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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

A STEEL-WIRE rope, six miles in length and weighing thirty-five tons, has been made at the Deptford Wire Rope Works, Sunderland. It is intended for the purpose of colliery haulage.

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Oak for decorative purposes is produced by fumigating the material with ammoniacal vapour, which effectively produces the dark colour desired. The ammoniacal liquid does not touch the wood, the vapour only being passed into the air-tight chamber in which the material is placed.

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Two vessels have been booked by two Tyneside firms to the order of the North German Lloyd Steamship Company, this work having previously gone to the Clyde. Sir W. G. Armstrong & Co. will build one, and Messrs. Wigham Richardson & Co. will build the other, and engine both vessels.

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The increased cheapness of nickel, owing to the large output of the Canadian mines, is leading to a more extended use of this valuable metal. Only lately it was mentioned that the French Government proposed to use 400 tons in nickel coinage. Austria is also about to follow her example.

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An arc light between mercurial electrodes in vacuo is very brilliant but rather unsteady at the positive pole; when the intensity is very nearly equal to that of an ordinary arc light, no variation is observed. The temperature is not high, and the negative pole is hotter than the positive.

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Fifty-two years ago a patent was granted to the brothers Elkington, of Birmingham, for plating and gilding by electricity. Now the quantity of silver deposited by electricity is said to be between 50 and 100 tons in the course of a year, a fair proportion of which is used in the Midlands.

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Eminent chemical authorities have stated that aluminium would resist the attacks of nitric and sulphuric acids, whether dilute or concentrated; it is now reported that experiments made by Monsieur G. A. Le Roy have shown that the pure metal is rapidly attacked by strong nitric and sulphuric acids, even in the cold. This precludes the use of aluminium in manufactures in which these acids take part.

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A machine for threading spokes for cycles has been recently perfected by Mr. A. Stevenson, of Paisley. With this new machine it is claimed that the spokes are threaded in half the time ordinarily taken; and whilst only boy labour is employed to work it, the results are more uniform. The cost of the machine is to be about £2, and our contributor has promised to send drawings of it for publication.

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A photograph of a small stream of water has been taken by electric light and exhibited by Professor C. V. Boys. The photograph shows that the stream—apparently solid to the naked eye—was resolved into a beautiful and regular series of drops. The effect on a fountain of playing or singing was to change its appearance to that of one, two, or three separate streams, but a photograph taken as a tuning fork was struck demonstrated that the water was disposed in a regular series of drops.

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Mr. Hornby, of Queen's College, Oxford, propounds a theory as to the nature of "flexible sandstone." This stone, Itacolumite, is found in India, and may be bent like a sheet of cardboard or metal. Mr. Hornby maintains as the result of his microscopical examinations that the flexibility is due "to rough ball-and-socket joints between the grains." Visitors to Agra are often imposed upon, and purchase a composition, made by the natives with gum and sand, thinking this is genuine sandstone.

* *

It is announced in Berlin that the works of Frederick Krupp and the gun manufactory of Gruson, near Magdeburg, have been amalgamated. Krupp, as is well known, possesses the secret of the manufacture of the best steel for heavy guns, while the Gruson works have hitherto produced the best armour-plating in Germany, and also the most effective armour-piercing projectiles of hardened steel in the world. The combination of these two powerful establishments is, therefore, calculated to give Germany a new advantage over other countries in preparations for naval and military warfare.

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Herr Alwin [illegible]ske, of Altherzburg, states that cement may be rendered waterproof by adding ten per cent. of acetate or palmitate of alumina. The cement may be also made refractory by adding chromate of magnesia to it. If the cement is to resist moisture, and also to be refractory to fire, a mixture is made of about equal parts of cement mortar with the palmitate and a chromic magnesia prepared from oxide of chromium, 32 to 42 parts; alumina, 18 to 22 parts; magnesia, 18 to 20 parts. The mixture is wetted with water and formed into briquettes, which are calcined and pulverised ready for use.

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The Metallic Tube and Flask Company of Birmingham are using a new method of making weldless cold-drawn steel tubes. The steel is of special quality and is received from the works in the form of sheets. Circular discs are cut out of the sheets and pressed into shallow cups, which are then passed through dies of decreasing size, thus reducing the diameter and increasing the length of the cups until they assume the shape of tubes with one end closed, which latter is cut off after the final drawing operation is completed. The tubes are made of any size, from $1\frac{3}{4}$ inches down to $\frac{1}{16}$ inch diameter.

* *

A new process for purifying iron and steel from sulphur has been invented. For this purpose about equal parts of calcium chloride and lime are mixed and ground to a powder. The mixture is placed on the bottom of the ladle and the molten iron run in; it then melts, and passing up through the fluid metal carries with it practically all the sulphur which the iron contains. The inventor states that the cost of materials is about 6d. per ton of iron treated. From experiments performed with this material it was found that from 73 to 100 per cent. of the sulphur present was removed, according to the length of time that the mixture remained in contact with the iron.

STENCILS FOR WALL DECORATION.

BY A LONDON DECORATOR.

IN previous volumes of WORK I have briefly reviewed the claims of modern wall coverings; the mission of decorative colour in our homes, and similar kindred "every-day" aspects of decorative art. I now purpose supplementing the article on Stencilled Ceiling Decoration (WORK, No. 188) with a few examples of wall decoration of a kind suitable for the ordinary cottage or villa. Although those of my readers who have carefully studied the above-mentioned papers on theory and technique will be better prepared for planning and executing these wall treatments than those who have not, I shall hope to direct the practical efforts of the latter to fairly successful ends.

This design shows a representation of a simple plaster cornice, having a stencilled fringe border beneath it, and also of a skirting with a base border on the wall. These ornaments are of the simplest kind, and suggestive, by their regular repetition of simple forms, of Greek decoration. The arrangement of base and frieze borders is most suitable for bedrooms and parlours; but a deeper frieze is preferable for the latter if skill and other circumstances permit. In the article on Ceiling Decoration to which I have previously alluded, directions were given for enlarging small designs, and converting them into stencil patterns. To this I must refer any unpractised reader; but I will again draw attention to the disconnected formation in which stencil ornaments must be drawn. *Ties*, or connecting links, in stencils should be so arranged that no subsequent making good is necessary, and in this respect the novice must give every care to his enlargements.

Assuming the two stencil patterns to be prepared, I will briefly review the method of application. In the first place, with regard to colour. Bedrooms are undoubtedly best treated in light tints, and although it is usual to treat a sunny room with cool tints, and *vice versâ*, the bedroom is used so little during hours of sunshine that the tint applied to its walls is chiefly a matter of individual fancy. But, supposing we here want a cool but cheerful room, we therefore decide on a greeny-blue tint. This latter will be the dominant colour-sensation of the room. We may then further proceed on these lines. The ceiling, D, is tinted "ivory" or cream white, preferably a tint of *raw sienna* (not of *chromes*, which are too bright). This will "throw up" the colour of walls by force of *colour contrast*.

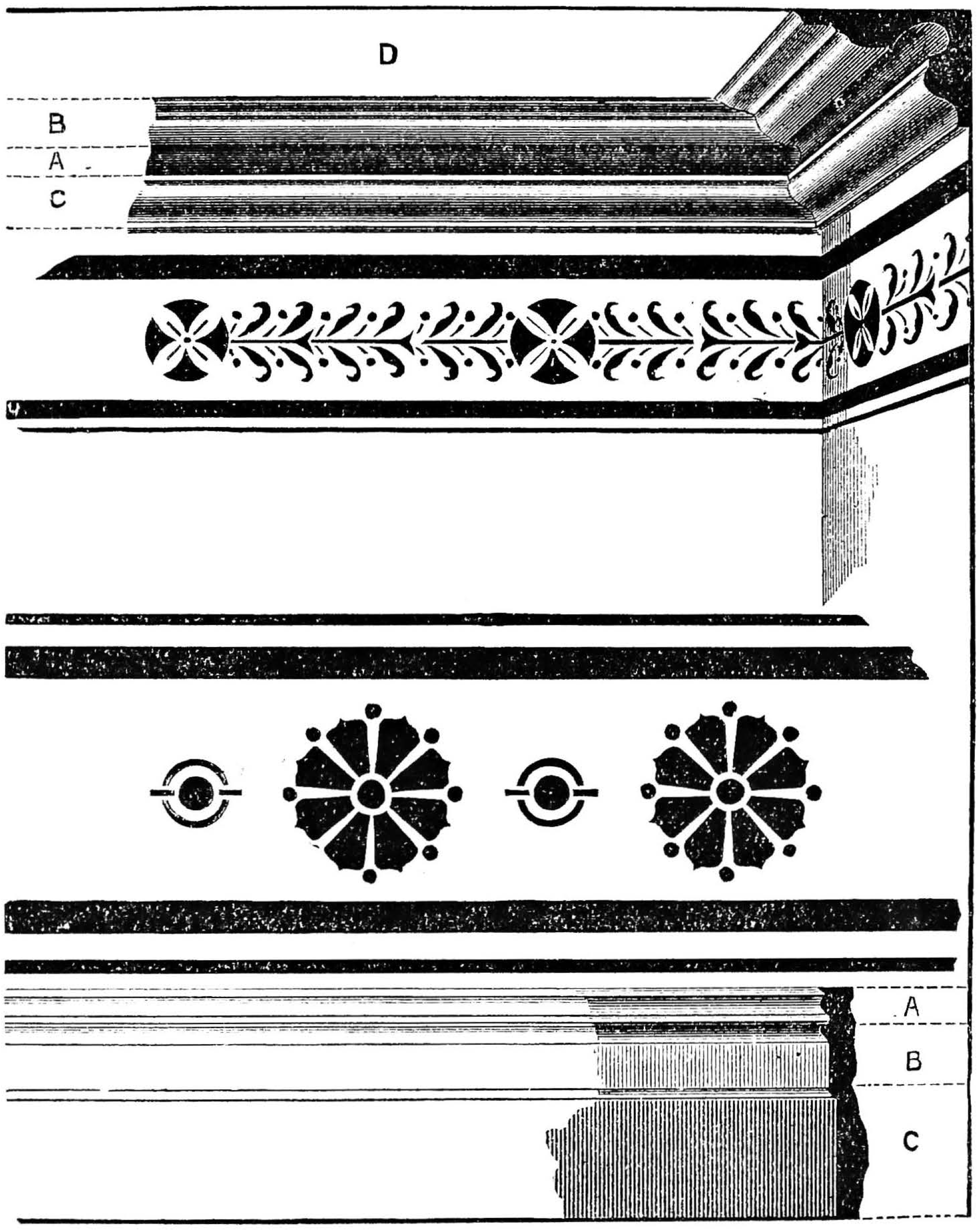
The wall colour—a medium tint made from white stained with blue, a little green, and a little umber—is also put on the top section of cornices. In the cornice cove we put a dull "old gold," and a darker shade of wall colour forms its base. These three colours I advise for the woodwork—namely, the panels of B, same as wall; the moulding A, "old gold;" and the remainder of woodwork C, a much deeper tone of wall colour.

Now concerning the ornamentation:—It is intended that the lines be "run in" at the last with a bevel-edge lath and a hog-hair lining fitch; but it is well to make the stencil wide enough to cover the place for lines, and to cut a little piece of each line on the pattern. These portions, when stencilled with the ornament, give us perfect guides or "keys" for running the lines. I have suggested that 6 in. and 8 in. be the width respectively of the frieze and base borders, between the thick inner lines. This, however, can be increased or diminished at pleasure, so long as the *proportions* are not materially disarranged. The ornament and lines may be in either the stile colour C—a darker tone of the wall colour—or in "old gold," same as mouldings. Should a more striking contrast be desired between pattern and ground, then the ornament may be a "nut brown," or that colour for lines, and deep grey or "old gold" for use with stencils.

It is impossible in the space of a brief paper to deal fully with the material. A few lines thereon may, however, be useful. Distemper of the ordinary kind is cheap, bright, and sanitary, and for bedrooms will answer admirably. If "Duresco," "Calcarium," or "Alabastine" is used, the makers of these "patent" distempers will advise as to the proper tints, or my readers can receive brief selections through "Shop." If cost and time do not stand in the way, good oil paint is most serviceable and sanitary; but in either case the stencilling should be done in "flatting" paint, and the ceiling is always best distempered.

The woodwork oil colours may not match the distemper tints accurately—this is on account of the different natures of lead and whiting—but pains should not be grudged in the effort. If we desire to varnish the woodwork, the palest "copal" is necessary; otherwise, our greys will be turned into dirty greens, and the whole colour-effect spoiled. But white copal varnish is costly; therefore, if we want a durable woodwork, and especially if we have American walnut furniture in the room, the door, skirting, etc., may all be finished "walnut brown," and varnished with ordinary oak varnish. If buff and salmon tints are desired for the room, then the woodwork and decoration had better be in darker tones—"terra-cottas;" the ceiling or door panels cream or "ivory."

The lines and ornament I have given in black, that they may the better be copied. When executed, the relative depth between ground and ornament will not be so extreme, and is better represented by the values of skirting. But it is better to make a little too much contrast than not enough.



Stencils on Greek Lines—A, Moulding Colour; B, Panel Colour; C, Stile Colour; D, Ceiling—"Ivory" Tint.

THE ART OF STAIRCASING.

BY GEORGE F. CHILD.

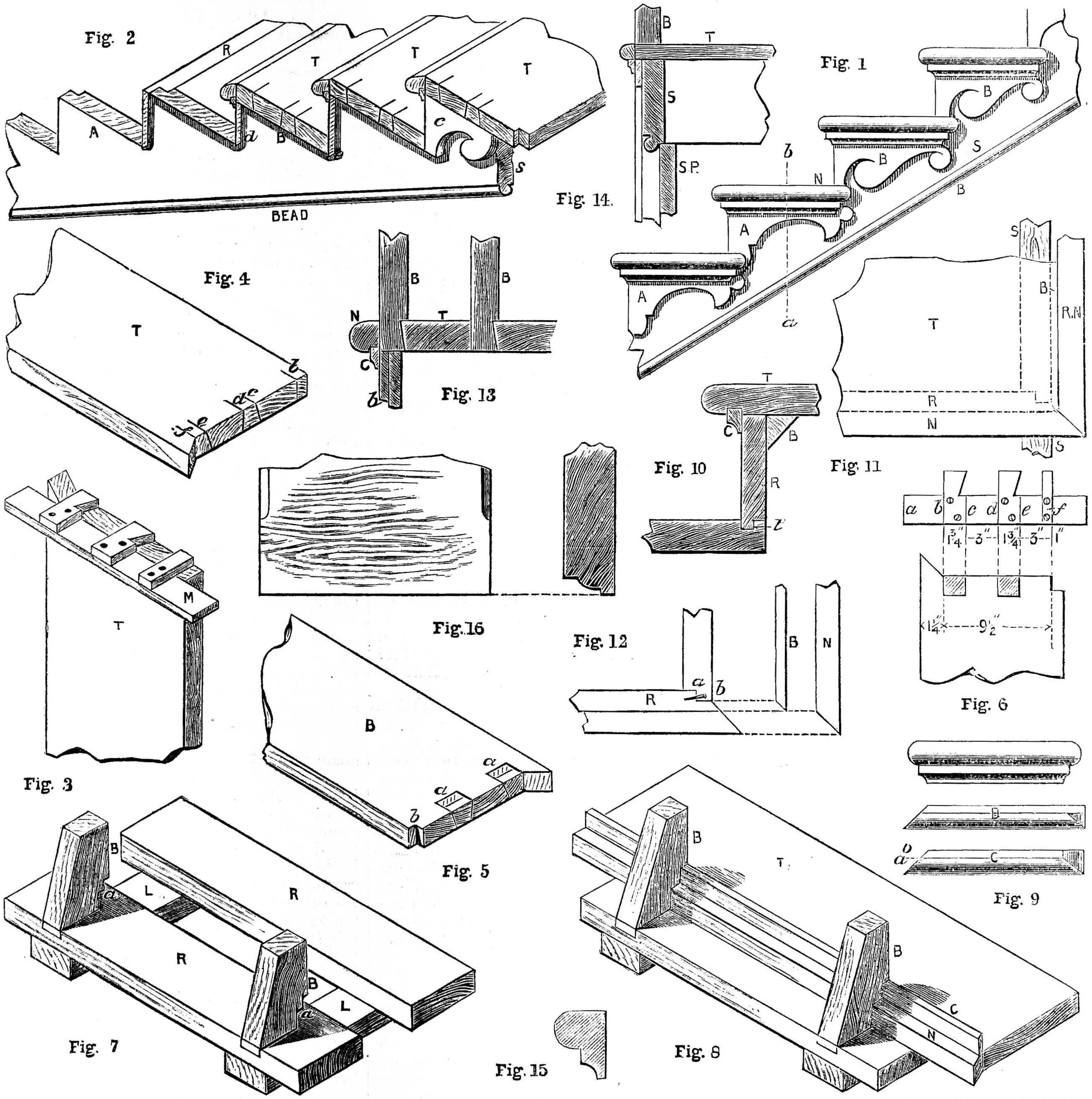
OPEN-STRING STAIRCASE.

INTRODUCTION — OPEN - STRING AND BRACKETS — STRING SHOWING VARIOUS PARTS— PREPARING THE TREADS— TEMPLATE FOR BALUSTERS— TO APPLY THE TEMPLATE— CUTTING TREADS FOR BALUSTERS—CRADLE FOR GLUING-UP STEPS—GLUING-UP STEPS — NOSINGS AND COVES — RETURN NOSINGS—SECTION OF STEP—PLAN OF ANGLE OF STEP—CUTTING RISERS— SECTIONS—PUTTING STAIRS TOGETHER—FITTING BRACKETS AND NOSINGS.

Introduction.—In the preceding paper we had an example of an open-string staircase, with two newels on the landings; now, as there are various processes in the construction of a flight of stairs of this kind that require very careful attention, we propose explaining in this paper the methods usually employed to ensure a good job. It is believed (this by the way) that there has never before been such a course of articles upon staircasing compiled, and explained so fully, as we here present to our readers; and being the result of personal experience, they should be of great assistance to the novice.

