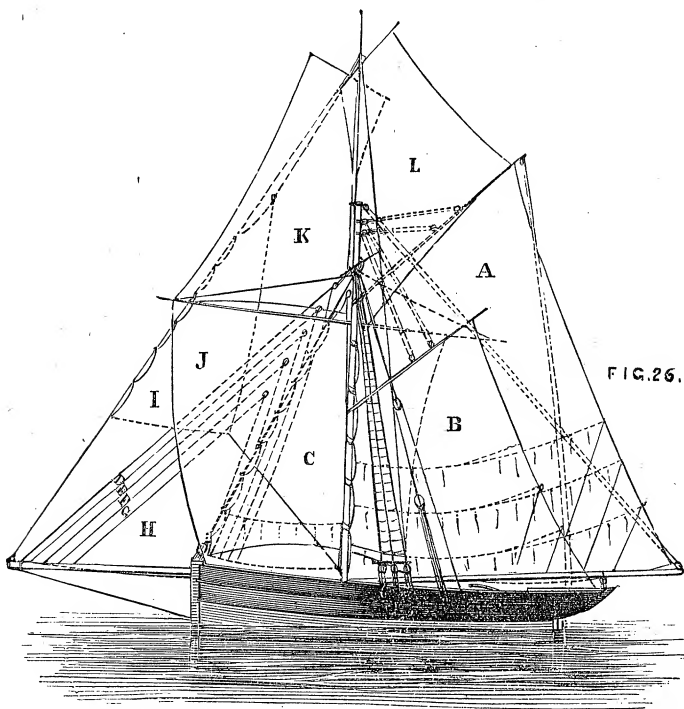
*Square-sail Halliards* (*t*) are three in number; one passes from the centre of the yard up through a block under the front of the cross-trees and down to the deck; two others are hooked to each of the upper corners of the square-sail, passing through holes in each end of the yard; they travel through blocks secured to the upper main-rigging just below the cross-trees.

### THE SAILS (fig. 26).

In all ships the sails are made of stout canvas, sewn together in long strips; a rope is likewise sewn all round the outer side, to give them additional strength. For your little yacht white calico will best answer your purpose.

*The Main-sail* (*A*) is the largest; the upper portion is laced through a series of small holes to the gaff;

being securely fastened at each end, it is attached to the mast by hoops which travel up and down.



THE SAILS.

*The Storm Main-sail (B)* is made in the same way, only smaller altogether.

*The Fore-sail (c)*, like the main-sail, is attached to

hoops which travel up and down the fore-stay, and is hoisted up by blocks placed under the cross-trees.

*The Jib* (D) is a sail on the bowsprit; the lower end is hooked to a ring called a traveller, and hoisted up by blocks at the upper corners to others above the cross-trees.

*Storm Jibs* (E, F, G, and H) are made the same as the jib, but smaller in proportion.

*Jib Top-sail* (I); same shape as jib, but also smaller; it is laced to the fore-top-mast stay, and hoisted up to the top-mast head, the front corner being secured by a rope passing through a small block at the end of the bowsprit, and from there to the deck.

*Square-sail* (J), hoisted up by a block in the centre, passing through or under the cross-trees, and down to the deck, and one at each of the upper corners, through the ends of the yard, to the main-mast head or top of main-rigging, and down to the deck.

*Half Top-sail* (K), hoisted up to the top-mast head, the outer lower corner passing through a hole at the end of the yard, and again through another block under the centre of the yard, and down to the deck; the inner lower corner of this sail is also brought down on deck.

*Gaff Top-sail* (L), also hoisted up to top-mast head, the outer corner passing through a block or hole at the

extreme end of the gaff, passing under it to another block near the mast, and down to the deck; the inner lower corner also passes straight down by the mast.

*Reefs.* A series of short cords for the purpose of tying in a portion of the sails; they are generally three rows in the main-sail and one in the fore-sail of yachts; none of the other sails have any.

*Reef-tackle.* These are ropes to haul out the ends of the respective reefs to the main-boom, while they are being secured.

*Sheets.* Used to regulate the angle at which the sails have to be set to the wind, in cutters.

*Main-sheet* is reeved through double blocks; one is attached to the main-boom, and the other to a "horse" or iron rod on deck.

*Fore-sheet.* This also travels on an iron rod to either side of the vessel.

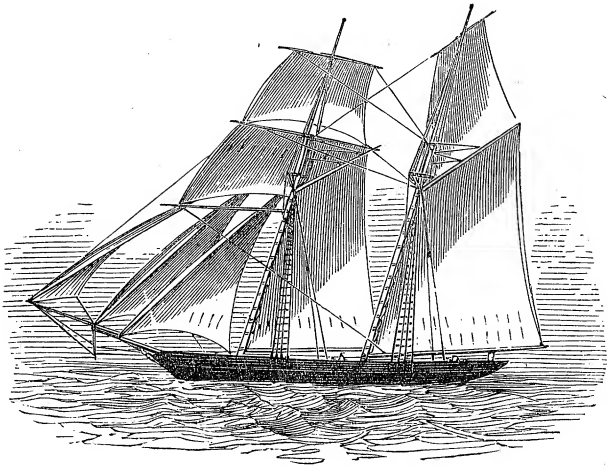
*Jib-sheets.* This sail has two—one on each side.

*Gaff Top-sail-sheet* is reeved through a sheeve at extreme end of the boom.

*Half Top-sail-sheet* passes through a block at the end of the yard; through another block below the centre of the yard, and down to the deck.

*Jib Top-sail-sheets.* This sail, like the jib, has two sheets—one on the port, and one on the starboard side.

## SCHOONER.

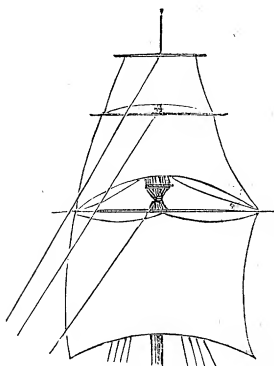


NEXT to the cutter—the schooner is the favourite rig for yachtsmen ; but it is more adapted for vessels of larger size. The schooner has two masts, and they are in two parts each, the same as the cutter. The lower portion is called the fore-mast, and the after one the main-mast ; the upper portions are called the fore-top-mast, and the main-top-mast ; they are joined together as in the cutter, through a cap, and the



bottom of the top-masts secured to the tressel-trees, the main-mast being a little longer than the fore-mast.

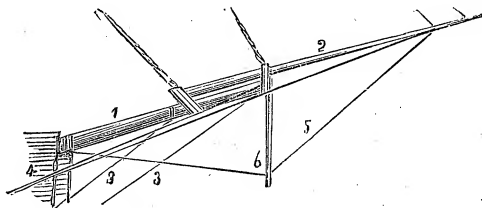
The main-mast is rigged similar to the one mast in a cutter, having a main-sail and boom, and over all a gaff top-sail. On the fore-mast it has a fore and aft fore-sail ; in front of the fore-mast, fore-top-mast, and fore-top-gallant-mast it has three square yards, one to each ; the lower one is called the fore-yard, the one above it the fore-top-sail-yard, and the upper one of all is the fore-top-gallant-yard. The sails belonging to these



are laced on the fore-top-sail and fore-top-gallant-yards, the square-sail being only used in going before the wind, and it is hoisted up to the yard from the deck. When the square-sail is not set, and the vessel sailing with a side wind, the fore-stay-sails and jib are set, as shown in the engraving.

Another distinctive feature between the cutter and the schooner is the bowsprit, where instead of being in one

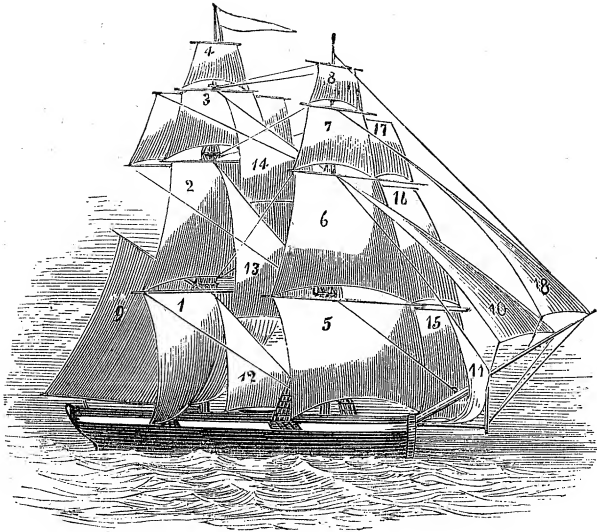
piece, as in the former, it is in two ; the part attached to the bow is called the bowsprit (1) ; there are two



caps fixed on this, through which the outer portion, called the jib-boom (2) is hauled out. Two bob-stays (3) support the bowsprit to the cut-water, as well as two or more ropes, called guys or shrouds, which lead from the end of the bowsprit to the sides of the vessel (4), the jib-boom being in like manner supported by guys, with the addition of a stay (5, 6) through the martingale, or dolphin-striker, to the bow of the schooner.

Vessels of this description are sometimes rigged without yards, occasionally using one large square-sail. The masts generally rake a little aft, and they sail very fast, particularly on a wind.

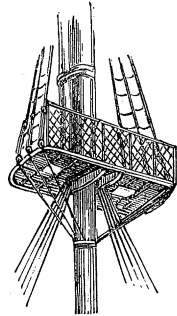
## BRIG.



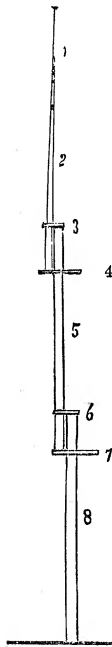
BRIGS and ships are distinguished as square-rigged vessels, the principal sails being set across the masts, instead of fore and aft. Like the schooner, they have two masts; the difference being that each mast has three distinct parts in the place of two, the lower

portions being called the fore-mast, and the after one the main-mast. The various parts are joined together

similar to those already described in cutters and schooners, only the lower masts have in the place of two cross-trees, two round tops; they serve as greater supports to the main-top-mast, &c. Above the main-top-mast is the main-top-gallant-mast, and this is



fixed to the former by a cap and cross-trees similar to those already described for a cutter:—1, royal-mast and truck, on which the royal is set; 2, top-gallant-mast, on which the top-gallant-sail is set; 3, the cap; 4, tressle-trees and cross-trees; 5, top-mast, on which the top-sail is set; 6, cap; 7, round top, tressle-trees, &c.; 8, main-mast.



Both masts are alike, the after or main-mast being a little the longer.

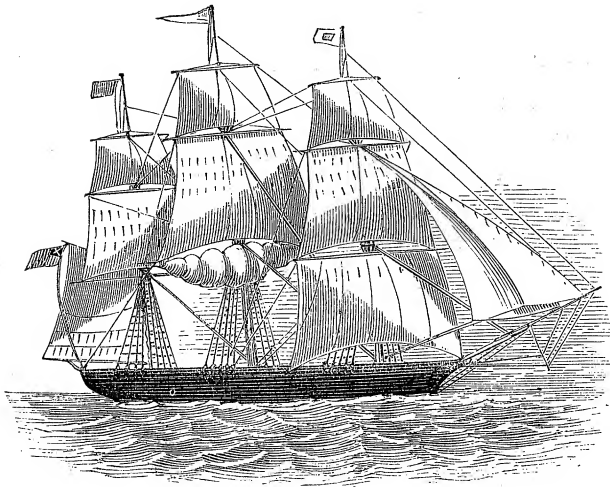
The sails of a brig are—1, the main-sail; 2, main-top-sail; 3, main-top-gallant-sail; 4, main-royal; 5, fore-sail; 6, fore-top-sail; 7, fore-top-gallant-sail; 8,

fore-royal; 9, spanker; 10, the jib; 11, fore-top-mast stay-sail; 12, main-stay-sail; 13, main-top-mast stay-sail; 14, main-top-gallant stay-sail; 15, fore-studding-sail; 16, fore-top-mast studding-sail; 17, fore-top-gallant studding-sail.

The same are used on the main-mast, and are called the main-top-gallant studding-sail, &c.; these sails, however, are only used occasionally, in light winds and fair, as well as the flying-jib, 18.

Brigs are much used in the merchant service, and in the coasting trade. Several thousands of this class of vessels are used in the coal trade alone. The celebrated Captain Cook first went to sea in a small brig, which, until lately, might be seen as a river police station, moored in the Thames near Somerset House. Robinson Crusoe, our young readers may remember, also first sailed in a brig.

## CLIPPER SHIP.



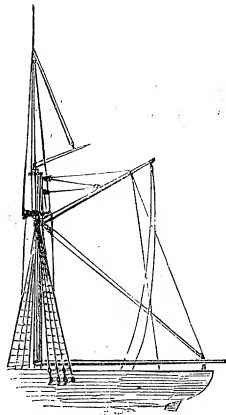
THIS is the manner in which all the largest ships are rigged; formerly it was the custom to have very square-built vessels with very long masts; but in the modern clipper ships they are much shorter in proportion to the extra length and sharpness of the vessel; they also rake aft a little more. A ship has three

masts, and all square-rigged. The description already given of a brig will answer for a ship, the first two masts being the same, as well as the sails and their respective names; the third mast is the same, but much shorter—it is called the mizen-mast, mizen-top-mast, mizen-top-gallant-mast, and mizen-royal. The sails are the mizen-top-sail, mizen-top-gallant-sail, mizen-royal, and spanker.

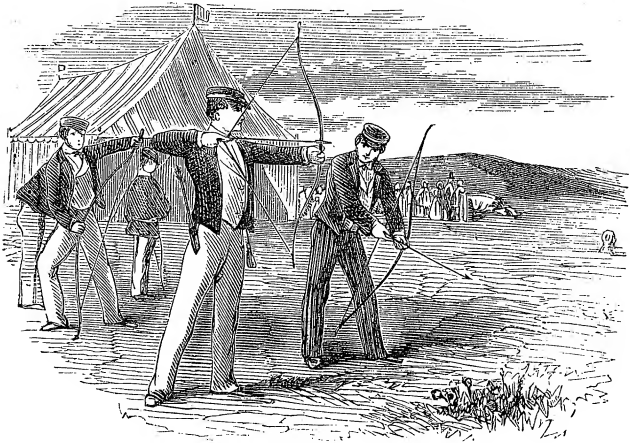
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### A BARK

Is also a three-masted vessel; but the difference from a ship is in the rigging of the mizen-mast, which instead of having square sails and yards on all the three masts alike, the after one is rigged exactly like a cutter, being in two pieces, with cross-trees, and carrying a gaff-top-sail and fore and aft mizen; they are preferred in the merchant service, as they do not require so many hands to work them.

