WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. III.—No. 144.] SATURDAY, DECEMBER 19, 1891. [PRICE ONE PENNY.

MODERN WALL COVERINGS.

SOME NOTES ON THEIR PRACTICAL AND DECORATIVE ATTRIBUTES.

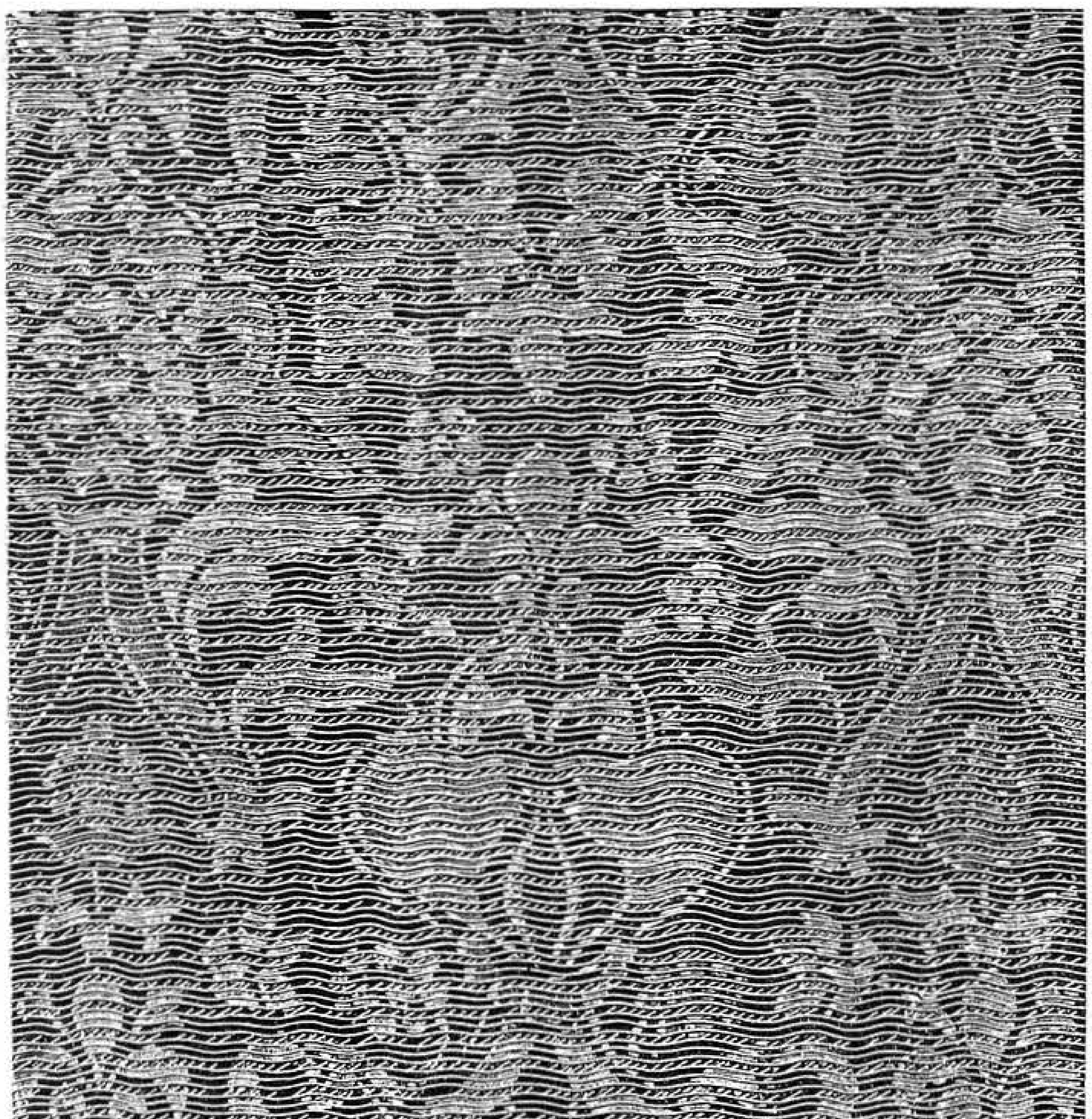
BY FREDERICK PARSONS, F.S.SC.

NEW AND OLD WALLS: HOW PREPARED—THE CLAIMS AND QUALITIES OF OIL PAINT, "TEMPERA," AND WALL PAPER—FLAT *v.* GLOSSY SURFACES—PAPERHANGINGS—LEATHER PAPERS AND DECORATIVE RELIEF MATERIALS.

"WHAT shall I do with the walls?" No question relating to the interior of the home comes to the scribe who deals with "Home Art" so often as the foregoing. To whiten the ceiling and carpet the floor are decisions "as a matter of course" to the average householder; but when it comes to the walls, he usually "hesitates and is lost"—or rather, his peace of mind often is. Doubtless, many readers of WORK have already found themselves in the above predicament. Many others will, in time, equally doubtless, be so situated. The capabilities of the "Shop" columns are almost illimitable in all directions excepting that of space; therefore, notwithstanding this momentous question of taste will continue to be asked through all time, it will fairly entitle the writer to the thanks of a patient and long-suffering editor, as well as the present generation of our readers, if we succeed in removing for a time so prolific a claimant for "Shop" space.

Although the ground we try to cover herein is of no slight dimensions, it must not be expected that the substance of folios can be condensed into a paragraph. The intention is rather to enable an inquirer to find within the limits of a brief paper, aided by the knowledge of his own individual circumstances of selection, a useful and correct answer to the opening sentence.

New and Old Walls: How Prepared.—In order to obtain the best results, a well made



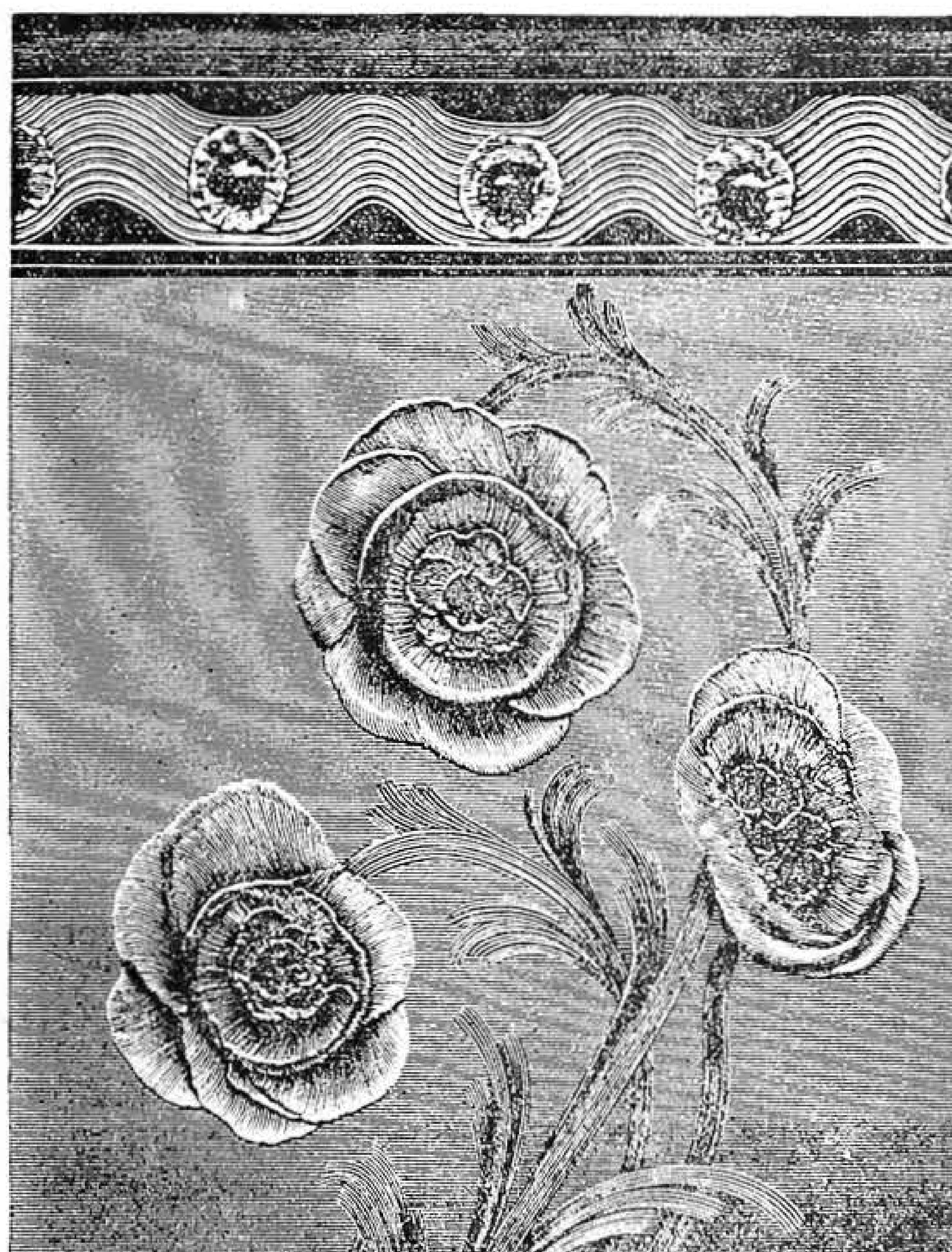


Fig. 1.—Diaper for Walls (Ecclesiastical). Fig. 2.—Dado and Border: Semi-natural Treatment of Floral Motif (Domestic). Being Reproductions showing the Artistic Possibilities of Alabastine, the most Modern of successful Wall Coverings.

and finished plaster surface is a *sine quâ non*; but, unfortunately, this is a condition of extreme rarity in the bulk of modern buildings of the cottage and villa type. However, we must make the best of that which we have. All old papers having been removed, and the old putrid paste and size well washed off the surface with warm water and a little soda or carbolic acid therein, we look to the plaster. If the surface skimming is cracked or blistered, cut it out; well wet the surface beneath, and make good to an even face with plaster and lime-putty, or plaster only if in small quantities. All holes and cracks being repaired, we rub down with glass-paper, and proceed according to the finish determined upon. If we adopt white lead and oil painting, see articles in WORK, Vol. I.; distemper or *tempera* processes are also explored therein. We therefore turn to the most favoured plan—wall papers. In fixing the latter, it is necessary to give ordinary plastered walls a preparatory coating of glue-size, diluted to a jelly consistency (when cold), and spread when warm. If this be not done, the moisture from the paste is at once absorbed into the plaster, making it difficult to fix the paper and to ensure proper and lasting cohesion between the two.

The Rival Claims of Oil Paint, Distemper, or Paper must be judged from various standpoints, some general to all circumstances, others particular to individual cases. Assuming that an ordinary plastered wall is under consideration, we state briefly the main practical attributes of the three treatments.

Painted Walls are somewhat costly, both for time in execution and for material; but, outside this, are certainly very serviceable, permanent, and sanitary, in the common acceptation of the term. With reasonable care, and having once been properly treated, a painted dining-room should last ten years, with careful washing every spring. It has one disadvantage: that in all but well-ventilated places any excess of moisture in the air condenses on the surface and trickles down the walls.

Distemper—in which term I include all water paints—is the antithesis of oil paint in many respects. It is not serviceable except in positions beyond reach and abrasion. It cannot be washed as can oil paint, and therefore permanence depends on position chiefly. Its chief qualities are cheapness, the temporary absorption and subsequent giving-off of atmospheric moisture, and the facility with which it can be completed.

Wall Papers to a certain extent combine the qualities of utility common to both paint and distemper. The main advantage of a pattern-paper lies in the fact of such giving a partly furnished sentiment to a room; whilst the pattern further prevents the eye noticing the knocks and soils that living-room walls are subject to. The cost of fixing a paper is about the value of distempering the walls; and since we live in an age of marvellously good and inexpensive papers, "you pay your money and take your choice" accordingly.

Flat v. *Shiny Surfaces.*—This is an aspect of the question directly connected with the previous treatments, which is well worth a little attention here. In oil-painted surfaces it is possible to finish the work in either a glossy or perfectly lustreless face—the latter appearance being technically known as "flat." The presence or absence of gloss thereon has much to do with the effect upon our mind of any painted wall. A flatted surface is obtained at some small sacrifice of durability; but where permanence is not the great object of using paint, a lustreless effect is infinitely preferable for the walls of all dwelling-rooms. By the judicious intermixing of linseed oil and turpentine, it is possible to vary the "shine" of paint to several definite degrees between the flat and oily extremes. The merits of the former are softness and repose to the eye, added to a full charm of *colour* employed; whilst the latter tries the eye by its reflection of light, destroys all feeling of softness, and mitigates against the effect of any tint employed. If flatted paint is cleaned by those who understand its nature, it is almost as durable as the oil coats; but when the average housemaid gets to work every spring with soft soap and the scrubbing-brush, nothing but the hard and glittering surfaces of oil paint, varnish, or enamel can long withstand these periodical onslaughts. We must, therefore, with respect to painting, choose between flatting and artistic effect on the one hand, and oil and durability on the other. Concerning distemper processes, little need be noted here, since a perfectly dead surface is one of the chief merits of water paints for use in the embellishment of interior walls. Where dados and such-like divisions of walls are permissible, paint may well be used for the lower part, and distemper for those portions out of danger of abrasion. Turning now to gloss on wall papers, we are confronted by a common practice of varnishing such—a practice against which we cannot speak too strongly. We may say at starting, that excepting such papers as imitation "oaks" and "tiles," for bath-rooms and butchers' shops, etc., not one paperhanging in ten can be varnished without great detriment to its appearance. Now, the main purpose of putting design on paper is certainly to increase the *artistic effect* of our homes; whilst, as before mentioned, the pattern prevents wear and tear from showing as quickly as on a plain-coloured surface. To varnish a paper with *copal* varnish (the usual plan) means to destroy the colour, and also all repose of the design. Staircase papers, with which we mainly are dealing, should invariably be cheerful and light in tone. If ordinary copal varnish is spread after twice sizing, as is necessary, upon any light paper, it gives it a nasty, shabby, "twenty-years-old" look; and although *spirit* paper varnishes are made which are almost colourless, they have not half the wear of copal, and, as is common to all, show every little inequality of paper and surface—a definite and lasting eyesore with badly plastered walls. The main and sole advantage of bright-varnishing walls is that they may be washed occasionally. It cannot, however, be too well known that copal varnish, even where washing is to take place, can be entirely dispensed with.

Flatting, or Dead, Varnish, although it will also *slightly* alter the colour of a paper, can be applied to such walls at a cost of a few more shillings than ordinary copal. We are of opinion, however, that no dwelling-house walls need be varnished at all. During the last few years sanitary washable papers—viz., papers printed in oil colours—have been greatly improved, and now possess sufficient durability even for staircases and bathrooms. Not once in a hundred instances is a copal-varnished surface destroyed by fair wear; the householder gets tired and disgusted with it long before, and then the cost and trouble of removing it is an experience desired only once in a lifetime. The house-painter has been responsible for many common offences in his generation; but the worst, we think, must be the introduction and practice of varnishing wall papers.

Paperhangings and Decorative Relief Materials.—Having in the foregoing reviewed the practical *pros* and *cons* of my subject concerning wall coverings of comparatively an inexpensive nature, I will briefly notice the claims of the more costly products and materials. But first, a few useful notes on the varieties of ordinary wall papers. These may be divided into three classes, according to *quality, make,* and *surface.* The cheapest are known as "machine pulps," meaning papers in which the ground or pulp is itself coloured, and which are printed on afterward by machinery. They are retailed in prices from 2d. per piece of 12 yards run, to 1s., or even twice that sum, when sold with a good design upon them, and in tasteful colourings, as the speciality of a Regent Street firm. The next grade higher is known as "grounded papers" and "satins." The former term implies that the paper used, being white in the first instance, is grounded all over with the desired tint previous to the pattern being printed thereon. "Satins" are papers in which the ground or part of the design has been polished by the aid of powdered French chalk, etc., to a satin gloss. The value of the two last varieties is from 1s. to 2s. 6d. per piece. "Hand-printed" papers—viz., those having the design blocked on by hand instead of by machinery—are the most costly and artistic of paperhangings, ranging from 3s. to 10s. per piece. We have next the invaluable sanitary papers, made and sold in every range of colour and design, from 1s. to 3s. per piece. Embossed goods and imitation tapestry papers are the grounded and hand-printed kinds which are afterwards treated to a process of embossing, whereby varieties of texture effects are given to the surface, and softness to the colour and design is imparted. "Talc," "frosted," or damask papers are those of the best kinds, in which very silky effects are obtained by the use of powdered glass, etc. "Gold papers," so termed, are such as have parts of the design in gold bronze. If it were only possible to persuade the British public of their unsuitability for walls, the status of English home art would be greatly raised. Gold papers invariably give a flash and garish effect for a time, and then very soon the bronze turns black, and—instead of richness—shabbiness and gloom predominate. Gold papers are, happily, gradually going with "satins" into the list of things that *have been* popular. "Flock papers" are designs printed in flat relief of varying degrees of thickness. They are very expensive; but as it is usual to paint and flat them, a very soft and artistic surface of everlasting wear is obtained. Of leather papers and relief decorations, which are fixed like ordinary paperhangings, only with stronger mixtures of glue and paste, I must here say but little. The qualities of the former are those of the durability of paint, and with every range of artistic effect without the necessity of after-treatment. They range in value from 1s. 6d. to 10s. per yard super. Lincrusta Walton, Anaglypta, and similar well-known decorations, usually require after-painting; but both may now be purchased made in plain or elaborate colourings. Perhaps the most interesting recent addition to the formidable list of relief decorations is the "Alabastine," which has previously been brought to the notice of our readers, and of which the two panel illustrations will speak volumes for its artistic possibilities and future. In a subsequent paper I will endeavour to further assist the reader respecting the mission of *colour* on our walls, with hints to its successful application.

A TUNING METRONOME AND MONOCHORD FOR AMATEUR TUNERS AND MUSICAL INSTRUMENT BUILDERS.

BY H. CLARK.

The Tuning Metronome.—The simple apparatus to be described in this paper is intended for the assistance of amateur tuners and musical instrument builders, and was devised by the writer to enable him to tune, without professional assistance, a chamber organ which had come into his possession. It is not, however, in connection with *organ* tuning alone that this apparatus is useful, as it is equally useful in the tuning of the piano or harmonium.

The necessity for such an apparatus, and even its utility, may, perhaps, be questioned by professional tuners and qualified musicians, but it is confidently believed that such will not be the case with those who, whilst freely admitting the paucity of their musical acquirements, have still a love for the beautiful art, and are desirous of employing such talent as they possess in overcoming the difficulties which they may encounter in its pursuit. The apparatus has, however, received very favourable professional notice.

As most of the readers of this article will be aware, with the exception of the octave no musical interval, as rendered by fixed-toned instruments, like organs, harmoniums, and pianos of ordinary construction, is perfect, and it is usually the object of the tuner to so "temper" or distribute the imperfections of the various intervals as to allow of an approximately equal degree of softness and harmony being obtained in whatever key a piece may be played. This distribution of imperfections is termed tuning by "equal temperament."

If we take our place at the piano, and, selecting any note the strings of which are in unison, strike the key belonging to such note, and at the same time very gradually relax one of its strings by means of a tuning hammer, we shall observe a succession of "waves," or "beats," which, commencing slowly, will gradually increase in rapidity, until at length the result of our experiment is extreme discordance. If we strike any "third" or "fifth," a similar succession of slow waves will be noticed, and it is in regulating the rapidity of these waves, which varies as we ascend the scale, that our little apparatus comes into use.