Open-string and Brackets.—In Fig. 1 we have the part elevation of an open or cut string, complete with nosings and brackets. At A A is shown a form of bracket that may be called continuous, on account of one joining the other. A bracket of this description is often adopted where expense is an object, it being easy to work, and allows the nosing to be *returned* in *itself*. Brackets are usually about ⅜ in. thick, and are fixed immediately under the treads, which project over the string, and fore the nosing must pass on to the string itself. It is a good plan to plane up and thickness a piece of board (pine by preference, it being easy to work), and cut out the brackets with a saw; after a sufficient number are sawn out, they may be cramped not work far into the eye of the scroll, but this can easily be done afterwards.

String showing Various Parts.—Fig. 2 is a portion of the string showing various stages of the work. At A is seen the string itself, as notched or sawn out ready to re-



Staircasing. Fig. 1.—Elevation of String—S, String; A, A, B, B, Brackets; N, Nosing; *a b*, Section Line. Fig. 2.—Details of String and Steps—A, String; R, Riser; T, T, T, Treads; B *e*, Projection of Step over String; *d*, Mitre on Riser; *s*, String Section; *c*, Bracket. Fig. 3.—Application of Mould—M, Mould; T, Tread. Fig. 4.—T, Top Side of Tread—*b, c, d, e, f*, showing Cuts for Balusters, etc. Fig. 5.—Under Side of Tread—*a, a*, Cuts for Balusters; *b*, Cut out for String. Fig. 6.—Template—*a, b, c, d, e, f*, Clear Distances for Balusters, etc. Fig. 7.—Cradle for gluing-up Steps—R, R, Rails; L, L, Ledgers; B, B, Blocks; *a, a*, Notches for Nosings. Fig. 8.—Tread in Position for gluing—T, Tread; B, B, Blocks; N, Nosing; C, Cove. Fig. 9.—Nosings—B, Returned in itself; C, Mitred in return. Fig. 10.—Section of Step—T, Tread; R, Riser; B, Block; C, Cove; *t*, Tongue. Fig. 11.—Plan of End of Step—N, Nosing; R N, Return Nosing; S S, String; R, Riser; B, Bracket. Fig. 12.—Mitre on Nosing and Bracket—R, Riser; B, Bracket; N, Nosing. Fig. 13.—Section of Step to show Balusters, B, B—T, Tread; N, Nosing; C, Cove; *b*, Mitre on Riser. Fig. 14.—Section on *a b* (Fig. 1)—S, String; S P, Spandril; T, Tread; B, Baluster. Fig. 15.—Section of Nosing. Fig. 16.—Sketch of Cove Plane.

finish *flush* with them. At B, B a different form of bracket is shown, which may be called superior to that at A. This bracket, finishing each in itself, causes the nosings to be mitred, and to return ⅜ in.: this being the thickness of the bracket, which does not pass under the nosings at this point, there- together, and worked up with "hollows and rounds" of various sizes, finishing up with glass-paper. This is to be preferred to working each up singly, as it takes less time and ensures all being alike. Of course, *portions* of the bracket "B" cannot be worked in this manner, as the planes will ceive the steps. B illustrates the *tread* and *riser* in position, *d* being the mitre on the *riser* (under which the *tread* below passes), which projects the thickness (⅜ in.) of the brackets, and is mitred to it; *e* is the portion of the tread passing *over* the outside of the string; *c* shows a part of the bracket nailed in position; *s* being a section of the string.

Preparing the Treads.—In setting out the steps to length, we must remember that they *pass over* the thickness of the string and $\frac{3}{8}$ in. beyond, also $1\frac{1}{4}$ in. for the returned nosing; this $1\frac{1}{4}$ in. represents the thickness of the tread, which is usually taken as the projection of nosing over the riser. The treads are now set out for the return nosing by squaring them across, at a distance equal to the projection of nosing from the end; they are then marked for the mitre with a *mitre square* or a bevel set to an angle of forty-five degrees, after which the piece is cut out clean, leaving the tread as at Fig. 5. The tread must now be ploughed on the *under* side to a depth of $\frac{1}{4}$ in., with an $\frac{1}{2}$ in. plough-iron; this is to receive the piece ($1\frac{1}{8}$ in. × $\frac{1}{2}$ in.) for the cove, or small moulding under the front edge of step.

Template for Balusters.— Having proceeded thus far, we have next to prepare for the balusters; the first thing, then, will be the making a mould or template by which to mark the treads. Plane up a piece of stuff about 14 in. × 2 in. × $\frac{3}{8}$ in., also two pieces equal to the size ($1\frac{3}{4}$ in.) of the balusters; these last pieces should now be cut in the form of a *dovetail* on one end and equal to the thickness of treads. Also a small piece is required about 1 in. wide. Now from the pitch-board obtain the width of the tread, from *inside* of nosing to *outside* of the next riser above, which we will take as $9\frac{1}{2}$ in.; now deduct the thickness of *two* balusters ($3\frac{1}{2}$ in.) from this, dividing the remainder (6 in.) into two parts. Fig. 6 will best illustrate our meaning. At a short distance from one end screw one of the strips on to the long piece, as from *a* to *b*. Now mark 3 in. from this and screw on the other, as *c d*, again marking off 3 in., *e f*, and fasten on the 1 in. piece *inside* the mark.

To apply the Template.— To apply the template, place it upon the *end* of the tread, with one edge of the *first* strip close up to the mitre, as seen at Fig. 3; now mark round the strips with a pencil, and square the marks down the face of tread equal in distance to thickness of baluster ($1\frac{3}{4}$ in.).

Cutting Treads for Balusters.—Our next proceeding will be to cut in for the balusters. This is managed by running a saw down the marks made on the *face* of the tread, being careful not to pass beyond the $1\frac{3}{4}$ in., or it will be visible after the balusters are fixed. This process is plainly seen at Fig. 4, T being the top side and B (Fig. 5) the under side of tread. The parts *a*, *a* on the under side are next *partly* cut through with a mallet and chisel, the pieces being completely cut out, when the balusters are fixed, after the stairs are in position; the small piece *b* is cut out to allow the tread to pass over the string in front of the riser above, as this gives the width of tread.

Cradle for Gluing-up Steps.—At Fig. 7 is shown a very useful appliance for gluing-up the treads. As it is obvious that the risers should be at right angles to the treads, every care must be taken to ensure this result; hence the use of the cradle. To make the cradle, prepare two pieces of stuff, R, R, about 3 ft. long, 4 in. wide, and $1\frac{1}{2}$ in. thick; also two similar pieces, L, L. Now cut two other pieces as B, B, sawing out the notches *a*, *a* to a distance equal to the nosing and cove. Nail R, R and L, L firmly together, and let the pieces B, B into R as seen, being sure that the face of each is perfectly square with R, R; also nail these in.

Gluing-up Steps.—Having first glued in the pieces designed for the coves, place the tread *face downwards* upon the cradle, as at Fig. 8. Now fit each riser in its place by "shooting" the edge until its face coincides with B, B; also fit three blocks in at the back, *being sure they fit*, as upon this depends their usefulness. Having fitted all the risers, glue each to the tread, with the blocks behind, and place them on one side to dry. The risers should now be worked to their proper width, to be obtained from the pitch-board.

Nosings and Coves.—The nosings should be worked with the nosing-plane described before; the coves are also worked with a special plane, as shown in the sketch (Fig. 16).

Return Nosings.—The return nosings will depend upon the bracket selected; they should first be worked as at Fig. 15: that is, the nosing and cove in one piece. If the bracket is to be as A (Fig. 1), the nosings must be returned as at B (Fig. 9): that is, returned in itself; if as B, C will be the plan; in this case a mitre is cut on *each* end and a small piece glued on the return; *a b* shows the thickness of the bracket.

Section of Step.—Fig. 10 is a portion of the step when worked; T is the tread, C cove, B block, and R the riser. The riser is sometimes tongued into the next tread, as here shown at *t*.

Plan of Angle of Step.—At Fig. 11 T is the tread, S the string, N the nosing, R N return nosing, B bracket, and R the riser.

Cutting Riser.—R (Fig. 12) is the riser, as cut out for string and bracket; it is cut in this manner (and the string to correspond) to save the necessity of thicknessing the string, which would be the case if "*a*" was cut back.

Sections.—Fig. 13 shows a portion of tread with balusters in position: T tread, B baluster, *b* bracket, N nosing, and C cove. Fig. 14 is a section taken at A B (Fig. 1), S string, S P spandril, T tread, and B baluster.

Putting Stairs Together. — In putting "open-string" staircases together, we have to guard against the chance of wedging them up *out of square;* to prevent this fault arising, it is advisable to place each step in its proper place in the wall string, and firmly screw each riser into the next tread below. If this is properly done, and the ends of the steps all kept "fair," it is scarcely possible for them to be out of "true." Having wedged the steps into the "wall string," the "cut string" should now be placed in position with a piece of stout "quartering" placed against the nosings; "cramps" are now applied, drawing the string tightly up into each step. It will be seen from Fig. 2 that the "risers" being placed on the top of the "treads," the cramp is sure to draw the steps firmly down. The "string" can now be nailed through the face into each riser, as the bracket will cover all up as at *b* (Fig. 12). A few nails can also be driven carefully into the treads on the "*skew*," and blocks should be glued at the back of each step and string. One of these blocks, often made by splitting a piece of square timber, is shown in Fig. 10, marked B.

Fitting Brackets and Nosings. — All brackets should now be fitted and bradded on, taking care that they are *fair* or *flush* with the portion of treads projecting over the string, as the nosings will be nailed on top of these. The return nosings should not be fixed permanently, as they have to be removed to fix the balusters; therefore, two nails should be only driven partly home, so that they may be easily withdrawn with the pincers.

BOOT AND SHOE MAKING.

BY WILLIAM GREENFIELD.

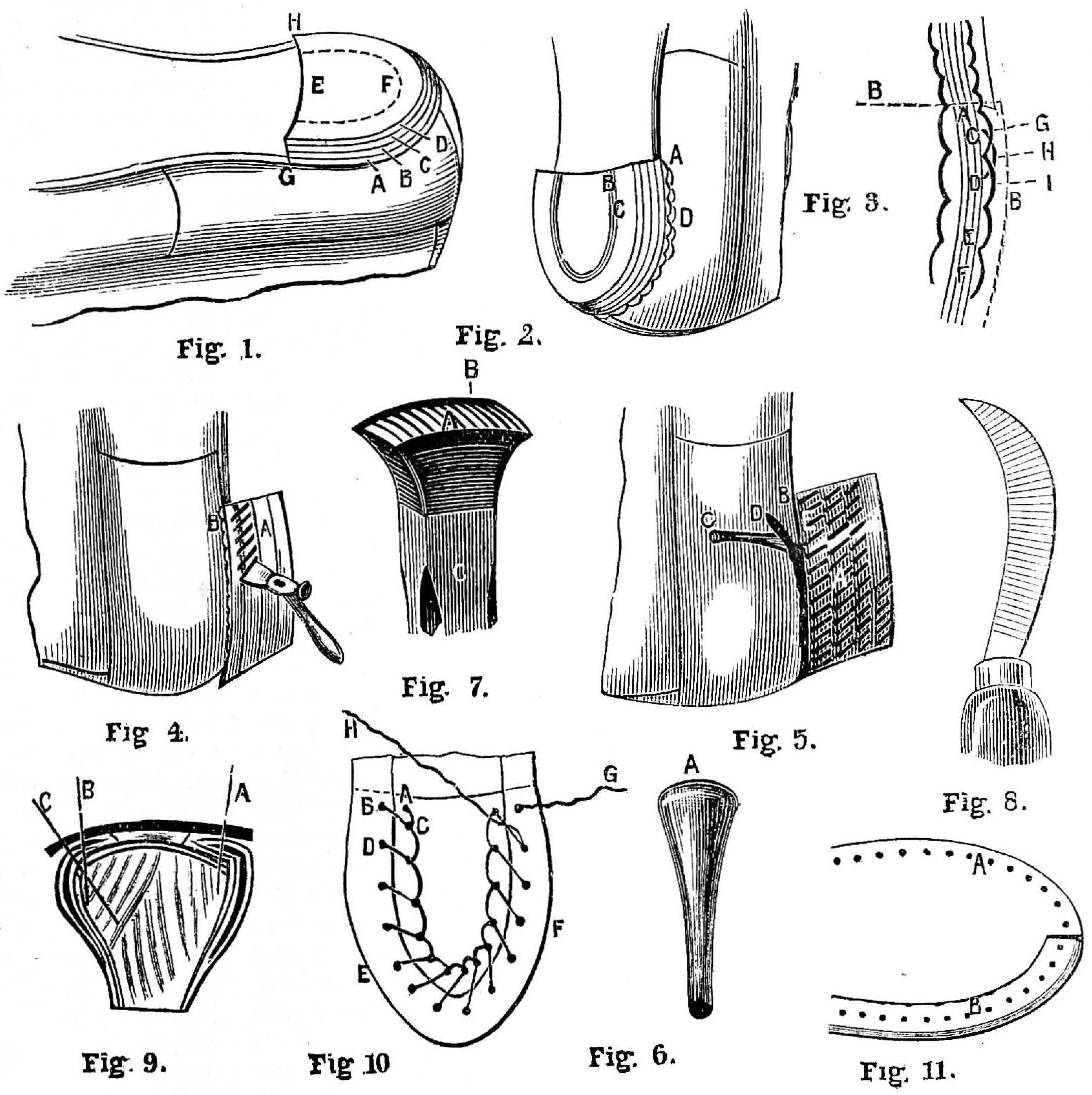
THE WAY TO GET THE HEEL READY TO SEW DOWN—HOW IT IS SEWN DOWN—THE WAY TO MAKE THE SEAT (SEWN SEAT)—THE WAY A PEGGED SEAT IS MADE.

The Way to Get the Heel Ready to Sew Down.—In WORK, No. 194, page 594, the split-lift was left pegged in its proper place on the seat. Now, when the top of this is rasped nicely and rough, it must be pasted, and the first entire lift put on grain side upwards, first roughing and pasting the flesh side. It is well, until having learnt to judge the size each lift should be, to place a piece of paper over the split-lift, getting a straight edge of it against the breast, holding it there with two fingers of the left hand. Then, with a piece of coarse sand-paper in the right, stroke the edge of the paper over the edge of the split-lift, until the edge of the paper and pattern of the heel is worn asunder. If the heel is to be square, this pattern will do for roughing out all the lifts. These should be a little larger than the pattern, unless the heel is going to be a smart (hollowed) heel; in which case each one may be a little smaller than the other. For present purposes, there will only be wanted two whole lifts to make the heel, as in Fig. 1, A being the sole and seat-pieces, B the split-lift, and C and D the first and second whole lifts. In putting on the first lift, about five pegs can be inserted midway between the centre and edge, as was done in the split-lift; the top of them cut off with a portion of the lift. Then the top is well rasped until nearly all the grain is off; and when it has been trimmed round to the shape of the remainder of the heel the second lift can be roughed, the two pasted, and the second fixed in its place on the heel, and kept there by putting in, permanently, two $\frac{3}{8}$ rivets at E and F, or two sole tacks that can be withdrawn after the sewing down has been done. At the breast of the heel the first lift should overhang the ends of the split-lifts a little, and the second should overhang the first, and so on, until the top piece is on, and the heel is the height required. I have shown how to cut a channel, and one must be cut some distance in this top lift, as shown by the dotted line. It need not be deep, and if the knife be held the reverse way and a second cut made an eighth of an inch from the other, it will cut a V-piece out, and form a nice groove for the stitch to lay in. The sole and sole-piece should be rubbed round with the bone at G to H, to open it a little from the seat stitches, so that they may be clear. Then see that the seat and lifts are not too dry.

How it is Sewn Down.— It is held on the knees, as it is in the diagram (Fig. 2), with the heel towards you, and the lifts to the left, and held very firm by the strap. The heel thread should be stouter than the sewing thread—about four or six strands more will be sufficient. The heel awl is an instrument something like the sewing awl, only nearly straight. It is used in a large-sized sewing-awl handle, and the blade will want to be dipped into soap before it is used to make each hole. It has a thick substance to go through, and for this reason the bristles on the thread also will need to be good. To make the first hole, the awl must be put in at A (Fig. 2) and brought out at B. To show you the exact place in the sole that the point of the awl is to be put, I give in Fig. 3 a section of the welt and seat. Supposing B and B (the dotted lines) to be the heel, the first hole is made exactly over A. This done, one end of the thread is drawn through, and it is then halved. The second hole is made in the same way over C, and brought out at C in Fig. 2; and in making this hole, as with all the rest after the first, the awl must not touch the seat stitch (Fig. 3), or the wriggling of it would cause the stitch to be burnt or heated enough to impoverish it of its wax, and make it somewhat rotten. After the hole is made, just the point of the awl is placed under it, to raise it to be in a line with the mouth of the hole, so that the thread may well run through the two. This is done by putting the two bristles in one after the other, and then pulling the two ends through at once, pulling very hard on both sides; the third hole made in the same way by putting the awl in at D, and the former process repeated. This, it will be seen, will make a stitch as at H, that loops out of G into I; and when it is drawn tightly in as before, it will be seen that it draws the upper leather to the sole leather, and so holds the heel on; and this is repeated until the whole of the stitches that lay on the upper leather are sewn down—each hole following as at E and F, and so on. The stitches in both these diagrams are shown loose to illustrate the position of each, and each one should fall into the groove on the top, the last stitch being finished off with a knot. Each time a stitch or so is set the heel should be hammered down on the top of the stitches, at A C (Fig. 2), in order to keep it in its place. When the heel is sewn all round and the ends cut off, it can be firmly and well hammered down all over.

