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STAGE CARPENTRY.

BY WILLIAM CORBOULD.

PROFILE — BOARDS FOR PROFILE — COVERING BOARDS WITH CANVAS — PREPARATION OF GLUE—GLUING AND PRESSING BOARDS—SET PIECES—MAKING WINGS AND SET PIECES—PUTTING PROFILE ON WING.

IN this series of papers I shall deal with the making of profiles, set pieces, practical doors and windows, vampires, etc., borders, rollers wings, etc.

Profile.—I shall commence first with the making of profile, and I may here say that to do this properly you will require no little attention to the instructions here laid down, because if badly done it will entail a deal of after trouble; on the other hand, if well done you can cut it and work it to anything.

Some of my readers, no doubt, will not know what profile is, and what it is used for. Profile is a thin board with canvas well glued down to it on both sides. When this is dry and hard you can cut it with a knife or profile saw into any form: such as the edges of wings in which you wish to represent foliage, rocks, etc., when a straight-edge would be out of place; but if a piece of profile is put on to the straight-edge of the wing, you can cut it to the painting. This, however, will be carefully explained hereafter.

Boards for Profile.—The boards required for this purpose are usually about 10-cut — that is, a 3 in. deal would cut ten boards about ¼ in. thick, and either 9 in. or 11 in. wide. The canvas required for the purpose must be pretty open—that is, rather coarse in the web. Many use paper-hangers' canvas, but canvas not quite so coarse may be used, or even common unbleached calico will do. Let your glue be the best you can get—that is to say, get Scotch glue, and always use it. Now for the preparation.

Covering Boards with Canvas.—We will suppose that we have three boards to do—they may be 9 in. or 11 in. wide. You must cut your canvas a little less than the width of your boards, so as to allow of stretching when rubbing down; the canvas must not come beyond the edge of the board when finished, because it must be part and parcel of the board itself when cutting it up as may be required.

Preparation of Glue.—The best way to prepare the glue is to have a small pail and break up the glue into it; place this in a large pail, put water into both, place them on the fire, and let them boil until all the glue is dissolved. The glue should be of the same consistency as castor-oil.

Gluing and Pressing Boards.—Lay the board on a bench or table, and take a large brush and well cover the board with glue about 4 ft. at a time; lay the canvas on, well stretching it, rubbing from the centre towards the edges; go on gluing and placing the canvas on the same way until you have covered the board. Now take a piece of canvas or rag, soak it in the water, and squeeze it out, but do not leave the rag too dry; commence at the end, and rub until you bring the glue through the canvas—that is, until it assumes the appearance of soap. When you have finished, turn the board over, and go through the same process on this side as on the other. When you have finished, you must get a number of pieces of wood, about 1 ft. long and 1½ in. thick. Lay these pieces on the floor in a dry place, and where you will not want to disturb them for four or five days at least. Place the pieces about 18 in. apart, lay the board that you have just finished flat on these pieces, and having done this, go on with another board. When finished, place some more pieces of wood on the board you first laid down, placing the second board on the slips previously laid on the top of the first one. Go on doing this until all the boards are finished. On the top of

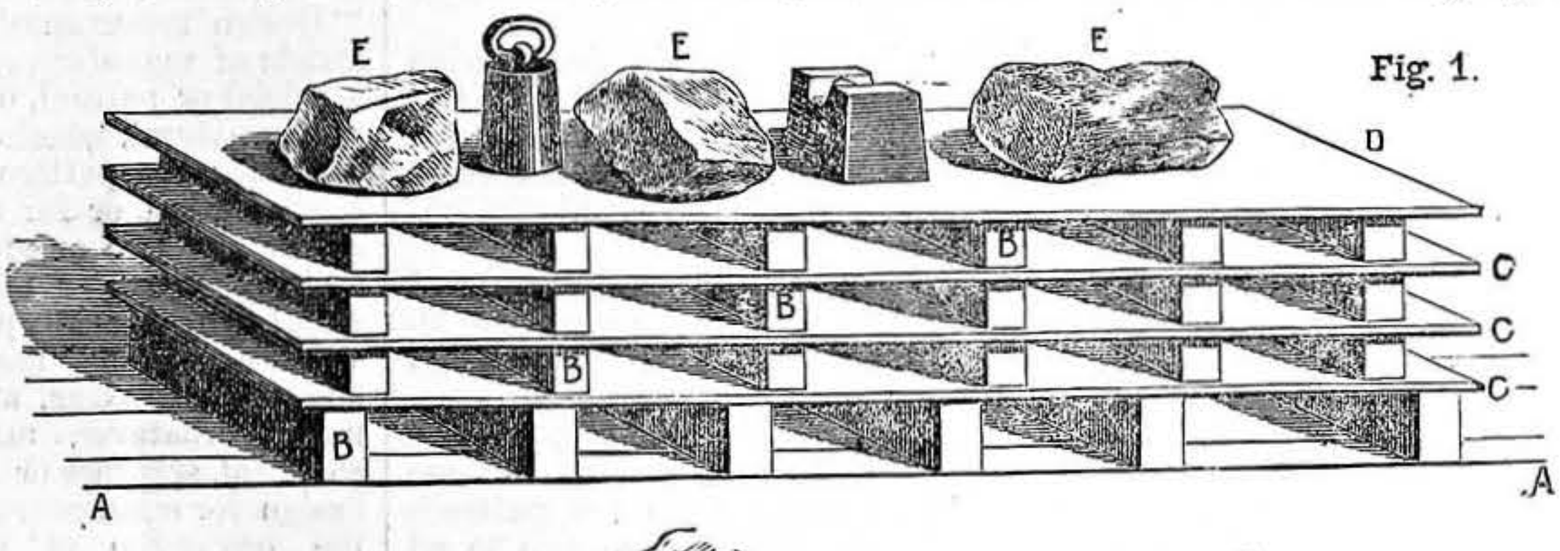


Fig. 1.

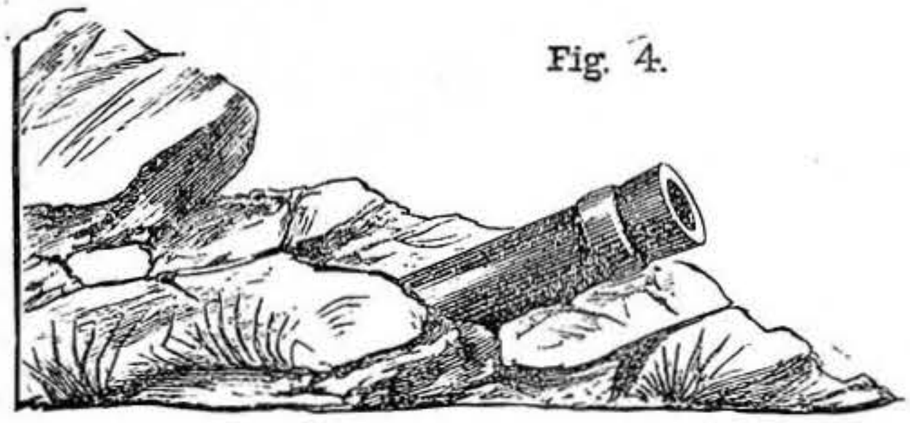


Fig. 4.

Fig. 2.

Fig. 3

Fig. 1.—Boards glued and covered with Canvas, piled to allow them to dry. Fig. 2.—Wing (A) and Two Set Pieces (B, C) in Combination. Figs. 3, 4.—Set Pieces.

the last board place some slips of wood as before, and on the slips lay either one board or some pieces of board, as you may happen to have about the workshop. On these pieces of board place some heavy weights—anything will do, whether iron weights or stones. In four or five days the whole will be dry and fit for use. You will see by this method that the air can freely circulate through the whole pile, as shown in Fig. 1. In this, A A is the floor; B, B, the blocks of wood placed between the boards; C, C, C, the three profile boards; and D is the board placed on the top of the profile boards, whereon are the weights, E. As I said before, anything will do if heavy.

Set Pieces.—Set pieces, such as rocks, banks, or foliage pieces, are sometimes set partly on the stage from one of the wings, and at other times right across the stage, as shown in Figs. 2, 3, and 4. In Fig. 2 the wing is seen at A, the set piece at B, and the bridge, C, is also a set piece, placed a little back from the wing, leaving an opening between for entrance or exit. The bridge piece, being set also a little in front of the scene, gives the stage a very picturesque appearance; but more of this hereafter, when we come to borders.

Making Wings and Set Pieces.—We now come to the making of these wings and set pieces; 3 in. battens are generally used for the framework, or floor boards, which run about 6 in. wide when ripped down through the middle, answer the same purpose well enough. Let us take a wing first. Supposing it to be 12 ft. high and 3 ft. wide: you would cut two 12 ft. lengths and three 3 ft. lengths; the proper way to put them together would be by mortise and tenon, as in Fig. 5; on the other hand, if it should be that the "scenic artist" or stage carpenter is an amateur, and does not happen to have the proper tools, he may put the framework together by halving, as shown in Fig. 6. By using good glue and wire nails, say 1½ in. long, so that they will turn and clench, the wings will be quite as strong as if they were mortised and tenoned.

Putting Profile on Wing.—The following is another way:—Butt the parts together, cut a piece of profile neatly, and glue and nail this on as shown in Fig. 7, in which A is the piece of profile with the edges bevelled off; B is the corner when finished. Fig 8 shows how the profile is put on. We will suppose O P to be the side of a wing; it will be seen that a rabbet is cut at A so that the edge of the profile board may be laid in it when ready. Well glue the rabbet before laying in the profile, and then fasten it all along with small flat-headed nails; of course, the wing or set piece is made first, and in covering them with canvas, never allow the canvas to come too close to the edge of the frame, and keep the tacks quite 1 in. from the edge of the canvas, because after tacking down you must hold up the canvas with one hand while you use the glue-brush with the other. Then take a damp rag and rub it well down; when dry, it will be ready for painting, as in Fig. 13. You must at all times allow sufficient canvas to cover over the edge of the profile after it is nailed on. Do not forget this.

Figs. 9, 10, 11, and 12 are the back views of wings and set pieces, Figs. 2, 3, and 4 showing the way they are put together. Fig. 12 would be hinged together in the centre by hinges known as back-flaps, so that the portions of the painted side shut up face to face. The centre partition must be covered with a strip of canvas to hide it, making the painting appear as one.

HOW TO SECURE COPYRIGHT IN DESIGNS.

BY CHARLES KELSEY.

INTRODUCTION—DEFINITION OF A DESIGN—SCULPTURE NOT INCLUDED — HISTORY OF THE DESIGNS COPYRIGHT—WHERE DESIGNS ARE REGISTERED—ACT AND RULES, PRICE, AND WHERE OBTAINED—WHO CAN REGISTER—DEFINITION OF "PROPRIETOR"—DESIGNS MUST BE NEW OR ORIGINAL—DEFINITION OF "NEW OR ORIGINAL"—WHAT IS "PUBLICATION"—SUBDIVISION INTO CLASSES—LIST OF CLASSES AND REMARKS THEREON.

Introduction.—In past numbers of WORK, several papers dealing with Patent matters have appeared, which have been of great value in explaining the method of procedure necessary to obtain the grant of a Patent, and also in putting before the readers the general principles of the law relating to Patents. But hitherto the section of the law which deals with the protection by Registration of Designs, Patterns, Shapes, and Ornaments — that is, the Designs Section of the Patents, Designs, and Trade Marks Act of 1883—has not been prominently brought before its readers; and I propose, in the following pages, to deal with this subject in a similar manner to that in which Patents have been treated.

A slight reference to this Registration appeared at the latter end of C. C. C.'s paper on Patent matters in Vol. I., page 545; but the subject is of so much value that it deserves treatment in an independent paper.

The information will be found useful and valuable, more especially by those—manufacturers, designers, and artisans—who design or produce novel articles of manufacture, new shapes for articles of utility, or who ornament or decorate such articles in some new manner, or who design the patterns for such purposes. The law applies to all materials, and therefore the information will be useful to workers and designers engaged in all the varied manufacturing industries which are carried on at the present time.

Also, it will be useful to those amateurs who design or produce for pleasure some article, shape, pattern, or design, which, if manufactured and placed on the market through the ordinary channels of trade, would be likely to "hit the public taste," and secure a sale.

The inventor of simple articles may here also find welcome information as to this alternative method of securing protection to that involved in "taking out a Patent," which is open in some cases by proceeding under this section of the Act; for the protection acquired by Registration is fully as effectual—if the subjects are such as may be rightly included in its scope—while the cost is much less, the procedure in making the application much more simple, and the granting of protection much quicker; thus enabling the inventor to put his goods on the market without delay, which is frequently of great importance to catch some particular market. Frequently these points—the initial cost and the inability to make the application unassisted or to employ a Patent agent—form insurmountable obstacles to the worker who is desirous of obtaining a Patent; but if the subject be such a one that it can be registered as a design, these obstacles will be evaded, for, after perusing the present paper, any person with ordinary intelligence will find no difficulty in making an application unassisted, and the fees are so trifling as to be within the means of almost everyone.

It will be my aim at the same time to give much necessary information as to the rights so acquired, and the general principles of the law.

It is but natural that designers and inventors should be anxious to secure, as a reward for their ingenuity and industry, a fair share of any profits earned by the sale of their inventions and designs; but they frequently fail in doing so from ignorance of the steps to be taken to secure their rights, and my object in writing this paper is to do my best to supply this deficiency.

