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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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A JACOBEAN SIDE-TABLE WITH LOCKER.

BY MARK MALLETT.

THAT decorative and useful piece of furniture for constructing which drawings and instructions are now offered, is, as regards its original, of the James I. period. The type is a somewhat unusual one, for though the writer is a tolerably inquisitive student of English seventeenth-century furniture, he has met with two examples only—one in Dorset and the other in Warwickshire. The professional and amateur worker may alike find it worth the labour of reproduction.

Unlike most of the articles of that age, this table is without any carved decoration whatever, the ornament being entirely *appliqué*. As regards its construction, its peculiarity is that its top is made to open, and thus give access to a kind of locker, fitted with handy compartments of various sizes. The material of the original article is oak.

Fig. 1.—A Jacobean Side-Table.

The dimensions of the table drawn are:—Height, 2 ft. 6 in.; breadth of top, 3 ft. 9 in.; projection of top, 1 ft. 6 in.; breadth of frame of table, 3 ft.; projection of frame, 1 ft. 2 in.; and depth of locker, 5 in. A general perspective view is given in Fig. 1, which is on a scale of about 1 in. to the foot. All the remaining diagrams are on a scale of 1½ in. to the foot.

From Fig. 1 it will be seen that the supports are pillars of a pattern well known in Jacobean work. In the judgment of the writer, these pillars have merit not merely as being characteristic of the style, but also as having in their strength and solidity that kind of beauty which comes from fitness. Opinions differ, however, and some may think them too heavy; if so, lighter and more ornate turning, or even twists, may be substituted for them without any great prejudice to the general effect; and into the bases and upper parts of the pillars the framework, which is of 1-in. oak, is mortised. The frame pieces should not be less than 1 in., if the solid character of Jacobean work is to be kept; indeed, 1¼ in., when planed down, is scarcely too thick. The pillars can be cut from 2-in. plank.

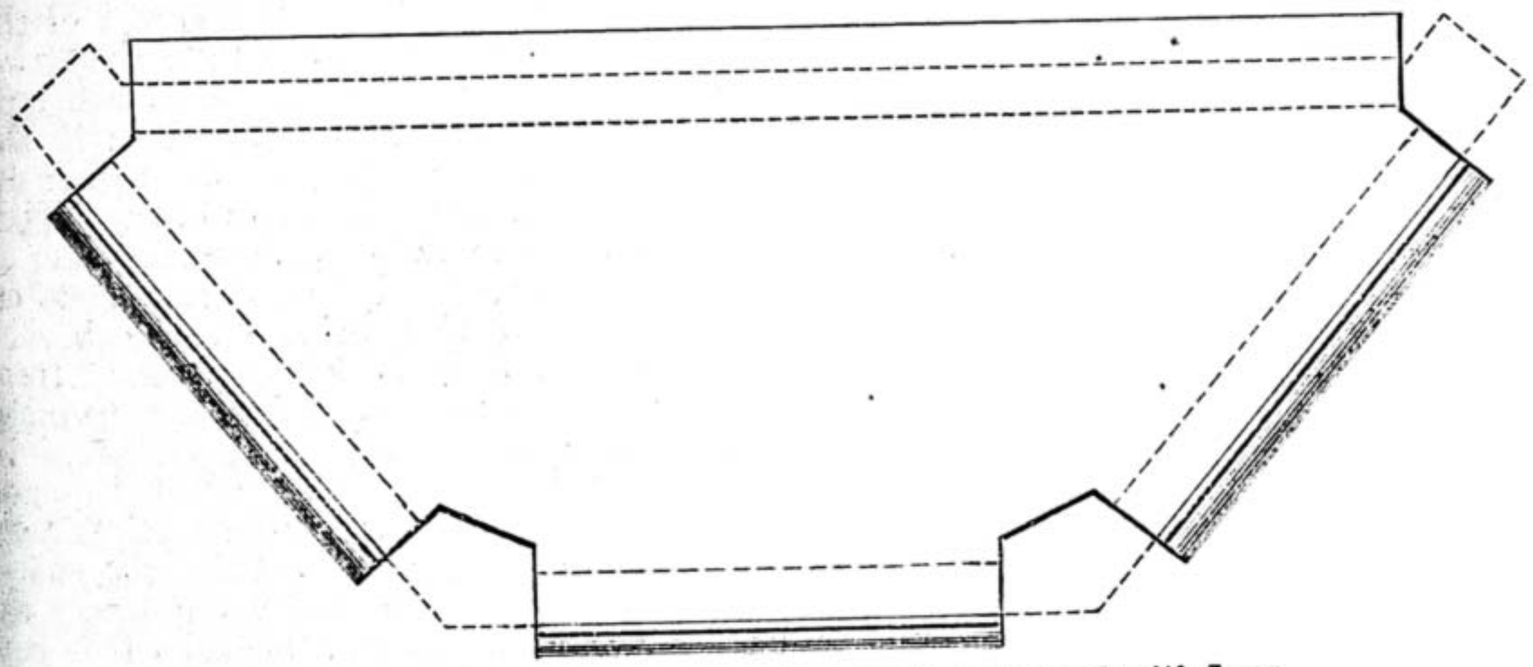


Fig. 2.—Foot-Shelf supported on Rails connected with Legs.

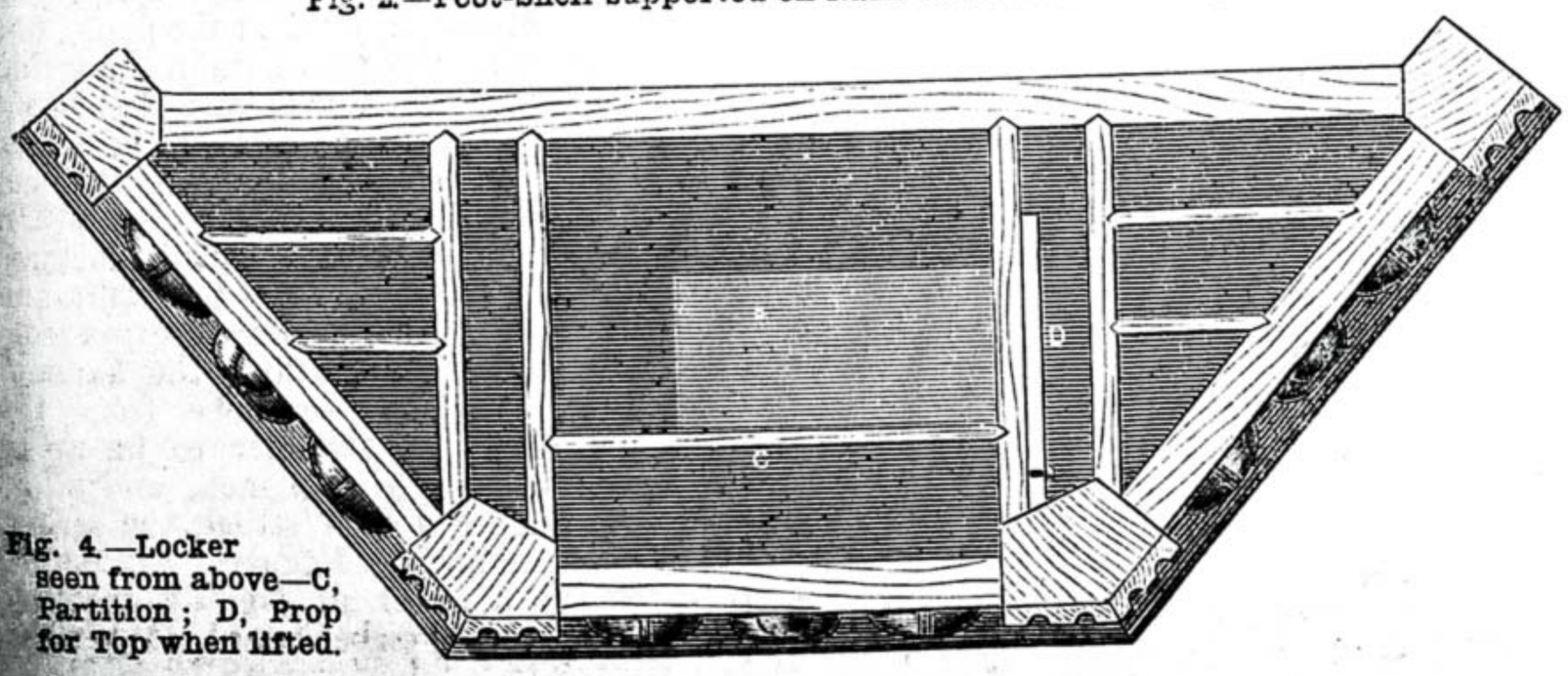


Fig. 4.—Locker seen from above—C, Partition; D, Prop for Top when lifted.

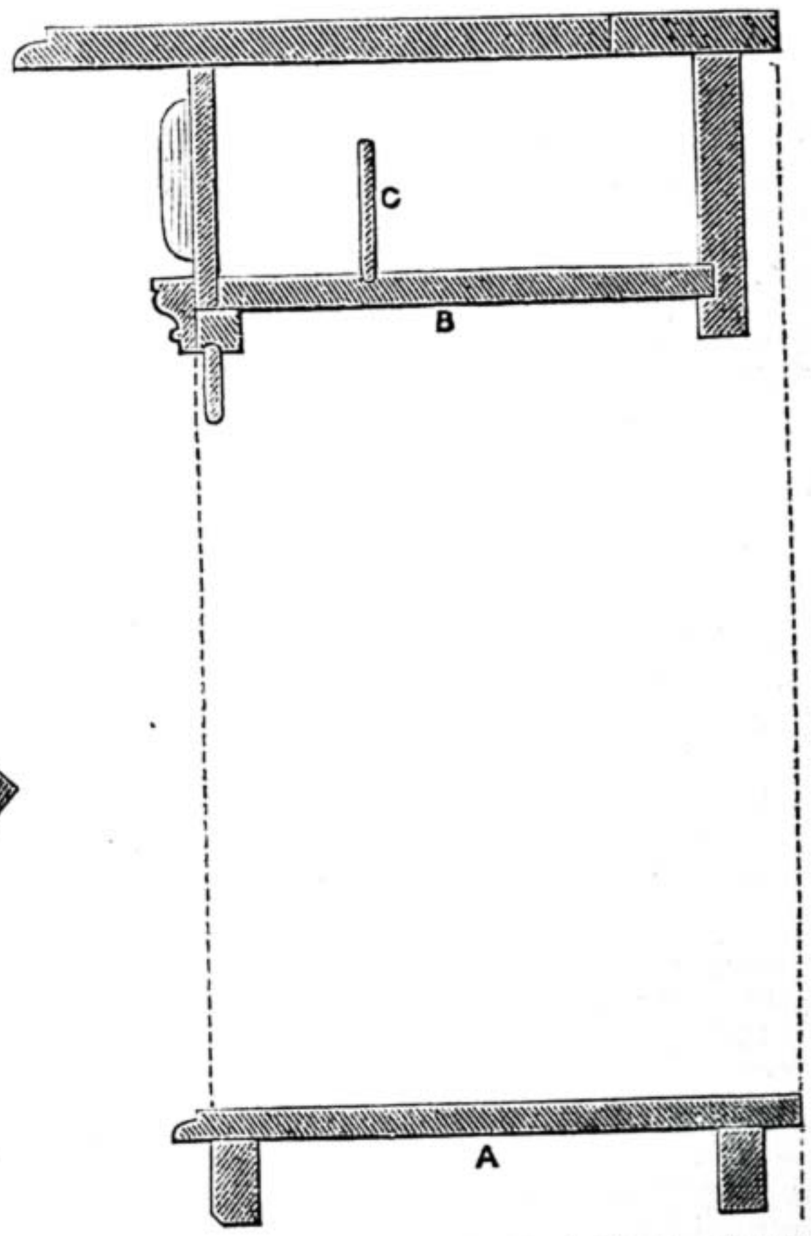


Fig. 3.—Vertical Section—A, Foot-Shelf; B, Bottom of Locker; C, Partition.

Fig. 2 shows the foot-shelf which rests on the bottom framework, beyond which it projects some ¾ of an inch. This foot-shelf is lettered A in the section Fig. 3; and the frame on which it rests is indicated by dotted lines in Fig. 2. It is of ½-in. board, and its edges are moulded, as shown, except at the back. This foot-shelf will form no bad place for the display of artistic pottery—three vases or other articles, a taller one in the centre and lower ones at the sides, will show well upon it.

Fig. 3 is a section through the centre of the table. In it may be seen how the bottom of the locker, marked B, is supported by the framework of the upper part. But the arrangements of the locker are more completely illustrated in Fig. 4, where they may be seen as from above, before the top of the table has been fixed in place. This locker is divided by partitions into compartments of convenient size for papers or other small matters. The largest compartment is 11 in. long by 7 in. broad, and the whole locker is 5 in. deep. The more important partitions—those from back to front—are of ½-in. board, and about 4½ in. high; the subdivisions are of thinner stuff, and for them a height of some 3 in. is sufficient, as shown at C, Fig. 3.

At D, Fig. 4, is shown a strip of wood attached by a screw to one of the partitions. It is for the support of that part of the table-top which forms the lid of the locker, when it may be desired to prop it open. To prevent all danger of slipping, it may not be amiss to notch like a rack that part of the lid which rests upon it.

In this same diagram (Fig. 4) is to be seen something of the relative relief of the different pieces of applied ornament. These pieces are in a general way simply glued to the surface. Among the furniture makers of the seventeenth century it was rarely usual to trust the effect of their work entirely to *appliqué* decoration. They more frequently used it in combination with carving or inlaying, or both. *Appliqué* work, however, survived carving, for we find abundant, and some of the best, examples of it dating from as late as the earlier part of last century, and from a period when carving had passed out of fashion. The example before us is, as regards ornament, anything but an elaborate one. The two carbuncles on each side are, of course, turned in one and sawn through. The lozenge between them is sawn out and worked by hand. The fluted pieces at each end are also readily worked by hand; in restoring the original of the drawings, the writer had to supply one of these pieces, and found it could be quickly worked with the gouge.

In Fig. 5 we have the top, ¾ of an in. in thickness, and moulded at all its edges except the back one. Access to the locker necessitates that it should be in two pieces, of which that at the back—the fixed one—is 4 in. wide. If, however, any person making such a table should object to such a division in the lid, an alternative is open to him—he may omit the locker, and instead have a drawer on the front side. More than one drawer he could not well have; and this would, of course, involve some loss of space, and make, on the whole, a less useful article of furniture than the original, which will serve many of the purposes of a bureau.

Indeed, to the writer, the locker appears so characteristic a feature of this table, that he would not willingly sacrifice it. An ingenious combination of purposes, analogous to that shown in this table, is not unfrequent in early seventeenth-century furniture. The writer has met with joint-stools of the Jacobean period, the tops of which, by removing a secret fastening, could be made to open and disclose unexpected receptacles within. Such receptacles were, no doubt, useful in days when portable property was even less secure than in our own. Another instance with which he has met was an arm-chair, of much the same date, the back of which, when turned down on the arms, made a circular table some 3 ft. 6 in. in diameter. A chair-table like this, or one on somewhat similar lines, would not make an unattractive subject to amateur carpenters, and possibly a corner may at some time or other be found in Work for drawings of one.

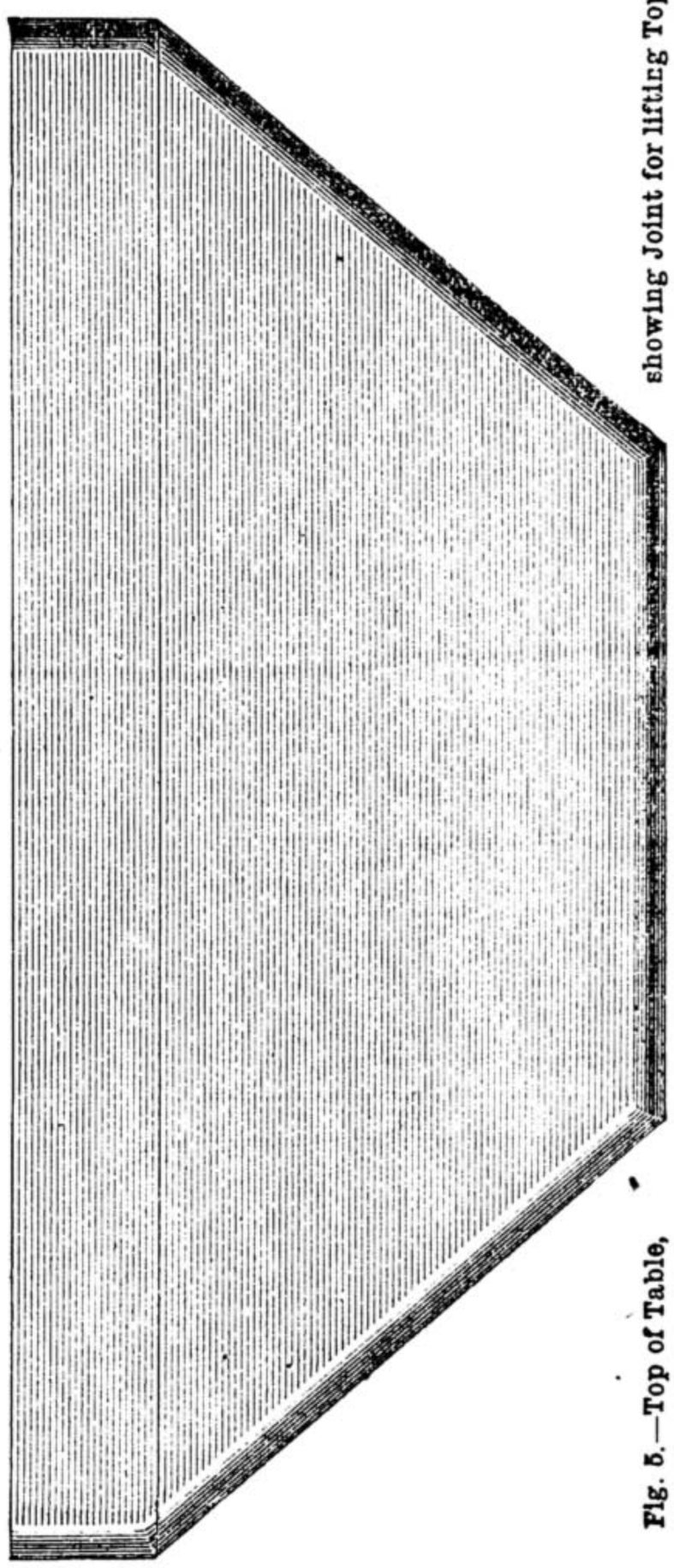


Fig. 5.—Top of Table, showing Joint for lifting Top.

The original of our Jacobean side-table is, like most of the furniture of the age in which it was made, formed wholly of oak; and oak will be the best material for any one who attempts an exact reproduction of it. A pretty table, however, on much the same general lines, but more lightly made, might be constructed in pine, and ebonised—the amateur joiner will probably prefer to work in the latter less costly and more easily wrought wood.

A suggestion may be added for the benefit of any one making such a table as this in oak and wishing it to harmonise with other oak furniture which is carved. He may gain that end with little labour by running a carved enrichment—some Jacobean variety of the "egg-and-dart"—along the moulded edges of the table-top and foot-shelf.

HOW TO MAKE A PIANO.

BY "NIL DESPERANDUM."

Regulating, Tuning, and Toning—Conclusion.