The Way to Make the Seat (Sewn Seat).—Although this is a sewn seat, which I have explained above, the making of it is not practically commenced until it has, as there described, been sewn down. Now, as the leather is damp and workable, it is the time to make the seat; and after it has been hammered on top, the stitches A, D (Fig. 2) should be rubbed down well with the bone; it can then be pened up with the pene end of the hammer, and it will need to be done most carefully, for all these stitches here must be covered by the leather in this process. It will be seen by A (Fig. 4), that in commencing, the pene of the hammer must only hit the heel at the bottom of the split-lift and the top of the sole and sole-piece. This is done to get the leather that is directly over the stitches as near to them as possible. When this has been done all round the heel, turn the boot round again, and commence at the extreme edge, B, holding the boot in the position shown; and when getting round towards the back, throw the toe between the knees. The hammering does not want to be hard, but sharp and frequent, and continued all round the edge of the heel in various rows, as at A (Fig. 5), and leaving no part untouched. Then it can be slightly hammered down with the other end of the hammer. The next step is to hold the boot in a firm place upon the knees (as at Fig. 5), and just start to cut the rough edges of the seat at B with the point of the knife; and to save it from slipping into the upper, the handle of an old metal spoon will be found very handy.* This is placed on the upper, as at C, moving it along with the knife to cut off the rough edge, D. This is trimmed up, so that E is left firm and solid, and well covering the stitch. The next start is made upon the other corner of the seat; and this, by running the seat-breaker† round. The guard B (Fig. 7) is put against B (Fig. 5), only at the other corner, and taking sweeping strokes in one direction only three or four times, until the seat is smooth and even all round. If not, the lumps must be cut off with the knife, and the breaker used again. This makes the edge E all right; and now the edge B must be rubbed round with the welt file,‡ and the heel can be allowed to dry. It can then have the remainder of the lifts put on.

The Way a Pegged Seat is Made.—If the seat is to be pegged, this must be decided upon before the boot is lasted, as it is necessary to skive the stiffener much thinner and more tapered than is the case if the seat is to be sewn. Otherwise it is the same as at Fig. 7, page 181, No. 168. With regard to the inner sole, it is not fitted and holed as before described, but left quite square and plain to the edge, as far as the heel is coming; only the waist and fore-part holed, as C. Even when the seat portion is left its full substance, it will be found that the centre is higher than it is at the sides, unless the bottom of the last at the heel is very flat—which it should not be, or it will perhaps feel very uncomfortable to the heel in wear. I have explained how to make a "split-lift," and a thin pair must be made to go on just round the edge of the inner sole (on top) about half inch wide. The substance they should be must be decided by the amount of drop that the last has at the edge, as you want to get the top as near flat and level as possible. It can be pegged on with a few short fine pegs. This is done so that in pegging the seat the sole and all the upper leather and stiffener should lay quite flat. The pegs must go straight through each substance, instead of on the slant; for pegs that do not go through everything, inner included, are never solid, as they tend to yield to any strain from top and bottom. This can be easily seen by looking at Fig. 9, which is a transverse section of the heel (seat, upper, stiffener, inner sole, split, and sole), with the right side with the split, and the left without. The difference can be seen between a peg that is driven through, as the line A, and the one at the line B. To get the same effect upon the leather on the left as the line A, the peg would have to be driven as the line C, which is not to be compared with A for strength. The inner sole prepared, the top can be lasted round the seat as before described, with this exception: that the upper must come over towards the centre fully three-eighths more than what is really needed for a sewn seat. Bought tops are generally quite large enough to admit of this, without making the golosh too low at the back; but, if not, then you must make them sewn. The upper is sewn down to the inner sole, but not as it was for a sewn seat. There are several ways of doing this; it can be felled round, one end being round the edge of the upper, or the stitch can be set, first on the sole side and then on the upper; but that is not quite solid enough for my liking, as everything must then depend upon the



Boot and Shoe Making. Fig. 1.—The Seat, with Sole, Split-lift, and two Lifts ready to sew down. Fig. 2.—The Stitch buried in the Lift, and how the Stitch is caught up. Fig. 3.—Section, showing how the Stitch is set and where the Hole is made. Fig. 4.—The Leather made to cover the Stitches by the Pene End of the Hammer. Fig. 5.—The Seat trimmed without cutting the Upper. Fig. 6.—Metal Guard, made from the Handle of an old Spoon. Fig. 7.—A Seat-breaker. Fig. 8.—Welt File. Fig. 9.—Section, showing how a Pegged Seat is made, with the right and wrong way of driving the Pegs. Fig. 10.—The proper way to sew the Seat down for a Pegged Seat. Fig. 11.—The Position of Pegs on Seat and Split-lifts.

* If the handle of an old metal spoon is hammered out thin and flat (as A, Fig. 6), it makes a nice guard to the knife for several purposes.

† A seat-breaker; A is the cutter, B the guard, C the handle (Fig. 7).

‡ A welt file for smoothing the welt, etc., made with cross-cuts on one side only (as Fig. 8).

pegs; therefore, I shall not illustrate these, but only the best method, which is as follows:—Hold the boot as you did for the sewn heel, with the heel towards you (as Fig. 10). The sewing awl is put in at A, and the point must come out at B, and a thread put through and halved. The next time the awl is put in, it must be at C, and come out at D; this is a little on the slant, and the remainder of the holes can follow the alternate dots on either side in like manner. Now, the way the stitch is set is like this: the end that is hanging out of B is held in the left hand, and when you have made the hole C D, the end that is at A is put into C; B is then put under the thread that is going to form the stitch on this side, between A C. The thread A is then pulled out at D with the left hand, and the thread B pulled through under the stitch A C. This, it will be seen, will draw the upper well over at B. The next stitch is set in the same manner, which will, of course, draw D over, and so on right round. Each time a stitch is set it can be hammered down on top, and also at the side; this beats the stiffener in its place, and helps to make the edge of the line E F nice and square, to form the seat upon. By this diagram being turned the other way up, it can be seen by the last stitch that if the two ends G and H are tied together it will make a good finish, that the whole is a solid and smooth seam, and that the top is nice and flat to receive the sole. The sole and sole-piece is put on as I said before, only that it is pared nearer to the upper, leaving about a sixteenth all round; then a row of fine pegs (just long enough to go through the inner sole) put in, as near to the edge of the sole and sole-piece as you can (as shown by A, Fig. 11); but they must reach the edge of the inner sole and just go through it. The proper awl to use is a straight fine awl, like an ordinary bradawl, only fine, and in a short stumpy handle; and if the leather be too hard for it to be forced in by hand pressure, it can be held in its place with the left, and be driven in with a hammer in the right. The tops of the pegs must be cut off, rasped, and pasted, ready to receive the split-lifts, as shown in my last article. When the split-lift is put on, it must have a row of pegs put round, as shown above, only they must not be quite so near the edge, as shown by B F. The first lift is treated in the same way, and, with these exceptions, all is the same, as with a sewn seat; and so in my next, after giving a brief account of pegged and spring-waist, called flexura waists, I shall show how to finish building the heel, and not leave you till "all the stuff is on."

TOOTHED WHEELS with short teeth usually run much easier and smoother than those with longer teeth. The teeth should be also so pitched that the tooth of the driving wheel does not touch that of the driven wheel until the line of centres has been passed. The difference of motion between this, and that which ensues when the driver touches the driven tooth, is similar to that noticeable between trailing a stick and pushing it along the ground. The teeth should be carefully set out by means of a rolling circle, and the pitch of the driving wheel made about half per cent. coarser than that of the driven wheel. When the driven wheel has the coarser pitch, the pushing action will occur, and any slight irregularities in the surfaces of the teeth will cause much jarring and vibration.—F. C.

HOW TO MAKE AN IMPROVED BIRD-CAGE.

BY J. WHITFIELD HARLAND.

IT is proverbial that pets, especially birds, invariably come to grief and a tragic end, the manner of their death being "cats." In their interest, I once designed and made a cage which effectually protected them from the feline race; and, presuming that amateurs and others might desire to do the same, I submit the present design.

The improvement consists in a double set of wires, at a distance of, say, 3 in. apart all round, to prevent pussy, after fascinating her destined prey, getting her claws far enough to be dangerous, and maintaining thereby a respectful distance between them.

The design itself, as shown in the illustrations, is octagonal in plan, is semi-Gothic in style, two storeys in height, and stands upon a square base, which projects 3 in. all round beyond the wires of the inner caging, whilst it has double eaves to its roof, each of which carries a separate caging. At one end of the base is a drawer front, with a pull in the centre, attached to the false bottom of the cage, allowing it to be withdrawn for cleaning, and fastened, when closed, by a button. At front and both ends are projecting bays in both storeys. These are to serve as enclosures for baths, seed-boxes, and nesting spaces, and are projected from the cage to avoid droppings falling into them. In the lower storey they are entirely of wood, and consist of a framing, roofed with wood, and filled in at front and sides with thin wooden louvres; and in the upper storey are almost solid wood, with trefoil apertures fitted inside with wire gauze, but framed and panelled as shown. At the back, *i.e.*, to the left in the drawings, there are no projections, thus permitting a full view, thence, of the interior. The double roof of the cage is of the kind known as hip and gable; the wires of the outer caging being vertical, whilst the inner wires are laid horizontally. The ridges and rafters die into a framed square base, for ornamental ventilator, into which they are mortised, which also receives the ends of the upper wires of inner caging roof, so far as those coming opposite are concerned. The ventilator above is framed together, fitted with louvres, and the horns, or awms, are left long enough at each corner to slide into the square base tightly.

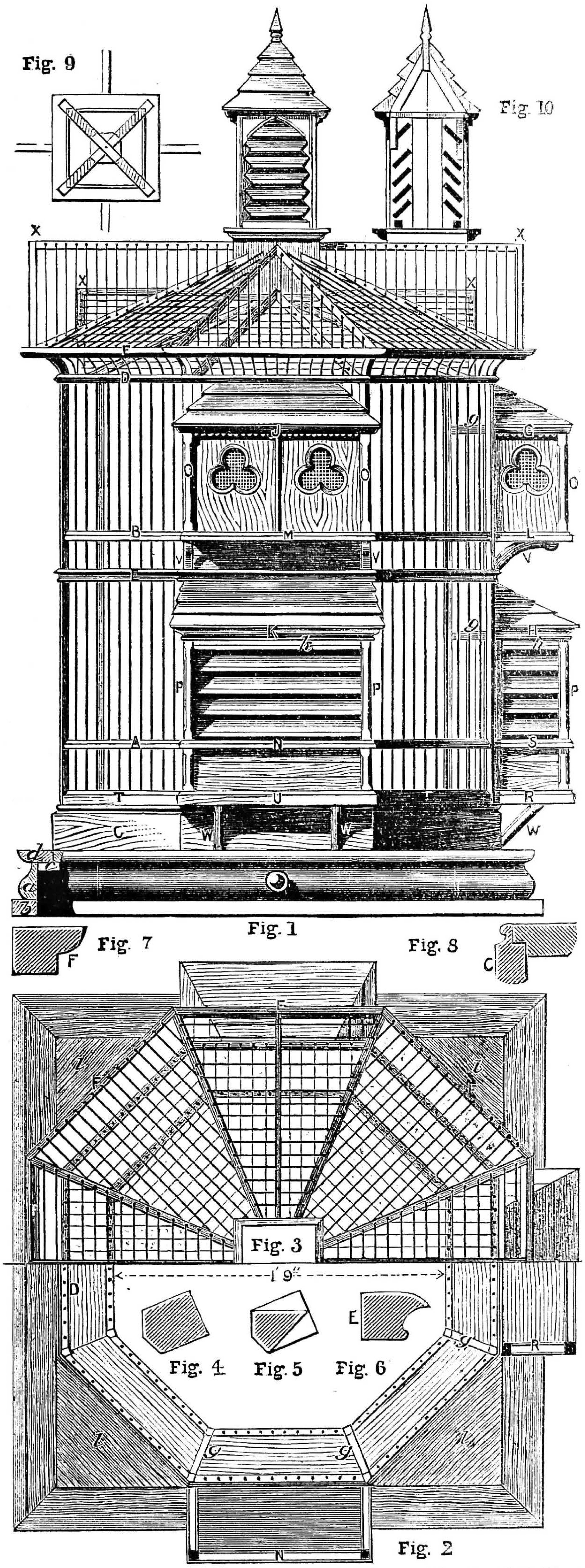
The general construction is as follows:—Select some hard wood—preferably "Honduras" (a cedar, which in some parts of the country is called "bastard mahogany"), which is very little liable to warp as oak does—and first make the base of the dimensions shown in the plan by "concealed-dovetailing" it together at four corners, having first stuck the mould, *a*, on its face (see sectional part of Fig. 1). Then stick a bull-nose on edge of the top piece, *d*, and mitre it, and plant it upon the upper edge of the base-mould, *a*, fixing it to a strip, *c*, glued and screwed to *a* by screws and glue from its under side. Then plane up a flat piece, *b*, and glue and screw it to lower edge of *a* from below. This completes the base, except that the four corners (see plan), which are the difference between the octagon and its containing square, marked *e e*, should be floored by thin triangular pieces, of the size shown, and the false bottom drawer-front. This latter may be made by sawing the mould, *a*, right through with a very fine tenon-saw before planting on the pieces, *b*, *c*, and *d*, on one side of the square, afterwards fixing their ends only to other part of frame, so as to allow the length sawn away to slide between *b* and *d*, to act as the drawer-front. The pieces, *b*, should be made wider on the two sides right and left of the drawer, to act as runners, or separate runners fixed, with strips planted on to form rebates, to keep the sides of the drawer in square line with front, such sides being mere $\frac{1}{2}$ in. strips nailed on upper side of the $\frac{1}{4}$ in. false bottom of cage. Before covering this bottom with very thin sheet-zinc, it should be coated with a solution of alum, and both it and all inner parts of the base, cage, etc., should have a coat of shellac dissolved in naphtha or methylated spirits, especially in all joints, however close. This prevents the tiny parasites from finding harbour in the cage and multiplying, to the destruction of the birds. In the base and lower part of cage it will not do to trust to glue alone, on account of the unavoidable moisture. All parts should be also screwed.

The eight uprights forming the outer cage should be carefully got out exactly the same length and thickness, out of $\frac{1}{2}$ in. × $\frac{3}{8}$ in. stuff, to the section (Fig. 4). The lower ends should go right down the full depth of the plinth, C (Fig. 1), which is octagonal, and be screwed to their places, from inside, to it. This plinth should be $\frac{1}{4}$ in. thick, with a small bead and hollow worked on its upper edge (see Fig. 8). This should be mitred, the angles being blocked together inside flat part. The lower edges of the rails, A, B, and of the mouldings, D, E, should now be marked off on the eight uprights on both sides, then, scribing thickness of the rails above the mark for them, notch the sides to nothing at back and to front edge of the sides, as shown in section (Fig. 5), the part left white being the notch, which enables ends of rails to be exactly square. The mouldings, E and D (Fig. 6), are made wider—viz., $\frac{1}{2}$ in. × $\frac{3}{8}$ in.—finished so as to project beyond face of uprights, there to mitre, the hinder part to be squared for notches, as before, into uprights. When these are all fitted to their places, before gluing up, the six uprights should be marked and mortised for the cills and heads of the projecting bays (right through that part of face which is square to them only) into the notches made for rails, A, B, and to the other side for heads, G, H. These mortises should only be $\frac{1}{16}$ in. × $\frac{1}{8}$ in. These side heads, G, H, should be mitred to the front heads, J, K, externally, and should be scribed to, and cut to fit, the rails, A, B, in one case, and the cills, in like manner to the uprights themselves, in the other case, all dying into the frame of outer cage. The posts, O, O, O, and P, P, P, should be of $\frac{3}{8}$ in. square stuff, stop-chamfered, as shown, the latter being mortised for receiving tenoned ends of cills, S, N (part through only), and at top for the head-rails, *k*, *h*. They should be grooved for $\frac{1}{16}$ in. panels in O, O, O, and for louvres in P, P, P, above N, S, and below for panels from R to S, and from U to N on the sides next to them. The under sides, inside edge, of cills, L, M, should be rebated $\frac{1}{4}$ in. wide, $\frac{1}{16}$ in. deep, for $\frac{1}{16}$ in. flooring to be afterwards nailed from below with very small wire nails, filed off if they project through to inside. The rails, A, B, L, M, N, S, are $\frac{3}{8}$ in. × $\frac{1}{4}$ in. Heads, G, H, J, K, are $\frac{3}{8}$ in. square before moulding. The bottom rails, T, T, U, R, are $\frac{5}{16}$ in. deep by $\frac{3}{8}$ in., mitred at the bays and bevelled to die into principal uprights, as may happen. The mitres to posts, P, P, P, to be recessed to $\frac{1}{16}$ in., and the posts must be recessed also, that the rails may be planted on recessed part of posts, leaving the mitred portion projecting beyond them, as shown. The under sides of the mouldings should be slightly notched, to receive the hip-rafters of bays ($\frac{1}{4}$ in. square), at their points of intersection. The plinth, C, should next be rebated at top edges to receive a filling, similar to the flooring of space in base below (already explained), to cover the angles of the octagon exterior to the contained octagon, so that the rails, T, T, U, R, may rest on its diagonal edges, and its eight sides be in rebate, the top flush with upper edge of the plinth (see Fig. 8). This being done, the framing of the outer cage, excepting roofs and bays, may now be glued up, and held together till the glue is dry by string, tightly tied round at top, middle, and bottom by way of cramps. The panels and louvres being made whilst the glue sets hard, the curved cantilevers cut out and chamfered (V, V), the straight struts made, chamfered, and housed on under side of R, the flooring of bays fitted roughly, the hip-rafters got out and bevelled to proper angle, the bays may then be glued up ready for fixing to the carcase.

The inner cage, being intended solely to keep the birds away from the outer cage, may, and should be, very light. The eight uprights may be of the same section as the outer cage, but thinner (or be $\frac{1}{4}$ in. round), and should be secured at foot to the filling (before described) of the top of plinth framing; at top they may be halved into their corresponding roof-rafters. One rail will suffice at the height of E. A plate at top, level with D, should go all round, halved at angles, and nailed to the uprights with wire nails.

If the cage be intended for larks, etc., instead of wiring the roof of inner cage, it should be filled in solid, and the lower storey should be discarded, the rail, B, being dropped to the height now occupied by A; otherwise, they would kill themselves by attempting to soar.

We now come to the roof construction, having so far only gone as high as the eaves-plate, D. Get a moulding, F (see Fig. 7, which is a section of it), and mitre it so that it will be larger (as shown in roof plan, Fig. 3), and saw out eight curved cantilevers for the angles, which must be nailed to the plate, D, and also to the eaves moulding, F, which they support. The wires of outer cage should be also bent to the same curve after they have passed through D and before they pass through F. Into the square box, which serves as the base of the ventilator, mortise the four ridges of outer and four ridges of inner cage, X, X. Next make the four pairs of gable-rafters for each casing, and fix them to outer ends of ridges.