Definition of a Design.—In dealing with this subject, evidently the first step must be to ascertain what is or can be rightly included under this section of the Act; and the step is an important one, because it is worse than useless to attempt to gain protection by provisions which are not applicable to the subject in hand. The term "Design" is a very wide one, and different definitions of it will be found in different dictionaries; but as the term is defined in the Act itself, in Sec. 60, we must turn to that source for our information. The definition is rather a long one, but its importance must be my apology for quoting it *in extenso*. Sec. 60 runs as follows:—"'Design' means any design applicable to any article of manufacture, or to any substance, artificial or natural, or partly artificial and partly natural, whether the design is applicable for the pattern, or for the shape or configuration, or for the ornament thereof, or for any two or more of such purposes, and by whatever means it is applicable, whether by printing, painting, embroidering, weaving, sewing, modelling, casting, embossing, engraving, staining, or any other means whatever, manual, mechanical, or chemical, separate or combined, not being a design for a sculpture or other thing within the protection of the Sculpture Copyright Act of the year 1814 (54 George III., Cap. 56)."

First, it will be noted that the field covered is very wide. We may take it for granted that designs in any material will be included, no matter how executed.

It should be noted, also, that the words "for the pattern, or for the shape or configuration, or for the ornament thereof," are the essential words of the section, on which everything turns; and anything which is included under these terms may be rightly registered under this section.

Under the terms "for the pattern" and "for the ornament" are included all designs or patterns used for the decoration or ornamentation of surfaces or articles, and thus the works of pattern designers for all materials, such as calico printing, paper staining, house decorating, lace weaving, leather embossing, etc. etc., are included; as also are the works of the decorative artists and workers who are engaged in ornamenting articles of beauty or utility—such as china decorators, wood carvers, marquetry workers, metal chasers and engravers, jewellers, bookbinders, etc. etc.

Under the terms "for the shape or configuration" are included the external or internal shapes or forms of all the various articles of manufacture—such as the shapes of the potter, wood-worker, glass-blower, metal-worker, stone-carver, ornamental modeller, etc. etc.

It will be noted that "sculpture" is specially excluded from this section, as its protection is dealt with by the Act before referred to. As, doubtless, amongst the

readers of Work are sculptors, modellers, and plaster-cast makers, I propose dealing with it in a supplementary paper, for a brief *résumé* of this Act would be welcomed by them.

It is the terms "for the shape or configuration" which render this section useful for the protection of many minor inventions. If the essential novelty in an invention consists in making the article, or portion of the article, of some novel shape or configuration—perhaps to enable it to better perform its purpose, or, it may be, to ensure greater facility in its manufacture, or for some other such reason—it will be possible to secure protection for it by Registration as effectually as by patenting it. But if the invention does not conform to these terms, it is useless to register it under this section, for if a certificate was granted by the Office, a plea that it was not such a one as should have been registered would, if upheld by the Courts, invalidate the Registration.

The history of this part of the Act throws a good deal of light upon what may and what may not be protected under the Designs Copyright, and so I give a brief *résumé* of it.

History of the Designs Copyright.—The first attempt of the legislature to grant a Copyright in Designs was the Act 27 of George III., Cap. 38, which came into operation on June 1st, 1787. This was intended to protect the patterns printed upon linens, calicoes, cottons, and muslins. It gave a protection for two months only from the date of publication. The designs were not registered, but the proprietor's name had to be printed upon each piece. The Act was enacted for one year only. In the following year a continuing Act was passed. By subsequent Acts the period of copyright was extended, and designs printed upon other textile fabrics were included.

The next great step was in 1842, when a further Act was passed, 5-6 Vic. Cap. 100, known as the "Ornamental Designs Act," which instituted the present practice of registering a design to secure copyright, and the protection was extended to patterns and ornaments applied to the articles produced in other trades. The shapes or configurations of articles of manufacture were also covered, the object being to protect, in like manner, the shapes produced by the potter, metal-worker, and other manufacturers.

In 1843 was passed the "Useful Designs Act," 6-7 Vic. Cap. 65, the object of which was to protect articles of utility which were not designs for the ornamentation of articles, or ornamental shapes of articles, such as were included in the "Ornamental" Act previously alluded to. The protection granted, to quote from the Act, applied "to any new or original Design for any article of Manufacture having reference to some Purpose of Utility, so far as such Design shall be for the Shape or Configuration of such Article, and that whether it be for the whole of such Shape or Configuration, or only for a part thereof."

This Act was, in fact, used for the protection of the many minor articles which were being invented, which were not considered by their owners sufficiently important or sufficiently valuable to be made the subjects for application for the grant of a "Patent." At that time the Patent fees were much higher, and the procedure very complicated.

These laws remained in force up to 1883, when the present Act was passed, which extended the term of Copyright to a uniform period for all designs, lessened the fees, and brought both useful and ornamental designs under one head.

Under the old arrangement it was very difficult to draw the line between a useful shape and an ornamental shape, so the distinction was abolished. Now any article of manufacture in which the shape or configuration of the whole or of some part is the essential

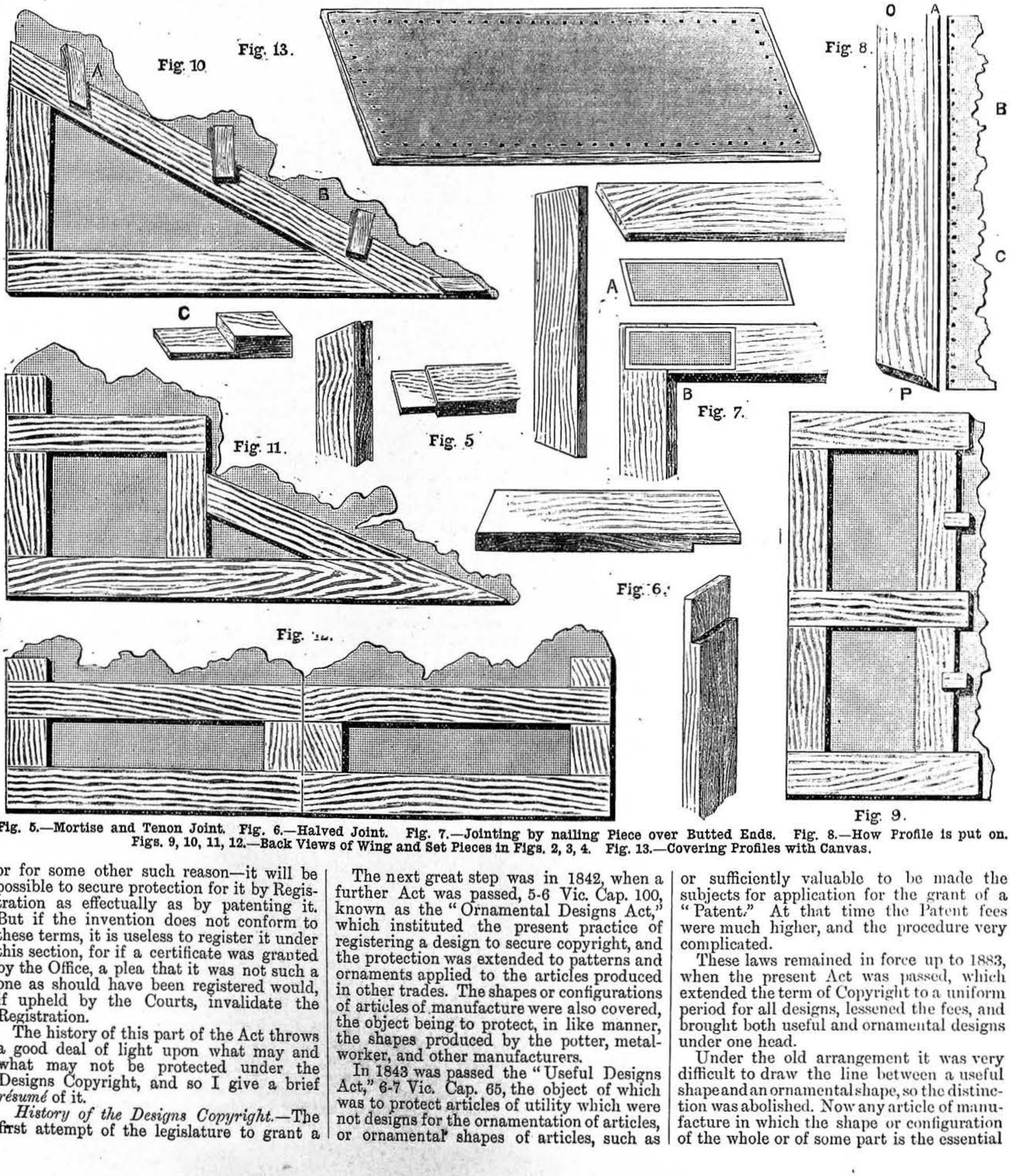


Fig. 5.—Mortise and Tenon Joint. Fig. 6.—Halved Joint. Fig. 7.—Jointing by nailing Piece over Butted Ends. Fig. 8.—How Profile is put on. Figs. 9, 10, 11, 12.—Back Views of Wing and Set Pieces in Figs. 2, 3, 4. Fig. 13.—Covering Profiles with Canvas.

novelty may be registered, whether it is for some purpose of utility or for ornament merely, in addition to designs, patterns, and ornaments formerly included under the "Ornamental Designs Act." It is this inclusion of the old "Useful Designs Act" in the present Act which renders it applicable for the protection of many minor inventions for articles of utility, and if they conform to the conditions stated, such articles may be thus fully protected.

Where Designs are Registered.—As will have been gathered from my foregoing remarks, this forms part of the business carried on at the Patent Office, situated at 25, Southampton Buildings, Chancery Lane, London, W.C., which is under the direction of the Comptroller-General and his staff, who act under the powers conferred upon them by the Act of 1883 and the rules made in connection therewith, the terms of which control and regulate all their actions.

Acts and Rules, Price, and where Obtained.—Copies of this Act, commonly called the "Patents, Designs, and Trade Marks Act, 1883" (price 1s. 7½d., by post 1s. 9d.), may be procured at the Sale branch of the Patent Office, 38, Cursitor Street, Chancery Lane, London, E.C., or will be forwarded to any address if Postal or Post-Office Orders are sent addressed to the Comptroller.

Copies of the Designs Rules, 1890, are 6d., by post 6½d. Copies of the amending Act of 1888 are 1½d., by post 2d.

Copies of "Instructions to Persons who wish to Register Designs," which contain much valuable information, are given gratis at the Office, or will be forwarded by post if applied for.

Who can Register.—The person entitled to copyright is the proprietor of the design, and the Act gives a definition of "proprietor" in Sec. 61. It runs: "The author of any new or original Design shall be considered the proprietor thereof, unless he executed the work on behalf of another person for a good or valuable consideration, in which case such person shall be considered the proprietor; and every person acquiring, for a good or valuable consideration, a new and original Design, or the right to apply the same to any such article or substance as aforesaid, either exclusively of any other person or otherwise, and also every person on whom the property in such Design or such right to the application thereof shall devolve, shall be considered the proprietor of the Design in the respect in which the same may have been so acquired, and to that extent, but not otherwise."

In this respect the Designs section differs from the Patent. The grant of a Patent to a person who has seen some invention abroad and first brings the knowledge to this country is valid, but the definition of proprietor seems to preclude such a proceeding in the case of a design. Here the applicant must be either the author, *i.e.*, the original inventor, or designer, or a person who has acquired the right from such original inventor for a "good or valuable consideration," such as works executed while the designer or inventor was in his service, or by purchasing the design from the original designer. In the case of purchasing a design, it will be well to have a formal document to that effect, to prevent difficulties arising on that point in the future. In one decided case it was held that the grant of a sole agency in this country was not such "good or valuable consideration" as the law meant; and so it would seem that the design must be acquired by cash or its equivalent. Persons who have stolen or copied a design without giving the original designer or inventor some consideration for it, will not be protected, even if a certificate be granted to them.

Designs must be New or Original.—All designs applied for should be "new or original," and such as have not been, prior to the date of application, "published" within the United Kingdom. These are important points to be borne in mind, for neglect of them will invalidate the registration. They are the most usual pleas raised as a defence to an action for infringement of copyright, and have given rise to many interesting decisions from the judges who have tried these actions. As these decisions govern the construction, or the meaning of the words used in the Act, they are useful in deciding what the Act deems "new or original," and what is meant by "publication." In one case it was held that the reproduction of an article which had been published in a different material—such as making a design in metal which was well known in china—did not constitute a "new or original" design; and in another case it was held that the copying of a photograph of a well-known person upon china was also not a new design; but it has been held that a new combination of old parts was perfectly valid. The law is, evidently, only for the protection of the design or invention which has been *bonâ-fide* invented or designed by the applicant or by some person working for him, and which they have registered before publishing.

It has also been held that designs must be "substantially new or original" to claim protection. Some slight variation is not sufficient: there must be, in each case, a substantial novelty.

What is Publication.—On the question of publication, it will invalidate the Registration if the design has been exhibited, before Registration, for the purpose of seeing if orders could be obtained for the article, although, in the same case, it was held that consulting an expert as to the workability of the design was not such "publication" as would be fatal to the after-acquired rights.

It should be understood that, even if a certificate of Registration has been acquired, if these points of publication and novelty have not been attended to, the Registration will be invalid.

Subdivision into Classes.—The Act and Rules subdivide designs, for the purposes of Registration, into fourteen classes, taking as the distinguishing feature the material in which the design is to be produced.