Take out the keys and place them on your bench; then take a thin piece of wood about an inch wide, and wrap round it a piece of fine glass-paper, and rub over the wood of the keys, behind the ivory or sharp, cleaning one at a time; then brush the dust off them; if you see any on the key bottoms, remove it. Between the balance and front rails fit a piece of thin wood to prevent the light being seen through the spaces of the keys. Now, where the ends of the sharps were cut off, black with ink about an inch wide; also black the lower part of the sharp from this line. While the keys are out, take off your damper rail carefully, and by moving each hammer to the string, see that each hammer strikes it fair; if the shank has cast to one side or the other, as shanks do sometimes, you can alter it by warming an old file, or flat piece of steel, and hold it to the side you wish to bend over. Now you can see that the bridles or tapes of your action are properly adjusted; put one finger under the lever and raise lightly, and there ought to be $\frac{1}{16}$ of an inch play between the top of the fly and the hammer butt; if there is not, you can make it so by bending the bridle stay either backwards or forwards. Now take the action out and put the keys back in their place, and take each key separately, and see that it works free; if not, ease it with your file, but do not make it loose; if you find it a trifle loose, you can tap it gently with a hammer over the hole; this will tighten it. Having done this, put the action in its place and see if there are any pilot screws which need turning up, as in the finishing. Now look over the keys and see that they are straight to your straight-edge, then tap on the keys with your straight-edge, and those that are high will move; take a shaving off these and make the low ones level with tissue paper. The spaces of the keys must now be adjusted, then the action must be regulated or set off. I will now describe what is meant by this: if the reader will kindly look at the action, he will find that through the fly of the hopper there is a wire, with a button on the end; as the key is depressed, this button rests on the slide rail, this being on the bevel; as it rises, the fly is pushed forward from under the hammer, allowing the hammer to fall into check. This is accomplished in the following manner. As the hammer moves towards the string, the check follows it, and when the hammer falls, the check is there to receive it, holding it firmly by the check arm. Make a hook, so that you can turn the wire that has the escapement button on. Now sit down at the piano, and commence with the first note in the treble, press the key gently down, and watch the hammer; if you turn the escapement button to the left, you will find that the hammer will bump against the string; therefore it damps the tone, or, as it is called, blocking. Now turn the escapement to the right, and you will find that the hammer escapes from the string; the check allows the hammer to fall the requisite distance from the string. Allow the hammer to go up to the string within $\frac{1}{16}$ of an inch, and allow it to fall, after it has struck the string, about $\frac{3}{8}$ of an inch. Regulate the check, to catch the hammer at this distance, by bending it forward or backward. When the key has taken the hammer to the string, it

ought to rest on the front baize; if it does not, the touch is a little deep, and that means loss of power; remedy this by placing a piece of brown paper under the baize. If the touch is too shallow, and the key does not carry the hammer far enough, you can strike the baize with a hammer to compress it, so that the key carries the hammer further. Regulate every note in this way. Now put your damper rail in its place, and see that it works without noise. Put your foot on the right or loud pedal and press it down, so that it removes the dampers clear off the strings; then put a small block under the front of the rocker to prevent it going down further than is necessary; glue a piece of cloth on the top; also glue the bottom to the bottom board of the case. Now serve the celeste, or left pedal, in the same way, so that when the foot is pressed on the pedal, the hammer strikes the felt or flannel; stop this with a block also.

You now proceed to tune the piano, but before you do so, you will have to make a wedge; this is made of a thin piece of wood or cane, about a ¼ of an inch wide, with a covering of leather at each end. When the reader chipped the strings, it was only necessary to chip one at a time, but now the hammer strikes two and three strings at one time, it is more convenient to damp either one or two of them in tuning. It is for this purpose that the wedge is used. The same process is adopted in the tuning as in the chipping up, only that the action being in, you will be able to hear the notes more distinctly. You sit down at the piano (and in a quiet room if possible), and put your tuning hammer on one of the pins of pitch C. Now place your wedge between the string you are not tuning and the next note; this holds the wedge in position, and damps the string or prevents it vibrating while you tune the other. The wedge is about 7 in. long, and you put it between the hammers a little further on than the note you are tuning, so that it is at an angle; this is so that the hammer of the note you are tuning does not strike the wedge; a little practice at this will soon make it easy. While the chipping up is rough tuning, until the piano has been tuned two or three times it will sound very rough. Pull the string up until it is in unison or sounds the same as your tuning fork. Now take your wedge out, and you will find it sounds out of tune. Put your tuning hammer on the other pin of the note and pull it up until it is in unison with the other string; listen attentively, and pull the string up gently, so that when the note is struck, it sounds like one note without beats. This is the way to tune the unison. Practise this well until you are proficient, then try to tune the octave; this is the same note C, an octave nearer the bass end of the piano. When the note and its octave are struck at the same time (when in tune), it sounds as if you had only struck one note. Do not turn the wrest pins back if you can possibly avoid it, as this tends to loosen the pins. If you pull a note slightly sharp, give it several sharp blows; this will make it a shade flat. If you can get access to a piano, you will be able to try the scale and octaves. If you do not know the notes on the piano, I may say that the C is the white key which comes before the two sharps, then towards the treble the notes would follow in rotation, so: C, C sharp, D, D sharp, E, F, which is the white key before the three sharps, then F sharp, G, G sharp, A, A sharp, B, C; this forms the octave. Having tuned the octave C below pitch C, move your tuning hammer to the G below, or towards the bass; damp one string of the note, then strike C and G at the same time, and pull the G up carefully and slowly, listening attentively, and although it may sound rough and discordant when you start, with a great number of beats which sound like woo, woo, woo, you will hear it gradually coming into tune, and it will sound pleasant to the ear, and without a beat. Take out the wedge and pull up the unison, then move to the D above, or towards the treble; repeat the same operation as before, and so on through the scale, a description of which was given in the paper on stringing and chipping up. The thick end of the wedge is used for the bichord notes, the thin end for the trichord. In tuning a trichord note, you would put the thin end of the wedge between the two treble strings of the note, that would allow you to tune the first string; then use the thick end to tune the middle string of the note, and draw the wedge out to tune the third string. The pianoforte has no E sharp, or B sharp, so this deficiency has to be made up by tuning

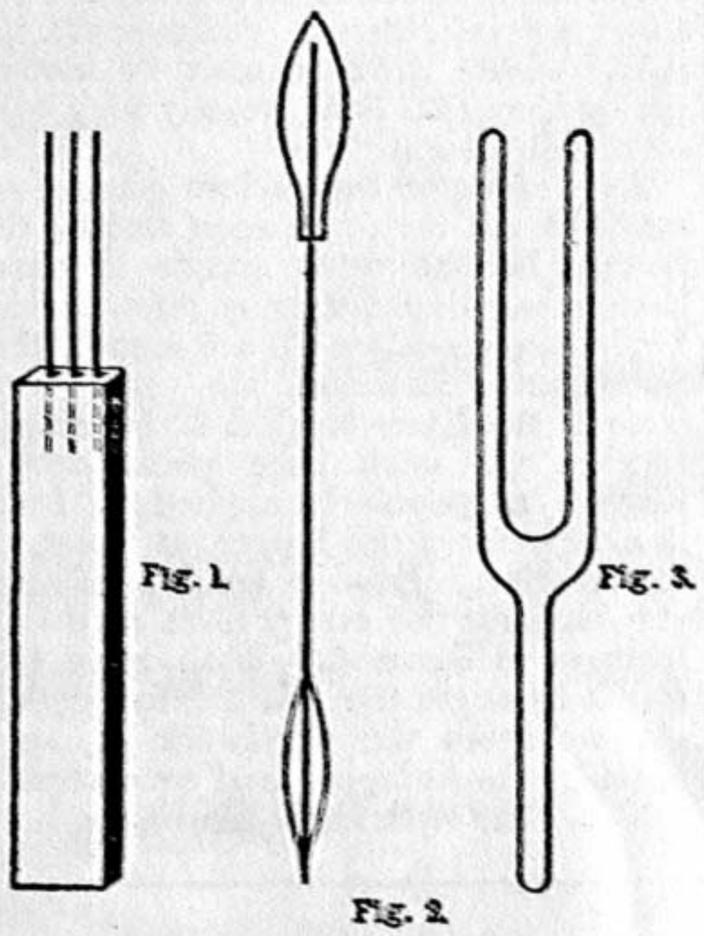


Fig. 1. Fig. 3.

Fig. 2.

Fig. 1.—Toning Needles. Fig. 2.—Tuning Wedge. Fig. 3.—Tuning Fork.

all the fifths a wave sharp, and the fourths a wave flat, towards the bass. To be able to tune perfectly requires a large amount of practice, and tuners' ears in time become sensitive to the slightest discord. No doubt the reader is well aware that there are some persons who have no tune in them, therefore it would be impossible to teach them tuning. I have known some persons during my lifetime who, when they have made an attempt to whistle, or sing a tune, have made some awful discordant noises, while they were totally ignorant of having inflicted pain on those who possessed a sensitive ear, believing they were singing or whistling in perfect tune. They say, where ignorance is bliss it is a folly to be wise, but I think in this case it would be a kindness to tell them not to sing again, and put an end to their bliss. I worked with a man at one time who had never been known for years to hum or whistle a tune; I expect some one had put an end to his bliss. I think I have said enough to give the amateur a start in tuning his piano; the rest depends on practice and perseverance.

There is one other matter that ought to be attended to now—that is the toning: this is making the inequalities of the tone more equal. I will explain to the reader what is meant by this: one note, if the felt on the hammer is too hard, may sound like a tin kettle, while another may seem much softer; to remedy this, you must prick the felt at the point of the hammer with a sharp needle, or two or three held in a piece of wood; this softens the tone. Now, in the extreme treble, it is just as well to have it sound bright, or brilliant as it is termed; this can be accomplished by passing a warm flat iron over the points of the hammers; try the heat of the iron on a piece of paper, so that you do not burn the felt.

Your piano is now complete; and I hope those who do not wish to make a piano, may have found in the perusal of the papers on this subject something to interest and edify them. I am aware that a great many wrong impressions prevail with regard to the manufacture of the pianoforte, and I hope I have dispelled them. As the church organ is sometimes called the king of instruments, I would claim for the pianoforte the title of the queen of instruments. For the home, it will always be a favourite; whether for sacred, dance, or secular music, it possesses qualities which commend it to our esteem. And as the education of the people progresses, so will the manufacture of the pianoforte, as a knowledge of music is thought to be indispensable in our modern schools. To those who intend to make a piano, I hope I have made everything so simple, that they will readily understand it. Should any difficulties arise, or the reader not see his way clearly, I shall be most happy to set him right through the columns of "Shop."

A CARVED BUREAU.

BY D. ADAMSON.

SHERATON'S STYLE—EARLY ENGLISH STYLE.

To put theory into practice, let us take a drawer front—it can serve no good purpose to give an illustration showing the whole of the bureau—and see how it may be treated in a style typical of Sheraton's, merely observing that the objectionable cross-banding has been done away with. Let us then refer to Fig. 18, showing part of a drawer front, the main portion of which, by the way, we may regard as mahogany or rosewood; there is the familiar inlay, which has so often been reproduced, representing a series of flutes or beads converging to a common centre. Such pieces of inlay can easily be made by those possessing the necessary patience, but as they are somewhat tedious and by no means ornamental unless neatly put together, it may be satisfactory to know that they can be obtained through most cabinet makers who make a display of inlaid furniture. More elaborate inlays may be used if preferred, but it would take too long to describe their mode of construction here. Suffice it to say, as the process of marquetry cutting is very little understood by those who do not follow it as a profession, that full instructions have lately been published in the "Art of Fret Sawing and Marquetry Cutting." Beyond the mahogany veneer we have a stringing of a light wood, such as box. These stringings are sold at such a cheap rate, that it would be merely a waste of time for any amateur to prepare his own. Much skill is requisite to do it properly, and besides the work is purely mechanical. Next to this stringing, which is very narrow, say ⅛ in. wide, we have another, a broader one of black, and beyond this a band of satin

wood, or if preferred as being less costly, boxwood, between which and the outer border of mahogany the thin black and white stringing may be repeated. It will be noticed that the stringings, etc., must be mitred at the corners, but as they are very narrow no great difficulty ought to be experienced in doing this neatly. The same cannot, however, be said of laying them and the veneers, an operation which might, perhaps, deter the amateur artisan from attempting to form a Sheraton bureau unless explained to him. But as to give anything like a full explanation would be to forestall an article on veneering, which will shortly appear in these pages, the novice is referred to it.

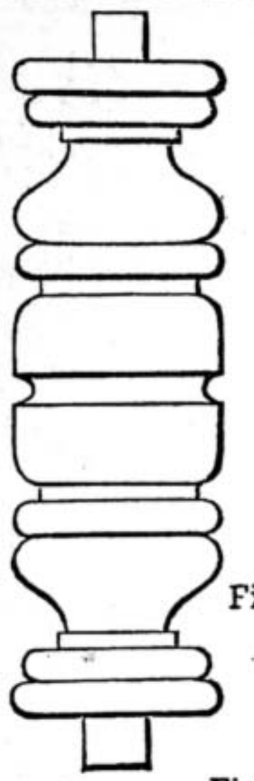


Fig. 13.

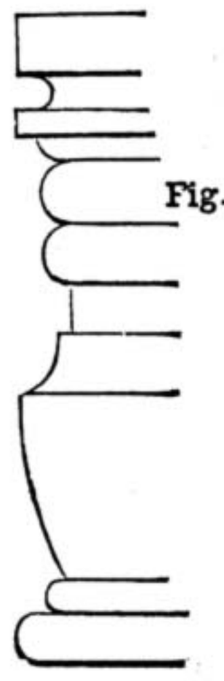


Fig. 14.

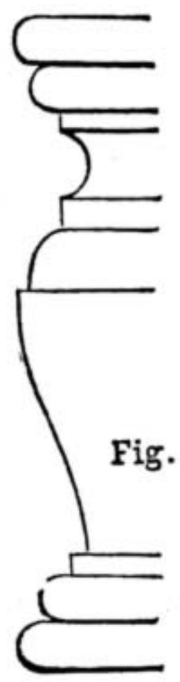


Fig. 15.

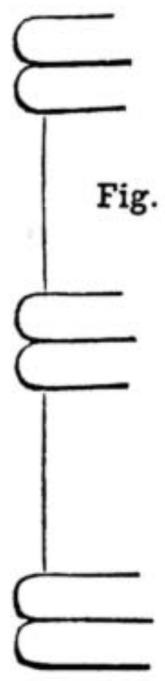


Fig. 16.

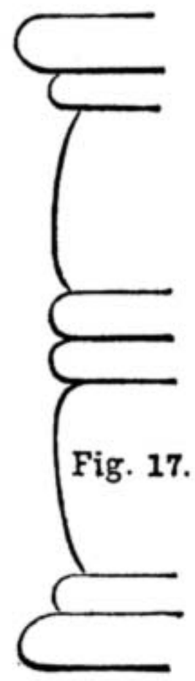


Fig. 17.

Figs. 13-17.—Examples of Different Forms of Turned Spindles.

Early in the present century a marked decadence in the artistic features of furniture is very perceptible. We have already noticed this as evidenced in the later productions of Sheraton, whose later works may be taken as a sufficient illustration of the debased taste which during his short career had set in. It is difficult to believe that a man of his ability could possibly have fallen so much under the influence of popular fashion as to design some of his later works, which he seems to have been conscious were not so good as his earlier efforts. However, whether he originated the degraded style or merely followed the lead is beside the question. There can, however, be no doubt that for fifty—or might the time not be extended to seventy?—years from the beginning of this century, our domestic furniture was possessed of few if any artistic features which are deserving of perpetuation.

The workmanship might be good—indeed much of it was good—but any pleasure which could be experienced from this quality is lost in view of the utter want of any artistic merit both in decoration and structural design. Truly, so far as beauty or sense of ornamentation is concerned it was a desolate age, and those who pay any attention to such matters may well be thankful for the great improvement which has taken place in recent years. Perhaps the only class of men who have reason to cast a longing glance backwards to the good old times of bad or no art are manufacturers and designers of goods, such as furniture, which are influenced by artistic considerations. Anything then seems as if it served provided it were florid enough; but perhaps I am treading on the toes of some elderly readers who "can't abide them there straight things," so desist from further comment, beyond saying that though articles of furniture when perfectly plain might be worthy of regard, the same cannot be said of much that was elaborated by fanciful decoration. At any rate, there was no feature sufficient to characterise an epoch in furniture style, although here and there an enlightened designer might be found whose works cannot be indiscriminately ignored. Still, we may very well pass on to the present time.

As a result of the modern general renaissance in art, furniture soon feeling the influence became more simple in character than it had been for many years previously. Under the guidance of such men as the late Sir Charles Eastlake, the severe straight lines of the Early English style became the fashion. I must here point out Early English as popularly applied to furniture is altogether a misnomer, at least, if we regard Early English architecture as the standard, for the two present no decorative features in common. With more truth it might be called the *Old* English style, if by old we mean the woodwork of, speaking roughly, the sixteenth and seventeenth centuries. The term Early English is, however, a popular one, and as applied to furniture is so well understood, that notwithstanding writers have repeatedly called attention to its inaccuracy, it seems as though it would still remain in vogue, and it may as well be retained here.

Without going very deeply into the subject, let us then see what alterations will be needed to turn our bureau into an Early English one.

The prevailing characteristics of this style being straight lines, it will at once be perceived that in our original we have it already, with perhaps the beading round the edges of the drawer fronts omitted, and the mitred framing of the fall changed into an ordinary mortise and tenoned frame.

But probably along with severity and general plainness, scratched beads are equally associated in our minds with Early English, not to mention spindles. We all know how these were used a very few years ago. Spindles here, spindles there, and spindles everywhere. In moderation they are well enough, but really when they were brought in so very freely and indiscriminately, one began to get a little tired of them. In the bureau, fortunately, there is not the same temptation to use them in excess as with many pieces of furniture, for the only position in which they can be either ornamental or serviceable will be on top, where, in conjunction with top and bottom rails, they will form a very suitable guard to prevent papers, etc., slipping off. The guard may be either along the back alone or returned along the ends to the front. The latter will look better, but as the work is done in the same manner, the only difference being that there is a little more of it in one than the other, one description will serve for both. The illustration, Fig. 20, gives a general idea of the end of a spindled back guard, only without the return pieces. Analysing this, it will be seen to consist of an end piece into which are mortised two straight rails supporting the spindles. These will look better if placed moderately close to each other than if with a great interval between each, and two inches apart may be considered a fair distance at which to place them. In size they may be about a couple of inches long, and turned down from ¾-in. stuff, but it must be quite understood that considerable variation is permissible from these measurements. For one thing a good deal will depend on the pattern of the turning, a few suggestions for which are given in Figs. 13 to 17, the first of them being a spindle complete,

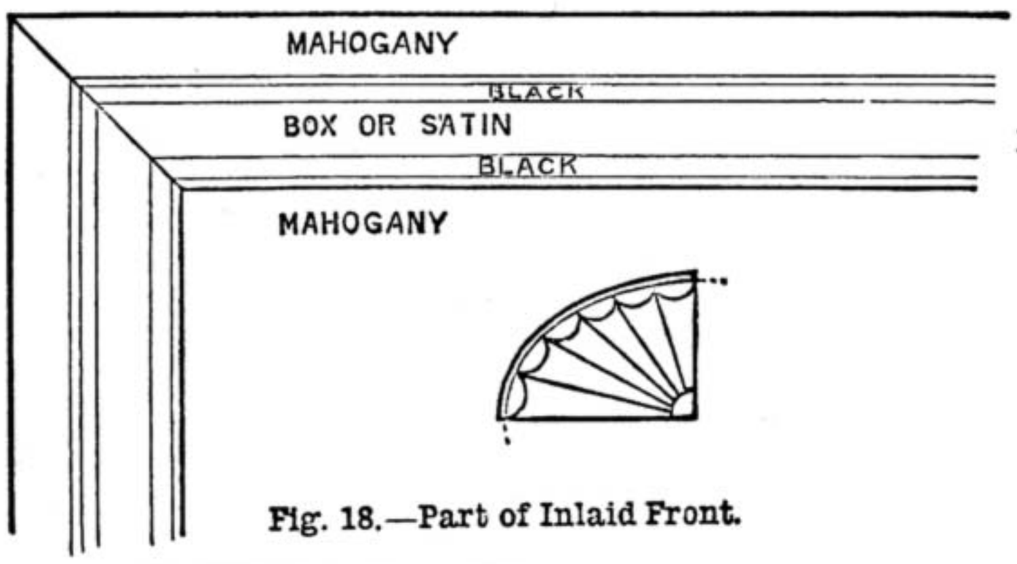


Fig. 18.—Part of Inlaid Front.

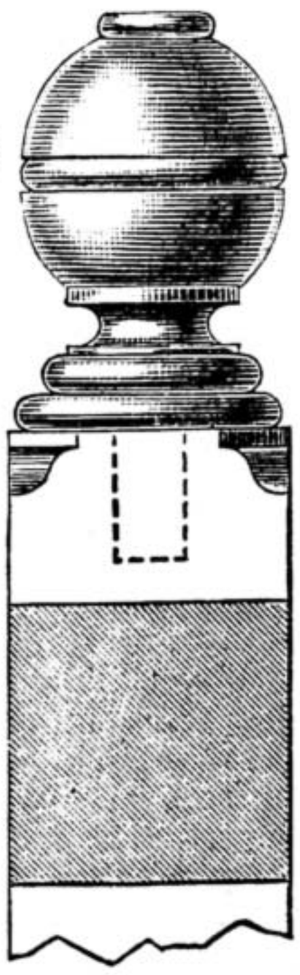


Fig. 19.—Knob at End of Spindled Guard.