The tuning metronome, shown in elevation in Figs. 1 and 2, consists essentially of a pendulum so suspended as to be readily adjustable to any required length, and is constructed as follows:—Two pieces of 1 in. deal board, 4 ft. long and 2 in. wide, are planed up true and square. At the distance of $\frac{1}{2}$ in. from one edge of each piece a groove, $\frac{1}{2}$ in. in width and depth, is made, as shown at *a*, in Fig. 3, after which the part *b* is planed away to the depth of $\frac{1}{4}$ in., as shown in Fig. 4. These two pieces are then screwed together with the grooves facing each other, as shown in Fig. 5, thus forming the standard. A strip of hard wood, such as beech or birch, 6 in. long, is then prepared, as shown in full-size section in Fig. 6. This will have to slide with as little play as possible, but without binding, in the T-groove formed in the standard. A flat bit of similar hard wood, 6 in. long, $1\frac{3}{4}$ in. wide, and $\frac{1}{2}$ in. thick, is now to be screwed with a couple of screws to the tongue, *a*, of the slide, which should be left sufficiently high to prevent binding on the face of the standard. A piece of clock-spring, or hard rolled sheet brass, 6 in. long, is formed into a spring, as shown at Fig. 7, and fastened with screws through the straight part into the groove, *b* (Fig. 6), the curved part projecting somewhat beyond the face of the wood. At one end of the grooved face of the standard the wood must be cut away 3 in. long and 1 in. deep—*i.e.*, to the bottom of the T-groove—and a block of hard wood, $1\frac{1}{2}$ in. thick, fitted and screwed into the recess, leaving $\frac{1}{2}$ in. projecting on the face to correspond with the slide described above. Two pieces of brass wire, $2\frac{1}{2}$ in. long and $\frac{3}{16}$ in. diameter, are now taken, and two holes, 1 in. apart and $\frac{1}{50}$ in. or less in diameter, drilled through each parallel to each other, one hole being $\frac{1}{8}$ in. from one end of the wire. Two similar holes are drilled through a piece of similar wire, $1\frac{1}{4}$ in. long. The two longer pieces are to be slightly tapered at the undrilled ends. These pieces are then to be tightly driven into the face of the slide and the block at the top of the standard respectively, the holes being kept parallel to the length of the standard, and the inner one $\frac{1}{8}$ in. from the wood when fully driven. The pin in the slide must be in the centre of its length, and that in the "head" 2 in. from the top. A pianoforte "wrest-pin" should be fitted into the head at 1 in. from the top and about $\frac{1}{8}$ in. toward one side. This, likewise, is to be drilled with holes corresponding to those in the brass pins. A pendulum "bob" of about 4 lbs. weight, and preferably of lenticular form, must now be procured or made. The "bob" of an old "grandfather" clock, if available, will be just the thing. The short piece of drilled wire must be attached at the edge of the "bob," or to the regulating slide if the bob possesses one, the wire being kept parallel to the axis of the bob and at right angles to the slide, if any. A reference to the side elevation (Fig. 2) will clearly explain what is meant. Now lay the standard, face upward, on the work-bench, lay the bob upon it, with its centre not less than 36 in. from the pin in the head of the standard, and carefully mark the position of its top and bottom edges on the standard. These marks must be permanent. Find the centre between these two marks, and so place the slide that the lower side of the drilled brass pin in its face shall be exactly $7\frac{5}{8}$ in. from the centre mark just found, the distance being measured toward the top of the standard. Score across the face of the standard close to the upper edge of the slide and mark the line F—C^{1}. Proceed in like manner to set off the following distances from the same starting-point, viz.:—$8\frac{9}{16}$, $9\frac{5}{8}$, $10\frac{3}{4}$, $12\frac{1}{16}$, $13\frac{1}{2}$, $15\frac{5}{16}$, $17\frac{3}{16}$, $19\frac{1}{8}$, $21\frac{1}{2}$, $24\frac{1}{4}$, $27\frac{3}{16}$, and $30\frac{3}{4}$ in., scoring across as before, and marking the lines E—B, E♭—B♭, D—A, C♯—G♯, C—G, B_1—F♯, B♭$_1$—F_1, A_1—E, G♯$_1$—E♭, G_1—D, F♯$_1$—C♯, and F_1—C. The pendulum bob has now to be suitably suspended. To do this, procure two pieces of hard wire of such a size as will just pass easily through the holes in the brass pins, and sufficiently long to reach from the pendulum bob to the wrest-pin in the head of the standard, with an inch or two to spare. These wires must be attached by soldering or otherwise to the cross wire of the pendulum bob, and threaded successively through the holes provided in the slide-pin, head-pin, and wrest-pin, which last must be twisted a few turns to retain the wires in their places. The foot for the standard is made of two pieces of 1 in. stuff, 18 in. long and 3 in. wide, the end of one being fitted to the centre of the other by a double tenon and mortise, as shown in the elevations, Figs. 1 and 2, and plan, Fig. 8. The standard is made to ride on the part A, Fig. 8, at *a*, where the thickness of A is reduced to $\frac{1}{2}$ in., the solid wood at this part of the standard being removed to correspond. These parts should be well fitted, as a considerable strain is put on this joint when the apparatus is in use. Before use, the length of the pendulum must be so adjusted by means of the nut, *d*, immediately below the bob or by the wrest-pin, *e*, in the head, that the bob is truly centred in the position in which it was placed when the index scale was set out.

We have now a pendulum furnished with a flexible suspension, and so arranged that the touch of a finger will enable us to adjust it instantly as required to any length (and consequently to any speed) desirable. The lengths indicated by the index, commencing at the top and descending, correspond respectively to 11·3, 12·0, 12·7, 13·5, 14·3, 15·1, 16·0, 17·0, 18·0, 19·1, 20·2, 21·4, and 22·7 beats in ten seconds of time, and these rates correspond to the beats or waves heard when the fifths to which they respectively relate are properly tuned.

To use the instrument, middle C is first to be tuned with the assistance of a tuning-fork. We then proceed in the order indicated in the following scheme, in which the white notes indicate those already tuned and the black notes those to be tuned:—

The numbers at the top of the stave indicate the eleven fifths which are tuned successively by means of our apparatus, the test chord at the end being the remaining fifth of the circle. The unnumbered chords are octaves which it is needful to tune in order to keep our work within sufficiently narrow limits. Each octave is to be tuned "perfect"—*i.e.*, in exact concord—*and so left.* Each fifth must also be first tuned perfect, and the interval then diminished by *flattening* the *upper* note when tuning upward, as in intervals 1 to 8, and *sharpening* the *lower* note when tuning downward, as in intervals 9 to 11. The *amount* of flattening or sharpening is to be regulated by the metronome, which must be adjusted for each successive fifth by shifting the slide upward or downward as required until its upper edge lies exactly even with the line on the standard corresponding to the fifth upon which we are about to operate, and then setting the bob in motion. The note being tuned must be flattened or sharpened, as the case may be, *until the waves produced by the tempering exactly correspond with the beats of the pendulum,* when the note will be properly tempered. When the whole of the fifths 1 to 11 in the above scheme have been tuned in this manner, the result may be tested by trying the chord $A\flat_1$—$E\flat$, the separate notes of which have been obtained by working in contrary directions, thus making it a crucial test, which, however, our work should readily stand if proper care has been observed in respect of each step as it has been taken. Should it be found that the test chord is appreciably inferior to others the work must be carefully revised, an operation, by the way, which it is well to perform under any circumstances. Having tuned these notes, or, as it is technically termed, "laid the bearings," to our satisfaction, the remainder of our task is easy. We have only to tune the remaining notes on the instrument by octaves upward and downward from those already tuned. The correctness of this portion of our work may be tested by comparing each note in the treble with its *double* octave below, and each note in the bass with its double octave above, a proceeding which will most surely expose any error. The remedy for such an error is obvious.

The Monochord.—Thus far it has been assumed that the amateur tuner is directing his attention to an instrument which only requires the ordinary re-tuning operation, but as this paper is also intended to benefit the amateur instrument *builder*, it is necessary that we should "hark back," and suppose that our tuning operations have to be performed for the first time. In this case we shall derive great assistance from the use of a *monochord*, a simple instrument having, as its name implies, only one string, which string, however, is so arranged as to be capable of being "stopped" in such a manner as to produce successively all the semitones between the note to which its entire length is tuned and the octave to that note, the foundation note itself being obtained by means to be described.

The monochord, illustrated without string in Fig. 9, is constructed as follows:—The baseboard, *a*, is a piece of pine 2 ft. 6 in. long, $4\frac{1}{2}$ in. wide, and $\frac{3}{4}$ in. thick, rounded at the upper end, at 3 in. from which a 1 in. hole, *b*, is drilled as a means by which it may be suspended when in use. At 6 in. from the top this board is crossed at right angles by a "bridge" of hard wood, *d*, 1 in. deep and $\frac{1}{2}$ in. wide at the base, the top edge being reduced to barely $\frac{1}{8}$ in. in width, and afterward shaped somewhat as shown in the Fig., leaving only about 1 in. in the centre of full depth. This bridge may be attached by means of a couple of screws passed through the baseboard from behind, and will be all the better for having a flat-topped wire staple driven into the centre of its top edge to assist in sustaining the pressure which will be brought to bear upon it. The following distances must be carefully set off from the centre of the fixed bridge along the centre of the baseboard, viz., 10, $10\frac{11}{16}$, $11\frac{1}{4}$, $11\frac{15}{16}$, $12\frac{11}{16}$, $13\frac{5}{16}$, $14\frac{3}{16}$, 15, 16, $16\frac{7}{8}$, $17\frac{13}{16}$, $18\frac{13}{16}$, and 20 in. respectively, and corresponding lines scored across the baseboard at right angles to its length by means of a joiner's square. The best way to set out these distances is by resting one edge of a set square on the baseboard as indicated by the dotted lines in the figure, and then taking the measurements from the top of the bridge to a point 1 in. from the right angle of the square. A mark made on the baseboard at this angle will be at the correct distance. The lines so set out are to be marked at one or both ends, C', B, B♭, A, G♯, G, F♯, F, E, E♭, D, C♯, and mid. C respectively. We now insert a small screw-eye at *c*, and are ready to string our instrument. To do this we take a piece of small-size piano wire—about No. 24 B.W.G. will be found suitable—*very carefully measure off* $38\frac{3}{4}$ *in., and ascertain its weight in grains.* For example, taking a piece of wire about 4 ft. long, we stretch it tightly between two wrest-pins or screws inserted in a plank and carefully measure and mark off the required length, which we then cut off as accurately as possible at the marks made, and ascertain its weight. Suppose this to be 31·7 grains. *This is the weight in pounds avoirdupois by which the string of our monochord must be stretched to cause it to produce the sound mid. C when vibrating at its full length of 20 in.* We now twist a small open loop at each end of the wire, which we then attach by one end to the eye, *c*, at the upper end of the baseboard, which must be suspended to some convenient nail by the hole provided for the purpose, and to the other end suspend the necessary weight, 31·7 lbs., equal to 31 lbs. $11\frac{1}{4}$ oz. nearly. If we now take an ordinary violin bridge and insert it between the baseboard and the string at the mark mid. C, we shall find that the string, on being twitched by the finger, will yield the note mid. C, or a very close approximation thereto. The note is to be corrected, if needful, by comparing it with a C tuning-fork and *gradually adding to or subtracting from the stretching weight according as the tone is found* to be flat or sharp, until perfect concordance is arrived at, when our monochord will be complete.

We may now commence operations on our hitherto untuned instrument. We begin by tuning its middle C to accord with the monochord, and follow on by tuning C♯, D, E♭, and so on until we have completed the octave, the movable bridge of the monochord being adjusted as required. Having one octave tuned in this manner, we tune downward therefrom to the F in the octave below and then bring our tuning metronome into use as before described.

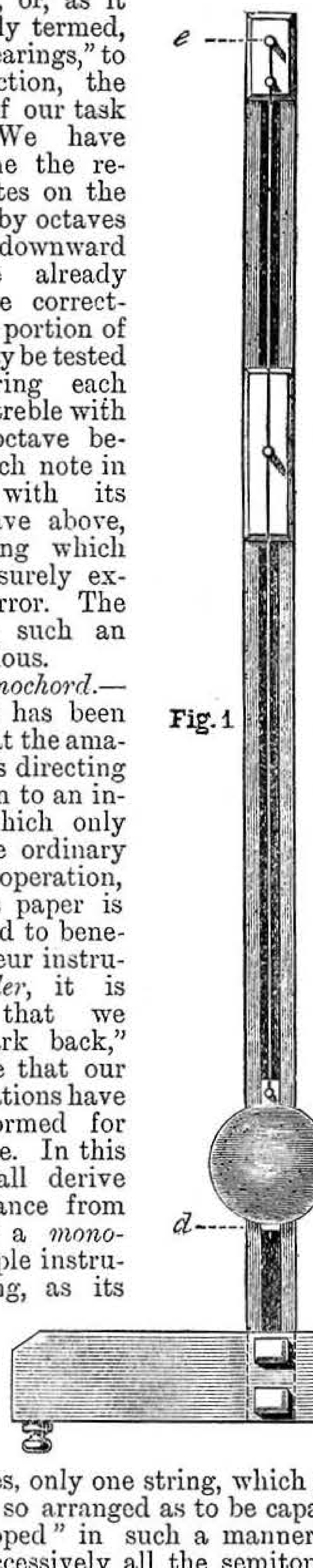


Fig. 1

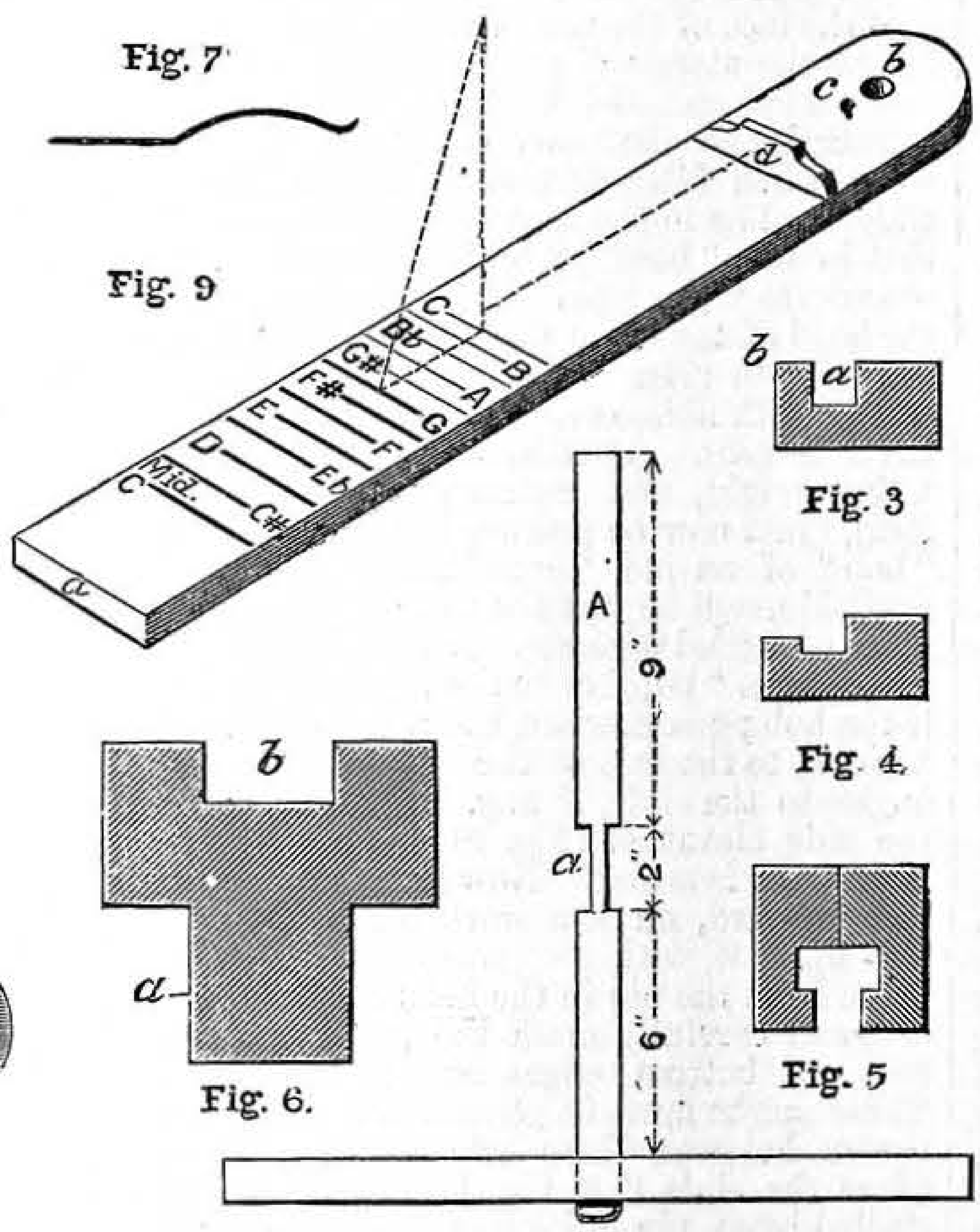


Fig. 7 Fig. 9 Fig. 3 Fig. 4 Fig. 5 Fig. 6. Fig. 8

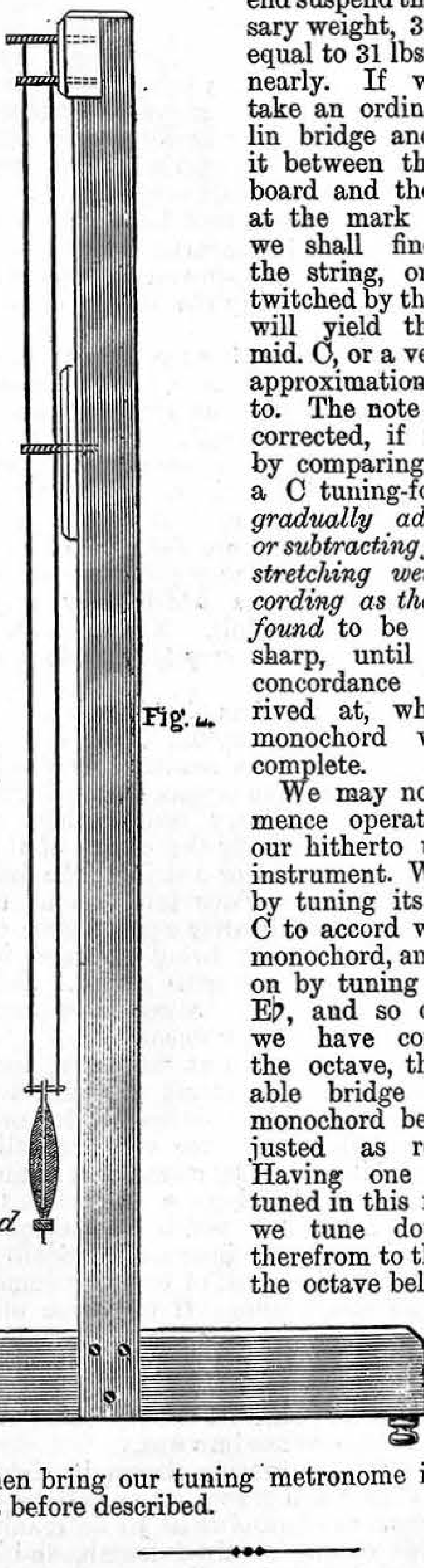


Fig. 2

Fig. 1.—Front Elevation of Metronome. Fig. 2.—Side Elevation. Figs. 3, 4, 5.—Sections showing Formation of Standard. Fig. 6.—Section of Regulating Slide (full size). Fig. 7.—Spring for Regulating Slide. Fig. 8.—Plan of Tripod Support for Standard. Fig. 9.—Baseboard of Monochord, showing Fixed Bridge (*d*) and Scale Divisions.

HOW TO MAKE A DOOR.

BY E. D.

THIS short paper is to be taken as a practical reply to a question too long for "Shop," embracing the making of a door, put by COWL (*Belport*).

Figs. 1, 2, and 3 show the front elevation, vertical and horizontal sections, of a four-panelled door. The horizontal bars are called the top, middle, and bottom rails respectively; the vertical pieces the stiles (hanging and lock); the centre-pieces the muntings, or mullions; the panels top and bottom, as the case may be.

Fig. 4 shows the various pieces, with their names, showing how the door appears when it is all ready to go together. The mouldings are left out, for the sake of clearness.

Fig. 5 shows the door partly put together, with the panels omitted.

The method of procedure is as follows:—

First cut off and joint your panels to the width required (that is, if they are more than 11 in. wide, for up to this width you can buy stuff without any very great extra expense, but after 11 in. wide stuff gets very expensive). The joint in panels should

The pieces are now ready for setting out. The way to do this is to first put your two stiles together, face to face, with the tried-up marks inside and upwards; square across both edges about 2 in. up from the bottom, the width of your bottom rail; now from the bottom of the bottom rail measure off the height of your door, and square off the width of your top rail, working downwards. Find the centre of the height of door, and 1 in. above the centre square across the top of the middle rail and the width, working downwards. The inside of the top and bottom rails, and both sides of the middle rail, having to be ploughed for the panels, ½ in. deep, it is quite evident that the tenons

as long as the plough groove is deep. This is termed the haunching. Now allow ½ in. above and below all the marks you have made for your mortises for the wedges, turn your two stiles down, still keeping them together, and square the mortises round to the opposite edges. The marks for the wedges are generally only put on the outside edges of the stiles, as they are not necessary on the inside edges—in fact, are apt to be very confusing.

Now lay your mullions on the stiles, and square them round to the distances between the top and middle and middle and bottom rails: not between the tenons, mind. This will give the cutting line for the shoulders. Now

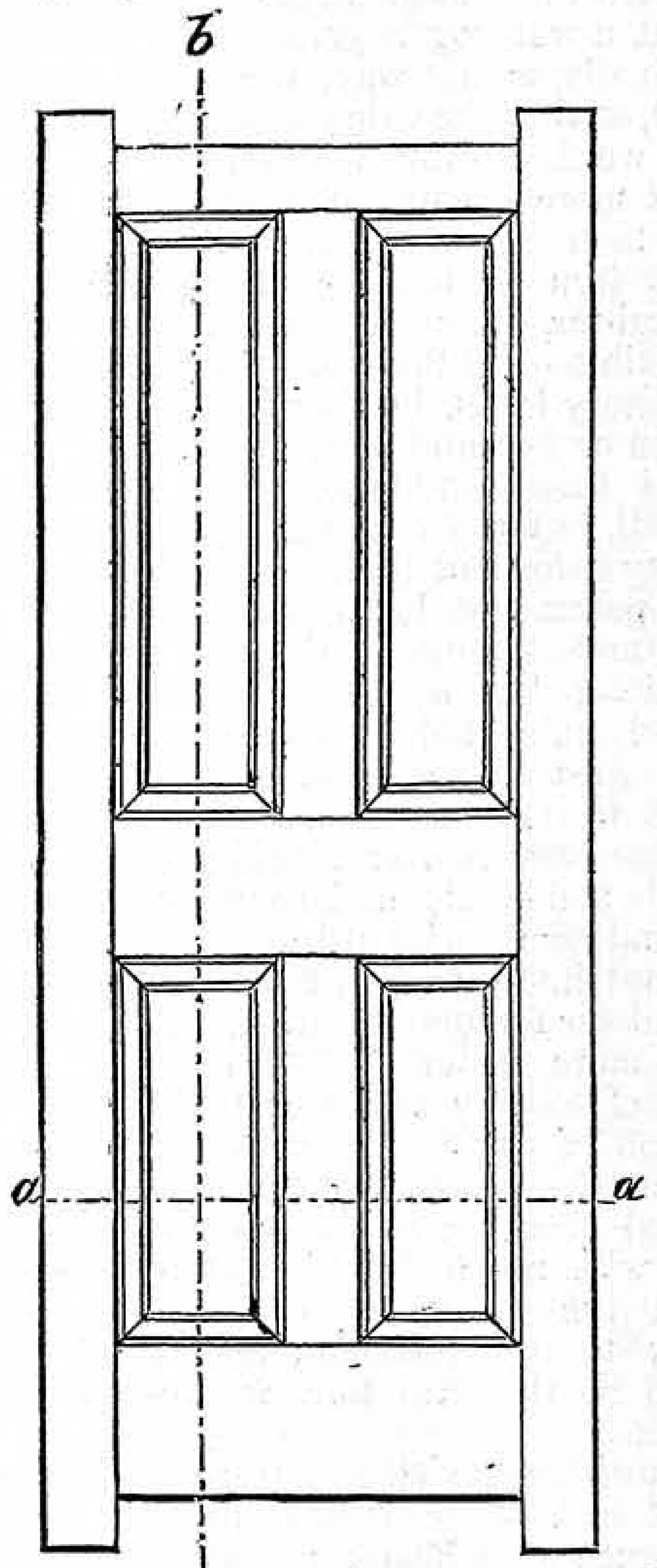


Fig. 1.