Registration only applies to the class or classes of goods for which application is made. Thus a design may be registered as a paper-hanging, and may be produced by another person as a cretonne or furniture print; so that it is necessary, if the applicant wishes to apply his design to more than one class of goods, that he should make separate applications for each class required. Only by taking this precaution can he prevent his design being used by other workers in different materials. In cases of doubt, where the applicant cannot decide for himself the proper class in which his application should be made, the Comptroller is empowered to decide for him by Sec. 47-5, and this is much the best course to adopt under such conditions, for this reason: placing in the wrong class by the applicant would most probably invalidate the Registration, but if placed in the class which the Comptroller directed, such a plea could not be raised, as he is specially empowered to decide such a point.

List of the Classes, with Remarks thereon.

The classes are:—

Class I.—"Articles composed wholly or chiefly of metal not included in Class II."

This includes, in addition to designs executed in all the ordinary metals, works in the precious metals, other than jewellery.

Class II.—"Jewellery."

This term, "jewellery," is treated by the Office as meaning personal ornaments. This class is not restricted to articles in metal, but includes designs produced in the other substances used in jewellery, such as precious stones, jet, coral, horn, etc.

Class III.—"Articles composed wholly or chiefly of wood, bone, ivory, papier-mâché, or other solid substances not included in other classes."

This is a general class for designs for works executed in solid substances other than those included in the special classes. It includes, in addition to the materials mentioned, designs for works in stone, and such substances as indiarubber, gutta-percha, vulcanite, etc.

Class IV.—"Articles composed wholly or chiefly of glass, earthenware, or porcelain, bricks, tiles, or cement."

Primarily for designs in fictile materials which are solidified by baking or burning, like pottery, bricks, and tiles, and also for glass. The term "cement" includes designs in artificial stone—possibly articles made in plaster of Paris—and such-like articles which are formed in a plastic state, and solidify afterwards without the aid of heat.

Class V.—"Articles composed wholly or chiefly of paper (except hangings)."

Includes, besides paper, designs on or articles made with cardboard and the like substances, and it becomes sometimes difficult to draw the line between these and the papier-mâché included in Class III. This class also includes designs for Christmas cards, greeting cards, etc., but such goods are much more frequently entered for Copyright at Stationers' Hall, and on this point it is difficult to say which is the more correct proceeding; but when they are of some novel shape in addition to the ornamentation of their surface, Registration as designs would appear to be the safest course. Frequently manufacturers register them at both Offices, and possibly they would be entitled to some protection under the law regulating Artistic Copyright.

Class VI.—"Articles composed wholly or chiefly of leather, including bookbinding of all materials."

This class includes designs for all leather-covered goods, such as writing and despatch and dressing-cases and the like, which are so covered. Also designs for bookbinding in all the materials which are used for this work.

Class VII.—"Paper-hangings."

The class includes designs for all the varieties of paper-hangings.

Class VIII.—"Carpets and rugs in all materials, floorcloths, and oilcloths."

This includes designs for practically all floor coverings with, perhaps, the exception of indiarubber matting, which is put with the other indiarubber goods in Class III. Also all varieties of oilcloths.

Class IX.—"Lace, hosiery."

Includes all kinds of lace goods, and such hosiery goods as stockings, socks, and the like, and knitted piece goods.

Class X.—"Millinery and wearing apparel, including boots and shoes."

May be said to be restricted to designs for complete articles of wearing apparel. Designs for portions of articles of wearing

apparel sold separately—not as complete, made-up articles—are placed in the class indicated by the material of which they are composed.

Class XI.—"Ornamental needlework on muslin or other textile fabrics."

Includes all designs for hand and machine-wrought embroidery or ornamental needlework.

Class XII.—"Goods not included in other classes."

This, as appears, is the class for designs for miscellaneous goods which are not included in any of the other classes. Designs for textile narrow goods—such as fringes, frillings, braids, gimps, ribbons, tapes, and the like—are included in this class.

Class XIII.—"Printed or woven designs on textile piece goods."

This is a very large class, including designs for all textile piece goods—that is, goods sold by the yard—including all the varieties of dress goods and furniture textiles. Includes, in addition to printed and woven designs, patterns executed by stamping or embossing and cutting, like varieties of velvets and velveteens.

Class XIV.—"Printed or woven designs on handkerchiefs and shawls."

In addition to the articles indicated, includes textile squares generally—such as bed-quilts, table-linens, towels, and such-like goods as are sold complete in themselves, singly or by the dozen.

It should be noted that in the wording of the first six classes—with the exception of Class II.—the words "wholly or chiefly" occur. This means that articles composed of more than one material should be applied for in the class of the predominating material. Previous to 1890 the words were "wholly or partly," and this necessitated registration in each of the classes over which the materials of the design ran, so that the amendment made is all in favour of the applicant.

It should also be borne in mind that it is the design or patterns applied to some material, or the forms or shapes executed in some material, that is protected—not the material itself.

Having now fairly launched the reader into the subject, I shall, in the subsequent papers, deal with making the application, and the procedure the Office takes thereon; and then deal with what constitutes an infringement, and various other minor matters relating to the subject. I shall deal with every branch as completely and succinctly as space will allow, and I shall make no apology for doing so on account of the interest which is evinced in everything relating to patents and patent laws and usages as soon as the subject is broached in the pages of this Magazine. That it is one that is of the highest importance to every workman cannot be denied, and on this ground alone it deserves consideration in WORK.

FITMENT TO HANG ABOVE A SMALL HARMONIUM.

BY PALGRAVE MORRISON.

"AND underneath her window He used to go and strum, In mode at which you would have wept, His dull harmonium." So sang Mr. Gilbert in an early "Bab Ballad," and the painful truth of his words will be echoed by all those who live next door to a plodding amateur who has begun to blow the reed-chest. Mr. Spurgeon was once asked if a man could play the trombone in a brass band and yet remain a Christian, to which he is reported to have replied: "That no doubt he might, yet, if he practised at home, his next door neighbour could not."

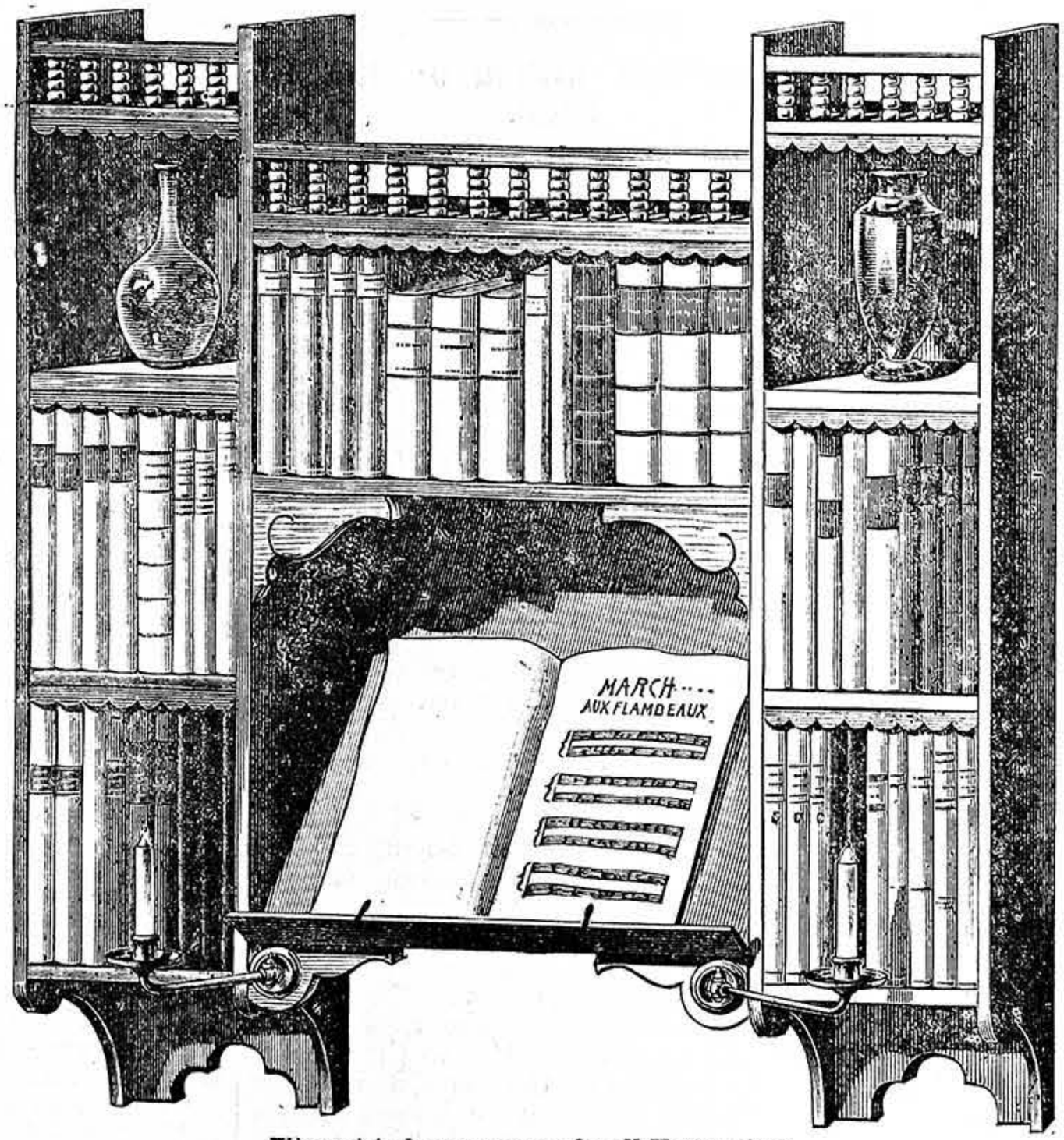
But in spite of well-deserved sarcasm freely launched at the people who make the most distressing noises with the aid of the harmonium, it is capable of excellent music; and if only I dared to give a column of advice—from one who knows—I fancy it might be more useful to the amateur than the music-desk and shelves it is my object to describe.

If one who has suffered the miserable incompetence of a so-called music-desk to carry out its professed intention could say here plainly what he really thought of that irritating imposture, either the Editor would cut it out, or the Magazine itself would be disgraced by profanity. For the arrangements made by the manufacturers of small harmoniums to keep the music at the proper angle and allow its pages to be turned over are, as a rule, merely absent—for the small harmonium never suggests that anyone might occasionally be tired of playing from memory, and wish to have his music in front of him.

Then, again, like a piano, the instrument, as a rule, has no convenient receptacle for printed music. To obviate these two omissions, and afford, beside conventional, artificial light, is the not very subtle problem attempted herein.

As a piece of joinery, it is enough to rouse the disdain of the ultra-professional workers who cannot tolerate simplicity; for it is but a set of shelves after all, and to seriously consider the readiest way to make such a thing is beyond hypothesis. The decorations are confined to a few small spindles—*à la* the anachronistic "Early English Queen Anne"—but these may be replaced by fretwork, or still better, by carving, if desired.

The practical point is that a good, useful music-desk is offered; that space for two candle brackets to be affixed is also given. The shelves will be useful for books if the amateur's musical library is limited. With regard to size, the desk should, I know, be 24 in. wide, and the whole structure not less than 3 ft. 4 in., the average width of the instrument. Supposing it to be built of 1 in. stuff, that would allow the side recesses to be only 6 in. each, whereas they are shown twice as wide. But I prefer the whole to overlap the instrument; if personal reasons decide otherwise, there is no reason why there should be any side shelves on the music-desk level. All the details are purposely left vague to suit the taste of any who wish to adapt an idea, for, after all, the idea is the main thing. If it be an idea, however badly treated, the clever worker soon discovers the way to better it; and so far as I know, obvious though such a thing be, no one has illustrated such a combination of desk and shelving as that suggested in this fitment. The article does not take long to make, and forms a useful present for a friend and a taking piece of furniture for bazaars, which will form a counter attraction to the too numerous cushions and antimacassars which usually form the staple article for sale at these entertainments.



Fitment to hang above a Small Harmonium.

ASHPAN MAKING.

BY R. ALEXANDER.

THIS short paper is to be taken as a reply to a query on the subject by J. W. (*York*).

The first thing to learn in making these articles is to know how to go and measure for them. I speak from experience, and no doubt many brother workmen can confirm the statement that not one person in twenty bringing an order for an ashpan to an ironmonger has a sufficiently intelligible order or sketch to enable the workman to make it without going to the range or grate and taking his own particulars. To do this, make a sketch of the bottom of the pan like Fig. 1; next measure the width of the fire-hole that it is to fit in; and here it is that an error often creeps in. Bricklayers or

range-setters are only human after all, and frequently the back part of the fire-hole is narrower than the front, so that an ashpan made the right size, apparently, when tried in jams half-way, necessitating either an alteration of the pan or a cutting of the brickwork underneath. To avoid this, cut a small piece of stick to the size of the front, and with that test the back of the fire-hole both at the bottom and top. Whatever the size is, write that at the back of your sketch as shown in example—7½ in. The next dimension to take is the "depth." Do not confound this term with the height, of which I will speak presently; the depth, A A, is the distance from front to back. Always mark on the diagram ¼ in. less than your measure, as a little space at the back does not matter, but it looks very bad to see an ashpan stand out from the grate. We will say for an example of depth 6½ in., and mark it on the plan as shown. The shoulder of the ashpan is generally about an inch each side. Draw a line from shoulder to shoulder and then mark the distance the front has to be from that; it varies from 4 in. to 7 in.,

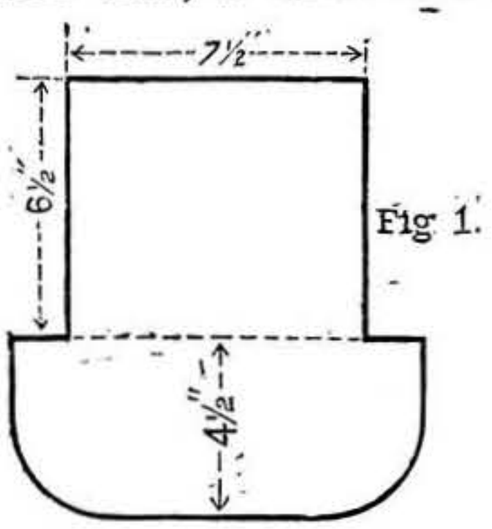


Fig 1.