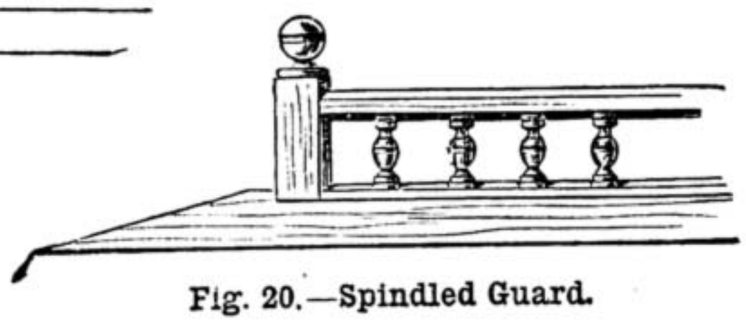


Fig. 20.—Spindled Guard.

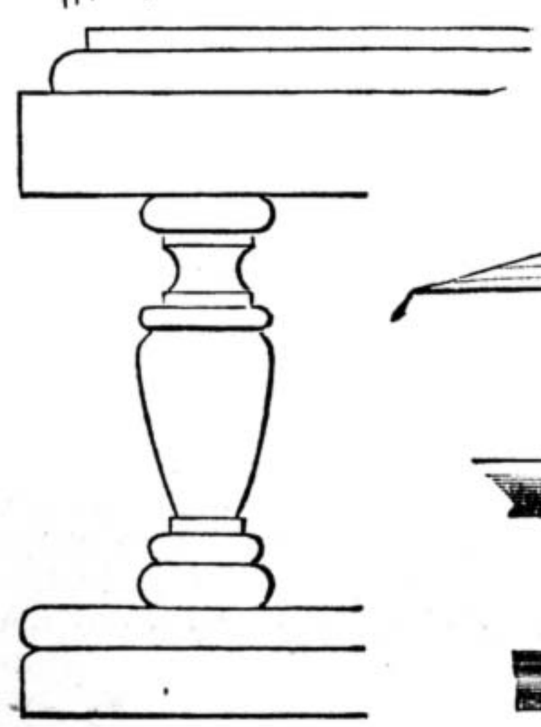
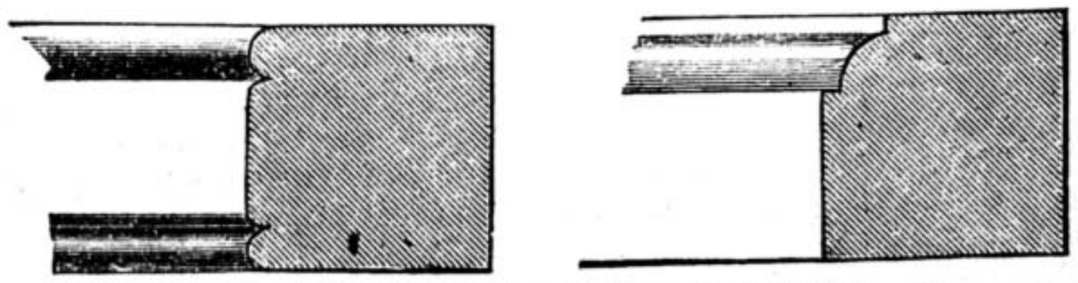


Fig. 21.—Alternative Mode of finishing Ends.



Figs. 22 and 23.—Top Rails of Spindled Guard.

and the others only showing the outline of members. From Fig. 13 it will be seen that the spindles are turned with a pin at each end, to fit into corresponding holes in the rails. As it would involve great waste of time to fit a piece of wood for each individual spindle into the lathe, the best way is to turn several on the same piece—the length, of course, of which will depend to some extent on the distance between centres, besides other considerations which the turner will well understand without them being specified. If the stick is of any considerable length, as it is only thin when turned down at the pins, a support attached to the lathe bed will be a necessity, but even without this several spindles can be turned on the same length. Great care must be taken to have all the spindles exactly the same length, so far as the show part is concerned. The length of the pins is of smaller consequence, as they can be cut shorter afterwards. They need not be more than ¼ in., that is on each spindle, not between two of these, though if they are not more than half this or ⅛ in. they may still be used. Further directions will not be required about these spindles, and we may next turn to the rails.

Some care will be required in boring the sockets for the spindles; first, that the pins may fit them fairly tightly; and secondly, that the spindles may be perpendicular. To ensure the former, all that is necessary is to turn the pin down to suit the bit the holes are to be bored with, while to prevent any mistake in the latter, the holes may be made in both pieces at the same time. Perhaps it ought to be explained that the holes may be bored right through the bottom rail, but only sufficiently deep in the other to take the pins.

Both rails must be of the same width, which should be a little greater than the diameter of the spindles, so that they overhang these a trifle. In thickness ¼ to ⅜ in. will do very well for the bottom one, but the top one will look better if it is a little stouter. It may be as much as ¾ in. thick without looking too clumsy.

Instead of leaving the edges square and plain in front, it will be better to finish them off in some way, say by running a bead at the top or bottom, as shown in Fig. 22; or the upper edge may be moulded, and the lower left plain as suggested by Fig. 23.

It has already been said that these rails are to be attached to end pieces, which will next be described by mortise and tenon. The ends themselves are merely square pieces of wood, standing a little higher than the top rail, and at least as wide, or it will be better if they are a little wider on each face than the rail which abuts on them. The top end is turned up into a knob, and the bottom into a pin, though if preferred the knob, of which a suitable pattern is given in Fig. 19, may be turned separately with a pin which can be let into a hole bored for it in the end of the square piece, or it may be fastened with a double-ended screw. The pin or dowel at the other end of the square piece may also be let into it in a similar manner. In the bureau top holes are bored for these dowels to be placed in.

Fixing and fitting this part of the work is somewhat troublesome, but with a little patience all the spindles can be properly arranged between rails; the rails are then fixed into the end pieces, after which these are ready for fastening to the top. A little glue may be used to a spindle here and there, especially towards the middle of the rail, but if the upper one be stout it is not necessary. The mortises and tenons of course must be glued, and so must the dowels into the top. By this means the rail should be firm enough, but if any apprehensions are felt that it is not, glue may also be used to secure the bottom rail to the bureau, either along its whole length or only at intervals.

If the spindle guard is to be at each end, the mode of procedure is exactly the same, the rails being fastened to the square uprights, another of which will, of course, have to be at the front ends of each return.

As a variation it may be suggested that the finish in front might be as shown in Fig. 21, when each rail stops short without any terminal upright, and is merely rounded off at the ends to correspond with whatever beading or moulding is on the sides of the rails. By the way, the beads or mouldings should be on both sides of the return pieces, unless the bureau is to stand in a recess. The reason for this is so obvious that it will be unnecessary to explain the why and the wherefore. If, however, there be any reader who is unable to arrive at the reason without assistance, I can only say that I shall be happy to clear up the mystery for him in "Shop."

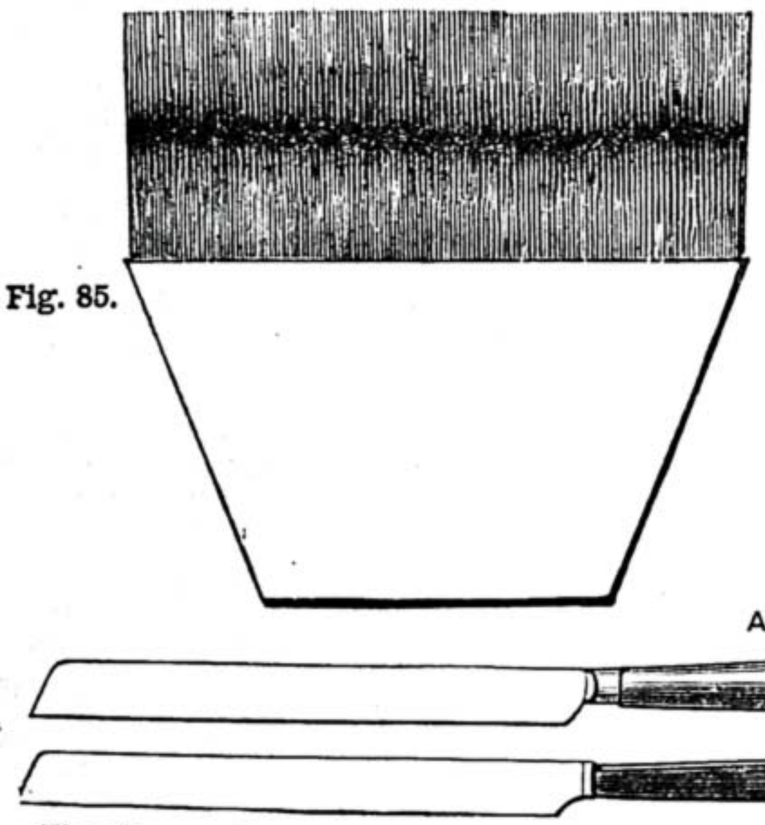


Fig. 85.

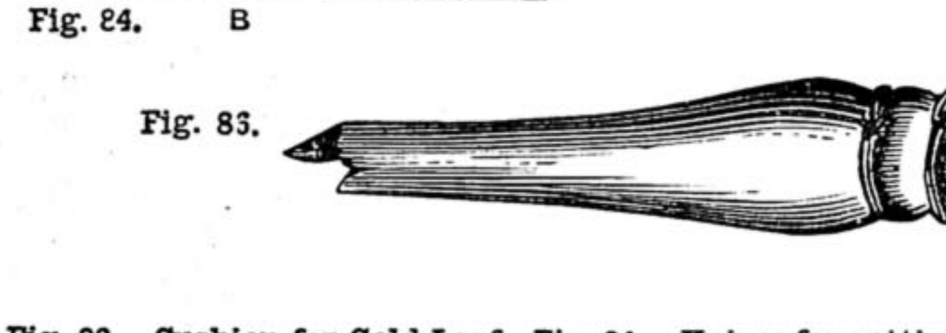


Fig. 84. A B

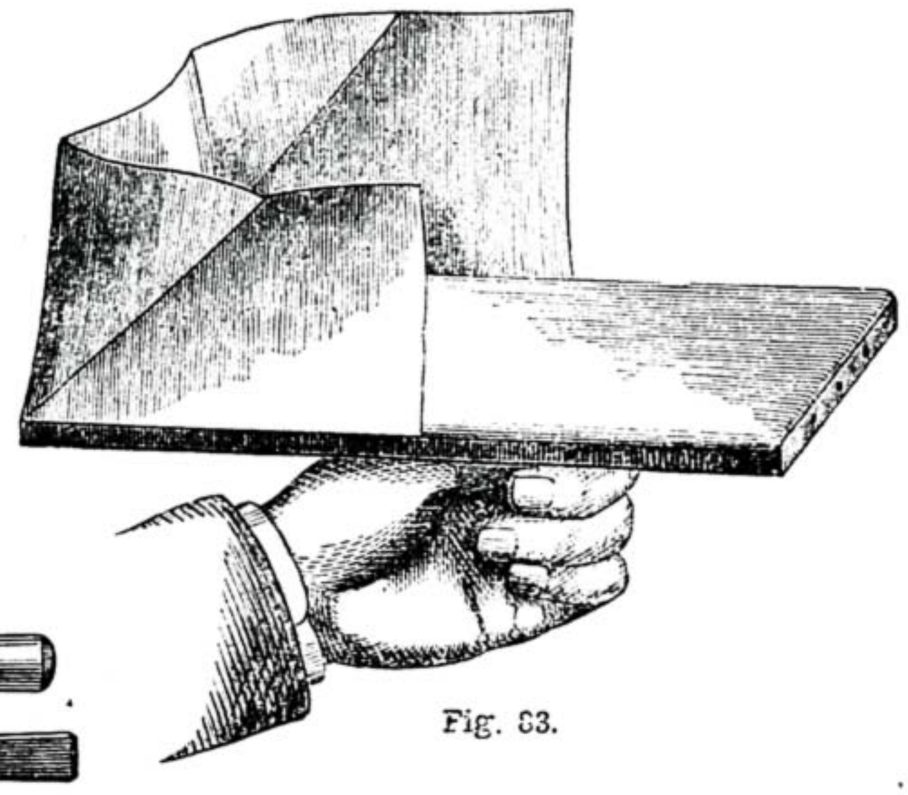


Fig. 83.

Fig. 86.

Fig. 83.—Cushion for Gold Leaf. Fig. 84.—Knives for cutting Gold Leaf—A, Knife with Balance Handle; B, Plain Knife. Fig. 85.—Gilders' Card Tip. Fig. 86.—Gilders' Mop or Dabber.

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

GILDING MATERIALS — GOLD LEAF — HALF GOLD LEAF—GILDERS' SIZE—HOW TO GILD A SIGN—CUSHION AND TIP METHOD—TRANSFER GOLD LEAF—DUTCH METAL—BRONZES, ETC.—ADVANCED TEXT-BOOK FOR FURTHER STUDY—CONCLUSION.

A TREATISE on sign-writing could hardly be considered complete without a description of the method employed by writers for gilding letters and ornaments with gold leaf. I can only give a description of the process as it is at present used in every-day practice, throwing out, perhaps, a few useful hints here and there as the result of my own practical experience in the work. It will thus be seen that I have nothing new to tell the practical workman, and as I am, therefore, writing for the novice alone, it will be necessary to be as plain-spoken and explicit as it is possible to be in describing a somewhat difficult process.

It will first be necessary to explain the uses of the tools and materials used by the sign-writer in gilding letters, only mentioning here those that are actually used in letter work, as there is no space to treat upon gilding in general in these papers.

The most important item is a suitable surface to manipulate the gold upon, and this is to be found in the gilders' cushion (Fig. 83). This is a wooden slab about 8 in. by 5 in., covered with a soft leather, and padded between the wood and the leather. A piece of parchment is tacked round one end, and half round the two sides, as shown in the illustration. This is to prevent the gold leaf from being lifted off the cushion, as the slightest movement of the air is sufficient to carry it away. Under the cushion will be found a leather loop; through this the thumb is inserted, being held in the left hand. There is also a smaller loop for holding the palette knife when not in use.

The knife (Fig. 84) consists of a long blade in a handle, and it has a hard, smooth, but not sharp edge. It must be kept clean and bright, otherwise it will tear the leaf instead of cutting it. It is used to cut the gold to the required size and shape.

The "tip" (Fig. 85) is a thin layer of camel's hair glued between two pieces of cardboard, and is used for lifting the leaf from the cushion, and carrying and attaching it to the spot to be gilded. It is 4 in. wide, and varies in length, the most useful being 1 in., 1½ in., and 2 in.

The gilders' mop (Fig. 86) is either flat or domed; it is used to dab the gold with, in order to make it adhere firmly to the prepared surface.

These are all the important tools that are really required, but a variety of sable, camel's-hair, hog's-hair, and "skewing" brushes will come into request in actual practice. Some powdered chalk must be tied up securely in a piece of fine muslin to make a pounce bag for dusting on the painted surface. Sponges, dusters, and other requisites should be kept specially for this work, and the whole of the tools and materials are best kept in a compact tin box.

The materials used for gilding, or for the imitation of solid gold, are—1, genuine gold leaf; 2, adulterative ditto; 3, Dutch metal; and 4, bronze powders.

In genuine gold leaf, there is always a certain amount of alloy, as pure gold is too ductile to be worked between the gold-beater's skin without it. It is sold in books of twenty-five leaves at about 1s. 4d. each, and gilders' work is measured and estimated by the "hundred" (leaves). Gold leaf must be kept in a dry place; if allowed to get damp, it will be impossible to remove it from the book without tearing it to pieces. Damp has also the power of tarnishing the leaf, and if any is discovered in this condition, it should never be used or it will spoil the work.

Gold leaf should fall freely from the book on to the cushion by a gentle breath from the operator; if it does not do so it is damp, and should, therefore, be placed in front of a fire for an hour or so to dry it. There are three shades of gold leaf sold—1, very pale; 2, medium or yellow; and 3, deep gold. No. 2 is the best for the sign-writer; it looks the best when varnished, and is the most durable if left unvarnished. It also stands the best against atmospheric influences when used on outside work, which, of course, comprises sign-writing.

Upon inquiry, I find that Messrs. Brodie and Middleton sell a "half gold" leaf at 5d. per book, which appears to be a very good article for the price charged. It is much thicker than ordinary gold leaf, and is, therefore, easier for the novice to apply, and it wears quite as long as the more expensive article. The same firm also make a special writer's gold size, which is very pale and clear, and of excellent quality.

There is now a cheap form of gold leaf upon the market known as the Venetian Ducat Gold Leaf, and sold at 7s. 6d. per thousand; it requires, I think, a special oil size and enamel, the latter being required for coating it after it has been applied to the surface to be gilded. It is then claimed to be permanent and washable, but although I have never seen a sample, I am inclined to the belief that, after all, it may be only a better sample of Dutch metal. It is made and sold by T. Pavitt and Sons, 70, Southampton Row, W.C. Dutch metal is a mixture of copper, brass, etc., and is made on the Continent. It is largely used in theatres for pantomime and burlesque scenery, hence the writer's acquaintance with it is pretty extensive. It is also used for gilding Christmas articles, and any kind of cheap and temporary work. It may be used by sign-writers and others for any temporary purpose, but soon turns black unless protected with a coat of patent knotting. Gold bronze powder may also be mixed with this, and applied to any surface, and will stand for years without tarnishing or getting discoloured.

Dutch metal is 1½d. per book at any large London colour warehouse or theatrical store. I now come to a somewhat modern article of convenience—I mean "transfer gold leaf." This is a perfect godsend to the sign-writer when working out of doors in windy weather. It is prepared as follows:—Procure a sheet of strong white tissue paper and three pennyworth of white wax, lay the paper upon a drawing board, and rub it all over—on one side only—with the wax. This must be well done, so that no small portions of the paper are missed; this can be ascertained by holding the paper sideways to the light, when the waxed surface should have a glossy and even appearance. The paper is now cut up into squares a size larger than the leaves of gold; the wax side of the paper will now have a slight amount of tackiness by which we are able to transfer the gold leaf by adhesion. The book is carefully opened, and a piece of wax paper is laid upon the gold and slightly pressed down with the hand, and this is continued right through the book until all the leaves have been provided with a sheet of waxed paper. The book should now be placed under some gentle pressure and it is ready for use. The method of using it will be described further on in this paper.

Letters for gilding are written in oil gold size, procurable at any colour shop. There is a slow and a quick size; the former is prepared by grinding up fat linseed oil and yellow ochre; for a quick gold size, a quick-drying varnish with a little oil gold size added to it to keep it tacky is a good preparation.

By regulating the quantity of oil put with the varnish, the mordant may be made to dry in three or four hours. Japanners' gold size and picture-frame-gilders' size may also be used for lettering.

Having enumerated the few necessaries required for letter gilding, I will now take the student through the process of writing and gilding a sign in simple unshaded letters on a black ground. The first thing to do is to so prepare the painted surface of the sign, that the leaf will be prevented from sticking anywhere except upon the sized portion, *i.e.*, the letters.

A sign which is to contain gilded letters which are afterwards to be varnished, is always given a coat of "flatting" as a finishing coat, and on this surface there is not much chance of the gold adhering anywhere except upon the letters themselves. If the edges are not sharp and clear, however, the sign just round the letters must be "egg-sized." But there are a great many people who will not have their gilded letters varnished over, as it takes so much off the brilliancy and richness of the gold, and in this respect I concur with such people. In such case, the sign has to be painted, varnished, and finished in every way before the letters are put on, and so we have to be careful how we work, or we shall spoil our own work and other people's too. The varnish, which should be of the best and hardest drying quality procurable, should be allowed to set quite hard; it can very well be left for a week after being applied to the sign. When hard, we commence by removing every trace of dust and sponging the board over with cold water; this will remove a certain amount of greasiness from the varnish; when dry, again dust, set out the letters in pencil, not in pipe clay, and then dust round with the pounce bag containing the powdered chalk. This need not be done to any unnecessary extent, as one frequently sees to be the case, but should be carefully applied to the spaces between the letters, and for an inch or two top and bottom of the letters. I need hardly say that this chalk is to prevent the gold from sticking anywhere but to the letters, and giving to the same a sharp, clear edge. A very slight dusting should be sufficient, and it must not obliterate the outline of the letters. Should any chalk grit get upon the letters, it must be carefully dusted off with a small brush before applying the size, which we are now to get into a workable state. The oil gold size sold in the little jars by oil and colourmen is generally too thick for use, and, therefore, requires thinning to the proper consistency. Brodie and Middleton sell it both "thick" and "ready for use." Taking as much as we require for immediate use from the jar, we thin it down with a little boiled linseed oil, and strain through a fine piece of muslin into a small jar for use. The slow-drying size is laid on one day and gilt the next, but if we require to apply the gold leaf on the same day as the size is applied, then we must use one of the quick-drying mordants already mentioned.