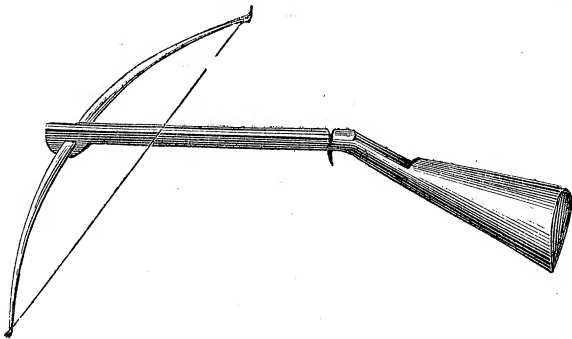


## ARCHERY.



## THE CROSS-BOW

Was a popular weapon in England; the arrows

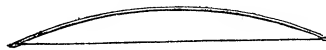




shot from it were called *quarrels* or *bar-bolts*, which is synonymous with the arrow of the long-bow; it was fastened to the stock and discharged by means of a catch, or trigger, which most probably gave the notion of the lock of the modern musket. It is said they were used at the battle of Hastings, and Harold's death was caused by one of them. After the introduction of gunpowder the science of archery declined as a military art, but from the glory and renown which Englishmen achieved by the use of the bow and arrow, it is to this day practised as a healthful and elegant accomplishment.

*How to make Bows and Arrows.* The most easy method is to take a common cane, cut a small notch near each end, and tie a piece of small cord or twine thereto, giving it a slight curve (fig. 1). The best bows are made of yew-

FIG. 1.



tree, laburnum, acacia, or thorn. The wood ought to be free from knots; two pieces are joined together, the back being of different wood to the front, and the grain reversed. The flat or outward part of a bow is called

FIG. 2.

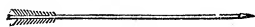


its back, and the inward part the belly; the proper

length for a youth should be from four and a half to five feet; the most finished have their ends tipped with horn (fig. 2).

*Arrows* are generally made of white light wood, such as deal, ash, &c.; the most finished are varnished. The length of the arrow must be in proportion to the size of the bow; the nicks of the best are cased with

FIG. 3.



horn, and should fit the string exactly. The principal thing to be attended to is that they are perfectly straight, and the feathers can be tied with a piece of strong thread, the lower portion being about half an inch from the end; a grey goose feather is the best of all for the purpose.

It is not necessary for the young archer to have all the equipments of a complete bowman; our object being to give such directions as will enable him to make a bow and arrow, and use them properly. Having made these, he must have an object to shoot at, and that is generally a target (fig. 4). They are made of plaited straw bands wound round a centre and sewn together; over

FIG. 4.



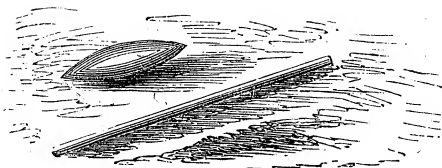
this is placed paper or canvas, and painted white; a series of four circles is then painted upon it at equal

distances, the inner one is called the bull's-eye, and the great object is to hit this if possible.

*Position in shooting* (fig. 5). The archer taking his stand before the target, his face being a little inclined to the right, turning slightly round so that his eye and the target are in a direct line; the body perfectly upright, with the left foot slightly in advance and holding the bow horizontally in the left hand, the fore-finger holding the arrow secure on the wooden part of the bow, in the centre—the right hand fixing the nick of the arrow on the string where it is held fast between the first and second finger, the fore-finger of the left hand is next removed from the arrow, the centre of the bow grasped tightly, gradually raise the bow with the left hand, at the same time pulling the string by the right, and when the arrow is drawn about two thirds of its length, the nick of it should be brought close to the right ear, and the aim taken; this must be done quickly, and it can only be done well by practice.



## TIP CAT.



THIS is a common sport among boys, more particularly in the country; it has a great advantage in being easily made with a common knife. The piece of wood which is called the "cat" is about six inches in length, and from one and a half to two inches in diameter, gradually tapering from the middle to each end.

The cudgel with which the game is played is about the length and thickness of a common hoop-stick. The player taking this in his right hand strikes one end of the cat smartly, which causes it to rise in the air, high enough to be struck before it again falls to the ground.

There are several ways of playing the game of cat. The most common is to make a ring, selecting a piece of flat ground; one boy holds a piece of string that will make the circle required at the centre, and another one takes the extremity of the line, and with a piece of chalk he walks round and forms the ring; the

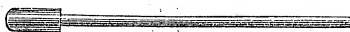
player takes his stand in the middle, and his business is to strike the cat outside the ring; should he fail in doing so he is out, and the next player takes his place. If successful, he judges with his eye the distance the cat is driven from the centre of the ring, and calls for a number to be scored to his side; if the number named be found to exceed the same number of lengths of the stick, he is out; if, on the contrary, it does not, he obtains his call.

Another game is to make six or eight holes in a circular direction, and at equal distances from each other; at every hole the players take their stations, with their sticks; one on the other side tosses the cat to the nearest batman, and every time the cat is struck the players must change their positions, and run once from one hole to another. If the cat is sent a great distance, they continue to run in the same order claiming a score towards their game every time they change from one hole to another. If the cat is stopped and thrown between any two of the players, and it crosses him after he has left one hole and before he reaches the next, he is out.

## POP-GUN.



SELECT a straight piece of an old branch of the elder-tree ; cut it about six or eight inches long. The pith in the inside is then forced out with an iron ramrod, or one made of hard wood turned or cut to this shape.

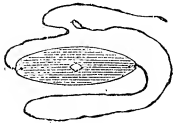


*The Pellets* are made with moistened tow or brown paper ; when the pellet is prepared it should be laid over the mouth of the gun in sufficient quantity to require squeezing or plugging in. The first pellet must be driven through the gun to its other end, and the second again driven in a similar manner. When forced through the gun, the air between the pellets being incompressible beyond a certain point, forces out the lower pellet with a loud pop, from which the name of pop-gun is taken.

## SLING.

THIS, which is a mere toy in modern days, was in ancient times a formidable weapon of war, and as late as the battle of Hastings, was used in the English army. It is extremely simple in its construction, and even now, by dexterous and expert throwing, its results are astonishing.

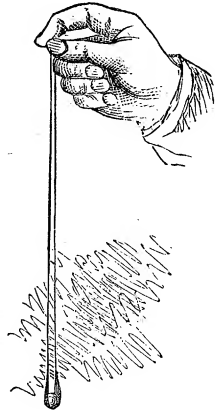
It is made of a leathern thong, broadest in the middle, and tapering off gradually towards the ends, sometimes a small hole is cut in the centre to



fix the stone upon. A piece

of strong string or small cord is fastened through a hole at each end, one of which has a loop at

the end which is put on to the middle finger of the right hand, and the extremity of the other string is



held between the fore-finger and thumb; it is then whirled round and round until it has gained sufficient impetus, and suddenly letting go the string held between the finger and thumb, the stone is shot forth with great velocity.

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### STILTS.



THIS is a favourite out-door amusement among boys in many parts of England at the present time. To a casual observer it appears rather a dangerous sort of sport, but it is not so; with a little practice it is extremely easy. Many of the shepherds in the desert of Landes, in the south of France, use them with perfect freedom and great rapidity; constant



habit enables them to preserve their balance so well that they run, jump, stoop, and dance with the greatest ease and security. They are by their stilts enabled to see their flocks at a much greater distance, over a perfectly flat country, their feet being protected from the water during the winter, and the heated sand in summer. In addition to the stilts, they use a long staff, which they carry in their hands; this guards them against an accidental trip, and forms a third leg when they require to rest.

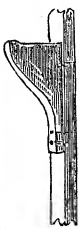
*To make Stilts.* Procure two poles about six or seven feet long, and nail on a strap of leather, about one third from the bottom of each; into these the feet are placed, the poles being kept in a proper position by the hands, and moved for-

ward by the action of the legs. A wooden step, however, is better, and it gives greater firmness to the tread; it is nailed or screwed to the poles. But the best of all are those that do not reach the hands, but are secured to the leg just below the knee by a strap, the footstep being the same as fig. 2. With the addition of a long staff, any boy could soon manage to walk in safety upon them.

FIG. 1



FIG. 2



## ANGLING.

## RODS, LINES, FLOATS, HOOKS, AND BAITs.

REVISED BY J. HARRINGTON KEENE, AUTHOR OF  
"THE PRACTICAL FISHERMAN," ETC.

ANGLING is almost an instinct with most boys, particularly those brought up in the country, and as every boy may be an angler if he pleases, it will be useful for him to know how he may make his own fishing tackle.

*Rods.* These are made to great perfection, and may be had of every variety from the professional makers, but they are generally expensive for a boy. With a little trouble and skill he will be able to make one that will answer his purpose almost as well as the most costly. For the very young angler a hazel or nut stick will make a good rod for fishing for small fish, such as sticklebacks, minnows, &c. Having selected as straight a one as possible, it should be dried thoroughly, or seasoned, as it is termed, by *hanging* it by its thinnest end to some support in a warm place. This seasoning process will occupy a few days only if the stick be placed near the kitchen fire. Should it not be quite straight, a weight attached to the end while it hangs will generally make it so. Of course this should remain attached

for a time sufficient to effect the desired purpose. A sharp knife is all that is required to polish it into shape.

A good rod may be made with but little real trouble and some care. Go to the nearest plantation or wood (if you are not trespassing, of course), and cut an ash plant or stick; let it be at the largest end not more than  $\frac{3}{4}$  inch in thickness, and as tapering as you can find. Cut it to about three feet in length; carefully level down the knots and peel off the rind, then hang it to dry as before directed. When it is quite dry, get a piece of sand-paper and smooth it very nicely. Next cut a nice hazel stick of about five feet, taking care that its largest end corresponds in size with the smallest end of the ash. Treat this as the ash stick was treated. You have now two nice smooth pieces of wood. Now cut the ends as shown in the engraving (fig. 1). Do

FIG. 1.



FIG. 2.

this with great care, until when they are placed together they may fit quite closely and truly. Next take a length of sewing silk, of the rather stout kind known as twist—or sewing thread will do, though not so well—

and fixing one end to a nail take a piece of cobblers'-wax between your finger and thumb, and rub it on the silk till it is thoroughly waxed. Now take the two joints, and placing together, wind on the silk from one end of the joint to the other, still keeping the silk attached to the nail, and turning the *rod* round instead of turning the silk round the rod. This is the easiest way of binding, and enables one to do it easily. When you get to near the end of the joint, cut the silk, and tie it as shown in fig. 2. This tie is made as shown in fig. 3, which is shown loose, to make it perfectly plain to the learner.



FIG. 3.

We have now two parts of the fishing-rod completed, with the exception of the varnishing, which will be referred to presently. The top is the next consideration, and it is almost absolutely necessary that this be of a pliant sort of wood—lance-wood for preference. Now, in making this, due regard should be given to the kind of fish one desires to catch—for large fish, such as pike and big perch, it should be of a stouter build than that necessary for carp, roach, and dace. The hazel joint ought to be carefully tapered, so as to join, in due proportion with the top joint, and the top joint of lance-wood may be shaved to a more or less fine

point with a sharp knife, and rasped or sand-papered till perfectly smooth and tapered. This requires care and a little thoughtful trouble, but is by no means a difficult task for a lad to undertake. The top joint is bound like the other. Having so arranged the three joints that they taper symmetrically from end to point, it is advantageous to affix some rings, that the line—if one is possessed of a winch—may run freely. The best form of ring for the body of the rod is shown in fig. 4, and the best kind for the top is seen at fig. 5.



FIG. 4.

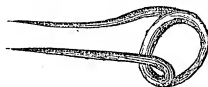


FIG. 5.

Now both these rings can be easily made from a few pennyworth of brass wire, and a pair of common tweezers. The ingenuity of the reader will readily find this so.

Having bound the rings neatly on, the next thing is to varnish the rod. For the bindings the following varnish is best:—Dissolve an ounce of gum-shellac in about three times as much methylated spirits of wine, and apply it with a camel-hair brush or feather tip. Let it dry in a warm place. For the rod the best varnish is coachmakers'; two coats will be sufficient.

Dry in a warm place, hanging the rod up by the top ring.

Thus we have a rod quite as generally useful for all round fishing as a much more elaborately fitted one. Its chief disadvantage is that it is in one piece ; still it is easy enough to drive in the wall of some out-building half a dozen long nails to support it when not in use.

It is almost impossible for a boy to satisfactorily make a ferruled rod like the London manufacturers, because the latter use a lathe, and make the fittings by machinery.

The best rods are made of bamboo cane, greenheart, or hickory and lancewood, with tops of various lengths : twelve feet will be found a convenient length for these, but they are sometimes made to fourteen and even eighteen feet long. The great point is to have a rod as free as possible from imperfections, and tapering gradually from the butt-end to the top. They are often fitted as walking-sticks, or made to pack in canvas bags.

*Lines* are made of twisted silk, or silk and hair, and of flax. Silk is the best material. Brown, green, and white are the best colours.

It is obviously impossible for boys to make their own lines, as they require very great dexterity and special machinery. A few pennyworth of red carpet thread makes a capitally strong line, if it be dressed with the

following dressing : equal parts of gold size and boiled linseed oil. Stretch out the line, and apply the mixture with a piece of chamois leather. Water-cord is also a very good line in lieu of silk for the larger and stronger fishes. It must be dressed two or three times with the above composition, and thoroughly dried each time before it is used.

*Gut lines*, or lines of hair, are easily made. The gut should be soaked in water before tying, and then tied with the following knot (fig. 6)—so also, indeed, should hair. The engraving exhibits it tied loosely; by drawing the long end it becomes very secure. The knot is termed "Fisherman's."

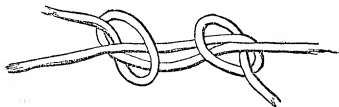


FIG. 6.