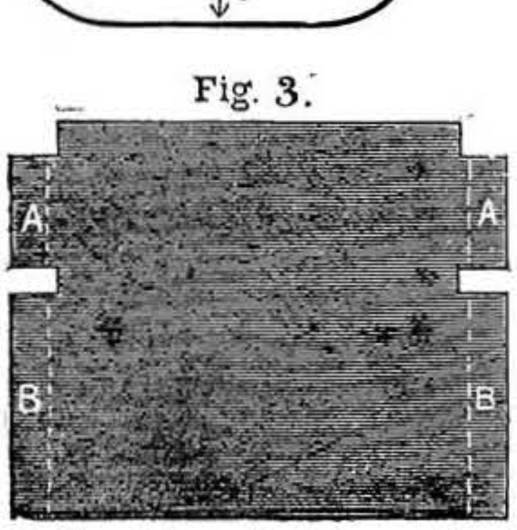


Fig. 3.

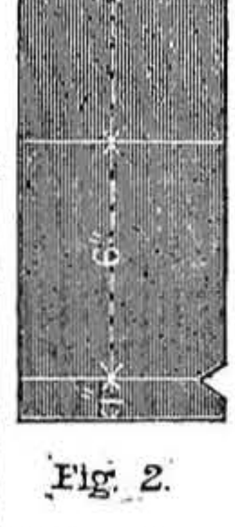


Fig. 2.

Fig. 1.—Plan of Ashpan for Kitchen Range. Fig. 2.—Flat Pattern of Back Part. Fig. 3.—Flat Pattern of Front.

according to the size of the ashpan. In our example I have marked it 4½ in. Two more dimensions now need to be marked down—that is, the height of the back part and the height of the front. These, of course, vary with circumstances. I have marked: back 7 in., front 10 in., which is about an ordinary average. Some people cut a paper pattern, but this is unnecessary if the directions I have given are followed, though in the case of a register grate ashpan it is generally necessary. I can only give very brief directions for working up, and must presume, as you are an improver, that you know something of the trade and names of tools and technical terms. Use 24 gauge charcoal iron or soft steel for small size, and 22 ditto for larger ones. First cut out the piece for the back, marking it out like Fig. 2, which is supposed to be for the size given above. Fold the top and wire, leaving the wire out 3 in. at each end; bend square on the hatchet stake down the lines, then bend on the lines; you will find that you must mark them on the other side. Next bend the wire that you leave out straight up. Having got this part of the ashpan true and square, bend a strip of tin or zinc to get the length to cut the front. Cut the piece, and cut a notch each end at the part that is to be the top; at the height of the wire of the back part cut a piece out of the front as shown in Fig. 3; wire the top, and bend round to shape. The parts marked A are bent round and closed over the wire left out of the back, and the parts B are riveted to the 1 in. parts thrown off the back (see A, B, Fig. 1). Next throw off the edge for the bottom, shape up again, and mark out the bottom with a slate pencil, allowing nearly ¼ in. all round; turn up, pane down, and knock up in the usual way. Punch a hole in the centre of front, and rivet in a bright range knob with two or three thick washers inside. If any further information is required, I shall be pleased to give it to any who may ask for it.

SADDLES FOR RIDING ON HORSEBACK.

WITH RECENT IMPROVEMENTS IN STIRRUP HANGING.

BY JOHN CHARLES KING.

SEVERAL patents are taken out in England in each ensuing year for saddle improvements: for cross and side saddles, some of them to obviate or nullify the very parts which had at some previous time been patented as improvements. And some without the patents are correct as far as they go.

The hunting season is here, and its sure fatalities and lamings of riders follow with increased intensity every year. Seven deaths and six hundred falls, with injuries, were last year's hunting season's record.

A Queen's huntsman boasted ten falls in one run. Thirty riders tilted out of the saddle in view at one fence. All this is discreditable for a nation of horsemen, and should be rectified.

The fault, in the judgment of some experienced riders, is that the stirrup is hung so forward that it does not serve to support the body of the rider at his centre of gravity, but about six inches in front of it, where the feet fail to support the body, unless the body is leant forward over the stirrup fixings. This action of the rider decentralises him, and causes him to tilt forward over the forelegs of the horse, and to use his reins and hands on the horse's withers to effect a balance at the landing from a leap. This weight thrown on to the forelegs of a horse causes him to knuckle-over, or pitch on his knees, unless he pitches the rider over his head and breaks his neck, and thereby saves his own. For it is noticed that if the horse unseats his rider he saves himself often, but if the rider hangs on to the horse, both come down together, sometimes the man undermost.

As all correct riding is by knee-grip, it is obvious that the supplementary aid of stirrups should not interfere with this grip, which in all riders would be the same—at the middle of the horse's body from hip to shoulder, and at the middle line from back to belly. This part of a horse moves but little up or down or radially in turning, hence the graceful pose of the barebacked rider.

The legs need support, and the slighter the better, but it must not interfere with knee-grip, and need not.

The horsemen of the pampas of South America have a hole in the skin strapped on their horses, or a strap pendant from the girth for the leg support, with a hole in it for the toe. If a stirrup is used by them, it is still in the same position, though the stirrup is a block of wood with a hole in it mostly. These men are rarely ever unseated from the wildest horses in flight over rough ground.

So far, all horsemen agree that the stirrup hanging should be more central on the saddle. Why is it not? requires a view of a tree to convey an answer.

Modern trees are made in a way to prevent a central hanging, as will be seen from Fig. 1, of a saddle-tree with its stirrup-bar, which is fixed partly to the pommel point and partly to the belly of the tree, or that part which joins the pommel in front to the cantle behind. This is just three inches too forward at the least, and is the main cause of the mischief that results to both horse and rider.

Why fix it here? begets the question—Why make trees which render any other fixing impossible? Tree-makers know nothing about horses or riders; they make by the gross, and that is all they know or care about. The saddler buys these trees, and assumes they are right, and covers them.

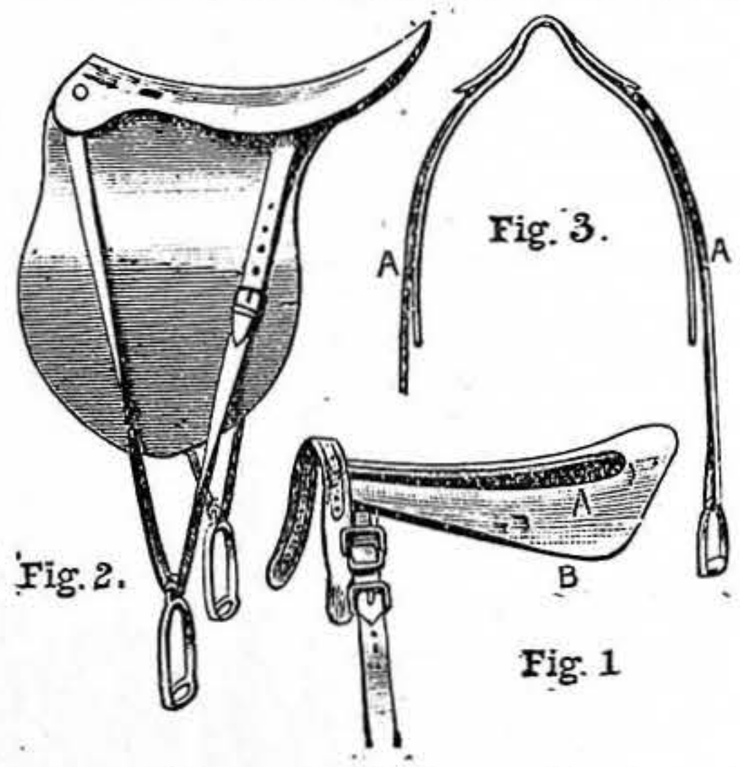


Fig. 2. Fig. 3. Fig. 1

Fig. 1.—Ordinary Saddle-tree with Forward Stirrup Leather. Fig. 2.—Double Suspension Stirrup Leather Fixing. Fig. 3.—Front View of Saddle, showing where Stirrup Leathers come under the Rider's Knee-grip at A, A.

The rider buys the saddle, the groom mostly has an interest in approving of it, and the new thing starts on its break-neck career.

"Four men have been killed from that saddle," remarked an old helper in a stable. "Where's the fault?" was asked of him, and answered—"The bars are so forward, that the riders who lean on the stirrup get tipped out before they know it. The old style was to hang stirrup leathers on the bar of the tree three or four inches back, then a man was safer. Military saddles are made so."

However hung, the stirrup leather is right in the way of knee-grip, and forms a shifting wad of leather that prevents fair and easy gripping, as at A, Fig. 3.

The diagram given in Fig. 3 gives a sectional view of a saddle and stirrup from the front. A, A, are the three thicknesses of leather under the knee on each side, being one inch total thickness, to spread the legs wider and mar the perfect grip of the knees, often causing eczema inside the knees with old riders.

The purpose to be gained is of a twofold character in centralising the position of the stirrup and removing the leather from the knee. This has been accomplished in the simplest way possible by a rider who, as

soon as he thought of it, altered his hunting saddle, he being a workman as well as horseman.

The result was a saddle with the stirrup leathers parted so as to hang from two latches, one on the cantle point, the other on the pommel point, as is shown in Fig. 3, so that the grip of the knees comes between the two straps, and the knees are spread an inch less; an essential consideration for safe and comfortable riding, as has been satisfactorily proved by its use by one rider in 10,000 miles' riding in seven years, on young horses, without once having an accident to horses or rider.

SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

The Plane.

In our first lesson we tried to understand the plane, how to take it apart, sharpen, and put it together. We will now proceed a step, and try to learn to use it.

The learner must not work on a bench that is too high. When the board to be planed is in position, and the worker takes the jack-plane in hand ready to begin, a line drawn through his elbow and wrist should be rather lower than higher at the wrist, though if the fore-arm is level it will do.

Be sure not to attempt to take off thick shavings at the outset, and do not be disappointed—as so many are—if you cannot at once take a shaving off from end to end. If the wood has any hollow in it, it will be impossible to do so, and even if perfectly straight, very improbable that a beginner can do so. Amateurs at the beginning always plane too much off the end near the bench stop, and are too apt to move the arm in the arc of a circle. These errors must be avoided by careful attention. There is no royal road to efficiency in anything.

Try to plane the centre of your material rather than the margin, for if you have a good plane in good order, it is impossible to make the wood much too hollow or concave; whereas, however good the plane, careless use of it can and will make the work convex in every direction.

I know of no better lesson than to try and "face up"—that is, level—two pieces of stuff so that they will, when brought together, be in mutual contact. You will fail several times, but unless you persevere until successful, you need not try to make a piece of furniture or attempt anything difficult.

Just a word on the wood. If you try to plane too small a piece of wood, you will not make such good progress; the little pieces are sure to be made convex in length by a beginner. If experience may give advice, I would say take a piece not less than 2 ft. long—it may be more, in fact. The best results have been obtained by a class of boys under my superintendence by using pieces of wood 4 ft. long, 4½ in. wide, and 3 in. thick. The wood was best spruce, and being too stiff to bend, and affording a good surface, it was cheap material for practice.

When some facility has been obtained, the blade of a 12 in. square or a straight-edge should be employed, to test the accuracy or want of it.

It must not be forgotten that the edge of the plane-iron is necessarily "rounding," or the corners would dig in. The result is that the work tried across presents the appearance of a series of shallow curved grooves. The plane, therefore, must be so sharpened and used as to make these as little noticeable as possible. This is another reason for advocating finely-set planes.

If the 4¼ in. by 3 in. stuff has been adopted for a lesson, it will be possible to take another step—that is, to learn what "winding" means, and how to correct it. Procure two pieces of wood equal in size—say, 12 in long, 1½ in. wide, and 1 in. thick. See that they are parallel. These pieces are to be placed across the work, one at each end; then by viewing both, bringing the eye down to glance from one to the other, it will be seen whether the two are in one plane. If they do not appear to lie in one plane, the surface is "winding," and opposite corners must be reduced till satisfactory.

These two lessons must be worked, as, taking so short a time to read, they might be thought unimportant; but upon complete mastery of the plane depends the success of the worker.

A USEFUL METAL LATHE.

BY SELF-HELPER.

Receipt of Castings—Lining Out—Scribing-block—Drilling the Headstocks—Simple Drilling Press—Reaming out Poppet Cylinder—Grinding out Ditto—Fixed Headstock—Milling Cutter—An Offer—Preparing Cylinder Mandrel—Centre for Ditto—Cylinder Screw—Hand-wheel—Locking Handle—Fixed Headstock—Cones for Mandrel—Lock Nuts—Pulley—Thrust Bracket—Re-lining of Castings—Fitting Bases of Headstocks.