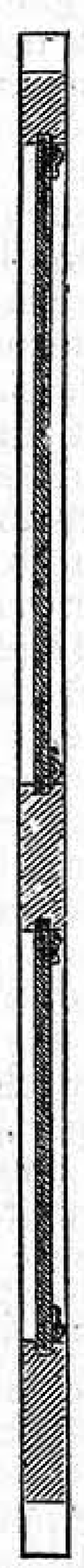


Fig. 2.

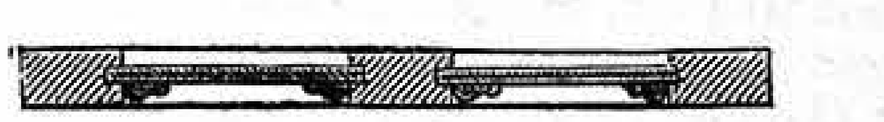


Fig. 3.

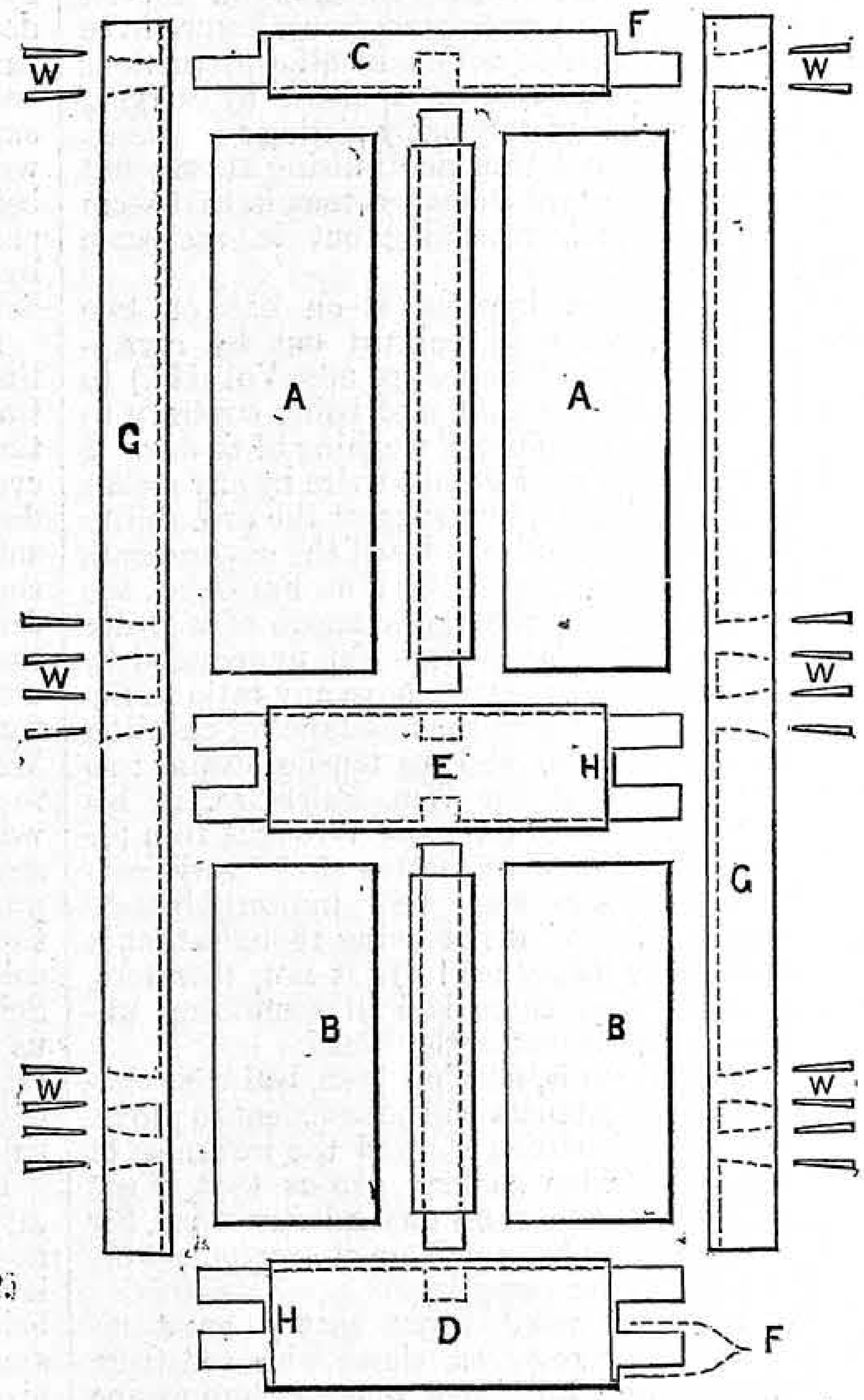


Fig. 4.

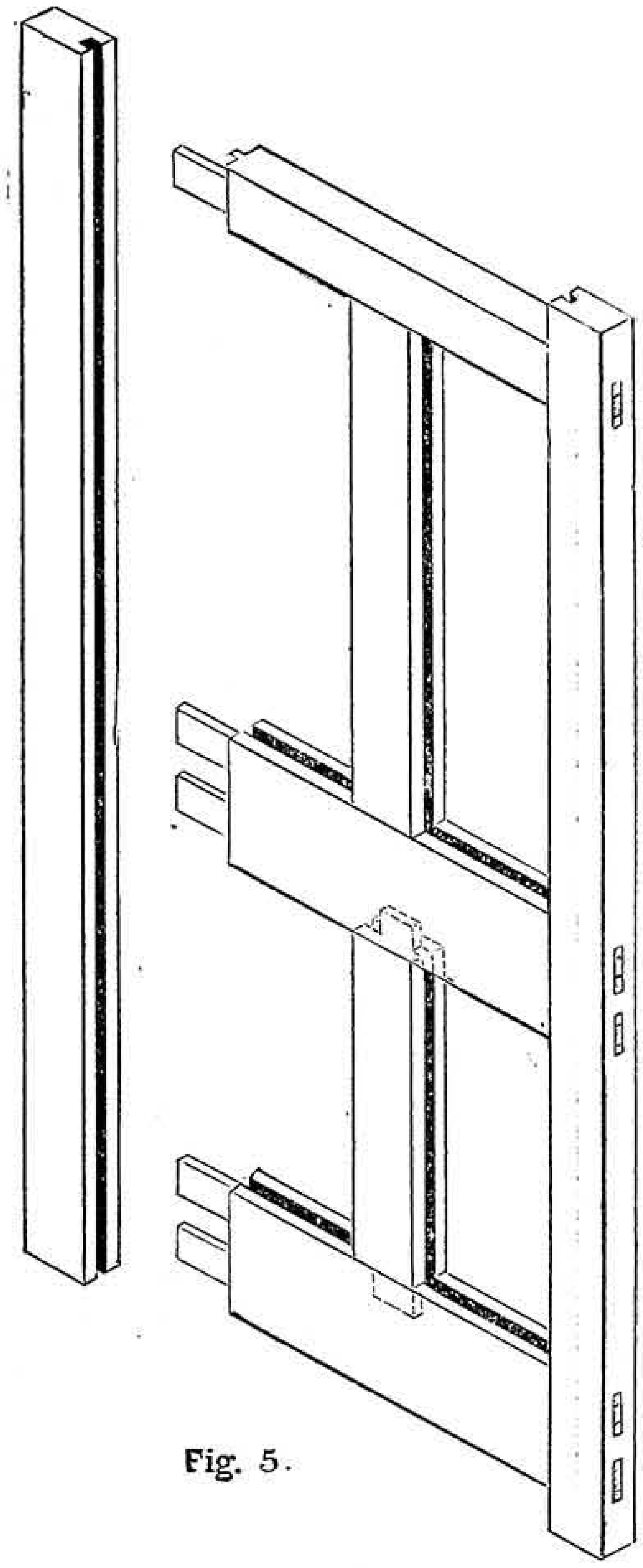


Fig. 5.

Fig. 1.—Four-Panelled Door: Front Elevation. Fig. 2.—Ditto: Vertical Section. Fig. 3.—Horizontal Section. Fig. 4.—Various Pieces of Door, except the Mouldings—A, A, Top Panels; B, B, Bottom Panels; C, Top Rail; D, Bottom Rail; E, Middle Rail; G, G, Stiles; H, Shoulder; W, Wedge. Fig. 5.—Door partly put together, with Panels omitted.

be what is known as tongued and grooved. Now rip out the stuff for the stiles. These are generally what is termed 4½ in. wide—that is, a 9 in. board cut down the centre. The top rail should be the same width as the stiles; the middle and bottom rails should be 9 in. wide. The stiles and rails must now be planed very straight, and out of winding on one face, and one edge shot perfectly straight and square with this face. If possible, try and arrange that this tried-up edge works with the grain, so that when you plough for the panels you do not have to work against the grain. Put a tried-up mark on the planed face and edge. (See p. 696, Vol. I.) Next gauge your various pieces to as wide a width as the stuff will hold up, and thin or gauge to a general thickness.

on those edges of the rails will be ploughed out, so set up and down, as the case may be, ½ in. on the edge of stiles—this will give you the inside edges of the mortises. Next set down, 1½ in. from the top of top rail, and 1½ in. up from the bottom of the bottom rail, and this will give the width of all your tenons; but as the bottom and middle rails are so wide that to make a mortise as wide would greatly diminish the strength of the stiles, there is generally two tenons, formed as shown. (See Fig. 4.) In good work there are always four tenons on the end of the middle rail that take the lock, so that the lock passes between the tenons, and does not weaken the door so much. A piece is left between the tenons of the middle and bottom rails and above the tenon of the top rail, and below the tenon of the bottom rail,

take your rails: lay the bottom one on the bench face upwards, on top of this the middle rail face upwards, and then the top rail face downwards, keeping the tried-up edges towards you. Square down the distance between stiles and the width of mullion in centre, allowing the mortise for the mullions ⅛ in. less on each edge for the plough groove. Take the middle rail out, and square over to the opposite edge for the mortise for the top of bottom mullion; square over the shoulders of the rails of both sides, and then with a mortise gauge, set to the thickness of the panels, which should be just under the third of the thickness of the framing, but of such a thickness that will suit your plough iron and mortise chisel.

Now cut the tenons, make the mortises, and plough for the panels, taking care that all your gauging and ploughing are done from the tried-up or face side. After ploughing the stiles and rails, plough a groove in the same manner across the end-way of a piece of stuff, about 4 in. long, 2 in. wide, and the same thickness as the stiles. This is called a mullet, and is used for gauging the thickness of panels.

The framing should now be knocked together, and see that all the shoulders are up. By doing this, you know that if the shoulders do not come up when you get the panels in, the fault is in the panels, and not the framing. Now having got the door together, you can easily get the exact height and width of your panels, which should be now cut off to the exact size, allowing them a trifle narrower and shorter, so that they do not stop the framing from coming together all right. Plane up one side of the panels, and then try to get the grooved mullet on the edge all round, reducing them until you can do so. You may then be sure that the panels will go into the grooves in your stiles and rails quite right, because a similar groove has been all round them. Knock off the stiles, put in the panels, cramp the door together, to see that everything is as it should be, prepare your wedges, and you are ready for gluing up.

The method of gluing up a door is to lay two pieces across the bench as long as the width of the door. See that they lay out of winding, and are just a little above the bottom rail and below the top rail, so as not to interfere with the cramp. Take the door to pieces, glue the mullions into the rails, taking care that no glue gets into the panel grooves, put in the panels, and knock the stiles on as quickly as possible, but not quite home. Now glue as much of the tenons as is left exposed between the shoulders, and cramp up; drive the wedges of the middle rail first, then the bottom, and lastly the top rail, wedging the bottom rail upwards on to the bottom mullion, and the top rail down on to the top mullion. Now set the door on one side, to allow the glue to dry. When the glue is dry, take the two pieces off the bench, lay the door flat down, and cut a piece of wood thinner than the door, tightly between the horns, above and below the top and bottom rails; nail these pieces to the bench, and they will hold the door firmly whilst you clean it off and put in the mouldings.

In bradding in the mouldings, care should be taken that you do not nail into the panels, but into the framing, for if you fasten the moulding to the panels they cannot shrink (not that they ought to), and so split up the middle, or wherever they are jointed. After this is done the door is completed, with the exception of cutting off the projecting ends of wedges and the horns; but the horns are generally left on to protect the rails, etc., until the door is fitted into its place.

In giving this description of making a door, I have assumed that you are conversant with the method of making the mortises, cutting tenons, and planing up stuff, or you would never attempt to make a thing that could be bought for the same money as you could buy the materials, if bought in small quantities, allowing for waste, etc. But if you only want to make it for the pleasure of doing so, I should advise you to first thoroughly digest the above, and then buy an old door for about a shilling; cut it right across the lines marked *a a* and *b b* in Fig. 1, and this will give you a practical demonstration of the horizontal and vertical sections.

CONSTRUCTIVE STRENGTH IN METAL WORK.

BY J. WHITFIELD HARLAND.

HYPOTHESES CHALLENGED—SIR WM. FAIRBAIRN AND HODGKINSON—TAY BRIDGE—SIR JOHN FOWLER'S CONDEMNATION OF RAILWAY BRIDGES—NEUTRAL AXIS NOT ALWAYS, IF EVER, CENTRAL—SUGGESTED EXPERIMENTS—WROUGHT IRON PREFERABLE TO CAST—USE OF STEEL TO SUPERSEDE THAT OF WROUGHT IRON—REITERATED TRANSITORY LOADS—CONTRACTION AND EXPANSION—BOX-GIRDERS: THEIR COMPARATIVE STRENGTH—DISHING OR CORRUGATING PLATES—DOUBLE BOX-GIRDER BRIDGE—DRILLING RIVET HOLES PREFERABLE TO PUNCHING—TANKS: THEIR SHAPE, CAPACITY, WEIGHT OF CONTENTS—STAYS—CROSS-STAYS—BEARERS FOR—CONCLUSION.

I HAVE endeavoured to show in former papers how to counteract forces known to be in imperceptible action in all constructions tending to destroy them, either by carrying them off harmlessly or by pitting one against the other, and thus neutralising them; but a few important items yet remain that seem to me worth reasoning out in the same connection.

My former hypotheses on one or two points have been pointed out by correspondents (see "Shop," p. 363, Vol. III.) to be open to the charge of being contrary to the leading engineers' teaching of to-day. I would say that I do not write by any means as an authority, but suggest the probability of error in practice. Until the experiments of Hodgkinson and Sir Wm. Fairbairn, the proportions of the upper flange of a girder to the lower flange were not understood *by the then authorities* to have any ratio to the difference between the resistance of cast iron to compressive and to tensile strains; so much so that Sir Wm. Fairbairn, in his "Application of Cast and Wrought Iron for Building Purposes," states that "very commonly girders were laid indiscriminately either side up," it not being thought that it made any difference! Is it not, therefore, possible that there is still something unknown to present authorities?

That there is, and has been, bad construction, two instances will be sufficient to prove. Sir Wm. Fairbairn showed the weakness of the Tay Bridge so long ago as 1864, if not earlier; and now, on one railway alone, Sir John Fowler has condemned *nearly half the bridges* as dangerous.

I further pointed out that a great responsibility rests on those who construct bridges and buildings, where failure means often a sacrifice of life and limb, and I consider it is their duty to find out by actual experiment the value of any suggestion thrown out. I repeat that I think the centre of the web is the most fatal position for holes (by centre, I mean equidistant between upper and lower flanges).

One correspondent quotes Sir John Anderson: "Holes may be made with impunity in the neutral line." I have not referred to the book to see whether this is in reference to *cast* girders, but supposing that it is so, still this does not absolutely contradict my theory, although it appears to do so, because the neutral axis is not always—if it ever is—equidistant between the flanges. Is it not probable that holes *alter* the neutral axis? I will not here repeat my reasons, already given, for holding this opinion, but suggest that model cast-iron girders (for I limited the remarks solely to cast girders) on a small scale, all off one pattern, could easily be made and subjected to pressure till broken, after the holes had been made in different positions in each; the breaking weight in each case would show the value. In like manner, holes in the upper flange of same diameter, in similar positions relatively to the length between supports, being made, such diameter to be, say, equal to thickness of the web, and the breaking weights being ascertained, would give the value for comparison. It is, of course, quite possible that these experiments have already been made; but if so, I have not seen the results. It is true that in modern times the tendency is to substitute wrought iron for cast, because, strength for strength, the former is both lighter and more economical in the long run, and because its elasticity and flexibility are nine or ten times as great, and also from the fact that a warning is given of its fracture by gradually giving way, which the latter does not, so that the value of the above experiments would be much dwarfed. As steel becomes more cheaply obtainable, we may expect that it, in turn, will supersede wrought iron in building construction, it being lighter, strength for strength, still more flexible—and therefore, after deflection by transitory loads, leaving less permanent deflection or *set*—and more fibrous.

It has been established that not only time itself, but the constant application of transitory loads and their removal, in addition to permanent loads, upon all girders, ever reiterated, must in the end result in destruction; but so far it has not been sufficiently subjected to research and experiment. Just as we know that "constant dripping wears away stone," so we know that trains passing over a bridge time after time will ultimately undermine its constitution, and result in its ultimate destruction. We do not know, as yet, the true antidote to administer for deterioration. Therefore, we use more material and increase the strength of construction to a probably safe proportion of three, four, or even six times the greatest possible strain before the calculated breaking strain can be reached. Science will, no doubt, ultimately furnish us with the means of overcoming this tendency to deterioration; at present we ought to be thankful that we know of its existence.

I must disagree with a correspondent who says that in bridges of 40 ft. to 50 ft. span no allowance for expansion and contraction is made—which may be the case—as to its being unnecessary. If the expansion only amounted to ½ in., something would have to give way. However slight the extent might be, still the strain would be there; and in the event of the bridge having been deflected permanently, there would be a tendency to increase still more such deflection. I think I remember being told whilst walking over the top of one of the tubes of the Menai Tubular Bridge that its expansion, in all, had in some cases exceeded 1 ft. in its length. Every schoolboy knows that this was foreseen and provided for.

In my former papers I omitted to mention the so-called box-girder, which consists of the longest possible strips of wrought-iron plate riveted to angle-iron at their edges, to form a square, or, rather, oblong tube, instead of a central web and two flanges. The box-girder has, therefore, two webs, one at each edge of the flanges. Sir Wm. Fairbairn gives the proportionate strength, other things being equal, of the box-girder at 100, the plate-girder (one web) at 93, and the trellis-girder (not the lattice-girder) at 84. It has, however, one drawback—viz., that its interior cannot be re-painted from time to time; but this might be remedied by the plates being made rustless by the Bower-Barff process at but slight expense, when neither inside nor outside would require painting at all. Certainly, the tendency to buckle must be less in them than in other (single-web) girders. The longer the strips the fewer joints across there would need to be: hence, if possible, the whole of the girder should consist of but one long strip from end to end for each side, for top and for bottom; and if joints are required, the plates should lap over sufficiently for eight or ten rivets in line (chain-riveting, as it is termed), lengthwise.

Of course, a box-girder should be laid, not on its side or widest dimension, but on its narrowest; the deeper it is, within certain limits, the stronger it will be. I am inclined to think that it would be strengthened yet more by fixing inside it crosswise plates fitting its hollow at intervals, and still more by dishing or corrugating the long strips of which its sides are constructed, which would stiffen it still more. This would also tend to take out of the plate the inherent buckle that seems to occur in almost all rolled plates: due, no doubt, to unequal contraction in cooling. The top and bottom might also be corrugated, but lengthwise—not as in the case of the sides, across or merely bellied out to form a slight arch. Whether the extra cost of thus adding to strength and stiffness would or would not discount its advantages is another matter.

For a bridge, it occurs to me that with two girders of the box type, the upper one straight and the lower one arched to a segment of a circle, and so fixed that it should abut on springers at the pier, and, rising, meet the underside, and support at the centre the straight upper girder, good construction would result, and the spandrels thus left might be strutted with radial diagonals or otherwise, or might even be filled up with dished or corrugated plates riveted to angle-iron first riveted to the centre of underside of top and upper side of lower girders. In all riveting operations I should prefer drilled holes to punched ones, firstly, because there is less disturbance of the iron fibres, just as a clean cut is better than a bad bruise; and secondly, because it is easier to set them exactly opposite the corresponding holes in the angle-iron or the other plate, and thus greater accuracy is secured: and as many holes can be drilled simultaneously, the cost of the work can hardly be greater.