The method of pouncing the sign with chalk is a somewhat dirty and untidy method of working, although it is the one in general use; many of our best writers, however, use instead, egg-size, which is prepared in this way:—A nice fresh egg is pricked at both ends with a large pin, and the white of the egg only is blown into a cup; this is diluted with a little water, and the whole whisked up into a froth with a clean new sash tool. This is now applied to the sign and well worked over the entire surface, and if properly done, will prevent the stray particles of gold from sticking upon any part of the board. After the gilding is completed, the egg-size is washed off with a sponge and warm water.

Having thus prepared our sign and gold size, and marked the letters out, we take a suitable sable pencil and line and fill them in with the size, and leave it to get nearly dry. The great point now to be decided upon is, when is the size ready to take the leaf. This is somewhat difficult for the novice to decide. In the first place, if it is too moist and tacky, the gold will sink right into the size, and lose all its brilliancy, besides showing every joint and looking dirty in places. Secondly, if it has got too hard, it has lost most of its tackiness, and there is not sufficient left to cause the gold to adhere properly. The beginner generally fails from the first cause, but he is just as liable to err in the opposite direction if he allows too long an interval to elapse between brushing on the size and applying the gold leaf. The state of the atmosphere has, of course, a lot to do with the drying, and the drying qualities of the size vary in a great degree; so, as no two cases are alike as regards time of drying, a sharp eye must always be kept upon the work. I cannot give more explicit directions, beyond saying that a very slight tackiness will cause the gold to adhere, and this is all that is required.

Taking for granted that the size is now right, we proceed to apply the leaf, and as many signs are painted and lettered in the shop, we will first attempt the work indoors where no one can see our failures, or make us nervous by looking on. This is the tip and cushion process. Taking up the book of gold leaf, we open the first leaf, and breathing very gently at the edge of the leaf, and holding the book at the same time close down to the cushion, we cause the leaf to fall upon it. About four leaves are quite sufficient for the novice to take out at once, as he will be sure to waste the lot, and a few books besides, unless he has an "old hand" beside him to give him personal instruction.

Some, however, are bound to be self-taught, or not at all, so instead of paying for a tutor, they have to pay for experience, which comes to the same thing.

We now take the cutting knife, and wipe it to free it from moisture, and gauging the width of the letters, we cut the leaf into suitable sizes. A little dexterity is required in using the knife, and the quickest way to attain it is to get a practical man to show you "how it is done." We next take the "tip," and drawing it lightly through our hair, we lay it upon the leaf lengthways, and gently carry it from the cushion on to the sized letter; this operation is repeated until the whole of the letter is gilded, when we apply a slight pressure by dabbing it over—very lightly—with a piece of cotton wool, the mop, or the dabber, according to fancy. The whole of the letters are treated in this way until the job is finished. It is very seldom this method of gilding can be employed in the open air, but if it can, it is certainly best, as the gold leaf can be laid upon the size without pressure, which adds very much to its brilliancy, but when the gold is laid on from tissue paper or from the book, a certain amount of pressure must be used, and this is liable to disturb the size, and press the gold into it, and cause very uneven work.

We now come to outdoor gilding, and in this, writers of the old school simply take up a book, turn back the paper leaves, and without any cutting, place the leaf direct against the sized letter; this, I may say, is a very wasteful way of going to work, as if there is the slightest wind a great deal of the gold is wasted. The slightest movement in the air renders it very difficult to proceed in the way mentioned, and for this reason, when gilding with the tip or without it out of doors, the sign-writer is generally surrounded with a large coarse sheet to shield him from the evil effects of the wind.

The easiest of all methods in gilding is with the transfer gold leaf, the preparation of which I have already described. The work is very simple, as the leaf is now so easy to handle; this is the way to do it. Open the book at the first page, and take out the tissue square (with the metal attached) with the left hand, place it with the gilded side on to the letter, and with the right hand gently and lightly rub it with a piece of cotton wool, but only on that portion which you wish to adhere; now remove the tissue and apply what leaf there is left to another portion of the letter until all is used up.

As the tissue is transparent, it is very easy to see how much gold is used each time, so that every particle can be used up for odd corners and soon. And, moreover, there are no ragged edges with the gold flying all over the place as in the old method. Always save the tissues, as they may be used over and over again with an occasional re-waxing. As regards the application of Dutch metal, I presume that the ordinary oil size may be used as in gold leaf, but for theatrical purposes we use a preparation called madong, and this is how we make it. "Take equal parts of pitch, Venice turpentine, resin, beeswax, and Russian tallow (all to be had at the colour shop), put them into a madong pot and melt them together, but should the mixture work too stiff and thick, add more wax and tallow. The more tallow that is added, the more pleasantly it will work, but if too much is added, it will never harden sufficiently to work upon. It can be used harder in hot weather than in cold, as the heat keeps it 'tacky.'" Apply hot with a camel's-hair brush.

I need hardly say that this must not be used upon a sign-board; I give it to the sign-writer as a valuable secret recipe—secret no longer, perhaps—by which he will be able to gild letters upon canvas and other material for all temporary decorative purposes.

Writing with gold powder or bronze is hardly worth mentioning here I fancy, although I have used a great deal for room decoration, which has kept bright for years when applied by my own process. There is, however, real gold powder to be obtained, the price of which is 7s. 6d. per pennyweight, and pure silver powder at 14s. per ounce, or 1s. per drachm. Bronzes of all shades and colours run upwards from tenpence to two shillings per ounce. Bessemer's gold bronze, as used by the *Graphic* newspaper people, may be had at 4s. 6d. per pound direct from the manufacturer, and this is what I always use myself with good results.

There is a great deal more to be said and learnt upon the art of gilding letters, sign ornaments, Royal Arms, medals, etc., and all this is fully set out in Mr. Sutherland's "Art and Craft of Sign-Writing." As regards these pages, however, my readers must now rest content with what I have given them upon this interesting branch of the letter-maker's art.

I am now, through stress of space, obliged to bring these articles to a conclusion, but I have far from exhausted my subject. I would remind the student that he must not stop where I have left him, but keep going on and on, till he reaches that ambitious goal, perfection.

In conclusion, I can honestly recommend, as an advanced text-book, "The Art and Craft of Sign-Writing," by Mr. W. Sutherland, price 21s. This book measures 18 in. by 13 in., and contains twenty pages of alphabets (some in colours) and designs for sign-writers. Also coats of arms and shields, emblems for church and other decorations, with full instructions as to all methods and processes. Altogether, it is the most complete work published upon the subject with which it treats.

ELECTRIC CLOCK FITMENT.

BY H. J. L. J. MASSÉ.

AFTER reading Mr. Bonney's article on "Electric Alarms" in a recent number of WORK, I thought that some readers might perhaps be interested in another electrical clock fitment.

My drawing-room clock is an old Louis XIV. eight-day upright, with a movement made in Amsterdam nearly two hundred years ago. As a time-keeper it is practically perfect, and being in want of a striking clock on the bedroom floor, it occurred to me to fit up a single-stroke electric bell in connection with the old clock downstairs. After purchasing a single-stroke electric bell, two Leclanché batteries, a switch, and some wire, I set to work.

I did not wish any of the wires or fittings to show in the drawing-room, so I carried the wires from the back of the clock-case along the wainscoting, pushing them underneath where I could, then out into the hall up along the mouldings of the door-posts, and along the edge of the stairs, as invisibly as possible, till they reached to the electric bell, which I had fixed on the top of my bedroom door.

Of the method and the rationale of connecting the wires to the battery and the bell it is not necessary to speak, as all requisite descriptions have been given in previous articles. It will be enough to say that the circuit is only completed when the hammer of the clock rises preparatory to striking the hour. One of the insulated wires is securely fixed on to the thin metal rod which forms the handle, so to speak, of the clock hammer, and a portion of this wire (about half an inch or so) is laid bare, care being taken to so fix it that it does not touch the clock anywhere. The other end of the wire is fixed on a small bracket, at right angles to the wire on the hammer, and has likewise a small portion laid bare. When the hammer is raised to strike the hour the two bared portions of wire touch; the circuit is then completed, and the electric bell strikes upstairs.

The batteries—of which there are two, a No. 1 and a No. 2 Leclanché—are on two small brackets fixed to the back of the clock case, where they are, of course, invisible, as the clock stands across a corner of the room, though they are easily accessible

I found that a single cell Leclanché was not sufficient to do the work alone.

The switch is fixed upstairs, so that the clock may not strike upstairs during the daytime, or whenever its striking would seem to be undesirable.

At the present time I am endeavouring to find a means (electrical, of course) of pulling the cord which makes the clock repeat. This would enable me to tell the time at any hour of the night without the necessity of striking a light, or, what is worse, especially in winter, of getting up to see the time.

THE KALEIDOSCOPE: ITS CONSTRUCTION AND APPLICATION.

BY THOMAS RICHARDSON.

THE OPTICAL PORTION—USE OF THE INSTRUMENT—CONCLUSION.

(*For Illustrations to which references are made in this Paper, see pages* 424, 425.)

SEEING that all necessary processes required in lacquering and polishing the exterior of the instrument have been frequently dealt with by other writers in the current volume, it seems superfluous to again revert to these matters here. We will, therefore, pass these by and concern ourselves with the interior, which should now have a coat of dead black paint; ivory black would be most suitable, made up thin, and sparingly applied to all surfaces except those in sliding contact.

The two pieces of patent plate glass required for the reflectors are 8 in. long, 2 in. wide, and $\frac{1}{12}$ in. thick, and previous to silvering the surfaces, all sharp edges must be removed by rubbing on a level piece of sandstone with water, all grit being afterwards cleared away by well washing and rinsing in clean water. Our next business is to make up the two solutions to be used in silvering. The first is prepared by dissolving 72 grains of nitrate of silver in $8\frac{1}{2}$ ounces of distilled water in a clean glass jar, capable of holding a pint or more. Holding the jar to the light so that you can see through the liquid, add slowly a few drops of solution of ammonia, when a precipitate will be formed; more ammonia must then be added drop by drop until the precipitate is *nearly* re-dissolved. Be very cautious in this latter particular, as if the ammonia is rashly poured into the jar the precipitate will suddenly form and as

suddenly disappear. Filter, and after adding another 8½ ounces of distilled water, label the jar—"Solution A."

The second is prepared by dissolving 15½ grains of nitrate of silver in 17 ounces of boiling distilled water; whilst still boiling add 12 grains of Rochelle salts which have been previously dissolved in half an ounce of distilled water, the boiling being continued until the precipitate which forms becomes grey. Filter, and when cool, pour into a jar and label—"Solution B." If distilled water is difficult to procure, rain water, if caught in the country and filtered, will serve for the purpose. The boiling may be conducted in a flask on a retort stand, or in a porcelain dish covered with a glass plate, and heated on a stove. When these operations are complete, the two glass plates must be made chemically clean by rubbing them with a slip of wood dipped in strong nitric acid, the process being conducted in the open air to avoid inhaling the noxious fumes. The acid is then washed off with soft water and a solution of caustic potash applied in the same manner, after which alcohol or rectified spirits of wine is applied. Lastly, they are thoroughly washed in distilled water, and placed, whilst still wet, side by side in a clean dish, when equal quantities of the solutions A and B are poured over them and mixed by stirring with a glass rod. Six or eight ounces of each solution will be sufficient, and a meat dish will be found to be a suitable vessel for the purpose. If any suspicion is entertained as to its cleanliness, it will be well to subject it to the same searching process as described for the glass plates. At a temperature of 60° the silvering will be complete in two and a half or three hours. The glasses are then taken out, washed in distilled water, and when dry the surface may be polished with rouge, gently applied with a small pad of cotton wool. The reflectors may now be said to be in readiness for fixing in position, by applying a little cement to the backs in a few places where the glass is in contact with the slips of wood on which they rest, being careful to notice that the mirrors clear the case equally at each end, and also to refrain from applying pressure, but simply laying them on the supports at *i*, Fig. 2, and leaving them in that position for a day or so to allow the cement to harden; after which the slips at *h*, Fig. 5, may be gently screwed in their places, and the angle of the lower edges carefully adjusted by the screw at *f*, Fig. 2. A suitable cement for attaching the reflectors consists of 1 ounce of isinglass dissolved in 1½ ounces of glacial acetic acid, the bottle containing it being placed in a little warm water when required for use.

Fig. 8.

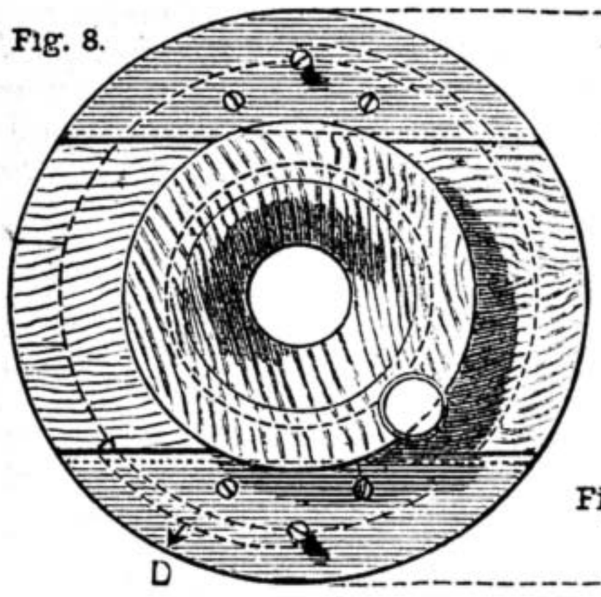


Fig. 10.

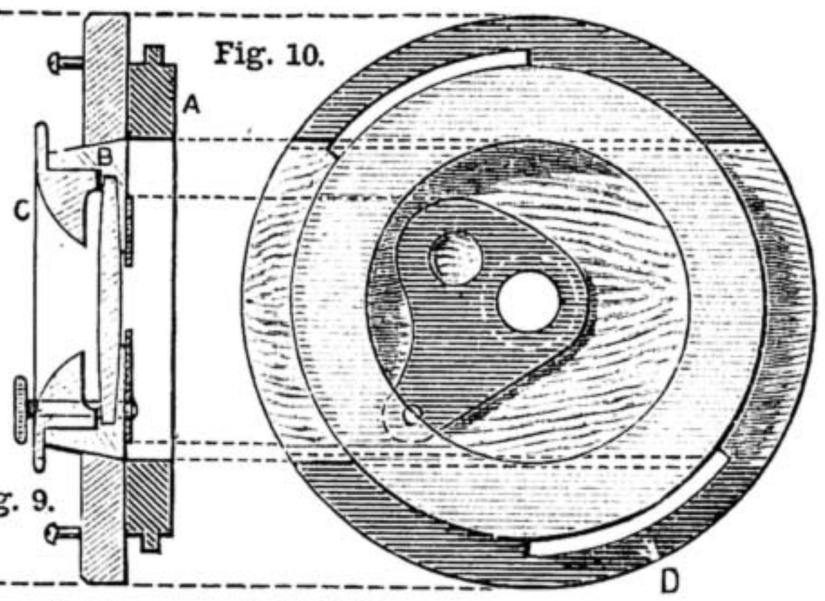


Fig. 9.

Fig. 8.—Front View of Small Eye-piece of Compound Kaleidoscope. Fig. 9.—Section of ditto, showing Lens and Method of mounting the same. Fig. 10.—Back View of ditto, showing Position of Diaphragm. (Scale of Figs. 8-17 inclusive, half size.)

Fig. 11.

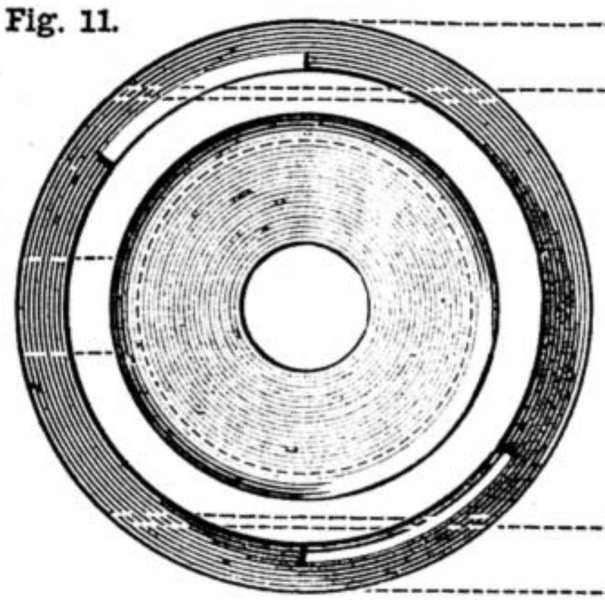


Fig. 11.—Back View of Larger Eye-piece.

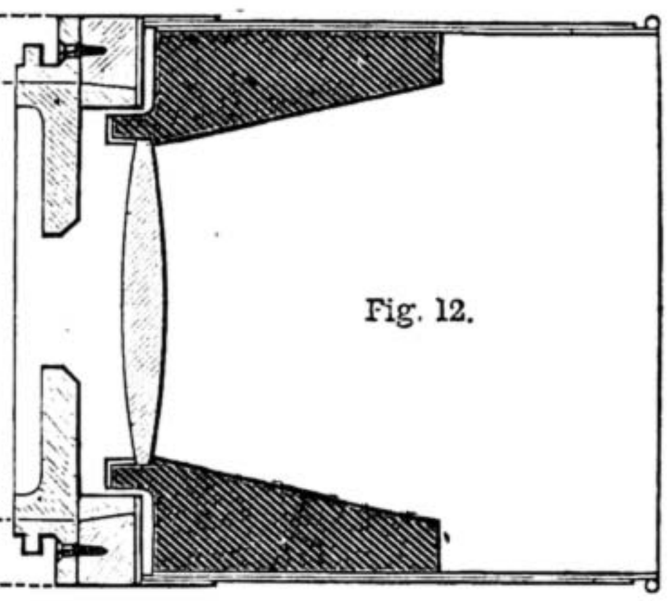


Fig. 12.—Section of ditto.

Fig. 13.

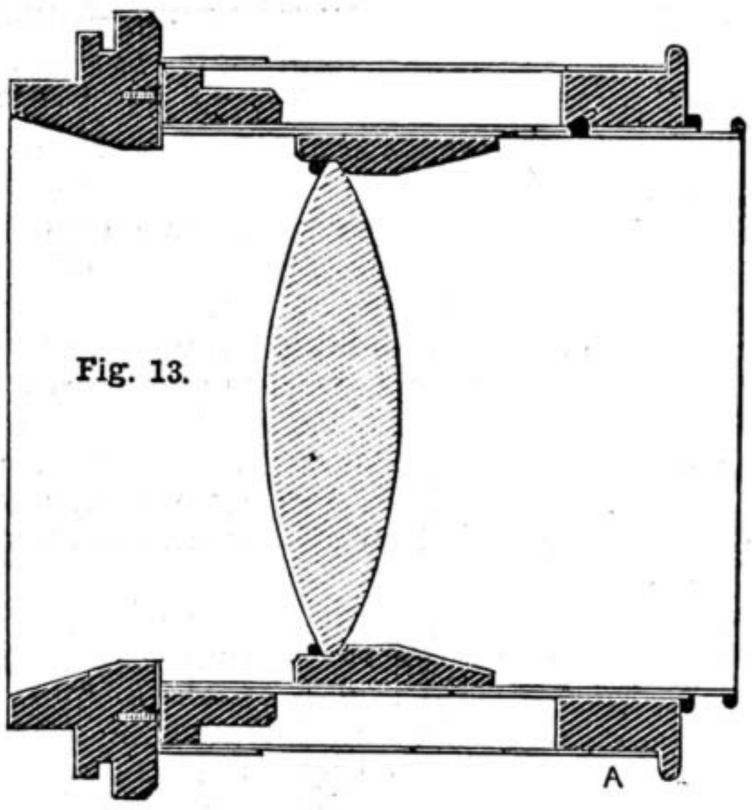


Fig. 13.—Sectional View of Objective.