On the arrival of the castings, the first thing to be done is to look them carefully over, and if there are any lumps or rough parts they should be touched up with a chisel and an old file.

It is scarcely within my province in this present paper to describe all the operations of turning, chipping, and filing; but I hope that either myself or another writer in these pages will, in a future number, fully describe these operations, for the benefit of any who do not understand them.

The castings of the headstocks will then require to be "lined out." This is a very important matter in all engineering work, and would require far more space for its full treatment than I am able to devote to it here.

We will take the poppet, as embodying most detail, and proceed to line it out. The centre of the cylinder at the top is found at each end by means of a compass, and centre-punched lightly. It is scarcely necessary for me to describe a centre-punch, but I may mention that it is a piece of steel, as at Fig. 2, having one end coned down to a point, the angle of the point being, when perfect, 55°, and hardened.

The middle point, B (Fig. 1), across the base of the headstock is also found, and marked very slightly at each end. The casting is now laid on its side on some flat surface, and blocked up until the points A and B (Fig. 3) are exactly the same height. It will be found that the corresponding points at the other end will be nearly the same height also, but if the casting is not straight they may not be. In such a case I would have the two points representing the centres of the cylinder—that is, A, and the corresponding one at the other end—brought to the same level; then I would bring the two points, B, and its fellow at the other end, to such a position that one would be higher and the other lower than A. Now I would draw a line right round the casting, on a level with A, as shown. In these operations an engineer would use a metal surface which had been planed and scraped perfectly true to lay the casting on, and to draw the lines and gauge the heights would employ a scribing-block, one form of which is shown in Fig. 4. The pointer can be moved up and down the pillar, and secured at any point by means of a thumb-screw. It can also be drawn in and out and fastened by another thumb-screw. A flat piece of wood, or the top of the dining-table, would do for us instead of the surface-plate, and the heights could be measured by a compass until regulated, and the line drawn round by means of a parallel strip of wood planed down until just wide enough to reach from the surface of the table to A. The lines on the casting will show up much more distinctly if it is rubbed over with chalk before marking, and they can be made permanent by dotting them over at short intervals with the centre-punch and a light hammer. Measuring from A 4 in. along the line, another deep dot may be placed at ×, and a line scribed and dotted at right angles to the line A ×, which we will denote by C D. By standing the square on the table top this can easily be done. The same should be repeated at the other end. A couple of lines, E F and G H, should also be drawn, seven-eighths of an inch at either side of the centre line, and these continued along the base.

Until now the casting should not have been moved when it was once set. It may now be taken up and stood so that the line A × is vertical, and the line C D at one end and its companion at the other will be horizontal. They should be blocked up to the same level, and lines drawn at each side of the casting connecting them, so that there is a line right round the casting near its base. This will be a guide afterwards for us to chip and file down to.

Taking A for centre, a circle ½ in. in radius may be described and dotted at each end, and the lining-out of the poppet is completed. That for the fixed headstock will be done in exactly the same way, except that the lines E F and G H may be omitted. The operation of lining out may appear unnecessary and tedious to the beginner, but it is of the greatest service in supplying lines to which we will work afterwards.

Drilling next demands our attention, and it is here the amateur will find the greatest difficulty, if he has not a lathe or some suitable drilling machine at hand. I will suppose he has only the pillar press and hand-brace, which are to be found in most country smithies. He will require, for the present, two drills, one to bore three-quarters and the other seven-eighths of an inch hole. The chief difficulty is to enter the drill truly. To do this I would describe a number of concentric holes having A (Fig. 1) for the common centre. I would then start the drill, and if it did not work concentrically with the circles, cut a chip out in the direction I wished it to go with a tool like Fig. 5. This can easily be made of a piece of round steel. It is a sort of gauge, and is used like a cold chisel—in fact, the corner of a cold chisel could be made to act as a substitute. When the drill is driven in a little further, it will be found to move towards the part cut out, and by withdrawing it often enough it can be made to become quite central before the shoulders have entered.

The $\frac{7}{8}$ in. drill is to be put through the poppet cylinder, and the tyro will be pretty tired of drilling before it is done. When it is half through, the poppet should be reversed, and the remainder bored from the other end. For the sake of those who have not even a pillar drill to fall back upon, I give in Fig. 6 a plan which I adopted one time to bore a hole about this size with. A pillar was bolted to the leg of the bench, and a long arm pivoted to it with a strong bolt. Another pillar at the other end prevented the arm from swaying about, and also supported a lever by means of which the drill could be released. A weight attached to the end of the arm supplied the necessary pressure. My drill was made of $\frac{5}{8}$ in. square steel, a foot long, and a flat bar of iron, two feet long, with a square hole in the centre and a handle at each end, served to convey motion to it. Of course, the top of the drill was coned to fit a centre in a piece of iron screwed to the lower surface of the arm. A brace could be used in this affair instead of the handles. I do not recommend this in preference to a better machine; I just mention it to show what can be done, and perhaps it will be a useful hint to some readers who might find the drilling an insurmountable difficulty. If the holes from both ends meet pretty fair in the centre of the cylinder, it will be a great matter; but if they are out to any considerable extent, a round file must be used until there is a through hole without any violent projections. This must now be cleared out to size with a reamer. A capital reamer for the purpose can be made of a worn-out flat file, one inch wide. The teeth must be ground off, and the edges backed off to give a cutting edge, as seen at Fig. 7. The point will enter the hole in the poppet for a considerable distance, and act as a guide, and a couple of semi-circular pieces of wood should be employed to steady the tool. It might be held in the vice vertically, and the poppet revolved, if necessary, with a short lever passed through the space between base and cylinder.

The reamer should be worked right through, and the hole will then be found to be very nearly, if not quite, parallel and smooth. If we want to make a really good job of it, we should grind it out. This is effected by casting a cylinder of lead on a bar of iron, and turning it parallel for six inches, and a tight fit for the hole; then it should get slightly bigger—just a shade—and be parallel for three or four more inches.

The front part of the lead *lap*, as it is called, acts as a guide, and the remainder grinds out the hole as it passes in. This will make a far truer and rounder hole than to have the lap fit through at first, and then to press the cylinder which is being ground as equally as possible all round. The grinding is effected by smearing the lead with emery and oil, which is frequently replenished, and revolving it in the lathe. It is a more rapid operation than would appear at first sight. Of course, I need scarcely say that the smallest amount should be taken off by this means—only enough to true and smooth the hole.

I have thus been careful in describing the drilling and clearing out of the hole in the poppet, because it will be found, I think, the hardest part of the work to the beginner; and if he succeeds in producing a perfectly smooth and parallel hole concentric with the casting, he may hope to construct a very good lathe. No pains should be spared in this or in any other part of the work to go as near as possible to absolute perfection.

I now turn to the fixed headstock, which is to have two $\frac{3}{4}$ in. holes bored, one at each end, concentric with the bosses. These holes must be coned out to take the mandrel. The best way to do this is, I think, with a milling tool, which I represent in Fig. 8. It is a tool made from a piece of cast-steel, turned down to a long, conical point, and having teeth cut in its surface similar to those found in the common rose-bit. A spindle passes through a hole in its centre, and a pin prevents the tool from turning on it. The spindle is fitted to a brace or chuck, and, the tool being revolved slowly and pressed against the work, produces a beautiful coned hole, the exact counterpart of itself.

A loose cone at the other end of the spindle keeps the two holes exactly in the same line, which is a matter of the utmost importance.

The dimensions of a suitable milling arrangement would be as follows: Spindle, five-eighths of an inch in diameter and a foot long; mill, largest diameter one inch, length two inches; a quarter of an inch to be parallel, and the remaining inch and three-quarters tapering from an inch to three-quarters of an inch. The loose cone should fit the spindle nicely, and be of the same taper as the cutting cone. Most beginners would find a great difficulty in making a satisfactory milling tool, and so I am tempted to make an offer which is likely to be useful to many of my readers. It is to lend a mill to anyone of the subscribers to WORK who is following my instructions in lathe making, for the purpose of coning out a pair of holes, on condition that he pays postage both ways, and deposits with me the value of the tool, as a guarantee for its safe return and careful use. I am induced to make this offer solely through a desire to help beginners, and can in no way gain anything by it.

When the holes are milled out, it would be well to give them a rub of a lap coned down to the proper angle; but I would avoid emery here, as it is almost impossible to get it out of the metal. The grit that is found in the bottom of a grindstone trough, or pounded whetstone, would be just the thing. I ought to have mentioned that the hole, when coned, should taper from an inch at the biggest part, to thirteen-sixteenths at the smallest, thus decreasing three-sixteenths of an inch in an inch and a quarter full.

We have now the handstocks bored and must prepare the mandrels. These are frequently made of good wrought iron, but I prefer steel, either Bessemer or cast. The poppet mandrel is a plain cylinder six and a half inches long, and an inch and a sixteenth in diameter, the extra sixteenth being for turning up. If it comes from the forge rough it should have centres drilled at each end and a cut taken off the entire surface. The ends should be truly squared also. Then it is to be mounted in a chuck and the end supported with a boring collar. In Fig. 9 I show it in the dead centre lathe as being the simplest. A block of wood is screwed against the pulley, a hole having been made in it to clear the centre. Then the lathe is driven, and a hole turned out carefully with a chisel in the centre of the block of wood. The mandrel is driven into this hole, and if it fits tightly it will be amply sufficient to carry it. The free end is supported by the boring collar, which is a plate having a conical hole that the mandrel will enter, but not pass through. This plate is attached to an angle iron, which is bolted to the lathe bed.

While the mandrel is thus driven into the lathe, an $\frac{11}{16}$ in. drill can be pressed against its end with the back centre, and a hole bored to the depth of about three-quarters of an inch; a smaller drill, one nine-sixteenths of an inch in diameter, can then be substituted and the hole continued for about five inches. The mandrel may then be reversed, and a hole a quarter of an inch drilled at the other end for a distance of an inch and an eighth. This hole must then, with a tool, be coned until it is three-eighths of an inch large at the outer end. This tapering would be done best by means of a slide-rest, and some would declare such assistance necessary; but I have often coned out holes by hand.

Having completed the holes, the centre may be prepared to fit the coned hole. It is of the best cast steel, and turned to fit the hole, and afterwards ground into it. The point is then turned while the mandrel is supported as in Fig. 9. The point of the centre should be coned to an angle of 55°, which is something smaller than that made by a triangular file in a piece of thin iron. It is a good test for the coned hole if the centre will run true after having been turned half round from the position in which it was finished; but even if it is a shade out of truth it would be well to be satisfied, as I question whether the hole could be made quite true without very good tools.

Having proceeded so far, the mandrel may be placed between the lathe centres and the outside turned to fit the cylinder, which has been prepared for it. If the centres of the working lathe are too small for the holes which have been made in the mandrel, these latter may be plugged with pieces of iron turned to fit. The centres on which the plugs were themselves turned should be used when turning the mandrel.

It will not be easy to turn this mandrel perfectly round and parallel. Very light cuts should be taken, and then the last touches given with a fine file, and emery cloth stretched on a piece of board. When the point enters the hole in the poppet, on no account should any more be taken off it, for if it is found to fit the end of the hole and not go in further, the hole cannot be parallel. If, however, care has been taken in the lapping operation, this will not be likely to occur. In really well-made lathes, this mandrel fits most beautifully. I know some in which it will not shake when it is out almost to its furthest extent, and we should aim at this degree of perfection in our work.

In Fig. 10 will be seen the cylinder mandrel fitted with its centre pushing screw and nut. The pushing screw is half an inch in diameter and of the length shown, with a collar in the place indicated. It is very often made with a square thread, sometimes left-handed, but this is a matter of fancy more than anything else.