It is necessary to use a stained gut line sometimes : a pale bluish tint is the best generally. This stain is easily made of ordinary writing-ink mixed with an equal quantity of boiling water. Steep it while the liquid is hot. Hair should be from the tail of a young and healthy horse, and gut ought to be as round as possible.

*Floats.* For small fish and slow waters quill floats are the best; they are made of various sizes, the ends being painted blue or red.

Turkey, swan, and goose quills are chiefly used for

quill floats. To make them: take a quill, and having stripped off the feathers, bind a little waxed silk round the middle, and varnish this with shellac varnish to prevent water getting inside the quill, as is sometimes the case unless this precaution be taken. A little ring may be attached to the top and bottom (see fig. 7), and the binding should be touched with sealing-wax varnish, made by dissolving chips of the best red sealing-wax in methylated spirit.

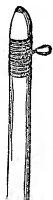


FIG. 7

*Tip-capped Float* is one of the best that can be used; it is made of quills or reeds for the middle, and ivory or tortoise-shell for the top and bottom—narrow at the ends, and gradually increasing in circumference to the middle. It is almost impossible for a boy to make these himself.



*Cork Float.* Take a sound cork, and bore it through the middle with a red-hot iron, put in a quill to fit it, and cut it to the shape of a pear; rasp it with a fine rasp, or with very rough glass-paper, and then with fine, until the surface is perfectly smooth. Then fill up the pores of the cork with a little white lead, rubbed in, and paint any colour preferred. Varnish with coachmakers' varnish. Or if you fancy it

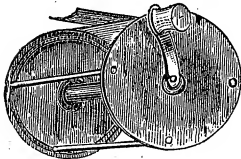




plain, simply varnish once or twice without painting at all. Some anglers never use a painted float, thinking that it scares the fish.

*Shooting the Line.* The shots are to make the float partially sink in the water; place them all together, within three inches of the bottom of the loop of the gut, fix the loop of the gut to which the hook is tied, and place two very small shots about two inches from the hook, which will cause the bait to swim steadily, and the others above the first loop.

*Winch.* This is a necessary addition, to large rods particularly; it enables you to play your fish with more ease and certainty, and to reach places which, without its assistance, you could not attempt. Winches may be had of various constructions at the tackle shops.



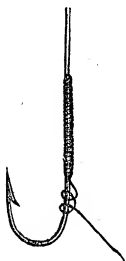
Though a brass winch, such as is figured, is compact and neat in appearance, the wooden reels, if properly made, are cheaper and quite equal to the former in utility. The line should never be allowed to remain wet upon them, however, as they readily warp and become quite useless.

*Hooks.* There are five kinds of hooks:—The Sneck-bend, the Limerick, the Kendal, the Kirby, and the

Pennell. There is a great variety of opinion as to the relative merits of each among the best anglers, some preferring one to the exclusion of the others. The Kirby, or the Pennel, however, are two that we can recommend: either shape being well adapted for hooking and holding the fish. The hooks are numbered from the largest (No. 1), to the smallest (13), according to size. The hooks most suitable for the following fish are—

Minnow . . . . .	13	Bream . . . . .	6
Bleak . . . . .	13	Perch . . . . .	4
Gudgeon . . . . .	12	Eels . . . . .	2
Grayling . . . . .	10	Carp . . . . .	3
Roach . . . . .	10	Tench . . . . .	3
Dace . . . . .	9	Trout . . . . .	3
Chub . . . . .	5	Barbel . . . . .	2
Ruff . . . . .	9		

In tying on hooks, you must use strong but fine silk; it must be as near the colour of your bait as possible. If you are tying many hooks, it is well to liquefy your wax in this way. Take a little methylated spirit, and having broken the wax into chips, pour the spirit over it till quite covered. This can be done in an egg-cup for preference. When the wax is of the consistency of treacle it is ready for use, and will be found to completely permeate the silk, and thus render it exceed-



ingly durable. Bind the hook from the end of shank to near the bend, and finish off either with the tie advised when speaking of rods, or with two half-hitches (fig. 8).

*Plumbing the Depth.* Much of the success of the



angler in bottom-fishing depends upon his knowing the proper depth. This is ascertained by a plummet; they are of two kinds. The folding plummet will be found the most convenient; it is made of a slip of sheet-lead folded up. To fix it on the line, unfold it about two inches, pass the hook over the side, and then fold the plummet up again. When the plumb-lead touches the bottom, and the top of the float is even with the surface of the water, you will have the correct depth.

The foregoing articles of tackle are specially adapted for the capture of such fish as the roach, carp, tench, barbel, &c. We now proceed to give a list of the various other articles in use by the ordinary angler for fish of greater value, such as pike and trout.

*The Gorge Hook.* This is a hook which is weighted with a conical cylinder of lead. It can be thus made by boys so as to answer every requirement. Take a length of gimp, and tie a brazed double hook to it, as directed before. Then obtain some drilled shot, of large and graduated size, and thread them on the gimp,

passing the largest down on to the binding of the hook, and the next successive sizes in rotation, till about two inches of gimp next the hook are clothed. Then secure the last small shot with a turn or two of silk binding, and you have a gorge-hook, if anything superior, because of its flexibility, to those which consist of a solid piece of lead, and usually sold at the shops. A baiting-needle is necessary to bait this hook. It is attached to the gimp, and is passed from the head to the middle of the tail of the little fish selected for bait; the lead is then drawn into the stomach.

*The Trace.* This is used when spinning with a fish-bait for pike and trout, &c. It is mostly of gimp, and consists of a length at intervals in which are swivels—brass for preference, because they do not rust—and a sinker. Its length is usually about three feet.

*The Sinker* is a cylinder of lead, bored through the centre to admit of its attachment to the *trace*. It ought to be painted green or some neutral colour.

*The Leger.* This is also a lead of flat, coffin-like shape, and is used when it is desired to fish for barbel, &c., on the bottom. It is perforated, and is threaded on the line when in use.

*The Flight.* A “flight” of hooks is an assemblage of triplets, i. e. three hooks placed in a triangular

position and soldered together, or of single hooks arranged for the capture of pike.

*The Paternoster.* This is a piece of tackle specially used for perch capture. It consists of a length of three feet of gut or gimp—the latter usually—whereon at intervals of a foot single hooks are attached on gut at right angles. A lead plummet is connected with its lowermost end. It is baited with live minnows or worms.

*The Gaff* is sometimes used in place of a landing-net (figured further on), and consists of a steel hook of large size, like a meat-hook, mounted on a stiff handle. It is used to secure large pike and salmon after they have been tired out by the angler.

*The Creel* is a specially constructed basket, for holding tackle or fish.

*Baits.* Worms are the most natural baits, and nearly every fish will take them. If the river is at all muddy it is the best bait that can be used. The principal are—

Lob-worm and Dew-worm.  
Brandling.  
Tag-tail or Cockspur.  
Cow-dung Bait.  
Caterpillar.  
Gentles.  
Caddies.

Grasshoppers.  
Wasp-grub.  
Beetles, Cockroaches, &c.  
White Bread-paste.  
Cheese-paste.  
Sweet-pastes.  
Ground-bait.

*The Lob-worm and Dew-worm* are familiar to every schoolboy. The lob is commonly known as the large earth-worm, with bands round it close to the head; and the dew-worm is of the same species, but without these bands. The latter is preferable for a hook-bait, and the former best for ground-bait. These worms are to be found in summer at night-time, after or in the rain. Take a lantern, and seek for them in any ploughed field or on any lawn. They can be brought up to the surface in the driest weather, on any lawn, if it be well watered just before dusk.

*The Brandling* is a handsome worm, with bright yellow bands, and is found in old manure heaps. It is of most offensive smell.

*The Tag-tail or Cockspur* is a worm of bright coral appearance, with a yellow tip to its tail, and is found wherever the brandling appears.

*The Cow-dung Bait* is a larvæ or grub of a species of beetle. It is found under old and dry cow-dung in cattle pastures. It requires keeping in bran for a day or two before using.

*The Caterpillars* of various butterflies and moths, especially of the tiger moth, are always acceptable to fish.

*The Grasshopper* is an excellent bait for chub and

trout. Cruel as it may seem, it is best to detach the jumping legs as they are caught. This is not actually cruel, as the creature frequently sheds its legs itself as it seeks to escape.

*The Wasp-grub* should always be prized as a bait for roach, chub, tench, carp, &c. The grubs should be detached from the comb and placed on a colander, and boiling water poured over them for a few minutes, and then thrown into bran to cool. This renders them tough, and less liable to drop off the hook.

All the *Pastes* are exceedingly useful, and are made chiefly with flour or bread—preferably the latter. A little honey or aniseed is often very effective with roach.

*Ground-bait* is composed of raspings, stale bread, carrion, gentles, bran, and, in fact, anything of this nature. It should not be too copiously thrown in.

*Gentles* are the larvæ offspring of the blow-fly. Liver produces the best.

*Caddies* are the larvæ of certain flies which deposit their eggs on the water. They build themselves a shell of sticks, pebbles, &c., and are a very deadly bait for almost any fish that swims.

*To scour and preserve Worms.* Procure a quantity of fresh moss, wash out all the earth, and squeeze it,

but not too dry ; press it tightly down in a jar, and throw the worms upon it. Gentles should be thrown into a mixture of damp sand and bran, to clean them ; and they will be ready for use in two days.

### FLY-FISHING.

To be an expert fly-fisher is generally the ambition of the most enthusiastic angler ; it requires much more neatness and skill than for bottom-fishing, and it is assuredly more gratifying in its results. The learner, if possible, should go out with some experienced angler, watch his movements closely, and imitate them as well as he can. He should begin with the line only, not putting on any flies, trying a short line first, and lengthening it gradually ; the rod should be carried gently back, without effort, and thrown forward again when the line has reached its full extent behind him ; great care must be taken in doing this, or the fly will be whipped off when he comes to use one. After attaining tolerable proficiency in this, the learner may then put on one fly, and fish for a while with that, adopting two or three when he is able to use them properly. The great art is to drop the fly lightly, that it may resemble a natural fly settling upon the water.



Suffer the line to float gently down the stream, at the same time dragging it towards you to your left hand.

The best time for angling with the fly is when there is a gentle breeze upon the water—south and west winds are to be preferred. The best time of day is morning or evening. You must be careful not to go near the bank, for fish are very quick of sight. If you see a rise, throw your fly about half a yard above, and let it fall with the stream, watching it narrowly, and strike the moment the fish rises; when you have hooked one, play him carefully, keeping up his head, and running him down the stream, at the same time drawing him towards you; a smaller fly is required when the water is smooth.

*The materials required to make Artificial Flies.* Feathers of the grouse, snipe, duck, bittern, golden plover, jay, starling, and peacock. Furs of all colours, from the skins of squirrels, moles, and water-rats; camel's hair, hare's ear, and fur from the neck of the marten; mohairs of different shades, and camlets; black horse-hair; hog's down, dyed various colours; gold and silver twist, and sewing silk of all colours and thicknesses; a pair of fine-pointed scissors, and small pliers.

## HOW TO MAKE AN ARTIFICIAL FLY.

It is extremely difficult to impart directions how to make an artificial fly, but if the reader is very careful not to miss the meaning of what is here set forth before him, and if he has carefully gone through the instructions for making coarse fish tackle before given, he will be quite competent to attempt to imitate the natural insect he finds by the water-side, so as to catch trout.

The following shows how to make a *plain Hackle-fly*, that is, a fly which is, strictly speaking, not an imitation of anything, but is, notwithstanding, very often attractive to fish. A hackle-fly looks as if it were all legs, and probably is supposed by the fish to be an insect with buzzing wings.

Take your hook between the points of the thumb and forefinger of your left hand. Hold it firmly by the shank, with the tip of the shank slightly projecting beyond your finger-end towards the right. The back of the shank is to be upwards. Take your waxed silk, holding the left point of it as you do the hook, and whip it three times tightly round the shank of the hook towards the end—that is, in a contrary direction to the bend. Hold down your silk out of your way by placing

it and holding it between the middle and third fingers of your left hand. Then take your link of gut with a single knot at the end, and having moistened it in your mouth, place the knotted end parallel with the shank, and between the shank and your left forefinger, and let the gut pass down the shank a little more than half way towards the bend. Take your silk between the forefinger and thumb of your right hand, and whip it tightly round the shank and gut three times in the direction of the bend. Put your silk as before between the middle and third fingers of your left hand. You have now finished the first operation, that of attaching the hook and gut together, and bear in mind that in dressing all flies this operation is thus performed.

Now take your hackle feather, and having denuded it of the down, on either side its stem, place it against the shank of the hook on the side nearest your body, with its root pointing towards the bend of the hook. Then, and in the same direction, whip the silk sharply three times round the hook, gut, and end of the feather, and cut off, with fine-pointed small scissors, any of the root that remains. Having done so, take the feather by its point between the thumb and forefinger of the right hand, and wind it in close laps five or six times—the number of laps to be proportioned to the size of the

hook and fly—down the shank towards the bend, then make two laps of the silk over the point of the feather, cut away with your scissors what remains wavered by the silk of the point of the feather, and, lastly, waxing your silk again, fasten with two half-hitches opposite the point of your hook, or just where the bend begins.

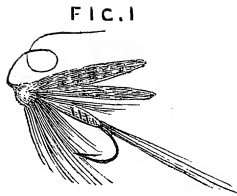
These directions, if followed out, are the foundation of fly-tying. After the learner has learned to make the above with ease, he can readily teach himself the rest.

The following is a recipe for the best wax for fly-tying. Take two ounces of yellow resin, one dram of beeswax, put them in a pipkin and let them simmer for ten minutes, then add a quarter of an ounce of lard, and simmer for a quarter of an hour longer. Then pour it into a basin of cold water, and while yet warm work it with the fingers to give it tenacity. Judson's dyes are the best and simplest for dyeing feathers, silk, &c.

The fly at the end of the line is called a stretcher, and the next the dropper. The first dropper should be about a yard from the stretcher, and the second about three-quarters of a yard from the first; made on pieces of gut four or five inches long to detach at pleasure.