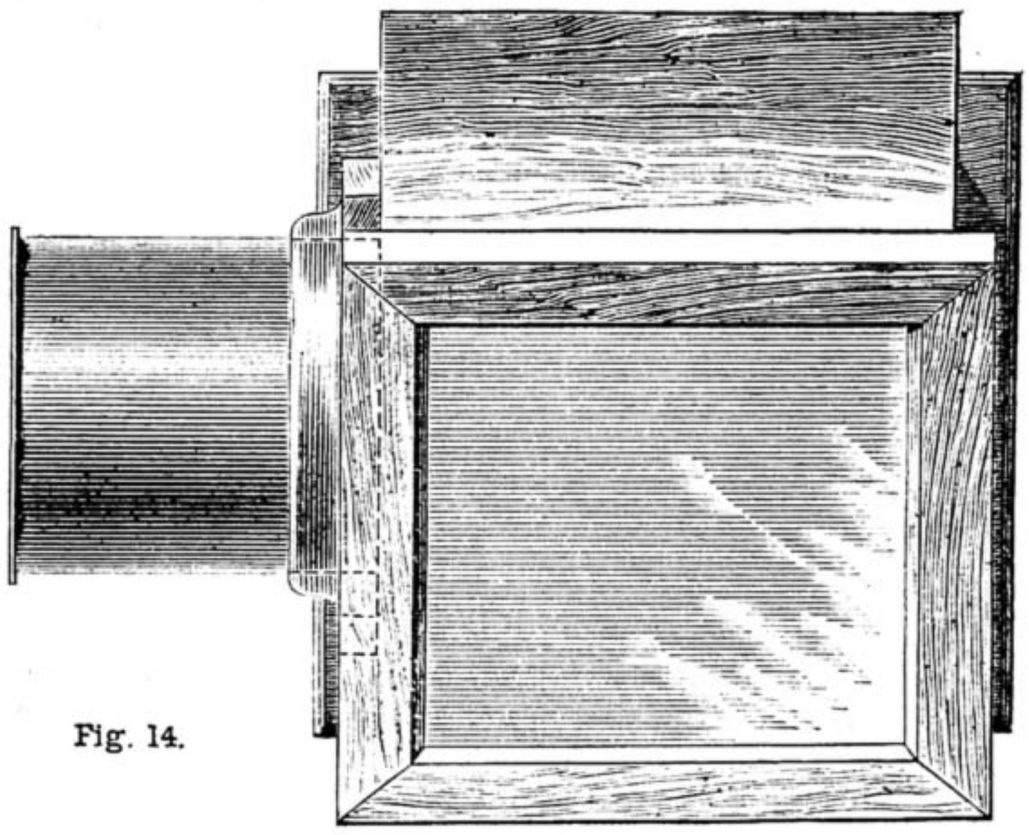


Fig. 14.

Fig. 14.—Plan of Camera Obscura for Use with Compound Kaleidoscope.

In replacing the sides of the case which have been removed to reach the interior, it would be an improvement to affix a pair of hinges and a catch to the side on the right of M, Fig. 2, to accelerate the process of cleaning the reflectors, which is effected by means of a camel-hair brush.

When satisfied that the working of the instrument is perfect, by testing it in the various movements of which it is capable, as described in the first paper, we may now bestow some attention on the construction of object-boxes. In these there is room for great diversity of form, according to the purpose for which they are intended. The object-box shown in section at z, Fig. 5, is intended for the reception of transparent objects which are attached by the cement already mentioned to the inner surface of the ground glass disc. When required for thin, loose objects, the space between the two discs is so reduced that it is impossible for one piece to slip behind another, and yet allow of perfect freedom of movement in the pieces. If it is desired to have two cells, one in front of the other, a disc of clear glass occupies the place of the ground glass disc; then a brass ring somewhat thicker than the objects in the second cell is laid in to support the disc of ground glass, and if deemed necessary, the ring of brass wire which secures the latter as shown in the section is replaced by a brass flanged ring similar in section to that which secures the lens in the eye-piece, as shown in Fig. 12. The process to be followed in making the object-boxes resembles that given in the case of the carrier, the outside being always finished first where the work in hand is so slight in character, as in this instance, for if the opposite course is adopted, on attempting to turn the outside, the work will bend and spring under the tool, and probably end by flying to pieces. To facilitate withdrawal from the carrier, they should be furnished with a round-headed brass screw at each side, in the same way as shown in the eye-piece (Figs. 8 and 9), the construction of which we will now pass on to consider. In the first place we must provide a ring, A, of particularly close-grained, hard mahogany, turned to fit smoothly in its bearing, being especially careful respecting the thickness of the tongue, so that when finished it shall be quite free from shake. To this ring is attached a dovetail slide, B, held by a piece at each side, secured across the grain by screws to the ring; the slide B carries an ordinary eye-glass which is mounted centrally, and secured by the cap, C. The opening in the slide under the lens is ½ in. diameter, and to further close this aperture a diaphragm is provided at the back of the slide, having two holes ⅜ in. and ¼ in. diameter respectively. The diaphragm is formed of a piece of thin brass, and is manipulated from the front by a small milled head, having a

shoulder which bears on the slide, and the point is screwed and afterwards riveted or soldered to the diaphragm. In choosing the lens, it will be of a correct focus if print can be discerned or read clearly at a distance of 10 in. When finished, the eye-piece should have a deep mark cut on the upper edge, as shown by the crow's foot at D, Figs. 8 and 10, to indicate the exact position for entering the bayonet joint, after which a small pin or screw must be inserted in the grooves to act as a stop when the slide is exactly vertical, when it will be found that the latter requires grooving to clear the index above, and further, the ring requires cutting away somewhat to clear the diaphragm. There is yet another eye-piece to be made, as shown in Figs. 11 and 12, for projecting the picture on to a screen or camera obscura for copying. In this case the ring is heavier, and the screws which secure the guides on each side of the dovetail slide pass from the back, as seen in Fig. 12. The tubes required may be of brass, and may be procured of Messrs. Cotton & Johnson, 14, Gerrard Street, Soho, London, W., and secured to the woodwork by lugs of brass, soldered or riveted to the tubes. In the present case, however, they are formed of biscuit tins, the lid being firmly screwed to the slide while in the lathe, and perforated as shown in the diagram; the bottom is then removed with a file, and a short mandrel of wood is prepared to fit the tin tube, when the two lengths required are cut off truly at each end. The smaller tube carrying the lens is then reduced by dividing the seam with a knife, the mandrel being also reduced to take the two tubes, one within the other, after which the inner one is bound with wire at each end, and soldered afresh, the end being finished with a ring of brass wire to afford a hold of the tube in focussing, and the outer tube soldered to the lid. The lens, which is 2 in. diameter and 6 in. focus, is secured by a brass flanged ring, and mounted in a mahogany cell, turned to a tight, sliding fit within the smaller tube. The ring is then marked, and a recess cut as indicated by the dotted lines in Fig. 11, as adopted in the preceding case.

On precisely similar lines we must prepare the objective, shown in Fig. 13, but in addition, we require a larger tube and lid to form an extra draw, the difference in diameter being made up by a ring of mahogany attached to the inside of the larger tube at A, and a second ring fixed by screws to the outside of the middle tube. The lens is 3 in. diameter and 4 in. focus; it is mounted in a cell of mahogany, and held in position by a ring of brass wire. The camera obscura, shown in Figs. 14, 15, and 16, consists of a cubical box, whose interior measures 6 in. in every direction. It may be constructed of pine, and should be perfectly square. The ends are mortised into a baseboard, and shapen so that the top, which is left open, is inclined or tilted 30° from the horizontal line, the reason for this being that the picture

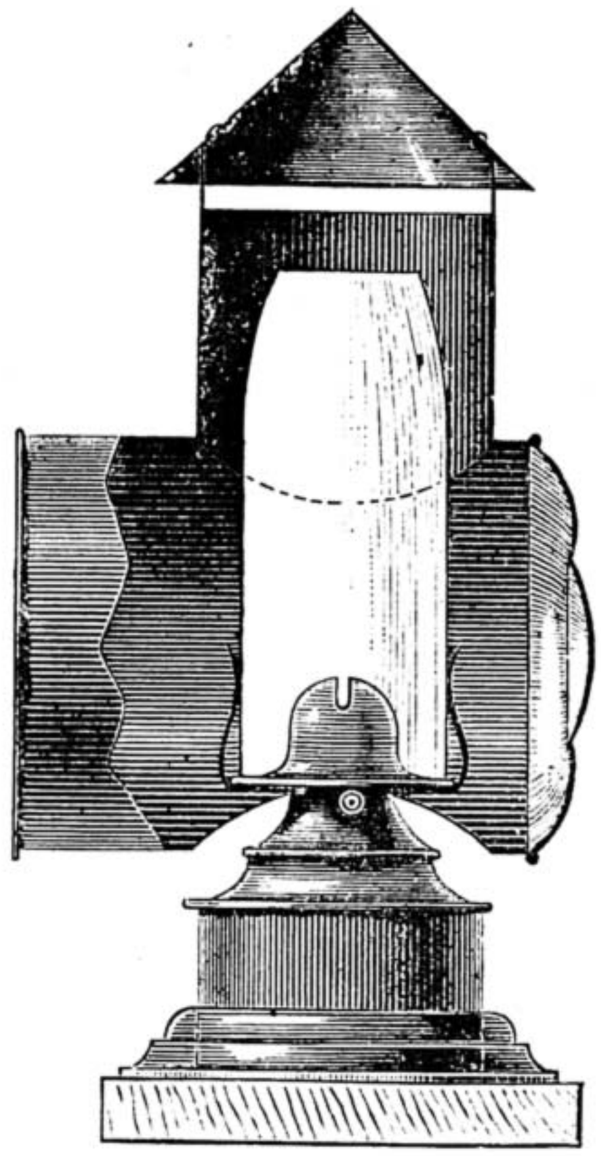


Fig. 17.—Lamp with Shade and Reflector for illuminating Objects.

may be viewed without inconvenience by the observer seated in front of it, the kaleidoscope being placed to the left. On the front is an opening covered with a slide which carries a tube projecting over the tube in the larger eye-piece, to exclude extraneous light. Previous to nailing the ends to the sides of the box, a diagonal line is drawn from one corner of each piece to the opposite, and immediately below this line a slip of wood is screwed to each side. On these slips the mirror rests, and the image is reflected upwards on to a piece of ground glass, which lays, ground face downwards, within a shallow ledge, $\frac{5}{16}$ in. wide, which runs all round the top of the box, the ledge being of the same thickness as the square of ground glass. Over this latter is a frame of mahogany rabbeted or built up as shown, which holds the tracing cloth or paper on which the picture or design has to be drawn.

To intensify the light, and shade the eyes of the observer as much as possible, such a lamp as that shown in Fig. 17 will be found useful. It is furnished with a $\frac{5}{8}$-in. wick, and a silvered metal reflector, 5 in. diameter. The shade is of strong tin plate, and the lamp is mounted on a wood base, 6 in. wide and 8 in. long, which corresponds to the width of the kaleidoscope, so that on placing the instrument and any accessories not actually attached to the same, they may be kept central with each other on a board having slips screwed to its true face 8 in. apart, as shown in section, Fig. 15. All tubes in the optical portion should receive a coat of dead black, as advised in respect to the interior of the instrument itself.

An extremely useful addition to the object-boxes already mentioned is the oblong form. This is 10 in. or 12 in. long, and 5 in. or 6 in. deep, with a clear glass in front and one of ground glass at the back; it is placed in a slide in front of the objective, which projects the image of the objects arranged in the box, and illuminated from behind by means of the lamp.

By the exercise of a little ingenuity in the arrangement of the materials in the object-box, so that each colour harmonises with those in its immediate vicinity, and a careful adjustment of the light and focussing of the lenses, a series of patterns will be observed in the camera obscura which, by the brilliancy and the perfect harmony of their tints, will delight the eye of every beholder.

To assist the reader in the selection and combination of colours which harmonise with each other, I mention a few of the most important, viz.:—Red with green; yellow with purple: blue with orange; olive with orange; purple with citrine; russet with green; blue, red, and yellow; purple, green, and orange; olive, russet, and citrine. Space will not permit of my pursuing the subject further here, but the student is recommended to peruse the articles on this difficult subject in "Cassell's Technical Educator," by Professor Church, in which he will find it treated by a masterly hand.

The materials introduced into the object-boxes may consist of carved gems; lace; glass, either flint or crystal, plain, spun, or twisted; flowers; leaves; figures, cut out and cemented to the glass of the object-box; and when using the objective we may dispense with the object-box, and project the image at once on to the end of the reflectors, the most important thing being to have them strongly illuminated on all sides; sometimes they can be improved

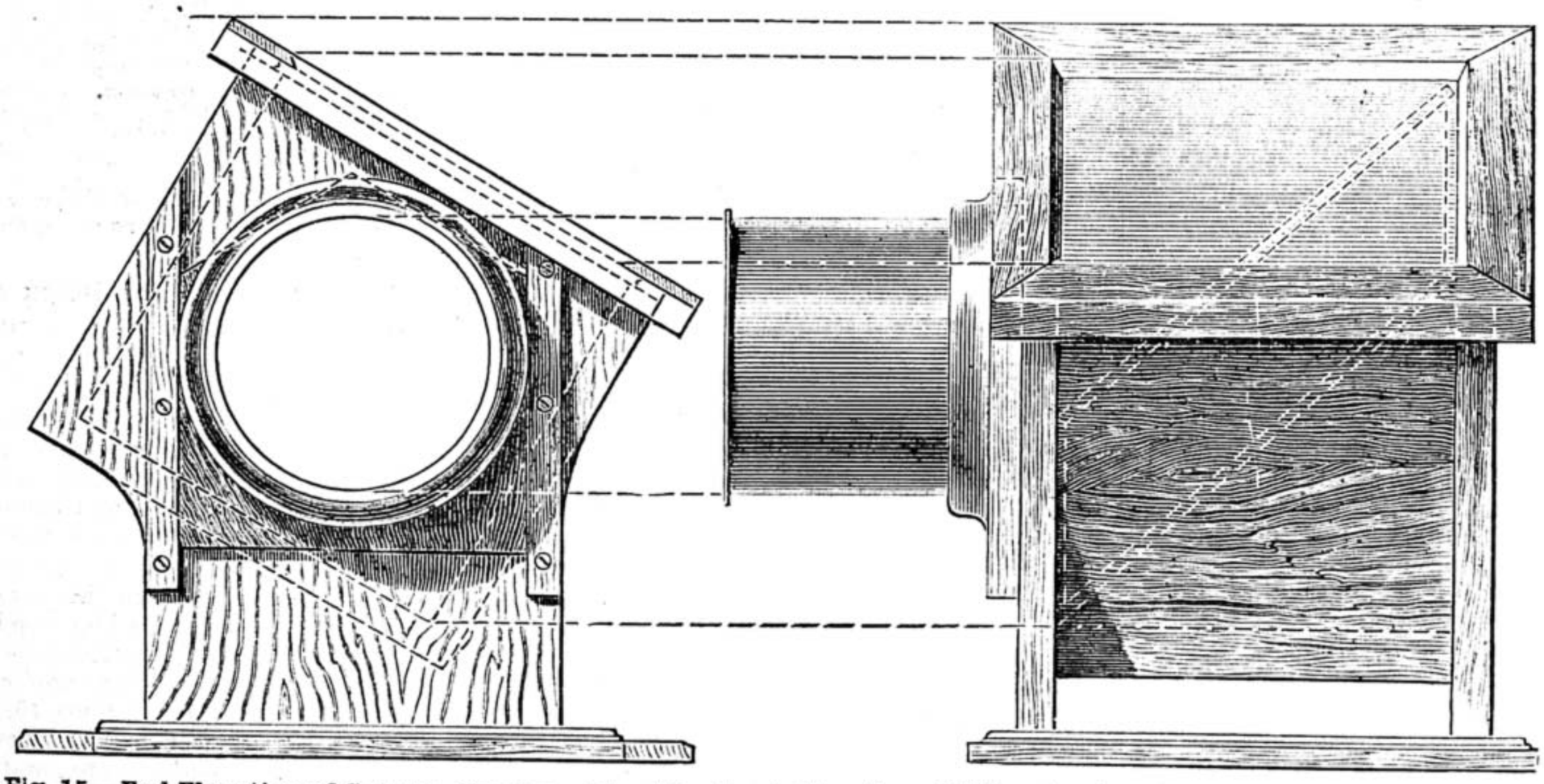


Fig. 15.—End Elevation of Camera Obscura. Fig. 16.—Front Elevation of ditto, showing Position and Angle of Mirror.

by cementing to mirror glass, and at others two lamps can be judiciously employed for the purpose, care being taken to exclude the direct image of the flame.

Respecting the application of the kaleidoscope to the arts, it is difficult to transfer the brilliant colours of some patterns to materials of a sober character, and therefore it appears most fitted for materials of a brighter and more reflective character, such as embroidering, and otherwise ornamenting in silk, and yet more especially in paper and glass staining and painting; and I cannot conclude these articles in a more excellent way than by quoting a passage from the writings of the talented discoverer of the kaleidoscope.

Speaking of the artist who forms windows of painted glass, he says :—"In this last profession, in particular, the application of the kaleidoscope cannot fail to indicate combinations far superior to anything that has yet been seen in this branch of art. From the uniformity of tint in the separate pieces of glass which are to be combined, the effect produced by the instrument from portions of the very same glass that is to be used for the windows may be considered as a perfect fac-simile of the window when well executed on a large scale."

THE SLIDE VALVE.

BY T. R. BLACKETT.

"LAP" AND "LEAD"—ECCENTRIC SHEAVE.

THE slide valve of a steam engine has been so often ably discussed that I have almost to apologise for writing a paper upon it. But, however, it is my intention to put the matter so plainly before my readers, that many who read this paper will know how to proceed, should they be called upon to set a slide valve.

Very few workmen, who build, and draughtsmen who design really high-class engines, are versed in the higher mathematical branches, hence my putting it in a practical light.

The parts of a steam engine move with geometrical precision with each other; thus every part must have some angular or linear relation with each other. Now such being the fact, why not do away with the time-honoured though time-taking custom of setting the slide valve before the eccentric is keyed on to the crank shaft? The proper angular relation of the eccentric to the crank is a right angle plus an angle obtained by the linear advance of "lap" and "lead."

By "lead" is meant the distance the steam-post is opened at the commencement of the piston's stroke. By "lap" is meant the distance the slide valve overlaps the opening edge of the steam-post at the end of *its* travel.

Let us take, for example, a common D slide valve (Fig. 1). We will suppose that it has $\frac{3}{4}$-in. "lap," and it is to be set with $\frac{1}{8}$-in. "lead" on each steam-post, with the travel or stroke of slide valve to be 4 in. We will now proceed to fix the eccentric, *for good*, in its proper place upon the crank shaft.

If a small shaft, we will put it on the surface plate or marking-off table, letting it rest in a pair of V-shaped bars.

The next thing to be done is to plumb the centre of the crank pin directly over the centre of the crank shaft; having done this, erect a perpendicular line from the bottom of the crank shaft, as shown in Fig. 2; next the total "lead" is $\frac{1}{4}$ in.; set the dividers to that radius, and mark off from the centre of the crank shaft *downwards* an arc cutting the perpendicular line *a* (Fig. 2).

