WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

BY years of exposure to atmospheric temperature, hardened steel loses hardness.

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The Southport Corporation has adopted the high tension system for its electric supply.

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Steel not only loses its magnetism, but becomes non-magnetic when heated to an orange colour.

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At the World's Fair will be an exhibit of bells displayed in a reproduction of the Tzar Kolokol (king of bells); the famous broken bell of Moscow, which is 22 ft. in diameter and 21 ft. 3 in. high, weighs 443,772 lb. This bell is now used as a chapel.

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The positive plates of a storage battery when fully charged should look like wet slate, nearly black; when partly charged they are dark red, chocolate, or plum colour. The negative plates are always much lighter than the positives, and have a pale slate colour.

* *

Inspection and tests with the St. Pancras electric installation elicited some of the applications of electricity for trade purposes. A ventilating fan was set in motion, a tailor's flat-iron and a hatter's iron were quickly heated; so also were a pair of lady's curling tongs. Cooking, we know, can be done by the heat generated. Gas should now go.

* *

An 8-ft. water tunnel, extending four miles out under Lake Michigan at a depth of 80 ft., has been completed. It was begun over four years ago, and has cost over $1,100,000. When connected with the water-works pumps it will supply 130,000,000 gallons of water per day to the city, bringing the total available supply up to 300,000,000 gallons daily.

* *

Bridgnorth now owns the steepest inclined railway in England. It connects the high and low towns which have hitherto been joined by means of 200 steps and long sloping paths. The entire length is 201 ft., with a vertical rise of 111 ft.—passing through a cutting in solid rock 50 ft. deep—thus giving what is generally termed a gradient of 1 in 1½ ft. The motive power is water, furnished by means of two gas engines.

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Tanning is now being done largely in America by electricity. The following table gives a summary, from the standpoint of duration, of the advantages that tanning by electricity possesses over the old chemical tanning:—

Nature of the hides.	Duration of tanning. By the new process.	By the old process.
Light calf ...	24 to 32 hours.	3 months.
Heavy calf ...	48 ,, 60 ,,	4 ,, 6 ,,
Light cow and horse	72 ,,	8 ,, 10 ,,
Heavy cow and med. ox ...	84 ,, 96 ,,	10 ,, 12 ,,
Heavy ox ...	96 ,, 108 ,,	12 ,, 15 ,,

* *

The trade in macadamised stone between Cherbourg and this country has recently grown with extraordinary rapidity. In 1890 the export from that port increased tenfold over that of 1889, and from 1890 to 1891 it has trebled, amounting in the latter year to nearly 30,000 tons. Railways and tramways are shortly to be made to facilitate the conveyance of this material from the quarries in the Montagne du Roule to the shipping quays, to avoid the expense and delays of cartage, and more powerful machinery is to be erected at the quarries.

* *

On the day of opening the Vyrnwy water supply to Liverpool, 14½ million gallons ran into the reservoir. The surface area of the lake is 1,121 acres, its length being 4¾ miles, with a width of ¼ to ⅝ths of a mile. The dam is constructed of masonry, the weight of which is 510,000 tons, with a length of 1,172 ft., and 161 ft. in height from foundation to parapet. The greatest thickness of the dam at base is 120 ft.; while the length of the aqueduct is 77 miles, divided by balancing reservoirs into six sections. The aqueduct crosses twelve railways, five canals, and about two rivers, including the Mersey, which has proved very formidable to tunnel.

Edison has been awarded the Albert Medal for 1892. This medal was instituted by the Society of Arts in 1862 in memory of Prince Consort, for eighteen years President of this society, and is awarded annually for merit in promoting the arts, manufactures, or commerce. It was first presented, in 1864, to Sir Rowland Hill, and among others the following have been its recipients:—Faraday, Whitworth, Liebig, Lesseps, Bessemer, Siemens, Armstrong, Thompson, Joule, Hofmann, and Helmholtz. Captain Eads, another American, received it in recognition of his engineering feats at the mouth of the Mississippi in 1884.

* *

Tempered steel may be straightened during the process of hardening. Files taken from a bath of melted lead are chilled while red-hot in a stream of running water; the immersion for an instant hardens only the surfaces, while the interior is pliant with heat. At this time the file may be straightened by bending over and under bars. It is stated that a crook has been taken out of a tempered rymer when heated at the bend by a spirit lamp; the heat was sufficient to allow the steel to give, but not enough to start the temper. Steel tempered blue may be straightened by blows with a pened hammer on a smooth anvil, the face of which should be warmed to remove the chill.

* *

The adhesiveness of properly prepared glue will resist a force of 715 lb. per square inch. In an experiment recently performed, a force of 1,260 lb. applied gradually was found necessary to separate two cylinders of dry ashwood, the ends of which presented a surface of 1·76 square inch, and which were glued together, end to end, and allowed twenty-four hours to set. When the joint gave way, after two or three minutes, it was found that the intervening layer of glue was very thin, and did not entirely cover the surfaces joined. The wood used showed a lateral cohesive strength of only 562 lb. per square inch, so had the joint been lateral the wood would have split before the glue yielded. In view of the common idea that a glue joint of timber ends is not strong, this is instructive.

A WARDIAN CASE.

BY C. MAYNARD WALKER.

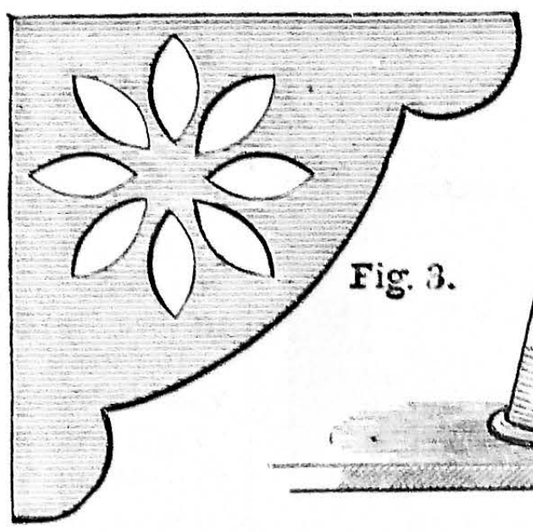
THE illustration prefacing this article will at once explain the use to which a Wardian case is put; but perhaps I may be permitted to explain the use of the name itself. The term "Wardian" is applied properly to a kind of glass case in which plants are grown, and thus worthily perpetuates the name of Mr. Ward, the originator of indoor fern or plant cases, an invention which a recent writer on a branch of horticulture describes "as one of the most useful inventions of the age." Certain it is that if the value or usefulness of an invention were measured by the pleasure it affords, then a Wardian case would stand very high upon the list; and although its value may be unappreciated by those who possess gardens and plant houses, yet such cases of living interest are admirably suited to the wants of thousands of persons not so blessed, but who live comparatively cooped up in towns and cities. Even in the most unfavourable localities for outdoor vegetation, such indoor gardens (really miniature conservatories) may be replete with beauty alike secure from the changes of our fitful climate or from the more deadly impurities of town air, or the poisonously polluted atmosphere of gas or artificially lighted rooms, and continue to thrive, and even luxuriantly flourish, where nothing else exposed would grow. That this is really the case with properly constructed fern-cases, I am able from a long experience to unhesitatingly affirm. I think the most striking instance of the efficacy of the principle of a Wardian case was one which I met with in a showroom of a London house of business situated in a narrow and dingy lane in the City, the showroom itself being directly over a storehouse for paraffin-oil, which, as everyone knows, is more or less volatile, so much so that, in the room referred to, if water was left in a basin, the surface became filmed over with a kind of scum. In this atmosphere a hart's-tongue fern was bravely flourishing under a round glass fern shade; but so soon as the glass was removed, the fern leaves would in a very few minutes droop and hang down, recovering when the shade had been restored a few hours later. If ferns could be cultivated under such conditions, I think a Wardian case may be trusted to behave efficiently anywhere. The term Wardian does not, of course, apply to any particular design, nor the value depend upon the form—the simpler forms of cases, costing but a few pence only in their construction, being as good in their way as more elaborate erections costing as many pounds, providing they are properly managed. The design under present consideration is submitted to the reader as being one which may be easily constructed by any worker of average ability, and one which will cost comparatively little, and be a really serviceable article. It is intended to be made of zinc and glass, except where further enrichment may be desired; the external pillars and cross-bars may be of polished brass, adding very materially to the value of the work.

Fig. 1.—Wardian Case Complete.

And here, having in my mind's eye some reader mistrustful of his ability, and looking with wistful eyes upon a design which appears too elaborate to undertake for anyone who is not an experienced workman, permit me to say that there is no real difficulty in the work, and I will promise complete success to anyone who, being able to solder neatly and *see straight and true*, will follow the directions herewith. The ornamental borders at the base, the shoulder, and top of the case are zinc stampings, and may be purchased in large or small quantities through ordinary zinc dealers, or of Messrs. Still & Co., metal spinners, and are designated in that firm's catalogue as follows:—The top border is No. 373, and costs about 8d. per 3 ft. length; the fret on shoulder of case is No. 231, sold in 8 ft. lengths at about 1½d. per foot run; the stamped border at base of case is No. 384, and costs about 1s. per 3 ft. length. So that in ordering these all that is necessary is to quote the numbers given and to forward the cash. The frame of the case is intended to be made of zinc bar, and this can be obtained through any zinc worker, or direct from Messrs. Treggon & Co., the well-known firm, numbered as follows:—For the base frame, inside the ornamental border, is a rebated bar, No. 53, of which Fig. 2 shows a section; the uprights for the corners of glazed frame of No. 10 bar, and for the cross-pieces at shoulder No. 8 bar, similar in shape to No. 10, but lighter; the frame of the roof being also made of No. 8 bar. There remains the outside pillars, which may be of 1 in. zinc or brass tubing, with cross-bars of ⅝ in. ditto.; six white "Ottoman knobs," obtainable at any ironmonger's, will be wanted for the six feet; as also some ornamental knobs from the same source for the pillar tops. The corner ornaments are made by cutting out the designs, Fig. 3, for the corners of shoulder—the other two can be cut by the eye—from sheet-zinc (about No. 10 gauge) with an ordinary fret-saw. The first thing now to be decided is the size of the case to be made. This is a matter of individual taste and requirements, and will not affect the design in any way. I would suggest that it be oblong in shape; and while being large enough to make a good show, should be handy enough to be easily moved from its position. I would suggest length 2 ft. 4 in., width 1 ft. 2 in., height 2 ft. 9 in.—over all measurements in each case. The requisite materials to correspond must now be obtained, and, having these, we can set to work. First the base frame of No. 53 bar; this, as also the other bar, can be readily cut with an ordinary back-saw to form the necessary mitre, just as though you were making a picture-frame. Care must be taken that these are cut and soldered up true. To this end, constantly apply the square to try the work. The object of this particular form of bar is, first, to provide a base for the outside pillars, and then a flat edge to which can be fastened the ornamental border, and leave a neat flat surface between it and the glass frame. Next cut a piece of No. 10 sheet-zinc about ¼ in. smaller each way than the frame, and solder the same to the under side of the frame. Make a centre mark in this bottom, and drill a ¾ in. hole, into which solder a zinc tube about 2½ in. high, leaving about ¼ in. projecting underneath. This tube is an air-vent to the interior of case. Next cut up some No. 10 bar for the corners, the rebates of which must be cut away a

distance of 2 in. from the top, so that the end of bar above the frame gives the effect of a free pillar. Where the rebate is cut off must be made good with solder, and filed up neatly. These uprights are to be soldered into the rebate of the base, leaving a space so that each corner outside pillar has room to stand clear as shown (Fig. 1). Again, great care must be taken that these are soldered perfectly upright, and square to each other; the same remark applies to fixing the cross-bars of the shoulder. The roof is now to be made, and is very much more convenient if made to take off and on as a separate affair. This is made of No. 8 bar, carefully mitred and fitted, so that the glass is put in from the outside. The construction is shown by the plan, Fig. 4, the middle portion forming a ventilator when in use with slips of glass. For smaller cases no end doors are necessary, but in one of these or larger dimensions a door must be fitted at each end. These consist of a pair of frames of No. 8 zinc bar, hung on hinges, and high enough to clear the cross-bars, so that the ends are divided into two by an additional length of bar. Across the ventilator at top are fixed two bars upon which to hang the fern baskets—a short length of bar, with a hole drilled and fitted with an S-hook, answering the purpose. Having the borders and fret pieces ready, and fastened by solder into their respective positions, the frame should now be glazed. Leaving the outside pillars for the present, the two large squares of glass should be of 26 oz. sheet, as also the lower part at the ends, while the roof and the doors may be of ordinary window glass. The reason for adopting so thick a glass is that, if it be desired to use the case as a combination of aquarium and fern case—*i.e.*, the lower portion on a level with the cross-bars being used as an aquarium, and an ornamental rockwork rising from the bottom to a little above this level, upon which to grow ferns and sub-aqueous plants—all we have to do is to stop up, or do away with, the air-tube at the bottom, make it waterproof, and our glass is strong enough for the purpose; but our present aim is a plant case only. Having glazed the case neatly with ordinary putty, we shall add considerably to the rigidity by mixing up a batter of Portland or Roman cement, and pouring the same into the case to nearly the height of the air-tube, the work standing on a perfectly level place during the operation. This will set into a hard and self-fitting bottom. Previous to doing this, however, the knobs should be put on by passing ordinary screws through them and the bottom of the case, the cement setting them in firmly. All the work should now be cleaned up neatly; and, lastly, fix the pillars and fender bars and their ornaments, and the case is ready for painting. Any of the following will look well—chocolate, black, French grey, or celadon, each picked out with gold. We now come to the important question of planting the ferns. It will be seen from the illustration that the plan of arranging these differs from that generally in vogue; every reader may not endorse my opinion, but I think where the lower part of the case for some 6 in. or so deep, and close up to the exterior lines, is used as a box to contain the fern mould, a needlessly clumsy and heavy effect is produced. This is avoided, and a much larger show of foliage is visible, by adopting the plan of building up a rockwork enclosure formed of cemented pieces of coke, about 2 in. from the glass sides, of a rustic and irregular form, rising higher towards the centre (see Fig. 5), the margin of 2 in. being covered with shingle or crushed shells. A thick layer of broken crocks are laid in the bottom of rockwork first to provide drainage; a root or two of ivy is under-planted, of a *non-clinging* variety, and the ferns planted over all to taste. The spacious roof of the case is intended to be occupied as shown with hanging baskets. These are easily made by taking two flower-pots, and boring three equidistant holes under the rims, which, after being roughly covered with Roman cement and coloured to taste, are suspended with chain or wire (see Fig. 6). There is very little difficulty in growing ferns. Get the mould from a good nurseryman, and you will have little to do but keep the roots always moist. With regard to the position in which the case should stand, my own experience favours a window looking west; if this is not obtainable, and you are obliged to put up with a window exposed to strong sunshine, care must be taken to shade it during the sunny hours.

Little more remains to be said, as the figures in the illustration explain themselves; but should any difficulty arise, "Shop" is at the service of all readers.



Wardian Case. Fig. 2.—Section of Bars. Fig. 3.—Fret for Corners. Fig. 4.—Plan. Fig. 5.—Plan of Base of Case, showing Position of Rockwork. Fig. 6.—Method of making Baskets. Fig. 7.—End of Case, showing Position of Doors.

HOW TO MAKE AND WORK THE SPECTROSCOPE.

BY CHARLES A. PARKER.

PREPARATION OF THE OBSERVING TELESCOPE—TUBING—OBJECT-CELL—EYEPIECE—DRAW-TUBE—CELL FOR EYE LENS—CELL FOR FIELD-LENS—MODE OF MOUNTING LENS—STOP COLLAR—MODE OF MOUNTING LENSES WITHOUT CELLS—EYEPIECE COLLAR—BAYONET-JOINT FOR COLLAR—MOUNTING LENSES IN WOODEN CELLS—SELECTION OF SUITABLE LENSES.

We must now turn our attention to the preparation of the observing telescope, the body tube of which is precisely similar to the body tube of the collimator described in the previous paper, as will be understood by the following condensed description:—Take a 10¾ in. length of stout-drawn brass tubing, of 1½ in. diameter, to match the collimator tube, and having trued up both ends, provide it with a ¾ in. brass stop, which is soldered in the middle of the tube the same as before. When this has been done, prepare a brass cell to contain the object lens, which should be an ordinary 1½ in. plano-convex lens of 12 in. focus, similar to the collimating lens. As two methods of preparing these cells were described in the previous article, it will be unnecessary to repeat the mode of procedure, which is in every way identical with that already given.