*May-fly* (fig. 1). The wings are made of the

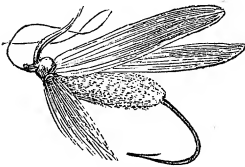
light feather of a grey drake, dyed yellow; the body of amber-coloured mohair, ribbed with green silk; the head of peacock's harl; and the tail of three long hairs from



a sable muff. This is one of the most killing flies for trout; it generally rises about the end of May, and continues for about three weeks; it is found in great plenty in sandy, gravelly rivulets.

*Great White Moth* (fig. 2). The wings are made of

FIG. 2.

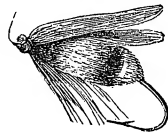


a feather from the wing of a white owl; the body of white cotton; and a white cock's hackle wrapped round the body. This is a night fly, and should be used in a dark, gloomy night.

*Bee-fly* (fig. 3). This is an excellent chub-fly, and is in use during the summer months.

FIG. 3.

The wings are made from the feathers of a blue pigeon's wing; the body of chenil of various colours, arranged in stripes in the following order: black, white, light yellow, white, black and white; the legs of a black hackle; and the body dressed thick.



*Red Palmer* (fig. 4). The body of this is made of dark red mohair, ribbed with gold twist, and wrapped with a red cock's hackle. Palmers are all good killing baits, and may be used all the fishing season.



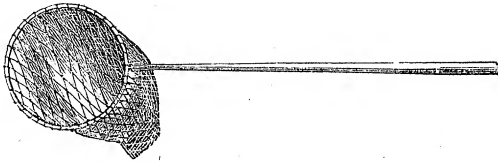
We give these specimens for the young angler to practise upon. When he has accomplished the art of fly-making, he will prefer making them after his own fashion, and it is always best to make the fly you wish to imitate—one that you know frequents the locality you propose fishing in. The following flies are also favourites with the best anglers:—

Black Gnat.  
Hare's Ear.  
Whirling Dun.  
Cock Tail.  
Peacock Palmer.  
Black Silver Palmer.  
Red Ant.  
Governor.  
Gold Spinner.  
Oak Fly.  
Yellow Sally.  
March Brown.

Willow Fly.  
Haze Fly.  
Fern Fly.  
Black Palmer.  
Black Palmer ribbed with gold.  
Orl or Alder Fly.  
Blue Gnat.  
Little Iron Blue.  
Gravel or Spider Fly.  
Granham or Green Tail.  
Whirling Blue.

*Landing Net.* The ring of this can be made of a common cane, to which is fastened a small net, with

a long pole or straight piece of wood for the handle.



A ring made of iron or stout wire is better, when it can be procured.

## RABBIT HUTCHES.

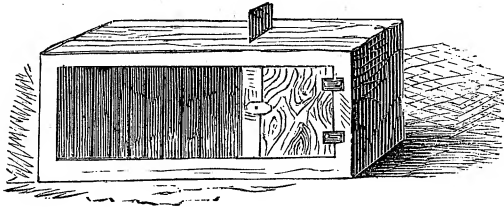
RABBITS have always been great favourites with boys, and are not only a pleasant, but often may be made a profitable amusement. The domestic rabbits are of various colours. A variety of the hare-colour, that has much bone, long body, long ears, and large eyes, much resembling the hare—which they nearly equal in size, is in flesh considered superior to the common rabbit.

When choosing young ones to rear for does, take those that have the smallest litter. When six weeks old they may be removed from the doe, and placed in hutches two and two, until they are four months old, and after that time they must be kept separate. Does with long heads and ears are the best, and give the most milk. There are many varieties of fancy rabbits, but the lop-eared is the most popular; these also have many varieties, such as the up-eared, the forward or horn-lop, the ear-lop, and the real lop. Our young readers must please themselves as to the kind of rabbits



they prefer to rear; our object is rather to instruct how to make houses for them, which are called

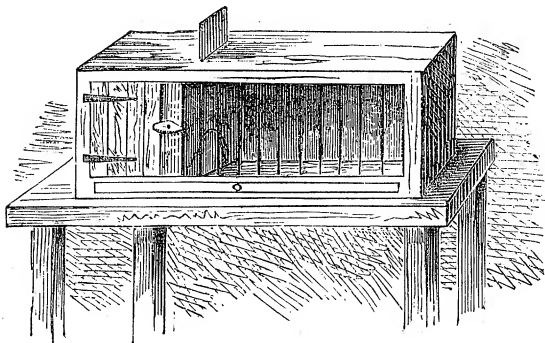
*Hutches.* The most easily constructed can be made



out of an old tea or egg chest; one third being divided by a partition for a sleeping-place—a hole being cut in it sufficiently large for the rabbit to pass through. A sliding door must be made in the partition, to confine the rabbits during the time of cleaning. Stout wires must be driven into the top and bottom of the hutch for the front, about an inch apart, and the door put on with two leather hinges, and fastened with a latch or buckle.

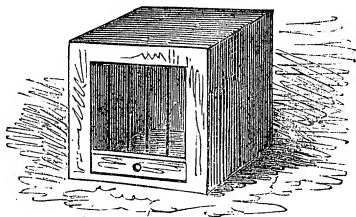
More finished hutches may be constructed for fancy rabbits on the same plan, with the addition of a drawer for the food; this should be tinned round the edges; also the circular hole in the partition, as well as every other part of the inside of the hutch which the rabbits can bite with their teeth. The

bottom should be quite smooth, with a slip taken off



the lower part, and the hutch set a little backwards for the water to run off.

*The Buck's Hutch* is generally made of quite a different shape to that of the doe's or breeding hutches, but there does not appear any good reason for its being so. The form is something of the shape of a Dutch oven, with very little room for exercise. One made on the same plan as already described for does, with the wires a little stronger, should be more gene-



rally used, as the separate apartment enables the rabbit to exercise himself when he pleases. The buck must always be kept in an apartment of his own.

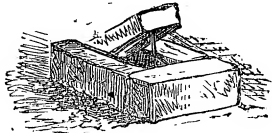
Hutches may be set one upon another, or in rows, as most convenient; they should never be placed upon the ground, but elevated on wooden stools or benches; and not put close to the wall, but sufficient room left for the dung to pass off from the apertures made in the back of the floor. They should be kept in a dry place, exposure to humidity being fatal to rabbits. Fresh air and thorough draught are necessary.

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### BIRD TRAPS.

BIRDS of all kinds are great favourites both with young and old. The splendour of their colours, the melody of their sweet voices, and the wonderful art with which they construct their nests, inspire a love and admiration to the great Creator of all. Without going into the natural history of the various singing-birds; we shall confine ourselves to the means of catching them. There are different modes; the most common for boys is the

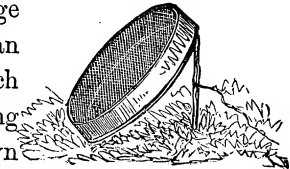
*Brick Trap.* It is made of four bricks—two being placed lengthways upon their narrow ends, and the third in like manner across one end; the fourth being placed between the two sides, so as to form a cover or lid.



A forked twig is placed horizontally, and rests upon the edge of the front brick—the lid or top brick being supported by a short piece of wood resting upon the narrow end of the fork. The weight of the bird alighting on the forked branch destroys the equilibrium, and the brick falls, and forms a close box in which the bird is a prisoner. A few bread crumbs or oats should be first put in as a bait at the bottom of the trap.



*Sieve Trap.* This is another simple and readily constructed trap. A large sieve is propped up at an angle with a stick, to which is attached a piece of string at the middle. Having strewn your bait under the sieve, take the end of the string, and conceal yourself behind a tree or wall, and when you observe the bird well under the sieve, quickly



jerk the line, removing the stick, which causes the trap to fall over the bird.

*The Springle.* This is an excellent trap, but more complicated to make. Take a hazel rod, four feet long, thick at one end, and tapering towards the other, and fix a piece of string, about fourteen inches in length, to the small end; it must be shaved off a little on one end to fit the notch in the spreader.

*The Spreader* is a small bent switch about a foot and a half in length; make a notch at the thickest end to receive the small one, and fasten it within an inch of the thicker end.

*The Catch* is a small piece of wood half an inch long, about half as broad, and a quarter as thick.

*The Noose* is a slip-knot of stout horse-hair, fastened to the end of the string below the catch.

*The Stump* is made of a short stake of wood a few inches in length, fixed firmly into the ground; the head remaining about an inch above the surface.

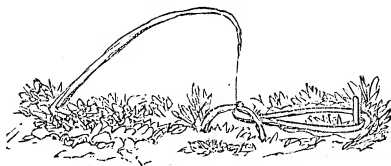


*The Bender* is also a pliant switch of hazel, the ends of which are fixed in the ground, forming an arch.



*To set the Springle.* The stump must be driven firmly into the ground, and

the bow of the spreader over it, the bight being in contact with it. Fix the two ends of the bender securely into the ground, about the length of the former from the stump. The thick end of the springer is next fixed in the ground a short distance from the bender, and the small end



beat down till you can put one end of the catch upwards, and on the outside of the bender. The spreader being raised about an inch from the ground, and the smaller end of the catch being placed in the notch, to support it. The horse-hair slip-knot is next arranged round it, and the trap is complete.

A little seed is scattered inside and around the trap, and the bird being attracted to it perches upon the spreader, which falls with its weight, and the catch being set at liberty flies up, and the bird is caught in the noose; care, however, must be taken to remain at a short distance to take your bird quickly, or in his efforts to escape he might be strangled, or flutter himself to death.

*Liming a Twig.* One of the most simple modes of catching birds is with bird-lime; it may be pur-

chased in towns of the bird-fanciers, oilmen, or druggists. A branch of a tree is first taken and trimmed of the leaves, and then coated all over with the bird-lime; a cage in which are your call-birds is then fixed in a low hedge, and the smeared bough is placed over it. The wild birds being decoyed to the twigs, you conceal yourself somewhere near, and when the birds alight on the tree they stick fast, and you must lose no time in securing them.

The London bird-catchers use a large net—some as much as twelve yards long, and about two wide; they are spread upon the ground, and decoy-birds placed in small cages, at short distances from the net. The wild birds being attracted to the spot, the bird-catcher watches his opportunity, and closes them in by a sudden pull of the strings which he holds in his hands at some distance from the trap.

When birds are taken, they should be first placed in a dark place, or the cage covered over for a time, or they may seriously injure themselves by fluttering about in the cage. The best time for catching birds is early in the morning, soon after daylight; for after that time, the birds are too busy looking after their food to be easily attracted by your decoys.

## BATTLEDOR AND SHUTTLECOCK.



THIS is an old and favourite sport ; it is also a very healthy pastime. In the time of James I., it was a fashionable game amongst grown-up person. The Chinese play at it with their feet, hands, and elbows, and keep the cocks up in a most extraordinary manner. The practice of the game in this country is to keep the shuttlecock in the air by striking it from one person to another.

*Battledoors*, as the name implies, were formerly all made of wood ; they may easily be cut out of a piece

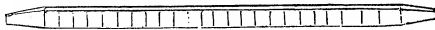


of flat deal, not thicker than a quarter of an inch—the spades about five inches in length, and the same in breadth; the handles about six or seven inches long;



and they will serve every purpose for young beginners to practise upon. The best

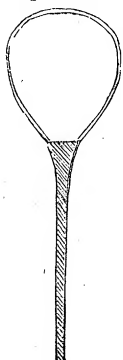
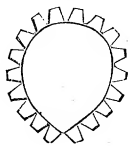
kind are made as follows: procure a slip of lance-wood, about sixteen inches long, an inch and a half broad, and a quarter of an inch thick, the edges of the outside slightly rounded; to make it bend to the shape of the spade of the battledoor, cut a slight nick, about an inch apart, all along the inside, and not quite half



way through the wood; boil or steam it with hot water, and it will curve to the shape, the two ends being bevelled off to fit to the handle; this must be previously prepared quite round, except at the end to which the spade is attached, which must be quite square at the sides, and tapering a little at the extreme end. The spade end must then be glued to the two sides of the handle, and afterwards firmly bound round the join with fine waxed string; it



must then be allowed to dry; in the meantime, prepare your covering of parchment, cut round to the shape of the spade, with a margin large enough to turn over the wood-work. The ends, to turn over nicely, must be cut out in this form; the skin must then be soaked in water, the damp taken off, and the ends glued round the wood-work, and when dry, you will have a superior battledoor. The handle may be finished off by binding a strip of coloured leather or velvet all round it.



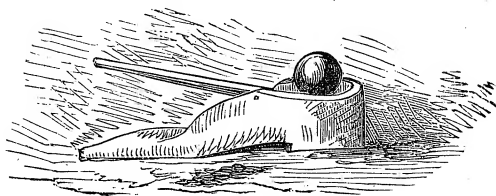
*To make a Shuttlecock.* Cut a piece of sound cork to this shape, in it fix a short brass-headed nail at the lower end. Procure five grey goose feathers about four and a half inches long, not too full, and all the same size; fix the ends of these into the top of the cork in a circle—



each one standing in an oblique direction to the other, and your shuttlecock with the battledoor will be ready for play.



## TRAP, BAT, AND BALL.



THIS is also an old English game. As early as the fourteenth century we have traces of its existence. The old method of playing was much the same as it is in the present time, only the trap was a little elevated, and not placed on the ground as it now is, commonly in the shape of a shoe. The trigger being struck at the extreme end forces upwards the spoon containing the ball, the motion describing a small arc or curved line; when set free from the spoon, the ball rises in a right line, and is projected forward in the same direction it was taking when set free.



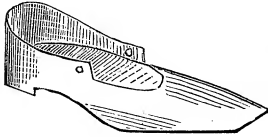
The game is played in various ways in different parts of the country. The usual plan is to choose sides, tossing up for the innings, boundaries being

placed at a given distance from the trap; the batsman must send his ball over the line, or he is out; he is also out if he strikes the ball into the air, and it is caught by an opposite player, or if it is bowled back and hits the trap, or if he strikes at the ball twice without hitting it he is out, and another player takes his place. In many parts there is a practice, when the bowler has sent in the ball, for the striker to guess the number of bat's lengths it is from the trap, if he guess correctly he reckons that number towards his game, but if more than there really are, he loses his innings.