The ordinary Whitworth thread does very well, and it can be cut with a set of dies, and chased to finish and make it true. The nut is turned to fit the $\frac{3}{4}$ in. hole in the end of the mandrel and secured with a couple of little screws as shown. The disc at the back of the collar is drilled, put on a mandrel between the lathe centres, and turned all over; four holes are drilled and countersunk, by means of which to attach it to the poppet. The hand-wheel is also bored and turned, and a little key or feather put in to secure it to the screw, a nut at the back preventing it from coming off. A small slot must be cut in the mandrel, as is seen

Fig. 2

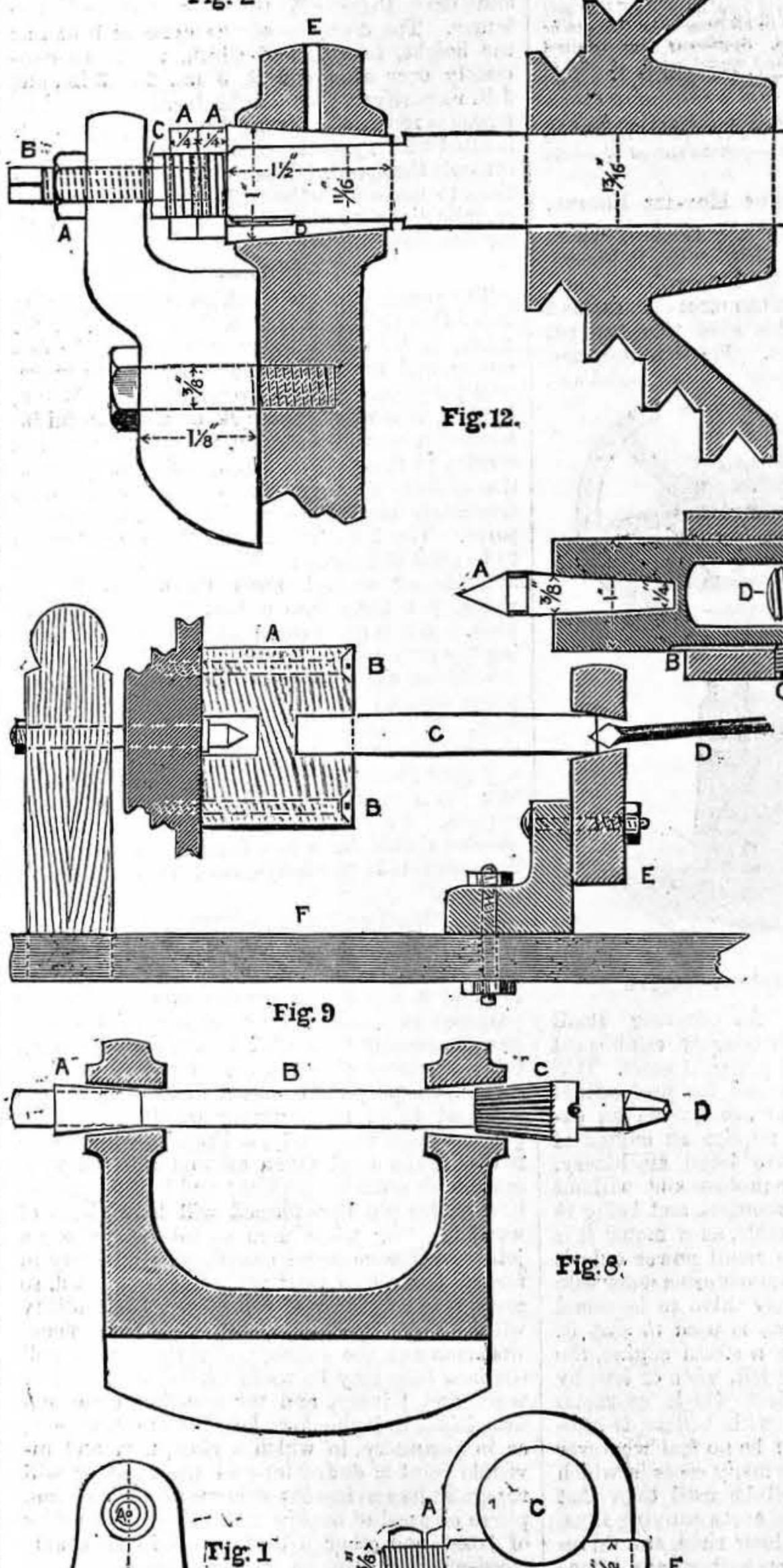


Fig. 12.

Fig. 7.

Fig. 9

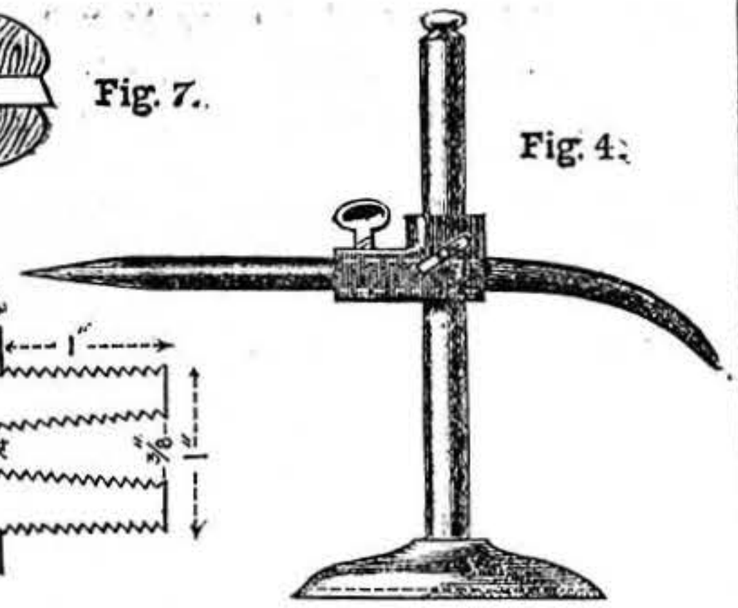


Fig. 4.

Fig. 5.

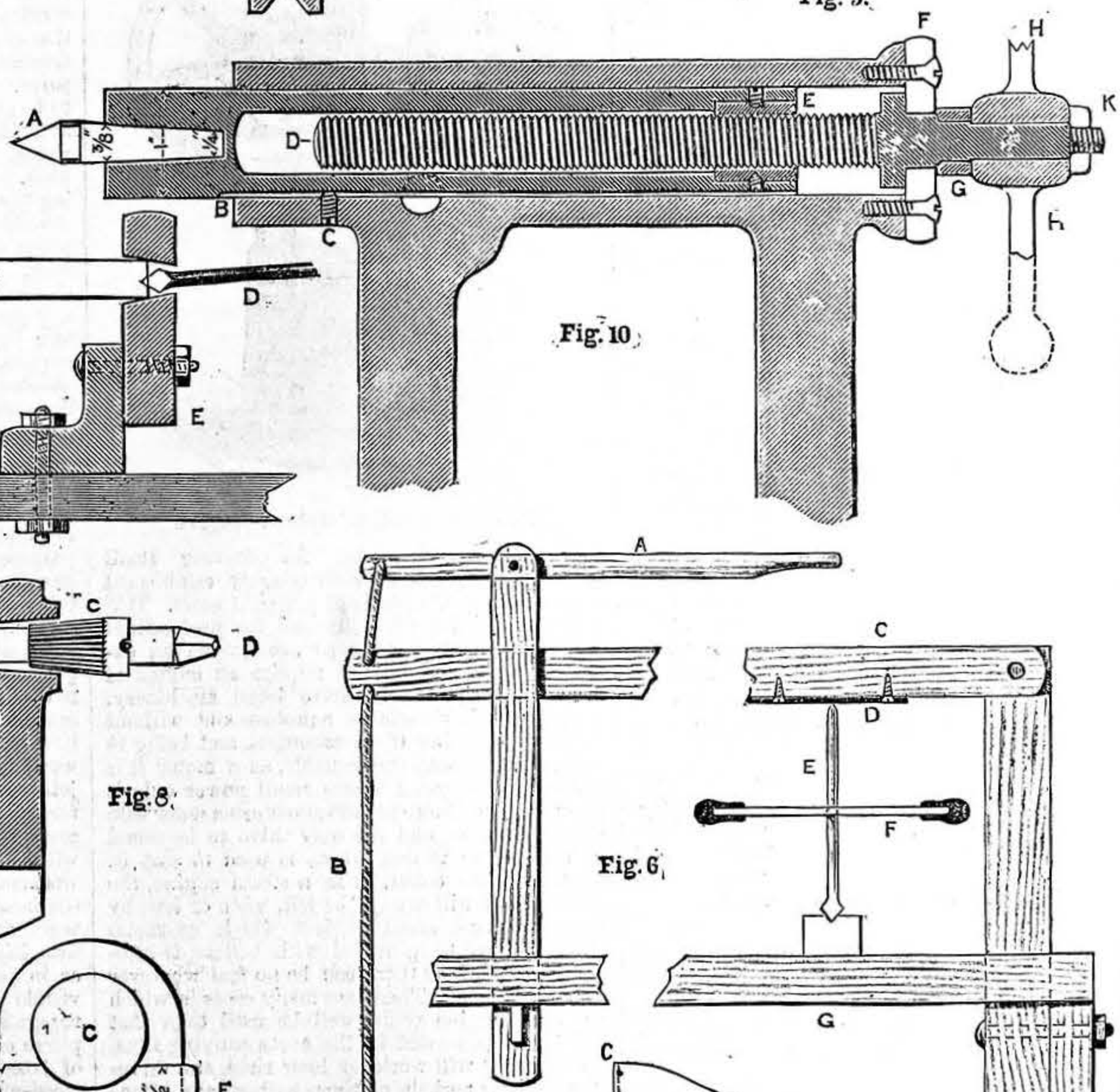


Fig. 10

Fig. 8.

Fig. 8.

Fig. 6.

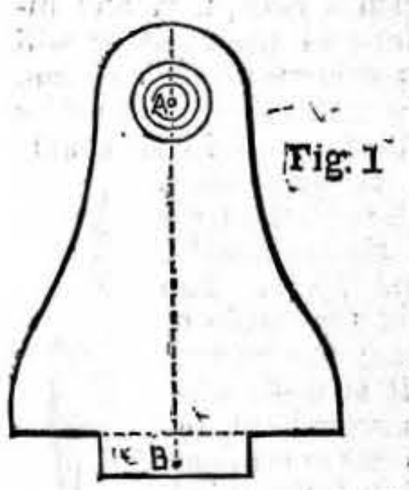


Fig. 1

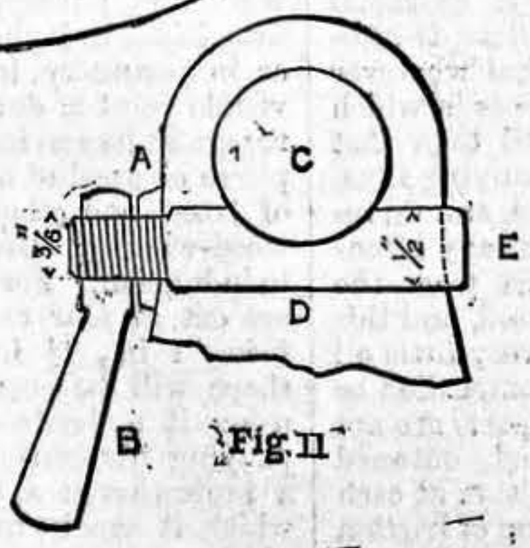


Fig. 11

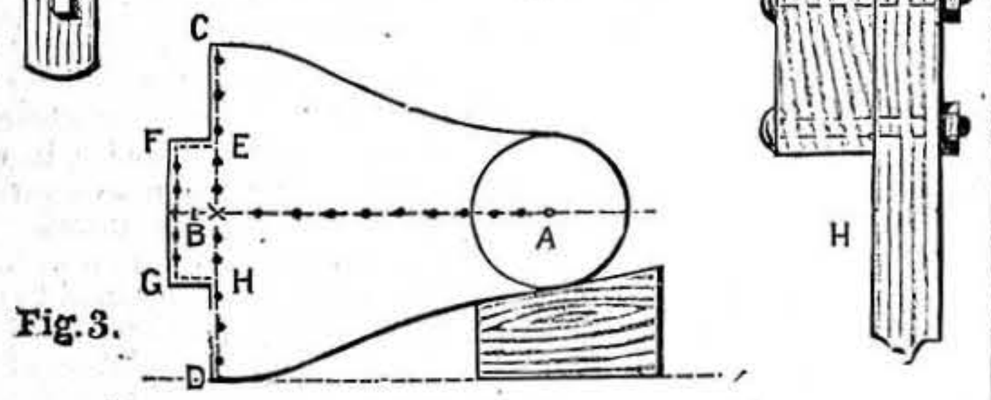


Fig. 3.

Fig. 1.—End of Poppet—A, Centre of Cylinder; B, Centre of Tenon. Fig. 2.—Centre-punch. Fig. 3.—Poppet laid for Lining out. Fig. 4.—Form of Scribing-block. Fig. 5.—Tool for drawing Drill Point so as to make it enter truly. Fig. 6.—Simple Form of Drilling Press, which can be bolted to any Bench—A, Lever to relieve Drills; B, Cord to Weight, W; C, Lever to press Drill; D, Metal Strap; E, Drill; F, Handle; G, Bench Top; H, Leg of Bench. Fig. 7.—Section of Tool for truing out Poppet Cylinder—A, Wood; B, Steel. Fig. 8.—Section of Fixed Headstock, showing Mill Boring Bar and Loose Collar—A, Loose Cone; B, Bar; C, Drill; D, Square for Brace. Fig. 9.—Mandrel Forging supported for Drilling—A, Wood Block; B, B, Screws; C, Mandrel; D, Drill; E, Boring Collar; F, Lathe Bed. Fig. 10.—Section of Poppet (half size)—A, Centre; B, Slot; C, Screw to fit Slot; D, Screw, ½ in. Pitch; E, Nut; F, Disc; G, Washer; H, Hand-wheel; K, Key. Fig. 11.—Transverse Section of Poppet through Clamping Bolt—A, Washer; B, Handle; C, Mandrel; D, Drill; E, Boring Collar. Fig. 12.—Section through Mandrel (half size)—A, A, A, Lock Nuts; B, Steel Screw; C, Hard Steel Plug; D, Feather; E, Tube for Oiling.

underneath, to engage the point of a screw which is made to project into the cylinder. This slot can be cut out without much difficulty by means of a cold chisel, an eighth of an inch wide, finishing with a small file.

The entire headstock is seen in section in Fig 10. and Fig. 11 explains the action of the locking handle. A ½in. hole is bored in the position shown in such a way that it breaks into the cylinder. A piece of steel is then fitted to this hole, and a hollow filed out to the curve of the mandrel; a washer and a handle turned from a piece of half-inch square steel serve to do the locking. It is a very efficient arrangement, and not difficult to make.