The object-cell being completed, we must next provide the telescope with an eyepiece, which is shown in section in Figs. 21, 22, and 23, with the lenses mounted in three different ways, in order to suit the taste or ability of the maker. The lenses required for the eyepiece will be an ⅝ in. eye-lens of 1 in. focus, and a ¾ in. field-lens of 2 in. focus, both being of the ordinary plano-convex type. First true up both ends of a 3 in. length of drawn brass tubing, 1 in. in diameter, and then proceed to fit it with a couple of brass cells to contain the above lenses. These cells should be cast from suitable patterns, prepared according to the section of the eyepiece shown in Fig. 21, after which they may be turned in a lathe to fit the eyepiece tube, the cell to contain the eye-lens being threaded to screw into a corresponding thread inside one end of the above-mentioned tube. In turning the seat for the lens the edge should be left as thin as possible, and only $\frac{1}{32}$ in. above the lens, being turned very thin, so that a slight pressure with a burnisher will be sufficient to turn the edge down over the lens, and thus secure it in position.

The cell for the field-lens is made in precisely the same manner, with the exception that it will not require to be threaded, as it is simply intended to slide somewhat stiffly into the eyepiece tube until about 1¾ in. from the eye-lens. The best way to secure the lenses in position is to first mount the cell in a recess bored in a soft wood chuck, and then bend the edge of the brass over the lens just sufficient to hold it in position,

after which the cell is mounted in a lathe for the edge to be burnished over the lens while it is being spun round. A small disc of brass, pierced with a ½ in. aperture, is now soldered into the eyepiece tube at 1 in. from the outer end, in order to form a stop, after which the eyepiece is fitted into the body tube of the telescope by means of a suitable collar, through which it is made to slide. Having cast the collar from a pattern made to the form of A, Fig. 21, fit the same into a wood chuck, and then mount it in a lathe and bore out the interior, so that the tube of the eyepiece will just slide easily within it, the fitting being finished by rubbing the tube lengthwise with emery cloth applied on hollow rubber to suit the tube, after which the collar is threaded, and then made to screw into a corresponding thread at the end of the telescope tube, or, if preferred, it may be fitted to the latter by means of a bayonet-joint, to be shortly described.

The following plan of mounting the lenses, which is much more simple than the foregoing, does away with the necessity for making castings of the cells, and for this reason it will doubtless be employed by some of our readers. First obtain a 3 in. length of tolerably thin drawn brass tubing, exactly 1 in. in diameter, together with another length of similar tubing, which will just slide in telescope fashion inside the first. Next proceed to true up both ends of the first piece in a lathe, so that the tube, when placed on a perfectly level surface, will stand exactly vertical. This done, prepare a stout circular disc of brass, to measure 1⅜ in., and then cut or drill a ⅜ in. countersunk circular opening in the centre, after which the disc should be soft soldered to one end of the larger tube just prepared. Assuming that the eyepiece and the field-lens measure exactly ½ in. and ¾ in. in diameter respectively, prepare five discs of brass of the following dimensions, which will just slip into the larger tube of the eyepiece :—The first disc should be furnished with a ½ in. hole, which must be cut or drilled straight through the metal, and not countersunk ; but the second disc may have a ⅜ in. slightly countersunk aperture, and the third a similar ½ in. opening ; the fourth disc, which is ⅝ in. in diameter, also being countersunk ; the fifth is, however, a ¾ in. circle cut straight through ; but the sixth disc has another ⅝ in. countersunk hole. Now hold the eyepiece tube cup downwards, and drop the eye-lens in first, plain side downwards, and after this the first and second of the discs—the last named having the chamfered side next to the lens—following this up with a ¾ in. ring of the smaller tubing, and then the third disc, which forms the stop of the eyepiece, with another ¾ in. ring of tubing above this. The fourth disc is now slipped into the tube with the countersunk side towards the eyepiece ; then the field-lens is dropped on to this, plain side downwards, after which the fifth disc is put on to this, thus centreing the lens in respect to the tube ; and, lastly, the sixth disc, with the chamfered side next to the lens, the remaining length of tubing being afterwards pushed into the tube, in order to retain the whole in position.

The eyepiece will now be ready to be fitted into the adjusting collar. To make this, true up both ends of a ¾ in. ring of 1¼ in. brass tube, and then fit a disc of brass tightly into one end of this collar, flushing a small quantity of soft solder round the edge of the disc as an additional security. This done, turn in a lathe another disc, stouter than the first, to measure 1¾ in. in diameter, and then cut a 1 in. hole in the middle of this, into which the eyepiece tube should be made to tightly fit, afterwards soft soldering this disc on to the open end of the collar just prepared. It will now be requisite to mount the collar in a lathe, and turn a corresponding hole, 1 in. in diameter, at the other end of it, which will thus enable the eyepiece tube to slide smoothly through the collar. It is important to see that these holes are cut perfectly parallel and true to each other ; for if this is not so the eyepiece, when fitted to the telescope, instead of looking at the centre of the object-lens, will point round the corner, like the Irishman's gun.

The collar thus prepared may now be fitted to the end of the telescope tube by means of a bayonet-joint, prepared in the following manner :—Take a tolerably stout

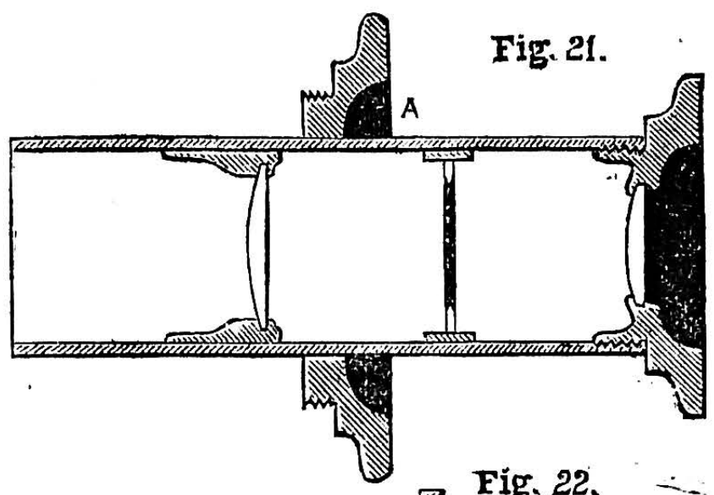


Fig. 21.

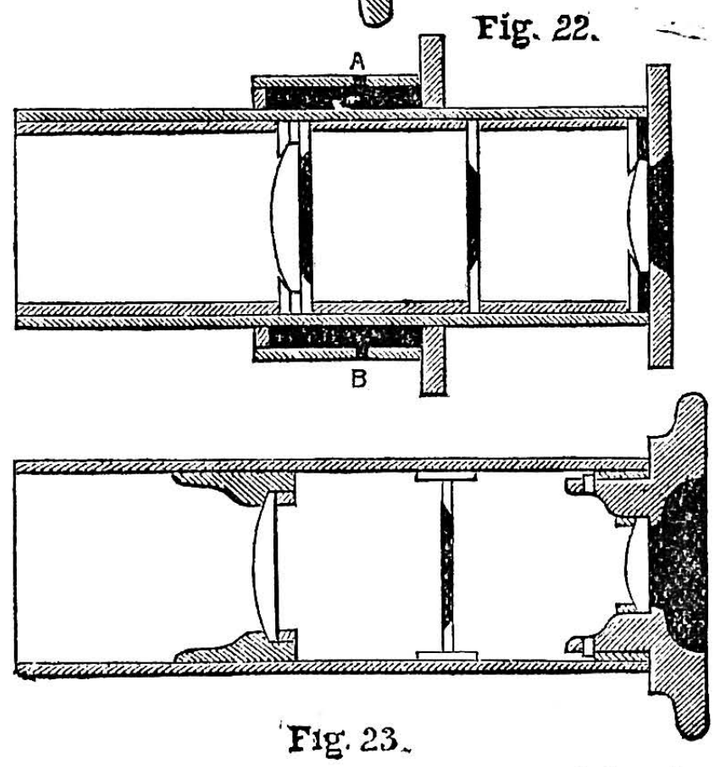


Fig. 22.

Fig. 23.

The Spectroscope. Fig. 21.—Section of Eyepiece Tube. Fig. 22.—Simple Form of Eyepiece. Fig. 23.—Section of Eyepiece with Wooden Cell.

strip of brass, about ¼ in. wide, and bend it into the form of a ring, which will just spring tightly into the end of the telescope tube, flush with the outer surface, in which position it is fixed by means of some soft solder run round the ring between the two surfaces, any extraneous solder being afterwards removed by the aid of an old file. A couple of holes are now drilled and tapped on opposite sides of the collar, in the position indicated at A and B in Fig. 22, to receive a couple of small screws which form the bayonet-catch, and are tightly screwed into the tube, after which a couple of slots are filed in a corresponding position in the ring of the telescope tube, through which the screw-heads pass until they are just clear of the ring, when a slight turn in either direction serves to secure the collar in position. The screws must, of course, be planted in a suitable manner, so that the collar fits securely into the telescope tube without unnecessary freedom. It is better to file the collar to fit the tube than to have it too easy.

In Fig. 23 is shown yet another plan, the lenses being mounted in wooden cells, a mode of procedure which will doubtless be adopted by those of our readers who are not adepts at brass finishing. To make these cells, mount a piece of well-seasoned Spanish mahogany in a chuck, endways of the grain, and then proceed to turn it to fit the tube, afterwards truing up the end carefully. Now proceed to turn the seat for the lens, after which the hollow should be worked out from behind and the wood finished off as clean as possible. As soon as the lenses have been fitted in the cells thus prepared, turn a couple of brass rings to fit into each one, for the purpose of securing the lenses in position, after which these rings should be blacked in the usual manner. The wooden cells may be painted with the dead black at the same time that the body, tubes, etc., are varnished. It may also be stated that the eyepiece is attached to the telescope tube by means of a collar, constructed according to one or other of the plans before described. In the event of wooden cells being employed for the lenses, it will be necessary to mount the eyepiece by means of a bayonet-catch, made in the manner above described, which is clearly illustrated in section in Fig. 23.

Before passing on further, it may be advisable to give a few details with reference to the lenses. As previously stated, we shall require an object-lens for each tube, 1¼ in. in diameter and 12 in. focus, together with an eye-lens, ½ in. in diameter and 1 in. focus, and a field-lens, ¾ in. in diameter and 2 in. focus, all these lenses being of the ordinary plano-convex type. A telescope constructed in the manner described will give an inverted image, but this is of no consequence in a spectroscope.

It must be understood there are two distinct classes of lenses—the chromatic and the achromatic ; the first named giving a coloured fringe to all objects viewed through it, which in a spectroscope is not of very great importance. In the achromatic lenses this fault is corrected by the use of a second lens, which is cemented to the first by means of Canadian balsam. Although achromatic lenses may be employed with advantage, the results obtained are not of sufficient importance to warrant their use, unless the reader is so disposed.

When purchasing the lenses it will be well to see that they are correctly edged—that is to say, see that the edges have been ground away in a lathe at an angle to the plain side of the lens. Lenses, as above named, can be obtained from any manufacturing optician, at prices varying from about 6d. each to 1s. or more, according to the firm supplying them. In the trade they only cost a few pence each. The focus of a lens can be readily ascertained by holding it between the sun and a piece of card or a whitened wall, the distance which gives the most distinct image furnishing the focus of the lens.

It will be necessary to keep the hands quite clean and free from brass turnings when handling the lenses, otherwise the surface will soon be spoilt with ugly scratches. For this reason it is advisable to spread a newspaper over the bench when they are being tried in the seating of the cells ; or, better still, this job may be done clean away from the litter of the work bench.

In my next paper I shall hope to speak about the Stand, Table, Supporting Collar, and other parts of the Spectroscope. Meanwhile, master what has already appeared.

SCREW-CUTTING IN THE LATHE.

BY J. H.

Leading Principles and Simple Trains.

Mode of Treatment proposed—The Lathe—The Leading or Guide Screw—Graphic Examples of Relative Rates of Revolution—The Case of Fractional Pitches—Meaning of "Driver" and "Driven" Wheels—Meaning of a "Simple Train."

Mode of Treatment proposed.—Many of the lads in our turneries experience so much difficulty in learning the mystery—for so it appears to them—of cutting screw threads, that it seems desirable to treat the subject in a way rather different from the mere descriptive method usually adopted. I propose, therefore, to explain it by means of graphic outlines; and if to some lathe men my descriptions may seem rather elementary and somewhat prolix, my apology is the difficulty which many apprentices and, for the matter of that, metal turners experience in mastering the principles of screw-cutting.

The Lathe.—I think I may safely assume that every reader of Work who feels any interest in lathe matters understands the essential mechanism of the screw-cutting lathe. At any rate, I shall make that assumption, and not occupy a page of our valuable space with illustrated details of headstock gear and slide-rest mechanism. Should, however, the ideas of any of our younger readers on this subject be rather hazy, they can find the mechanism of the screw-cutting lathe described clearly and fully in "Cutting Tools worked by Hand and Machine" (Cassell & Co.), Chapter VI., and in "Metal Turning" (Whittaker & Co.), Chapter I. I will therefore plunge at once into my subject.

The Leading or Guide Screw.—In Fig. 1 let A represent the leading screw of a self-acting lathe, and B a rod upon which screws

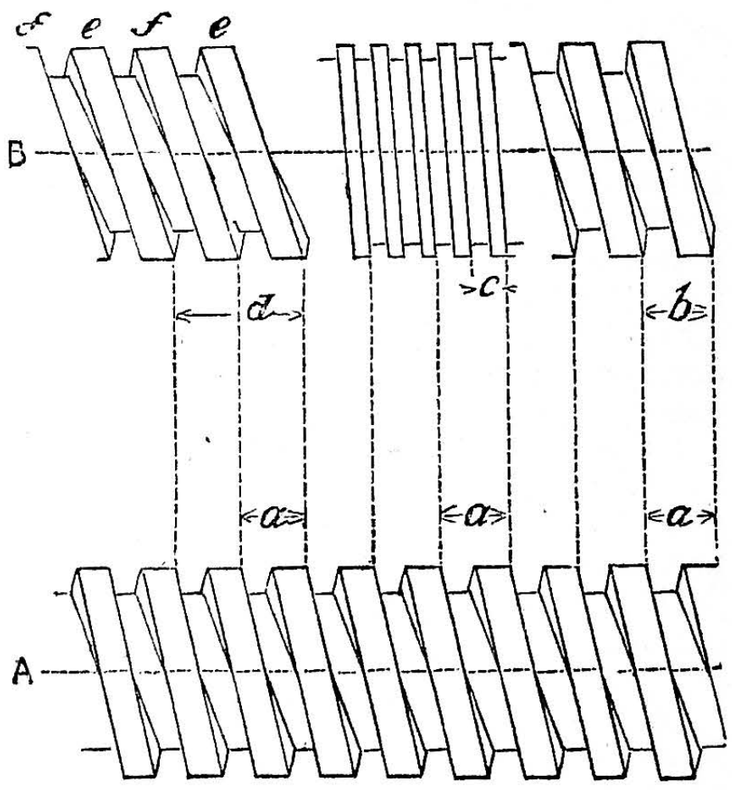
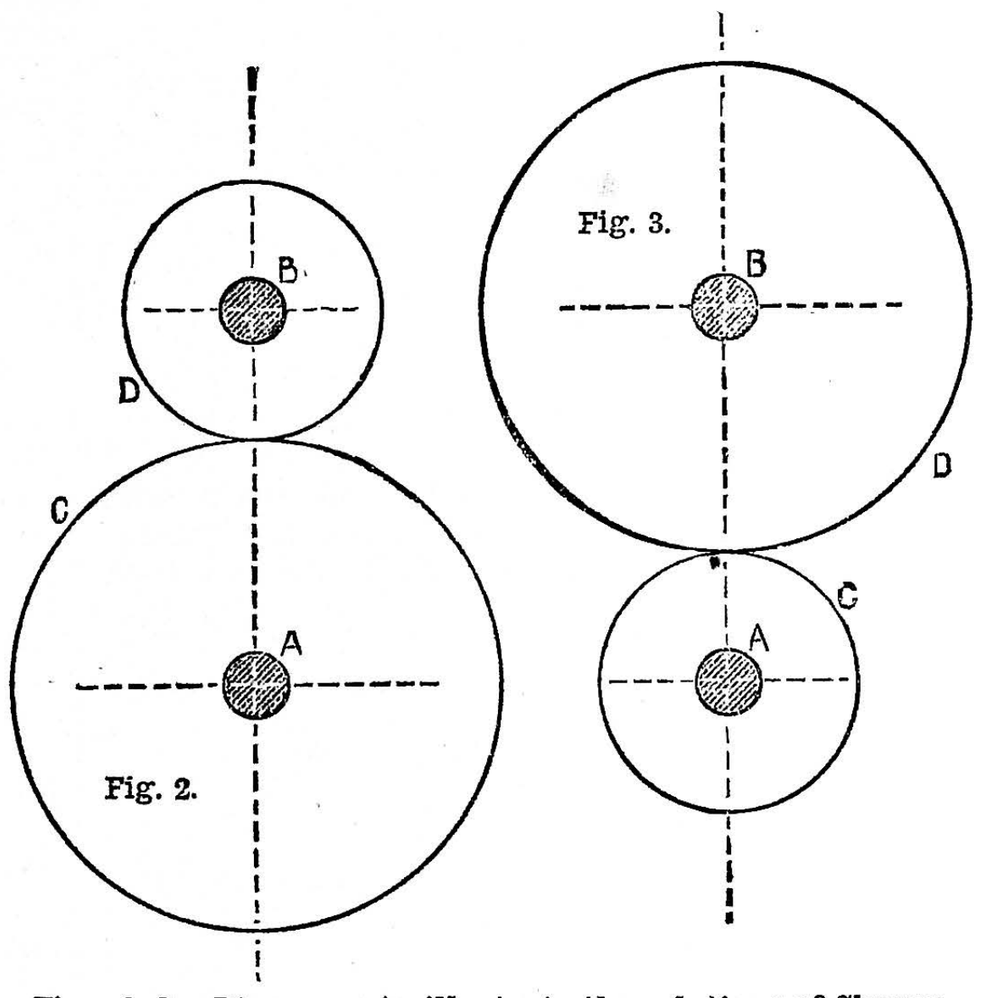