In conclusion, I should like to put in a word or two about cisterns and tanks: not that they demand any great amount of science in construction, but because they are, for that very reason, more likely to be attempted by amateurs; and some remarks on them may be appreciated by WORK readers.

Tanks made of galvanised iron, as it is termed, are not really made of this material, but of ordinary iron riveted to angle-iron at the corners and round the open top, and when finished are "galvanised" by being dipped whilst hot in melted zinc—a process which most makers, and, therefore, all amateurs should, delegate to those who make this their business.

The shape of the tank must often be governed by the space at one's disposal: it may be square cubically, or long, narrow, and deep, or long, broad, and shallow, etc., and still hold the same quantity of water. To find its capacity in gallons, multiply its length and breadth together, and then this by its depth, and the total in cubic feet by 6¼. Thus, a tank 3 ft. long × 2 ft. wide = 6 square ft. × 1 ft. deep = 6 cubic ft × 6¼ (gallons in a cubic foot) = 37½ gallons. To ascertain weight of water, multiply number of cubic feet by 1,000 (ounces in a cube foot) and bring it to lbs.; thus, in this case, $\frac{6000}{16}$ oz. = 375 lbs. when full.

In cisterns or tanks of greater length than 4 ft., unless of very thick plate, a stay should be riveted across to prevent the sides bulging out; when they are also more than 3 ft. deep, another stay, halfway up, should be riveted across, and if the width be over 4 ft., a cross-stay will be necessary; two if it be also deep. Its total weight plus weight of water when full should be ascertained, so as to guard against the bearers on which it rests being too weak to carry it. As it is not a permanent load, but varies as it empties and fills, the bearers ought to be able to bear at least four times its maximum weight.

Such tanks are far preferable to wooden ones lined with sheet zinc, are far less liable to deteriorate, and could readily be made by an amateur, especially if he had a good drilling machine. Do not use copper rivets, but red-hot iron ones; otherwise, should any portion of the galvanising be imperfect, magnetic action would be set up between the copper and the zinc, and the tank would soon leak in consequence. This concludes the *causerie*—for it cannot be called much more—on Constructive Strength in Metal Work, which subject is far too vast for more than mere passing notice of a most superficial character, intended only to show what to expect and what to investigate, and what experiments to try before any important construction is attempted.

SUB-STAGE AND POLARISCOPE FOR MICROSCOPE.

BY H. B. STOCKS.

SUB-STAGE—UTILITY OF POLARISCOPE—METHOD OF MAKING SUB-STAGE—STANDARD SIZE OF SUB-STAGE—METHOD OF MAKING POLARISCOPE—FITTING OF POLARISCOPE PROPER — OF ANALYSER — PRISMS USED — METHOD OF FIXING SUB-STAGE TO MICROSCOPE—CENTRE-ING.

To those readers of WORK who have a microscope, the adjunct which I am about to describe will no doubt be valuable, as it consists not only of a polariscope, but also of a sub-stage into which many other accessories may be fitted in place of the polariscope, and also when using the apparatus they may be thrown in or out without disconnecting them, which has usually to be done.

The polariscope is a useful adjunct to the microscope for the examination of starches, and also rock and mineral sections, and the price is about £1 4s. for polariser and analyser. As I had a microscope without a polariscope, it occurred to me that one might be made for much less than that sum, and the following is a description of how I made it. Those who have a lathe will find no difficulty in the making, but as I had no lathe I had to get the turning done for me.

Fig. 1 shows a general view of microscope with polariscope fitted, and Fig. 2 underside of stage, showing the two positions of sub-stage. The fitting consists of four portions: (1) The sub-stage; (2) the fitting for polariscope; (3) the polariscope; and (4) the analyser.

(1) The sub-stage consists of a casting of a ring, having a projecting portion upon it of about ⅛ in. thick. The ring, when turned, is ¾ in. deep, and must be perfectly true on the face, and turned inside to such a size that a ring 1½ in. external diameter will slide within it, but will not slip out: what may be called a full 1½ in.; the outside of the ring may be turned down to about $\frac{1}{24}$ in. thick to reduce the weight, leaving the upper portion, the width of the projecting piece, a little thicker. The projecting portion is for fixing to underside of stage of microscope, and will require filing into shape (Figs. 2 and 3).

The sub-stage, being of the standard size, will take any other fitting made of the standard size—*i.e.*, 1½ in., which is the usual one.

(2) Fitting for polariscope.—A piece of tubing is now required 1½ in. external diameter and ¾ in. wide; this can be bought. If it is a trifle over 1½ in., turn it down to the proper size. Now cut out a circle of

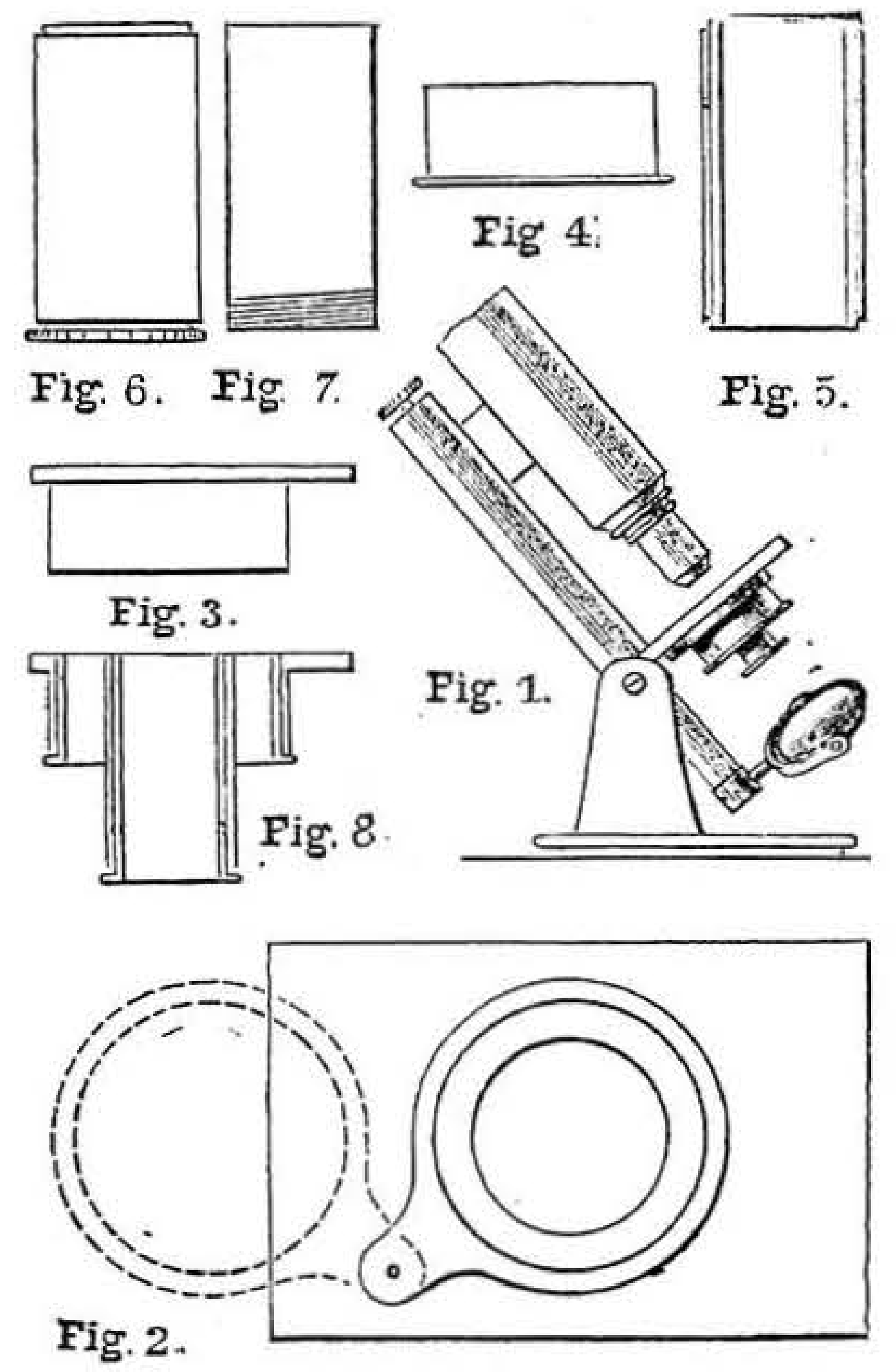


Fig. 1.—Microscope with Polariscope fitted. Fig. 2.—Underside of Stage, showing Two Positions of Sub-stage. Fig. 3.—Sub-stage. Fig. 4.—Ring and Circular Plate. Fig. 5.—Tubes of Polariscope. Fig. 6.—Polariscope Tube finished. Fig. 7.—Analyser. Fig. 8.—Polariscope and Ring combined.

sheet brass 1¾ in. diameter, and exactly in the centre bore a hole ¾ in. in diameter; this will require enlarging slightly to take polariscope. Braze or solder the circle to the ring (Fig. 4).

(3) The polariscope consists of two pieces of tubing, one of which will slide easily within the other; the inner tube is ¾ in. external diameter and 1¼ in. long., and as it will be found difficult to get a tube to fit over this, a piece of tubing may be taken ⅞ in. external diameter and 1 in. long. Cut it open lengthways by means of a fret saw, file a little off each face of slit, and solder or braze together again. It will now be a trifle too small; the smaller tube may be turned down outside until they fit (Fig. 5).

Another portion of the larger tube may be treated in the same way and cut into two rings, each ⅛ in. wide. Braze or solder one of them on to one end of small tube; on the other ring, inside, get a thread turned, and a corresponding male thread on the other end of small tube. Now cut out a circle in sheet brass 1 in. diameter, and in the centre drill a hole $\frac{5}{8}$ in. diameter; solder or braze this circle on to the ring with thread cut upon it, and it will then form a kind of cap, screwing on to the smaller tube. Place the larger tube on to the smaller one, and then screw on the cap. When screwed up tight it should allow the outer tube to move round easily; a drop of oil will help it to do this.

The polariscope tube is now finished (Fig. 6). Solder or braze it into the hole which you have made for it in the $1\frac{1}{2}$ in. ring, having the top of the polariscope flush with the top of the ring, and the screw cap outside (Fig. 8).

(4) The analyser.—Fig. 7 is a plain piece of tube similar to the smaller tube of polariser, with a thread cut on one end to fit thread which is usually cut inside of objective, and it is screwed into the objective before screwing it on to the tube of the microscope, and of course goes inside the tube. If there is no thread inside the objective, then some other method of fixing must be devised; even placing on top of objective will do.

The two prisms of Iceland spar had better be bought; I do not advise anyone to try to cut and polish and cement them, as it is a difficult thing to do. Send inside diameter of small tube of polariscope to any microscope maker, and I have no doubt he will supply them. They are fixed in the tubes by cutting a cork in two, cutting out the centre of the shape of the prism, and putting the whole thing, cork and prism, into the tube, taking care that the prism is exactly in the centre of the tube; if a thin glass circle is cemented on to each end of the corks, it will prevent dust and moisture getting to the prisms.

The difficulty now will be the fixing of the sub-stage to the stage of the microscope. Drill a small hole in projecting portion of sub-stage for screw to pass through; glue to the upper face of the sub-stage a sheet of paper, and make a small hole directly in the centre of the ring (this can be done with compasses). Fasten the sub-stage to the underside of stage by means of clamps somewhere about the right position, and having a moderately strong objective, look for the pinhole in the paper, move sub-stage until it comes into view, and bring it directly in the centre of the field; you will be surprised to see the pinhole, as it will look more like the crater of a volcano than a pinhole. But, however, proceed. Having got the pinhole right in the centre of the field, with a steel point placed in the hole in projecting portion of sub-stage, make a mark on the stage, and bore your hole there, not quite through; tap it (small taps are sold at 6d. and screws at 6d. per dozen, very suitable for this kind of work), and having filed the screw to the proper length, screw on the sub-stage. Also fix a peg for it to rest against when in proper position (Fig. 2).

It is important that the sub-stage be properly centred, otherwise on revolving the polariscope the field of view does not appear properly dark and light, which is essential for good work.

For the properties of polarised light see WORK, page 389, September 7, 1890; and the lacquering has already been described in "Shop," so there is no necessity for me to say any more on this part of my subject here. To save readers the trouble of asking where the instructions have been given, let me suggest a search in the index to each volume, which every amateur workman and reader of WORK should possess and use.

SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

SETTING OUT, INVOLVING THE USE OF THE SQUARE AND GAUGES.

WE have dealt with the plane and saw, only using the square to test the accuracy of our planing, or to make guide lines for sawing. This naturally leads on to "setting out," in which judgment is required. First, as to the joinings required. In order to make, say, a table top, the use of the plane is required, as has been described. There are several lessons on the subject in Vol. I., to which reference should be made. Such joints are to add to the width of wood, or to allow it to be made into articles for which one width of stuff is not sufficient. Then there are a multitude of joinings to unite pieces at right angles to each other; of these, the dovetail and the mortise and tenon are, perhaps, the most important, though other joints are of constant occurrence. When two pieces, say, 6 in. wide and $1\frac{1}{2}$ in. thick, are to be joined at right angles, if the joint is in the width, or the 6 in. of each united, then dovetails are usually suitable; if the edges, or the $1\frac{1}{2}$ in. surfaces, are to be joined at right angles, the mortise and tenon will be, no doubt, more eligible, but much depends on the direction of the grain, as tenons are only suitable when at the end of a rail, and mortises are only available when chisel cuts at right angles to fibre of wood.

If mortise and tenon are chosen, appearance and custom suggest that the mortises should be cut in the vertical pieces, or stiles, as they are usually called; this implies a vertical joint, and that the vertical portion of the frame is continued to the base. An illustration may be found in doors and shutters. If the wood is joined like the sides of a box, probably dovetails will be more suitable.

In either case the use of the square and gauge must be acquired. We will first look at the tenon. This is formed by cutting away part of the wood at each side. Generally, but not always, the surfaces of the tenon are parallel with the surface of the wood; a gauge is therefore a proper instrument to mark the lines to guide the sawing of the tenon. As the tenon is of uniform thickness, a gauge with double teeth may be used; this is called a mortise gauge. The mortise gauge is set so that the distance between the two points is equal to width of chisel used to make the mortise.

The mortise also is usually parallel with the surface of the work, so this gauge, which might with equal truth be called a tenon gauge, is applicable to both purposes.

The proportions of mortise to the work are not very definitely fixed, but custom has fixed the width of the mortise at about one-third of the thickness of ordinary work, or a trifle more, rather than less. As suitable chisels are made for mortising to every $\frac{1}{16}$ in., between useful limits, we can easily find one suitable for any purpose or thickness of wood. The width of the tenon is generally about two-thirds of the width of rail, but in some cases, internal rails for instance, they are often the full width of the wood. Tenons that are too wide, however, are apt to become loose through shrinking. In wide rails, therefore, two or more narrow tenons are preferable to one wide one.

In order to ensure correctness and good work, the rule, square, and gauge cannot be used too much.

STAGE CARPENTRY.

BY WILLIAM CORBOULD.

PRACTICAL DOORS AND WINDOWS—MODE OF MAKING DOORS AND WINDOWS—SPRINGS, DOGS, ETC.—VAMPIRES—HINGES FOR VAMPIRES.

Practical Doors and Windows.—In scene painting, doors and windows are, of course, frequently painted, but it is of those which are used in a practical manner that I wish to treat here. These are generally made in cottage set pieces or in flats. I must here explain. A cottage set piece is usually set from one of the wings, as shown in Fig. 14. Flats, on the contrary, are two built pieces sent on from each side of the stage, meeting in the middle, and buttoned or hooked together, forming one flat surface, similar to a cloth when rolled down. At the same time a flat may be drawn up where there is room to do so, but then it would be made in one instead of two parts. We will suppose that a cottage is either on the right or left side of the stage, usually called the P. and O. P. sides—that is, "prompt" side and "opposite prompt."

Mode of Making Doors and Windows.—The door or window of a cottage is made with the same framework as the set piece, covered with canvas the same. When making it leave a good $\frac{1}{8}$ in. all round, so that it may work easily. Use back-flap hinges: those about $1\frac{1}{2}$ in. or 2 in. will be found to be strong enough. There should be an india-rubber spring on the front of the door at the top corner, so as to ensure its closing after passing through, as there may be scenery on the other side, or inside of the cottage, which would not be appropriate if the door should not close. The cottage might be standing in front of a foliage or rock scene, instead of showing the inside of a cottage. Therefore, as soon as the person has passed through the door should close. By the same rule windows should do the same.

Springs, Dogs, etc.—In Fig. 14, D is the wing, C the cottage, B the sky border. The spring is seen fixed at A. These springs are bought at about 7d. each. They are shown in Fig. 15. A shows the spring; the rubber is bound round two brass eyelet holes; one end is fixed on the doorpost with the screw, B, the other end is caught by the hook, C, fixed on to the door, as at D. Cottages or set pieces are usually held in their place firmly by the use of dogs. There are several ways of making these; the most simple one is dog No. 1, which is shown in Fig. 16. Dog No. 2 has a twisted half screw at one end, and the dog, when being fixed, is held on one side, the twist being put into the eye and the other end brought down to the stage and fixed with a stage screw, B. Dog No. 3 would be fixed with two small stage screws or screw-eyes, one to the set piece and the other to the stage. Sometimes a staple or screw-eye is put into a wall or post, one in the set piece, which may be held by a dog, as shown in Fig. 17. Another good way of fastening, which I invariably adopt when possible, is to tie with a piece of cord. Have a screw-eye in the set piece with a piece of good cord, such as small sash-cord or Venetian blind cord: keep this on the set piece so that it is always ready when placing it in position. Have another screw-eye in the wing, or whatever the piece may be set against; slip the cord in, and make fast by a good slip-knot. This method of tying is much safer than hooks and eyes, as these often come undone, which should be avoided; all fixings should be made as safe as possible, rendering accidents almost impossible.

Vampires.—We now come to the making

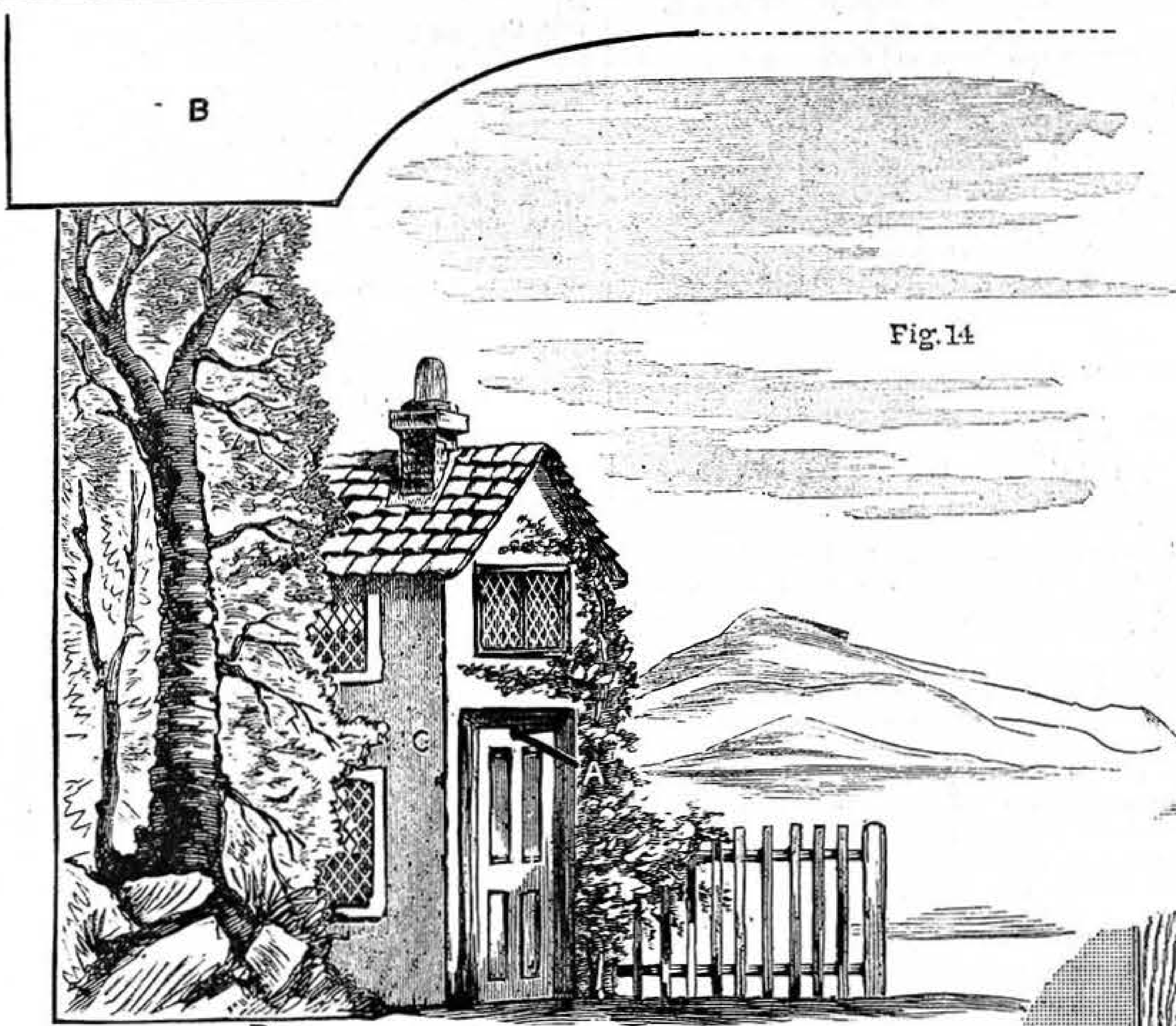


Fig. 14.