In playing, the trigger must not be struck too forcibly, but just sufficient to rise the ball about a foot, or a little more, above the trap; you may catch it once or twice in your hand before you call *play*, which will enable you to judge better where to take your stand, and strike the ball with the utmost force, and observe in which direction you should send it with the least chance of its being caught. Take plenty of time before you attempt to hit the ball; young players are apt to be in too great a hurry. You will have sufficient time to take a good aim, and strike the ball in the act of falling.

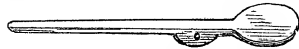
*To make a Trap, Bat, and Ball.* The trap must

first be cut out of a soft piece of wood about seven or eight inches in length, in the shape and in the proportion of an ordinary shoe; hollow out the heel



about half way down, and one-third at the toe, through which drill a small hole; in the hollow is fixed the spoon end of the trigger which holds

the ball—it is secured by an iron or wooden pin, which acts as a fulcrum. The trigger, or tongue, is cut out of a piece of wood of this shape, a hole being drilled through the thick part, and the spoon end slightly curved out to hold the ball.

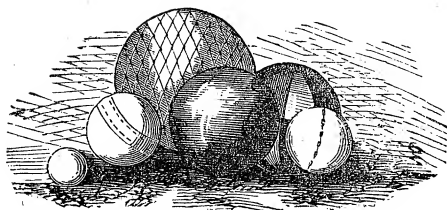


*The Ball.* The directions given at page 130 will do for the purpose.

*The Bat.* The spoon-shaped is the one now most used by players; it is made out of a piece of flat wood about an inch thick, and in the form of the cut, but they vary according to taste or fashion.



## BALLS.



GAMES played with balls are of great antiquity. The Greeks used four kinds, viz. : the little ball, the great ball, the empty ball, and the leathern ball. The empty ball was blown up with air, something like the foot ball of the present time; and the leathern ball was stuffed with sand or bran, and suspended from the ceiling. The Romans, also, had four kinds of balls, and it is stated that Augustus Cæsar, particularly, was greatly delighted with the amusement.

*Hand Ball, or Fives.* This was formerly a very popular pastime in England; in modern times it has been partially superseded by the use of the *racket*. For boys, the hand ball has all the advantages of exercise, and does not require so high a wall or regular

ground as for racket. The game is played with the palm of the hand: two or more take sides, the best players being nearest the wall; a chalked line being previously drawn upon it, about two feet from the ground, and the great art is just to send the ball over the line, and keep it within the boundaries.

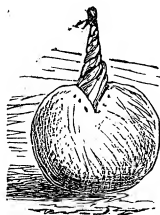
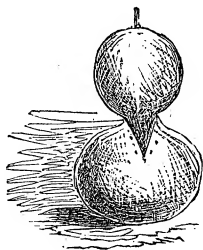
*To make a Hand Ball.* Take a piece of India-rubber, or cork, about the size of a large marble, and wind round it worsted till you have worked it quite round, and about the size of an ordinary orange; fix the end by lacing it under the layers, and without making a knot. For an ordinary game, the ball will then do, but if you wish to preserve it, or make a more finished work of it, you must cover it with soft leather, and make all as tight as possible, that it may rebound easier.

*Racket Balls* may be made in the same way. It is stated that this game was introduced into England during the reign of Henry III., by persons of rank and family, who erected what are called *tennis-courts*, for the performance of the exercise.

*Foot Ball.* Formerly this game was the popular holiday amusement. It is a most exciting sport, the best place for it being a large field or common. Any number may play at it. When a match is made, each

party takes a side, till equally divided in numbers two sticks being driven into the ground for a goal, a few feet apart. The skill of the players is best displayed by attacking and defending the goals. Shins occasionally suffer, and the exercise is sometimes exceedingly violent.

*To make a Foot Ball.* Take a large bladder, steep it in water, blow it out by the aid of a piece of pipe, and tie it tightly round the neck with string; being satisfied that it is perfectly air-tight, you must untie the string and empty the bladder again. You must then proceed to place it in the leathern case, which ought also to be soaked in water, to make it work more easily into form. Insert the lower end of the bladder into the hole in the leather, fill it again with air, and tie the neck-string, and it will then be more like two balls than one. You next



take a firm hold of the outer portion of the bladder, and twist it round, gradually driving all the air into the lower part of the leathern case, and the shape will be further developed. The outside portion must then be forced gently into



the case, and a tongue of leather placed over the orifice; the whole must be laced together, and your ball will be ready for use.

India-rubber, which appears to be coming into use for almost everything, is now much used for making all kinds of balls.

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### THE BOOMERANG.

THIS is an instrument lately introduced into this country from Australia. It is said to be used by the natives with great skill and dexterity; so much so as to kill a man behind a tree. If skilfully flung, it may be made to go in any direction, and after striking the desired object it will return to the thrower. It should be held horizontally when thrown, and cast by bringing the arm backwards.

It is made of a curved piece of wood, flat on one side, and a little rounded on the other. It is so simple, and its results so extraordinary, that it has already become very popular in this country



## GOLFING.

IN Scotland this game is much practised at the present time. It is much the same as a rustic game of the Romans, and is played with a long club, and a small ball made generally of gutta percha. The game is played with four persons—there being two on each side; only two balls are used, one belonging to each party, and each one striking in turn; if the last striker does not send the ball as far as his opponent, the next one of the same party must then strike one, and so on, counting one, two, or three, as the case may be. The object is to drive the balls into certain holes in the ground, and the party that does so the soonest, or with the fewest number of strokes, wins the game.

*The Golf Club* is generally made in two distinct parts—the shaft, which is of hickory or lance wood (rarely the latter nowadays), and the head of beech or apple, or some such wood, planed off to adapt itself to the handle, to which it is partly glued and tightly corded down. They vary in length



from three to four feet, according to the height and length of arm of the player. The handle is bound with leather over list or some such stuff; and in addition to the face of the club it is sometimes further secured by a piece of bone or ivory, about an inch thick. Clubs, however, vary according to circumstances, and the nature of the ground; for instance, some have iron heads for playing in sand, &c.

GLOSSARY OF TECHNICAL TERMS USED IN GOLFING.

- Baff.*—Striking the ground along with the ball.
- Bone.*—A piece of that substance inserted in the sole of the club, to prevent it from splitting.
- Bunker.*—A sand hole.
- Caddie.*—A person who carries the Golfer's clubs and who is generally conversant with the principles of the game.
- Dead.*—A ball is said to be dead—1st, when it falls without rolling; 2nd, when it lies so close to the hole that the put is a certainty.
- Dormy.*—As many holes ahead as remains holes to play.
- Draw.*—To drive wildly to the left.
- Fore.*—Contracted for Before; a warning cry to people in front of the stroke.
- Flat.*—A club lies flat when its head is at a very obtuse angle to the shaft.
- Gobble.*—A rapid straight put at the hole.
- Grassed.*—A term used instead of spooned, to signify the slope of a club face.
- Green.*—Sometimes the links, more generally the putting ground.
- Hanging.*—When the ground rises in any way behind the ball.

*Hazard*.—General terms for bunkers, whins, or bad ground.

*Heel*.—The crook of the head where it joins the shaft.

*Leather*.—The leather covering the grasp of the club shaft.

*Lie*.—1st, the inclination of a club when held on the ground in its natural position with respect to the player; or, 2nd, the situation of a ball.

*Links*.—The open downs or heath where the game is played.

*Loft*.—To raise the ball.

*Match*.—1st, a party contesting a game; 2nd, the game when won.

*Odd*.—1st, an additional stroke allowed a weak opponent; 2nd, the stroke played in any match in advance of the opposite party.

*Put*.—A gentle stroke towards the hole when close to it.

*Rind*.—The roll of cloth under the leather, used to thicken the grasp.

*Scare*.—The point of junction between head and shaft. A club is said, also, to be scared when a piece of wood is inserted in a splinter, and the whole whipped. The answering term to scared on board ship is fished.

*Scruff*.—Slightly raising the grass in striking.

*Shaft*.—The stick or handle of the club.

*Steal*.—An unlikely put holed from a distance, but not by a gobble.

*Swipe*.—A full shot or drive.

*Swing*.—The circular sweep of the club in driving.

*Tee*.—A pat of soil on which the ball is elevated for the first stroke.

*Topping*.—Hitting the ball above the centre.

*Upright*.—When a club-head is not placed at a very obtusive angle to the shaft.

*Whins*.—Furze-bushes.

*Whipping*.—The pitched twine uniting the head and shaft.

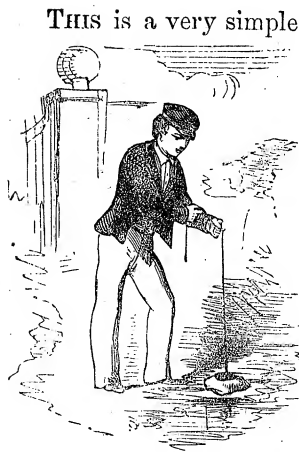
## HOCKEY, OR CLUB.

THIS is also a favourite game in the north of England. Two or more parties form sides, and the object is to drive the ball (a wooden one) over the bounds, which are generally marked out at about forty or fifty yards. The best place for it to be played is in a by road, not too wide, with a hedge or palings on each side; and the party that first sends the ball over the bounds, wins the game; either party sending it over the side bounds, loses the game. The clubs are formed

according to the taste and fancy of the player. Some boys prefer one with a stout knobby handle, and others, again, like those with more curve at the stroke; but when one is got to answer the purpose, it is valuable to the owner. The best way is to select one from some wood or hedge, and have as little cutting or making about it as possible.



## THE SUCKER.



THIS is a very simple toy, and easily made. Take a piece of leather, and cut it perfectly round, about the size of the palm of your hand; make a small hole through the centre, just large enough to insert within it a piece of fine cord, about four or five feet in length; at the end inside the sucker tie a knot, and to the other end tie a piece of wood five inches long, for the handle. When completed, soak the leather for some time in water till it is sufficiently pliable, and take a smooth stone and press down the leather upon it with your foot; underneath the sucker a *vacuum* is formed, and by lifting the string, the external air pressing on all sides of your sucker, you will be able to carry a considerable weight.

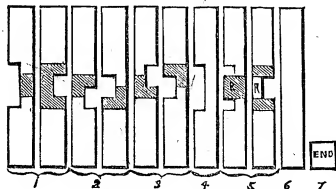
## Practical Puzzles.

MANY of the best puzzles have no doubt been invented by captives, to wile away the time of a long and dreary imprisonment; thus does the misery of a few frequently conduce to the amusement of many. A good puzzle requires considerable thought, calculation, patience, and management. It is sometimes highly amusing to watch the progress of any one attempting to perform a puzzle for the first time; to see him elated with hope when he thinks he is doing it so cleverly, when you know he is farther off the desired end than when he actually began. And it is equally laughable to witness his increasing despair as he finds himself getting more and more involved, when you are fully aware, by a single happy turn, how easily he might terminate his troubles.

### THE CHINESE CROSS.

Procure six pieces of wood, bone, or metal, made

of the same length as No. 6 in the adjoining figure,



and each piece of the same size as No. 7. It is required to construct a cross with six arms, from these pieces, and in such a manner that

it shall not be displaced when thrown upon the floor. The shaded parts of each figure represent the parts that are cut out of the wood; and each piece marked *a* is supposed to be facing the reader, while the pieces marked *b* are the right side of each piece turned over towards the left so as to face the reader; No. 7 represents the end of each piece of wood, &c., and is given to shew the dimensions.

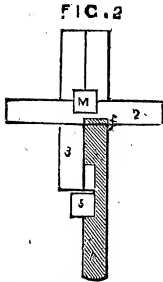
*To make the Chinese Cross.* Place Nos. 1 and 2 together as in fig. 1; hold them together with the finger and thumb of your left hand horizontally, and with the square hole to the right; push No. 3—placed in the same position *facing you* (*a*) in No. 4—through the opening at *K*, and slide it to the left at *A*, so that the profile of the pieces should be as in fig. 2. Now push No. 4 *partially* through the space from below upwards, as seen in fig. 2. Place No. 5 crossways upon the part

FIG. 1





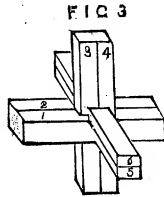
B, so that the point B is directed upwards to the right hand side; then push No. 4 quite



through, and it will be in the position shewn by the dotted lines in fig. 2.

All that now remains is to push No. 6 which is the key through the opening M, and

the cross is completed as in fig. 3.

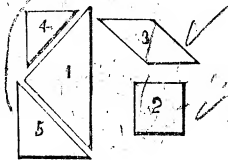


**Tongram** (see Dictionary)

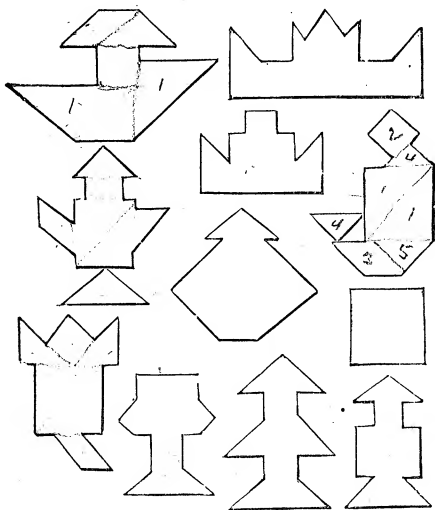
*Two of each of these (see next page)*

THE CHINESE PUZZLE.

This puzzle being one for the purpose of constructing different figures by arranging variously shaped pieces of card or wood in certain ways, requires no separate explanation. Cut out of very stiff cardboard—or thin mahogany, which is decidedly preferable—seven pieces, in shape like the annexed figures, and bearing the same proportion to each other; one piece must be made in the shape of fig. 1, one of fig 2, and one of fig. 3,

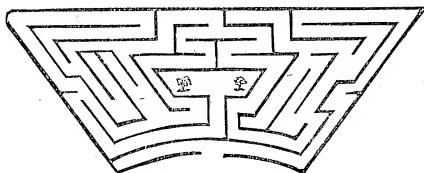


and two of each of the other figures. The combinations of which these figures are susceptible are almost infinite, and we subjoin a representation of a few of



the most curious. It is to be borne in mind, that all the pieces of which the puzzle consists must be employed to form each figure.