Fig. 1.—Graphic Diagram to illustrate Pitches Equal, Finer, and Coarser than that of the Guide Screw.

have to be cut. Now the problem is simply this: How to utilise the leading screw, A, whose "pitch," or rate of thread, is constant and invariable, for the cutting of threads of diversified pitches upon rods, B, running between lathe centres. This evidently resolves itself into a question of the relative rates of revolution of A and B. The headstock mandrel, to which the work, B, is centred, drives the leading screw through the medium of change-wheels. The problem, therefore, is to impart the required ratio of speed from the mandrel, through the change-wheels, to the guide screw.

Graphic Examples of Relative Rates of Revolution.—In Fig. 1, *a*, *a*, *a* is the pitch of the guide screw, which screw is encircled by the clasp-nut. The pitch, I may remark, is equal to a thread and a space; or the distance from centre to centre of adjacent threads; or from centre to centre of the spaces; or, in the most accurate language,



Figs. 2, 3.—Diagrams to illustrate the relations of Change-Wheels.

the longitudinal or axial distance covered by a thread in a single revolution round its cylinder. Say this screw is of $\frac{1}{4}$ in. pitch. If we want to cut a screw of $\frac{1}{4}$ in. pitch—*b* on B—then the clasp-nut and tool point must be made to traverse the distance *a* and *b* in equal times. In other words, A and B must each make a complete revolution simultaneously. Clearly also, if we desire to cut a thread on B of $\frac{1}{8}$ in. pitch, *c*—viz., of one-half the pitch of A—the rod B must make two revolutions while A is making one. But, on the other hand, if we want to cut a thread on B of $\frac{1}{2}$ in. pitch, *d*—viz., of twice the pitch of A—then B must make but one revolution while A makes two. (Note, by the way, that this screw is double threaded—that is, *e* is one thread and *f* another.) The problem, therefore, is resolved into one of relative rates of revolution and of relative traverse of the cutting tool in equal times. *And the rates of revolution of* A *and* B *are clearly in inverse proportion to the pitch of* A *and* B. That is to say, to cut a screw upon B of half the pitch of A, then B must revolve at twice the speed of A; and to cut a screw on B of twice the pitch of A, then B must revolve at half the speed of A. Hence the change-wheels used must be selected so that the numbers of their teeth shall bear the same proportions as the screw rates of the guide screw and of the screw to be cut; and they must be so fixed that the inverse relations required shall be obtained. So that, if the rates are equal, wheels of equal size will be used on the spindles both of the guide screw and screw to be cut. But to cut a screw, *c*, of $\frac{1}{8}$ in. pitch on B—viz., of half the pitch of A—a wheel must be put on mandrel B half the size of that one put on A (as in Fig. 2). Then wheel C, Fig. 2, will only make half a revolution to a complete revolution of wheel D, and the leading screw, A, will be retarded in relation to the rod, B, by just one-half, and a thread of $\frac{1}{4}$ in. $\div$ 2 $= \frac{1}{8}$ in., will be cut on B. Conversely, to cut a thread of $\frac{1}{2}$ in. pitch, *d*, on B—that is, twice the pitch of A—a wheel, D, will be put on B, Fig. 3, having twice the number of teeth of the wheel C on A, and the rate of traverse of the leading screw, A, will be double that of the rod, B.

These are the fundamental facts, which, better than any set rules, should be well assimilated in the mind of the screw-cutter. There need be little floundering among the rules which appear in so many and various forms in treatises on screw-cutting, and which are often a source of mental confusion.

The Case of Fractional Pitches.—Going a step further, precisely the same inverse relation must exist when cutting fractional threads. At A in Fig. 4 we have the same leading screw of $\frac{1}{4}$ in. pitch. At *b* one and a half threads are cut in the length of the pitch of the guide screw. At *c* one thread is cut in the space occupied by one and a half threads of the guide screw. To cut *b* a wheel must go on the guide screw, A, having one and a half times the number of teeth of that on the lathe mandrel, B. To cut *c* a wheel must go on the lathe mandrel, B, having one and a half times the number of teeth of that on the guide screw.

Meaning of "Driver" and "Driven" Wheels.—The wheel that is put on the lathe mandrel, B in the figures, is called the driving or "driver" wheel; the one that goes on the guide screw, A, is termed the "driven" wheel. We say, therefore, that the same ratio must subsist between the number of teeth (or diameters) of the driving and the driven wheels as exists between the pitch of the guide screw and the pitch of the screw to be cut. The same thing is said in another way, convenient to remember, thus: When cutting threads of finer pitch than that on the leading screw, the smaller wheel must drive and the larger be driven. When

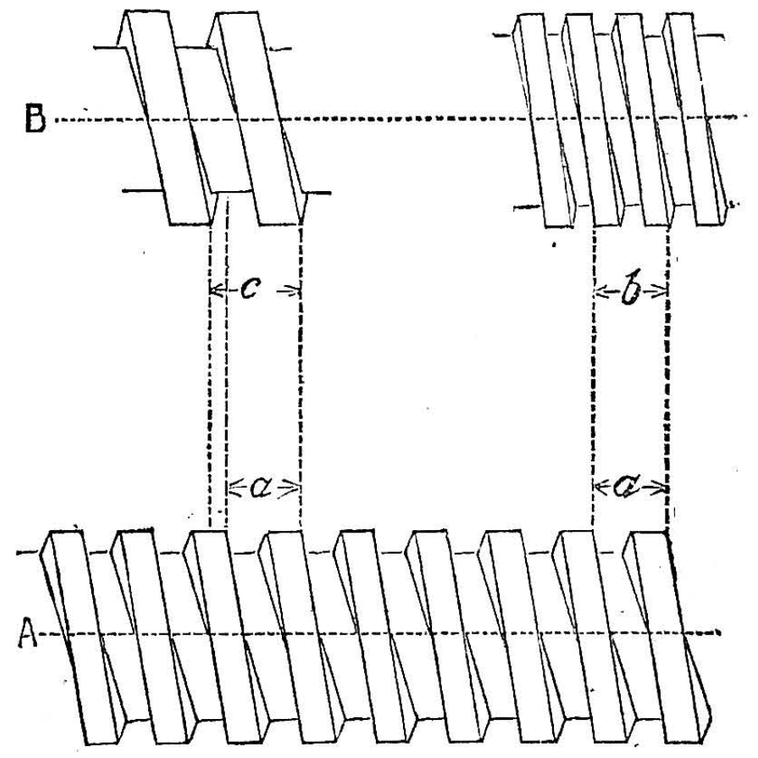


Fig. 4.—Graphic Diagram to illustrate Fractional Pitches.

cutting threads coarser than that on the leading screw, the larger wheel will drive and the smaller be driven. These are axioms to be committed to memory.

Meaning of a "Simple Train."—When there is only one driving wheel and one driven, we have what is termed a simple train of wheels. But it often happens that several wheels are required to cut a screw of very fine or of very coarse pitch, and these

compound trains, as they are called, sometimes occasion difficulty as to the correct relative locations of the several wheels. The necessity for the employment of a compound train arises when the numbers representing the ratio of the leading screw and of the screw to be cut extend beyond the limits of an ordinary series of change-wheels. Those limits are commonly wheels of twenty and one hundred and twenty teeth. The ratio of these is $\frac{120}{20} = 6$, and when limited by these wheels, the ratio between the pitch of a guide screw and that of a screw to be cut on any lathe cannot exceed six, unless a compound train is employed. In a lathe having a guide screw of $\frac{1}{4}$ in. pitch—*i.e.*, of four threads to the inch — twenty-four threads to the inch mark the limit that can be cut with a simple train, thus: $\frac{24}{4} = 6$. In a lathe having a guide screw of $\frac{1}{2}$ in. pitch—*i.e.*, of two threads per inch —the limit is reached at twelve threads per inch, thus: $\frac{12}{2} = 6$. I will not now commence this rather wide subject of compound trains, but will leave my readers to digest the fundamental principles laid down in the present article, leaving compound trains to be treated in the second paper.

PHOTOGRAPHIC PRINTING FRAMES FOR THE MILLION.

BY CHARLES R. KING.

WHAT is more annoying than to find, with the ordinary small printing frame, that the movement of opening the back has caused the print to shift?

Here is a printing frame that is proof against such a failure. The writer has used it for two years wherever he wanted a close contact all over the paper on the negative, and to be certain of its not moving. For this reason he values these frames at double that of the shop-made articles.

How to make it. A steel glass-cutter to cut up your waste negatives, and several dozen of the paper-clips known as "bull-dogs"; or you can use ordinary wood-clips, as does a well-known Parisian photographer, who employs this device almost exclusively; but the iron clip is far better, because—please note—you can print up to the very margin of landscape views, without being obliged to use a face-glass, as he does. This face-glass takes the place of the plate-glass in large printing frames. Here, with these clips, it is unnecessary. You will have made a dozen printing frames with their pads of blotting-paper in the same time this has taken to write. The "frame," minus one-half, is shown in Fig. 1.

For printing plates up to 15 in. by 12 in., the only additional work necessary to make a first-rate printing frame is strips of wood just the length of the backing-glasses, which may be two, three, or four in number. The ends need to be bevelled. The clip is clasped over them in the manner shown (Fig. 2). If the strips are so thin as to slightly spring off the middle of the backing-plate, a little tuft of paper may be inserted without fear of breaking the negative, so long as it is done with reasonable care.

By using a face-glass of large size, this frame enables one to print small negatives on any size piece of paper where broad margins are required, as in contact bromide printing and platinotype.

Try it; you will never use a wooden printing frame again. It is no expense. There are always old negatives about, and the clips are always useful in the office. If you are a traveller, you will never add to your baggage a clumsy printing frame. You will take some clips, and your failures will supply the glass you may require.

THE ART OF STAIRCASING.

BY GEORGE F. CHILD.

Close String Stairs with Winders.

INTRODUCTION—WORKING DRAWINGS, PLAN, AND ELEVATION—SETTING OUT WALL-STRINGS—SETTING OUT OUTSIDE STRING—GLUING UP WALL-STRINGS—CROSS-TONGUES FOR JOINTS—GLUING UP STAIRCASE—HALVING NEWELS — FORM OF BULL-NOSE STEP — HOUSING NEWELS—EASEMENTS.

Introduction.—In the plan of the staircase before us it will be seen that we have a somewhat awkward arrangement to deal with, the "going" being so little that winders at both top and bottom are imperative. It will also be remarked that a door,

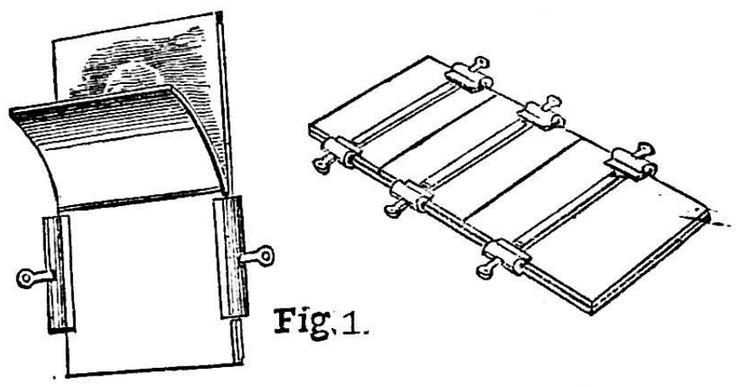


Fig. 1.

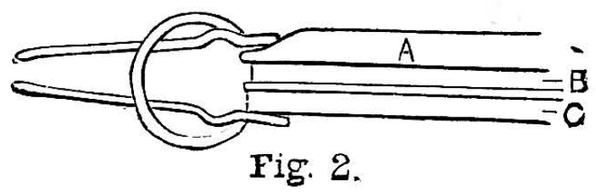


Fig. 2.

Photograph Printing Frame with cut Wood. Fig. 1.—Frame. Fig. 2.—Clip—A, Wood; B, Negative; C, Glass Back.

D, opens directly upon the stairs at the top, thus making a special arrangement at this point necessary.

Working Drawings, Plan, and Elevation.—Having drawn the enclosing walls of plan and elevation and marked in the height for landing, L, we find that we cannot manage with less than thirteen risers, which, as we know, gives twelve treads, or steps. Now, on referring to the plan, we plainly see that to arrange for a straight flight it will be necessary to introduce a landing at the top and a space equal to a landing at the bottom. This, of course, cannot be done, as we could not obtain space for our twelve steps. We now try if it can be managed with winders at the bottom, and again fail to get the necessary going. By this it will be seen there is no alternative but winders at top and bottom also. Having decided upon our course of action, we proceed to set out the winders at the bottom. By introducing a step in front of the newel we materially assist our going, as it gives us an extra tread; therefore draw the step No. 1. Now draw the three winders as previously described. Next set off the width between wall and newel at the top, making it equal to the bottom. We now notice that the door on the landing, L, comes rather close to the top step, thus making it dangerous for a person passing through in the dark. To obviate this, the top winder (or, more correctly speaking, the landing) should be brought forward as from *a* to *b*, which is, of course, an improvement. Next set off the three winders, dividing them out equally as before.

We now find that by this performance we reduce the number of our treads by seven—being four at the bottom and three at the top. This gives us five to deal with; therefore, divide the space remaining between the winders into five equal portions, thus completing our plan.

To finish the sectional elevation, project the treads from the plan to intersect with the lines drawn for the risers as before, and drawing the easements on string. The dotted lines at the bottom represent the two first steps and newel, and at the top the landing, newel, balusters, and handrail respectively.

Setting out the Wall-Strings.—We now, by taking the most careful measurement, obtain the length necessary for the string, which would be the distance between *a* on Fig. 5 to *b* on Fig. 6. (These two figures really should be one, as plainly shown; the reason for being drawn thus is obvious.) Now roughly draw the three steps from 5 to 9, and produce the lines 4 and 10 for the winders, and the lines 3 and 11 also. The spaces between the dotted lines represent the necessary stuff to be glued on for the winders. It has been assumed that the winders have been set out full size on a board, as before described, as to repeat the full directions with each plate is altogether unnecessary. There being something different in each plate renders a careful study of the whole desirable.