Improved Birdcage. Fig. 1.—Elevation of Cage. Fig. 2.—Half Plan. Fig. 3.—Half Roof Plan. Fig. 4.—Section of Upright. Fig. 5.—Ditto, showing Notching. Fig. 6.—Section of Rail, E. Fig. 7.—Section of Eaves Moulding, F. Fig. 8.—Section of Plinth, C, showing Rebate and Filling. Fig. 9.—Plan of Ventilator. Fig. 10.—Section through Centre of ditto.

Then get out and fix the valley-rafters, housing their higher ends into the base of ventilator, and note that the valleys of inner casing will be cut to an angle, to nail under the said base. Note also that the feet of the eight outer roof-valleys and the gable-rafters, rest on, and are nailed to, the eaves moulding, F, whilst those of inner roof rest upon, and are fixed to, the lower plate, D, thus maintaining the distance between them. Before fixing the roof in place, we must not forget that some protection is needful to fence off the entrances to the bays between the two cages. This is provided for by fitting and fixing the pieces marked *g*, *g*, from the inner to the outer posts, and wiring the space between them.

For instructions as to wiring, I refer readers to information on the subject which has already appeared in WORK.

The inner roof should be wired purlinwise—*i.e.*, horizontally; the outer one vertically (see roof half-plan, Fig. 3, and elevation, Fig. 1).

This design would look well in ebonised wood, with gilt wire, or in French-polished mahogany, with nickel-plated wires; or it might be enamelled any colour, to suit surroundings.

ALUMINIUM SOLDERING.—For sheet aluminium soldering an iron-tin solder may be used with a flux composed of resin, neutral chloride of zinc, and grease. The metal should not be cleaned or scraped unless it is absolutely necessary to do so, in which case alcohol or essence of turpentine should be used for the purpose. For 5 per cent. aluminium bronze, tin solder may be employed, but this is not possible with the 10 per cent. alloy, in which case a preliminary copper-plating is recommended. If it is difficult to dip the ends to be plated directly into the solution, pieces of blotting-paper soaked in a solution of $CuSO_4$ may be laid on them, and a current passed. The flux mentioned above may be used. Another solder which is recommended is one consisting of copper, 56 parts; zinc, 46 parts; and tin, 2 parts, applied with borax. Tests showed that with these solder plates of aluminium soldered together edge to edge, a tractive effort of from $16\frac{1}{2}$ tons to 18 tons per square inch was required to pull them asunder; if the edges overlapped, $22\frac{1}{4}$ tons per square inch were needed. Pieces of cast aluminium bronze, if placed in sand moulds, can be joined together autogeneously by running in some of the molten metal. If this operation is properly carried out, the joint is indistinguishable from the rest of the casting.

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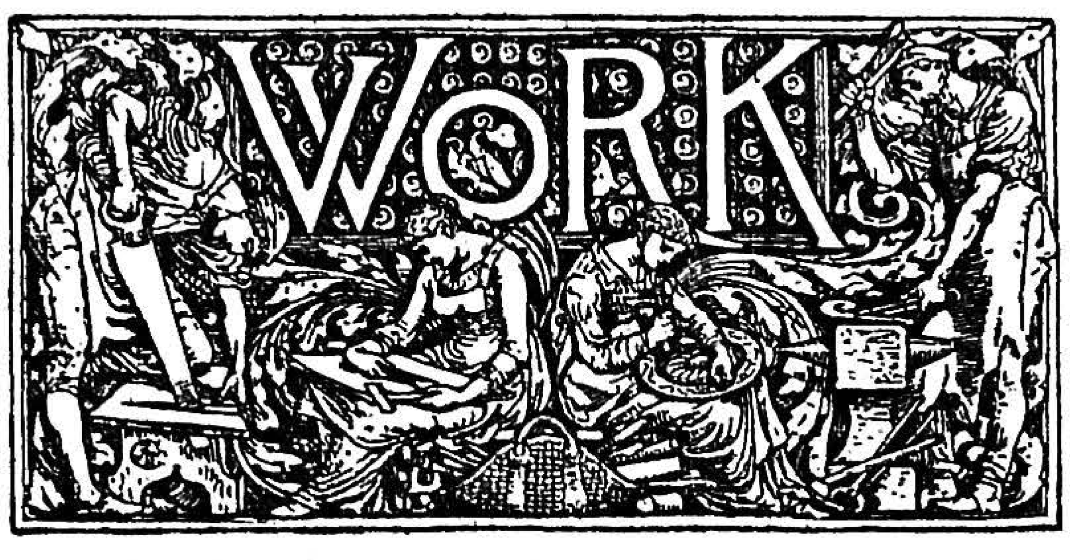

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WORK correspondents are wanted in every Town.

DANGEROUS WORK.—The Home Secretary, Mr. H. H. Asquith, has issued another notice in the *London Gazette* in regard to dangerous workshops and work. It schedules chemical works, quarries, and a large number of explosive substances. But, important as it is, this is only a preliminary order. It asserts jurisdiction. It does not regulate procedure. The practical steps must be subsequently taken. By Section 8 (1) of the Factory and Workshop Act, 1891, it is enacted that "Where the Secretary of State certifies that in his opinion any machinery or process or particular description of manual labour used in a factory or workshop (other than a domestic workshop) is dangerous or injurious to health, or dangerous to life or limb, either generally or in the case of women, children, or any other class of persons, or that the provision for the admission of fresh air is not sufficient, or that the quantity of dust generated or inhaled in any factory or workshop is dangerous or injurious to health, the chief inspector may serve on the occupier of the factory or workshop a notice in writing, either proposing such special rules or requiring the adoption of such special measures as appear to the chief inspector to be reasonably practicable, and to meet the necessities of the case." Mr. Asquith now certifies that in his opinion such processes carried on in factories and workshops, or parts thereof, as the manufacture of earthenware, the manufacture of explosives in which dinitro-benzole is used, chemical works, and quarries are dangerous or injurious to health.

VULCANISED INDIARUBBER. — It would be difficult to find material of more heterogeneous composition than the so-called vulcanised indiarubber. Chemical examination is simply useless in this connection, but some physical experiments of value have recently been conducted by Lieutenant L. Vladimiroff at the St. Petersburg Technical Institute. These experiments lead to the following conclusions :—(1) indiarubber should not give any sign of superficial cracking when bent to an angle of 180° after five hours' exposure to a temperature of 125° Centigrade ; (2) rubber that does not contain more than half its weight of metallic oxides should stretch to five times its original length without breaking ; (3) caoutchouc, free from all foreign matter except sulphur, should stretch seven times its length before rupture ; (4) the extension measured immediately after rupture has taken place should not exceed twelve per cent. of the original length of the test piece ; (5) softness may be determined by measuring the percentage of ash formed by incineration, and by this the different grades of rubber may be determined ; (6) vulcanised rubber should not harden under exposure to low temperatures.

SHEFFIELD STEELMASTERS AND ALUMINIUM.—A statement has been going the rounds of the technical press that Dr. Meyer of Berlin had invented a process by which aluminium could be produced at a cost of twopence per pound. Upon this discovery statements have been based as to the ultimate employment of aluminium for the multifarious objects for which steel is at present used—obviously not a favourable prospect of the trade interests of Sheffield. However, experts in the manufacture of the metal do not accept the statement with regard to the German invention, and they declare that no development of the electrical processes at present used for smelting the metal from clay can reduce the cost of production to less than 1s. 6d. per pound. Moreover, aluminium is not fitted in any way to contest with steel the position of general utility as a constructive material which belongs to that metal. It only comes into competition with brass and copper, and its principal extended use of late years has been as an alloy with iron and steel to impart special properties to them. In this latter use the researches of Mr. R. A. Hadfield of Sheffield have shown that aluminium is a less valuable agent than others now employed, such as manganese, chromium, and nickel. The annual output of aluminium, notwithstanding the advances made in its production, is only 520 tons, of which 150 tons are produced in England. The single use into which aluminium has come into competition with steel has been in the building of light electric and petroleum launches, and it is quite possible that the torpedo-boat of the future will be constructed of this material instead of steel. Metallurgists are, however, agreed that aluminium could not be rolled into plates, or cast, or forged, so as to meet the requirements of shipbuilding and engineering. The talked-of reduction in price, even if it is actually imminent, need not, therefore, involve any evil to Sheffield industry.

WOOD PAVEMENT OPHTHALMIA.—Wood pavement fumes are responsible for even greater optical changes than mere ophthalmia or disease of visional powers—it is said they change the colour of the eyes. If the theory be correct, the inference would be that those who desire to have blue eyes should select a quarter where granite blocks are used for pavement ; those wishful for black eyes would naturally choose asphalt-paved streets ; while people who like old mahogany-coloured eyes should get as near wood pavement as possible.

BENT IRON WORK, AND HOW TO DO IT.

BY J. H.

Lantern and Floral Ornaments.

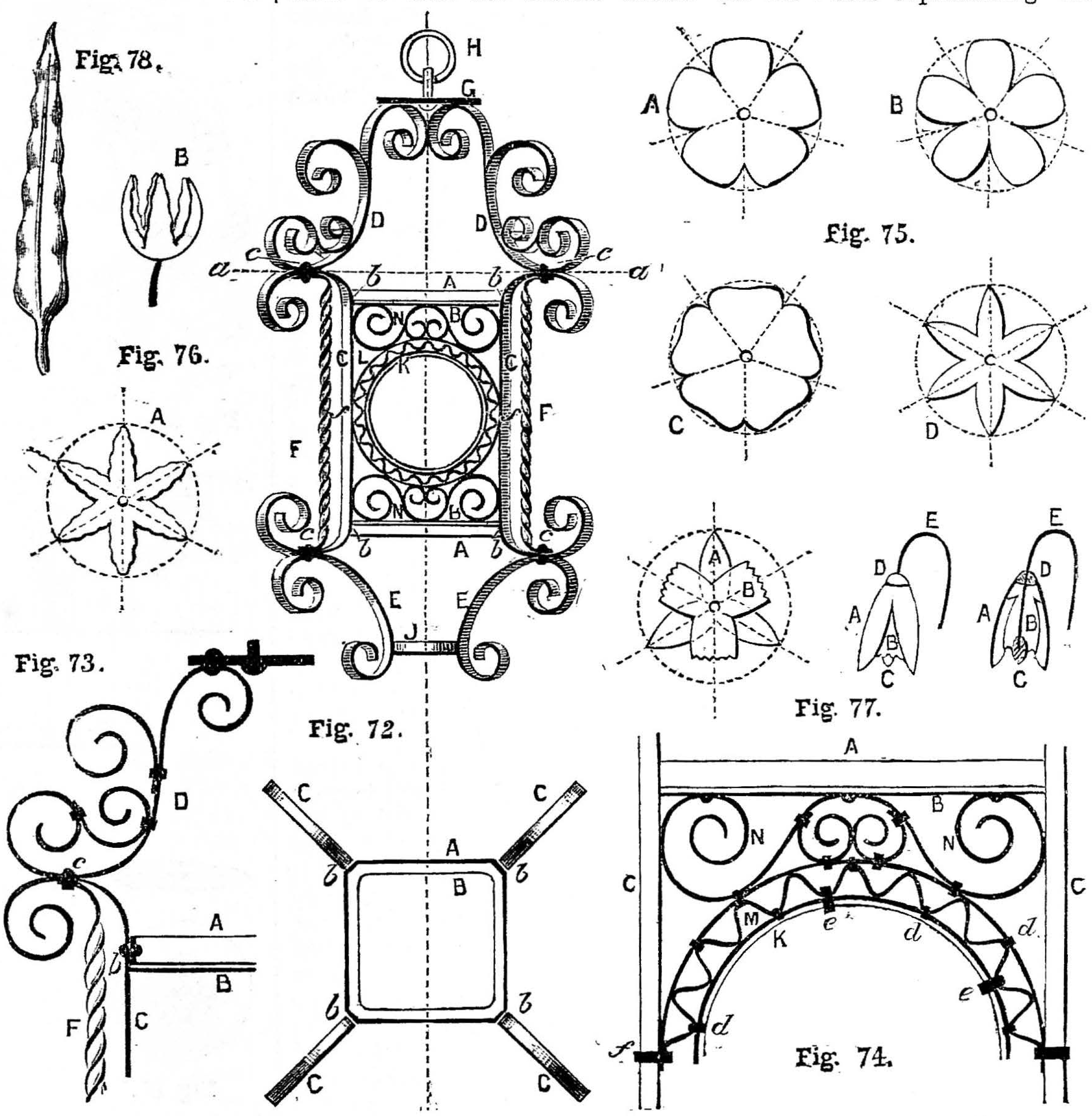
Lantern Framing — The Panelling—Floral Ornaments—Leaves—Varnishing.

Lantern Framing.—An alternative method of making lantern framing is shown in Figs. 72—74. The frames are made differently from that shown in the last article. First, there are two rectangular frames, A, A, made with flattened corners. On the edges of these two other frames, B, B, are soldered, so forming an angle iron section. Four corner strips, C, are bent round into double scrolls, as shown, and these are riveted to A, A at *b*. Upper and lower scroll-work, D, E, is formed, and also twisted shafts, F. C, D, and F are riveted together at *c*. D and a portion of C and F are shown enlarged in Fig. 73. Above there is a circular plate, G, with ring attachment riveted into it. The plate is riveted to D. The lower scrolls, E, are riveted to C and F, and are themselves connected at the bottom with a ring, J, riveted to them. This completes the main framing. Thin bent iron will do very well, the parts being well tied together, unless the lantern is of large size, in which case iron of about $\frac{1}{16}$ in. in thickness should be made use of.

The Panelling.—The centre panelling on each face is formed thus: Two rings of thin iron, K, L (also seen partly enlarged in Fig. 74), are made by bending, and soldering or brazing. Between these a zigzag pattern, M, is fitted, and secured with clips, *d* (one clip at every second or third point of contact of the zigzag with the rings). Within K a disc of coloured glass is inserted, and held with clips, *e*, bent round as shown, and simply pressed against the opposite faces of the glass. The ring L is fastened to C, C with clips at *f*, *f*, and also to the scroll-work, N, as shown in the enlarged view (Fig. 74). A bottom is inserted in the latter like that shown in Fig. 70 of the last article.

Floral Ornaments.—In a previous article I have alluded to and illustrated plain floral ornaments. I will conclude the series with another example or two rather more elaborate.

Fig. 75 illustrates various forms of dentition and construction, which, however, only embody a few out of many designs possible. Of course, in these ornaments there must be a good deal of conventional or formal treatment; but the main thing is good effect, and this can be obtained in such forms and by variation in colour. Some conventional forms of petals are shown in this figure. These are made from sheet copper, tin, or iron. If made of copper, they are left of their natural colour; if of tin or iron, they are blackened with a dead-black varnish. The original circles from which the rays of petals are cut are shown by the dotted circumscribing circles. In each case there are five petals, and the circles are therefore divided into five equal parts, which correspond with the divisions between the petals, or else with their centre lines—it does not matter which. In the figure A and B are similar, but B is cut more deeply than A. C and D are of different types. In each of these instances a single circle of petals only may be used to form a flower, or, alternately, several such may be superimposed, with their cleft portions alternating. In this case the upper sets of petals should be cleft more deeply than the lower ones, or else be cut to smaller circles. Three, four, five, or six may be superimposed in this fashion with good effect. Some amount of concavity must be imparted to each disc and to each separate petal, the amount being varied according as they are in an upper or lower series—more in the upper, less in the lower—or according as the flowers are required to appear—full-blown or partly opened. A round-faced steel punch is used to impart their concavity, the metal being laid upon a block of pitch or of compo, such as is used in *repoussé* or raised work. Observe that a hole is punched or drilled in the centre of each circle. Through this the petals are secured in their superimposed positions, copper or iron wire being passed through the holes. A central boss is required in this flower to represent the disc of the composite flowers, or the ovary-case, etc., of other orders. This may be formed neatly by soldering an ordinary rivet-head, like those used in model work, upon the end of the copper or iron wire; or a spot of solder may be run upon the end in the centre of the petals, and rounded up neatly. In the case of flowers with long projecting stamens and anthers, these may be formed with small nails, or with pins soldered into the boss representing the seed-case. Other ways will suggest themselves to those who work in ornament.



Bent Iron Work. Fig. 72.—Lantern. Fig. 73.—Detail of a Portion of Lantern Framing. Fig. 74.—Detail of a Portion of Panelling. Figs. 75, 76, and 77.—Floral Ornaments. Fig. 78.—Leaf.

Another form of floral ornament is shown in Fig. 76. It is formed by cutting deep petals with waved edges, A, and turning these over as shown at B. An ovary and stamens will be formed in the manner just described.

Another ornament is shown at Fig. 77. Petals A and B are cut separately into conventional outlines, and are bent or dished into concave forms—seen to the right hand; the one to the extreme right being a section, the central figure giving an external view of the flower. A pistil, C, is formed with solder or other suitable means, and a calyx, D, similarly. The latter, if made of solder, serves to secure the copper wire, E, in the centre of the petals.

Leaves.—Conventional leaves have been shown in previous articles. A narrow lanceolate form, suitable for combination with floral ornament, is shown in Fig. 78. It is cut from copper, or tin, or iron, and such amount of waviness or concavity as is required is imparted on a pitch-block, as in the case of flowers.

A good variegated effect is sometimes obtained by using, in combination with iron, strips of brass and copper. These are more easily cut than iron. The sheets are sold in any gauge, and most coppersmiths will cut off pieces of any size asked for. Brass is about 10d. per pound; copper, about 1s. 1d.

Varnishing.—There is a glossy face on all new sheet-iron; but in time this will become rusted, and the edges, being clean cut, will soon rust. So the practice is to paint all ironwork when finished with a preservative coating of varnish. This is always a dead-black, of which there are several preparations sold. Judson's Black is one; drop black, ground into fine powder and mixed with gold size, is another.