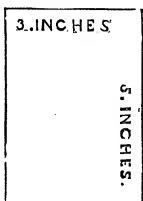
## THE MAZE, OR LABYRINTH.



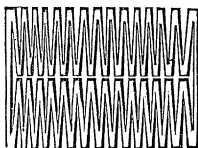
This maze is a correct ground plan of one in the gardens of the Palace of Hampton Court. No legendary tale is attached to it of which we are aware, but its labyrinthine walks occasion much amusement to the numerous holiday parties who frequent the palace grounds. The puzzle is to get into the centre, where seats are placed under two lofty trees, and many are the disappointments experienced before the end is attained; and even then the trouble is not over, it being quite as difficult to get out as to get in.

## THE CARDBOARD PUZZLE.

Take a piece of cardboard or leather, of the shape and measurement indicated by the diagram; cut it in such a manner that you yourself may pass through it, still keeping it in one piece.

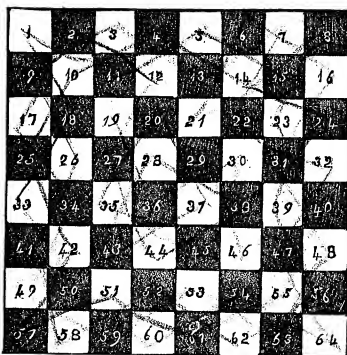


*To cut the Cardboard Puzzle.* Double the cardboard or leather lengthways down the middle, and then cut first to the right, nearly to the end (the narrow way), and then to the left, and so on to the end of the card; then open it, and cut down the middle, except the two ends.



The diagram shews the proper cuttings. By opening the cardboard or leather, a person may pass through it.

MOVING THE KNIGHT OVER ALL THE SQUARES  
ALTERNATELY.

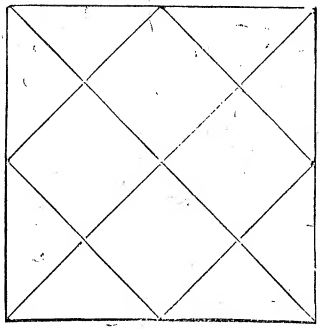


Let Black Queen's Rook's square count 1 (as in the above diagram); Black King's Rook 8; and count all the other squares in the same way, from 9 to 64. Place the Knight upon Black King's Rook's square, 8, and move as follows:—23, 40, 55, 61, 51, 57, 42, 25, 10, 4, 14, 24, 39, 56, 62, 52, 58, 41, 26, 9, 3, 13, 7, 22, 32, 47, 64, 54, 60, 50, 33, 18, 1, 11, 5, 15, 21, 6, 16, 31, 48, 63, 53, 59, 49, 34, 17, 2, 12, 27, 44, 38, 28, 43, 37, 20, 35, 45, 30, 36, 19, 29, and 46. It may be well to chalk the figures on the board as a guide, until the feat is understood.

*Square to rectangle*

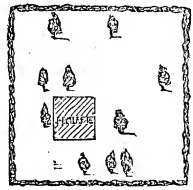


THE ACCOMMODATING SQUARE.

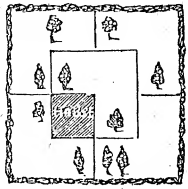


Take eight squares of card, and divide four of them from corner to corner, so that you will have twelve pieces; form a square with them when put together.

THE DIVIDED GARDEN.



A person has a square plot of ground having a house built upon it, which he lets out to various tenants; he was desirous of dividing it so that each of the five inmates should have an equal share of the garden, and two trees. He contrived it in this way.



THE ARMY SQUARE.

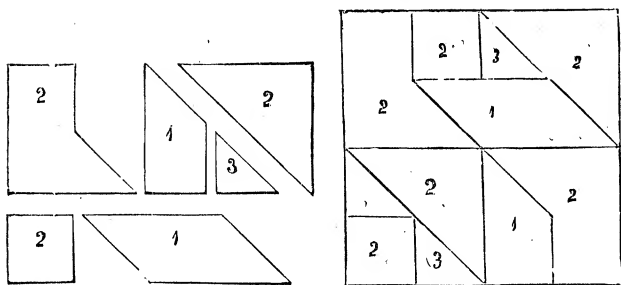


FIG. 1.

FIG. 2.

Cut as many pieces of each figure in cardboard as they have numbers marked on each; then form the pride of the English army, which can be done by arranging the pieces as shewn in fig. 2.

THE JAPAN SQUARE PUZZLE.

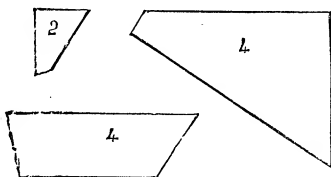


FIG. 1.

Cut out of cardboard or wood of the same sizes

and shapes as in the preceding diagram, and then form a square with them, and the result will be as in fig. 2.

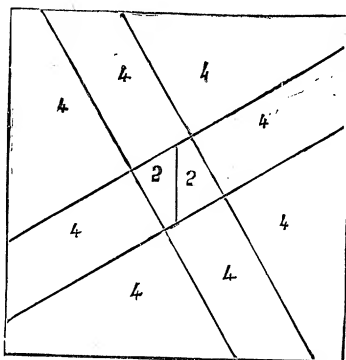
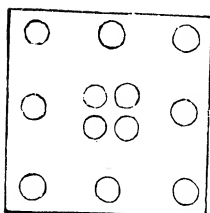


FIG. 2.

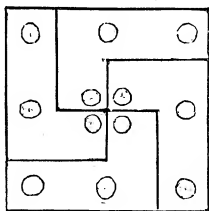
### THE SQUARE AND CIRCLE PUZZLES.



Get a piece of cardboard, the size and shape of the diagram, and punch in it twelve holes or circles, in the position as shewn. The puzzle is, to cut the cardboard into four pieces of equal size, each piece

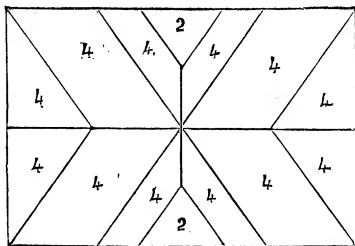
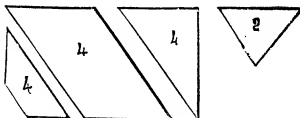


to be of the same shape, and to contain three circles, without cutting into any of them; and the result will be as follows:—

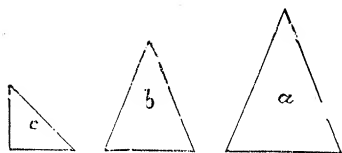


THE PUZZLE OF FOURTEEN.

Cut out fourteen pieces of paper, card, or wood, of the same size and shape as those shewn in the cut, and then form an oblong with them, as in the following cut:—

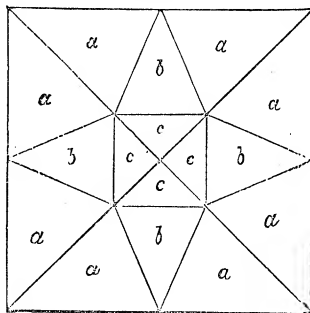


## THE CARD SQUARE.



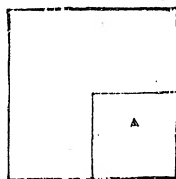
Cut out eight pieces of card or paper of the shape of  $a$ , four of  $b$ , and four of  $c$ , and of proportionate sizes,

and with them form a square.



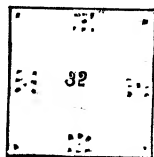
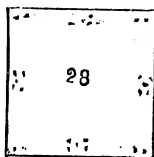
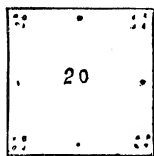
## PUZZLE OF THE TWO FATHERS.

Two fathers have each a square of land. One father divides his so as to reserve to himself one fourth, as in the adjoining cut. The other divides his so as to reserve to him-

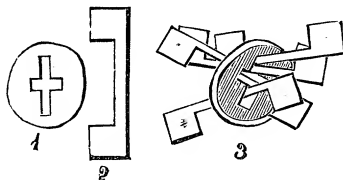




nine each way? The four who went out returned bringing with them four friends; how were they all placed so as to count nine each way, and thus deceive the sister as to whether there were 20, 24, 28, or 32 in the square?



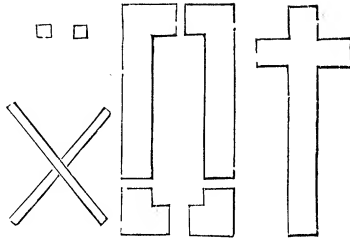
### THE DOUBLE-HEADED PUZZLE.



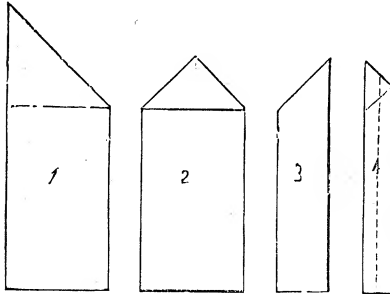
Cut out of a piece of wood the circular form of fig. 1, and four others like fig. 2; the puzzle is in getting them all into the cross-shaped slit, until they look like fig. 3. After which arrange them side by side in the short arms of the cross, draw out the centre piece, and the rest will easily follow. The reverse of the same process will put them back again.

## CUTTING OUT A CROSS.

Cut out of a single piece of paper, and with one cut of the scissors, a perfect cross, and all the other forms of the diagram.



Take a piece of writing paper, about three times as long as it is broad, say six inches by two.

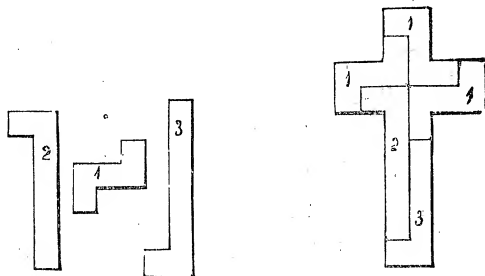


Fold the upper corner down, as fig. 1; then fold the other upper corner over the first, and it will appear as fig. 2; you next fold the paper in half lengthwise, and it will appear as fig. 3.

Then the last fold is made lengthwise, also in the middle of the paper, and it will make fig. 4, which, when cut through with the scissors in the direction of the dotted line, will make all the forms mentioned.

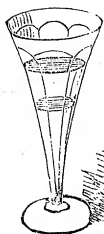
## ANOTHER CROSS PUZZLE.

Cut out of cardboard three pieces of the shapes and numbers following, and with them make a cross.



## THE GLASS AND COINS.

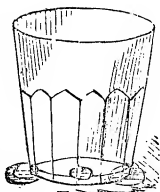
Place a sixpence in the bottom of a glass, and over the latter put a half-crown. The puzzle is to remove the small coin from beneath the larger one without touching either of the coins, or touching or upsetting the glass. To do this, you must blow with considerable force down one side of the glass, upon the edge of the half-crown. The sixpence will be expelled by the force of the air, and will fall either upon the upper surface of the half-crown, or upon the table.



## ANOTHER GLASS PUZZLE.

Place a sixpence between two half-crowns, and lay upon the larger coins a glass. Remove the sixpence without displacing either of the half-crowns or the glass.

To do this a table-cloth is necessary; for this reason the trick is best suited to the breakfast or dinner-table. Having placed the glass and coins as in the above cut, simply scratch the table-cloth with the nail of the fore-finger in the direction you wish the sixpence to move, and it will answer directly.



# Scientific Toys.

## CHEMICAL

### TO MAKE A CRYSTAL BASKET.

WATER will, especially when boiling, dissolve large quantities of various substances, which, when it is dried up, are left behind in the form of most beautiful crystals, the shapes of which vary with the substance employed. Advantage of this fact may be taken to make many very handsome ornamental objects. Boiling water will take up a much larger quantity of alum than cold water will, and if we dissolve in the former as much alum as possible, as the liquid cools, crystals of alum will be deposited on any object placed in the fluid. A piece of coke or cinder allowed to hang in a boiling solution of alum will become coated with numerous glistening crystals, as the liquid cools, and will have all the appearance of a naturally formed mineralogical specimen. Wire or willow baskets covered in this way form very handsome ornaments. The most suitable baskets are those made of wire covered with cotton or worsted (like bonnet wire), as the surface to be coated with crystal must be



somewhat rough. Take twice as much water as will be sufficient to cover the basket, boil it in a saucepan, and add as much alum as will dissolve in the water; a quart of water will require about eighteen ounces of alum. Strain this through muslin or blotting-paper into a large jar, and hang the basket in the liquid. Stand the jar on one side to cool, and keep free from dust; in a few hours the basket will be completely covered with white crystals of alum. Should it be desired to colour the crystals, add the requisite dye-stuff to the alum solution before straining it. A few drops of Judson's cheap dyes will serve the purpose very well.

#### HOW TO MAKE A LEAD TREE.

Get two drams of acetate of lead from the chemist's, and place it in about a quart of water. Stand the liquid on one side to settle, and leave it for a day or two, being careful to keep out the dust. Pour the clear liquid into a small, clear bottle, and hang in it a piece of zinc. Place it again on one side, and do not disturb it; in a few days crystals of lead will arrange themselves upon the zinc in the form of a tree or shrub.

#### HOW TO MAKE A SILVER TREE.

A very beautiful crystal tree may be made in the

following manner. Buy from the chemist six drams of a "saturated solution of nitrate of silver," and four drams of a "saturated solution of nitrate of mercury;" mix the solutions, and add five times the quantity of pure (if possible, distilled), water. Now make an amalgam, by taking seven parts of mercury and one part of silver, which should be in as finely divided a condition as possible. Mix these ingredients thoroughly together in a mortar, and place a piece at the bottom of the bottle into which the solution above described is to be poured. Set the bottle and its contents aside, keep free from dust and perfectly still. In about two days a beautiful shrub of glistening silver will be formed upon the amalgam.