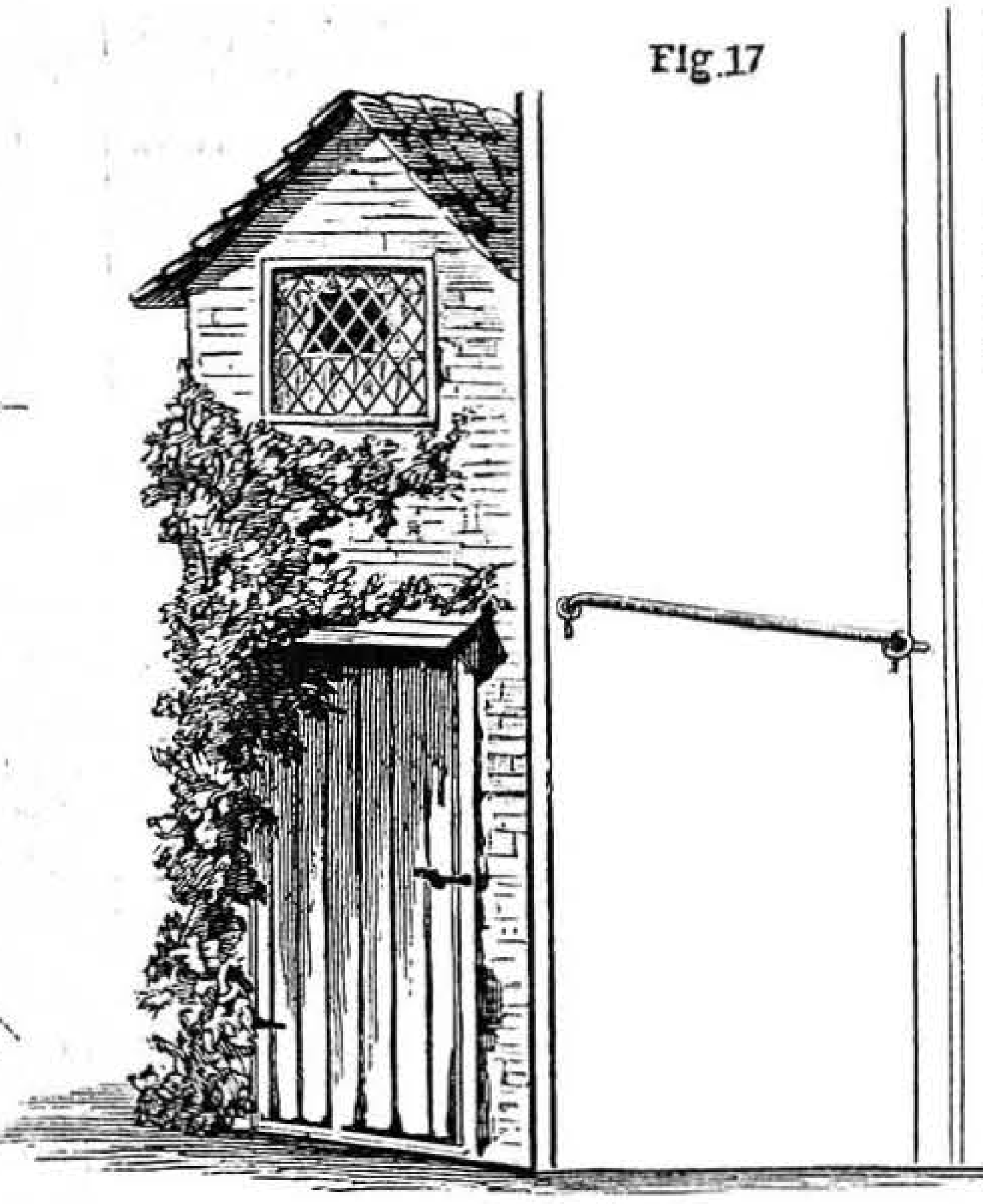


Fig. 17

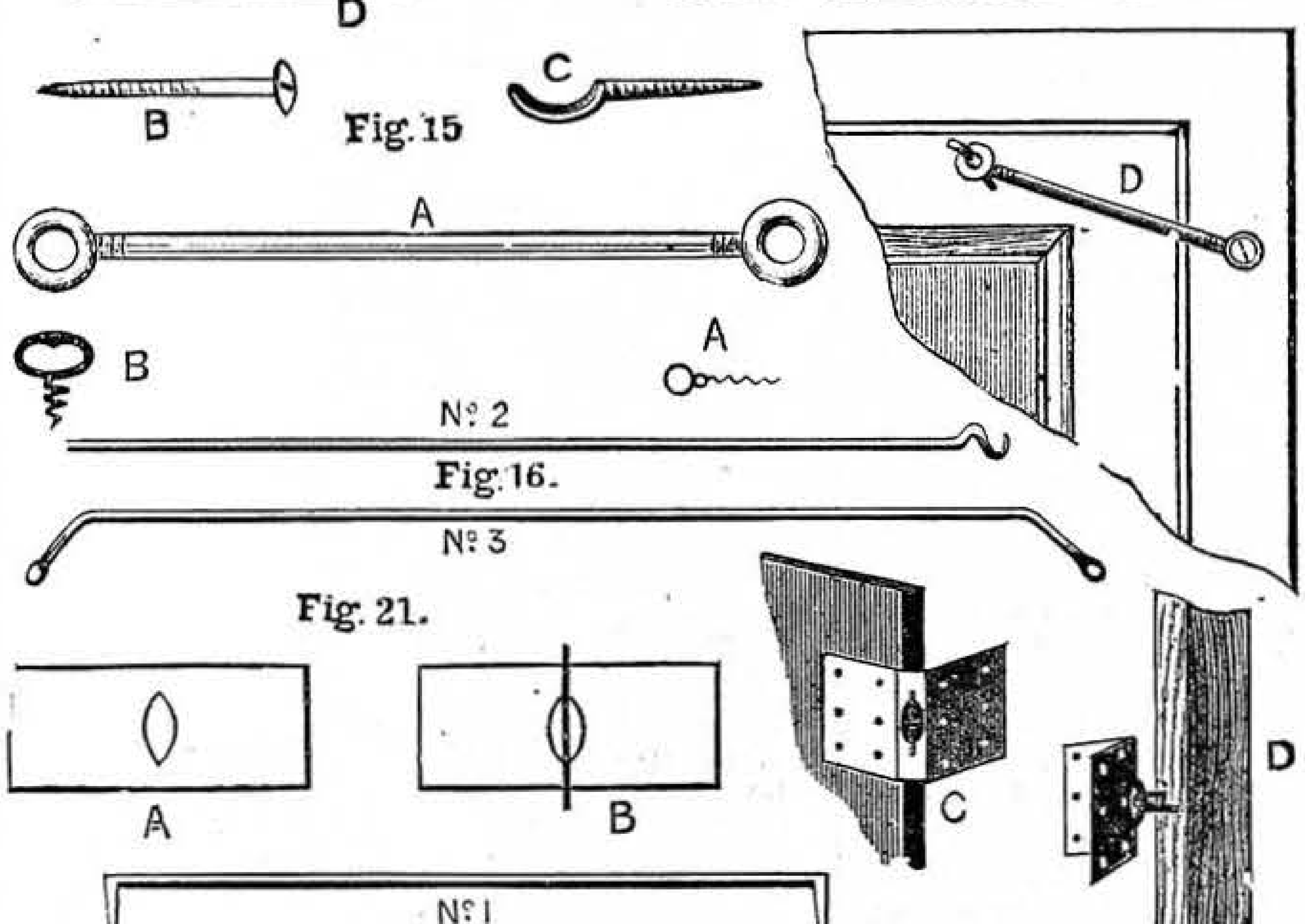


Fig. 15

Fig. 16.

Fig. 21.

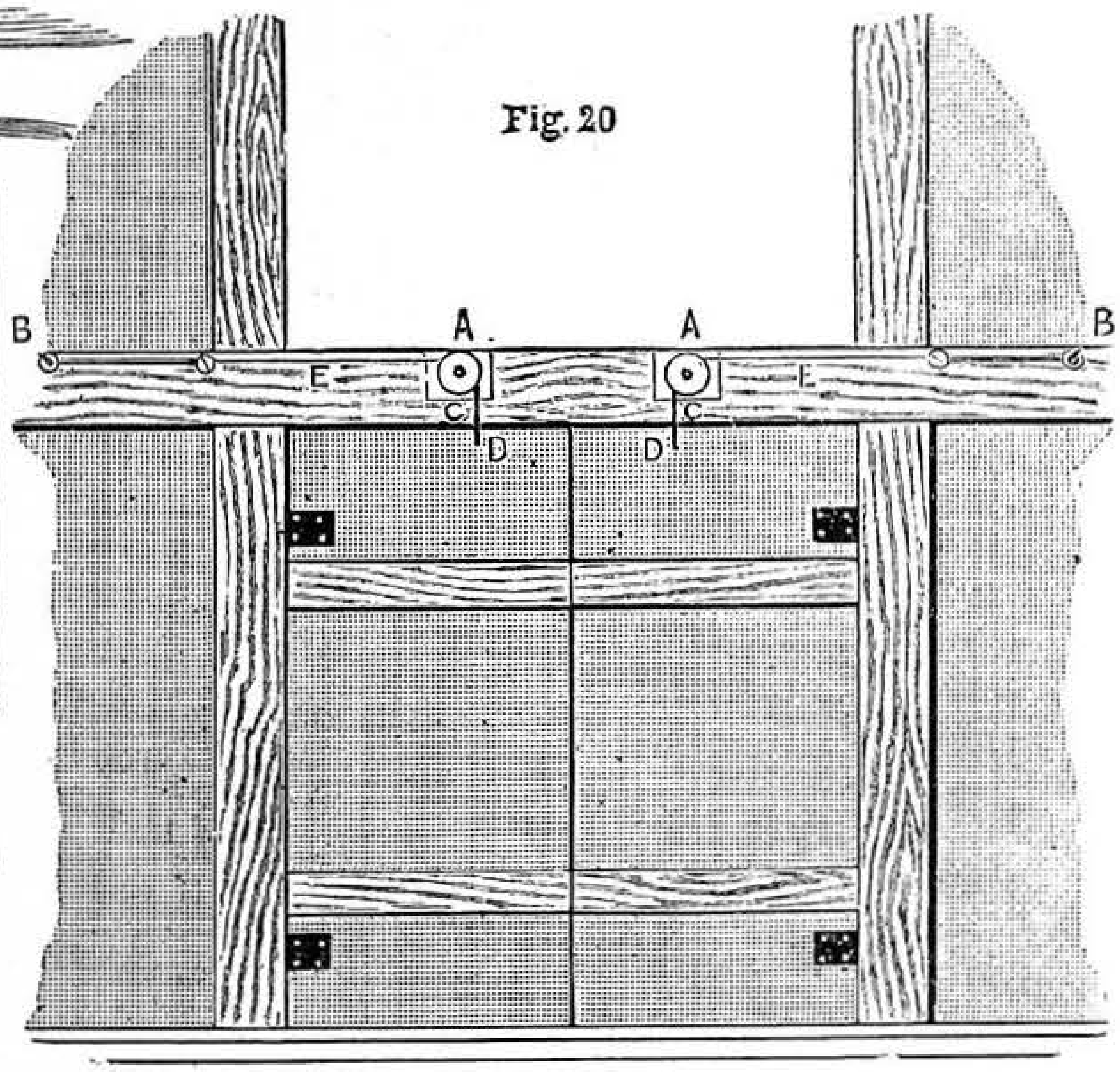


Fig. 20

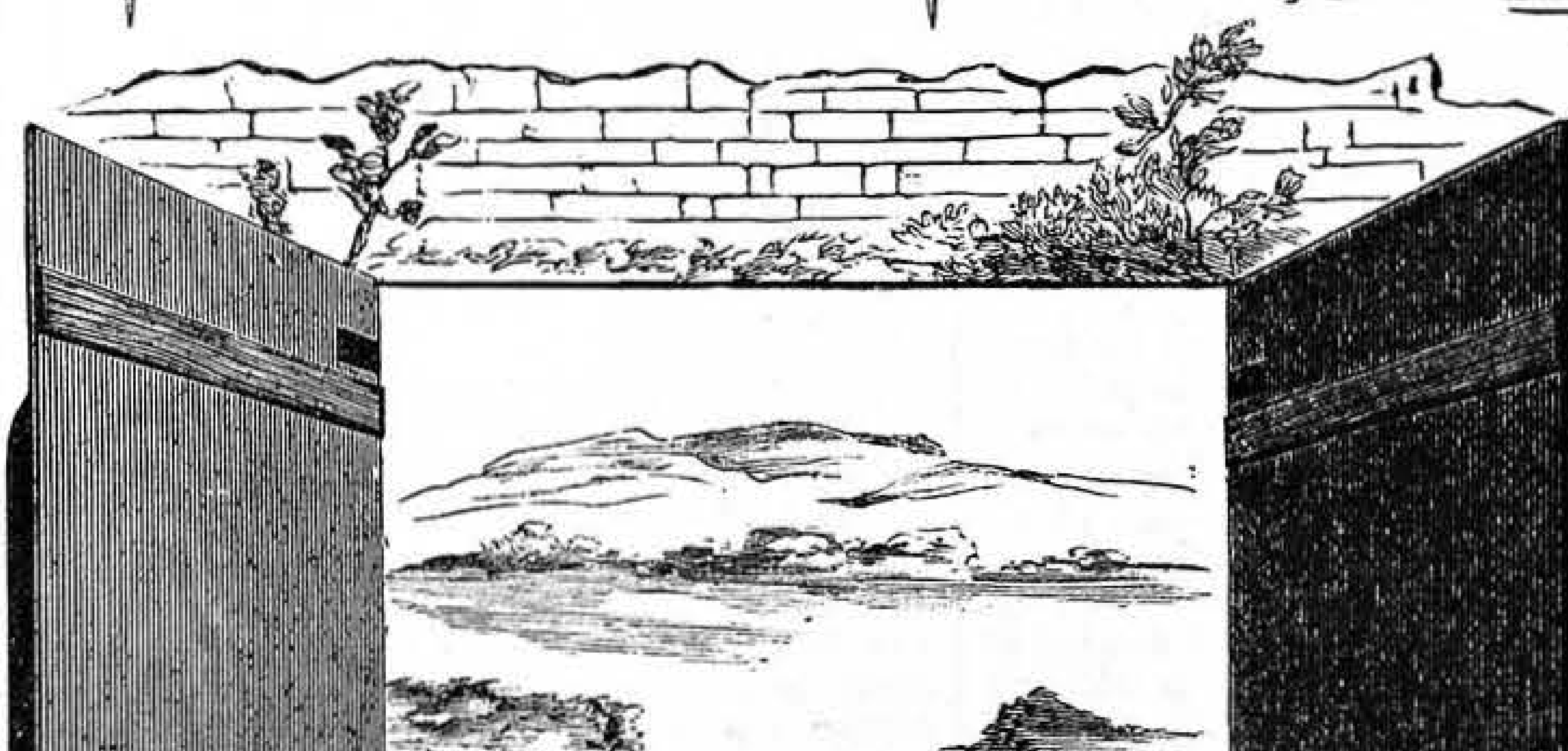


Fig. 19.

Fig. 18.

Fig. 14.—Cottage with Practical Door and Window. Fig. 15.—Springs. Fig. 16.—Dogs. Fig. 17.—Part of Set Scene secured by Dogs. Fig. 18.—Vampire in Garden Wall. Fig. 19.—Vampire Open. Fig. 20.—Back of Vampire. Fig. 21.—Diagram showing how to make Hinges.

of "vampires." They may be doors, windows, or the walls of the house or set piece, such as garden walls, the trunks of trees, rocks—in fact, anything may be made to open or close directly the actor in the scene passes through. For instance, jumping through a window from the stage and rolling back through the brick wall under the window. The "vampire" is usually made with two profile boards, hinged to a frame, each one having a rubber spring, A, as in Fig. 15, fixed on the inside, which closes the vampire so quickly that the audience hardly see the working of it. In Fig. 18 we have a vampire in a garden wall; the square lines and the line down the centre show the vampire closed. In a scene on the stage these lines would not show if painted properly. Fig. 19 shows the vampire open. It must be understood that the doors seldom come back as far as shown in the drawing, the vampire pressing against the individual passing through and closing the moment they are released. In Fig. 20 is shown the back of the vampire: the open part at the top might represent a window, cupboard, pier-glass, clock-face—in fact, it might be anything, as we see in pantomimes, in which the clown will go through and roll out of the vampire, followed by policemen and others in quick succession. I will now explain the way the vampire is made to act. In Fig. 20, A, A, shows two small grooved wheels, such as are used for Venetian blinds. Cut out two mortise holes so that the wheels work in the centre on a pin. Bore a hole through at C so that the trick-line over the wheel passes through it and makes it fast to the two doors at D, D; cut a groove out of the top of the framework at E E, so that the trick-line may lay in it; this keeps the line away from the hands and feet of the party jumping through. The line is attached to the indiarubber springs, B, B. When the jump is higher up than represented at Fig. 20, or when in a wall, as Fig. 18, no groove need be cut out at E E, as the line and spring may be placed higher up.

Hinges for Vampires.—Fig. 21 shows how to make the hinges. Cut a piece of tin about 4 in. long and 2 in. wide, make an oval hole in the middle, as at A, then cut a piece of stout wire a little longer than the plate is wide; solder this to the tin, turn the two ends over and solder them down, as shown in B. Now bend the plate round the edge of the vampire door, as at C; after bending it to the shape of the edge of the door, take a small staple, place the hinge against the frame of the vampire in its proper position, and drive the staple over the wire and through the hole; the hinge will now be ready to receive the door, as at D. The staple should be driven in as far as possible, to admit of the door working close and easy.

It may be objected by some reader of WORK that, although practical doors and windows are and must be used in scenery constructed for amateur theatricals, yet the pieces that are played are not such as involve the introduction of vampires as an absolute necessity. Everyone, however, who urges this objection must kindly bear in mind that these papers are not written in the interest of amateur performers only, but for those who are, or desire to be, professional scene painters; and who, possibly, are, and have been, unable to obtain instruction at first starting. Moreover, in entertainments, and especially in pieces based on fairy tales, a vampire is most desirable for the introduction of all characters who have to come and go with the utmost rapidity.

OUR GUIDE TO GOOD THINGS.

⁂ *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

94.—"THE ART OF GRAINING AND IMITATING WOODS."

IN Vol. III., page 90, of WORK, I noticed at some length Parts I., II., and III. of "The Art of Graining and Imitating Woods," produced by the Decorative Art Journal Company, Manchester, and I dwelt then and there on the nature, aim, scope, and character of the work itself, the beauty of the colour printing, and the wonderful fidelity with which various kinds of wood were portrayed as guides for the inexperienced and unpractised hands in their endeavours to carry out the instructions conveyed in the text, and the comparison of the results obtained with the results that should be produced by means of the specimens of colour printing that are placed in the worker's hands. Part IV., which completes the work, and with which a title page and index to the whole are given, contains fine and striking representations of pollard oak, brown oak, and satin wood; a fine inlaid panel exhibiting a rosewood ground inlaid with tulip, ivory, and boxwood, and enriched with painted decorative work; studies in maple graining showing the progressive work in various stages; studies of mahogany in three stages of the work, and other studies of the same wood when roughed in with the tool; an oak door complete with suggestions at the sides for treatment of dado; and—a study most useful in itself, especially for beginners—examples for grounds of various woods. The entire volume is most valuable, both as a technical work and a work of art, and should be found in the hands of every professional grainer.

95.—HOLLIER'S SAFETY STAND AND HOME TRAINER.

As very many readers of WORK are cyclists, and as much interest has been evinced in the papers relating to cycles which have appeared from time to time in the pages of this Magazine, it will not be out of place to call attention to a new contrivance by which the attainment of a double purpose is secured, namely, the provision of a safe and convenient stand for the bicycle—I should say, safety bicycle—when not in use, and means whereby the yet unpractised beginner may learn to ride on his own machine, and get used to pedalling without risk of doing any injury to either the machine or himself when learning to ride. The appliance to which I am referring is known as Hollier's "Safety Stand and Home Trainer," and is illustrated in the accompanying engravings, of which Fig. 1 shows the Safety Stand with a safety bicycle placed upon it, and Fig. 2 the bicycle, thus placed, utilised for home training. That a good stand for a bicycle is a desirable thing for every cyclist who owns a machine to have is undeniable, for by its use both wheels are always kept in the same plane, and it is raised above the level of the ground, which is a better position for cleaning and oiling, and takes off much of the strain and tension of the framework which must result from allowing the machine to rest continually on the parts—I had almost said points—of the tires of the front and back wheels where the wheels come in contact with the surface on which the cycle is standing. Regarded as a home trainer, when the machine is fixed and mounted on the stand, the weight of the rider brings down the back wheel on to a pulley, which revolves, and is regulated to work hard or easy by means of two brakes and movable weights on each side, as shown in Fig. 1 and also in Fig. 2. The distance covered may be indicated, if desired, by a crank log or cyclometer, but this adjunct is not supplied with the stand, and forms an extra. The advantages claimed for the Safety Stand, which has been patented by Mr. Hollier, are:—First, that every person who has a machine may, by purchasing one of the stands, have a home trainer complete at the cost only of the stand itself, which is estimated at about one-third the cost of those already in the market; secondly, the supports are not fixtures, and the machine can be placed on them and removed in less than a

Fig. 1.—Bicycle on Hollier's Safety Stand.