Having done this, we take the total "lap," which is $1\frac{1}{2}$ in.; we set the dividers to that radius, and mark off downwards as before, from where the first arc cuts the perpendicular line to *b* (Fig. 2). We will now look to the stroke or travel of the slide valve itself; we find it is to be 4 in.; set the dividers to half that distance, viz., 2 in. Having done so, describe a circle from the centre of the crank shaft, which is called the travel circle. Here we take the scribing block, or, as some call it, the surface gauge; set the pointer or scriber at *b* (Fig. 2), and draw it along in a horizontal direction across the end of the shaft until it cuts the travel circle at *c* (Fig. 2). Now take a straight-edge and draw a line from the centre of the shaft, *o*, to the outside of

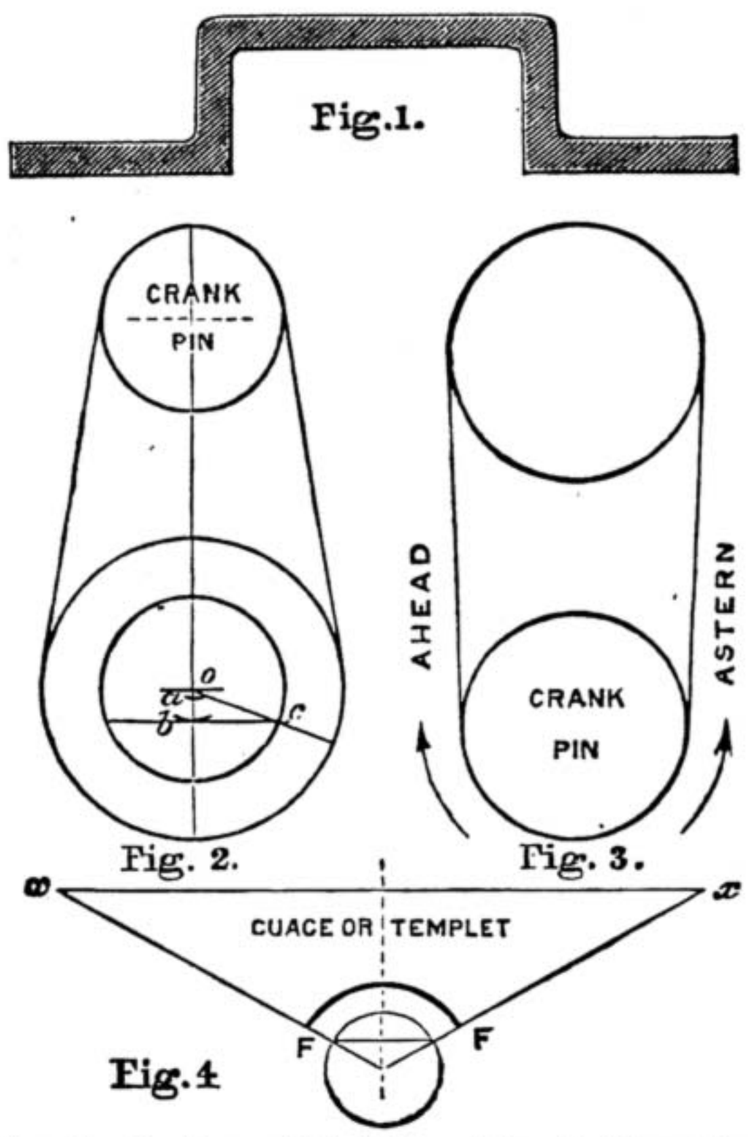


Fig. 1.—Section of D Slide. Fig. 2.—Plumbing Centre of Crank Pin over Centre of Crank Shaft, Centre Line of Eccentric. Fig. 3.—Plumbing Crank Pin for Marine Engine; Shaft to be Plumb, Pin down. Fig. 4.—Gauge or Templet; when tried upon Shaft for Marking Centre Lines, *x x* to be levelled by Spirit-Level.

the shaft cutting *c*; this line produced along the shaft is the centre line of the eccentric sheave.

We have here the true geometrical relation of crank and eccentric sheave.

Although draughtsmen have for years followed this method of showing the position of the eccentric sheave upon the shaft, working mechanics have been loath to make use of the same method to fix their eccentrics, and keying them up for good.

But thanks to the advancement of education and science, we see old "rule of thumb" notions put to one side, and gigantic undertakings executed by practical mechanics on a scientific basis.

Again to our subject: the horizontal distance of the eccentric along the shaft, from centre of crank pin to the centre of the eccentric sheave, is equal to the distance from the centre of the cylinder to the centre of the slide valve spindle. I think that any one who makes himself master of the above facts, either the amateur making his model engine, or the professional workman in the workshop, who needs the instructions cannot fail to turn out an efficient engine.

In the case of a large marine engine, for example, where the crank shaft cannot be placed on a marking-off table, we have to plumb the crank pin *downwards* (Fig. 3), and make a gauge or templet (Fig. 4), constructing the same geometrical figure as described before, but showing both the ahead way and the astern way of the engines; the two lines, F F (Fig. 4), are the centres of the two eccentrics to be produced along the shaft. The thickly-marked lines are where the gauge is cut out to fit the shaft. The proper distance of the eccentric from crank pin is got the same way as the first-mentioned case.

When the eccentrics are keyed on, and the shaft is placed in position in the engine, the setting of the slide valve is now an easy matter, viz. :—Place the eccentric sheave on either of its centres, or, if you choose, put the engine on its "dead" centre; give the slide valve the required lead; our valve is now set.

These remarks are practical, and will, I think, be easily understood.

Marine slide valves are allowed more "lead" on the bottom steam-post on account of the obliquity of the connecting-rod, which I will describe fully in another paper, as well as the settling down by the wear and tear of the engines.

I have here endeavoured to set forth the vital parts of the steam engine, and should any amateur or his professional brother wish for further information, I shall be most happy to provide him with it, either through "Shop," or by post, if he will only pay the postage, as far as lies in my power. Having shown the proper place for the eccentric sheave, in my next paper, I shall consider the obliquity of the connecting-rod and its remedy; also reason of "lap" and "lead."

OUR GUIDE TO GOOD THINGS.

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

127.—SYER'S MITRE BLOCK AND SAW.

IT will doubtless be fresh in the memory of many of my readers that a full description of the appliance known as a mitre block, or mitre trap, was given in page 273 of this volume, and that its construction, and the mode of making one for one's own use, were clearly defined. To this paper, "A Mitre Block, and How to Make It," by David Denning, I must therefore refer all who wish for more than the necessarily brief notice I can give here in reference to the Mitre Block and Saw, which has lately been improved—I may say, perfected—following the general lines of the original appliance, and introduced by Mr. Thomas J. Syer, 45, Wilson Street, Finsbury Square, E.C., of the firm of Thomas J. Syer & Co., tool makers, etc., and dealers in all tools and appliances used in carpentry, joinery, and cabinet making, and Principal of the Finsbury Amateur School of Practical Mechanics. The mitre block is, as its name implies, a contrivance for mitreing joints, and available also as a means for squaring off the ends of pieces, such as door-rails, stiles, etc. Mr. Syer's mitre block possesses value in being exceptionally well-made, perfectly true, and admirable in action,

the facility with which the movable block works, and its grip on the wood, that may be placed between it and the fixed block, being secured by the screw which is attached to it, and which is worked by an iron bar passing through the spherical termination at the outer end, as shown in the illustration given in Fig. 1. The projecting piece below the platform on which the blocks are placed supplies the means of securing the block in the jaws of the bench vice. The most attractive thing in connection with Mr. Syer's mitre block is the tenon saw that is supplied with it.

The construction of, and mode of handling adopted for, this saw will be understood from Figs. 2, 3, and 4, which show respectively the plan, the side elevation, and the end elevation of the tool. From these it will be seen that the

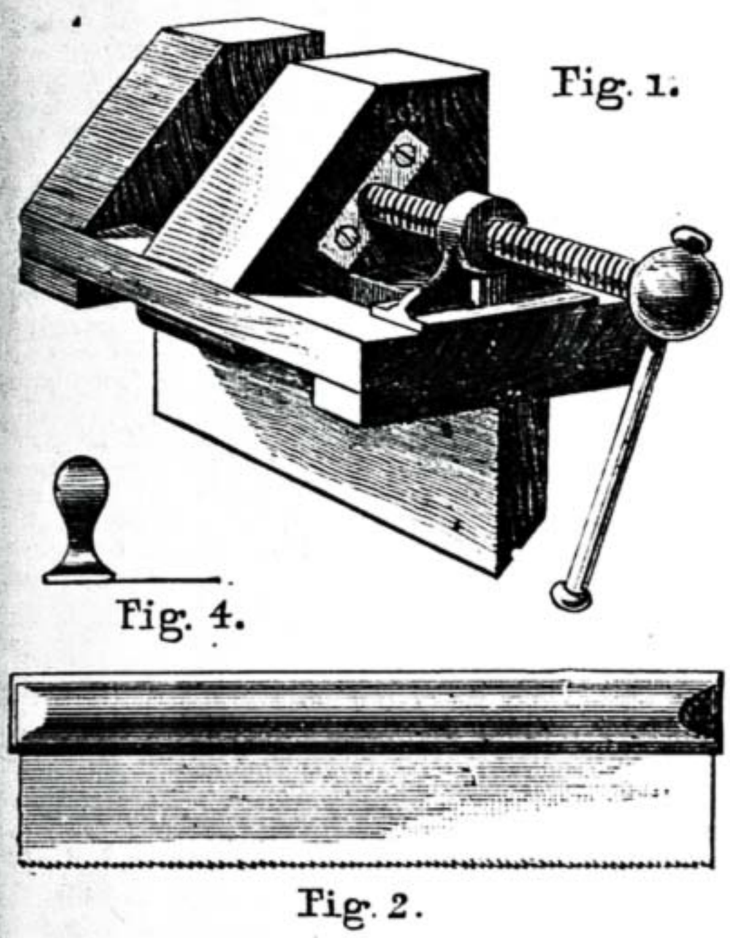


Fig. 1.

Fig. 4.

Fig. 2.

Fig. 3.

Fig. 1.—Syer's Mitre Block: perspective view. Fig. 2.—Plan of Tenon Saw, handled for Use with Mitre Block. Fig. 3.—Side Elevation of Saw. Fig. 4.—End Elevation of Saw.

saw blade is pierced with holes along the side opposite to the toothed edge, and that it is thus attached by screws to a handle extending the whole length of the side. This handle, being hollowed out on either side, can be grasped at any place along its length at the convenience of the operator, or can be worked from the end, near which is placed a hole (shown in Fig. 3) for the reception of the thumb. By this form of handle mitres can be sawn with the utmost ease, the surface of the blocks acting as a guide for the saw, which passes over them without doing any injury to them, as the heads of the screws are countersunk in the saw blade. The value of the saw lies in the fact that the blade is parallel to the guides over which it moves, and therefore makes a clean and true cut. This could not be done to the same extent, or so conveniently, with the ordinary tenon saw, as the thickness of the back would tend to throw the plane of the blade at an angle with the surface of the blocks. The price of the mitre block without the saw is 31s., or with the saw, 35s. The saw is supplied separately for 4s. 6d.

As a matter of course, the drawings of the saw given above will prove highly suggestive to many workmen, both in professional and non-professional ranks, and doubtless there will be many who will handle an old tenon saw in the manner shown above, after despoiling it of handle and back. I shall be glad to hear from any workman who may attempt the operation and prove successful in it. I can assure him he will find the saw a very useful one.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

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

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

I.—LETTERS FROM CORRESPONDENTS.

Wood Mitre Cramp.—J. S. A. (*Edinburgh*) writes:—"With reference to G. R.'s reply to J. C. (*Blackburn*) in No. 38, page 605, of WORK, I give the following as a very simple and useful form of wood mitre cramp. Get a piece of birch or any other hard wood 1 in. square, and any convenient length, mark off with a square four pieces ¾ in. each; then make four holes through the corner (Fig. 1), saw off the four pieces, and shape them, as in

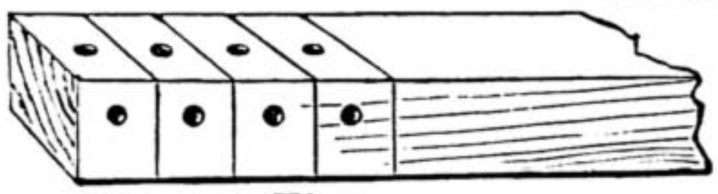


Fig. 1.

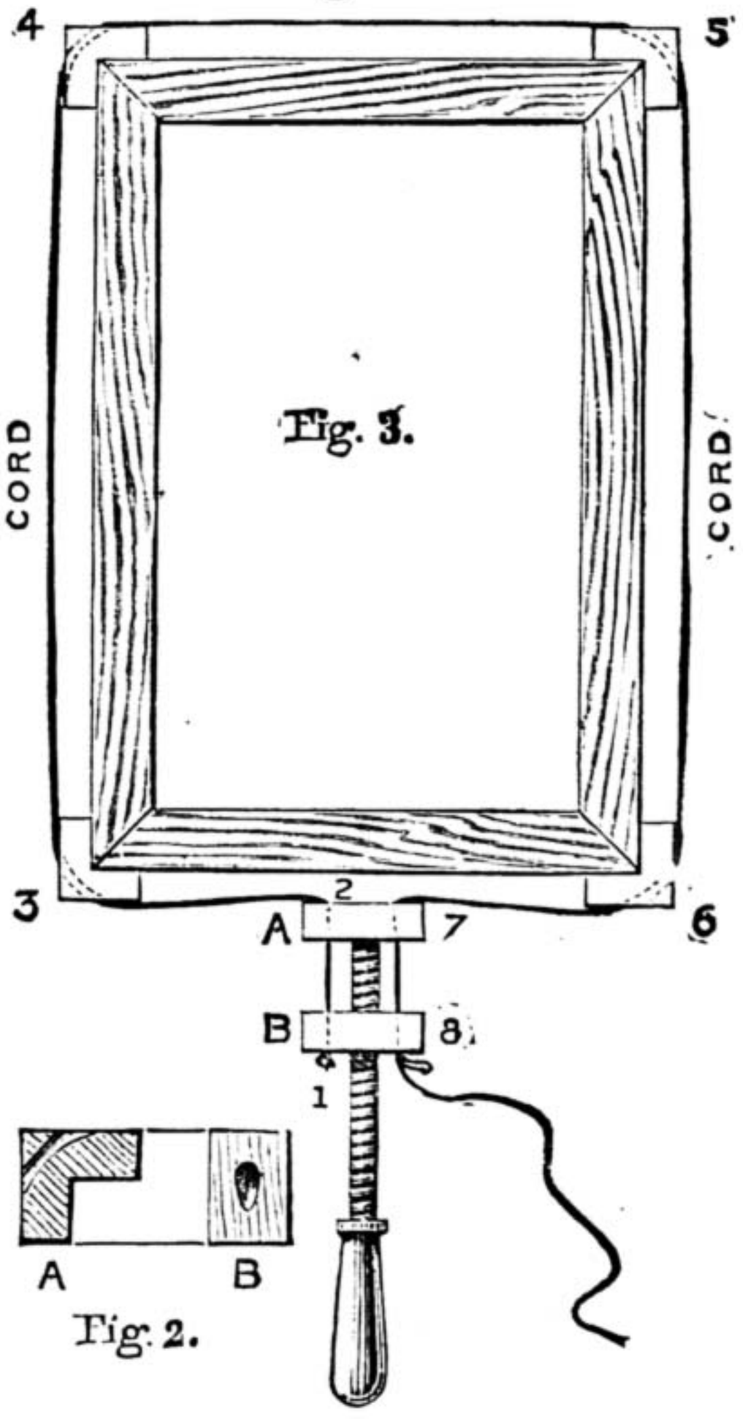


Fig. 3.

Fig. 2.

Wood Mitre Cramp.

Fig. 2. Take a square piece out of the corner of each (A, Fig. 2), and shape the holes so that a cord will pass through easily (B, Fig. 2). Then you require a wooden screw, which you can get from any turner or joiner for a few pence, if you cannot make one for yourself. Fig. 3, I think, will explain itself. A is a piece of ⅛-in. birch 2 in. by 1½ in. In the centre there is a hole half-way through, into which the point of the screw fits, and on either side there is a hole for the cord to pass through. B is a piece of the same size which forms the nut of the screw, having two holes for the cord as in the other piece. Now get a piece of strong cord (not too thick), put a knot on one end, and pass it through the holes, beginning at 1 and finishing at 8. Glue your mitres, and lay the frame in position on a table; place one of the little blocks on each corner, keeping the screw at the side next you; then draw the cord tight, and put a running knot at 8, Fig. 3; then screw up, being careful to notice that your mitres are all fitting in properly. The frame must now be left in the cramp until the glue is dried, when it can be taken down and nailed with ease."

Mail Cart Wheels.—J. J. K. (*Ireland*) writes:—"I am making a mail cart according to one of the designs in No. 30 of WORK, and when I had the body made I got a pair of wheels from the Victor Cycle Co., Grimsby (as advertised in your Sale and Exchange column), for 7s., and I must say they are the best value I have ever seen, and send you the particulars for the benefit of my fellow-readers, who might be making mail carts. They are as follows: 23½ in. in diameter, rubber tires, axle, brass caps, washers, pins, etc. They set off my cart to perfection."

A Correction.—F. A. M. thanks BRUM (*Keighley*) for the following:—Errata, Milnes Lathe, page 618, lines 21 and 23 from bottom, for "withdraw spring D" read "spring G"; for "arm D D" read "arm B B."

Useful Scroll Saw.—ARTIST IN WOOD writes:—"One of your correspondents says the useful scroll saw will not work; it is not likely it will work if a watch spring saw is the thing that is wanted. It is for cutting board, not thin fretwood."

Combination Bedroom Suite.—J. S. writes in reference to F. C.'s remarks (p. 684):—"Before reading your letter I had replied to T. B. R., and perhaps by this time you will have read my letter, wherein I state my objections to a drawer for basin, etc. Although 'two heads are' said to be 'better than one,' it depends upon whether they work together, or follow one another. Personally, I could not tolerate a partner, and I am afraid, if I had one, that one head would be worse—by a few punches—than the other; but I read such letters as yours in the spirit in which they are doubtless written—friendly. Concerning the suggestion of giving a summary of the total amount of wood required, very few writers do this, as space must be taken up, and any one with a small amount of arithmetical ability could manage it himself, as sizes of every part are always given. It would be almost useless to mention the cost, as WORK pokes its ever welcome nose into districts so far and wide apart that prices are bound to be different in some of them. You will have seen that I said it would cost nearly as much to make one of the robes as to purchase a complete bedroom suite. The bottom side drawer front can be either 'mocked' or panelled. Why should the latter prevent dovetailing? The framing would have the same solidity as a whole board. Front drawers certainly do show bevels, and I intended in my written article to say that if made so, a small piece of wood would have to be fastened to the front of job on to which to hinge towel-rail. Certainly the risk is always at hand of the glass door falling downwards, but just as certainly is the risk always at hand of the whole article tumbling together, if not properly and strongly made. I have remarked in an article the Editor has in hand that it is difficult to understand sometimes how designers and inventors obtain their ideas. It will perhaps surprise you to know that the main features of the article under consideration 'came to me' at about three o'clock one summer's morning, after a fruitless endeavour to court and wed sleep. This is not always the case, but I should advise no one to start on this plan. About the thicknesses it would, no doubt, have been better had I stated some parts as being thicker than others, but it was not on account of ignorance. Some time ago I sold a design (the Editor has seen a copy of it) to a manufacturer, who made several of them. It was a differently constructed affair to the present one, and was 5 ft. 6 in. wide, although answering the same purposes. I have seen one or two that he has made, and it struck me, when I 'got up' this one for WORK, that thinner stuff would answer the purpose for it. However, the idea doesn't seem to be relished. In a seaside hotel, in a gentleman's office, in the green room of a theatre, etc., the slight inconvenience of not being able to wash the hands often would be counterbalanced by the convenience of washing the whole head once or twice per day, without having extra furniture for the purpose. To avoid the effect of wet, why not paint the inside of the panel (as I said paint the outside of article) in an enamel which would stand either hot or cold water? The trouble of wiping the panel must not be considered. If you leave the panel open all day, and your clothes thus exposed to dust, etc., you will be able to wash your hands oftener; if you close the panel you cannot be accommodated with washstand, but your clothes will be free from dust. In conclusion, I must thank you for your letter, and ask you to criticise any other articles of mine if you see any faults."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Book on Organ Building.—E. B. (*Longton*).—"Organ Building for Amateurs," published by Ward, Lock & Co., Salisbury Square, Fleet Street, E.C., price 3s. 6d., will give you all the information you require.—M. W.

Lathe.—J. E. (*Liverpool*).—Much has already appeared in WORK upon working the lathe, and from time to time further papers will appear. Any specific question on how to use the lathe will be answered in this column if you will put such.—ED.

Protection by Patent.—A. E. S. (*London, E.C.*)—The Patent Office protections cover Great Britain and Ireland and the Isle of Man. The Government stamp upon an application for a Provisional Protection is £1. Great care should be exercised in

preparing specifications, which must be written in duplicate upon the properly authorised forms, and accompanied by the stamped application form. If you merely protect a shape or design, it is probable that you may require protection under the Designs Act, and not under the Patent Act. Should you obtain Provisional Protection under the Patent Act, it stands good for nine months from the date of the application, when the complete patent must be applied for, which will remain in force for fourteen years. The protection for a design is only given for a period of five years.—R. & C.