Setting out the Outside String.—To set out this string, all that is necessary is to mark the shoulders, s, s, Fig. 12, and draw the steps from the pitch-board. The tenons are cut as shown, and draw-bored into the newels.

Gluing up the Wall-Strings.—The wall-strings must be glued up with a tongue, as before described. The elevation in Fig. 3 is obtained by projecting the winder and marking the height of each riser to meet it. Fig. 4 is drawn in exactly the same manner, F L being the floor line and s the skirting. The method of applying the bevel for these two strings has been described in a previous article.

Cross-Tongues for Joints.—To ensure a good job, a tongue should be used for all joints known as a cross-tongue. This is so called on account of its being cut across the grain of the wood, which, of course, makes it much stronger. This form of tongue is illustrated at Fig. 11. A piece of board is obtained of the requisite thickness, and a portion cut off at an angle, as from *a* to *b*; the tongues are then sawn off from this point until a sufficient number are obtained.

Gluing up Staircase.—To glue up this staircase, it is well to fix the flyers first, as previously described. The newels may then be joined, and the winders, with the short strings, glued and wedged into their proper positions.

Halving Newels.—As these newels might be of an inconvenient length, and perhaps prevent the staircase being carried into the building, it is a good plan to halve them together above the winders, and fix them with screws when required.

Form of Bull-nose Step.—The step seen at Fig. 7 is a common form of bull-nose, often used where brought forward beyond the staircase, it being less likely to be in the way than a square one.

In this example the riser is simply cut to a mitre and nailed, blocks being glued in the angles at the back. The tread is nailed on the top, showing the same margin (about

1 in.) at the front and end. A solid block of deal is often used in place of this arrangement of riser, but this is entirely a matter of fancy, either plan answering equally well.

Housing Newels.—Fig. 8 will give a very good idea of the manner in which the winders are housed into the newels. M represents the mortise into which the tenons on the strings enter. The top step passes round the newel and under the last riser on landing, which is plainly seen. More will be said in the following chapter on the subject of housing the newels, as it is very important that this point should be perfectly understood, so much depending upon it.

Easements.—Two methods are here shown of obtaining a perfect easement in a practical manner. This is often done by simply bending a thin strip of wood and marking round the curve with a pencil. Fig. 9 is very little trouble, and gives a perfect easement. To construct this, draw any number of equal divisions from the angle, and draw lines from corresponding numbers on both sides, when the points thus obtained give the required curve.

Fig. 10 is another method. This is drawn by taking any equal distances, as A and B, and erecting perpendiculars to them, when the point where the lines meet gives the centre from which to strike the arc.

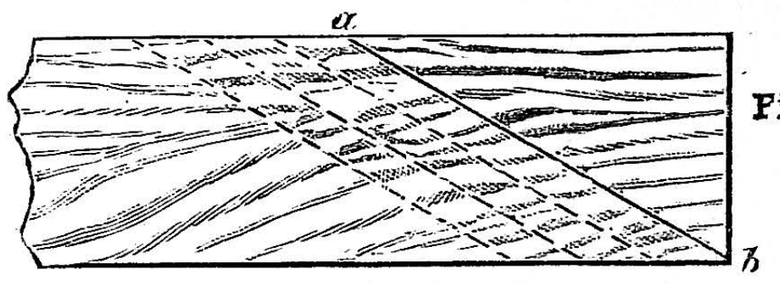


Fig. 11.

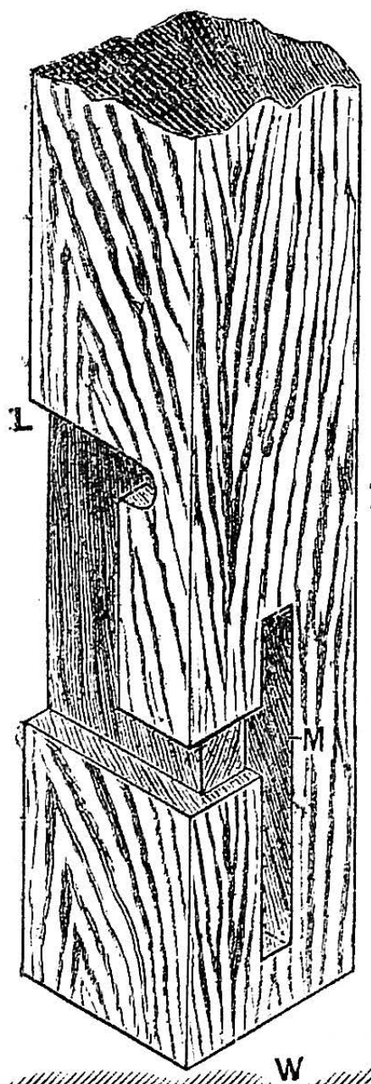


Fig. 8.

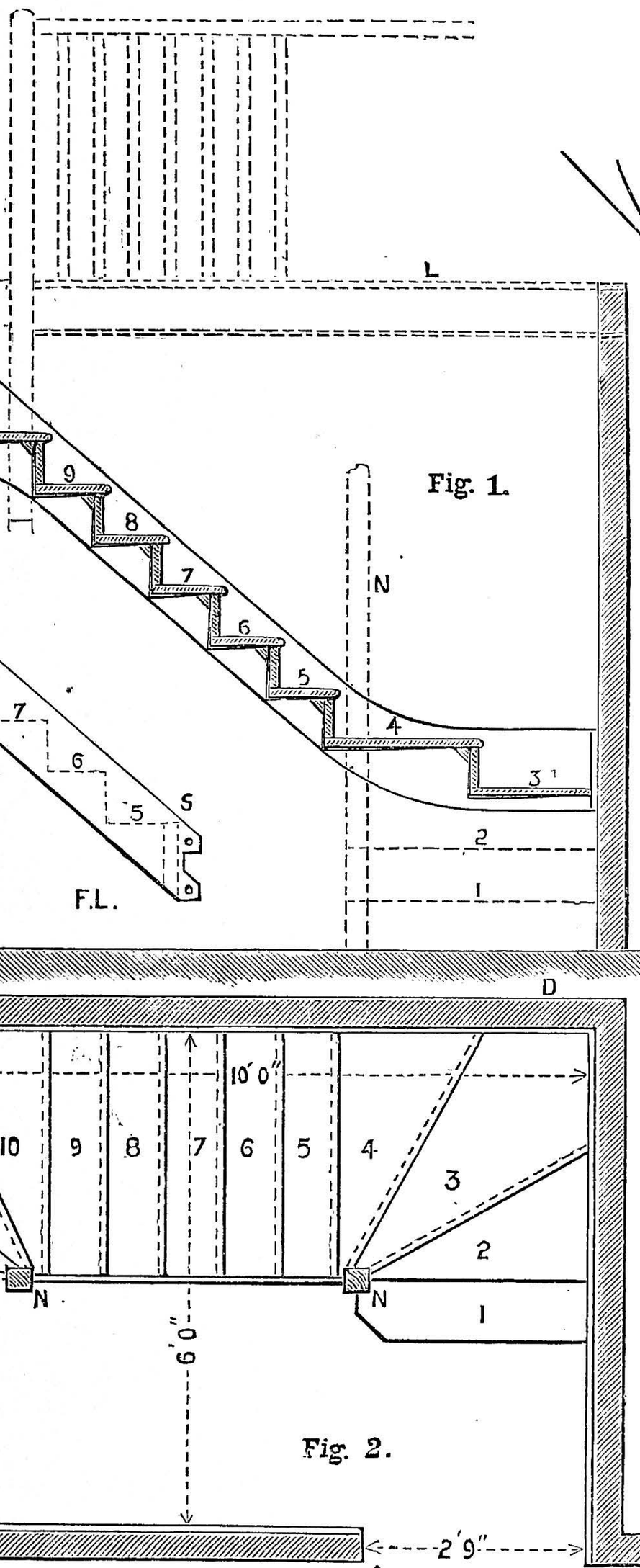


Fig. 1.

Fig. 12.

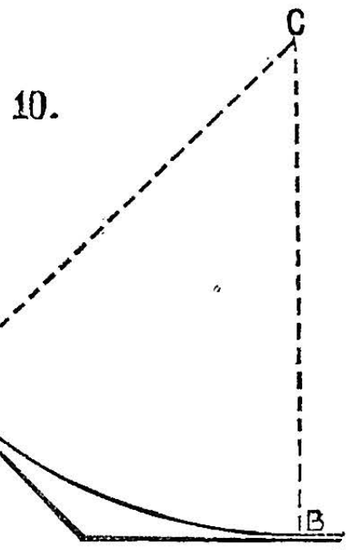


Fig. 10.

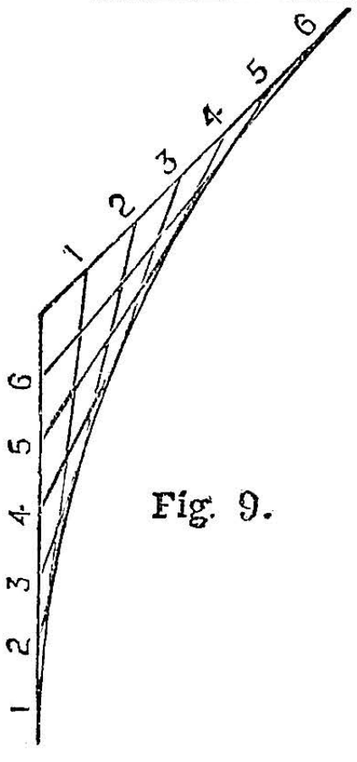


Fig. 9.

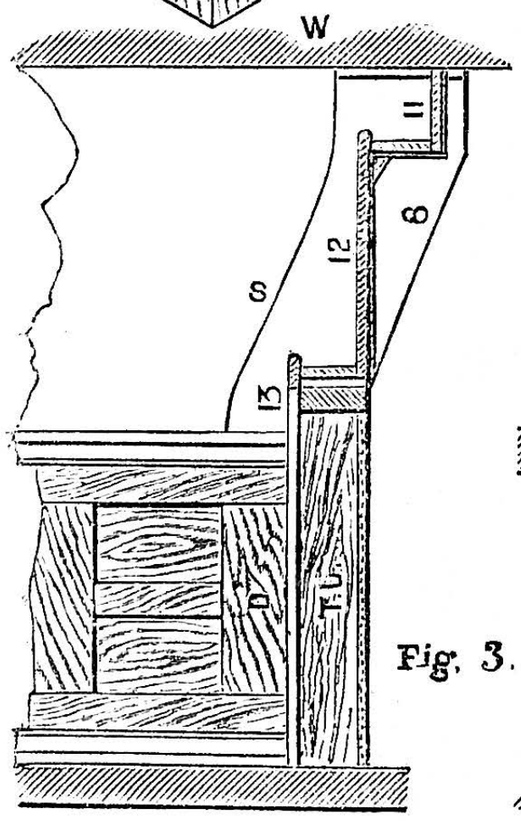


Fig. 3.

Fig. 2.

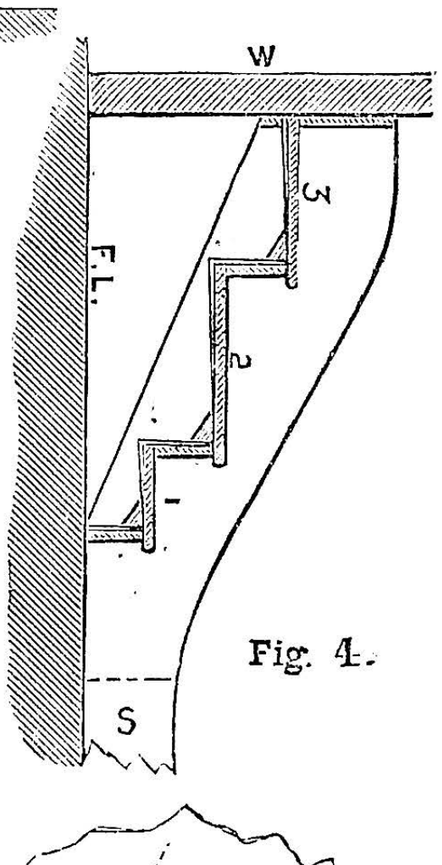


Fig. 4.

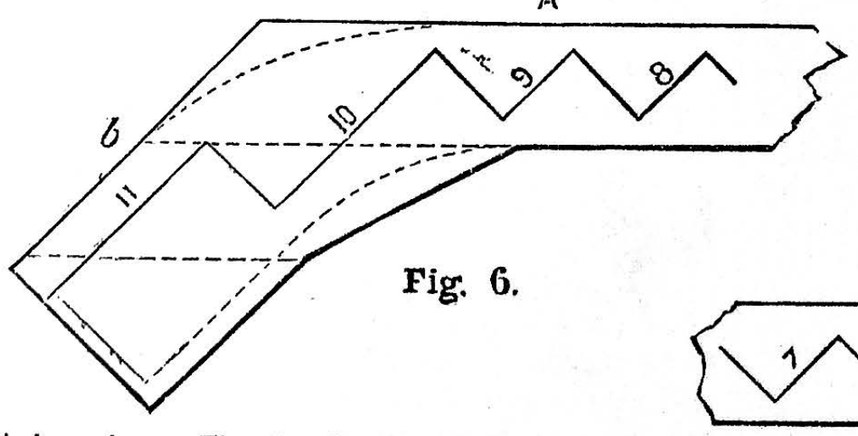


Fig. 6.

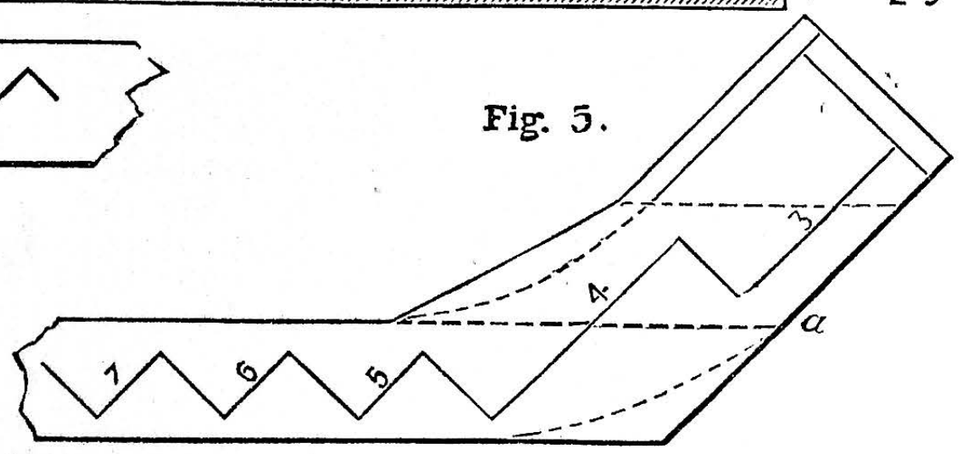


Fig. 5.

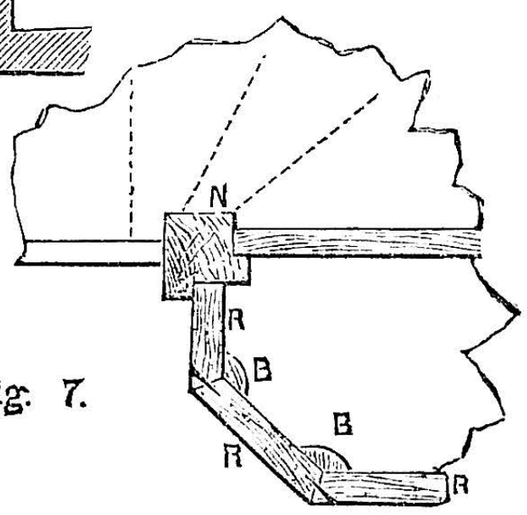


Fig. 7.

Staircasing. Fig. 1.—Sectional Elevation—F L, Floor Line; L L, Landing; N, N, Newels. Fig. 2.—Plan—L, Landing; N, N, Newels; D, Door; *a b*, Space from the Door to top Step. Fig. 3.—Elevation on A B—W, Wall; T J, Trimmer Joist; D, Door; S, String. Fig. 4.—Elevation on C D—F L, Floor Line; S, Skirting; W, Wall. Figs. 5 and 6.—Enlargement of Wall-String—*a* to *b*, Length of String. Fig. 7.—Bull-Nose Step—N, Newel; R R R, Riser; B, Blocks. Fig. 8.—Enlargement of Newel—M, Mortise; L, Landing. Figs. 9 and 10.—Two Methods of obtaining Easements. Fig. 11.—Method employed to cut out Cross-Tongues. Fig. 12.—Outside String, S S being the Shoulder Line.