Fig. 2.—Bicycle on Stand for Home Training.

minute, and the stand placed away, occupying but little space when not in use; thirdly, the stand, or stands—for there are two in reality—supply a great want to learners in practising pedalling, which, when thoroughly mastered, overcomes one of the beginner's chief difficulties; and fourthly and lastly, as a stand simply for cleaning, oiling, repairing, etc., the supports are most desirable, because, when the cycle is raised on them, the wheels are free and elevated, and they are stable in themselves from their construction, and save any undue stooping. The supports are so constructed as to adapt themselves to any kind of machine and width of tire.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

*** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Rate of Circular Saws.—A. R. (*Scorrier*) writes in reply to CHOPSTICK (see No. 135, p. 491 of WORK):—"I might say that I am not the proprietor of the Scorrier Saw Mills, but am pleased to say that what I have written in reference to circular and hand saws is the result of experience; and I am of opinion that there are not many men within the last twenty years who have had greater experience in circular, frame, band, and hand saws than myself. Again, I do not sneer at home-made machinery. We have a home-made machine, and it does its work well; but there are many home-made and factory-made machines that are not worth their room, especially when driven by hand. In reference to a rip saw cutting 3 in. pine, what I said was that the joiner for whom I sharpened the saw said he had been cutting 2½ in. and 3 in. pine with it two days. I don't suppose the man meant that he was continually cutting with it, but that was his principal work for the two days. Time must be allowed to prepare his work; and I argue that a good hand saw, well sharpened, would cut in clean pine most of the two days before being re-sharpened. Of course, if you use an inferior tool it has to be sharpened often. CHOPSTICK let the cat out of the bag when he said he could saw as much 3 in. deal in one day as six men with the hand rip saw, with a labourer to turn the wheel. I suppose he meant if the poor labourer could continue to turn the wheel at a good speed! Since my reply to CHOPSTICK on p. 379, more than one reader of WORK has said to me, 'I was pleased to see your reply to CHOPSTICK, and quite concur with what you said in reference to driving a circular saw by hand.' Again, I think there would be no difficulty in CHOPSTICK getting a job in a respectable joiner's shop, where there is a small circular saw to be driven by hand, if he would take his labourer with him to turn the wheel—even if they only do the work of three men with the hand rip saw, leaving six men quite out of the question. Perhaps CHOPSTICK will say (using his own words—see p. 398) whether, if I should be wanted to cut 3 in. deep, I should require two labourers, as it would be hard work for one. I, for one, should be pleased to see a description of CHOPSTICK'S saw bench, and how he can cut 3 in. deep so much easier than those I have seen at work; and I have seen many."

Fiddle Making in Earnest.—A. X. E. (*Nottingham*), an esteemed correspondent to WORK, sends the following cutting from a local paper, thinking, no doubt, that it will amuse some of his fellow-readers. We think so too; for which reason a little editorial license is granted in this case:—"At the Leigh County Court, the case of Beaumont *v.* Medling came on for hearing. This was a claim for teaching the defendant how to make violins, and also how to play the same from music. Mr. Grundy represented the plaintiff, and Mr. Whittingham defended. Plaintiff's case was that he told defendant what kind of wood was necessary, and he replied that he had two beech planks in the back yard, which would do for the body of the double-bass, and an old cart-shaft, which would do for the neck. Defendant also purchased some deal, and the instructions began. Defendant was in a great hurry to finish the instrument; and when he had finished gluing the belly, it was found that he had forgotten to take out the glue-pot. (Laughter.) The neck was made from the cart-shaft, according to instructions; but defendant fixed it on the wrong end of the instrument. After everything was prepared for the strings, plaintiff told defendant to go to a music shop for them; but, instead of doing so, he went to a watchmaker's, and got the catgut rope of an eight-day clock. (Laughter.) He put this string on, and when he was winding it up to tune the fiddle, the string broke, struck him in the face, and gave him a black eye. (Renewed laughter.) When all was completed, it was found that defendant had made the instrument so large that he could not get it out of the room.—After hearing a mass of evidence on both sides, his honour gave judgment for the plaintiff for £3 16s., and for defendant, on a counter-claim, for 3s. 6d., which had been paid into court."

Air Pump.—A CORRECTION.—O. B. (*Preston*) writes:—"Please read 'Sprengel' for 'Springle,' on p. 497, Vol. III. The mistake was not observed in reading proof. And Mawson & Swan's 'operator,' at foot of front page, should read 'aspirator,' as in the text of the articles. As I did not see the proof of the illustration, I had no means of correcting it."

Blacklead.—H. B. S. (*Liverpool*) writes:—"In WORK, Vol. III., p. 509, is an answer to H. P. by F. P., in which, in the interest of the correspondent, I would like to make one or two corrections. The chemical name for blacklead is carbon; the terms blacklead, plumbago, and graphite are technical terms for one particular form, or, as it is called, allotropic modification of carbon. Plumbago is not an oxide of carbon; there are only two oxides of carbon: carbonic acid and carbonic oxide. F. P. should read some new text-book on chemistry, such as Roscoe's, before answering correspondents on chemical subjects. He will no doubt take this hint kindly, as it is intended."

II.—Questions Answered by Editor and Staff.

Patent.—J. S. (*East Dereham*).—Before patenting, J. S. would do well to consult some person of repute in each of the trades to which his inventions belong. Such persons can best tell him whether his ideas are of any commercial value. If he fears that, by so doing, he will expose himself to piracy, and does not object to paying for the £1 stamps, he should first obtain provisional protection. He will most readily bring his inventions before the public by getting them taken up by established firms; and the necessary information as to obtaining provisional protection and patents he will find in the article on "Taking out a Patent" in WORK, Vol. I., p. 545.—C. C. C.

A Patent.—ONE FROM THE START.—Your invention appears to be one by which a considerable saving in time in office work might be effected, and as the article is to be purchased at so small a cost, it ought to have a good chance of success. You cannot do better than first obtain provisional protection (see WORK, Vol. I., p. 545), and then offer it to some well-known firm which manufactures such things—say, such as Messrs. Perry & Co.—C. C. C.

Shipping Models.—TOYMAKER.—You will be able to get anything you want in the way of model boat fittings from any of the following firms, who would probably name prices in the ordinary way of business if you apply to them:—Stevens, Model Dockyard, Aldgate, London; John Bateman & Co., 131, High Holborn; John Sowles & Co., 75, Queen Victoria Street, London; Hitchen & Squire, 36, South Castle Street, Liverpool. When you ask us to give you prices of "rigging and deck fittings of small model steamships or sailing ships," I wonder if you think there is unlimited space in "Shop," and that we have nothing to do but collate price-lists. The best way, when you or anyone else wants to know the price of anything, is to write to dealers. The names of these we are always happy to give; but it is quite another matter to give prices of a few hundred articles, when perhaps only half a dozen are wanted by the inquirer. If you had specified what you wanted, we might have helped you.—D. D.

Frame Moulding.—W. S. B. (*Leeds*).—You can get D. F. O. G. rosewood, as your sample, of City Frame Company, 29, Basinghall Street, E.C., who are sole makers of this article. We have sent your letter, with request to give you their trade terms, which, no doubt, they have complied with.—G. R.

Mitre-Cutting Machine.—NEMO.—In reply to yours, Messrs. Booth Bros., Dublin, are the patentees of the mitre-cutting machine. You can get it through any respectable tool maker of your town, price 15s. complete.—G. R.

Moulding Composition.—GALA.—The moulding composition used in rubber-stamp making consists of a mixture of china-clay and French chalk, kneaded with water to a stiff "dough;" two parts of clay to one part of chalk will answer very well, but the proportions may be considerably varied. Considering the cost of materials when purchased in small quantities, and the labour of mixing, it is better to purchase the compo. ready prepared. Some wholesale houses, as the London Rubber Printing Company, 33, Cheapside, London, E.C., sell the compo. in the dry state, so reducing expense when cost of carriage has to be incurred. The above-named firm supply handles and all other stamp-making accessories wholesale.—QUI VIVE.

Stamps.—F. G. H. B. (*Rowley Regis*).—It is quite "possible for an amateur to make indiarubber stamps in his own handwriting." To perform this apparently puzzling feat, it is necessary to procure a *fac-simile* block from an engraver in wood or metal, and use the block instead of type. The name to be copied is written, preferably with copying or lithographer's transfer ink, and transferred to the blank block of wood or metal by laying its face in contact with the block, and applying some little pressure. By this means sufficient ink is transferred to the block to give a clear outline of the matter to be copied—reversed, of course—and the bare metal is then removed by the aid of gravers. With a little perseverance, F. G. H. B. might manage such a job for himself.—QUI VIVE.

Iron Work.—J. M. (*No Address*).—Bradley, 180, Fulham Road, West Brompton, sells the iron.—J.

Violin Case.—A READER OF "WORK."—A description of how to make a violin case appeared in No. 131 of WORK.

Waltham Watch Parts.—W. P. (*Dundee*).—Apply to the Waltham Watch Depôt, Holborn Circus, London, E.C.

Telescopes.—J. J. M. (*Liverpool*).—It would occupy too much of "Shop" space to reply adequately to your question there. Please await Vol. IV. of WORK, when it is hoped the subject of telescope construction will be exhaustively treated.

A Self-acting Fountain.—HYDROSTATIC.—A fountain constructed upon the lines of your sketch would be quite useless. An illustrated article upon the construction of a self-acting fountain is in the hands of the Editor, awaiting space for publication, which will give you full particulars as to principle and method of construction.—C. M. W.

Graph Solution.—T. S. (*Huddersfield*).—I have not been able to try the solution you give; but, of course, indiarubber will not dissolve in water. You do not say whether you applied heat or not. I should be inclined to add sufficient methylated spirit to the rubber to dissolve it; add the gelatine next, and stir in the glycerine, oxalic acid, and water, mixed together, both solutions being warmed. The spirit will ultimately evaporate when the plate has been poured and cooled, leaving the ingredients you mention. If this does not answer, write again, and I will try to find time to make the experiment, and let you know the result.—J. W. H.

Artificial Eyes.—JUSTICE.—A guinea each for artificial eyes, to fit exactly and match the other optic, is the ordinary price; and even much higher prices are charged, as they are frequently painted from life to match in colour. Of course, it is not the material but the highly skilled labour that makes the price appear disproportionate. Glass eyes, such as are used for waxwork figures, human life size, any colour, may be bought for half a crown a pair, whilst those for large wax dolls, for about thirteen to fourteen pence a pair, from Meeke, Westminster Bridge Road, or Wheelhouse, Waterloo Road. On inquiry at Mr. Grossmith's, 175, Fleet Street, E.C. (the oldest house in the trade, established 1760), we find that if a second quality be required, made by German artists, the price is 10s. each, if selected from stock, or 15s. each if made to order; and if the eye be sent to be re-enamelled, the cost is 5s. I am also informed that a movement is obtained, in the best quality, at £1 each, if selected from stock, precisely in accordance with the action of the natural eye; and that they can be fitted in a few minutes without pain or operation. As to your second question, I cannot say at all when articles on coach-building will appear in WORK.—J. W. H.

Hammock.—J. R. W. (*Portsmouth*) asks me what size to make a hammock for his brother; but as he does not give me the size of his brother, I cannot help him further than to say that the usual size is 6 ft. long by 2 ft. wide, exclusive of rope for suspension. I have seen grass hammocks sold in New Oxford Street at 1s. 6d. each, but do not remember the address. At a seaport such as Portsmouth, I should have thought J. R. W. could easily have obtained the information he requires from the store-dealers and others.—J. W. H.

Stereo Plates.—AMATEUR STEREO.—I cannot see the cause of your failure, and can only suppose you have not followed the instructions. I advise you to write to the firm who supply your metal. Perhaps they have sent you metal intended for other purposes instead of paper process metal, which differs from that used for plaster, for backing electrotypes, or for casting type, etc., all of which also differ. I am almost inclined to think that your metal is dirty. Keep stirring it well at the proper heat—that is, when it will just scorch, but not light, a piece of brown paper. Some put a pinch of salt or a piece of resin in, to kill the sulphur and make the scum rise. A few drops of fatty oil also help. Then skim it well until the metal is quite clean, and pour at the heat indicated.—J. W. H.

Besom Makers.—£ S. D.—I have inquired in vain and looked over several directories for name and address of such. I hear the gipsies make them in the forests, but can obtain no information. Perhaps some WORK reader may be able to throw some light upon the matter.—J. W. H.

Metal Soldiers.—L. A. C. (*Wigan*).—If the toy soldiers you refer to as so largely imported from Germany are to be made as an experiment, I think I can give you some assistance; but if you wish to try to establish it as a business in competition with the present makers, I could not guarantee that I know enough about the trade to give reliable help, and should advise you to take a trip to Nuremburg, where you could easily get to know how it is done and made to pay. The moulds—for they are evidently cast—are, I should say, electrotype matrices, made by depositing copper upon wax models, coated first with plumbago, made to part in the central plane of the figure into two halves. This may be done by modelling each side separately, and putting a strip of sheet gutta-percha between them, or they may be electrotyped separately. The metal may be any of the ordinary fusible alloys, which consist of lead, tin, and bismuth. Bismuth melts at 267°, lead at 334°, and tin at 228°, only 16° above boiling point of water. Equal parts of each would melt, therefore, at about 276°. The more tin and less lead you use, the lower the melting point and the greater the cost. For painting, use ordinary tubes of oil-colour, mixed with copal varnish, and lay it on with a sable brush (not a hog's-hair). I do not know of any book on the subject; but I fancy that a similar industry exists in Birmingham. Let me add that a slight pressure of the two halves of the mould will be necessary when poured; and perhaps they are hinged together, as in the case of casting type, and the mould held head downwards as the hot metal is poured, and an upward jerk given to force the metal into all the parts of the mould, which, in a few seconds, could be opened, and the figure shaken out of it, as the metal soon cools.—J. W. H.

Coopering.—J. S. (*Longsight*).—The prices paid for repairs, and for butts, puncheons, etc., vary in different towns and at different times. I am afraid, therefore, that I can only advise J. S. to pump coopers in and around Manchester for the information he requires.—J. W. H.

Stair Block Wood.—J. P. A. (*Walthamstow*).—The "square blocks" you refer to are cut out of teak, as this wood will stand a lot of hard wear; although I think that "Jarreh" wood would last just as long and at a less cost, being cheaper than teak. It is now being used for wood-paving in many of the principal streets of London.—A. J. H.

Astronomical Telescope.—J. J. M. (*Liverpool*).—Although your questions are well put, practical replies to each one—that is to say, supposing you wish to construct a serviceable achromatic telescope—would occupy much more space than can at present be accorded in these columns; but if you merely wish to make a simple form of cheap chromatic telescope, you might carry out the following directions: First, procure or make a brass or zinc tube, to measure 53 in. long and about $3\frac{1}{2}$ in. in diameter, and, after first making the ends quite true, solder a diaphragm, having a 2 in. aperture, at about 8 in. from one end of the tube. Now proceed to fit the 3 in. object glass into a turned wooden cell, retaining the lens in position by means of a ring of springy brass wire; after which the cell is tightly fitted into the end of the body tube nearest to the diaphragm. The draw tube must draw through a wooden collar, which is turned in a lathe to a suitable size, and fitted to the other end of the body tube. This collar should be furnished with a $1\frac{1}{4}$ in. opening in the middle, to receive the draw tube, which must be made of brass, about 12 or 14 in. long. The best form of eye-piece to use will be the Huyghenian, which is composed of a couple of plano-convex lenses of 1 in. and 3 in. focus, mounted 2 in. apart, with the latter next to the object glass, and the plane sides of both the lenses outwards. The lenses are mounted in a suitable length of brass tubing, with a small diaphragm, having an aperture about equal to the diameter of the eye-lens placed midway between them; after which the eye-piece is slid into the draw tube of the telescope, with a small wooden cap, lastly, fitted on to the outer end. This cap should be furnished with but a small aperture, as it is only the centre of the lens that is used. The interior of the tubes, including the cells of the lenses, should receive a coating of dull or dead black. An eye-piece of this description will have a magnifying power equal to a single lens of $1\frac{1}{2}$ in. focus, so that the telescope will magnify forty times. Although this telescope is extremely simple, it will be capable of doing good work, and will show Jupiter's moons, and, probably, some traces of his belts, as also Saturn's rings. As you ask to be referred to some articles on telescope making, mention may be made of the article on "A Four-draw Telescope," which appeared in WORK, No. 142. Opinions differ as to the relative merits of refracting and reflecting telescopes; but the latter will be found the cheapest to make—if this is any advantage. Messrs. Lancaster & Son, of Colmore Row, Birmingham, used to supply amateurs with sets of lenses for the construction of astronomical telescopes, together with lithographed diagrams and instructions for mounting. As above, with a 3 in. object glass of 50 in., from 5s. 6d.; or, with an achromatic object glass $2\frac{5}{8}$ in., £2 15s.; and 3 in. object glass, £4 10s. You could also procure the lenses cheap from Prof. Caplatzi, Chenies Street, London, W.C. I quote the following from an old list: Ordinary chromatic object glass, 3 in. diameter, 3s. to 4s.; eye-piece lenses, 1s. each; achromatic object glass, $2\frac{1}{4}$ in., 25s.; 3 in. ditto, 40s. to 50s. Wholesale firms do not care to supply amateurs; otherwise, some of these lenses would cost considerably less.—C. A. P.

Telescope.—T. M. (*Liverpool*).—You probably require a short monocular telescope. The object glass would be $1\frac{3}{4}$ in. in diameter, and be fitted with a pan-centric eye-piece. A glass of this description would be capable of showing the time by a church clock at six miles, or a flag at twenty miles. The lenses would, however, be expensive. A full set of lenses, including an achromatic object glass and erecting eye-piece, for a telescope of a more simple form, to do what you require, would cost between 3s. and 4s. Full directions for making telescopes of either form would occupy too much space in these columns, and must, therefore, remain until space can be spared for a series of papers on the construction of telescopes of various forms. In the meantime, you might write to The Science Exchange, Chenies Street, London, W.C. Write fully, stating your wants clearly, and they will be able to supply you cheaply, and, moreover, give you advice if needed.—C. A. P.

Metal for Gilding.—T. R. (*Sheffield*).—For all descriptions of leaf metal for gilding purposes, write Mr. James Smith, Bridge Street, Manchester. I am not familiar with "bundles" of German metal, as described by you; but it is probably put up in that form for some particular class of work. All metal—either pure or base—that I have handled has been in books. Respecting the keeping qualities of imitation gold, this chiefly depends upon the atmosphere. If well lacquered over with a solution of shellac in spirits, it will keep its colour almost as well as gold-leaf; but for picture frames and fancy articles for our personal service and use, it is well worth the extra money for the genuine article. The specimen you send is of the commonest quality. A very good imitation gold—or "ducat," 'tis often called—can be bought for 3d. and 4d. per book. Picture frames (German) are gilded with "white metal," and lacquered with a yellow-stained spirit solution. All articles appertaining to gilding, Mr. Smith (as above), or Pavitt & Sons, Southampton Row, London, will supply at fair prices, and of reliable quality.—F. P.

Bunsen Gas Burner.—T. M. (*Liverpool*).—The great mistake in your query, and what makes it impossible for me to answer, is that you have not stated *how much glass you want to melt*, and whether you use a furnace or not. I cannot by any means tell how to arrange one, and what size to make it, until the above is answered. The amount of heat given out by a burner is proportionate to the size of the flame when burning properly. There are only so many units of heat in the flame of a burner of a given size; but this flame can be concentrated, by means of a blowpipe or the blast in a furnace, so that it will melt objects which, without this means, it would not have much effect on. Do you want to use it in a specially constructed furnace, or otherwise? as I am afraid you will not be able to melt glass in any quantity without the aid of a furnace. A very small size of burner, or even a candle or lamp flame, in combination with a blowpipe, would be ample, I should say, if the amount of glass was very small. If you want to use it in a furnace, a great deal lies in the design of the furnace itself. The best thing I can do is, therefore, to give a sketch of a Bunsen burner furnace for metals, with crucible in position, and the position and size of the top of the burner. From this and Fig. 2, which shows an ordinary burner, you should be able to design one to meet your requirements, making the diameter of the burner tube proportionate to the crucible, as in Fig. 1. You must first get a crucible that will hold the amount of glass you want to melt, and proportion the top of burner to it. If the flame alone from the burner does not melt the glass in crucible, perhaps

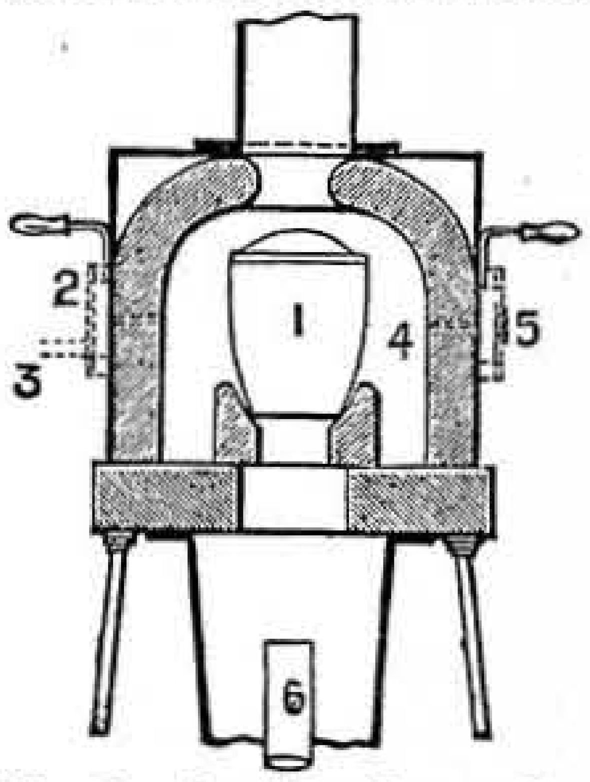


Fig. 1.—Section through a Bunsen Burner Furnace—1. Crucible; 2, Air Chamber round Cupola; 3, Entrance for Blast; 4, Slits round Cupola; 5, Small Door; 6, Burner Top.