#### OXYGEN GAS.

A most interesting experiment is that of making oxygen gas, and though somewhat elaborate apparatus is generally supposed necessary, the exercise of a little ingenuity will enable the reader to make plenty of oxygen with such materials as may be easily obtained. The apparatus necessary is as follows:—Four or five clean quart pickle-bottles, an old, but clean basket-oil-flask, some small *soft* glass tubing, a small spirit-lamp or candle, an old flower-pot, a hand-basin, a three-legged wire stand, a small tart tin, a few saucers or pieces of

glass, and a little silver sand. The requisite materials are a quarter of a pound of oxygen mixture, or, if this cannot be obtained, three ounces of chlorate of potash and one ounce of black oxide of manganese. The only articles in the above list of apparatus not usually found in an ordinary household are the glass tubing and the wire stand; sufficient of the former may be bought for two or three pence at a glass works or a chemist's; the latter may be easily constructed by bending rather stout iron or copper wire into the form of a stand with three legs, and is intended to support the flask over a spirit-lamp or candle.

*First thoroughly clean all your bottles or flasks.* Now proceed to fit a good sound cork to the flask, and having done so bore a neat hole through the cork, big enough to take a piece of the glass tubing. The best way to bore this hole, in the absence of a cork-borer, will be to burn it through with a red-hot wire, or iron skewer. Bend a piece of glass tubing twice at right angles, as in fig. A, and fix the shorter limb into the cork of the flask, and *be sure it fits well*; you can easily bend glass tubing by heating it in a gas or candle flame, and when

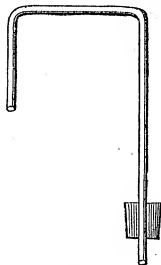


FIG. A.

cold you can wipe off the soot with a duster. Now proceed to make a "wash-bottle" in the following manner. Take a clean pickle-bottle and fit it with a good bung. Bore two holes through the bung the size of your tubing, and pass the longer limb of the tube from the flask through one of these holes. You must now bend another piece of tubing thus: (fig. B). Fit the straight portion into the second hole in the bung, and be careful that it does not reach more than an inch below it; the tube from the

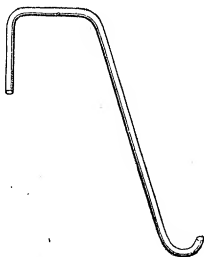


FIG. B.

flask must reach nearly to the bottom of the wash-bottle. Next take the flower-pot and *chip* a piece carefully out of the side, and place it bottom upwards in a small tub or hand-basin, and pour in water until it reaches as much above the flower-pot as the tub or basin will allow. Lead the curved end of the glass tube from the wash-bottle through the hole you have broken in the side of the flower-pot, and either place it in, or just under the hole in the bottom of the pot; your apparatus is now ready, with the exception of the wash-bottle, which must be three parts filled with clean water. Reduce the chlorate of potash to powder, and mix it thoroughly

with the black oxide of manganese. Place the mixture in the flask, and put a little silver sand in the tart tin, which then place on the wire stand, and lay or stand the flask and its contents on this, so-called, *sand-bath*. Apply heat beneath by means of gas, a spirit-lamp, or a candle. In a minute or so bubbles of gas will pass through the wash-bottle, and into the water in the hand-basin through the glass tubing. To collect this oxygen gas, fill your pickle-bottles with water by placing them under the water in the hand-basin. When one is full, hold it bottom upwards, and, *without raising the mouth of the bottle above the surface of the water*, place the mouth over the hole in the bottom of the flower-pot; the bubbles of gas will enter the bottle and drive out the water, and in a few seconds all the water will have given place to a clear colourless gas, which is oxygen. When one bottle is full remove it, and put another in its place in the manner described above. To remove the bottle without losing the gas, take a small saucer, or a greased slip of glass, and, keeping the bottle still bottom upwards, and with its mouth below the water, slip the saucer or glass under it; then carefully remove from the water, and stand aside till wanted. When sufficient gas has been collected, first withdraw the heat from the flask, and then take the apparatus to pieces.

## A FIERY FOUNTAIN.

Take a small lump of charcoal, or charred wood, and attach it by a piece of wire to a slip of card or thin wood. Having ignited the charcoal, plunge it quickly into a bottle of oxygen gas, holding the card or wood tightly down on to the top of the bottle, so as to prevent the escape of the gas. The charcoal, which only smouldered in the air, will burn rapidly in the oxygen, and will give off the most beautiful showers of sparks, resembling a fiery fountain.

## A BLEACHING APPARATUS.

Take a small piece of sulphur, and, having ignited it at a candle, plunge it quickly into a bottle of oxygen. The bottle will speedily become filled with fumes of "sulphurous acid gas," which have powerful bleaching properties. If a bunch of wet violets or a piece of damp Turkey-red cloth be placed in the mouth of the bottle the colour will immediately disappear. In this way flannels and straw for ladies' bonnets are usually bleached.

## BURNING STEEL.

Get a piece of fine watch-spring, and dip it in

melted sulphur. Having attached it to a slip of card or wood, ignite the sulphur and plunge the steel into a bottle of oxygen. It will burn rapidly, emitting a most dazzling light.

#### FIRE ON WATER.

Purchase a small quantity of potassium at the chemist's, and place a small piece on the surface of water in a large basin. It will immediately take fire, and burn with a brilliant violet flame, darting rapidly about on the water until entirely consumed.

#### A GHOSTLY FLAME.

To about a wine-glassful of methylated spirit add a large teaspoonful of common salt, stirring well together. Now make a torch by tying a piece of soft rag on a glass rod, or piece of hard wood. Soak the rag well with the salt and spirit, and having turned down the lights, set fire to the torch. A deep yellow flame will result, and in its light every coloured object in the room will exhibit only black, grey, or yellow tints, while the faces of all present will assume a most ghastly hue. The effect will be greatly heightened by burning a piece of magnesium wire towards the end of the experiment, when the colours of surrounding objects will flash out again with surprising beauty.

## INVISIBLE INK.

Get from the chemist some "chloride of cobalt," and add to it four times its bulk of water. Write with a clean quill pen upon paper; the writing will be invisible, but on warming it gently before the fire the letters will appear. If the writing be allowed to get cold it will again disappear, but will reappear if again warmed. In this way the writing may be rendered visible or invisible at pleasure.

Another form of "sympathetic" ink is a weak solution of sulphate of iron. If words be written with this liquid they will be invisible, but upon being washed over with a solution of prussiate of potash the letters will become visible and will assume a bright blue tint. Unlike chloride of cobalt, this ink will not disappear after having been once rendered visible.

## COAL GAS.

Get a long clay pipe and fill the bowl carefully with powdered coal. Wet some sand and cover over the top of the pipe-bowl with it. If the bowl be now placed in a clear fire, gas will in a short time issue from the stem of the pipe, and may be readily ignited. This is an illustration of the principle upon which gas is made for ordinary illuminating purposes.



## COLOURED FIRES.

RED.—Pound separately in a mortar one dram and a half of chlorate of potash and two drams of sulphide of antimony. Mix these two ingredients together, and add one and a half ounces of nitrate of strontium, three and a quarter drams of powdered sulphur, and a little powdered charcoal. Mix the whole together and place some on a piece of tile or brick, and ignite with a match; a very brilliant light of an intensely red colour will be the result.

BLUE.—Mix together sixteen parts of saltpetre, four of sulphur, and one of orpiment. When ignited this will produce the well-known Bengal light.

GREEN.—Grind completely to powder and mix carefully together twenty-seven parts of nitrate of barium, thirteen parts of flowers of sulphur, five parts of saltpetre, three parts of charcoal, and two parts of metallic arsenic. All these mixtures should be made with a spatula or an old spoon, and should not be allowed to touch the hands.

## ELECTRICAL TOYS.

## TO ELECTRIFY BROWN PAPER

GET one or two pieces of stout brown paper about eighteen inches square; warm them carefully before the fire, and then rub them briskly with a clothes-brush or with the hand. If held near a wall and let go they will fly towards it, and will adhere for some little time. They will also attract feathers, bran, or other light objects. Hold one of the electrified sheets just above another person's head, or near a person's whiskers; the hairs will be attracted by the paper, and will literally "stand on end, like quills upon the fretful porcupine." This experiment succeeds best with hair which is tolerably free from grease.

Take two hot sheets of brown paper, lay them on a table one above the other. Rub briskly with a clothes-brush, and then pull them quickly apart; they will stick together owing to mutual attraction, and their separation will be accompanied by a crackling noise, and in the dark electric sparks may be seen.

Get an egg and place it in an egg-cup. Balance a lath upon the egg, and bring an electrified sheet of brown paper near one end of it; it will be attracted

by the paper, and may be made to turn round on its centre.

Take a small tray and stand it upon a perfectly dry tumbler. Cut a piece of brown paper to the shape of the tray but a little smaller, and electrify it in the manner described above. When electrified lay it upon the tray and bring the knuckle near one corner; an electric spark will be received, causing a pricking sensation, and emitting a snapping sound. Quickly remove the paper and again bring the knuckle near the tray, a second spark will be received.

#### ELECTRIFIED GLASS.

Warm a glass rod and rub it briskly with a silk handkerchief or any piece of old silk. It will become electrified and will attract light objects such as bran, pith balls, feathers, and pieces of paper in the same manner as a magnet attracts iron.

#### ELECTRIFIED SEALING-WAX.

Rub a stick of sealing-wax with warm dry flannel; it will become electrified and will act in the same manner as an electrified glass rod. Rubbing it briskly on the coat-sleeve will have the same effect, but may possibly be objected to by careful mammas. An amusing

trick is to throw up a light feather and chase it with an electrified stick of sealing-wax.

### AN ELECTRICAL MACHINE

A glass cylinder electrical machine is a very expensive toy to buy, but it is quite possible to make one for a few shillings, which though not quite so elegant as a bought one, will answer every purpose equally well, and possibly even better.

In fig. c a cylinder machine is shown, and it will be seen to consist of a cylinder of glass A B, supported on a wooden frame and made capable of being set in motion by a handle. H is a cushion covered with silk, which rubs against the cylinder as the latter is turned round. On the opposite side to c is the "prime conductor," N M, which is a metal cylinder supported on a glass leg, and should be provided with a row of points.

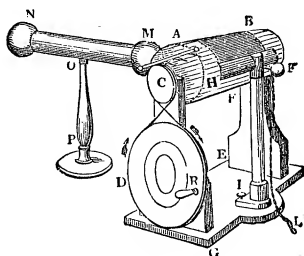


FIG. C.

The wooden stand presents no difficulty. The wood should be well-seasoned and thoroughly dry. Both uprights may be made of wood, and when the machine

is finished all these parts should be covered with shellac varnish, which is made in the following manner:—Get a small quantity of orange shellac from the oilman and dissolve it in warm methylated spirit, and your varnish is ready.

A glass cylinder may be purchased at the glass works for about one to three shillings, according to the size, but this expense may be avoided by using an ordinary wine-bottle instead, although a regular cylinder is much to be preferred. A hole may be made through the bottom of the bottle by igniting a piece of worsted tied round it and dipped in turpentine. A common round ruler or any round wooden rod answers very well for an axle. Pass this through the bottle or cylinder and then through holes in the uprights on the stand; the end to which the handle is to be attached should be squared. If the rod does not fit very tightly in the cylinder, fasten it in with a mixture of equal parts of melted resin and shellac.

#### THE RUBBER.

This should be made of several folds of dry flannel formed into a cushion or pad, and covered neatly with a piece of silk; it should be fastened on to a piece of wood, and to this should be attached a wooden support, so

that the entire frame is like the letter T, the rubber being attached to the top. Fasten this to the side of the stand by a small hinge, and as the rubber needs to be pressed against the cylinder with some force, it is best to fasten to the inner side of the support a piece of round solid indiarubber, which can then be passed through a brass eye driven into the stand beneath the cylinder. If the indiarubber cannot be got, a friend must press the rubber against the cylinder when the machine is worked. A small hook should be attached to the back of the rubber, and when the machine is worked a piece of brass chain or a long wire should be fastened by one end to the hook, and by the other to a gas-pipe, fender, or other metallic body.

#### THE PRIME CONDUCTOR.

This may be made as follows:—Get a piece of brass or iron tubing, about two inches wide, and a little shorter than the cylinder. Two old door handles soldered into the ends of this will increase its efficiency and improve its appearance. A strip of thin brass with a number of brass tacks driven through it should then be soldered along that side of the tube which is to face the cylinder. It is best to have two supports, one near each end of the conductor. These must be of glass rod

or tubing, and may be let into sockets at the side of the stand, and into similar sockets on the under surface of the conductor. These sockets may be easily made of thin brass, and those on the conductor should be attached with solder. The glass supports must be covered with shellac varnish. The conductor may also be made of wood covered with tinfoil, and pins may be used for the points.

#### TO WORK THE MACHINE.

Carefully dust all parts of the machine, and well warm it before the fire; connect the rubber with a gas-pipe or other metallic substance, and turn the handle briskly. A beautiful stream of violet light will be seen to pass from the glass to the points of the conductor, and if the knuckle be brought near one of the knobs a spark will pass, which, under favourable conditions, should be from one to three inches in length. The efficiency of the machine is largely increased by putting a little amalgam on the rubber. This may be bought, or may be made as follows:—Melt together in a ladle or old iron spoon, two parts by weight of zinc and one of tin. When melted add to this six parts of mercury, and pour the mixture into a stout wooden box, and shake until cold. When used this amalgam should

be mixed with a very small quantity of lard. A little of this may with advantage be rubbed on the cylinder with a piece of wash-leather.

#### THE ELECTRICAL JAR.

Get a wide-mouthed quart pickle or French plum bottle, and thoroughly clean and dry it. Cover it with tinfoil both inside and out to within about an inch from the top. Fit a wooden top to it, and into this fasten a piece of stout brass wire. To the top of this a brass ball, or a wooden one covered with tinfoil should be fixed, while a piece of chain long enough to reach to the bottom of the jar must be attached to the lower end. When finished, hold the jar in one hand and bring the knob near the prime conductor of the electrical machine while it is being worked. After holding it in this position for a few seconds, remove it, and touch the knob with your other hand; a sharp electric shock will be received. If several persons join hands, and the person at one end holds the jar, while the individual at the other end touches the knob, a shock will be received by the entire group.

#### AN ELECTRIC KISS.

Get four dry and clean tumblers and place a board



upon them so as to form a stool. While the electrical machine is being turned, let some one stand on this "insulated stool" and touch the prime conductor with one hand. Now persuade some one to kiss the individual on the stool; when this is done a spark will pass between the loving pair, and an electric shock be given to the person on the ground.