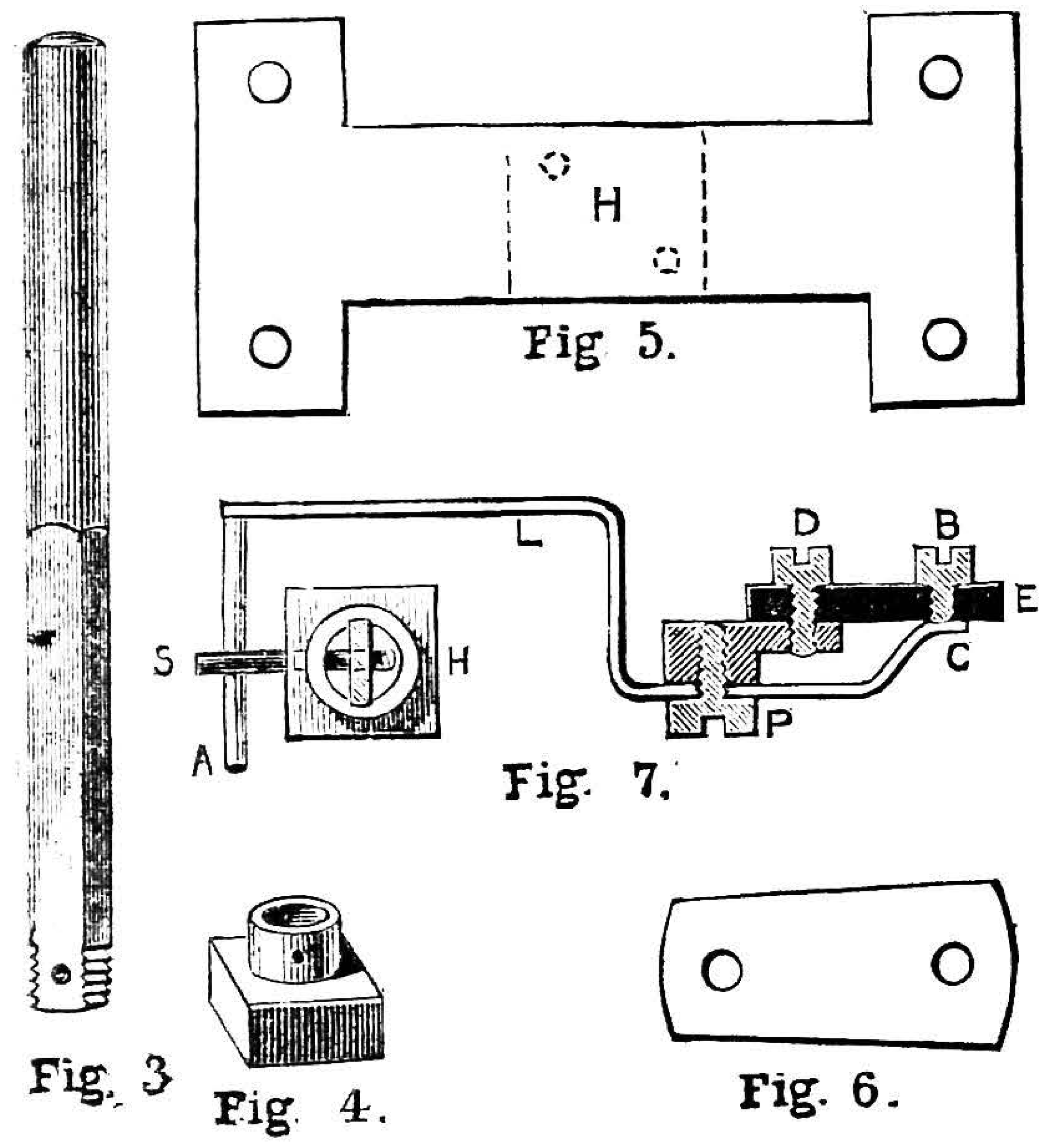
AN ELECTRIC HAMMER.

BY G. E. BONNEY.

THE PISTON AND HAMMER—THE ANVIL—THE REGULATING GEAR—MOUNTING THE INSTRUMENT—BATTERY POWER FOR WORKING THE HAMMER.

HAVING, in the first part of this paper, shown the general action of solenoids, and described the framework of the little instrument employed to practically demonstrate this action in an amusing and instructive manner, we will now give our attention to the remaining parts of the instrument.

The Piston and Hammer.—The piston (Fig. 3) must be made of a rod of soft iron $3\frac{1}{4}$ in. in length by $\frac{1}{4}$ in. in diameter. Take a light cut over this, to make it a loose fit in the bore of the cylinder. About $1\frac{1}{4}$ in. must be filed flat on both sides, to loosely fit the guiding-hole in the disc beneath the cylinder, the remaining 2 in. being left round. A thread should be cut on the lower part of the piston, to fit in the screwed socket of the hammer-head, and a transverse fine hole should be drilled through the end



Electric Hammer. Fig. 3.—Piston. Fig. 4.—Hammer-head. Fig. 5.—Base of Frame and Anvil —H, Position of Anvil. Fig. 6.—Shape of Ebonite Insulator. Fig. 7.—Sectional Plan of Regulating Gear—A, Lower Prong of Regulating Fork; B, Contact Screw; C, Tip of Contact Spring; D, Screw holding Ebonite Insulator to Lug; E, Ebonite Insulator; H, Hammer-head; P, Pivot of Regulating Lever; L, Lever; S, Striking-pin.

to take a lock-pin (as shown at Fig. 7), and thus prevent the hammer from unscrewing, this same pin being left long enough to form a striking-pin for the regulating gear. The hammer-head (Fig. 4) may be of iron or of steel, $\frac{1}{2}$ in. $\times$ $\frac{1}{2}$ in. $\times$ $\frac{1}{4}$ in. in thickness in the squared part; a small round socket, $\frac{3}{8}$ in. in diameter by $\frac{5}{16}$ in. in height, standing above this, turned out of the same piece of metal. The hole in this socket should be tapped to fit the screwed end of the piston, and be fitted with the striking-pin of brass above mentioned. The hammer-head may be larger and heavier, if so desired; but in this case a stronger current of electricity will be needed to lift the hammer.

The Anvil.—In Mr. Bowron's instrument the anvil is represented by a block of brass, forming part of the base of the frame. If the frame is cut out of sheet-brass, as before suggested, the base-plate may be cut out of the same material to the shape shown at Fig. 5, and the anvil (consisting of a block of brass $\frac{3}{4}$ in. in length by $\frac{1}{2}$ in. in width, and $\frac{1}{2}$ in. in height) be fastened to the base by set-screws from the under side, or by brass rivets passing through the block. The feet of the frame will rest on the base-plate of this block, and screws will pass through both, to hold the frame and base-plate together on the wooden stand of the instrument.

The Regulating Gear.—Supposing the bobbin mounted on the frame, and the piston, hammer, etc., placed in position: if, now, we send the current from two pint bichromate cells through the wire on the coil, the piston will be sucked up into the solenoid, and will remain there as long as connection is maintained with the battery and wire. On disconnecting the wire, the hammer will fall by its own weight on the anvil. We want some arrangement to break contact automatically, and cut the battery out of circuit when the upward stroke is completed. This is done by means of the regulating gear about to be described, which is an automatic contact breaker.

To a lug on one of the legs, is fastened (by means of a brass set-screw) a piece of ebonite or of ivory, shown full size at Fig. 6. In the narrow part projecting from the legs is fixed another brass set-screw, with its platinum-pointed tip on a level with the ebonite surface on the opposite side. To this screw is fastened the conducting wire from one of the binding-screws on the base-board. A piece of steel spring, such as a clock-spring, carrying a steel fork at one end and cut to a point at the other (as shown at Figs. 1 and 7), is pivoted on a set-screw passing into the leg of the frame. The longer end of this lever, carrying the steel fork, is bent to pass around the back of the hammer-shaft, with one limb of the fork resting on the anvil below the striking-pin, and the other limb $\frac{3}{4}$ in. above the pin. The shorter end, with its point tipped with platinum, is bent so as to let its platinum tip rest on the platinum-tipped screw when the hammer-head is resting on the block. The whole arrangement is shown in section at Fig. 7.

Now (after this has been made and fixed to the hammer) let us see what will happen when the battery is again connected to the instrument. The current will now pass through the wire coil to the small bolt holding the end of the wire to the frame, then by one of the legs to the pivot of the bent lever, and by the lever to the platinum-tipped screw connected with the binding-screw on the wood base. The hammer will now be drawn up, and its striking-pin will strike the upper limb of the steel fork, lifting that end of the lever, and moving the opposite end from the platinum-tipped screw to the ebonite plate. The circuit is at once broken, and the hammer falls, the striking-pin in its descent depressing the lower limb of the fork, and lifting the opposite end of the spring in contact with the screw. This action goes on rapidly (at the rate of 300 strokes per minute), and the consequent movement of the hammer resembles that of a steam-hammer.

Mounting the Instrument.—The instrument may now be mounted on a base-board of polished oak, teak, walnut, or mahogany, 4 in. $\times$ 3 in. $\times$ $\frac{1}{2}$ in., and furnished with two brass binding-screws. I prefer the telegraph pattern of binding-screws for these and all other small instruments, as these screws take a good grip on the connecting wires without cutting them.

Battery Power for Working the Hammer.—This must be arranged to suit the wire wound on the coil of the solenoid, or this must be wound to suit the battery power to be employed. With two layers of No. 22 on the bobbin, a low-resistance battery, giving a full, strong current equal to that obtainable from two pint bichromate cells in series, must be employed to get a full stroke. If the hammer is to be used with cells of the Leclanché or Gassner type, that is, bell-ringing batteries, the bobbin should be wound with a finer wire—say No. 24 or No. 26—and a larger number of turns must be laid on—say from four to six layers or more—and not less than three medium-size cells in series be employed. These types of battery are, however, unsuitable for solenoid working, even with fine wire wound on the bobbin, as full magnetic effects are best obtained from strong full currents.

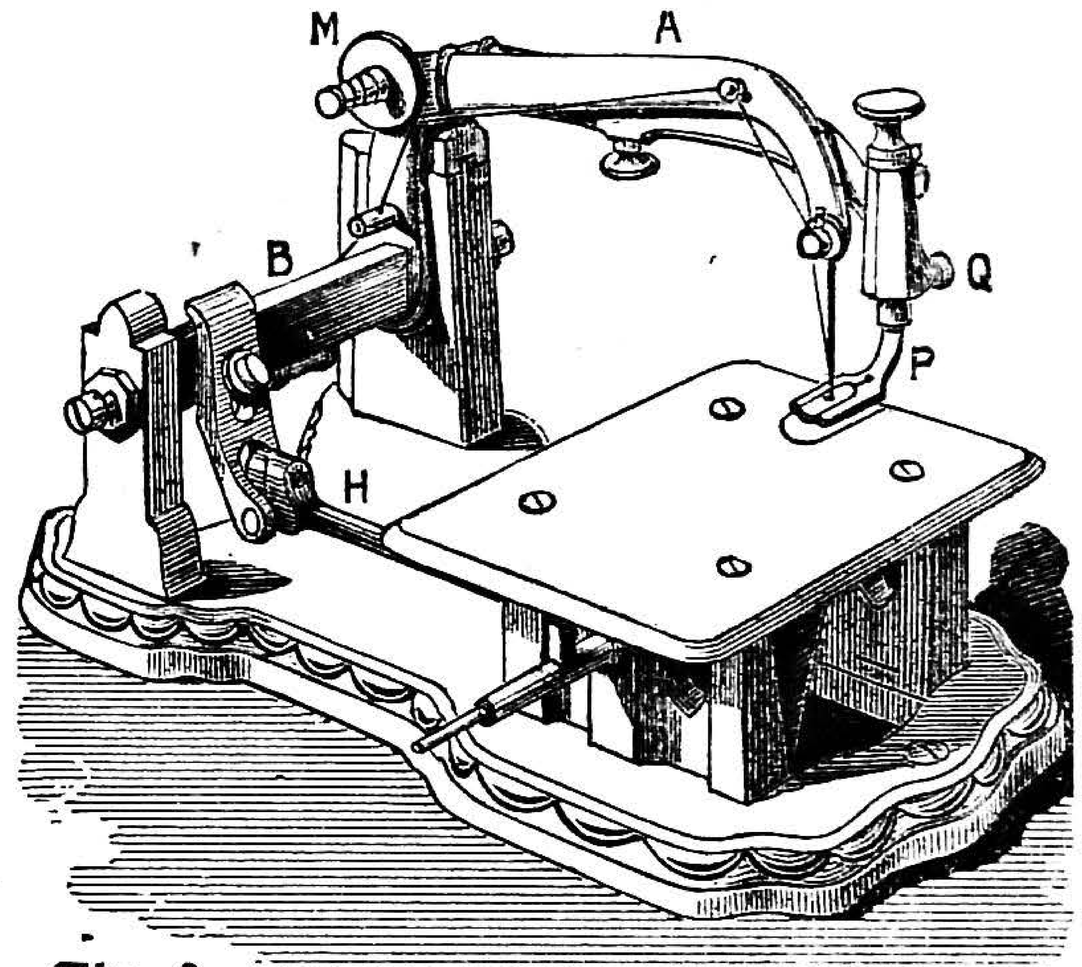


Fig. 8

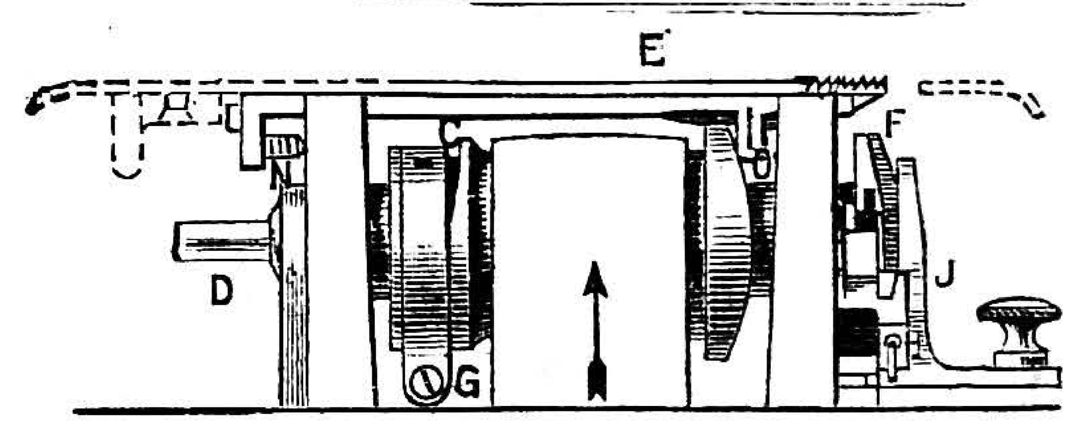


Fig. 9

Fig. 10

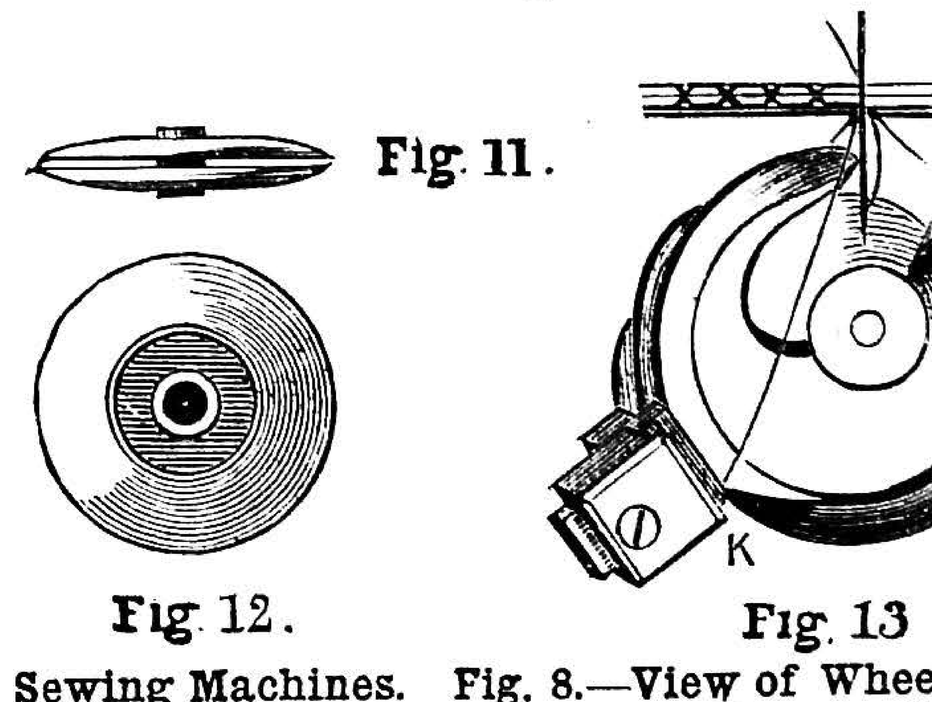


Fig. 12. Fig. 13

Sewing Machines. Fig. 8.—View of Wheeler and Wilson Sewing Machine. Fig. 9.—View of Mechanism under Cloth Plate. Fig. 10.—Feed-bar. Fig. 11.—Side View of Bobbin. Fig. 12. —Front View of Bobbin. Fig. 13.—Rotating Hook and Brush, showing Position of Needle and Sewing.

SEWING MACHINES AND THEIR MAINTENANCE.

BY CYCLOPS.

THE WHEELER AND WILSON STATIONARY SHUTTLE SEWING MACHINE—DESCRIPTION OF MACHINE —FORMATION OF STITCH—TENSION OF TOP THREAD—TENSION OF BOTTOM THREAD—FEED MOTION AND STITCH REGULATOR—POSITION OF NEEDLE AND NEEDLE-BAR.

Description of Machine.—This machine, which is a general favourite for manufacturing purposes in northern provincial towns, is unique in its appearance; and the arrangement of its mechanism differs in a marked degree from that of any other system of sewing machine.

As will be seen from a general view of it given in Fig. 8, it consists of two portions; the rear consisting of two pillars, between which the rocking-arm, A, is pivoted by a cross-bar, B; and the front, consisting of a square table under which are the pulley, C; shaft, D; feed arrangement, E; and hook, F (Fig. 9). The pivoted cross-bar carrying the rocking-arm receives its motion from an eccentric, G, on the shaft, by means of a connecting-rod, H.

Unlike most other machines, the work travels from left to right instead of away from the operator, and the needle, instead of being straight, is curved.