Fig. 12 is a sectional view of the fixed headstock, as Fig. 10 is of the poppet. The mandrel should be turned very carefully to the dimensions indicated in the figure. The loose cone at the tail end will require to be very carefully fitted. The hole in it, which is eleven-sixteenths of an inch in diameter, must be very carefully bored and lapped out perfectly round and parallel. It is to fit the mandrel "hand-tight," as some call it—that is, tight enough to be moved by firm pressure of the hand, but neither to shake nor fall off.

Before it has been brought to this state of perfection it should have been roughed down until it was nearly to the finished size; then, when put on its own mandrel and the lock nuts screwed up, it should be carefully finished until it will fit exactly the hole in which it is to run. The fitting of both cones of the mandrel to their bearings will be a tedious piece of work. The holes should be covered thinly with red lead and oil mixed to a thin paint; the mandrel and cone should then be put in place and turned once round by hand. If the cones are marked all over with the red lead they fit perfectly, but if not, the marked parts must be filed or scraped down in the lathe until the desired object is attained. The lock nuts should have a fine thread; gas threads will do very well, but if the work has been done satisfactorily hitherto, it would be worth while to get the mandrel nose and the thread at the back cut in a screw cutting lathe. I have represented the nose as an inch in diameter with Whitworth thread, but it may be made smaller, even as small as three-quarters of an inch. The centre is the same as that for the poppet, and the hole should be coned to the same angle, using the poppet centre to get the correct angle. The pulley is to be bored to fit the mandrel hand-tight, and then turned all over and the V's made. It is secured to the mandrel with a little key, as is also the back loose cone.

The little bracket at the back to take the thrust of the mandrel may be of wrought or cast iron. It is secured with two screws, and another of hard steel, towards the top, bears the end pressure. It works against a little bit of hard steel let into the end of the mandrel.

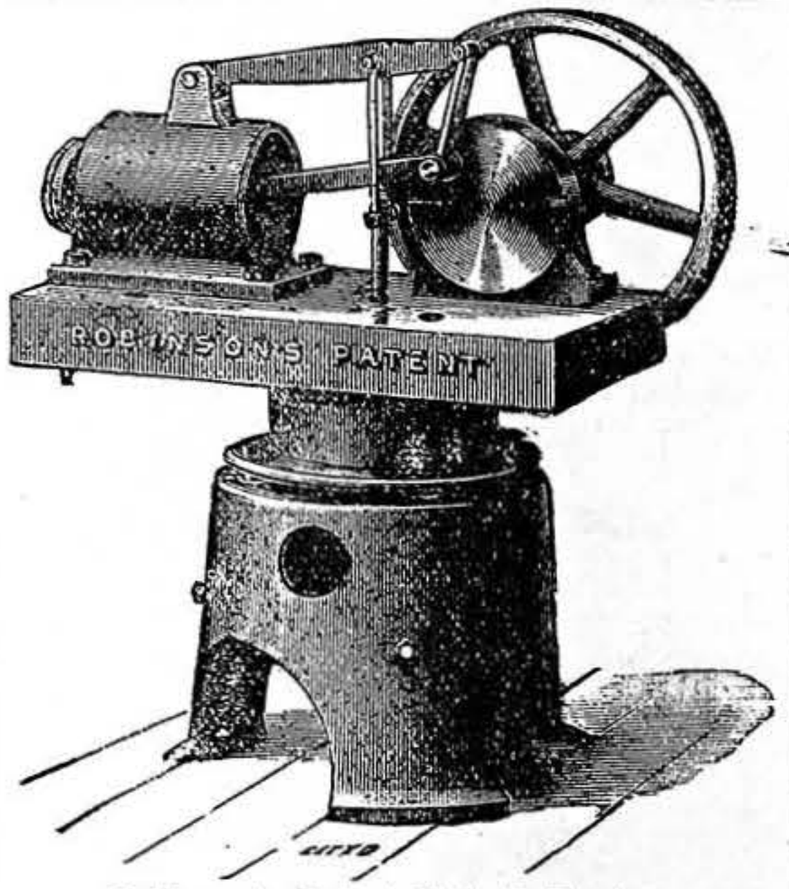
Having the mandrels fitted, the casting should be again lined out most accurately with their centres. If the mandrels occupy the place designed for them in the first lining out, of course the second will correspond with the first: but, if they are a little out, it can be rectified now. The bases of the headstocks are to be planed or chipped and filed to the lines, and the holes for holding down bolts drilled five-eighths of an inch in diameter, and the headstocks are finished. It would improve their appearance a good deal if the end surfaces could be turned smooth and true.

OUR GUIDE TO GOOD THINGS.

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

86.—The Robinson Patent Hot-air Engine.

The Robinson Patent Hot-air Engine, which was invented by Messrs. A. E. & H. Robinson, and is made and supplied by Messrs. Norris and Henty, appears to be one of the most efficient and useful of all engines of this kind that has yet been placed on the market. The inventors and makers claim for it that it is a most useful and



Robinson's Patent Hot-air Engine.

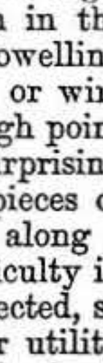
thoroughly good motor for driving small machinery, and is now thoroughly established as a success in the hands of practical users. It is well adapted for amateurs and for professional workmen whose workshops are not on an extensive scale, and do not require an engine of considerable power to drive large machinery. Thirdly, it is absolutely noiseless and without smell. Possessing these essentials, and being in every respect safe and reliable, as a motor it is suitable in any place where small power only is required. Neither eccentrics nor cams enter into its construction, and the only valve to be found in the engine is that which is used to stop it. As there is no boiler, as in a steam engine, the anxiety that will always be felt, more or less, by those who use small engines which, as steam engines, must be provided with boilers, is altogether avoided, as there can be no fear whatever of an explosion. There are many cases in which no other engine could well be used than that which is represented in the accompanying illustration, as it will work for long runs, and therefore for long periods of time, without any attention whatever. There is no exhaust from the cylinder, in which only pure air is used, and this at a moderate temperature, so that very little oil is required. There is no internal combustion or ignition in the cylinder, so that the parts are not subjected to severe shocks, but a steady outward and inward impulse is given to the piston at each revolution of the engine. A minimum of friction and regular working is thus obtained. The cost of working this engine is very low, being only about a farthing per hour where coal or coke is used as fuel. But slight attention to stoking is required, and this can be undertaken by, and entrusted to, a servant or anyone who may happen to be about the place, as no particular skill is required. Gas can be used as fuel, but at a greater cost per hour; and, if gas be adopted, beyond oiling at starting, absolutely no attention is required for hours together. The cost of putting in the engine is very small, there being no special foundation required—in fact, on a reasonably sound floor the simple bolting down to counteract the pull of the belt is all that is necessary. The engine, as above shown, is No. 4 size, and then there are three smaller and two larger. The diameter of the cylinder is 5½ in.; the height, length, and width, taken approximately over all, are 2 ft. 8 in., 2 ft. 3 in., and 2 ft. respectively; its weight is 2½ cwt., and its power is reckoned as being 2-man or ¼-horse. It is fitted with a patent governor, which thoroughly controls the speed. There are no water connections to make with the engine, and there are no complications of mechanism to be found in its construction.

87.—"Discovery."

The monthly magazine which is now appearing under this title, and is published by Mr. E. W. Allen, is "devoted to invention, scientific discovery, and the application of science to industrial purposes." There are few readers of Work, I think, who would not pick up much useful information which could be turned to practical service in the pursuit of any hobby or prosecution of daily employment. Correspondents have frequently asked for a good recipe for luminous paint. The following from "Discovery" seems to be good and cheap: "Take a few oyster shells, and having washed them thoroughly in hot water, put them into a fire for about half an hour. When quite cool pound them fine, rejecting the grey parts. Then put the powder into a crucible in alternate layers with flowers of sulphur; seal up the lid with a paste of sand and beer. When dry, place the crucible on the fire and bake for an hour; when cold, open it, and if any grey powder is still found, remove it. Then mix the remainder into a thin paint with fine varnish. Previous to applying, the article to be painted should have two coats of white lead and turpentine to form a body-ground for the luminous mixture."

88.—The Double-pointed Nail.

The Durrans Patent Nail Syndicate, Limited, have drawn my attention to a speciality in the form of a secret nail for dowelling and other purposes in wood-working, of which I should have frequently been glad to avail myself when jointing pieces of wood together edge to edge, for which purpose I myself have been in the habit of using the ordinary wooden dowelling peg, or, more frequently, a French nail or wire nail with the head taken off and a rough point made with a file in its place; and it is surprising how a wire pin thus formed will hold pieces of wood together when used at intervals along a joint, for I have found considerable difficulty in forcing two pieces apart when thus connected, so great is the tenacity of the wire. Their utility will be at once perceived, both by the professional workman and the amateur—for the former will see how they may be made available in cabinet work and joinery, and for effecting close and firm joints in laying floor boards and other floors, as in parquetry, in which a close, firm, and invisible joint is desirable; and the amateur will recognise its services in putting together shelving, pieces of wood of narrow width to form the sides of boxes, and other jointing work in the simple wood-working that he is accustomed to indulge in. For small work the nails are cut in four useful sizes—namely, ¾ in., 1 in., 1¼ in., and 1¾ in. The shape will be seen, and the mode of using it understood, from the accompanying illustration. It is made with a projection at A, or hammer-head, by which it can be driven home into one of the pieces to be jointed, the chisel edge at B readily making its way into the material under the successive strokes of the hammer, and the piece to be attached is then placed against the point that projects from the wood into which the lower half has been driven and blocked down. When used in connecting hard wood, holes for the points should first be made with a bradawl. They are, or ought to be, obtainable of all ironmongers.



Double-pointed Nail.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

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

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

I.—Letter from a Correspondent.

Incubator.—H. E. (*South Norwood, S.E.*) writes:—"In Work, p. 461, B. A. B. describes an incubator regulator. I am afraid he is dabbling in matters he doesn't understand, as anyone who has had much to do with mercury will know that under the conditions as drawn, the expansion will be practically nil, and quite useless for the purpose indicated. Hearson's regulator consists of a metal capsule filled with (I believe) the same liquid as used in my regulator described in No. 109, and also in the article you have in hand. The inventors are very jealous of their patent rights, and will take proceedings against anyone making or using infringements. Neither will they supply the capsules except with machines."—[Unless H. E. has tried mercury under the conditions indicated, he is not entitled to say it will be useless. Doubtless some other arrangement would do better, and, it may be, some other material than mercury would be preferable. It is scarcely fair to criticise too closely a reply, unless the question is known. It may be that the querist suggested mercury; it is used in several instruments where temperature increases its bulk, and where this fact is the feature of the invention. If the receptacle were narrowed in the part occupied by the float, it would be better—that is a matter for those interested to experiment upon; if the receptacle were air-tight, no doubt it would be an improvement, but it would be too dangerously near, being a capsule, besides which, to charge a capsule some volatile oil or spirit must be found to boil at about 103°, all which would be getting very near Mr. Hearson's patent. Anyone could find a liquid boiling at the temperature required if they tried. The sketch is only a suggestion, and if it had been a perfect invention it would have been very remarkable indeed. I may as well confess that my reply was written a long time ago, and that I think the arrangement in No. 109 is better, but it is much nearer the infringement H. E. is kind enough to warn me about. He criticised Mr. Walker in the same way; I hope to see his incubator soon, and that it will be beyond all criticism.—B. A. B.]

II.—Questions Answered by Editor and Staff.

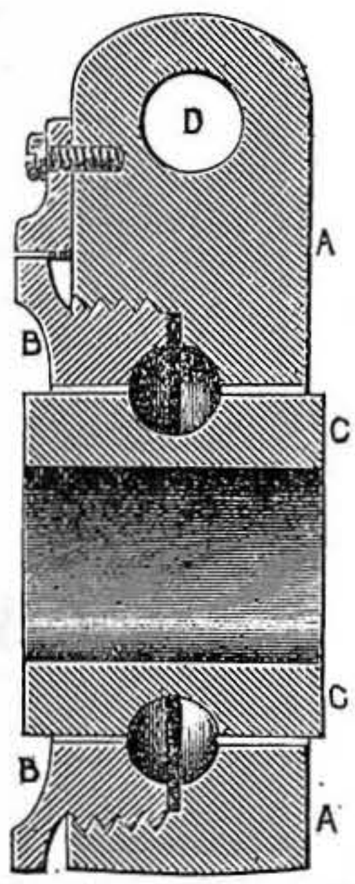
Silver-plating Opera Glass Fittings.—J. E. G. (*Carmarthen*).—As you have no practical knowledge of the art of electro-plating, I should advise you to send the opera glasses to a practical electro-plater or to an optician, and get the metal fittings silver-plated. As the body of the instrument is made of ivory, you would entirely spoil the colour of it by immersing it in a plating solution, and you could not silver the fittings without touching the ivory part with the solution. The fittings must be taken off, and this should be done by an optician. You will find instructions on electro-silvering in No. 112, p. 118, Vol. III. of Work.—G. E. B.