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WHEEL KEYS.—Workmen who have to fit keys into wheels, shaft couplings, and the like, will find it a good practical way to first make a wooden key and fit this neatly into the key seal and wheel or coupling keyway when on the shaft. The wood key should be a good tight fit. Then he would give the wooden key to the blacksmith to make a key a little larger all ways—say to the thickness of a piece of newspaper. This will be sufficient to file off, and by this method he will be able to make a better and also a quicker job. Giving the blacksmith the sizes in figures would most likely lead to his key being made perhaps $\frac{1}{32}$ of an inch all ways too large. Those who use the file every day know that to reduce such work down to the proper size means hard labour. It does not always follow in the mechanical trades that by doing a deal of hard work the most is accomplished. Far from it. Very often the thinking workman who goes about his work putting into operation the "tips" he has from time to time picked up, turns out more real work than a more active and willing comrade exerting even more manual energy.

WORLD'S FAIR EXHIBITS.—The Chicago Exhibition officials or authorities seem bent on making their offers of space, and invitation to show our products, as objectionable as they can. Now the English trade-price must not be put on goods for disposal. This is contrary to all rule that has hitherto guided exhibitions; any price the exhibitor chose to put on was the rule. But the motive is obvious—the prices of many things in England ticketed in Chicago would tell the sightseers how much cheaper the English market was than the American. Our cousins must forget the dollar for a time if they want our goods to adorn their show.

CARRIAGE-BUILDERS' TRANSFER PATTERNS.—These beautifully executed paintings are now to be obtained at a reasonable price. Artists who have graduated in the carriage-painter's shop are highly qualified in many cases to produce to order heraldic devices, landscapes, hunting scenes, and home-life views and fancies. But anyone with artistic taste, a facile touch of brush, and knowledge of colour-mixing, and their harmony when applied in juxtaposition, can execute these transfers, or "decalcomanie." Obtain a smooth sheet of gummed paper, similar to that used for postage-stamps. Upon the gummed surface paint in prepared oil colours, or colours made up as in the proper colours of body-painting work, if made by the painter, but preferably the capsuled colours from the artists' colourman, as they are superfine. When dry, get a similar sheet of plain gummed paper, slightly damp it evenly all over, lie it down on a hard, flat, smooth surface of table, and lay the painted sheet on it, with the design on the damp gum; press it between the leaves of a book, or felted boards of large size, till dry. Remove the upper pressing book-leaves or board. Then turn and damp all over the upper side of the sheet painted on, and when soft enough, remove it; it comes off easily. This leaves the painted design face downward on the gummed paper, ready for transfer to the varnished panel. This is done as follows:—Varnish the panel, and when tacky to the touch, press evenly on the transfer to the panel, so as to be sure the transfer is impressed in the varnish. When set, soak the paper with water all over, and peel off the paper, and your transfer is as firm on the panel as if painted there. The whole may then be varnished.

DANGER!—Artificial imitations of ivory and bone have yet another danger. We pointed out a short time ago that wearers of this composition in the form of buttons, etc., carry about with them, more or less, an explosive—in fact, an equivalent to nitro-glycerine, owing to its inflammable nature; and an instance has been known of a gentleman's collar of this substance catching fire whilst being worn, owing to the careless handling of a lighted taper. There has come under our notice a pianoforte with the keyboard destroyed, which was caused by a light falling upon it. As this composition is used largely for covering the keys of medium-priced pianos, organs, etc., we call attention to its danger, and warn our readers against laying lighted cigars, matches, or naked lights of any description in close proximity to anything made of this composition. It is easily distinguishable from ivory or bone by scraping with a sharp knife, or wiping over with a piece of rag damp with methylated spirits, when it will, if not genuine, emit a strong smell of camphor.

SOLDIER CYCLISTS.—We cordially agree with Major Holmes in his views on military cycling, and hope that some of the suggestions set out in his article upon the subject in the *United Service Magazine* will find favour in the proper quarter. When initiating our recent Prize Essay Competition upon "The Cycle: Its Worth to the Nation," we had in mind the possible future before it both for volunteer and army service purposes; we are, therefore, glad to see ourselves supported by a practical soldier. Major Holmes submits that the cycle will convey infantry with greater rapidity and under better conditions than any other available means, for which reason he suggests that a cycling regiment should be established in every county.

DESIGNS FOR WOOD, MODELLING, OR LEATHER-WORK PANELS.

BY J. EADIE-REID.

In introducing to the notice of our readers the accompanying page of designs for a laptation in wood-carving, a little talk on the principles of such designs would not be amiss. It must first be remembered that the designs have not been created so much for themselves as for their value as decorative features of the cabinet or sideboard, and then merely as enrichments, not as independent features. Having before us a given space, upon which we consider ornament would be valuable, we must next think what arrangement of lines will fit best, and at the same time quietly.

It is for the purpose of helping our readers out of this difficulty that the designs have been prepared for their use. The lines, forming the basis of the forms, are of the serpentine character, and more or less complete in themselves. In drawing the leaf forms, see that the serrations are carefully and clearly drawn—not simply an angular zigzag, but each serration must be drawn with its own curve and back. If this is slurred over, the design will immediately lose its character. (See Fig. 4.) This illustrative note is a characteristic leaf of the Byzantine period, and will help you in realising the conventional treatment.

There is no better training in leaf drawing than that which is to be gained from a day's study under the hedges.

It will repay the student of ornament far better, instead of the stereotyped water-colour sketch brought back in triumph from the country, if a neat little book, filled with careful pencillings of wayside sprays and ground plants, were in its place—perhaps not so interesting and pretty in the eyes of his admiring relatives, but infinitely more valuable to himself in his practical work. We cannot conventionalise if we have not the knowledge of plant form. Conventional treatment is not an improvement upon nature, but rather an application of the material nature has so lavishly

Fig. 1.—Vine Panel (Conventional) for Sideboard or Cabinet. Fig. 2.—Alternative Designs reduced. Fig. 3.—Byzantine Detail for Rosette.

spread before us—if we will but use our eyes.

The complaint is often heard from workmen that it is of no good their trying to draw with a fine point, for they can never do it.

In answer to this, may I remind the carver, for instance, that it is no discredit to him if he may not be able to produce a fine pencil line or a steady brush mark. If he is able to draw firmly and cleanly with his chisel is not that sufficient?

His drawings might be produced with the burnt end of a stick, but they are for his own purposes, and perfectly intelligible. They are, in short, working drawings, done in the method which comes easiest to the workman's hand. It may be pencil, brush, or charcoal. They are never intended for exhibition! He must, therefore, not be discouraged, when he begins sketching from natural forms, to feel that his first attempts are crude.

The power required for the chisel is somewhat different from the delicate touch necessary for a brush or pen. Practice and patience are all that is necessary, and no man who loves his art is ever without opportunities; no difficulties are so great that they cannot be surmounted.

HOUSE SAFEGUARDS.

CONSIDERING the number of inventions in the nineteenth century, it seems strange that the idea of house safeguards does not tempt some of our inventors to devise some plan or means of defence better than that already resorted to. The window fasteners now used so extensively, and "cracked up" for sale as the height of perfection, may be justly termed the "burglar's friend," as by the means of tools such as burglars carry nothing is more simple to unfasten. In many houses the ordinary pocket-knife blade will unfasten catches—more especially if the frames are loose in their sockets—so as to enable the windows to open easily, making access to the interior easy to accomplish. The best and simplest method at present is, undoubtedly, the plan resorted to in some houses in the western counties, which is to procure a small-sized gimlet, and with that bore a hole through the top and bottom frames, passing into the sashes or supports until a depth of about 2in. or 2½in. is attained. Then procure an ordinary wire nail, and pass through the incision made—viz., through both window-frame and sash. By colouring the nail-head to match frame the trick passes unnoticed. It is surprising to find what additional strength this one nail proves, a simple experiment of which will justify the fact. As the job does not injure the frames or sashes to any great extent, more than one of these "safeties" may be put in to give extra strength, but seldom is more than one necessary. One thing, however, must be borne in mind—namely, that in removing care must be taken either to draw out the nail or nails and putty up the holes, or to tell the incoming tenant the "wrinkle." So much for the safety of the windows. We will now proceed to the back doors. We mention the back more particularly because, it must be remembered, burglaries are generally first attempted there. The method employed for this is a simple contrivance, which is in the power of any amateur to make. Procure a piece of brass, copper, or other metal, and shape as in the illustration. Fig. 1 shows the contrivance: A, place for screw; B, top part, to be bent so as to allow easy handling. By this means the cleverest burglar will be baffled in opening a latch-door. It only remains to be noticed that the article works on the head part of the screw, it being fastened so as to allow easy working.

THE CYCLE: ITS WORTH TO THE NATION.

(*Being the First Prize Essay, by* "PHILOLAUS"—REV. F. A. WODEHOUSE, *Gotham Rectory, Kegworth, Derby.*)

THE cycle, like everything else, has its friends and foes, enthusiastic admirers of its merits and hearty depreciators of its worth; so much is there in the "point of view." For ourselves, however, we are inclined to say there is less room for disagreement here than in the case of many less controverted themes. We regard the various drawbacks which have caused many to look askance at the cycle, or perhaps at cycling, as unfortunate accidentals rather than inherent defects. Experience having given a bias to our judgment favourable to the subject under discussion, it is with sympathetic assurance that we endeavour to answer, "What is the cycle worth to the nation?"

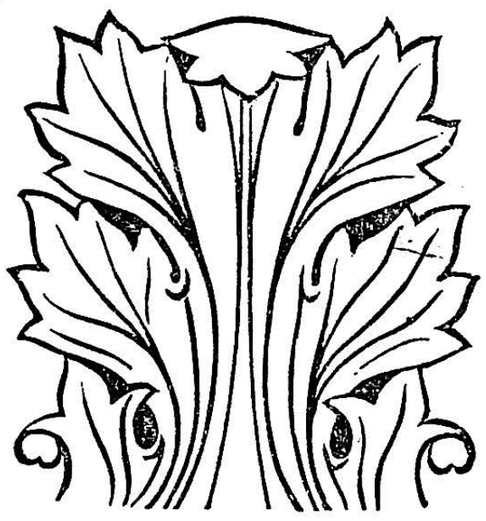


Fig. 4.—Leaf showing Serrations.

As a Trade.—In looking at the cycle from this point of view, it is less to our purpose to enter into actual figures than to mark a few points characteristic of this branch of industry. We claim for this trade that it is one diffused throughout the length and breadth of the land. True, to one town must be given a pre-eminence; Coventry, no doubt, can lay claim to being a kind of cycle metropolis, but priority in time, and a certain numerical pre-eminence in cycle factories, in no way means monopoly. Through the introduction of the cycle there has been created an industry which is everywhere. Whilst so many other manufactures we are able to locate, and to assign to different neighbourhoods almost an exclusive appropriation of production, as regards the one under discussion we ask, What town is there of any size without its makers and repairers, its cycle factories and cycle depôts? From Glasgow to Brighton, from Bristol to Norwich, the rule would be true, perhaps, with no exception. A large factory will, for several months in the year, turn out from 250 to 300 machines per week, and find employment for over 400 men and boys. The total number of machines sold last year was 600,000; this year the number will probably be more, but these will be made not in one or two places, but by many makers in all parts of our land.

The cycle trade employs essentially skilled labour. Of no trade can this be said more truly than of that now under discussion. We deprecate, indeed, any hasty stigmatising of any work as not skilled. The husbandman who drives the plough, delighting the eye with the straightness of his furrows, is a skilled labourer. He who steers the ponderous 'bus through the mazy labyrinths of metropolitan traffic is a skilled labourer. Nevertheless, there is such a consciousness in the mind of the mechanic of latent possibilities of further improvement, such an ever progressive elaboration of details, such a semi-conscious sympathy in the maker for the machine, that cycle makers may fairly claim a leading place amongst our artisans. The maker of a locomotive will probably never drive one; the needle of the sewing machine will never ply its busy work under the guidance of him who made it, but the constructor of the cycle is usually a rider. He knows the ins and outs of the machine. His very recreation inspires him with affectionate accuracy in his work; the hand, the head, and the heart unite in wholesome and conscientious harmony.

More important still, the cycle trade is an increasing one. We stand almost at the beginning of its possibilities of development. A writer, evidently acquainted with the subject, expresses his conviction that the 600,000 machines of 1891 will, in a few years, be more than doubled. The very development of type from the Bone-shaker to the Geared Ordinary demands an ever renewed supply. Other trades are pressed into the service. What if every vehicle, thanks to the exertions of cyclists, should be required to carry a lamp! or how much of our road improvement is due to the same cause? We chronicle great things of the trade; we prophesy greater. The cycle trade has taken its stand among the great trades of the land. What is a great trade worth? Who shall estimate? Not the adept at figures and statistics so much as he who can gauge the difference between the miserable concomitants of enforced idleness, and the happy home, contented mind, and sturdy children of the well-employed artisan.

As a Means of Locomotion.—The introduction of progression by steam marked a new era in the history of our land. We are not claiming for the cycle a like importance; from the nature of the case its use is limited to a certain portion only of our population; nevertheless we wish to point out how valuable are some of the characteristics of this new way of getting about for those by whom "it may be had."

It is Speedy.—The rider moves by "pneumatic despatch." "These cyclers fly along," is the cry of friend and foe alike. The rapidity with which he moves is indeed one of the chief causes of complainst against the rider. No reader will accuse us of exaggeration if we say that an ordinary rider on average roads will, compared with the traveller on foot, save forty minutes out of every sixty. The proverbial "four miles an hour" of the pedestrian becomes the twelve miles an hour of the cyclist. Three times the distance is accomplished with less effort; whilst the burden of enforced travel is transformed into a pleasure. This twelve miles an hour we may regard as a normal speed; but let it be an occasion of life and death, let the very existence of some loved one hang in the balance, we may well marvel at the speed that may be attained. Twenty-two miles in the hour sustained! What ideal powers of unimagined progression!

It is Cheap.—That this should be advanced as an argument that can be sustained may at first seem somewhat surprising, yet in estimating the cost of cycles there is need of care. Price lists and advertised prices are deceptive. The cycle trade has ranged itself among those which give large discount for cash. The £20 or £18 advertised may be found to be not more than £15 or £12 "cash down," whilst makers who have a name to lose advertise on these terms very serviceable machines for £10. But the cycle trade, from its peculiar position, is one with a large second-hand "connection." Auctions are, during the summer months, held in every large town. Advertisements in marts and emporiums (wisely selected, of course) are reliable. Agents who will sell at a small profit for quick returns are not few and far between.

The cycle world is largely composed of riders who are constantly selling good machines on low terms in order to provide themselves with better. The very inventions that run up the prices of the best, unduly lower the market value of less advanced types. Where the man of means will discard the solid and cushion tire, contented with nothing but a pneumatic; where the cross frame is contemned, and nothing will do but the latest base-extended diamond; where the chain has come to be regarded as obsolete, and ambition (or the love of cleanliness) demands a Geared Ordinary, a

"Loco," etc., a "poorer brother" can secure, at greatly reduced rates, a machine that will prove a boon companion for many a long day. Thus provided, what are his subsequent costs of maintenance? A horse is the only rival as to speed. Contrast the expense of shoeing, grooming, feeding, with the few pence required for oil. No doubt an opponent will ask, What is to be said about spokes breaking, wheels buckling, cranks loosening, above all, tires bursting? We answer, "Hundreds of machines can be bought superior to such fatalities." Pneumatics are luxuries, whilst their bursting propensities under newer auspices are somewhat exaggerated. Our rider, then, for £12 is furnished with a machine which, with care, will last him for at least five years, riding for eight months in the year, and an average of one hundred miles a week, and thus costing him about 1d. for every five miles; at the end of the time he sells his machine for £6, thus really halving his expenditure; and whilst merely expending his bodily energy, which is increased by the exertion, he conveys himself on a most reasonable estimate at a charge of one-halfpenny for every five miles!