The Formation of the Stitch in this machine is peculiar. It is a combination of the hook principle of the Wilcox and Gibbs machine and the under thread shuttle arrangement of other forms of machine. A good idea of the way in which the stitch is formed may be obtained from a glance at Fig. 13.

The under cotton is wound on a spool or metal bobbin of the form shown in Figs. 11 and 12, by fixing the bobbin on the projecting end of the shaft or spindle, and running the machine while the cotton is wound on or in the spool. This bobbin is placed, when charged with cotton, in the hollow face of the rotating hook, and kept loosely in place by the slide ring shown at J (Fig. 9). This ring is provided with an adjustable stop, which causes it, when pushed right up, to hold the bobbin loosely in its place, the object of this being to allow the loops of the top thread to pass completely round it.

On the descent of the needle (see Fig. 13) the point of the hook catches in the loop of thread and conducts the loop round the bobbin until it arrives at the point K, when the brush retards its movement and holds it back until the hook has caught the next loop; it then liberates it to perform the same operation with the new loop.

Readers will see that it is extremely difficult to illustrate this ingenious movement without a lot of diagrams showing the hook, needle, and thread in several positions, and, as space in WORK is so limited, we must try to fathom the mystery by a study of Fig. 13, which will not be found so very difficult after all.

Tension of Top Thread.—We have shown, from what we said in our remarks on the Wilcox and Gibbs machine, that it is necessary to have a tension on the thread. In machines where two threads are used, it is the rule to have both tensions adjustable, so that the operator may to some extent so regulate it as to give to the sewing the desired degree of tightness. But in this machine the bottom tension is fixed by the position and pressure of the brush, and the distance apart from the bobbin of the adjustable ring-guard, both of which it would be inconvenient to alter; so that the whole of the tension adjustment is obtained by the tension pulley, M (Fig. 8), round which the cotton is turned on its way to the needle. The tension consists of a steel pulley, having on its edge a milled groove in which the cotton lies, and by which it grips and revolves the pulley as it is drawn through the needle. The tension is obtained by screwing up a milled nut, which presses a spring against the pulley and thus prevents its free movement to any desired degree.

The Bottom Thread Tension.—The tension on the bottom thread is, as we have already explained, obtained by the pressure of the brush on the cotton as it passes round the hook. This, when once satisfactorily set, needs no further adjustment until incapacitated for its work by wear, when it can be taken out, cut straight, and again adjusted to the hook.

Feed Motion and Stitch Regulator.—In all sewing machines the feed motion and stitch regulator must necessarily go together, for the feed motion pushes the work along when freed from the needle, and the stitch regulator regulates the distance of that push.

The feed arrangement is shown at Fig. 9, and a separate drawing of the feed-bar at Fig. 10. The cam which operates this feed is a combination of edge and surface cam; that is, the forward movement of the feed-bar is given by the front face or surface of the cam, which is at right angles to its axis—the spindle; and the upward movement is given by the edge of the cam. The feed-bar slides in grooves across the top of the bearings carrying the shaft, and a spring, N (Fig. 9), placed against the left-hand bearing, presses it to the left, keeping the dropped piece, O (Figs. 9 and 10), pressed firmly against the face of the cam. An eccentric disc with a little handle attached is placed under the top plate in such a position as to come in contact with the end of the feed-bar, and by turning it backward and forward the play of the feed is regulated, thus increasing or diminishing the length of the stitches.

This arrangement is shown, with the top plate, in dotted lines, in Fig. 9.

Position of Needle and Needle-bar.—The position of the needle in respect of the needle-bar or arm, as we have indicated by what we said on the formation of stitch, is such that the eye of the needle should be exactly $\frac{1}{8}$ in. below the point of the hook when the hook is close on the needle (see Fig. 13). The needle-bar or arm should be adjusted by the pivots, between which it swings, so as to allow the needle to be nearly touching the inside of the hook, but not quite.

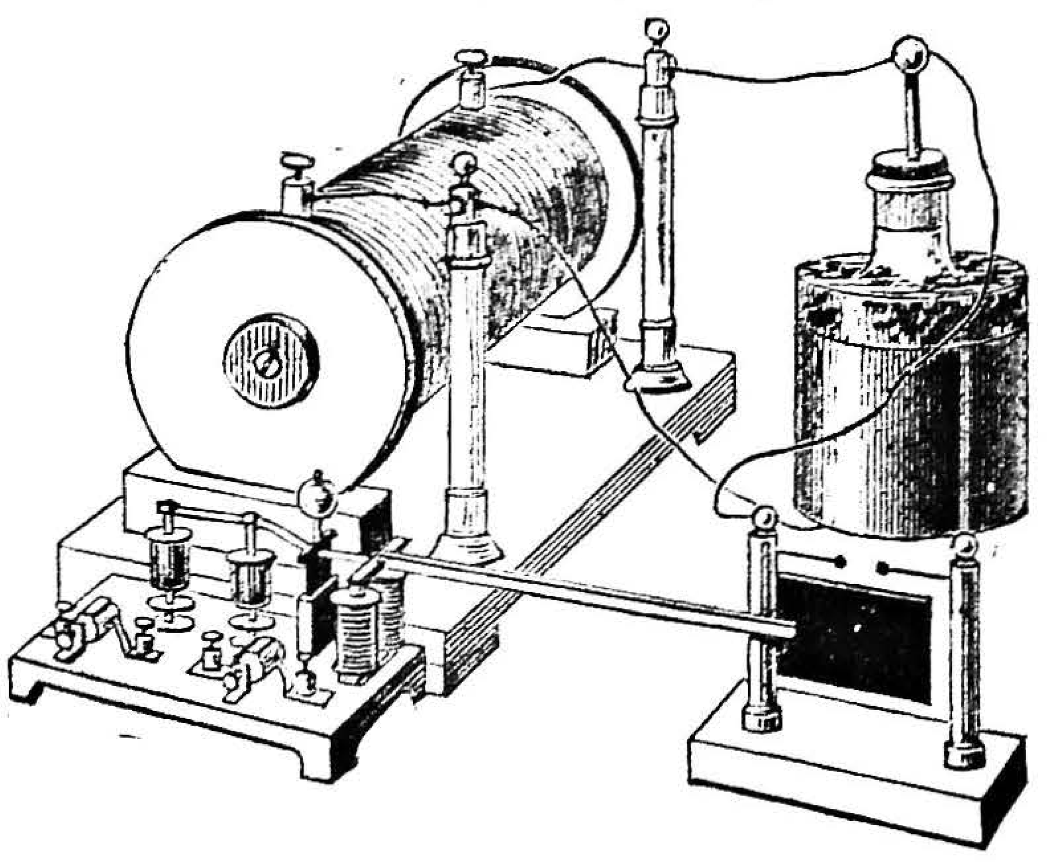
In our next paper we shall deal with the well-known Singer sewing machine, with reciprocating shuttle, and in its consideration we shall have a good opportunity of contrasting it with the two principles we have already described.

SPARK PHOSPHOROSCOPE.

EVERYONE is acquainted with the Phosphoroscope of Becquerel, the ingenious instrument by means of which a portion of a phosphorescent substance can be strongly lighted and studied after the lapse of a very short time, *e.g.*, the fraction of $\frac{1}{1000}$th of a second; in most instances, whereas all trace of the excitative light has disappeared, the substance under study still emits a brilliant light. The apparatus of Becquerel is intended to utilise the light of the sun; but it is interesting to study the phosphorescence excited by the light of an electric spark with an abundance of ultra-violet rays. For this purpose, a Mr. Lenard has invented a phosphoroscope which everyone can make with the ordinary resources of a laboratory.

Fit to the armature of a Foucault interrupter working a Ruhmkorff coil a wooden rod of 50 centimetres, with a piece of thin, blackened pasteboard at its extremity (see illustration). In the oscillation of the interrupter the paper will alternately cover and uncover the limits between which the spark appears: the apparatus is regulated in such a manner that the spark is produced at the instant when the space is about to be uncovered. The spark is made brief and brilliant by a condenser inserted in the secondary of the coil. The substance to be examined is placed very close behind the spark, so that it is uncovered very shortly after the emission.

In these conditions various curious phenomena can be observed. The short duration of the spark makes the screen appear to be at rest, and some $\frac{1}{1000}$ths of a second later a luminous substance is seen behind the spot it occupied, in such a way that at first sight one might imagine that the screen is opaque for the spark and transparent for the phosphorescent light. It is evident, however, that such is not the case, and that the observer is the object of one of the many optical illusions due to the persistency of luminous impressions. Let us make a brief digression. Some years ago we frequently found (more rarely nowadays) dynamo machines the brushes of which gave sufficient sparks to make the neighbouring objects clearly distinguishable. These sparks are produced at the instant when the brush passes from one plate to another in the collector; between one spark and the next the coil has turned one of its sectors, and presented the other identical with that just seen. We always see, then, the coil in



Spark Phosphoroscope.

the same position, so that it seems stationary; but if we move the brush the sparks follow it, and the coil seems to move slowly backwards and forwards with the angular speed with which the extremity of the brush describes the circumference of the collector.

Some substances, the various carbonates of lime for example, act in a manner almost similar in the apparatus of Becquerel, and in that of Mr. Lenard; some are more favoured in the first. On the other hand, arragonite crystals, invisible after solar lighting, give a slight reddish light after the spark. The duration of the phosphorescence is so short in uranium glass that the first parts uncovered are very luminous, the others much less. Glass gives a violet light; it can easily be demonstrated that it arrests part of the active rays. Let us put into two watch-glasses pastils of sulphuret of cupric calcium of the same size, respectively, covered with a sheet of quartz and a sheet of glass of 3 millimètres; the first, being thirteen times further from the source than the second, will give the same phosphorescence. The effect of the spark after the sheet of glass is then only about $\frac{1}{170}$th of the total effect, admitting the quantity absorbed by the quartz to be insignificant, as has long since been demonstrated. As for the glass, its transparency, which makes it so valuable, is due to the fact that the small part of the spectrum in which our eye is sensible to light is also that which it does not absorb; it arrests nearly all the short waves and many of the long. The Phosphoroscope offers us, as we just said, a very simple method of demonstrating this.—*La Nature.*

TRADE: PRESENT AND FUTURE.

⁂ *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

THE WATCHMAKING INDUSTRY at Prescot, near Liverpool, is being extended considerably. The Lancashire Watch Co. have just completed the section of additional buildings and machinery for the entire manufacture of English watches. This company already employs 600 or 700 workpeople, and these will now be increased to 2,000. Over £90,000 has been spent in the above works, and the opening will be made the subject of great rejoicing on the part of the workpeople, a dinner and tea being amongst the good things provided.

ENGINEERING TRADE.—The recent slight improvement in the condition of the Lancashire engineering trade is not being maintained, and, except in a few instances, scarcity of new work is generally reported. The locomotive building branch is particularly badly situated, and it is many years since so little work was in progress or in prospect.

IRON TRADE.—A distinctly noticeable improvement characterises the Lancashire iron trade; and while there is quite a fair amount of inquiry for pig iron, prices have a very decided tendency to harden. Forge qualities scarcely fetch more than 43s., but in foundry qualities 44s. and 44s. 6d. have been obtained. In manufactured iron, only a small business is being done, and £5 12s. 6d. is about the average selling price. Lancashire sheets are £7 2s. 6d. to £7 5s.

STEEL TRADE.—The steel market continues to be very much depressed, and hematites are slightly weaker, ordinary foundry qualities being obtainable at 55s., and steel billets at about £4 7s. 6d. In plates, good boiler-making qualities are now being quoted at £6 10s.

METAL TRADE.—Only a slow business is reported, especially in steam fittings, and list rates for both brass and copper tubes have recently been reduced ½d. per lb.

GLASS BOTTLE TRADE.—For some time past the masters have been talking of demanding a reduction of wages; but the crisis came last payday (23rd ult.), when upwards of 2,000 hands tendered their notices against the proposal. There are a number of branches in the trade—viz., Rotherham, Kilnhurst, Swinton, which includes Mexbro', Conisbro', Barnsley, Castleford, Ferrybridge, Hunslet, Wakefield, Thornhill Lees, Stairfoot, Blaydon, Newport, and London. The men have a strong society, and are well organised; and besides, they are connected with an international union, and its funds amount to close upon £30,000. The amount in dispute is 2s. per week on ordinary wages, nothing being said about overtime.

SHEFFIELD TRADES.—Before Christmas there was the customary show of activity in most of the local industries, seasonable novelties being most in demand. In cutlery there have been heavy shipments for South America, and there are further urgent orders. The silver trades have improved, but there is no urgency in this case; therefore the usual holidays have been observed. Cammells, of Sheffield and Workington, have again wrested an order from the Belgians, to the extent of 2,000 tons of steel rails. Inquiries for railway material have further slackened down. Hematites are still depressed, and Bessemer billets, for use in the local trades, sell slowly. Crucible steel is also slowly falling off, the improvement in the manufacture of Siemens-Martin and Bessemer productions gradually taking the place of the better brands of steel. In other branches there is little or no alteration.

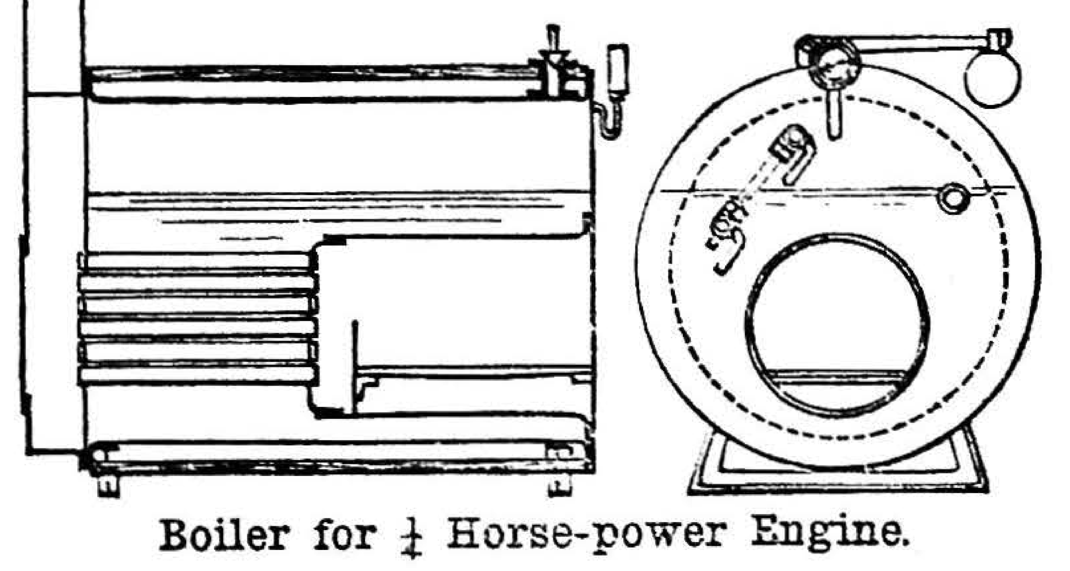
COTTON TRADE.—The great lock-out continues to be the chief topic of conversation in all parts of Lancashire. Hardly a day passes without house-to-house collectors being seen, some working in companies, and with a band of music to assist to draw custom; and no means is left undone to assist those locked out. A settlement of some kind would be welcomed most heartily by all, whether masters, men, or outsiders. The Secretary of the Masters' Federation maintained that the Federation had throughout been most reasonable in its demands. It was quite true that, two years ago, the operative spinners got a 5 per cent. advance, and that the strippers and grinders and female blow-room hands a 10 per cent. advance. This advance was made by the Oldham Masters' Association at a time when legitimate profits were not being made; the profits then were coming from lucky cotton speculation. Mr. Tattersall concluded by saying "That the state of the cotton trade warranted a greater reduction in wages than the one proposed."

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTER FROM A CORRESPONDENT.

Engine and Boiler.—H. J. C. (*Gloucester*) writes:—"I have watched with keen interest the evolution of your ¼ horse-power engine and boiler, and more especially the boiler, for this is the stumbling-block of a great many. I have studied the boiler from its several points of view, and I think there are one or two things that might be improved. In the first place, the fire-door of a vertical boiler is always a difficult subject, and in this case it appears to be cut partly in the single part of the fire-box and partly in the double part of the boiler, which, of course, makes a very difficult joint round the fire-door. In the next place, the tubes are placed vertically, so that the lower half of the tube is under water while the top half is under steam and hot air, so that the latter half gets very nearly red hot, which sets up an unequal expansion, and very soon makes them leak: and, as I have had an experience of about five years with a boiler of this type, I think I can well decide against vertical tubes unless covered with water. In the next place, the feed water passing through the fire is not good, for in good practice it should enter the boiler as near the water level as possible. I think the boiler, generally, from an amateur's point of view, is rather a difficult one to construct; and, from remarks I have heard, I think it hardly meets with a *general* approval, and so I think it would be as well to have an alternative design. With this end in view, I send you a rough sketch of a new design. I think this boiler has several advantages over the vertical type. In the first place, it gets over the difficulty of the fire-door, and, as the tubes are always under water, the chances of any leakage due to unequal expansion are avoided; and, as it has a flat front, it is much more convenient to screw fittings to. The shell of the boiler might be lagged with wood, while the smoke-box at the end serves for a jacket for that end, as well as increasing the heating surface. It stands on two feet, which may be fixed or loose—this making the boiler self-contained and requiring no fixing. I do



Boiler for ¼ Horse-power Engine.

not like the idea of fixing sections of pipe into brickwork, as suggested by F. A. M. I think a small boiler should always be portable. If this suggestion should meet with your approval, I should have much pleasure in making detailed working drawings and full description of the same."—[F. A. M. writes on the above:—"I am glad you are giving your mind to the boiler question, and I think a very good boiler could be made in the way you propose. Your criticism of the vertical boiler is just, and each point is already anticipated, as you may have noticed, in my remarks upon it, except your objections to the vertical tubes. Now, vertical tubes are certainly apt to leak, but they can be, and are frequently, made tight; therefore I should be inclined to attribute the failure of yours to the method of fixing. Before you send a working drawing of your proposed boiler to WORK, I should advise that you make one and try it thoroughly. I cannot see how an amateur can properly rivet the plates, etc., and cut and bend them to shape. I still think the proper thing for him to make himself would be a boiler made of pipes screwed together and built into a furnace of brick, which the amateur could easily put up himself."]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Iron Bridge and Girder Work.—T. U. (*Manchester*).—You seem to have a difficulty in understanding the drawings; I should therefore advise you to join some local class in which mechanical drawing is taught. In the first volume of WORK there appeared a series of articles on "Wrought Iron and Steel Girder Work," which might help you; they appeared in the following issues:—No. 8, p. 117, No. 11, p. 167, No. 12, p. 186, No. 15, p. 229, No. 21, p. 325, No. 24, p. 375, and No. 26, p. 407. There are also some papers, which commenced in No. 173, p. 266, on "Iron Bridge Modelling in Cardboard," from which you might derive some assistance. There are numbers of books on the subject to choose from, but to read them you require some knowledge of algebra and geometry. Messrs. Lockwood publish a little book, price 3s., with title "Materials and Construction," which shows how to calculate and design iron bridges.—F. C.