Bronzing Fishing Tackle. — BRONZING (*Leeds*).—I am sorry you have been kept waiting, but your letter inquiring about the bronzing of fishing tackle, etc., must have miscarried. The subject has, however, been brought forward in these columns in answer to other correspondents. Chloride of antimony applied to perfectly clean and polished brasswork will produce a charming violet steel colour, which I consider most suitable for fishing reels, rod mountings, etc., but whether the makers of such articles, or the connoisseurs among the fishing community, would approve, is another matter. Try it, however, before you decide. The brass should be turned up quite bright in the lathe, or "dipped" in the usual way, then heated moderately, and the chloride of antimony liquor applied with a rag until the work is evenly coloured, when it should be polished with a perfectly dry soft cloth and lacquered with clear—*i.e.*, colourless—lacquer. —OPIFEX.

Wheel Gearing.—G. R. (*Durham*).—The data you give are altogether insufficient. To design the wheels it is necessary to know the amount of force to be transmitted in order to determine the sizes of the wheel teeth, and of the driving chains and other parts. The ratios of the diameters of wheels to get the desired increase of speed will be as under:—Assuming the wheel, of which the circumference is to run at 40 miles an hour, to be 6 feet in diameter, it will make 200 revolutions a minute nearly. There must be a pinion on the shaft geared to a wheel 5 times its diameter on the next shaft, which must carry a pinion geared to a wheel 4 times its diameter, carrying a pinion 2½ times its diameter fixed on the shaft, which is to revolve 4 times a minute. If you let me know the class of machinery, if the size of the first or last wheel is settled, and the power to be transmitted, I can give you definite information from which you can work. Four revolutions a minute is remarkably slow for any kind of machine, except, perhaps, a water wheel.—F. C.

Magnetising Steel.—FLAX SPINNER (*Longton*). —In your former letter, sent me in July last, you asked for information respecting the means to be employed in developing the greatest power in an electro-magnet. From your letter just to hand, I gather that you wanted something different altogether. Why, then, make a mystery of your real wants, and enjoin me to secrecy? There is no secret about magnetising horseshoe magnets, or remagnetising them when they have lost their magnetism. You won't get a patent for the process. Make a pair of hollow bobbins, with holes in them to fit the legs of the magnet. To develop the greatest power in the magnet, wind on these enough No. 20 cotton-covered wire to make the whole three times the diameter of the hollow core. Wind one bobbin from right to left, and the other in the contrary direction. Connect the two together when on the legs of the magnet, and send through them the strongest current at your command. The current from your 10 Walker cells in series will develop considerable power in the small steel magnets. See also replies to C. E. B. E. (*Ebbw Vale*), V. R. (*Liverpool*), and ANXIOUS (*Liverpool*). I do not forget to answer the letters of correspondents. Every letter received has my prompt and careful consideration, but my replies cannot get into print as soon as you expect them.—G. E. B.

Magnetic Exploder.—A. C.—I do not know the conditions necessary to effect the explosion of benzine vapour by means of a magnetic exploder, so cannot tell you how to make the instrument. I hope to give an illustrated description of a small magnetic dynamo in a future number of WORK, and this may possibly suit your purpose, as it will make a wire white hot, and give sparks. I cannot give you any idea here in a few words how to make the machine, so must ask you to wait until I can explain it in detail.—G. E. B.

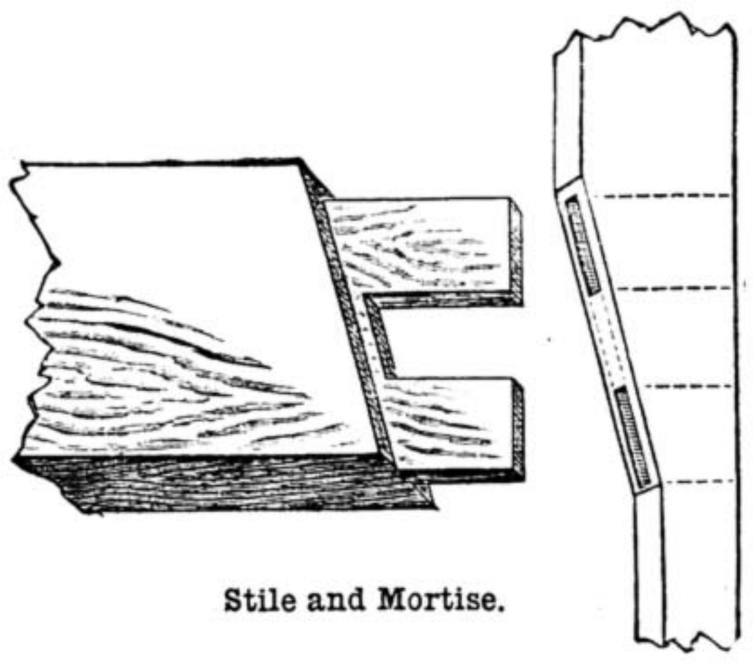
Shocking Coil.—J. B. P. (*Irthlingborough*).—Have you not heard that "everything comes to those who wait?" The coils will come by-and-by, and I hope the coil-makers are not tired of waiting. I have not forgotten them, nor my promise to them, but I wish to deal with the subject thoroughly when I set about it, so must first clear the bench of other jobs lying about on it waiting to be done. Dyer's book on "Coils" is a good, cheap book on the subject, costing only a shilling.—G. E. B.

Cleaning Engravings.—W. C. (*Somers Town*). —Put the soiled engravings in a bath of pure soft water—a flat porcelain tray or dish is the best receptacle; when thoroughly saturated, remove the pure water from the bath and add a bath of chloride of lime, which should be prepared by straining a strong solution of chloride of lime through muslin; watch the bath carefully, as the whole secret lies in *when to stop* the action of the lime: a few minutes will usually suffice, then rinse thoroughly in pure water, dry or strain.—F. B.

Repoussé Work.—J. L. R. (*Guernsey*).—All the necessary tools and materials for repoussé work may be obtained from Mr. Gawthorp, 16, Long Acre, London, and a useful little book of hints (6d.) for amateurs.—G.

Plating German Silver.—STRIPPER (*Soho*).—If your bath plates brass and copper well, and in a condition suitable for burnishing, but fails to deposit an adherent coat of silver or German silver, it shows either that you have not enough free cyanide in your solution to properly plate German silver, or you do not get each piece well coated before the other metals are put in the bath. Plate the German silver articles by themselves, and put in a small piece of cyanide just before immersing the articles in the bath. Also bring the anode a little closer to the articles at first, so as to get them quickly struck with a thin coat; then move it a little farther off whilst finishing. See to it also that the surfaces of the articles are slightly roughed in the acid pickle before being quicked in the nitrate of mercury solution, and transferred to the plating bath without loss of time, as German silver soon oxidises after it has been pickled, and the slight film of oxide would be enough to cause the deposit to strip under the burnisher.—G. E. B.

Door for Greenhouse.—W. H. (*Battersea*).—The framing of the door is made narrower at the upper part, to take away the heavy appearance which it would present if the stiles were kept the same thickness all the way up. The door stiles are first set out and mortised, then the upper part is cut down to the required width, stopping at the top of the belt rail, then bevelling off to the bottom of the belt rail. You will be unable to plane right up into the corner of the angle, and must use a chisel to finish off that part, taking particular care to keep the edge of the bevel quite square, as if it is unevenly done you will never get your joint to fit



Stile and Mortise.

closely. The ends of the belt rail are shouldered on the bevel to fit the stile. The accompanying sketch should give you an idea how to manage the work, the bevel of stile and mortise being shown, also the mode of cutting the double tenon, which you will notice is rebated at the under edge to allow for the grooving of the lower part of the framing to admit the panels. The upper edge has no rebate. The dotted lines on the stile show the position of the mortises. As you have succeeded so far with the building of the house, I hope you will not stick at the making of the door, but if you find any further difficulty I will be glad to help you out of it if I can.—G. LE B.

Porous Cell for Battery.—A. N. (*Waltham Cross*).—If you cannot get these cells in your neighbourhood, they can be sent by parcels post by Mr. Dale. See his advertisement in WORK, and write to him.—G. E. B.

Browning Gun Barrel.—W. B. (*Kent*).—For two recipes for browning a gun barrel I refer you to replies which have already been given in WORK; but, in case you might prefer a more elaborate process than that recommended to Paddy Brown, you can try the following, which is from the U. S. Ordnance Manual, as quoted in the *Scientific American* of September 21st. "Spirits of wine, 1½ oz.; tincture of iron, 1½ oz.; corrosive sublimate, 1½ oz.; sweet spirits of nitre, 1½ oz.; blue vitriol, 1 oz.; nitric acid, ¾ oz. Mix, and dissolve in one quart of warm water, and keep in a glass jar. Clean the barrel well with caustic soda water to remove grease or oil. Then clean the surface of all stains or marks with emery paper or cloth, so as to produce an even bright surface for the acid to work upon, and one without finger marks. Stop the bore and vent with wooden plugs. Then apply the mixture with a sponge or rag, and expose to the air for twenty-four hours, when the loose rust should be rubbed off with a steel scratch brush. Use the mixture and the scratch brush twice and more, if necessary, and finally wash in boilng water; dry quickly, and wipe with linseed oil, or varnish with shellac.—OPIFEX.

Coin Duplicates.—E. H. (*Plumstead*).—With reference to the first query in your letter, as to a publication which gives directions for making duplicates of medals, etc., I am sorry I cannot inform you, and hope that if any of our readers know of such a book they will let us know in these columns. I daresay that the method which I suggest is roundabout and clumsy, but I have found it answer very well, and so, hoping it may help you, give it for what it is worth. Half fill a shallow box or dish—I use a half-plate developing dish—with best plaster of Paris, in thick paste. Brush your medal over on one side with some of this paste. To guard against air-bubbles, lay the medal upon the surface of the plaster, press firmly and evenly until the medal is embedded, and the upper surface is flush with the surface of the plaster; see that the plaster touches the edge all round, and that it is not too thin and watery. Repeat these operations for as many medals as the bed will accommodate, leaving an inch at least clear round each. All this must be done as quickly as possible, as the plaster sets very rapidly; and it is better to make the experiment at first with one or two of the largest specimens. Now lay aside until the plaster is thoroughly set, and place in a moderately hot oven or before a hot fire to dry. When dry, with a sharp knife cut several angular grooves near the edge, say one on each of the sides; let these grooves be clean cut and V-shaped, and placed in such a way that they may not interfere with the medals, etc. Now dust very finely powdered blacklead over the face of the bed, and polish with a very soft brush, or rub lightly with the finger. Now mix sufficient plaster paste to fill the dish, etc.; paint over the medals as before, and pour in the plaster as quickly as possible; allow to dry thoroughly as before, and turn out carefully. The two portions of which the mould is composed may now be easily separated by gently prising at the line of juncture, when, if all has gone well, the medals, etc., may be removed—this very cautiously, so as not to crumble the edges—and we should have a perfect mould, the upper portion of which may be placed in exact position, being guided by the key grooves. The next step is to cut grooves from the edge of the medal to the edge of the mould—two for each medal, which are cut side by side, one to pour the metal through and the other as an air escape. Of course, half of each groove will be cut on each portion of the mould, and the groove for the metal should taper from the side of the mould to the edge of the medal, while the air vent need not be so tapered. Remove all particles of dust very carefully with a large camel-hair brush from the surfaces of the mould; place them together, and clamp them together. Place the mould in a hot oven, and get your metal ready. I use lead, tin, and bismuth, equal parts. Melt and well mix, and pour out into a bar; again melt, and it is ready for use. When the mould is hot—as hot as an ordinary oven will make it—hold it on edge, and very carefully pour in your metal; let stand in same position until cold. Open mould carefully, and the rest will suggest itself.—OPIFEX.

Sign-Writing.—TYRO (*Queensboro'*).—This is somewhat a pure matter of opinion, and you are quite as much right as you are wrong. It would perhaps have been better if you had added the letter "s" and made it read "Brightmans, Coal Merchants," when there could have been no doubt about the surname being in the plural number. At the same time, if a name is used to designate a firm of traders, such as in your own case, the very fact of you writing "coal merchants" conveys to the reader that there is more than one person connected with the firm, and consequently the whole is in the plural number. But, as I say, there are many to differ from me on this point, as with yourself. There are many well-known examples which you may point to in support of your contention, such as "Goy, Limited" (the word "limited" conveying the same information here as the word "merchants" in your case), or "Eastmans, American Butchers," a company which has a shop in almost every large town in the kingdom.—H. L. B.

Photographic Slides for the Magic Lantern. —JOHN BULL asks the following questions:—"How to make photographic slides for the magic lantern, and can they be made out of the plates?" Now, Mr. Editor, I do not want to develop into a growler in my old age, but will you allow me to say just a word in protest against such vague questions? It is a common fault with persons to ask questions in such a way that one is at a perfect loss to know what is wanted. I believe that the art of asking questions is one that few understand. Their want is palpable enough to themselves, but either they have not the power or are unwilling to take the trouble to place the idea—the word picture—before the mind of another. Now, I am not writing this in an unfriendly spirit, or through captiousness, but that our mates in the "Shop" may be induced to state their wants clearly, as it will save much time on the part of those who desire to help them, and very often much space in WORK—which is even of greater value. Now to refer to the question, I must presume a great deal: first, that J. B. can take a negative, etc. To take a transparency, make a wood tube, 5 ft. long and 3½ square inside measurement. Half an inch from one end glue four very small angle pieces in the corners, so as to form a ledge for the negative to rest on, with the picture side towards the end. Now lay a wet plate on this, but separated from it by $\frac{1}{20}$ of an inch, with the prepared surface towards the negative; fasten this in its place by any mechanical means that may suggest itself. Seeing that the end is light-proof, bring it into the light, and tilt the tube towards a north light if possible. Length of exposure must be determined by experiment—say five seconds; develop in the usual way. If I have not guessed the right answer, please ask again, and state distinctly, and I will try to give the needed information. As to the second question, "Whether they can be made out of the plates," I must treat it as a conundrum, and give it up.—O. B.

Electric Breast Pin.—QUOCUNQUE JECERIS STABIT.—An electric breast pin is made up of a very small incandescent electric lamp set in an ornamental metal setting, much as a stone would be set in a scarf pin or brooch. The tiny globe of glass, the size of a large pea, is very fragile, and can only be fixed by a skilled workman trained to do such things. Connection is made with the two tiny terminal wires of the lamp, at the back of the brooch, with a small flexible two-wire cord, leading to a small battery kept in the breast pocket of the coat. The lamp itself will, probably, cost you 5s., and you can get the pins for 7s. 6d., so it would be scarcely worth your while to attempt making one yourself, for you would run the risk of breaking one or two lamps in the attempt. Respecting the battery, see replies to ASCA (*Newcastle*), VENUS (*Norwich*), and H. E. (*Leicester*). Small accumulator cells are sold for the purpose at £1 each.—G. E. B.

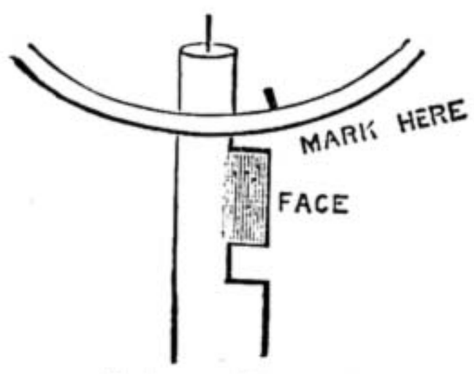
Telephone Magnets.—D. A. C. (*Aberdeen*).—I am very much pleased to find that my article on the telephone has been appreciated, and that it seems to have raised an interest in this subject among the readers of WORK. The magnets which you inquire about, and suitable for your purpose, can be had from Messrs. King, Mendham & Co., manufacturing electricians, Western Electrical Works, Bristol. The size is 5 in. by ⅜ in. (the form is round), and the price is 10d. each; if fitted with adjusting screw 4d. each extra. I am sure you would be able to purchase such magnets in Aberdeen. If you cannot get them the exact size and make, take the nearest thereto, and make the other parts to suit. Why not make them yourself?—W. D.

Fret Saw and Lathe.—MENDICUS (*Newcastle-on-Tyne*).—As a rule combination tools and appliances are not so satisfactory as those which are simple, and I do not think you will find fret saws and lathes any exception. The combinations, however, are by no means useless, for very fair work can be done with them. The principal objection I have against them is that the lathe is of small size and power. The Goodell and Companion lathes are the best in this respect, but the sawing arrangement is not of the best. If you want a really good fret-sawing machine there is nothing to equal the Britannia Co's. No. 8. This, however, has no lathe attachment in the ordinary way, though the manufacturers will supply one when desired, and from the unusually heavy flywheel of the No. 8 you will be able to manage any turned work which could reasonably be expected from a small lathe. I should, however, strongly recommend you to have lathe and fret saw as separate articles, for though at somewhat extra cost you will secure far greater efficiency. The same company's *multum in parvo* lathe is a really practical one at a small price. Let me say that you are not altogether correct in stating that the finest class of fretwork cannot be undertaken without the aid of a machine. As a matter of fact the finest work—viz., that in connection with inlays of veneers—is done with the hand frame. A good machine is quicker and more powerful than this, but that is all.—D. A.

Medical Coil.—W. B. C.—(1) A 3-in. coil should have a core 10 in. in length by ¾ in. in diameter, and be wound with 2 layers of silk-covered No. 16 B.W.G. copper wire, weighing about ½ lb., as a primary. The secondary may be wholly of 4 lbs. No. 32 silk-covered copper wire, or made up in 3 powers, with 1 lb. No. 32, 1½ lb. No. 34, and 1½ lb. No. 36. (2) Chromic acid is preferable to bichromate of potash, because it does not deposit crystals in the pores of the battery plates. 3 oz. of chromic acid in a pint of water, acidulated with 3 oz. of sulphuric acid. (3) Dyer's book on "Coils" will give you a tolerably general idea of their construction, but I cannot recommend a book treating specially on medical coils. This part of the subject will, however, come up for treatment in the next volume of WORK, when we deal with induction coils.—G. E. B.

Switch for Electric Time Alarum.—ONE IN NEED (*Coventry*).—I must refer you back to the illustrations, Fig. 13 and Fig. 14, on page 497. Cut out a round piece of hard wood, 4 or 5 in. in diameter, and hollow it on one side, as shown in Fig. 14. Smooth and polish the other side. This will form the base of the switch. Now make an arm of spring brass, 2 in. in length by ½ in. in width, and a thickness of about ¼ in. Drill a hole in one end to receive the pin in which it is to be pivoted. Drill a similar hole at the other end, and rivet to that end of the arm a button of bone, hard wood, or of brass. The pivot on which the arm moves should be in the form of a small brass bolt, with a nut to tighten it on the underside of the base. Pass this through the arm, then through a small brass collar to raise it from the base, then through the base in the centre. Next cut out two thin and narrow strips of brass to the shape shown on Fig. 13, and turn up a tiny piece of each to form stops; drill holes in each to receive small brass screws, and fasten these to the board. One of these strips is connected by a small bolt, or brass screw, to one end of the line wire, as shown at Fig. 14, and this is marked ON in Fig. 13; the other strip is merely a rest for the arm when we wish to switch the bell off. The other end of the line wire is secured to the nut of the pivot bolt, as shown at Fig. 14. The arm forms the connecting link or bridge between one wire and the other, and by moving it to the right the bridge is broken and the bell switched off. The switch may be put in any part of the circuit between the bell and the clock, or between the clock and the battery, wherever convenient to you. You have only to cut the wire at the spot where you wish to fix the switch, and connect the bared and cleaned ends to the two parts of the switch—one to the arm pivot and the other to the screw of the brass stop. You may make the base square if you like, and may fix all the wires to the face of the base instead of the back; but this does not look neat, otherwise it will work equally well. Respecting the lattice arm, the pillar (Fig. 7) is screwed into its foot (Fig. 8), and the lattice arm is pivoted to the top of the pillar. As these parts are therefore in metal contact with each other, you have only to fix one of the wires to the base of the pillar by means of one of its screws.—G. E. B.