It is a means of locomotion which can be employed where *such powers are most wanted.* This is a merit, the worth of which it is most difficult to appraise at its true value. To those who can deliberate as to their mode of transit, whether they will travel by cab or 'bus, tram or rail, the value of this idiosyncrasy in the cycle will probably be greatly underrated. For them it means little that the cycle can be kept at the "odd place" and the lonely cottage. The city world knows not how the country world lives. It is the lonely cultivator of fields, not the denizen of the well-vehicled mart, who can best appreciate a machine which asks alone for a narrow track at the side of a road, and then under his easy pedalling bears him quietly and unostentatiously to hives of human industry, and central homes of company and civilisation. If these are its characteristics as a means of locomotion, who shall rightly gauge its worth to the nation?

To say that only a limited number can avail themselves of it is but to say that its value is not simply measureless. After all, it reaches men, and men of all ranks and ages. The nation is made up of individuals; to how many among such is it a boon? The soldier finds a vast convenience for "orderly" work, its limited requirement of forage being no small recommendation in the eyes of the War Office; the doctor, a horse which will "patiently abide" while the complaints of the most exacting hypochondriac are explored; the clergyman finds the scattered parish robbed of its drawbacks, the commercial man, the working man, the political agent, not to say their sisters, cousins, etc.; but we forbear. Improved means of locomotion—how much it implies! How beneficial the tendency of such a new introduction into our ways and means of communication! Isolation is minimised; space is annihilated; Home Rule becomes a bugbear; the world lives together; brotherly love continues; man is one.

As a Pastime and Recreation.—Under this head the thoughts of many will turn to racing. We leave such to plead their own cause. As horse racing is supposed to lead to improvement in the breeding of horses, so we may conjecture that cycle racing tends to sharpen the wits of factors as to lightening and improving machines. For ourselves, however, we have in mind touring, and the half-holiday or evening ride. We can here only ask our readers to think for themselves what this must be. It is essentially recreation. The escape into the fresh air, the exercise given to muscles otherwise almost unused, this sense of expansion after confinement; of movement, after a state of almost enforced dormancy, how precious! The feelings of the cyclist are those of the bird let out of its cage, or the horse turned into the wide-spreading meadow. Every faculty finds vent and exercise. "Our sight," says Rogers, "is the noblest of all our senses. It fills the mind with most ideas, converses with its objects at the greatest distance, and continues longest in action without being tired." To sight, what endless dioramas are offered by cycling. "I had rather be blind than deaf," says another. Cycling bears the rider whose ears have been partially stunned all day by the roar of the 'bus, the tram, and the rail, to the home of the nightingale and the twitter of the sparrow. Is there any greater pleasure than rest after toil? Who knows more of this than the cyclist stretched on the mossy slope or reclining on the banks of some pellucid stream; whilst, acme of delight! we have heard of those who, in some unsophisticated dwelling, have found a Maud Müller destined to be, not a beacon of "what might have been," but a "safety match" for the remainder of their pilgrimage. Nor must we forget that many of those who have studied the mechanism of the human frame claim for cycling far more than the mere benefits, great as they are, of recreation. They find in the varied motion of up hill and down, of rise and dip, something far more than in the ordinary walk; in the expanded lungs inhaling the bracing air at the top of some eminence, and almost immediately after in the relaxing vale, a benefit far surpassing the proverbial "change of air"; whilst, though we venture the idea with diffidence, the abstainer from intoxicating drinks may recognise in the cycle one of the truest allies he has ever been fortunate enough to meet with in his philanthropic endeavours to stem the tide of our national curse. No cyclist, while such, can be a drunkard. We speak with caution. Our acquaintance with cyclists is limited. Cycling, we know, is a thirst-producer, somewhat remarkably so, but, on the other hand, the merest tyro knows as well as the most advanced rider, *strong drink taken in excess and cycling are utterly incompatible.* A drunkard, or a man the worse for drink on a cycle, must be a short-lived anomaly; and whilst the nation knows to its cost that the passion for drink is a master passion, we believe that it will in due time discover that for many there is a still greater counter attraction, and will behold the drunken slave of the *cup* transformed into the sober votary of the *wheel.* If so, we triumphantly canvass the sentiment—"The Cycle: its Worth to the Nation."

We note that our instructions advise us that suggested improvements will be taken into account in judging what the advocates of cycling have to say for their favourite pursuit. With all due deference to the thought, we hesitate to take up the pages of WORK with pictorial expressions of scarcely matured imaginations. The idea is excellent, but the fact is, that whilst in one sense the bicycle trade is in its infancy, and there is not the slightest reason to think that perfection of construction has been reached, on the other hand improvements in design have already been wonderfully developed. Anyone who has followed the history of the manufacture knows that the name of suggested improvements is legion, but that of the vast number those that can be adopted as genuine and practical are few. Everyone loves his own child, but we seem already to feel the chilling glance of the Editor cast on designs which we freely acknowledge will not be put upon the markets, at any rate, this season. We therefore elect to keep them to ourselves, and our suggested sliding saddle, our pedal crank, so arranged that the foot can be applied for almost the whole of the rotation, our brake applied by simply leaning back in the saddle, and our singularly happy improvement on the Zimer Gear, are only mentioned to whet the appetites of those who can appreciate the happiness of the idea underlying them.

But apart from this, we trust we have said enough to raise the cycle in the estimation of our readers. *Honi soit qui mal y pense.* One word to fellow cyclists. The cycle is an admirable piece of workmanship, yet what is the cycle compared to the rider? Shall the manufactured article be worth so much, its rider nothing? No! Cyclists! let us stand together! rally under our flag of industry, progress, and health; our ambition to demonstrate OUR WORTH TO THE NATION.

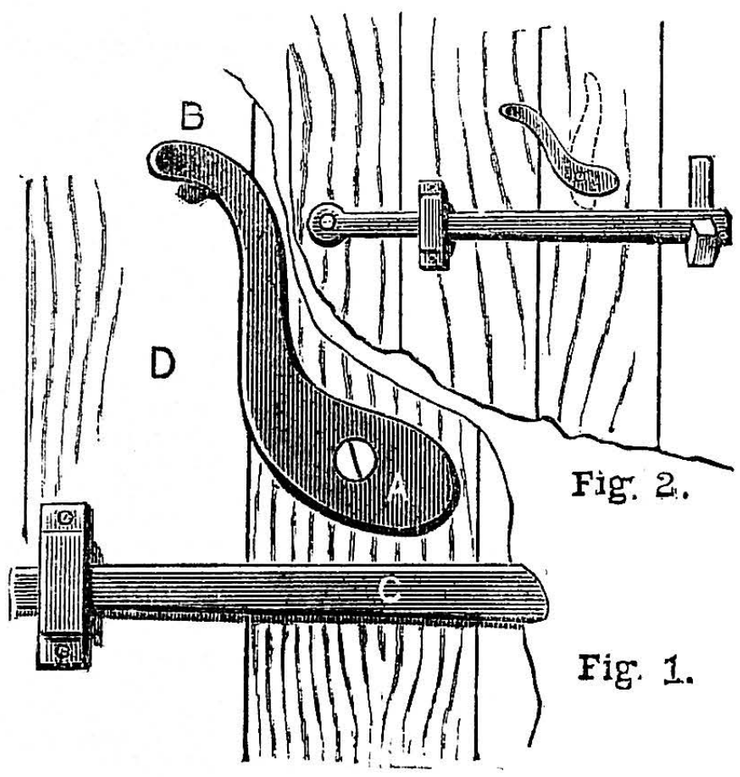


Fig. 2.

Fig. 1.

Safeguard. Fig. 1.—Contrivance—A, Place for Screw; B, Top Part; C, Latch; D, Door. Fig. 2.—Article in use.

NEW BREAD KNIFE.

THE advantages claimed for the Christy bread knife, which is the invention of a young American—Russ Jackson Christy—are its cheapness, lightness, great cutting efficiency, and that it slices bread without making crumbs. It is made entirely by machinery, the blades being sheared out of steel sheets 15 ft. long and 8 in. wide, and the handles being of soft steel wire. The blades are dovetailed—each one at the two places of attachment with the handle—and run into the grooved wire. The wire is then struck, the two sides of the grooves meeting in the dovetails. As will be seen from the illustration, the knife may be conveniently hung up by the handle instead of being placed in a drawer and having its edge spoilt by contact with other knives and forks. The reason it makes no crumbs is because the side next the loaf in cutting is flat, not an inclined plane, as in the ordinary wedge-shaped knife, the Christy being ground on one side only. The ordinary knife makes crumbs because, being wedge-shaped, the top of the wedge disturbs the bread particles in the loaf. This is avoided by the Christy blade, its perfectly level inner face exerting no lateral pressure on the loaf. Again, through the scalloped edge a greater extent of cutting surface is applied simultaneously. It will thus cut bread that is quite new and hot into thin slices. For left-handed people the blades are ground on the other side. The manufacturers also produce a cake knife and carver on the same principle, and a paring knife with a straight edge, but ground on one side only, the perfectly flat side being next the apple or potato or whatever it may be, and so preventing the knife from running into the article and cutting off more than is intended.

Crumbless Bread and Cake Knife.

As a proof of the conductivity of silver, a correspondent and eye-witness vouches for the following: At an hotel at Bordeaux the maid waiting at the dinner table—during a severe thunderstorm—had in her hair a large silver ornament in the shape of a dagger. Immediately preceding a terrific thunderclap came a flash of lightning, which struck the silver ornament in question, and burnt the whole of the back hair, without otherwise harming the girl.

TRADE: PRESENT AND FUTURE.

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

TIMBER TRADE.—The following are some of the latest prices realised: 1 in. by 12 in. 1st dry pine, £17 15s. std.; 3 in. by 9 in. 1st Petersburg yellow, £12 5s. std.; 3 in. by 9 in. 1st and 2nd Novrkoping, yellow, £13 std.; 3 in. by 9 in. 3rd Novrkoping yellow, £10 5s. std.; 2 in. by 4 in. yellow, from £6 5s. to £7 std.; 1 in. by 6½ in. yellow flooring, 9s. per square; ⅞ in. by 6½ in. yellow flooring, 6s. 6d. per square; and pitch pine timber, 53s. to 55s. per load.

COTTON TRADE.—Another serious crisis threatens the cotton industry of Lancashire. A general reduction of wages is expected to be announced, when a complete stoppage of the mills will follow, as the operatives will resent the least interference with their wages. As to the critical condition of the industry there can be no doubt; indeed, it is estimated that more money has been lost in Lancashire during the last twelve months than in any year since the trade was established. In Oldham alone the losses on one quarter's working have amounted to £100,000.

ENGINEERING TRADE.—There is a better tone prevailing in most branches. The large stationary engine builders are busier than they have been for several weeks past, while boiler makers generally are again moderately well off for work. The large firms who make a speciality of textile machinery are fairly employed. The machine tool makers have experienced a slight revival in trade, but locomotive builders report comparatively little new work coming forward, and some of the principal works are but indifferently employed. The reports for the past month of trade union organisations connected with the engineering industries reveal an unsatisfactory state of affairs, both as regards the general reports of the condition of trade and the number of unemployed members. In the Amalgamated Society of Engineers there are now about 5½ per cent. of the total membership in receipt of support, while in the Steam Engine Makers' Society the returns show about 2½ per cent. of the members on donation benefit; each of these returns is an increase on that of the previous month. The reports as to the state of trade show a tendency towards slackening activity in the principal industrial centres, and it is only in exceptional cases that trade is reported as good.

CYCLE TRADE.—This trade is fairly busy. The Whitworth Cycle Company are building large additions to their factory, by which their output will be doubled. The New Howe machines have done surprisingly well on the racing path this season. A good deal of discussion is going on as to whether the safety or the new geared ordinary will prove the machine of next season. As an indication of recent trading, it may be noted that the value of cycles and cycle materials exported from Coventry and Birmingham to the United States in the three months ending June 30th amounted to £333,741.

SILVER TRADE.—Many firms in Sheffield are on short time, save with a few manufacturers who have obtained important orders of a special nature.

SHIPBUILDING TRADE.—In the manufacturing branch there is no improvement owing to the small orders in the shipbuilding line.

HARDWARE TRADES.—Our Liverpool Correspondent writes:—Representatives of the Amalgamated Society of Engineers, Boilermakers, Iron Shipbuilders, Plumbers, and Labourers met their employers to consider notices of a 10 per cent. reduction of wages on men earning 30s. a week, 7½ per cent. on 20s. to 30s., and 5 per cent. under 20s. The men offered to accept a reduction of 2½ per cent. if an eight-hour day was agreed to, but this was refused, as also a proposal of 5 per cent. The men are resolved to have an eight-hours day as part of the settlement.

SHIPPING TRADE.—Our Liverpool Correspondent writes:—In the shipping line there is no change in freights. Shipments viâ Welsh lines are full and regular, but in other quarters the trade is very dull. At present one firm trading with India have five or six vessels lying up. Trade with the Mediterranean is bad, and until the new crop of currants and other fruit is ready very little will be doing.

BUILDING TRADE.—The trade in Manchester and district is still very good. The strike of plumbers at Bolton respecting the allowance for country work and lodging, which has lasted twelve weeks, has been settled by arbitration. The umpire awarded the men the same terms as the plumbers of Manchester and other large towns. Our Rochdale Correspondent writes:—The building trades continue fairly busy.

COAL TRADE.—In Sheffield trade is fairly good. London and gas coals are very slow of sale.

STEEL AND IRON TRADES.—There is a slight improvement in the local steel trade. Two or three good inquiries are in the town which, if they result in business, will give the crucible steel trade full employment. The makers of wheels, tires, springs, and axles are busily employed. There is not much activity in the rolling mills and tilt forges, and the older Sheffield trades show a corresponding depression.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTER FROM A CORRESPONDENT.

Hobbyists' Emporium.—THOMASO writes:—"As I understand this suggestion (see WORK, No. 169, page 204), it is proposed to provide an outlet for budding mechanical genius by establishing a sort of permanent exhibition where his (the b. m. g.'s) latest atrocities may be displayed to the wondering gaze of the uninitiated, and, it is hoped, sold to the foolish. Objections to such a course occur to me in such number that I hardly know where to begin. It is proverbially safe, however, to begin at the beginning, and so here goes. The concern cannot be conducted on any system of mutuality similar to that suggested by E. D. in page 204, for the reasons presently stated. His suggestion is absurd. Who is to take the profits resulting from the commission on sale and subscriptions? The concern clearly cannot be carried on, as E. D. apparently thinks, so that the profits shall always exactly balance the expenditure; and if the profits are to be divided among the members (the only possible way out of the difficulty), what is the difference between the proposed concern and an unlimited company, between the 'committee' and 'directors,' and 'members' and 'shareholders'? There is no difference between a number of people making articles independently of each other and then selling them at their mutual expense, each taking a profit, and a lot of people subscribing to buy articles ready-made, and selling them again at their mutual expense and dividing the profit, as in the case of public companies generally. Start the concern as proposed, and then see the legal disabilities it would be under. But it never could start business, for the simple reason that there being no one personally responsible for the rent, no landlord would let his premises; and if any debt was incurred, and there was not enough cash to pay it with, the committee and secretary would say, 'We are only acting for the members. We are not responsible'; and the members would say, 'We have paid our subscriptions, and acknowledge no further liability.' The result would, of course, be legal proceedings, when I have no doubt it would be decided that the concern was a company, and all the members personally liable for the debts; and the men of substance would have to pay for the men of straw. If, on the other hand, it is intended that the secretary and committee shall 'boss' some individual who starts and owns the concern and bears all the responsibility, all I can say is that that individual (when found) will turn out to have escaped from a lunatic asylum. E. D. also proposes that a subscription (annual) shall be payable as well as a commission. No matter whom it is paid to, it is bad. What right is the payment of the subscription going to confer on the subscriber? Obviously it confers the right to send in articles and have them exposed for sale. Is it intended that the proprietor, or whoever receives the goods, shall have the right of rejecting articles he may deem unsaleable or otherwise unsuitable, or is he to be obliged to take any rubbish offered him? If the former, what becomes of the subscriber's right to have his goods offered for sale, and (*inter alia*) what becomes of his subscription? If the latter, Providence protect us from the waggon-loads of rubbish! The annual subscription is rough on those who want to sell perhaps only one article in the course of the year. It is intended that the articles shall be made for sale, and shall not be 'second-hand'; this looks as if there was a sneaking sort of feeling that the affair would degenerate into its prototype—a marine store. Personally, I do not see how it can become anything else. Suppose a rule provides that only 'new' articles are to be eligible, will someone supply me with a definition of 'new' that shall enable 'new' articles made by an amateur to be distinguished from old? How long is the maker of an article to be allowed to keep it and still call it 'new'? If by 'new' is meant 'unused,' then I ask, is an article of ornament, for instance, to be deemed 'used' because it has been looked at for a time? Verily the second-hand articles are hard to define and keep out! It is further proposed—I presume in order to confine the work to amateurs—that the worker shall make a general declaration that he will make all articles himself. Now, it is well known among amateurs even that parts of many articles have to be bought ready-made. Marvellous is to be the power of E. D.'s declaration, therefore! It is actually going to decide how much of an article a man may buy ready-made, and yet say of the complete article 'I made it!' How and where is the line to be drawn to satisfy the very natural scruples of conscientious workers? and if the worker is not conscientious, what is the good of the declaration? If it is intended to exclude professionals, this declaration obviously will not do it; neither will it do if worded to exclude 'work by which the worker gets his living.' For he has only to vary the work slightly, and make the declaration with a clear conscience—clear to himself, that is. Verily fraud is hard to define and keep out! I do not think it necessary to show that if a subscription and commission is decided on, they must be small to pay the worker, and large to enable the concern to pay its way. For does not E. D. say that the exhibition should be in a central position, and in such positions are not rents high and rates tremendous? To add to the expense, it is proposed that stalls should be taken at London exhibitions to advertise the concern and sell the work. What midsummer madness! Set the mediocre productions of amateurs in competition with picked professional work! Who pays the cost of these stalls? Does it come out of the common fund? If so, the whole emporium will have to be exhibited, or I fail to see what sort of soft solder is going to be applied to those workers whose work is not exhibited. I think, after such an exhibition, there would be a goodly withdrawal of offended members. I have dealt with difficulties that occur to me with respect to the starting of such a concern. If anyone proposes a scheme which avoids them, it will be time enough for me to show why it cannot succeed. Whatever is decided on, the concern must belong to an autocratic *individual*. If we are going to have any more schemes suggested, pray let them be put forward by people with some knowledge of trading and business generally. The amateur promoter is not a being calculated to inspire either confidence or respect. I do not suggest a scheme myself, because I am satisfied that no scheme will be practicable. Others may 'rush in,' but I say, with Disraeli, that I am on the side of the angels, and (to complete the proverb) 'fear to tread.'"—[It would not be a bad plan if you furnished us with your real name and address.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Development of Inventions.—H. H. (*Finsbury*).—The title of the Association referred to is "The London Commercial Association"; its offices are at 47, Holborn Viaduct, London, E.C.—F. C.