Enamel for Bricks.—H. R. H. R. H. (*Ashby-de-la-Zouch*).—The ingredients are calcined flints, felspar, lead ashes, etc., the colours being formed from various oxides. Thus red is obtained from red oxide of iron, yellow from chromate of lead, blue from oxide of cobalt, green from oxide of copper, black from oxide of manganese, etc. The exact quantities must be found by experiment, as what would be suitable for one kind of clay would not be suitable for another. You could calcine the flints in a kiln, but, as they have to be ground very fine, unless you have suitable machinery you could not do the grinding. The flints are those found in the chalk. If you want to experiment on a small scale, you could procure the ingredients from some of the potteries, or from Doulton & Co., Lambeth; but if you want to make them for sale, you had better engage a competent man, or you may soon lose a lot of money in experimenting. You will find some very good articles on clay modelling and plaster casting in Vol. II. of WORK, entitled "The Mechanical Processes of Sculpture."—M.

Steel Sheets for Tin Plates.—W. H. T. (*Westminster*).—You cannot do better than write to Messrs. W. Jessop & Sons, Limited, Brightside Works, Sheffield, sending a sample of what you require; the above firm, rolling thin stuff for the steel pen trade, would, no doubt, readily supply your needs as regards the steel sheets themselves. With the pickling or cleansing process, I fear you will have to do that for yourself; that, however, need not be a very difficult matter, hydrochloric acid being the base. Look through Spon's manufacturing recipes for the proportions. Tin-plate manufacturers have all these facilities, but I very much question if they would assist anyone outside the trade. If you are unable to get the sheets "pickled," you might write to Messrs. Cocker Brothers, Limited, Wire Drawers, Nursery Street, Sheffield, asking them as a favour if they would clean for you a few sheets of steel.—N. M.

Telescope.—E. U. (*Wimbledon*) has made a "4 ft. telescope with a lens at each end," which has "answered his purpose very well." He now wants to make a more powerful one—6 ft. or more—but "at a rather cheaper rate." Now, seeing the first had simply a pasteboard body, a 4 ft. object-glass, a simple eye-piece, and consequently no focussing arrangement, it is difficult to see how a larger and much superior instrument can be made at a cheaper rate. In the first place, he asks what lenses he will require. The first thing will be the object-glass of 6 ft. focus, but nothing is said of the diameter of the same. Now, it must be understood the light-grasping power—viz., the diameter—must bear some relation to the magnifying power, viz., the length of focus. To largely magnify with a small degree of light would be to lose all definition. I cannot lay my hand on a catalogue that gives prices for lenses of 6 ft.; the nearest is Wray's 66 in., 4½ in. aperture, £22. Lancaster gives in his catalogue a 60 in. of 4 in. aperture at £10 10s.; another of 3¼ in. diameter, focus not stated, £6 10s. These, of course, will be achromatic. Common lenses can be purchased much cheaper. A 3 in. object-glass of 50 in. focus, with lenses for eye-piece, can be procured for 5s. 6d. of Lancaster, of Birmingham, and others. If E. U. had stated what kind of an object-glass he has used, I should be in a much better position to give information. As to the eye-piece, an article of mine which appeared a few week ago, under the heading of Eye-pieces, will give all necessary information. Another article which also appeared on a Four-draw Telescope will supply all information on mounting both object-glass and eye-piece. My advice to E. U. is, if it be a question of cheapness with efficiency, to purchase, say, an object-glass (achromatic) 2½ in. diameter and about 30 in. focus, for about £1 5s., which price would include two lenses for the eye-piece. Much better work can be done by this than by a 6 ft. chromatic, which would have to be stopped down probably to one-half its aperture to cut off the marginal rays. Some focussing arrangement is a necessity, not simply to adjust the instrument to objects of varying distances, but to suit various eyes.—O. B.

Air Gun.—YOUNG SPORTSMAN.—This piston spring gun to ensure the due pressure of the valves was described in WORK, No. 98, p. 749. For a powerfully acting gun this is the most effective plan, as far as I know. I am sorry I cannot furnish a reliable sketch to work from, not having any such mechanism to refer to and measure. Try and get a look at one.—J. C. K.

Electric Bell and Indicator.—J. B. (*Widnes*).—If you wish to ring one bell from ten different rooms, and have an indicator with ten holes in it to indicate the ten different rooms, you may easily plan the whole arrangement on a sheet of paper, and then lay the wires according to plan. Map out the outlines of each room, or put ten connected squares on the paper. In one of these put marks to show the positions of bell, battery, and indicator, the latter in the form of a square divided into ten partitions. Now select a division on your map to represent the most distant room of the house from the bell, and put a small ring in it with a dot in the centre to represent the push. From this, draw a main line passing through each room to the bell, then to battery, then to one hole of the indicator, then a return line back direct to the push. This will represent the connections for one room and the main line of wire. For the next and rest of the rooms put a push in each room, draw a line from each push to the main line, and run a separate return line from a separate hole in the indicator to each push. This rule will hold good for all rooms, however few or many.—G. E. B.

Output of Accumulators.—W. T. D. (*Manchester*).—Measure the surface of positive plate immersed below the acid, and estimate six ampère hours for each square foot of plate. This will give you the ampère hour capacity of the accumulator or the quantity of current obtainable from it when fully charged. The 15-plate cells are advertised to give 330 ampère hours, but accumulators should not be worked until fully exhausted. If your lamps require 60 volts pressure (and I suppose that is the voltage required, as you use 32 cells in series), the supply of current will be at the rate of ·8 ampère per hour, and you should get at least 375 hours' work out of your battery. At the rate of 1 ampère per hour you would only get about 300 hours' work out of the battery. If the lamps are arranged in several groups in parallel, the output of current will be at a faster rate, and the cells be more speedily exhausted. The best book on the management of accumulators is "Electric Light Installations," by Sir David Salomons, price 6s., published by Messrs. Whittaker & Co.—G. E. B.

Motor for Lathe.—ZETETIC (*Harrogate*).—As I have not received your former letter, and you do not find an acknowledgment of it in Section V. of "Shop," I fear it must, as you suggest, have miscarried. If you will kindly repeat your two or three questions relative to a motor for a polishing lathe, they shall receive attention. If your question related to an electro-motor for a polishing lathe, let me tell you in advance that such a motor, driven by battery power, will be a nuisance, unless it is only required for very light work, and occasional use for short periods. If, however, the motor can be connected to an electric light main, or to a similar source of electrical power from a dynamo, the use of such a machine is a luxury, as there cannot be any source of power equally clean, safe and convenient.—G. E. B.

Incubator.—J. H. S. (*Leeds*).—The size of case for machine of 100-egg capacity would be about 24 in. by 18 in. The capacity of any receptacle is easily arrived at by dividing the superficial area by 4=result the number of eggs it will hold. Having never made anything larger than that described in No. 143, I cannot say definitely what variation in fittings would be necessary. You would certainly want a larger lamp, and I should advise a larger evaporating tray. A larger damper would also be necessary. A 200-egg machine of the same design should work satisfactorily, although some deviations from the original might be necessary, which could only be determined by actual experiment. If you do make a larger machine, please let us know how you succeed, for the benefit of incubating readers of WORK generally.—LEGHORN.

Soldering Aluminium.—H. S. G. (*Fulham*).—It is a pity you cannot understand the paragraph; it is perfectly clear. If you understand soldering with powdered resin as a flux you should comprehend the analogous process wherein chloride of silver is used. The solder is melted, "as usual," by a soldering-bit or a blowpipe.—F. C.

Phonograph.—PHONO.—In the phonograph described by me in WORK the cylinder is not removed and replaced with others. It is the strip of tinfoil which contains the record, and this can be removed and replaced by others. Provision is made for holding these in the drawer in the baseboard. A cylinder of cast iron or brass would do, in fact, better than plaster-of-Paris, as this is liable to chip in the working. PHONO and others must not confound this instrument with Edison's phonograph. It was given to the readers of WORK as a scientific toy; if they want one of these *perfected* instruments they must look elsewhere.—W. D.

Circular Saw.—WORKMAN.—The diameter of circular saw required to cut ½ in. boards depends upon the depth of spindle bearings from the top of wood table. A saw from 8 in. to 9 in. diameter would be quite large enough to be driven by treadle. My advice to WORKMAN is to abandon all thoughts of such a toy. A hand saw has the advantage over a circular saw driven by treadle for such work. The machine would not only cost a deal more than a good hand saw, but the work would be more tedious. With the circular saw it would be hard work, while with the hand-saw three or four pieces may be placed on each other, and could be cut through at the same time easily. If WORKMAN has a good sale for thin firewood, why not start a small engine—say, from 1 to 2 h.-p.? then he would have the advantage over the hand saw. Unless a circular saw is driven at a high speed it is merely a drag.—A. R.

Glass.—J. L. (*Bexhill*).—I fear you would not be able to bevel the edges of your pieces of plate glass; it would be an intensely laborious and tedious operation for an amateur. Several different kinds of wheels must be used, some of sandstone used with water, others fed with sand and water, emery and water, and, finally, polishing wheels; and the expense of providing these for the small amount of work I gather from your letter you wish to do is not to be thought of, being prohibitive; and without them I do not see how you are to do it. There are files sold to take off the rough edges of glass; why not use these? or, if not content with this, I would certainly advise you to send to a manufacturer. As regards your second question—mounting photographs on glass—this you could easily do, and need have no fear of spoiling the pictures; the process is the same as what are called "opalines" at the photo. shops. If your prints are by the gelatine, chloride, or bromide processes, nothing is needed but to clean the glasses well. Soak the prints in clean cold water for about half an hour, place the glass in the water, under a print (which must be face downwards), and bring both up together; rub down to remove air bubbles and wrinkles, and, when dry it can be trimmed; it is then finished. Should they, however, be silver albumen prints, as will most likely be the case, the process is a little different: Soak about 1 oz. of soluble gelatine in cold water until soft, then add sufficient boiling water to make a rather thick solution, say about half a pint; when thoroughly dissolved, if needed, strain through muslin; pour into an earthenware dish, which will stand in another containing boiling water, so as to keep the solution warm and melted. Immerse a print in the solution, and when thoroughly soaked, lift it on to the cleaned glass as quickly as possible, and rub down; or both glass and print can be put in the gelatine, as in the first method, and lifted together; when cold, the superfluous solution can be cleaned from the face of the glass. Should you not be able to tell by what method your photographs are produced, and do not know anyone you could ask, if you will send me one (through the Editor) to look at, I shall be pleased to inform you.—W. E. D., JR.

Secrétaire.—AMATEUR.—I cannot tell AMATEUR where to get the spring steel in his town, unless he went to a clockmaker, which would be an expensive way to buy it. I am inclined to think from the quick curve sketched that neither steel nor shutter hinges would be suitable; I should prefer chair webbing or leather straps. There would be no difficulty in mortising the laths with $\frac{1}{16}$ in. holes if AMATEUR first bores, with a twist bit and brace, several holes near each other to each mortise, to weaken the core and give clearance for the chisel, afterwards paring the sides with a ⅛ in. or ⅜ in. chisel, very sharp. I have mortised right through 1½ in. by ¼ in. stuff with a $\frac{1}{16}$ in. chisel without difficulty. I give section of the end of lath, showing best form for the projection into the grooves, to enable them to run round the rather too sharp curves in his sketch (Fig. 1). I scarcely know what is meant

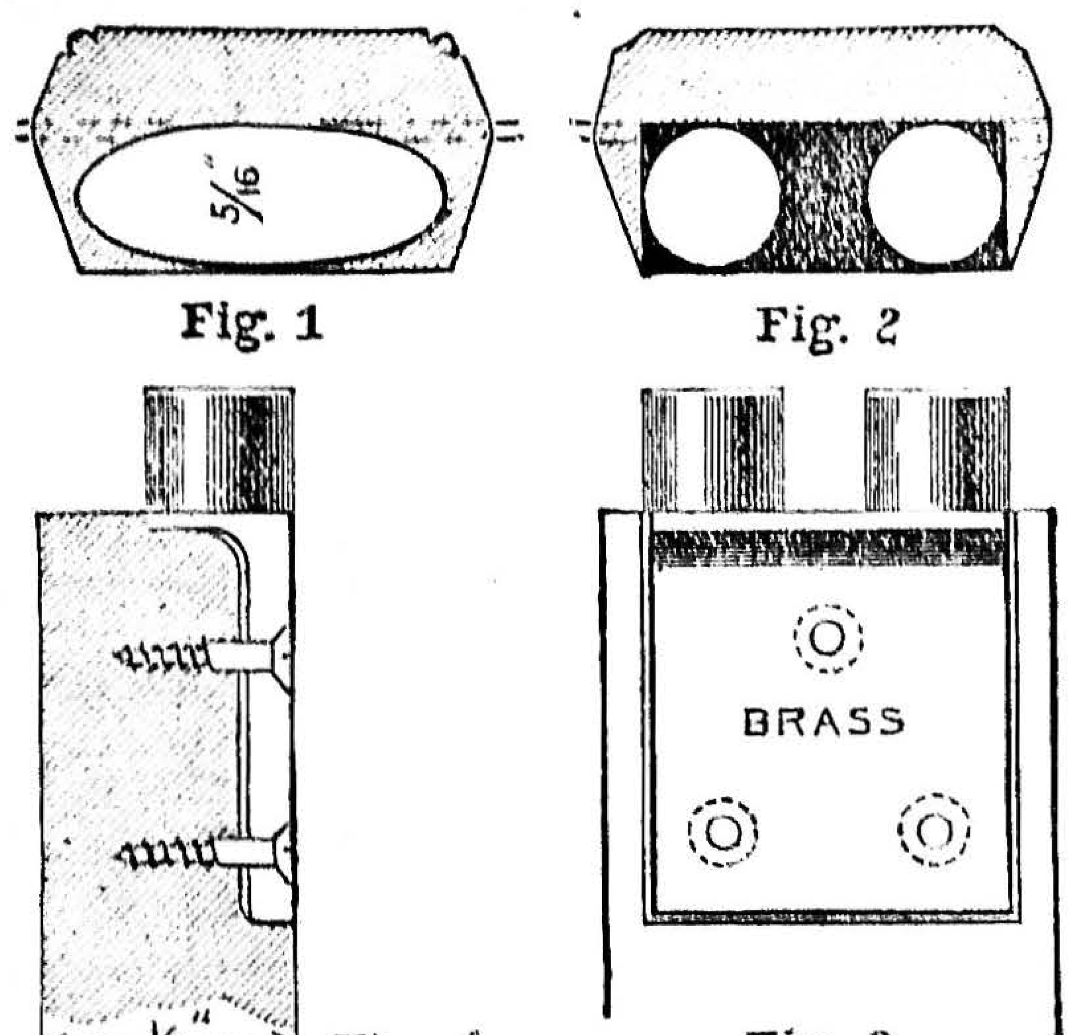


Fig. 1 Fig. 2 Fig. 4 Fig. 3

Joints in Secrétaire Shutter.

by "the most convenient moulding for the strips;" but if the design of the table top and the rest of the secrétaire is ordinary modern style, an eighth bead worked on each edge (Fig. 1) would be suitable and easily stuck; if semi-Gothic, a small chamfer at each edge would be *comme il faut* (Fig. 2). Unless AMATEUR is clever in using tools, I would suggest that the strips, instead of being left long enough to cut away for sliding in grooves, should be shot to exact length, which is much easier, and that brass plates similar to Figs. 3 and 4 should be screwed from back of each. Fig. 3 is top view and Fig. 4 is side view; both full size. Fig. 2 shows section of brass end. A small pattern in mahogany is easily made, and brass runs much more smoothly in wood than wood would do. The groove should be well black-leaded or soft-soaped at first, in either case.—J. W. H.

Xylonite—Acids.—W. B. (*No Address*).—The address you wish to find is: The British Xylonite Co., Limited, High Street, Homerton, London. As to your other question, I gather you have been using the gas for engraving on glass; if it is the acid you wish for, use hydrofluoric acid.—W. E. D., JR.

Garden Wall.—TAMAR.—I should advise you to point the wall with quick-setting Roman cement, mixed with three parts of clean, sharp sand. You can lay it on to within one hour of the water rising above it, as by that time it will be set. The joints should be well raked out, and any damaged stones should be cut out and new ones fixed, bedded, and jointed with cement.—M.

Bearings for Lathe Mandrel.—LITTLE JIM.—Whether cone or parallel bearings are best for a lathe mandrel is a matter of opinion; some think one way, and some another. Cone bearings are most usual in 6 in. lathes; parallel bearings are necessary in lathes with traversing mandrels; and there is a very good kind of parallel bearing used in America, in which the collar, while parallel inside, is coned outside, and fits a coned hole in the headstock. The collar is split lengthways, so that by drawing it into the coned hole by a nut, it can be slightly collapsed upon the mandrel neck. I do not know what is the plan adopted by Mr. J. Holroyd; you must send us a drawing of it if you want an opinion: you must tell me the dream if you want to know the interpretation, as I am not Daniel, but only—F. A. M.

Table.—T. C. (*Dewsbury*).—Please furnish further particulars. You state that you have already made a table, but you are not satisfied. If you tell us where you have failed, or where special difficulties appear in your way, you shall have our best attention. There are many others who have failed to realise their ideal, but it may be that these people are making good progress. Write again.—B. A. B.