Watch Repairing.—AN AMATEUR.—Thanks for appreciating "Watch and Clock Cleaning," and your patience in waiting. To loosen cylinder, have a piece of iron—smooth—with a hole in it that will just take cylinder; now have small hammer ready and very small punch—say a stout needle, point just off, if nothing better; warm by holding over gas jet with your tweezers, then pop it into hole and tap it out all round. In refitting new cylinder, have correct depths for pivots, and be sure height of escape part is right so as scape wheel will clear it. Before taking out you should make a mark upon balance rim, for the face of cylinder scape part, as in the accompanying illustration. So in replacing you will have no trouble about the three holes you set it in beat, or the next who may clean; you understand what I mean. When cylinder is ready to fix, and a neat fit, and all is set right to receive brass collet for height, etc., place it on, and heat it over small gas flame and touch it with shellac; it will be secure enough if hot enough to penetrate, but not too hot to alter tempering. Names of all parts are with each article. Repair prices I would not like to be printed; I should upset a hornet's nest.



Balance Rim, etc.

Enlargements.—A. S. (*Sheffield*).—With the enlarging camera described in No. 13 of WORK, you can enlarge up to 12½ in. by 10½ in. To make pictures from ½-plate negatives to the size you want—viz., 24 in. by 19 in.—you will have to increase the size of the back and front of the camera to suit, and increase the length of the baseboard to 6 ft.; the sliding boxes that carry the lens must also be lengthened—say, about 3 in. more than the size given. The lens used in taking the negative will be the most suitable for use in the camera, and in making such large pictures you must use a small stop to preserve the sharpness of the image. Use a focussing glass, as it is difficult to tell by the eyes alone when the image on the ground glass is quite sharp; and if you cement a small circular piece of thin glass (such as is used for covering microscopical slides) to the centre of the ground glass screen with Canada balsam, you will be able to get accurate definition by focussing on it. Use pine in preference to red deal, it is much easier worked. All the details of the camera remain the same as described in No. 13, and the manner of construction will be exactly similar, with the exception of the increase in the sizes of the parts I have mentioned. I am sure you will find much pleasure in the use of the apparatus, as you will be able to produce by its aid very fine wall pictures, that is, of course, supposing that you have suitable negatives.—G. LE B.

Polishing Boxwood.—E. C. (*London, N.*).—I must repeat once more that unless inquirers will state clearly and fully what course they have adopted whenever results of polish are not satisfactory, it is quite impossible to do more than surmise what is wrong. Numerous causes might be named as the reason of your failure to get a good surface, and very likely none of them might be the correct one. Describe your process, and then I shall very likely be able to tell you how to improve. In the meantime I can only suggest that you have used your rubber too wet. If this is not so, I cannot assist you at present, owing to the very limited data to go upon. To spirit off use a clean rubber moistened with spirits instead of polish, but if you have not got a good body on it is hardly worth your wasting time in spiriting. Glaze certainly gives a common-looking finish, especially on a badly-prepared surface, but so would spirit.—D. A.

Polishing Baywood.—SALFORD LAD.—I do not know of any wood called Spanish baywood, but I am inclined to think you have misnamed it, and mean simply Honduras mahogany or baywood. This is commonly used in your trade, the choicer Spanish mahogany being more employed where appearance has to be studied, as in furniture. If you will refer to No. 31 of WORK you will find the particulars you want are given in the middle column of page 493.—D. A.

Turkish Bath Making.—R. S. H. (*Dover*).—There is no occasion for anything elaborate. You can make a really serviceable portable Turkish bath without a mortise, tenon, or dovetail in its construction, nor are framed panels at all essential. All you have to do is to use nails instead. You probably know how an ordinary packing case would be made. Well, look upon your portable bath as a packing case, and with the knowledge you already have I hardly think you will require any directions beyond these few hints.—D. A.

Staining to Walnut.—W. G. (*Dalston*).—Having enamelled your washstand I am afraid you will not find it at all an easy matter to make a good job of it by doing as you propose—viz., staining it walnut colour. I certainly would not advise you to try this, as the result will probably not be satisfactory. If you want it walnut colour I should recommend you to paint (enamel) it. If, however, you wish to stain you must first remove the present coating. This you can do by scraping on any parts which can be got at by the scraper, and washing with strong soda and water. Why will the plane not take? After having removed the paint in whatever way may be most convenient, you must apply the stain in the usual manner, but it is more than likely that the stain will not be even. I have now told you what may be done with the best chance of success, but I cannot advise you to undertake the work. If you can give the date of former letter possibly it may be traced, but as it has not been answered, it is not at all likely it ever came to hand. You will easily understand it is hardly possible to look through the correspondence for a few months back without having an idea of date and subject.—D. A.

Upholstery in Morocco.—CAB HAMMER (*Cork*).—Whoever recommended you to use vinegar to enable you to put morocco leather on arms of couches and round frame furniture, without showing any wrinkles or creases, has either been "taking a rise out of you," or did not know anything about the matter. The backs of particularly obstinate skins are occasionally moistened slightly with water in order to make them yield, but this practice should not be adopted by any but a thoroughly skilled worker, who would hardly do it if he could effect his purpose by other means. Only skill can enable one to do as you desire, and it is utterly impossible to give instructions which can meet every case. I may, however, just indicate that judicious cutting of the skins, placing the tacks very close together, and manipulative neatness are important factors. If you have any special piece of work you are in difficulty about, and will let us know full particulars of shapes and sizes, I shall be happy to give you any assistance that may be possible. This will be of more assistance to you than pages of general directions.—D. A.

Zincography.—J. W. S. (*Sheffield*) inquires how to produce a zincotype. To enter into all the necessary details of manipulation and instructions for overcoming the difficulties likely to arise, would exceed even the ordinary length of our articles. Briefly, however, the process is as follows:—The subject should be drawn upon litho-transfer paper, or pulled from an engraved plate and put to stone, rolled up, washed out, brought up with a roller and again washed out, after cleaning and etching, and a transfer pulled. Then, upon a perfectly clean polished zinc plate, cut to size of job in a copperplate press, put down the transfer, and roll it up with a litho roller, and etch as if for printing from zinc. Then feed the job with an acid-resisting varnish, put the plate into a trough upon rockers, and bite it with weak nitric acid and hydrochloric acid mixed; the lines will be left in relief slightly; rinse well in pure water; dry upon a hot plate. Roll up when cool, but not cold, with a flannel roller, with a mixture of Brunswick black varnish, or other acid-resisting substance; paint sides of any lines which seem undercut by the acid. When dry again, place in the rocking trough—which must be kept moving, so that the acid washes away all oxide—using acid rather stronger, repeating the operation, drying, rolling up, etching, and rocking, until the plate is deep enough. In those parts where the lines are close together, at each drying care should be taken to paint them out as soon as they are deep enough, or the acid will eat underneath them and break them away. Then with terebine or turpentine wash off the varnish, cut out entirely all large white spaces with a fret saw, and mount upon a mahogany mount to type-height with small screws, countersunk at the edges of the zinc. There is a very useful treatise by Josef Bock, published at 2s. 6d., which fully explains the processes and gives the best formulæ. It may be had from the publishers of Wyman's Technical Series, 65, Chancery Lane, E.C., or by order of any bookseller.—J. W. H.

Mounting of Drawings.—T. A. W. (*Kilburn*).—For the proper mounting and straining of drawings, maps, engravings, etc., two things are absolutely essential—(1) good paste, and (2) cleanliness in handling; it is also advisable to practise your hand upon some small unimportant work before attacking anything large and serious. In preparing your paste, which must be free from lumps and about as thick as new milk, add a lump of alum as big as a walnut, then stir to boiling, but be careful not to allow it to burn; then squeeze through canvas. A plain wooden frame for straining is now necessary, or, if the drawing is to be framed afterwards, a permanent wooden strainer; in either case the wood should be about 2 in. wide. Obtain some plain, unbleached calico, about 4 in. longer and wider than your strainer, damp the calico with a sponge, then paste 1 in. all round, and, after laying the strainer, or frame, face down on calico, turn the pasted edges over frame; let this dry. Afterwards moisten with sponge and clean water the paper you intend to mount, sponging evenly all over,

so that it is quite *damp* but *not soaking wet;* then paste about ½ in. all round the border, take your frame with strained calico upon it, and lay it face downwards on the paper to be mounted, which it will take up; then with your hands, or a clean linen cloth, carefully press the pasted border all round, and leave to dry *slowly;* then you will find it strained as tight as a drum head, and you can either frame it in the ornamental frame you intend for it, or, after making a drawing on the strained paper, with a penknife cut it all round and release it from the strainer. Should this not be sufficiently clear, I shall be pleased to answer any further questions you may submit.—F. B.

Lathe Tackle.—J. R. (*Richmond*).—Glad to hear you have got so far. You should add the taper-screw to your set of chucks, which you can make by fixing a common joiner's screw into the centre of a small face-plate, putting it in so that it cannot turn round when the wood is screwed upon it. To turn wood you require two chisels and two gouges, say a 1-in. chisel and a ½-in one; a ½-in. gouge and a ¼-in. one will do to begin with. *Don't* have a grindstone to run in the lathe; you would have to take out your work every time you want to use it, and it would splash with dirty water all your lathe and tools. I cannot recommend anything cheaper than a 20-in. stone in a wood trough, with treadle; this costs 20s. A less stone than this has not enough momentum to do without a fly-wheel.—F. A. M.

Glass Embossing and Lettering.—LETTERING (*Farnworth*).—For outlining on glass use black japan or Brunswick black. An imitation frosted ground surface is secured by coating glass with a thin layer of white paint and working a dry brush upon the surface. Black japan and deep vermilion also make good backgrounds, but, of course, a "figured gold" groundwork is the most chaste of all in appearance. Epsom salts in solution, when applied to glass, give it a natural frosted appearance when dry, but this dodge is not of a very permanent character.—H. L. B.

Book on the Lathe.—A. C. (*Oldham*).—The Britannia Company's book is to be obtained from Britannia Company, Colchester. Cash can be remitted by stamps, or postal orders, or cheque, or coin in registered letter.

Repairing Broken Pivot.—B. P. (*Birmingham*).—I am pleased to see you and others appreciate my humble efforts; all descriptions in print so far have been too scientific for amateurs; of course they do not intend to convey information to the masses. Take your pinion with the pivot broken, and in a small size gas flame, soften it, file off level, and proceed to drill in the centre; but you cannot have a centring tool, so do the best you can. In drilling, if you move ever so few turns as much around your work as possible, this will keep you in the centre, and when you are sufficiently deep enough dress up a piece of steel softened about same as pinion. When it fits tight to the drilled hole, temper it; now hard solder it. I see you know how: but the next difficulty is to turn the pivot. I see you have one. Now dress up pivot, and get correct depth; this you must be very particular about. Polish the pivot well, and I think your difficulty will vanish. But is it not much cheaper, if you call your time of any value, to have a new pinion put in? In either your first or second mentioned job, it will only cost you 2s. at Barton's, Church Street, Liverpool; or Reid's, Basnett Street, Liverpool; or Morris Cohen's, Kirkgate, Leeds, all watch tool, etc., shops. Don't act green, but as if you were in the trade. Case-harden by making a fire of leather scraps, which are most exceedingly hot, and place your steel bar with wire affixed in centre until thoroughly heated, then plunge in coldest water you can get. I think you will not have any trouble in bending after that.—J. S.

Regilding Frame.—W. L. B. (*Hucknall*).—No; vellum size will not answer your purpose; we find bronze turn colour under any circumstances; it will retain its colour the longest, however, if you get the best bronze powder, and mix well with your varnish, and apply with camel-hair brush, as gold paint. Frame makers gild in the ordinary way with a Dutch metal leaf, and then varnish; this will keep for years. The cheap German frames sold are all gilded with this leaf; some, however, are gilded with silver; the best quality ones and coloured lacquer retain their colour. I have some which I have had in my house twelve years, and they are still very good.—G. R.

Index to WORK Volume.—D. A. B. P (*Hammersmith*).—You and every reader of WORK will have an opportunity of possessing an index, as one will be published after the issue of No. 52.—F. J. C.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Brush Making.—T. S. (*Wellington, Salop*) asks:—"How brushmakers make the one end of Mexican fibre to represent the flag on bristle; whether it is a dye, and what it is composed of?"

Re-waxing Meerschaum.—TOBACCONIST writes:—"Will any reader of WORK explain the process of cleaning and re-waxing meerschaum pipes, as done for the trade?"

Cutting Music for American Organette.—AMATEUR MUSICIAN writes:—"I beg leave to ask (through 'Shop') of your musical correspondents for instructions how to drop in chords when cutting the notes of a tune, such as marches, waltzes, songs, etc., on the paper for an American organette. I can cut the notes, and their octaves (or unisons), but there is not melody enough without occasional 3rds, 4ths, 6ths, etc., and where to drop them in I am not able to decide. Is there a fixed rule for doing so, and if so would some kind reader be generous enough to say what it is, as I am sure many of the readers of WORK would be glad to know how to add chords in the key of C for their organette. I have a list of these chords now before me, but cannot use them in their proper places, and I care not to purchase sheets of music for the instrument when I can make them, minus the chords. I have made the instrument myself from the patented one, and, in fact, improved it, and if I could complete the dropping in of the chords it would be a real good job. But as it is patented, I must keep silent on that point."

Springs for Artificial Legs.—R. F. (*Landore*) writes:—"Will any reader kindly inform me through 'Shop' where I can obtain springs for artificial legs and steels for trusses?"

A Simple Incubator.—NEMO (*Ospizio, Malta*) writes:—"In WORK for December (see page 654) I find described a simple incubator in reply to B. F. (*Liverpool*) (see page 302). May I ask how long the incubation takes place?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Fairy Bells.—R. F. writes in reply to SUBSCRIBER (*Bristol*) (see page 654):—"Bottom and sides are of ¾-in. pine. Wrest-pin blocks are of beech 1¼ in. wide by ¾ in. deep. Lower block, the front edge of which acts as bridge, is 1¾ in. wide, and shaped as shown in diagram. Under this and outside the bottom is hitch-pin block ¾ in. by 1 in.

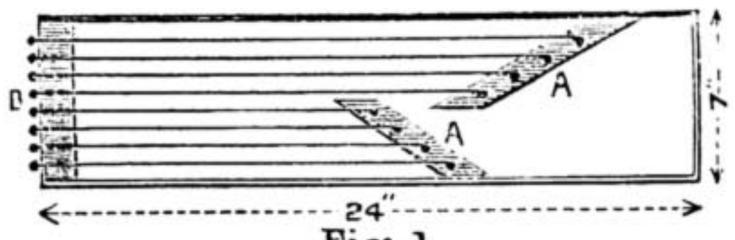


Fig. 1.

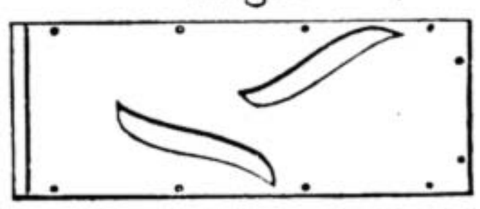


Fig. 2.

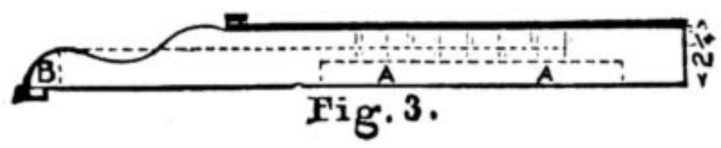


Fig. 3.

Fairy Bells.

Cover, which is made to take off, is of ¼-in. cedar or mahogany. Wrest pins are ordinary piano pins, and hitch pins are round-headed ¾-in. screws. The first four strings are of No. 11 steel wire, next two 12, last two 13. Strings must be wound round pins so as to quite clear blocks. The cover may be made to slide in and out, and is preferable this way."

A Steel Flux.—J. H. D. (*Luton*) writes in answer to G. H. S. (*Manchester*) (see page 670):—"You will find the following a good flux for welding steel: 1 part sal-ammoniac, to 10 parts borax, pounded together, and fused over the fire in an old tin until clear, when it is poured out and allowed to cool, afterwards reduced to powder, and used in the same way as any other flux would be used."

Pill Making.—CHEMICUS (*Tynemouth*) writes:—"In answer to J. C. (*Carlisle*) (see page 494) for the addresses of makers of machines: Kneading machines, Werner and Pfleiderer, 88, Upper Ground Street, Blackfriars Bridge. For piping, cutting, and finishing machinery, Mr. J. W. Pindar, 75, New Church Road, Camberwell."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—AN OLD SOLDIER; W. W. (*London, S.E.*); STANNUM; H. S. (*Tunbridge Wells*); J. R. (*Dundee*); W. W. (*Newcastle-on-Tyne*); H. C. (*Newcastle-on Tyne*); G. K.; S. R. (*Withington*); W. R. (*Fife*); W. L. D. (*London, S.W.*); BRITANNIA CO.; SKIBOO; W. C. (*Manchester*); A. J. E. (*Worthing*); M. A. T. (*Cambridge*); F. H. F. (*Kensington*); W. S. C. (*North Shields*); W. J. (*Swansea*); B. S. B. (*Warwick*); A FREEMASON; R. G. R. (*Blair Athole*); J. H. T. (*Manchester*); S. C. R (*Derby*); E. H. (*Clerkenwell, E.C.*); J. S. S. B. (*Dublin*); W. S. A. (*Aberdeen*); F. H. (*Streatham Hill*); C. W. (*Audrie*); A WOULD-BE INVENTOR; F. A. (*London, S.W.*); J. B. (*Dunbarton*); J. T. (*Liverpool*); F. B. (*Great Horton*); A. M. (*London, N.*); H. C. S. (*Notting Hill*); C. W. (*Kensington, W.*); F. H. C. (*South Woodford, E.*); CAMERA; J. W. R. (*Camberwell, S.E.*); NOVICE; N. R. (*Plymouth*); M. N. (*Plymouth*); A. C.; W. W. (*Patterdale*); POOR STRUGGLER; IRIS (*Dublin*); B. A. B. (*Hampstead*); YOUNG TINSMITH; EXCELSIOR; SUBSCRIBER; CLIMAX FOUNDRY CO.; A READER; E. B. (*East Dulwich*); H. S. F. (*Worcester*); P. W. (*Yorks.*); P. B. (*Kent*); BICYCLE (*Weybridge*); CATGUT (*London*); A WELL WISHER; J. F. (*Elgin*); BEWILDERED ONE; W. H. D. (*Plymouth*); P. J. (*Birmingham*); J. N. (*Glasgow*); ONE OF YOUR YOUNG READERS; J. H. W. (*Walton-on-Hill*); A. B. (*Pallas Green*); C. W. B.; J. G. (*Ashton-under-Lyne*); H. C. (*Yorkshire*); E. J. P. (*Birmingham*); W. C. (*London, S.E.*); F. F. (*Birmingham*); F. B. (*London, E.C.*); A. D. (*Burnley*); E. P. R. (*Gaye*); BRASS; M. S. R. (*Barrow-in-Furness*); C. H. O. (*Stanton*); P. K. (*Birmingham*); W. J. B. (*Bermondsey*); H. J. (*London, W.C.*); J. A. (*Norwood, S.E.*); TOM JONES; A. H. C. (*Barnsbury*); MAP COLOURER; A. C. (*Stratford*); AMBITIOUS; H. G. (*Bishopsgate*); G. J. G. (*Fulham*); A. F. V. C. (*London, W.C.*)

Trade Notes and Memoranda.

THE following particulars, which have been supplied by Mr. Leader Williams, as to the mechanical appliances at present employed in the construction of the Manchester Ship Canal, will be of interest. There are no less than 96 steam navvies, including 3 German, 4 French, and 58 Ruston & Proctor's navvies. There are 166 locomotives and 5,874 wagons, whilst 213 miles of temporary railway have been laid down. There are 162 steam cranes, 127 portable and other engines, 186 steam pumps, and 40 pile engines, on various sections of the works.

PETROLEUM motors are being simplified and improved to such an extent that they may now be ranked amongst the useful small motors. In one manufactured by Messrs. Altman & Company, of Berlin, ordinary common lamp petroleum is used with great success, and a number of these little engines, varying from one to four horse-power, have been running for over a year in different parts of Germany and Russia, whilst in Belgium a company for their construction has been formed, and the works, situated in Brussels, are in full swing. Insurance regulations constitute one of the formidable obstacles to the introduction of this class of motor in England.

THE supply of electrical accidents in the United States is being recorded. The latest report is about a damp horse smelling a damp lamp-post, and is not so impossible as usual. In the interests of electrical progress in Great Britain, it would be well to allow a technical man to see these telegrams before they are published, for no one knows how much damage may be done to a cause by the spreading broadcast of a number of reports apparently prejudicial to its interests.—*Industries.*

WORK

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