Quarter-Plate Camera.—A SUBSCRIBER.—If you will refer to WORK, Vol. I., No. 83, you will there find full directions for making a whole-plate camera, with explanatory diagrams. As a half- or quarter-plate is made on the same lines, it is quite easy to reduce the measurements from the diagrams given. They may be deviated from so far as the *strengthening* part of the construction goes; the wood may be lighter, and the base clamped instead of panelled. The back of the camera and focusing screen portion should be made first, to the size suitable for quarter-plate, and the rest built up to it.—D.

WORK, Vol. I.—H. S. (*London, N.W.*).—The best way would be to advertise Vol. I., with price. W. H. (*Huyton*) could then consider it.

Diaphragm.—F. S. L. (*Liverpool*).—It is a difficult matter to give the name of a *suitable* material for the diaphragm of a phonograph, there have been so many different substances used, sometimes with good results and oftentimes with the opposite. Parchment, mica, ferrotype, glass, etc., have all been tried. I would advise you to experiment for yourself. The papers on the phonograph will soon be given.—W. D.

Mirrors.—P. S. (*Wigan*).—The composition on the backs of mirrors consists either of an amalgam of tinfoil and mercury, or nitrate of silver deposited by means of other chemicals; either process is a difficult one for an amateur, but of the two the latter is the easiest. Should you wish to have a try, the following are formulæ:—(1) A, nitrate of silver, 175 grains; distilled (or boiled) water, 10 oz. B, Nitrate of ammonia, 262 grains; water (distilled), 10 oz. C, pure caustic potash, 1 oz. (avoirdupois); water (distilled), 10 oz. D, pure sugar candy, ½ oz. (avoirdupois); water (distilled), 5 oz.; dissolve and add tartaric acid, 50 grains. Boil in a flask for ten minutes, and, when cool, add sufficient distilled water to make up to 10 oz. For use, take equal parts of A and B. Mix also in another measure equal parts of C and D. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downwards in the solution. (2) A, pure nitrate of silver, 10 grains; water, 1 oz. Add carefully, drop by drop, strong ammonia until the brown precipitate is re-dissolved, stirring meanwhile with a glass rod. B, pure crystallised Rochelle salt, 10 grains; water, 1 oz. When ready, pour on sufficient to cover the glass, using two parts of A to one part of B. Let it stand in the warm sunshine for half an hour or an hour. Pour off the rest of the solutions, and wash gently with soft water and cotton-wool. With either recipe, the glass must be perfectly clean.—W. E. D., JR.

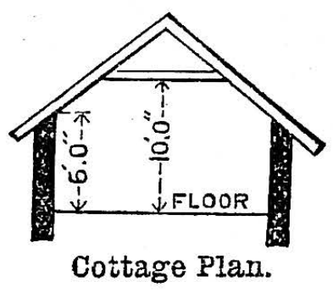
Paper-Cutting Machine.—A. S. (*Hockley*).—There are hundreds of such machines in the market as you ask a description of. Mr. W. C. Herne's "Advance" cutter would, I think, answer your purpose.—G. C.

Motor.—AMATEUR.—As regards the model motor (see WORK, No. 154, page 785), the coils will not be

close together on the outside of the bend. Keep them close on the inside, however, and make the coils radiate nicely for the sake of appearance; winding round the bend in this way will not interfere with the working. For your second question, you can use your No. 24 copper wire on the magnet, but make your winding fully ⅝ in. in diameter; don't use any much thicker wire than I have shown for the armature, although one size larger will not make much difference perhaps, as you see the space for winding is so very limited, and you want to get as great a length on as you can in this case.—J. B.

Spectacles.—T. W. M. (*Stepney*).—Whoever told you that you could repolish the lenses with sweet-oil must have been laughing at you. You may possibly brighten them with putty powder (oxide of tin, to be bought at the chemist's). This should be moistened, and may be applied with a small piece of very fine cork.—E. A. F.

Cottage Designs.—S. B. (*New Stockport*).—In answer to your letter respecting the cottages, published in No. 150, p. 723, the sizes of the various rooms are as follows: Parlour, 12 ft. by 10 ft.; kitchen, 14 ft. by 10 ft.; scullery, 10 ft. by 8 ft. All these rooms are 9 ft. 6 in. high. The sizes of the bedrooms are exactly the same dimensions as the rooms under them; but as regards their height, they are 6 ft. up to wall-plate, and 10 ft. to the collar, as per sketch.—W. B.



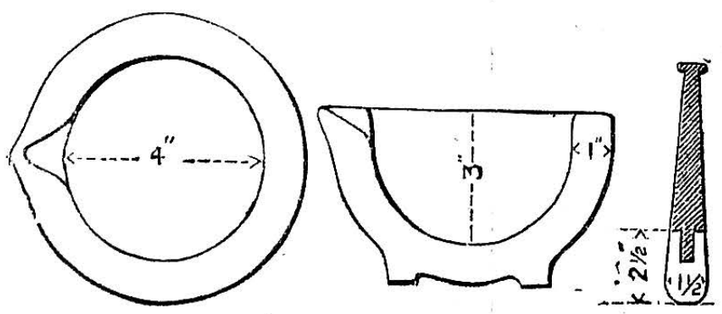
Cottage Plan.

Phonograph.—DELTA.—You will have seen that a further article appeared in WORK, No. 174.

Acid for cleaning Brass Rings.—J. C. G. (*Vauxhall*).—Boil the rings in a strong solution of washing soda, rinse them in hot water, string them on brass wire, and immerse them for half an hour in a pickling acid composed of a wine-glassful of oil of vitriol in one quart of water. The rings will then have a nice golden yellow tint without polish. To make them look like silver, take them fresh from the acid, rinse again in fresh water, and immerse them in a silver-plating solution or in a solution of silver made of 1 dram of nitrate of silver in half a wine-glassful of water, added to 1 oz. of cyanide of potassium in ½ pint of water. This is one of the simple silvering liquids sold in the streets. The acid you inquire for is simply an acid nitrate of mercury made by dissolving a little quicksilver in some aquafortis. It is most injurious to brass, copper, and all other metals, and its sale as a silvering mixture is a shameful fraud.—G. E. B.

Electrical Experiments.—J. A. (*Birkenhead*).—The Editor has a short series on Experiments with Induction Coils. My book on Induction Coils is published by Messrs. Whittaker & Co. at 3s. This deals entirely with coils and the apparatus for working them. A Henley's discharger can be purchased from any dealer in electrical apparatus. The names and addresses of several have frequently been given in WORK.—G. E. B.

Wire—Pestle and Mortar.—IN DUBIIS.—The very thin wire that you got out of the old electric gas lighter is platinum; whether it is absolutely pure or not I have not tested, but I suppose you do not require that. The samples of cotton-covered copper wire are: the smallest, No. 26 B.W.G.; and the largest, No. 22 B.W.G. As you seem bent upon making your own mortar, I give you a sketch



Pestle and Mortar.

of a marble one of my own, which, I think, is suitable for your purpose. You want yours of cast iron, and this is very nearly of a uniform thickness all through—a great thing in any iron casting. If you will take my advice, you will have it cast of the best malleable iron; it is not so liable to crack. But can't you purchase a marble one, say, second-hand? you will find it cleaner and more useful on other occasions.—J. B.

Railway Signals.—W. F. (*Pendleton*).—Thanks. Send your MS. in on approval.

Book on Electric Bells.—BELL.—You will find Mr. Bottone's book, advertised on page 72, Vol. IV., of WORK, a good book on the subject; but no one can foresee all the troubles likely to be encountered by the amateur bell-hanger, since he brings many of those on himself by acting in defiance of electrical laws and rules laid down for his guidance. Your battery is run down because wrongly made up and fixed. You do not require porous cells with agglomerate blocks, as these do away with the necessity of porous cells. The battery must be set up in a cool place. The solution in your cells simply evaporated through being in a hot situation, and the sal-ammoniac then crept out over the edges of the jars. If you must keep the cells in a warm place, smear the tops of the jars to a depth of one inch with tallow or some grease, and cover the solution with a layer of glycerine. I suspect you have also short-circuited the battery by wrongly laying the wires, fixing the pusher, etc. A slight leakage across the lines will soon run down a battery.—G. E. B.

Address of Electrical Firms.—F. P. (*Bristol*).—I am sorry not being able to oblige you. I do not know of any electrical firm likely to be in want of a new patent dynamo. The trade is full up with dynamos just now, and, therefore, a new type, to command attention, must be exceptionally good, and present some novel features of simplicity and economy in construction, together with efficiency in action. Your only chance of meeting with anyone willing to take up your patent is to advertise in our "Sale and Exchange" column for the person you require.—G. E. B.

Waterbury Escapement.—TIMA.—See if the pin projecting from the balance is bent or worn; if so, put it straight or put new one; or perhaps the staff is loose in the balance or has been shifted; if loose, tighten up. If all this is right, and it has still too much drop, grip the staff in a pin-vice or slide-tongs, and move round the balance a little, and try the drop—it should have about as much drop as the thickness of a tooth; if less, it may catch on some teeth, especially when the holes get a little worn; if more, it may miss catching some teeth, and so the vibration falls off. See that staff and 'scape-wheel holes fit nicely; if at all wide, put new ones, as that is a frequent cause of poor vibration and stoppage.—A. B. C.

Metallic Paper.—PERPLEXED LAD.—The reason why the leaves of your metallic note-books stick when gilding is simply that your size is too strong. There is no special treatment for this paper; it can be treated like all others, the only thing necessary being particular care as to the size. Try it a little weaker than usual and watch the result, and go on weakening until you get the proper strength.—G. C.

Magnetoscope.—YOURS TRULY.—I do not know the instrument you name—at least, by the above term—so I cannot give you any information. Try and find if it has another name, and I will do my best to help you.—W. D.

Enlarged Designs.—T. H. (*Burnley*) says he has seen many pretty designs for fretwork in the pages of WORK, and wishes to know how to enlarge them. Most methods of enlarging require a certain amount of skill in freehand drawing to fill in the curved lines between certain points, the positions of which have been ascertained. With the pantograph all kinds of lines, whether curved or straight, can be drawn either to enlarged or reduced scales; but a pantograph is a very expensive instrument to buy if a good one be required, and the cheaper forms are almost worthless. The best way that I can recommend T. H. to set to work is to take a sheet of tracing-paper or thin tissue-paper the size of a page of WORK, and rule it into squares of ½ in. or smaller. Write in the top row of squares A, B, C, D, etc., from left to right; and down the left-hand side number the rows 1, 2, 3, 4, etc., from top to bottom. If ½ in. squares be ruled, there will be about twenty of them in one direction, and fifteen in the other. This ruled sheet T. H. can keep by him for regular use. Now, then, suppose T. H. meets with a design which he wishes to enlarge to three times the size of the engraving: let him place his ruled sheet of tracing-paper over the design, and put some weights on the corners, to prevent it shifting its position. Now, then, let him measure the length of the design, and on a sheet of clean white paper set off a line three times as long as this dimension. The next step is to count the number of squares on his ruled sheet that are included in the length which he measured, and then to set off the same number of squares on the enlarged dimension on his clean sheet. Of course, if the length is three times as great as the length which it represents in the original design, the new squares will measure just three times as much across as the original squares. The whole of the drawing-paper must now be ruled with squares of the same size—that is, of the enlarged size—and the details of the design are copied by noting which squares they occupy in the original, and drawing them in the same squares of the copy. The letters and numbers should be repeated on the enlarged squares, and serve as a guide in picking out the right square quickly; thus, if a certain corner of the design is found in square D 3, or the third square under D, it will be easy to find D on the enlarged squares, and then the third square under it. The smaller the squares are drawn on the original tracing sheet, the greater will be the accuracy of the copy, but at the expense of so much more trouble.—A. B.

Cane Window Blinds.—BAPTISTE.—If you write to Messrs. Elmore & Son, High Street, Leicester, for their price list, I think you will find exactly what you want.

House and Shop.—ANXIOUS INQUIRER.—Before spending as much time on the above subject as it requires, I must ask you to furnish me with a few more particulars. For instance: is the site at the corner of a street? On how many sides could you put windows or doors? Are there any restrictions as to ancient lights or heights of adjacent buildings? Do you want a w.c. in the house? What business do you propose to use the shop for? And lastly, but not least, how much do you propose to spend?—E. D.

Hand Camera.—W. A. (*Watford*).—Instructions have been given from time to time in WORK. Consult the Indexes to Vols. I., II., and III. of WORK.

Watch Centre.—AMATEUR.—From your note, I cannot understand whether it is a staff or cylinder you want to put to the watch, or whether it is only a pivot. Is the watch a lever or horizontal, and have you done anything to turning and pivoting before? If not, I do not think for a moment you will succeed, as it is the most delicate piece of turning in the watch, and every measurement must be so exact; but if you will give further particulars, I will try to assist you. The tools you will require are turns, gravers, bow, screw and cement ferrules, pivot files and burnisher, pinion gauges and Douzième gauge, eye-glass; and which, unless you are intending to keep at it, will not pay you to buy for one job, as they will cost more than half a dozen cylinders at trade prices.—A. B. C.

Tool for turning Cast Iron.—G. B. (*Dulwich*).—To take off the first rough coat, use a tool shaped as shown at Fig. 1, with the cutting edges ground acute and keen, running the lathe slowly. After this, use a tool shaped as shown at Fig. 2, with the nose rounded a little, and the cutting edge less acute. The speed must be slow for cast iron, or you will grind away the edge of the tool. This work is best done in a back-geared lathe furnished with a slide-rest. You have either been running your lathe too fast, or the castings for your field magnets must be much too hard to be of any use to you. They will be useless if they have not been annealed soft.—G. E. B.