#### AN IMITATION SHIPWRECK.

Get a shallow trough and fix an upright at the middle of each end. Stretch a piece of string from one upright to the other, and fasten upon this a piece of cardboard, cut so as to resemble a cloud, and covered with tinfoil. Put some water in the trough and float upon it a miniature ship, which should be very flimsily made, especially the mast. Now charge an electrical jar and connect, by a wire, the outer coating with the vessel, and the knob of the jar with the cloud by another wire. When the vessel sails beneath the cloud a spark like a flash of lightning will strike the mast and shatter it to pieces.

#### A MIMIC THUNDERSTORM.

Make two imitation clouds, as in the last paragraph, and connect one with the knob, and the other with the

outer coating of an electrical jar. Bring the 'clouds together and a spark will pass between them in the same way as a flash of lightning passes between two thunder-clouds in nature.

### THE SPORTSMAN.

Take an electrical jar, as in fig. D, and pass through the wooden top two wires, each provided with knobs. To the knob A attach by silk cords a few imitation birds cut from elder pith or any other equally light material. Make a wooden stand, and fasten the jar upon it as shown in the figure. Then get a toy figure with a metal gun to represent the sportsman D. Bring the gun C near the knob B, and when the toy is set to work a spark will pass between them, and at the same time the birds will drop as if shot. The sportsman should be fixed so that he can be rotated by hand, and a wire should pass from him through the stand to the outer coating of the jar, the two wires A and B being connected with the inner

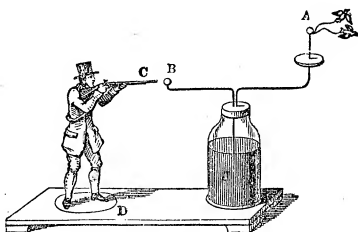


FIG. D.

coating. Charge the jar from an electrical machine, and bring the sportsman to the position shown in the figure; the electrical discharge will then take place in the manner already described.

### AN ELECTRICAL WALTZ.

Make two wooden plates and cover them well with tinfoil. Suspend one of them by a chain from the prime conductor of an electrical machine. Place the other plate on a stand or a pile of books, so that it is about three or four inches below the first plate, as shown in fig. E. Place some dolls made of elder pith upon the lower plate, and work the electrical machine; the dolls will jump up and down, executing a very tolerable electrical dance.

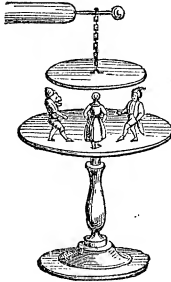


FIG. E.

### THE ELECTRICAL SEE-SAW.

Make a wooden stand about a foot in length and three inches in width, and balance upon an upright in its centre a piece of wood ten inches long, covered with tinfoil. Under the ends of this "see-saw" fix two uprights, and fix on the top of each a knob covered

with tinfoil; connect one of these with the knob, and the other with the outer coating, of a charged electrical jar, when the see-saw motion will be produced. To make the toy more complete two tiny figures should be placed on the see-saw, one at each end.

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## GALVANIC TOYS.

### A GALVANIC BATTERY.

GET a number of gallipots and some strips of zinc and copper. Place a strip of both metals in each of the gallipots, and connect, by copper wire twisted round each, the copper of one jar with the zinc of the next. Connect the two end strips (one of which must be copper and the other zinc) with each other by means of a long and tolerably stout copper wire. Pour into each jar a mixture of one part of oil of vitriol and ten of water, until about three parts full; your battery is now complete and in working order. The connecting wire will attract iron filings, and will turn a magnetic needle from its natural position.

### AN ELECTRIC TELEGRAPH.

The action of the simplest form of electric telegraph

depends upon the fact that an electric current passing through a wire has the power of turning aside a magnetic needle. All that is required, therefore, for an electric telegraph is a battery, two magnets, conducting wires, and two "receiving instruments," all of which may be easily made.

#### THE RECEIVING INSTRUMENTS.

To make these get two stout cards and some wire covered with silk or cotton (to be procured at an electrician's for a few pence). Wind about a dozen turns of this wire into a flat coil, thus:—



FIG. F.

Attach it by thread to the card, leaving both ends free. Get a piece of flat steel about the one-eighth of an inch wide and not quite so long as the coil of wire. Magnetize these by rubbing them several times with an ordinary steel magnet, and suspend them by their centres on a pivot, so that they are movable about it. This pivot must be fastened on the card, in the centre of the coil, so that the needle can move from side to

side in the coil. Now get a block of wood to serve as a stand for the card, which must be fixed in a groove in the block so that it will stand firmly in an upright position. Fix two strips of thin brass on the block, side by side in front of the card, and fasten one end of the coil to one strip, and the other end to the other strip; your receiving instrument is now complete.

#### THE BATTERY.

The battery may be made of two or three gallipots with strips of copper and zinc, and containing dilute oil of vitriol. These must be connected in the manner described on page 182, and the two end plates should not be connected with each other, but should have long wires attached to them, either by soldering or by twisting the wire tightly round the plates.

#### TO WORK THE TELEGRAPH.

Connect the two instruments by a wire, which must be attached to the same brass plate in each. Attach one of the battery wires to the unconnected brass plate of one instrument, and touch the corresponding plate of the other instrument with the other battery wire; both needles will be deflected at the

same moment. By arranging a code of signals, messages may be sent from one station to the other.

#### AN ELECTROTYPING APPARATUS.

Capital electrotype copies of wax impressions of seals and coins may be easily taken with the following simple apparatus. Take an ordinary tumbler and place in it a strong solution of sulphate of copper, made by dissolving two pennyworth of powdered blue vitriol in half a pint of boiling water. Make a porous cell by taking some stout brown paper and rolling it on a stick or on two fingers, fastening the side with sealing-wax, and fitting a bottom to it by the same means. Place this cell in the sulphate of copper solution, and pour into it a mixture (prepared beforehand), of five parts of water and one part of oil of vitriol. In the

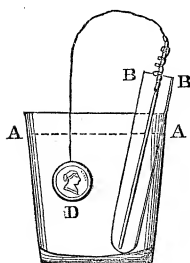


FIG. G.

cell place a thin strip of zinc, amalgamated by rubbing it first with weak oil of vitriol and then with a little mercury. Twist a piece of copper wire tightly round this zinc plate and attach to it the wax impression to be copied. The wax must be previously coated with black-lead, and polished with an old tooth-brush. After remaining in

the cell for about twelve hours a beautiful impression of the seal in copper will be obtained. A sketch of the apparatus is shown in fig. G, where AA is the tumbler, BB the porous cell, and D the wax impression to be coated.

### HOW TO MAKE A PAIR OF TELEPHONES.

The materials for making these amusing instruments may be obtained, at a small cost, of any philosophical instrument maker. They comprise two wooden cases, two magnets, two "bobbins" or reels, two pieces of "ferrotype" iron, four binding screws, and a quantity of covered wire. About twenty yards of covered wire must first be wound upon the bobbins, one of which is next to be placed in the wide end of each wooden case, and the two ends of the wire must be fastened to the ends of two binding screws fixed in the narrow end of each case. In the centre of each bobbin must be fixed the magnet, the end of which must nearly, but not quite, reach to the broad end of the case. This part of the case has a large hole in it, and behind this hole must be fixed one of the plates of ferrotype iron to form a "diaphragm." When the two telephones are finished they must be connected by two lengths of covered



wire attached to the instruments by the binding screws. If a person applies his mouth to the diaphragm of one instrument, and speaks or sings, the words will be heard by a listener holding the other instrument to his ear, the distance between the two individuals being quite immaterial, and limited only by the length of the connecting wires.

---

## OPTICAL TOYS.

### A PIN-HOLE CAMERA.

TAKE a small box, such as drapers use for keeping small articles in. Remove one end and paste over it a piece of stout white tissue paper, and prick a large pin-hole through the other end. Any object placed in front of the pin-hole will be reproduced on the paper screen, in an inverted position. The inside of the box should be blackened, and the distinctness of the images on the screen is much improved by having a lens fitted into the hole, which may then be made much larger.

### A GARDEN CAMERA OBSCURA.

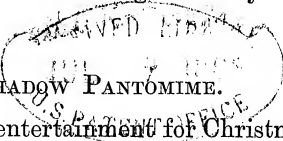
Wherever a small summer-house or tent exists a

large camera obscura may be readily constructed. The chamber must be thoroughly darkened, and when the audience is assembled for a performance the door must be closely shut. In the top of the summer-house a circular hole should be cut, and in this a small brass case containing a right-angled prism must be fixed. This part of the apparatus can be purchased at any optician's for a comparatively small sum. The table of the summer-house must be covered with a white cloth or with white paper, and upon this will be focussed, in an inverted position, images of the surrounding houses and gardens. A string may be attached to the prism case so that its open side may be turned in various directions, and different scenes focussed on the table. The height of the table must be adjusted to the focal length of the prism, in order that the images may be sharply defined.

#### THE KALEIDOSCOPE.

This interesting toy, originally designed by Sir David Brewster, is of very simple construction. Make a strong tube by rolling stout brown paper on a wine-bottle, fastening the edges with paste; a convenient length for this tube is about eight inches. Take two strips of common glass, six inches in length, and of

sufficient width to fit into the tube, and blacken one side of each strip by smoking it over a candle or lamp. Fit these two strips into the tube in an inclined position, so that their ends form the letter V, and place a third strip of glass, also smoked on one side, above the two side strips; when this is done the ends of the three strips of glass will form a triangle. A piece of cork glued to them will keep the two side pieces in position. It need hardly be said that the *unsmoked* sides of the glass strips must face each other. Get some very thin sheet brass and make a cap for one end of the tube. The outer end of this cap must be filled in with a piece of ground glass, while the inner end is filled in with plain glass; between these two pieces of glass place a number of fragments of coloured glass, and a few very small feathers or fern leaves. Fit a metal cap on the other end and pierce a hole in its centre. To this hole the eye has to be applied, and the well-known beautiful figures will be seen, which change at every turn of the kaleidoscope.


  
 A SHADOW PANTOMIME.

A most amusing entertainment for Christmas parties is a shadow pantomime, and though its effects are easily managed, few things are more surprising or

wonderful to those not in the secret. The most convenient place to arrange the pantomime is in two rooms which communicate by folding-doors; a sheet can then be hung up in the space between these doors, and the audience seated on one side of the curtain while the actors perform on the other, their shadows falling on the intervening screen.

The screen being arranged, a strong light should be placed on the ground at some distance from it. If the lime-light can be employed the shadows will be very intense.

#### TO THROW THE SHADOWS ON THE SCREEN.

To throw the shadow of a person on the screen, it is only necessary for the individual to stand in front of the light, and the size of the shadow will depend upon his distance from the light, the nearer the object is to the screen the smaller is the shadow, and *vice versa*. By taking advantage of this fact one person may appear to walk between another's legs. This is managed by arranging the two individuals at different distances from the light but in the same straight line; the spot where each person is to stand should be marked upon the floor before the commencement of the performance.

## TO JUMP TO AND FROM THE CEILING.

This remarkable and amusing effect is produced by the actor simply jumping over the light; if he jumps towards the audience from behind the light his shadow appears to descend from the ceiling, if the actor jumps from before the lamp his shadow appears to spring up to the ceiling.

## THE INVISIBLE RENDERED VISIBLE.

Get a small basin and place a coin at the bottom of it. Then get the bystanders to make a circle round the table and to walk slowly backwards until the coin is just of sight. Now let some one pour water gently into the basin, so as not to disturb the coin, the spectators meanwhile keeping quite still. Owing to the bending of the rays of light by the water, the entire coin will gradually come into view, and will be seen by all the bystanders.

## TO SEE THROUGH A BRICK.

Roll up a newspaper in the form of a tube. Hold a brick, book, or other opaque object in front of the eyes, and place the tube by the side of it. Hold the tube to one eye and look through it with both eyes open; you will apparently see right through the brick and discern the objects on the other side of it.

## TO RENDER THE VISIBLE INVISIBLE.

Make two ink-blots on a piece of white paper, in the same straight line, but about three inches apart. Now hold the paper exactly in front of the eyes at the ordinary reading distance, and close the right eye. Look at the right-hand spot with the left eye; by moving the paper slowly upwards and downwards a position will be readily obtained in which the left-hand spot will disappear.

## THE MAGIC LANTERN.

A simple magic lantern may be without difficulty constructed by adopting the following plan. Get a box either of tin or wood and make a hole in the top, into which fit a chimney for the escape of the heated gases from the lamp; the bottom of the box should also have a few holes for the admission of air to supply the lamp. In the front of the box, make a hole about one and a half inches in diameter, and fit into it a "plano-convex" lens (to be obtained from the optician). Make a tin tube an inch and a half in diameter and about four inches long, and fit into one end a double convex lens. Make a frame to receive this tube, and fasten it to the front of the lantern in such a way as to leave a space

between it and the plano-convex lens for the slides to be passed through. The tube should be rendered movable, so that the focus of the lantern may be adjusted. Behind the light, which may be any ordinary form of lamp or the lime-light, a concave mirror made of polished tin, should be placed. Slides for the lantern may be bought very cheaply, or they may be prepared by any one possessing a little artistic skill. The colours employed must be transparent.

#### MAGNETIC TOYS.

Magnetic toys, such as swans, fish, boats, &c., may be made of any light material, such as cork or elder-pith. Much pleasant occupation for winter evenings may be found in shaping these light objects, and if a small piece of steel or iron be placed in some prominent part of the object, it will float about in the water in obedience to the movements of a magnet held near it. Broken pieces of needles, if carefully handled, do very well to fasten into the floating objects, and serve as points to be attracted by the magnet.

#### TO MAKE A MAGNET.

Borrow or buy an ordinary bar magnet or a horse-shoe magnet, the first-named is the preferable shape.

Take a knitting needle or any piece of tolerably hard steel, and with one pole of the magnet rub it from end to end. Repeat this process several times, being careful to bring the magnet back *without touching the needle* to the end from which you started; in other words the rubbing must be in one direction only. If a horse-shoe magnet be employed, start from the middle of the knitting needle, pass the magnet along to either end, then bring it through the air to the other end, and stroke the needle several times, finishing in the middle.

THE END.



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