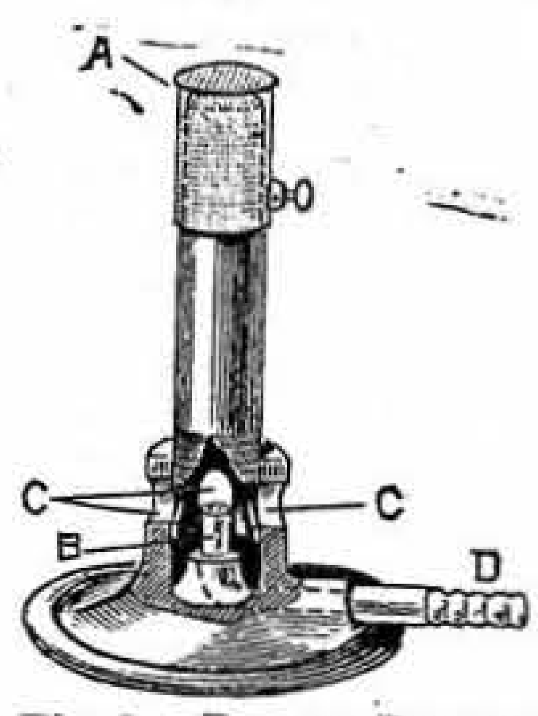


Fig. 2.—Bunsen Burner, Perspective View, partly in Section—A, Removable Perforated Metal Cap; B, Brass Burner; C, Air Inlet; D, Pipe for Indiarubber Tube.

by concentrating the flame on to it by means of a blast you might be successful. This could be arranged, as shown by dotted lines, Fig. 1, by cutting slits at intervals (the longer the better, if the furnace will stand it) round the cupola: these slits to be from $\frac{1}{16}$ in. deep and upwards, according to the size of the furnace. A narrow chamber, shown in dotted lines, Fig. 1, might be formed, completely encircling the cupola and enclosing the slits. By having this chamber rather deep, the blast is heated to a certain extent before entering the furnace proper. The blast, if the furnace is no greater than 6 in. by 6 in., might be produced by a pair of ordinary house bellows; if larger, by bellows worked by the foot or a small fan. At intervals round the outer casing, and opposite the slits, it is as well to have small doors, to clean out the slits should they get filled up by dirt. Perhaps it would be as well to have the slits slightly inclined upwards, by which means the flame will be blown both against the sides of the crucible and upwards, thus creating a draught as well. Fig. 2 shows a perspective sketch of a burner, partly in section, to show more clearly the method of distributing the gas and the position of the air-holes, of which there are four, placed at right angles, passing through both stand and tube, which is threaded to screw into stand; and by this means the admission of air can be regulated to a nicety by turning the tube round. Suppose perforated cap removed, as it is only a useful accessory: then you turn on the gas, which passes up the tube, taking with it air for its own consumption. If there is too little gas passing up, it will not burn at the top of the tube when a light is applied, but descend and burn below. This will show you that there is too little gas. The quantity being sufficient, the flame will remain burning at the top. Should there be too little air, the flame becomes golden; when burning correctly, it should be blue. When the finely perforated cap is used, a very inflammable mixture of gas and air can be thus burned, as the gas, whatever its pressure quantity or quality, cannot light below. By this means a burner can be made from 1 to 2 in. in diameter, and capable of burning 40 cubic feet of gas per hour. I have only mentioned this as a useful accessory. The proportion of a small tube in a burner should be from 4 in. to 5 in. long by $\frac{1}{3}$ in. to $\frac{1}{2}$ in. in diameter.—P. B. H.

Whitewash from Wall.—W. H. (*London, S.W.*).—The only recipe for removing this that I am aware of is a stiff brush and plenty of hot water and "elbow grease." I should say the simplest way to rid yourself of this eyesore would be to give it a coat of paint. Any old stuff, or even common tinned paint, would answer, so long as it dries well. Some dry Venetian red and common black, mixed with linseed oil and driers, would also make a cheap mixture, and of suitable colour.—F. P.

Folding Picture Screen.—A. H. B. (*Stalybridge*) should get No. 89, and in it, at p. 600, he will find answers to his queries. I imagine that he will find the varnish sold at the oilman's as "paper varnish" sufficient for his purpose; but if he is particular, he can get the more expensive "mastic varnish" from the artists' colourman's.—S. W.

Making a Chess-Board.—R. W. M. (*Carbury*).—I am sorry your query was overlooked. Even now I cannot tell you "how to remove scraps from screen" without knowing what the scraps are made of, or what the screen is, or how they are stuck on. If they are paper scraps, can you not soak them off? Since you ask the price of eight numbers of WORK and an index, I can only say they are one penny each; and if you will weigh nine of your own numbers, you can easily tell what the postage will be. To make a chess-board, you will require thirty-two squares of dark and thirty-two of light wood—holly, say, for the light, and then almost any coloured wood will do for the dark squares: say, rosewood. The squares may be about $\frac{1}{8}$ in. thick. Prepare two pieces of wood, one of light wood and the other of dark wood, each 6 in. long, and exactly square in section—say, $1\frac{1}{2}$ in. square—for a board one foot square. Now, if you have a circular saw you can saw off the thin squares one after another; if not, make a kind of trough of wood, with the sides cut through, perfectly square with the length; lay the prepared blocks of wood in the trough, and saw them up. Then have a board of sound wood ready to glue them down on; glue on strips round the edge, and smooth the top by rubbing down with coarse sand-paper; then smooth with fine sand-paper, and finish with French polish.—F. A. M.

Violoncello.—J. D. (*Glasgow*).—You would be wasting your time in making a 'cello from the outline pattern you send. The corners are very weak indeed; the *ff* holes have also a decidedly "amateurish" look about them. The measurements you desire are as follows: thickness of belly at jointing edge, $1\frac{1}{2}$ in.; thickness of back, 1 in.; width of ribs, $4\frac{1}{2}$ in.; thickness of ditto, $\frac{3}{32}$ in. The dimensions of the neck have already been given.—B.

Lancaster Camera.—F. M. (*Liverpool*).—The reason is *insufficient* exposure. To take portraits with magnesium, it is necessary to have a fairly quick-acting lens—say, an ordinary portrait combination—working with a wide aperture. With landscape lenses, the stops are necessarily small; therefore, much more light is required, also quick plates and strong development, to get a properly exposed picture. There should also be plenty of white reflectors about—as sheets, paper, etc.—to throw light into the shadowed parts of the subject. A good deal of skill is required to make *satisfactory* portraits with magnesium light, even with the best lenses.—D.

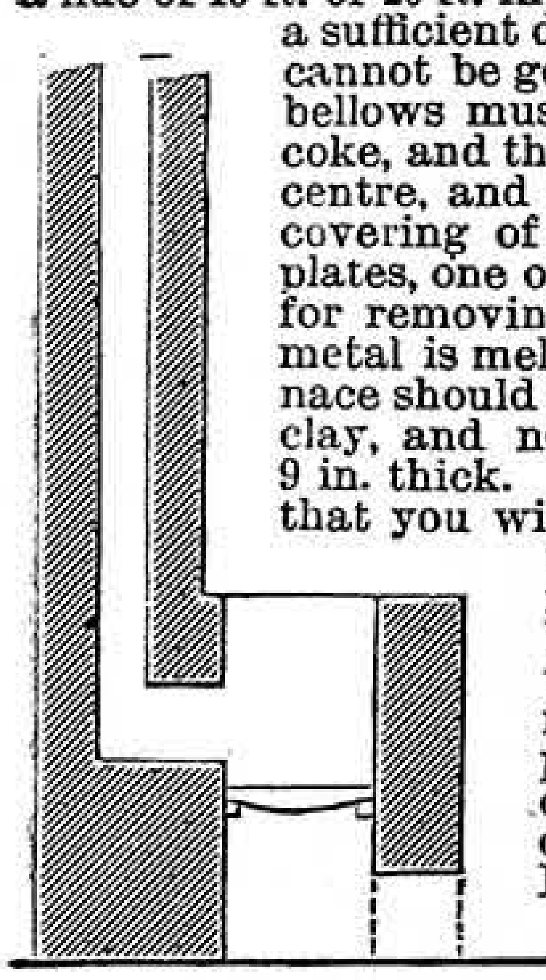
Musical Instrument.—A. B. (*Basford*).—The instrument, of which you send a drawing, belongs to the time of the Empire, and is known as a harp-guitar, from the shell or body being shaped after the harp fashion. I regret I cannot tell you the correct way of tuning it, as that is a matter of great uncertainty; but most likely it was tuned as the ordinary guitar, with the additional outside bass strings an octave lower than the fourth, fifth, and sixth. These instruments have gone quite out of date, and are now of no particular interest or value except to a collector. I should think it would be useless trying to get an "instructor" for it, it being, as a musical instrument, obsolete.—R. F.

Varnish for Zither.—CLERICUS.—Varnish does not give very satisfactory results; the instrument should be French polished, as this admits of a very much better finish, especially if the belly is of maple or rosewood. Varnish, especially spirit varnish, shows every little scratch or chip, and soon wears rough; and, from its drying so quickly when applied, it is difficult to get a good finish with it when spread over a flat surface. The breaking of the strings can hardly be attributed to one specific reason, but may proceed from one of many. Thus, the slot in the saddle may be rough; the holes in the wrest-pins may be sharp on the edges; or the angle of tension between the wrest pins and the upper bridge-pins may be too great; or the fault may lay in the strings themselves. If the breakage results from the first of these causes, it would occur at the saddle; examine it, and if any roughness exists, smooth it away with a fine file or piece of folded glass paper. The second would cause the breakage at the pin; the third, at the upper bridge; and the fourth, just anywhere in its length, between bridges. Finally, it may proceed from the fault of the tuner, in mistaking the pitch, and so trying to pull the string up above the note for which it is intended.—R. F.

Fortune-Telling Card.—AMATEUR.—This is in hand, but, being too lengthy for "Shop," you must wait until room can be found for it in the body of WORK.

Electro-motive Engine.—POINTSMAN.—It would be impossible to tell you in a few sentences how to make one. You should read an elementary treatise on electricity, and then get "Electro-Motors: How Made, and How Used," by S. R. Bottone, price 3s.—F. A. M.

Small Furnace.—T. A. E. (*Clapham*).—I send sketch of furnace, such as is generally used for melting brass, and which I suppose will be what you want. The air is admitted under the bars, and a flue of 15 ft. or 20 ft. in height is required to cause a sufficient draught; when the draught cannot be got by a chimney, a fan or bellows must be used. The fire is of coke, and the crucibles are set in the centre, and surrounded with it. The covering of the furnace is of metal plates, one of which is arranged to lift for removing the crucibles when the metal is melted. The walls of the furnace should be of fire-brick set in fire-clay, and not less than one brick, or 9 in. thick. You will see from this that you will hardly be able to get a furnace in the space named by you—viz., 2 ft. by 1 ft. 6 in. I should advise you to build the furnace in front of the fireplace, and use the flue as a chimney, or if you cannot do this, write to Mr. Thos. Fletcher, of Warrington, who supplies small furnaces for this purpose, which are heated by gas, and which will be much cleaner in a house.—M.



Section of Furnace.

Working Alabaster.—R. N. (*Grays*).—There is some information in Holtzapffel's "Mechanical Manipulation." In Vol. I., p. 164, I find that alabaster is sulphate of lime, or compact gypsum, found near Derby. But few tools are required for turning it: point tools for roughing out, and ordinary strong carpenters' chisels, ground straight for straight work, and rounded for turning hollows. Of course, the cutting angles would be more obtuse, and stronger, than for wood. Alabaster may be finished by fish-skin or Dutch rush. On pp. 1033 and 1034 of Vol. III. there is further information as to polishing; but I do not see if it should be turned wet or dry. Alabaster may be polished in the lathe by soft sandstone and water, rubbed in with a rag; then, after washing, by putty-powder and water applied in the same way; finally, with putty-powder and soap and water. It is also worked by the methods of the lapidary. It is about as hard as jet, copper, or soft brass; and, therefore, the dust would injure a soft steel mandrel, working in gun-metal collar, but should not have much effect on a hard steel mandrel. Perhaps someone will supplement this who can speak from experience.—F. A. M.

Design.—A. N. (*Horwich*).—I have sketched you a simple design, occupying one corner of the square you send; but whether it is "nice" or not, it is for you to say. I do not pretend to do much in this way, and would refer you to numerous designs, and their parts, in back numbers, such as "London Decorator's" portrayals of ceilings, etc. Surely it is not difficult to discover something suitable in the vast quantity of matter contained in Work and your fret-work catalogues! If not, I fear that, unless you specifically state in what direction your taste lies (whether for scroll-work, flower or geometrical patterns), difficulty will be experienced in pleasing you.—J. S.

Design.

Boot and Shoe Repairing.—H. B. (*Accrington*).—Papers on this subject appeared in Work, Nos. 112, 117, 122, 126, 130.

Enlarging Cameras.—E. C. (*London, S.E.*).—In an article on "Photographic Appliances," now being published in Work, full directions for constructing wooden dishes of any size will be given. Zinc dishes or metal dishes of any kind unless gilt or silvered are quite unsuitable for photographic development. Wooden ones answer every requirement, and for large-sized work are best of any. For small work, papier mâché, ebonite, or porcelain are to be preferred on account of their being less cumbersome; otherwise they are equally good. Strips of wood, grooved as in diagram, are framed together, the joints secured with white lead, and a piece of corrugated glass slipped in the groove, and the whole, when screwed together, varnished two or three times over with shellac varnish, one coat being thoroughly dry before the application of the next. A dish thus formed will answer every purpose, and last well.—E. D.

Enlarging Cameras — A, Glass; B, Groove; C, Corner.

Improved Bicycle Spoke.—C. H. (*Liverpool*).—In the sketch and description submitted by your correspondent I fail to see anything new, as almost every conceivable kind of spoke and nipple have long been in the market. Neither do I see any of the advantages mentioned that are not already in use. We have wheels with hollow rims, where the spokeheads or nipples never interfere with the tire, being in the hollow between the two sections of the rim. These hollow rims are made so light, that it is neither wise nor necessary to desire them lighter. As to using nipples and nuts at the rim, the thing has been patented, as far back as 1878, by a John Samuel Smith, and many makers have used the same or similar arrangements since. As to greater facility in building, a wheel can be built and tied up in fifteen minutes by the methods at present in use.—A. S. P.

Bicycle Wheel.—Wheeler.—In Fig. 1, if the wheel, A, is double the size of B, which is the driver, the power is increased and the speed diminished by one-half. In Fig. 2, where the larger wheel is the driver, the speed is increased and the power diminished in the same proportion. To put it more clearly, say the two wheels in Fig. 1 are each 6 in., and they are geared together by a band or chain, it should be clear to the dullest intellect that, when driven, they both would have the same speed. Increase A to double the size of B, and one revolution of B will only be a half revolution of A, and will only require half the power to do it. Drive the larger wheel as in Fig. 2, and one revolution will be two of the smaller wheel, C, and will require double the power to accomplish it. See pages 34 and 100, Vol. III.—A. S. P.

Patents in Bicycles.—V. L. (*Newcastle-on-Tyne*).—Anyone beginning cycle building has a large field to work in without infringing any patent. There is no patent cycle. There are patent parts or fittings, such as bearings, saddles, etc.; but these are usually bought by makers from the patentees or dealers at the prices they put upon them. Get the *Cyclist*, where many dealers and makers advertise, where you will find addresses, and can get catalogues and information from any maker of a machine you wish to copy. Or, if you wish to avoid being a copyist, and design for yourself, then you are independent of all makers. To get some information regarding nearly every machine made, write to the publishers of the *Cyclist*, Iliffe & Son, Coventry, where you can get the "Bicyclist's Indispensable Annual" for 2s. 10d.—A. S. P.

Freezing Mixtures.—J. R. W. (*Portsmouth*).—There are a great many ways of reducing the temperature of water and other substances to a point considerably below freezing; but some of them are not admissible for the purpose you require, as they give off an offensive smell; and others, again, are too expensive in use to be of any service to you. I should have thought that the usual freezing mixture of coarsely pounded ice and salt would not have been too expensive for you; 2d. per lb. is not an unusual price; for a single lb., in fact, I have paid 4d.; but, surely, you could buy a larger quantity at a much cheaper rate. However, as you ask for a freezing mixture, here is one that will give you 30° below freezing point: Take 1 lb. of muriate, or chloride of ammonium, commonly known as sal-ammoniac, and 2 lbs. of nitrate of potash, or saltpetre; pound each separately, and mix; to use, take equal parts of this mixture and of best soda, also pounded; place them in the vessel in which you have your ice pot, and pour cold water on the mixture. A little less water than it will take to dissolve the salts is the proper quantity. For 2 lbs of each, a quart of water will be sufficient. If too much water is used, which is a common fault in making these mixtures, the power of the stuff is wasted in cooling down the surplus water instead of the substances that you want to freeze. It is of no use trying to freeze with 2 or 3 ozs., and everything used should be as cold as possible at starting. The container for the mixture should be of wood, and the inner vessel of pewter, and well packed round with the mixture.—R. A.

III.—Questions Submitted to Readers.

*** *The attention and co-operation of readers of* Work *are invited for this section of "Shop."*

Luminous Paint.—R. R. (*Upholland*) writes:—"Could any reader kindly inform me how to make luminous paint, or where it could be purchased?"

Japanese Fiddle.—J. M. B. (*No Address*) asks any correspondent to kindly inform him how to make a Japanese fiddle.—[This is a toy instrument.—Ed.]

Bois-Duré.—J. S. (*Hampstead*) writes:—"Can any reader inform me what is *Bois-Duré*, and how it is made, and its application as a substitute for papier-mâché?"

Brass Lacquering.—L. M. (*No Address*) writes: "Will some kind reader of Work tell me where I can send a pair of iron hames of horse-collar to be carefully re-lacquered in brass?"

Carvers' and Gilders' Society.—J. B. (*Bristol*) wishes for the address of secretaries to above trade societies and their branches. Perhaps professional workers in this craft will oblige with any particulars relating to London and provincial branches.

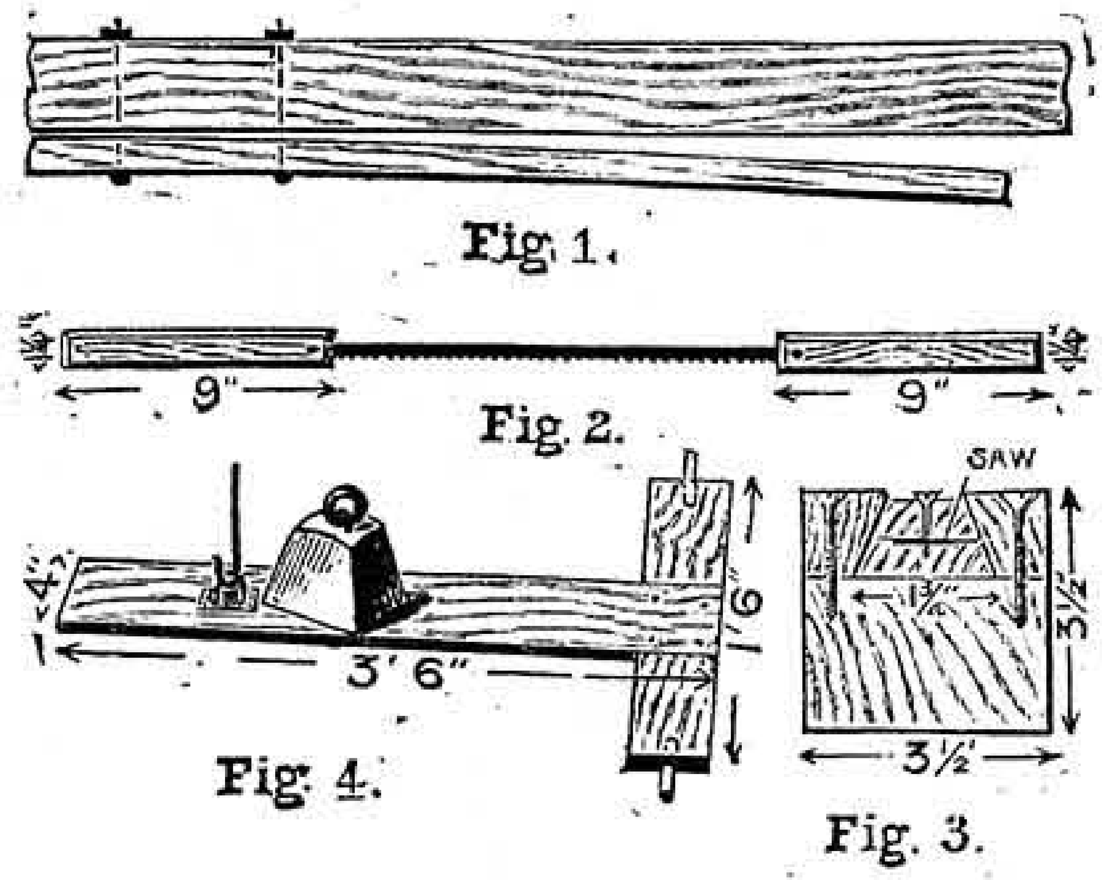
Skates.—Jack Frost writes:—"Will any reader kindly give me instructions for grinding my skates at home? Also, is it worth my while to do so?"