Toy-Whistles.—D. McD. (*Glasgow*).—(1) Upcott Gill publishes a good work on "Toy-making" (*Bazaar* Office, Strand). (2) Whistles can be made of any hard wood such as box; they are usually turned and bored on the lathe. (3) Ordinary turners' tools and a few boring-bits. (4) If you mean by toy machinery, models advertise. If you mean machinery to make toys—any maker of light machinery for the material of which the toys are to be made.—B. A. B.

Pantograph.—LITTLE JIM.—I have read reply referred to in No. 24, page 382, Vol. I., but find no *promise* of an illustration, as you state; but explanations have been given, accompanied with an illustration, too, on page 669 of our first volume. The following, taken from an old edition of "Treatise on Mathematical Instruments," by J. F. Heather, M.A. (Weale's Series), will, I think, just supply what is lacking on page 669:—"When the instrument is correctly set, the tracing-point, pencil, and fulcrum will be in one straight line. . . . The motions of the tracing-point are then each compounded of two circular motions—one about the fulcrum, and the other about the joints at the ends of the rulers upon which they are respectively placed."—B. A. B.

Staining Maple.—CONSTANT READER.—When it is required, as in your case, to stain the veneers right through, it is called dyeing. When the article is made before colouring up, it is termed staining. For the former process it is advisable to soak the veneer at least half a day in clean water; then take it out and allow a few hours to drain before inserting in the dye bath; this will cause the dye to strike more readily and be more evenly distributed, but for staining purposes this is, of course, impossible, nor is it necessary, as only the surface is stained. To give a list of all the materials and how they are used for all the different colours, as you wish, would take up more room in "Shop" than can be spared at present. I have already promised several correspondents that I will write an article on the subject, which will doubtless appear in due time; for the present I will confine myself to the two colours enclosed. Silver grey: (1) Acetate of iron made by steeping rusty nails, turners' swarf, or rusty iron of any description (say 4 lb.) in one gallon of vinegar; to this add 2 gallons of water. Immerse the veneers in this, and if possible bring up to boiling point; then add ¼ lb. extract of logwood and 2 oz. bruised nut galls. (2) Take the iron solution as above, soak the veneers, then to each gallon add ¼ lb. of green copperas. (3) The ebony stains much diluted should give the required shade, especially if afterwards coated with a weak green stain made by dissolving verdigris in hot vinegar, or both in combination. (4) Hermes grain, to which has been added copperas and tartar, is said to give many beautiful shades. Yellow: turmeric, fustic, Persian berries, gamboge, saffron, picric acid, and Barbary root all give shades of yellow. We cannot give the exact proportions of each; experiment must decide. As a guide, if barbary root is used it requires 1 lb. to 1 gallon; when cool, add 2 oz. of aquafortis to make the dye strike more readily. The veneers should afterwards be allowed to dry in the open air, not by the fire. If it is found impossible to immerse the veneers in a bath, apply frequently as hot as possible by means of a brush. Sometimes it is found sufficient if decoctions of the various roots, barks, etc., are thus applied, and the stain fixed by brushing over while the last coat is still wet with alum water (2 oz. alum to 1 quart of water), or pearlash, 2 oz. to 1 pint. Gamboge and turmeric can also be dissolved in spirits; 3 oz. of the former, 1½ oz. of the latter, to one quart of spirits makes a useful stain. You will be wise to experiment on odd pieces of veneer till you have gained the required shades previous to attempting large quantities.—LIFEBOAT.

Blueing Gun-barrels.—R. K. (*Hastings*).—The barrel must be highly polished, and the ends plugged with fireclay. Make up a clear fire, with an iron muffle or length of stovepipe in the fire, so as not to let the flame touch the barrel. Insert your barrel when the pipe is red hot, watch for the change of colour, draw it out in time, and let it cool in the air. Or you may get a more even heat to thick and thin parts of barrel alike by putting it into a molten lead bath till you get the colour you want. To prevent the surface of the lead from oxidising quickly, lay on powdered charcoal or powdered wood ashes. I hope this will suit your requirements, but blue gun-barrels are not usual things.—J. C. K.

Dye for Sheepskin.—ANXIOUS INQUIRER.—You can use aniline dye, but the skin must first be washed and cleaned, to remove all dirt, grease, etc. If one application of the dye is not dark enough, repeat the process till of the required colour. But, speaking from experience, I should recommend you not to dye it, as the dye appears to rot the material, and it does not wear well after. You can improve the appearance very much by well washing with soap and water.—M.

Power of Gas Engine.—W. T. B. (*Cradley Heath*).—The one-horse nominal, if the Otto, I should get to drive three small screw-cutting lathes, two drilling machines, one 24 in. fan, and one 6 ft. grindstone; but you had better rely on what the makers tell you.—F. A. M.

WORK, No. 42.—K. P. (*Stoke-on-Trent*).—Advertise for this in the Sale and Exchange column.

Elephant-man.—J.H. (*Stockton-on-Tees*).—Write to the Secretary of the London Hospital.

Bent Iron Work Patterns.—W. S. S. (*Leeds*).—Get all the numbers of WORK in which Bent Iron is treated, and you will have patterns enough.

Plaster Casts of Ecclesiastical Figures.—H. F. B. (*Norwich*).—Try C. M. Rock, 106, Great Russell Street, London, W.C.

Improved Fastening.—W. M. (*Accrington*).—We have examined the arrangement, sketches, and description sent, and considered the subject. The idea is ingenious, but we fear that, in use, it would not give satisfaction, inasmuch as each movement would be likely to cause it to unfasten. This, however, can only be decided by practical use. We do not remember to have seen it proposed or applied to the purpose named, but a precisely similar plan is in use and adopted in some of the modern breech-loading artillery, and for some other purposes. A well-considered and well-drawn specification might be made to cover the invention for the purpose proposed, and so create a property in it; but then comes the question: Is it an arrangement that would be taken up by the public? The solution of this question in a satisfactory manner is the only thing which could justify W. M. in encountering the worry, trouble, and expense which are always the accompaniments of ownership of patent property.—C. E.

Pantograph—Printing Press.—J. R. L. (*Aberdeen*).—For the former, see WORK, No. 187; for the latter, kindly await forthcoming papers.

Forecourt.—TENANT.—Take off the turf and soil, and cover the top of the cellar with a layer of asphalte ½ in. thick, with a slope to one side, and a drain laid from it to carry off any water which may sink through the soil when replaced. The top of cellar should be perfectly dry when the asphalte is laid on, and may require levelling up with cement to receive the asphalte, which may be dissolved in hot tar (about 1 cwt. to 30 gallons of tar, more or less, as it sets, which can be tried). The tar must be stirred while boiling, and boiled till all moisture is expelled. The cost would be from £4 to £5, according to the facilities for doing the work.—M.

Cost of Cottage.—COTTAGE.—Without knowing the cost of materials and labour, and how you want the work finished, an approximate cost can only be given; but, under favourable circumstances, you might get it done for £200. The best thing to do is to have a plan and specification prepared, and get an estimate from a builder on the spot. If you have no plan, send me particulars of what you want, and I shall be glad to help you. I should advise you to form a cavity in the outer walls, or they will be damp. You will also find it much more convenient to make it two storeys high instead of cellaring.—M.

Proposed Arrangement for Astronomical Telescope.—W. L. (*Middlesbro'*).—The arrangement which you show in your sketch is useless for the purpose you have in view. The 5 in. lens would have to be achromatic; there is absolutely no other way of correcting the colour. The practical effect of the introduction of the smaller lens would be to lengthen the focus. Experiments have been made with a telescope having an arrangement of lenses such as that which you suggest, and success was attained when the correcting lens (of much larger size than that which you show) was a fluid lens, made of the liquid sulphuret of carbon, enclosed between two concave discs of glass. But, necessarily, the arrangement was not of any permanent value. If you want to avoid the expense to which you refer, and yet desire to possess a perfect instrument, you should make a large reflecting telescope. Read the articles which are now appearing in WORK on the "Hand-working of Specula for the Newtonian Telescope," and carefully follow out the instructions contained in them. As you are a skilled mechanic, you ought not to find any difficulty either in the grinding and silvering of the glass or in the making and mounting of the eye-pieces and tube.—E. A. F.

Clock Chime.—X. Y. Z. (*Derby*).—Unless you know something of clock work (and from your third question I should judge you do not), I think it impossible for you to make a chime quarter clock from an ordinary grandfather's clock, as there would have to be a lot of new dial work made and fitted, and the present altered and added to. Then the plates are not large enough to take a third set of wheels to work the chimes, and the winding hole would come on the edge of dial. Then, too, there is the making and fitting up the train of wheels; and, lastly, making and pinning the barrel for the chimes. To give you any idea at all of the work would require a page or two of WORK, and then I doubt if I could make you understand, unless you have some knowledge. I shall be pleased to assist you if our Editor can find room, but chime quarter work, in my opinion, is beyond the capabilities of the majority of amateurs.—A. B. C.

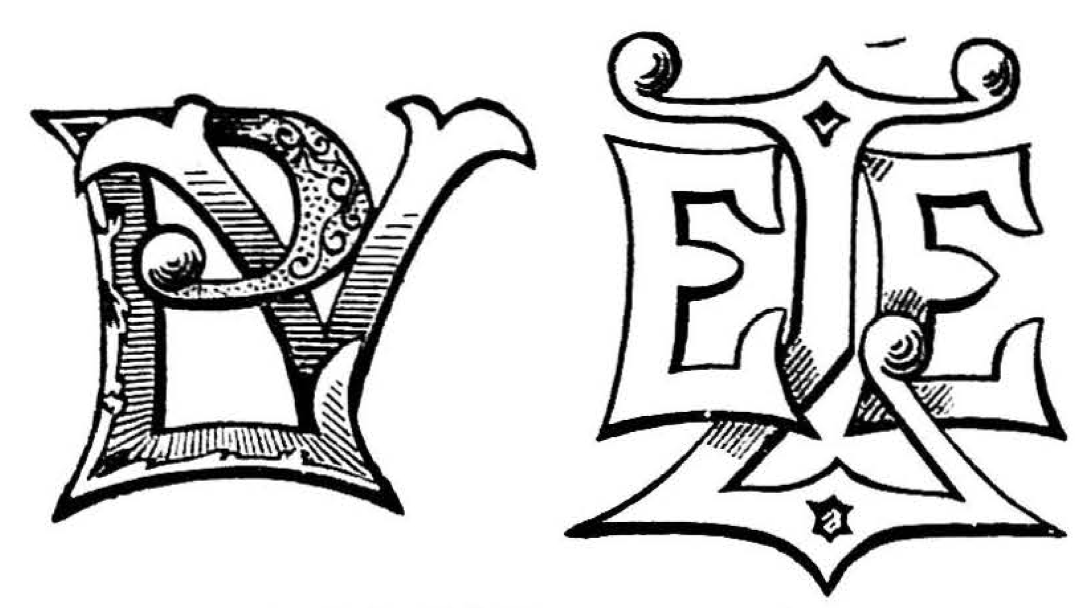
Book.—C. R. (*Nottingham*).—I am glad to hear that the furniture designs in WORK are so useful to you. Plenty of books are published with designs, but I find they do not generally give working details. You may get some hints from the "Art and Craft of Cabinet Making," which was reviewed in No. 151, Vol. III.—F. J.

Boring Bits.—IGNORANT.—Several answers to part of this question have appeared in back numbers. Besides centre bits there are "pin bits"—like a gouge; "spoon bits," like a rather pointed teaspoon at the cutting end; "nose bits," which have an edge bent at an angle with the stem. There are also several types of "auger bits," having a screw nose like a gimlet. These are Gedge's, Jennings's, Douglas's, and Whitehouse's, all excellent, especially Jennings's. I have seen and tried a very good copy of the "Morse twist bit," made in Germany, which I can recommend for holes between $\frac{3}{16}$ and $\frac{7}{16}$. There are also single twist bits of French and Swiss manufacture, the latter being often called Norwegian gimlets, some of which may be imported from Norway. These are good boring tools, and sold here under the name of "diamond twist bits." It is impossible to say how many form a full set; some are made to every sixteenth within their range of sizes, and some to every thirty-second, while pin, spoon, nose, and centre bits vary by small and apparently accidental differences; so much is this the case, that many tool dealers give an opportunity for trial of the bit, and the buyer measures the hole produced. There are also bits provided with moving blades, which can be set to various sizes; but, though handy, their performance is not so good as separate bits.—B. A. B.

Bread and Cake Knife.—W. S. (*Rydal*).—The address is Christy Knife Co., Fremont, Ohio, U.S.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Fret Monograms.—F. J. K. (*Tufnell Park*) writes:—"W. H. W. (*Castleton*) writes for monograms 'E. L. E.' and 'P. L. V.' for fretwork. I hope the enclosed designs will suit W. H. W. Being plain and simple, I think they are suitable for fretwork."



"P. L. V." and "E. L. E." Monograms for Fretwork.

Time.—M. L. (*Naples*) writes to A. R. (*Moseley*) (see No. 185, p. 462):—"To find clock time, modify solar time as follows:

JANUARY.

1	add	4 *m.*
3	,,	5
5	,,	6
7	,,	7
9	,,	8
12	,,	9
15	,,	10
18	,,	11
21	,,	12
25	,,	13
30	,,	14

FEBRUARY.

7	add	15 *m.*
15	,,	14
25	,,	13

MARCH.

2	add	12 *m.*
7	,,	11
11	,,	10
14	,,	9
18	,,	8
21	,,	7
24	,,	6
28	,,	5
31	,,	4

APRIL.

3	add	3 *m.*
7	,,	2
10	,,	1
14	,,	0
17	deduct	1
22	,,	2
28	,,	3

MAY.

6	deduct	4 *m.*
25	,,	3

JUNE.

2	deduct	2 *m.*
8	,,	1
13	,,	0
18	add	1
23	,,	2
27	,	3

JULY.

2	add	4 *m.*
8	,,	5
15	,,	6

AUGUST.

7	add	5 *m.*
14	,,	4
19	,,	3
23	,,	2
27	,,	1
30	,,	0

SEPTEMBER.

3	deduct	1 *m.*
6	,,	2
9	,,	3
12	,,	4
15	,,	5
17	,,	6
18	,,	7
23	,,	8
26	,,	9
29	,,	10

OCTOBER.

2	deduct	11 *m.*
5	,,	12
9	,,	13
13	,,	14
17	,,	15
23	,,	16

NOVEMBER.

14	deduct	15 *m.*
19	,,	14
23	,,	13
26	,,	12
29	,,	11

DECEMBER.

2	deduct	10 *m.*
5	,,	9
7	,,	8
9	,,	7
11	,,	6
14	,,	5
16	,,	4
18	,,	3
20	,,	2
22	,,	1
24	,,	0
26	add	1
28	,,	2
30	,,	3

Coffins.—A COUNTRY CABINET MAKER writes:—"Will you allow me to supplement the reply given by CHOPSTICK (No. 177, p. 334) to W. P. W. A. (No. 170, p. 222), by describing the plan we usually adopt. We make the coffin plain, and fit the lid on, then brad the battens (about ½ in. thick and 2½ in. or 3 in. wide, and moulded or bevelled on one edge) round bottom of the coffin, and also round the top, flush with top of lid, but bradded on to sides of coffin, *not on the lid*. Then lay another set on the top of lid just flush with outside of those on the side—slightly overhung and edges rounded gives a good effect. These must be mitred (or, rather, jointed) across the pinion, and the best plan is to put on the side-pieces first, and then cut the ends in, cutting away the moulding and fitting them between—just the reverse of those round the coffin, where the end pieces are put on first and then the sides. By this plan the lid forms a sunk panel. This makes a good medium-class coffin (we do it both in oak and in pitch pine); but if a first-class one is required, it may be full panelled by cutting pieces of the same batten stuff in between those of the head and foot, so as to make stiles there, and the same at both ends of the sides, and a double piece over the pinion and a single one moulded on both edges halfway between pinion and foot. There is no difficulty about it, except at the pinion, where two pieces have to be carefully fitted in and shot to fit, so that they can be rounded off without showing a bad joint. I have seen some men get over the difficulty by putting in a single-width stile moulded on both edges just above or below the pinion; it saves trouble, but does not look so well. I have also seen them done with square battens and a separate moulding, either plain or blacked, fitted in instead of moulding the edge. As to shape, I must differ from CHOPSTICK. I venture to think his head and foot are too wide. I will just give size of one or two which I can recommend as being good shapes:

Length.	*Head.*	*Foot.*	*Pinion.*	*From Head.*
6 ft.	8½ in.	7¼ in.	20½ in.	20 in.
5 ft. 4½ in.	8¼ in.	7¼ in.	18 in.	18½ in.
5 ft. 11 in.	8 in.	7 in.	20 in.	19¾ in.

About 12 in. or 13 in. deep at head and 11 in. or 12 in. at foot.

These and similar proportions will, I think, give satisfaction. I hope these notes may be of some help to W. P. W. A., and if I can help him with any further hints, I shall be happy to do so. One word of caution: Be sure and remove any screws used to temporarily fix the lid before nailing the battens on the top over their heads, and do not brad the top batten of the coffin both to side and lid. I have seen both these mistakes made."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. E. (*Clapham*); ENGINEER; T. H. (*Lisburn*); H. A. (*Handsworth*); ELECTRICIAN; TAR; B. B. B.; DUM DUM; W. H. C. (*Ilkeston*); W. J. D. (*Brecknock*); SPERO; CONDUCTOR: J. H. (*South Bromley*); J. K. (*Bishop Auckland*); J. S. W. (*Methwold*); A. W. (*London, N.E.*); STUDENT; N. E. R. SIGNALMAN; DONALD; C. R. T. (*Newington*); J. B. M. (*Dorset*); C. P. T. (*London, W.C.*); F. P. (*Bristol*): J. S. (*Ansty*); J. R. T. (*Ashington*); W. S. C. (*Birmingham*); H.T. C., JUN. (*Hounslow*); J. W. B. (*Huddersfield*); J. T. (*Sheffield*); W. H. B. (*Queenstown*); E. J. S. (*Maidstone*); D. M. C. N. (*Manchester*); J.N. (*Lancaster*); A TWELVE MONTHS' READER.

SALE AND EXCHANGE.