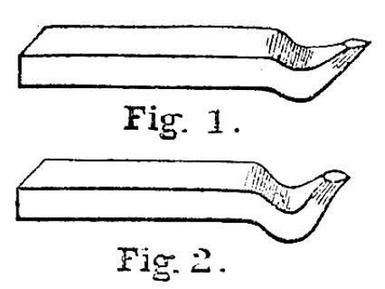


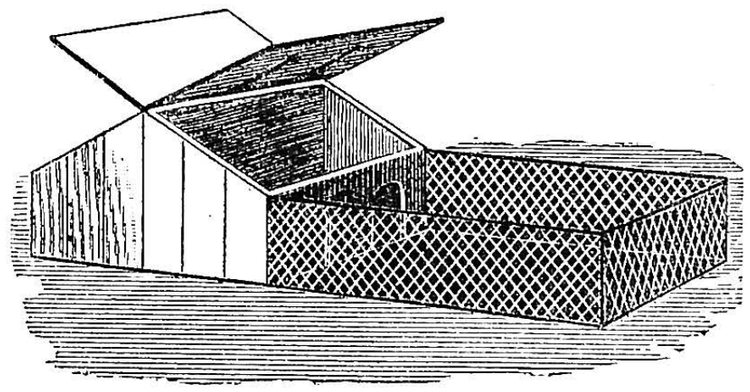
Fig. 1.

Fig. 2.

Tool for turning Cast Iron.

Safety Lamp.—G. B. (*Edinburgh*).—We do not know any particular firm our correspondent should apply to to take up his plan. There are a great many in Birmingham who occupy themselves in taking up and introducing novelties of this kind, but we do not know any of them. Our correspondent should examine the Birmingham directory, and select one or more names, and introduce the matter to their notice. We have an idea that the *means* adopted for actuating has been covered by a prior patent some years since, but at the moment we cannot decide this point. If this is so, the manufacture would have to be carried under licence from the prior patentee. We should strongly advise that this print be fully ascertained by means of a careful search before filing the complete, in order to ascertain exactly what novelty there is and what may be claimed, and so prevent the addition of another useless and invalid patent to the huge mass of such waste paper which the looseness of the Patent Office system permits to be poured into what might be a useful Government Office.—C. E.

Rabbit Hutch.—FRED.—Being a joiner's apprentice, you ought to have no difficulty in modifying the design of the rabbit hutch in WORK, No. 159, to your own particular fancy. As you think the front too open, you could make a double hip roof instead of a plain lean-to, and let the hips be on hinges so that the rabbits may be easily put in and out. In this case you need not have an open


Rabbit Hutch.

front at all, but doors in the back and front. You will, as you require accommodation for four rabbits, have to feed the animals somewhere else, and this is why the space in the one illustrated is so open, because the rabbits are supposed to be fed in that opening. You could have a wire run made to fit up close to the doors—covered in or not, as you like—while feeding (see sketch).—L. G.

Tin Extract.—A. R. (*Aberdeen*).—Melt it off in a furnace.—J.

Bellows.—LLUDWIG.—Melt and mix glycerine with glue.—J.

Charcoal Iron.—H.W. H. (*Heathfield*).—Samples sent are too thick. Use 23-gauge. If you can get guillotine shears, so much the better, but how many of our readers could obtain them? Snips will do. You can get the iron of Whiteley, Westbourne Grove, at 10d. per lb.—J.

Profitable Employment.—H. A. H. (*Leeds*).—You should know your aptitude better than anyone else. Try and make something, and offer for sale, or compete for WORK prizes.—J.

Bicycle Enamel.—C. A. (*King's College*).—To have your bicycle enamelled to look like the new

machines in shops, you must have it stove enamelled by a proper enameller. The machine must be taken apart, and every part properly rubbed down smooth and clean. Even in stove enamelling there are different grades, according to the price you are willing to pay for it. One coat is the cheapest, and may cost from 8s. to 10s. A high-class enamelled machine has at least three coats, each coat carefully rubbed down before the other is applied; the machine is then baked in the stove or oven three times. If you wish to do it yourself with a brush, get club black hard-drying enamel, which is very thin. Lay on one coat somewhat copiously; when hard, rub smooth with a woollen rag and flour emery, and apply another coat.—A. S. P.

Zither.—SUBSCRIBER FROM BEGINNING.—(1) No slip has occurred. Rosewood or maple make excellent bellies for zithers; and it is not the belly alone that vibrates, but the whole body of the instrument, back and front being connected by the inner long stay, which acts as the sound-post does in the violin. (2) The measurements given for the cross-stays—viz., 5½ in. and 10½ in. from the *bottom* on the straight side—are reckoned from the centre of stay. (3) The upper bridge is to be *on* the beech block, and the bridge pins go just through bridge and belly into the block (see Fig. 5, p. 392, Vol. III.). (4) Messrs. Chilvers & Co., 10, St. Stephen's, Norwich, will supply the necessary wood, Swiss pine backs and bellies being, I think, about 1s. 6d. each. —R. F.

Tailoring Articles.—S. W. (*Ashton-under-Lyne*).—These are under weigh.

Engineering Pupils.—F. W. (*Southampton*).—As to firms who take engineering pupils, I can only indicate the names of a few, leaving it to you to ascertain if any vacancy exists for pupils, conditions of entrance, and amount of premium payable:—R. Lloyd & Co., 135, Steelhouse Lane, Birmingham; Tangyes (Limited), Cornwall Works, Birmingham; Charles Taylor, Edmund Street, Birmingham; James Archdale & Co., Ledsam Street, Birmingham; Buckingham & Adams, Arthur Street, Small Heath, Birmingham; S. A. Daniell, Edward Street Parade, Birmingham; J. Watt & Co., Soho Foundry, Smethwick, Birmingham.—N. M.

Cabinet-making Designs.—C. D. D. (*Hammersmith*).—So many designs have already been given in WORK, Vols. I., II., and III., it would be difficult to enumerate them. Consult the volumes or indices.

Printing Outfit.—UNIVERSAL AMATEUR.—The papers are in hand, and shall appear shortly.

Sewing-Machine Adjustment.—C. K. (*Fitzroy Square*).—There is very little wrong with your machine. It is evidently a "Medium" on the Singer principle, and you seem to have got a "Family" shuttle, which is of course too small. You can never hope to do any sewing with such a shuttle, because, instead of taking hold of the top cotton loop left by the needle, as it should do, it is apt to miss, and thus miss stitches in the sewing. The shuttle should have at least $\frac{1}{32}$ in. *easy* play all round to allow of the thread passing easily round it, and the hook on the carrier should certainly fit in the slot on shuttle point, or the shuttle will "chuck," and catch against the top slides or miss stitches. The threading you show on the shuttle in sketch is right. Your next mistake is in the threading of the needle. The thread should pass from front to back—that is, *away* from the operator, not towards him, as you show in your sketch. With that exception, the whole of your threading is correct. As your needle is now threaded, the loop which it forms for the shuttle to catch is on the wrong end of your thread, and will draw, not from the reel, as it should, but from the loose end, and thus make stitches without either tension or regulation. The *short* groove in the needle should be on the shuttle side, and the eye in such a position that it throws out a loop at right angles to the travelling direction of the shuttle.—CYCLOPS.

WORK Volumes.—W. S. (*Appleby*).—You should advertise such matters in the "Sale and Exchange" column of WORK, which you can do for a few pence.

Clay Modelling Classes.—M. E. F. (*Stockton-on-Tees*).—We know of no classes specially open in August. Possibly some of our readers may enlighten you.

III.—QUESTIONS SUBMITTED TO READERS.

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

Clock Case.—S. C. (*Ashton-under-Lyne*) will be obliged to any reader for a suitable clock-case design to match the prize bookcase given in WORK, No. 48, p. 760.

R. H. A. Monogram.—R. H. A. (*Forest Hill*) will thank a reader for monogram of R. H. A. in circle.

Urn.—IRONMONGER asks how to touch up a brown enamelled urn.

Birds' Eggs.—W. L. J. (*Swansea*) writes:—"Could any reader tell me where I could get information as to how to make use of birds' eggs for ornamental purposes? I have seen butterflies arranged in cases for hanging on a wall, but I hardly know how to fix the eggs."

Lathe Change Wheels.—TURNER will be glad to know the best maker of these.

Firewood Splitting Machine.—MERCHANT writes:—"Will any reader give me the name of a good machine?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Coffins.—CHOPSTICK writes, in reply to W. P. W. A. (*Aylesbury*) (see No. 170, page 222):—"To give full instructions for making a so-called panelled coffin would take up too much space for the 'Shop' columns; but it may be of some assistance to you to state that the coffins are first made plain, same as ordinary coffins, and then strips bradded on to represent the framing, the plain board, of course, forming the panels. To make the raised panel lids, proceed as follows:—First fit the ordinary plain lid; then about 2 in. all round plant on strips with rounded edges, and on these strips plant on top

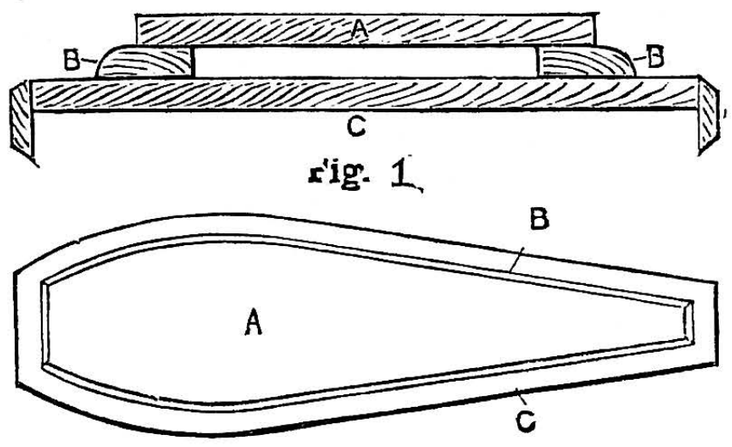


Fig. 1.

Fig. 2.

Coffins. Fig. 1.—Section of Coffin Lid. Fig. 2.—Plan of Top of Lid. A, Panel; B, B, Raising Strips; C, Lid.

panel. The accompanying sketch, which shows section and also view of lid thus made, will assist you to understand. The usual width of head and foot of a full-sized coffin is 10 in. and 8½ in. respectively, whatever the width of shoulders may be. I myself consider any flourishing on a coffin plate decidedly out of character, though it is often used. The Editor has a paper in his hands, written by me, giving instructions (with examples) for coffin-plate writing, and I shall be pleased to write on coffin-making at any time, if required to do so. In case you cannot wait until my paper appears, I should advise you to use block and plain Roman letters, written with gold. This is what I have always found to give satisfaction, and I have written largely for the trade."

Lathe Attachment.—M. (*Bishop Auckland*) writes (see No. 167, page 174):—"I send sketch of fret-saw attachment for lathe. Fig. 1 is the saw-frame of cast iron; the section is T-shape. Make the length 12 or 14 in. A and B are holes ½ in. square, in which two pieces of iron with split ends for holding saw are fixed; a screw in each holds the saw; a screw is formed on the top with fly-nut for tightening saw; the end is fixed by a pin in a double eye, C, the lower end of which is fixed in the rest-socket. Fig. 2 is the eccentric, which is fixed between the lathe centres, and works in the slot in the saw frame. Drill holes in each end ¼ in. from centre. A carrier is fixed on one end at D, by which it is turned. The table is of wood, with an iron pin fixed underneath, which can be fixed in another rest-socket, a saw-cut being made in it for the saw to work in. The saw will not have a perfectly upright motion, but by having a short stroke you can make very good work. The top of the table will be level with the centre of the frame. This is soon removed when the lathe is required for turning."

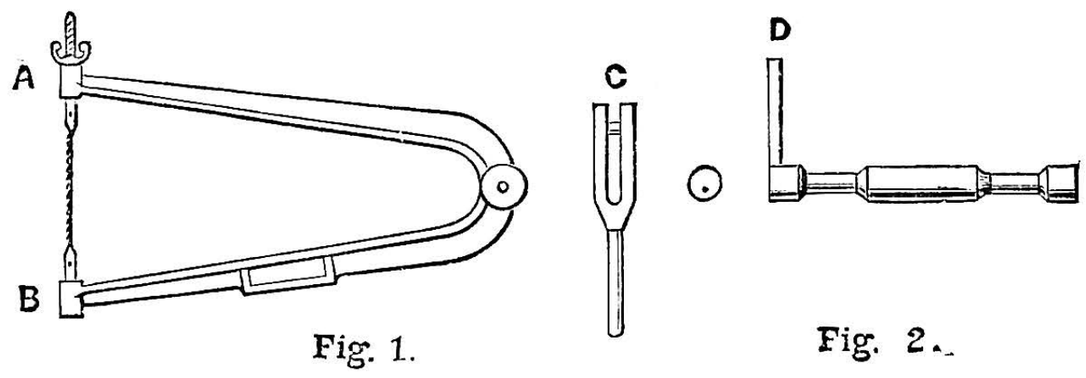


Fig. 1. Fig. 2.

Fig. 1.—Saw-Frame. Fig. 2.—Eccentric.

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. B. P. (*Winlaton*); M. W. (*Notting Hill*); J. H. B. (*Pendleton*); A. J. P. (*Manchester*); H. L. (*Finsbury Park, N.*); F. J. K. (*Tufnell Park, N.*); F. B. H. (*Sheffield*); W. R. R. (*Derby*); J. L. (*Wimborne*); YOUNG ORGANIST; M. & C., LIMITED (*Manchester*); A. E. G. (*St. Albans*); W. S. (*Oswestry*); SNAP SHOT; W. R. (*Shrewsbury*); H. F. M. (*Ramsbury*); A SUBSCRIBER (*Akyab, Burma*); CAMERA OBSCURA; PHONO; MUSIC; A. M. (*Glasgow*); OVAL; D. B. (*Batley*); S. W. (*Fitzroy Square*); G. A. (*Stockton-on-Tees*); G. W. (*Birmingham*); VENO; HAMMERED SHEET BRASS; A. E. N. (*Broadstairs*); D. B. (*Plymouth*); L. & P. (*Marlborough*); G. W. (*Carnoustie*); CAST STEEL; J. R. (*New Brompton*); W. B. (*Howden-on-Tyne*); T. B. (*Kirkbythore*); ARBOR.

"WORK" PRIZE SCHEME.

THIRD COMPETITION.

Escape from Fire Device.

FOLLOWING on with our Prize Competitions, we ask public co-operation in a subject of world-wide interest, viz., ESCAPE FROM FIRE. This is a matter which concerns every individual, and as the moment of emergency arises when we least expect it, and, as events too often prove, when we are little prepared for it, not a small service will be rendered to the readers of WORK and to the public at large by bringing the subject to the front in WORK. Thousands of people must have ideas of their own, already developed, or to be carried into effect *some day*, which will be none the worse for being made known to the world at once. It is the purpose of the present competition to elicit some of these ideas, and to gain an insight into the utility or dependableness of the plans at hand, in the event of anyone being called upon to make an escape from fire under circumstances which are never very favourable, and which sometimes are hopelessly the reverse. For the three best suggestions for an appliance, plan, or practical idea for Escape from Fire, the following prizes will be awarded—

First Prize, £3;
Second Prize, £2;
Third Prize, £1.

CONDITIONS AND RULES OF THE "ESCAPE FROM FIRE DEVICE" COMPETITION.

ALL Descriptions to bear the WORK Prize Coupon, cut from one of the numbers of WORK in which the Prize Scheme is announced.

Each Description to be signed with an original *nom de plume*, and to have the writer's real name and address securely attached to the manuscript in a sealed envelope.

Each Suggestion should be fully described in respect to its construction, conditional surroundings, and working, and, where possible, should be illustrated with a drawing of the device itself and its various parts to elucidate the description.

A Suggestion not illustrated will have an equal claim in the competition provided the description be sufficiently in detail to convey a full idea of the value of the device.

The Prize Devices and Drawings, and any others, to be published, if desired by the Editor, in WORK, but the copyright thereof to remain with the authors.

Copies of MSS. and Drawings to be retained by the competitors, as in no case can the return of MSS. be undertaken.

The Editor of WORK will supervise the judging of the Suggestions, and the selection as determined upon is to be final.

All manuscripts intended for the "Escape from Fire Device" competition must be addressed to the Editor of WORK, c/o Cassell & Co., Ld., Ludgate Hill, London, E.C. They must reach him on or before SATURDAY, AUGUST 27, endorsed, "Escape from Fire Device" Competition.