Size.—One in a Fix writes:—"Will some reader of Work kindly give me the ingredients for making builders' and paperhangers' size, and shoemakers' size, in proper proportions? I want to make a great quantity. I have every number of Work since it first came out on March 23rd, 1889, but cannot find what I require."

Hearthrugs.—C. F. C. (*Oldham*) writes:—"Will any reader kindly tell me, through 'Shop,' where I can buy designs for hearthrugs? Also the address of the manufacturers of the Auto-Copyist copying apparatus?"

IV.—Questions Answered by Correspondents.

Saw.—W. W. (*Caverton*) writes, in reply to Top Sawyer (see p. 478, No. 134):—"The wood spring for saw is about 8 ft. by 4 in. by 1½ in., and should taper a little towards the point, and is fixed to the rafter in the manner shown in Fig. 1. As to support for upper end of saw G (see p. 347, No. 126), I am not able to give any stated length, for that all depends on the height of your strap—mine is 9 ft. long, and 3½ in. by 2¾ in. thick, and is fixed to both upper and under rafters, and must be perfectly perpendicular and firm. The saw is 2 ft. long by ½ in., and is mounted in slides as in Fig. 2; the slots the slides run in must be double their length—18 in. The weight on the treadle strains the saw, and makes it heavy and powerful, and is placed immediately behind the wire which connects the under slide and the treadle. But all the same, the wood spring must be able to pull both treadle weight and saw to the top for the workman to get the downward stroke. It should not fall too hard against the top—just nearly balanced, of course; that can be regulated by the weight being placed either backwards or forwards. The wood is all larch, except the sides, which are ash. All the iron about it are the upper and under wires, and the staples, which are fixed in a piece of plate iron, and then fixed on to the slides and treadle. The height of bench is 2 ft. 10 in. All the wood must be perfectly dry."



Saw: Rafter, Treadle, Slide, etc.

Dovetailing.—E. H. H. (*Chatham*) writes, in reply to L. E. W. (*Hull*) on dovetailing (see p. 669, No. 93):—"I always cut the mortises first, and then place them in position on the end of front or back, and mark the lines in with the dovetail saw, and then cut slightly outside the lines so as to ensure a tight fit. L. E. W. would understand the work better if he got some of his joiner friends (I presume he has some) to show him, or by examining a drawer or box. Fig. 1 shows how two pieces of equal thickness are dovetailed together. Fig. 2 shows how drawer and box front are dovetailed together where it is desired to keep the end grain out of sight on one side or the face."

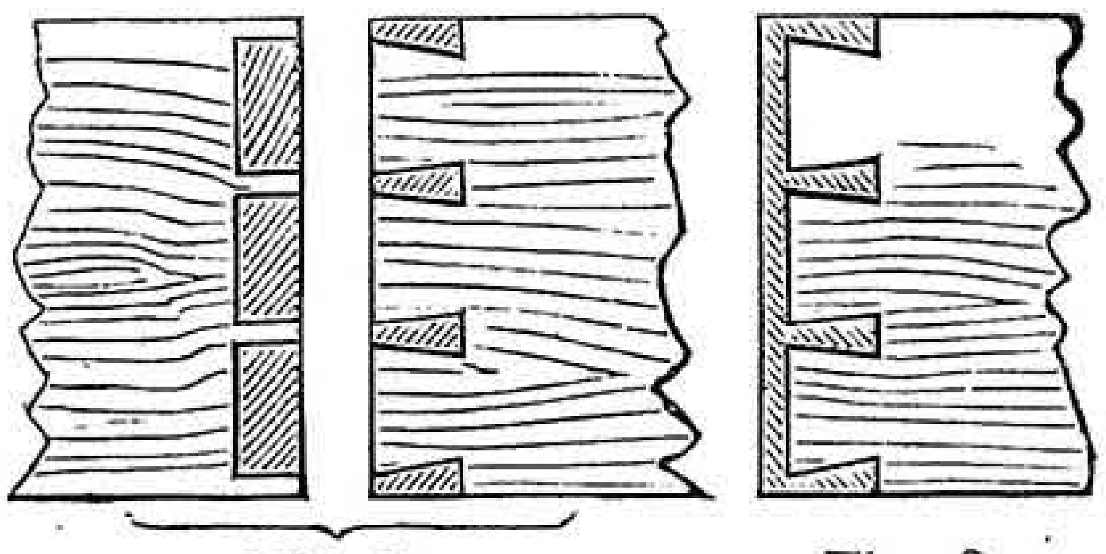
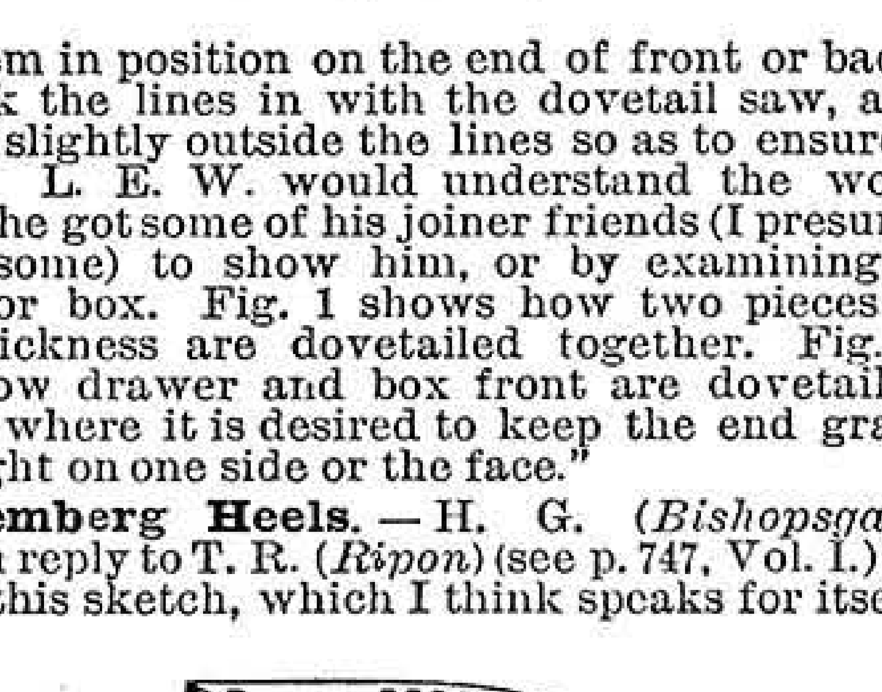


Fig. 1. Fig. 2.

Dovetailing Examples.

Wurtemberg Heels.—H. G. (*Bishopsgate*) writes, in reply to T. R. (*Ripon*) (see p. 747, Vol. I.):—"I send this sketch, which I think speaks for itself.



Wurtemberg Heel.

The dotted lines show where the leather is to be cut away. The heel when built should be placed against a straight bit of wood, and see that it is level with sole; if not, hammer the heel until it is."

Fountain Driven by Engine.—M. (*Bishop Auckland*) writes, in reply to C. A. P. (*Ealing*) (see p. 510, No. 136):—"You will require a force pump with an air vessel on the delivery pipe, and a very fine jet for the fountain. The pump will be worked by the engine. It should be a double-acting pump, or you might use two single-acting pumps. Without more particulars I cannot give you any sizes."

Boiled or Unboiled Oil.—G. P. (*Elgin*) writes, in reply to A WEEKLY SUBSCRIBER (see p. 454, No. 133):—He says he has WORK from the beginning; then let him look up 'House Painting' (Vol. I., p. 659); he will find there full information regarding the various oils used in painting. Again, on p. 125, Vol. III., of WORK, he will find a reply by F. P. to W. S. (*Inverness*); let him read this also. He will then have as full information as it is possible to give about the use of *raw* and of *boiled* linseed oil. It comes to this: both oils are glossy when applied in sufficient quantity; boiled linseed oil has more body and is more brilliant than raw linseed oil; raw linseed oil is lighter in colour, and is not so liable to blister as boiled linseed oil; boiled linseed oil dries quicker than raw linseed oil."

Polishing Pebbles.—T. F. (*London, S.W.*) writes:—"If SPES MEA (see p. 542, No. 138) will turn to Vol. VIII. of the *Boys' Own Paper*, he will there find not only full instructions as to the cutting of pebbles, but also instructions for polishing them after they are cut."

Locks.—W. L. (*Wolverhampton*) writes, in reply to J. G. (*Bloomsbury*) (see p. 478, No. 134):—"I beg to say that Mr. J. J. Wakeman, St. John's Square, Wolverhampton, is a good and cheap maker of letter locks. J. G. says he believes they are made 'somewhere abroad;' but I should certainly advise him to buy at home, as there is not a great demand for these things; moreover, the trouble and expense of getting them are considerable, and I doubt if J. G. would get any pecuniary advantage in the end. One thing he would get, and that is inferior workmanship. I have bought them for export for years, and had them made to foreign patterns; but I never yet bought a foreign make, and, what is more, I never intend. If J. G. prefers, I can give him the name of a foreign maker; but only if he *much* prefers it."

To Preserve Stone.—In reply to H. L. P. (*Montrose*) (see p. 526, No. 137), B. B. (*Deptford, S.E.*) writes:—"In answer to your query, I would recommend you to try Szerelmey Stone Liquid."

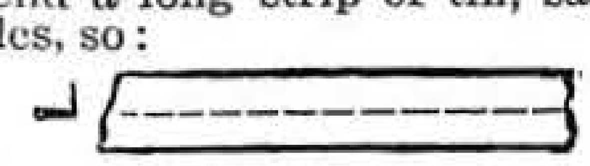
Colouring Bright Steel Surfaces.—LIFEBOAT writes, in reply to BARIUM (see p. 542, No. 138):—"Messrs. B. Newham, of Slude Lane, Sheffield, make a speciality of a spirit varnish suitable for this purpose, in gold, vermilion, and blue colours, for which they claim that it will not chip, and in the case of the blue, a deep, brilliant, and intense blue colour. They are made specially for edge toolmakers. Prices range from 8s. to 10s. per gallon for gold and blue to 16s. for vermilion, wholesale price-list; samples sent free. The intensity of the blue, and, I presume, the other colours, can be reduced by the addition of methylated spirits."

Preserving Stone.—M. (*Bishop Auckland*) writes, in reply to H. L. P. (*Montrose*) (see p. 526, No. 137):—"You can procure solutions for coating stone work, to preserve it from decay, from the Silicate Paint Company, Cannon Street, London; or from A. T. Morse & Co., Ward Road, High Street, Stratford; either of whom will give you all particulars respecting it."

Waterproof Fluid Glue.—THE WATERPROOF GLUE COMPANY write, in reply to LONDON (see p. 542, No. 138):—"Our glue can be obtained from Messrs. Moseley & Son, High Holborn, Messrs. Crowden & Garrod, or Messrs. W. B. Fordham and Sons, Ltd., London."

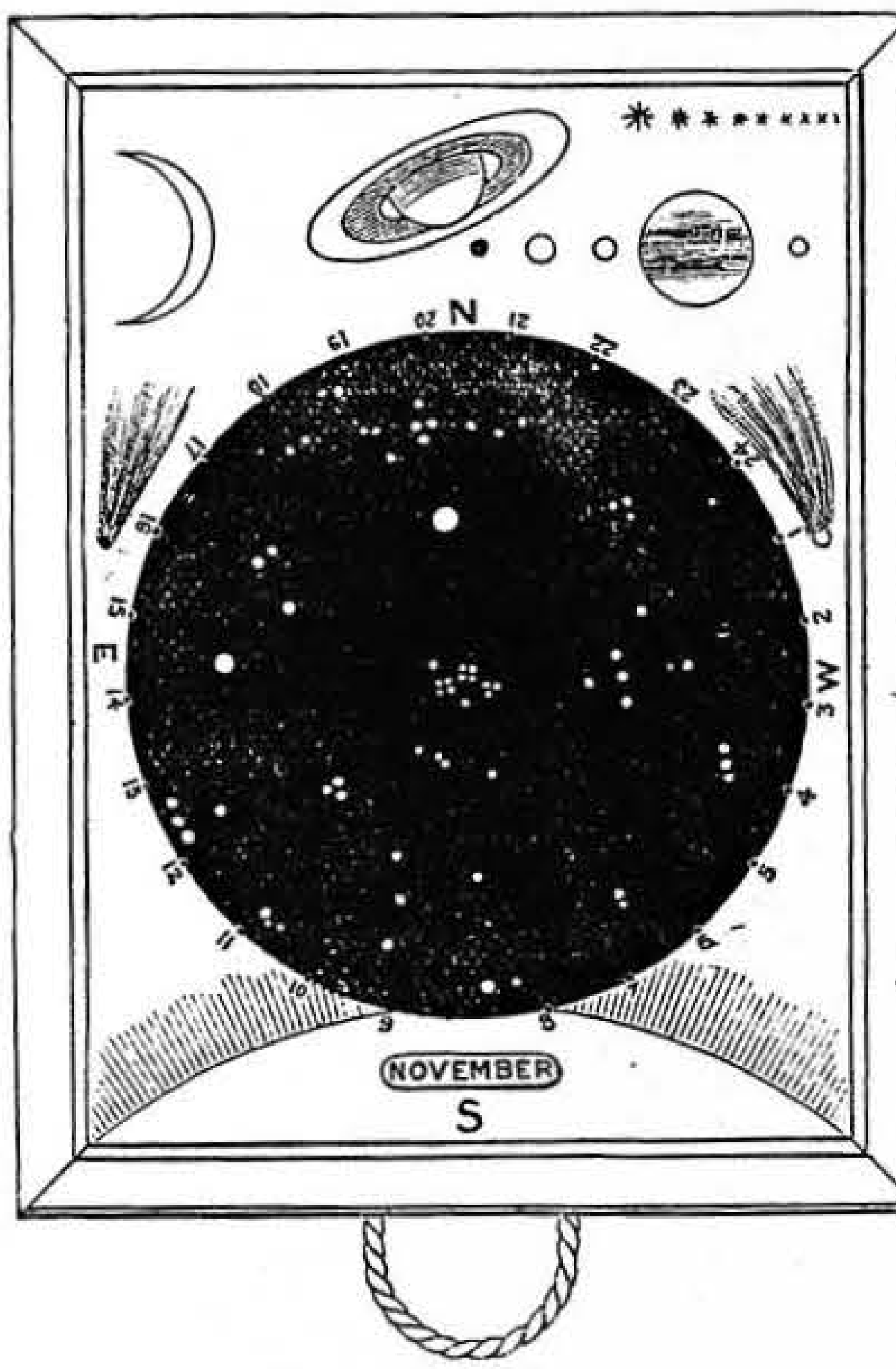
Steam Launch.—A. D. (*Sunderland*), writes, in answer to A. M. C. (*Holywood*):—"I should say, follow the plan of a steam launch given in No. 71 of WORK (Vol. II.). Enlarge the scale of it to the size you desire your model to be: then make a full-size model of the hull in wood, but do not hollow it out; then take two sheets of tin and block it on that pattern in two halves (starboard side and port side). Have the stern-post, keel, and stem of brass. I should advise it this shape:

and of one piece. Then solder your two sides on to it; bend some stout brass or other wire the shape of the sections given, and solder them in the inside. To take the place of frames in an iron ship, bend a long strip of tin, say ½ in. wide, at right angles, so:



and solder it round inside to form stringers to rest deck on. I leave the deck fittings and masts to A. M. C.'s judgment, and also the painting. A. M. C. can write to Stevens' Model Dockyard, 22, Aldgate, London, for illustrated catalogue, price 3d., and he can choose the engines he would like from it."

Plan of the Heavens.—F. H. (*Battersea*) writes, in reply to M. D. C. (*Liverpool*) (see p. 510, No. 136):—"I beg to offer my idea to utilise the plan of the heavens given with the first part of 'The Story of the Heavens.' Take two pieces of stout cardboard, 24 in. by 20 in.; on one piece paste the blue sheet, and when this is dry cut the circle out, allowing it to be ¾ in. larger than the blue centre. On the other sheet of cardboard draw a circle, the exact size of the ecliptic on the blue sheet, and let the line of the circle come within 2 in. of the bottom end of the cardboard. Divide this circle into twenty-four parts, cut out the circle, and also a small hole between the division at the bottom. These divisions are now numbered—mine is set for between eight and nine o'clock at night: that is to say, eight is marked on the right-hand side of the slot, and nine on the left, then ten, eleven, twelve, and so on round the ecliptic to the left. Around the blue sheet on the white margin, paste the names of the twelve months cut out of an old almanac, November at 24, December at 2, January at 4, and so on round the margin. At the back of the blue sheet, a small grooved wheel is glued in the centre. Around this wheel is an endless cord, reaching 3 in. below the outside of the blue sheet; through the centre of the blue sheet and wheel a hole is bored, to fasten it with screw or nail to the wall. The white sheet with ecliptic cut out is fastened over the blue sheet in such a manner that when the blue sheet is turned round, the name of the month can be seen through the slot at the bottom of the ecliptic. The best way



Plan of the Heavens.

to do this is to have the word August at the bottom, and adjust the opening to the circle of the ecliptic on the blue sheet. Before fixing, both sheets are sized, and varnished with spirit varnish. To use the star map, suppose you want to see what stars will be visible (on a clear night) on November 3, turn the blue map round with the cord until the word November is shown through the slot. The stars visible on the blue map will be the same as the heavens at about eight o'clock in the evening; if earlier, a little to the left; if later, a little to the right. The stars overhead are on the line bisected by the circle marked 60. The horizon is round the ecliptic, looking to the north at the top, to the south at the bottom, to the east or west at the side. I have suggested how some of the cuts given in the work may be utilised round the white sheet. The whole might be framed and glazed with a stout batten at the back for the blue sheet to work on, and a slot cut in the rabbet at the bottom for the cord. This frame then could be turned about, on its side looking to the west, or upside down for the north, and so on, which will be more convenient than if it be fixed to the wall."

Glass Blowing.—M. (*Bishop Auckland*) writes, in reply to SPES MEA (see p. 542, No. 138):—"You will require a Bunsen burner or blow-pipe, a bellows worked by the foot, two pieces of indiarubber tube to connect gas and air (these should have taps at one end to regulate the supply), a few files, some pieces of charcoal with conical ends for expanding tubes, some cotton wadding for annealing the articles, and a supply of glass tubes and rods: these are sold by wholesale chemists, but any local chemist would procure them. The bench or board at which you work should be covered with sheet iron."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—BRASS; KILDON; S. T. (*Oughtibridge*); M. H. T. (*Birmingham*); F. B. (*Leek*); J. S. (*Newcastle, Co. Down*); TINNER; E. A. J. (*West Bowling*); DAMP WALLS; SCRIBBINS; E. P. B. (*Penge*); J. McB. (*Tain*); J. N. (*Perth*); A. G. (*Sheffield*); G. T. (*Oldham*); R. D. T. (*Marylebone*); H. G. H. (*Sheffield*); A. J. T. LE G. (*Guernsey*); C. S. (*South Shields*); T. P. (*Frodsham Bridge*); MELTON CONSTABLE; LEGHORN; ART T.; A. P. S. (*Hyde*); W. J. T. R. (*Hamilton, N.B.*); F. R. W. (*London, N.W.*); H. C. (*Surbiton*); T. C. F. (*Coalbrookdale*); YOUNG CABINET; F. H. B. (*Halifax*); W. T. (*Llantrisant*); F. T. C. (*East Finchley*); TYRO; SIRIUS; W. W. (*Keighley*); J. C. (*Bristol*); J. T. S. (*Sheffield*); A. S. (*Glasgow*); AMATEUR TURNER; ANXIOUS ONE; NO NAME; T. W. (*Accrington*); E. L. (*Wednesbury*); W. W. (*Stamford Hill*); J. W. H. (*Edinburgh*); G. E. M. (*Downton*); M. J. C. (*High Wycombe*); A. B. (*Salford*); C. J. A. (*London, N.*); T. S. (*Bognor*); J. W. T. (*Deptford*); A. E. M. (*Cheshire*).

WORK

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

TERMS OF SUBSCRIPTION.

3 months, free by post	1s. 8d.
6 months, "	3s. 3d.
12 months, "	6s. 6d.

Postal Orders or Post Office Orders payable at the General Post Office, London, to CASSELL and COMPANY, Limited.

TERMS FOR THE INSERTION OF ADVERTISEMENTS IN EACH WEEKLY ISSUE.

	£	s.	d.
One Page	12	0	0
Half Page	6	10	0
Quarter Page	3	12	6
Eighth of a Page	1	17	6
One-Sixteenth of a Page	1	0	0
In Column, per inch	0	10	0

Small prepaid Advertisements, such as Situations Wanted and Exchange, Twenty Words or less, One Shilling, and One Penny per Word extra if over Twenty. ALL OTHER Advertisements in Sale and Exchange Column are charged One Shilling per Line (averaging eight words).

Prominent Positions, or a series of insertions, by special arrangement.

*** Advertisements should reach the Office fourteen days in advance of the date of issue.