Electric Lighting.—E. D. R. (*Camberwell*).—A small installation of two or three lamps in one room of a private house generally proves unsatisfactory to the owner. It is not large enough to warrant the use of a dynamo-electric machine and a gas-engine or water motor to generate electricity for the lamps, and it is too large to be fed with current from a battery. A large battery will be necessary to work two or three lamps of sufficient power to light up a large room, and this battery will have to be cleaned and re-charged every day. I have yet to meet with a battery that will prove anything but an intolerable and filthy nuisance to a gentleman using it for supplying current to an installation of electric lamps. If you wish for the luxury of a few electric lamps on one or two evenings, on the occasion of a party, ball, or similar festive gathering, and can afford the luxury, I should advise you to hire the whole apparatus, with a set of accumulators, from such a house as that of Messrs. Cathcart, Peto & Radford. You will find full instructions on electric lighting in Nos. 76, 82, 89, 92, 94, 97, 99, 101, and 104 of Work; the whole contained in Vol. II. I should advise you to read these articles before deciding on having the lamps.—G. E. B.

Dynamo for Charging Accumulators.—W. W. (*Bath*).—A set of *large* accumulators may be charged with current from a *small* dynamo, just as you *may* fill a large pond with water through a ¼ in. pipe. Time will be required in both cases, and time will win if you have enough of it at command. But as a rule, those small machines supplied for the purpose of lighting one or two incandescent lamps may be said to be unsuitable to the work of charging accumulators. The volume of current from them is much too small, and the tension of the current too low to charge anything but a small accumulator, one or two cells at a time. Machines of the Siemens pattern, with only a two-part commutator, are specially unsuitable, because the cells are liable to discharge themselves across the brusher as soon as they get a full charge, even whilst the machine is running. This tendency to discharge may be partially obviated by making the slits on the commutator wider than usual, and altering the lead and bearing of the brushes so as to have them touching one half of the ring only when at rest. The castings advertised include those for the field magnets, armature, and bearings. These are all the castings required. All other parts are wrought iron, brass, and steel.—G. E. B.

Series Dynamo.—J. D. (*Halifax*).—As you get current from the machine when the fields are excited by current from a separate battery or machine, but none when the machine is set to excite its own fields, it shows that your arrangements are defective. As it is a series dynamo, you cannot expect any current from it unless you connect the terminals together, or place work of low resistance between them. If the wire connecting the terminals has a high resistance, or the work has a high resistance, you will not get enough current through it to excite the fields; you may have reversed the polarity of the field magnets by sending current through their coils in the wrong direction. Try running the armature in the wrong direction also, and note the result. You may not, possibly (for I cannot say with certainty without knowing more about the machine than supplied in your letter)—you may not have the wire on the fields and on the armature in right proportion to each other. I do not think that the iron bed-plate would be at fault, or you would not get any results when the machine is separately excited.—G. E. B.

Bicycle Bearings.—H. H. (*Finsbury*).—It would be impossible for your correspondent to make ball bearings without the machinery specially made for the purpose, as the making of a ball bearing requires great accuracy. I submit a sketch showing Bown's knuckle-joint ball bearing in section. A is the body, B the screwing-in cap, C the sleeve for fixing to axle, D the knuckle joint for bolting to fork. This bearing is a patent, but the sketch will serve to show "how the side works."—A. S. P.



Sectional View of Bown's Knuckle-joint Ball Bearing.

Hydraulic Cement.—E. P. (*East Finchley*).—This material would be of no use as a cement for an aquarium, except for a bottom, after glazing. A recipe for aquarium cement has been repeatedly given in the "Shop" columns of Work. Here is another:—Take ½ lb. of pitch, ¼ lb. of gutta-percha, put them in an iron vessel over the fire (an old saucepan will answer very well), and melt together, adding sufficient turpentine to thin the mixture to a convenient consistency. In glazing with this cement, see that the glass is perfectly clean; the part where the cement will touch should be warmed by holding over a lamp, and when hot, smeared with the hot cement. The job requires doing quickly to ensure success.—C. M. W.

Boot and Shoe Repairing.—Snob.—You want to know, and also think that many others are in the same situation, how to take off the soles when you start repairing. To deal first with riveted soles: I said, in my first article, wet the boots; if you did this they ought not to have, as you say, "literally fell to pieces;" but as that is the case, and after a second trial, too, I must own you really want setting right. I omitted teliing you in my first article (as I have so seldom found it necessary, even where work was nearly to pieces, before starting upon it) that for taking the sole off a last can be put in to make a solid foundation to work on; then, after it is wet, the old sole can be prized off with a chisel, commencing at the toe, or the thinnest part: this will enable you to catch hold of it with nippers, and by this means pull off the sole with the nippers in one hand, and at the same time holding the under leather (welt, or runner, as they are often termed) down with the other. Then, should the under part still have a tendency to give way from the uppers, knock the sole back, so that it leaves the rivets sticking out, pull the rivets out with the pincers or nippers, and repeat the process till you have got the sole off without disturbing the boot, and then, before putting the sole on, the under part can be nailed down with a few short rivets to make it solid. Of course, if very long rivets have been used in the making or previous repairing, taking off the sole will, if you are not very, very careful, cause it to fall to pieces; therefore I want you to be careful, so that you will not be disparaged over so small a matter. Perhaps those you worked on had been worn rather bad, and thus made weak. This is one thing I have told you: that as your own repairer, never let them wear low—"a stitch in time," etc.—and the cheaper the boots, the more applicable this adage to boot repairing. For machine-sewn, you can follow the advice given in my next article—"Welting and Soling Hand-sewn Work"—which will also give you what you want to know about hand-sewn. I don't know how you got into such a muddle, but, any way, I will give you another system (for sewn work) which you will, perhaps, more readily grasp. When the lasts are in, and the boots wet, skive off the edge of the sole, not right through, or you may spoil the welt, but still deep enough to cut through the stitches, and cut their heads off. Then, as before, the toe can be raised or prized up from the welt; then the taking off the sole is an easy matter. I am glad you like the articles. I would advise you to look back to some of the questions answered in "Shop."—W. G.

Book on Brazing.—W. C. (*Paddington*).—I am not acquainted with a book treating of the different kinds of brazing, or that will give you some idea of how to do some jobs of brazing and soldering. You will find some good "Remarks on Brazing," by Mr. R. Alexander, on pages 664 and 797, Vol. I., of Work. If you wish to know any more about the art, consult "Shop."—G. E. B.

Sheet Metal Work.—Tinker.—Tinker points out a slight error in size in reply to a query by Blacksmith (Vol. III., p. 120). It is a printer's error, due, no doubt, to bad caligraphy. Instead of "19⅛ × 6¾," it should be 17 × 6¼. The size given would be for a 3 qt.—R. A.

Garden Workshop.—Chips.—I am rather afraid your ideas are too extensive for a garden workshop. You do not state whether the dead wall against which you propose to place it is as high, or higher, than the back of your shop, or if it in any way interferes with your neighbour's light. Should it interfere at all with the light or view that they may have enjoyed for any length of time, they have every right to stop its erection; and this can be done in a very friendly manner by writing a polite note to the powers that be. As to asking the permission of the district surveyor, as far as my reading and experience of the Act goes, he has no power to give you permission to build such a huge structure (for a back garden) of wood, and would at once condemn it. If you would reduce the size of the proposed shop, make it thoroughly independent, and put it on wheels, and shift it from time to time, to show that it was not a fixture, taking care at the same time not to offend your neighbour, you might get over the difficulty; but this is one of those things which depend so very much on circumstances. Many thanks for your suggestions *re* the Building Acts; but as they principally relate to matters outside the scope of an amateur or individual worker, saying nothing of the different ways in which each surveyor interprets them to suit the different contingencies to which they refer, I always find that it is better to let the surveyor read the Act, which is his business, and the tradesman to conform to his reading, which he generally has to do, no matter how well he may think he knows the extent of the Act.—E. D.

Fairy Bells.—F. R. H. (*Rochdale*).—I can assure F. R. H. that it is a real pleasure to help persons of his temper. He asks if I can procure him the material necessary for the construction of the instrument. As any country carpenter can supply the wood, I presume he refers to the strings and pegs. It occurs to me that there will be multitudes of readers of Work situated practically the same as F. R. H., who lives on a moor, a long way from a town, which is visited but rarely. I cannot help remarking, in passing, that Work must be indeed a boon to persons so isolated; and, for their benefit, I would say that Mr. Beach, Lime Street, Preston, has informed me that he will be pleased to supply small pegs at 1s. per dozen, and wire (Nos. 10 or 8) at 6d. per ring. Lest a mistake should be made, I would say that the numbers given are those known amongst pianoforte makers, and are not the same as B.W.G. I would further say, if it would help anyone, that, though I am not in business, being a minister, I shall be glad to supply anyone with such material at the price named, and postage, as well as F. R. H. A ring of wire contains sufficient to string several fairy bells.—O. B.—[F. R. H.'s suggestion that all contributors should imitate O. B., and give the probable cost of the articles they describe, is a good one, and might, with advantage to our readers, be adopted by all who answer questions.]

Telescope Lenses.—W. R. (*Oswestry*).—Your letter did not reach me. None of the lenses in a 36 in. telescope can in any way be utilised for a photographic camera. You will have to buy a proper lens.—E. A. F.

Advice to a Draughtsman (Furniture, Education in).—Tapestry.—You are promised a berth in a short time as draughtsman and salesman in the same firm for which you are at present shorthand writer, and you want a little bit of advice and information. Your letter has been handed to me, and if, after you had read this reply, you were to see me, I feel convinced you would be inclined to doubt my sincerity; for I gather from your letter that you are a *young* man, and I am but the same myself. However, if I am not experienced enough in the wicked ways of the world, and enabled to give you *fatherly* advice, I can, at least, give you a few

brotherly tips; and when we recollect that Scripture tells us our Saviour "sticketh closer than a brother," it would almost appear that the brother is the ideal of friendship in preference to the father. You must not place too much confidence in book-learning. By this I do not mean that it is advisable to depreciate *all* such study; but you will find, if you are continually craving for more books which will stock you with information, that you will never be satisfied with your own abilities, and thus, probably, defer personal endeavours until you have perused *all* the books that come within your reach. As you have purchased, and, no doubt, continue to buy, "Cassell's Technical Educator," and now take in WORK, you should be in a position to do something yourself in the course of a few months, with the addition of a few more publications; granting, of course, that you are a proficient draughtsman, and give your heart to your work. I am afraid you will find that the position of salesman, added to that of draughtsman, will detract somewhat from the latter profession, by reason of the chances always remaining of your being continually interrupted in your drawing; which fact may or may not disturb you, by always lying in the background of anticipation. But, there—I do not know you personally, so must not give way to anticipation myself. To be a good designer, you must strike out a path for yourself, in being original to the greatest extent that you can. There is no need to work always in one groove, and design articles only of one class, such as ordinary mechanical, folding, or combined. The readers of WORK are familiar with the three last classes of designs from my pencil, or pencils; but I am frequently designing something quite new in cabinets, sideboards, bedroom suites, chairs, tables, etc., and number among my patrons many a large firm in London. In the few years I have been in the furniture trade, I have been made aware of the fact that a mere draughtsman will be of no value in a few years' time; the demand will be for designers; but there is not much to fear by contemplating a strong competition among the latter, as, although a man may be a good draughtsman, it does not follow that he will ever be a good designer; for—although, perhaps, I really ought not to say it, and would not, were it not for the fact that I am asked by you for advice—good designers must "have it in them." Another particular thing you must be careful to study well, and that is—colour. I am looking forward to the day when every book, such as WORK, shall be embellished with diagrams and drawings in colours, tinted and shaded artistically—not the mere uniform tint over an engraved sketch, such as is common now. You will find the study of colour in application to furniture almost as difficult to overcome as the study of drawing; but aim at an end, and you will surely reach it. As regards books of designs of first-class furniture, the best "tip" I can give you is to obtain, in addition to the publications mentioned below, catalogues from as many firms as you possibly can; which task, I can assure you, you will find a most difficult and troublesome one; for a firm usually, after posting the catalogue, posts a traveller, and the catalogue has to be returned, unless the traveller's good humour is courted. An occasional peep into old bookstalls will reward you, as it has me; for you will often pick up books of work from the pencils of old designers, which will give you a true foundation on which to build your ideas. Observe all around you. If you see anything at all striking, retain it in your memory. We can be original, but our ideas cannot be entirely new; it is the form in which we apply them which gives the originality. For instance, one part of an article the Editor has in hand (which you will recognise when published) was really suggested to me by the well-known boat-swings, so arranged in groups of four, that they work round, up and down, and yet each always retains its horizontal position. Sometimes an idea occurs to me out of my own head; but I feel sure that, were search made, the same idea would be found, applied differently, in a different form of construction. By all means subscribe to *The Cabinet Maker* (Mr. Benn, City Road, London) and *Furniture and Decoration* (Messrs. Smith & Botwright, 6, Eldon Street, Finsbury, London, E.C.), each 6d. monthly, and both first-class books, exclusively, as their titles indicate, devoted to furniture and furnishing. *The Furniture Gazette* (Messrs. Wyman and Son, Queen Street, Holborn, W.C.) will also help you. And you may get some architectural ideas from *The Builder* and *The Building News*. Get an index of Vol. I. of WORK, and select from it those numbers in which my fellow-contributors have given instructions in joinery. I daresay you possess Messrs. Cassell & Co.'s catalogue; in addition, get Messrs. Blackie & Son's catalogue, from Old Bailey, London, for drawing and colouring. Always satisfy yourself in your work, and you will be sure to satisfy your employers. Become on friendly terms with the masters and men in as many cabinet-making shops as you can: you will find the British workman an obliging and friendly fellow. Art schools are all very well; but my opinion is that the learners must, naturally, always work in the same groove, and become so used to it as to be too dilatory to strike out a path of originality for themselves. I have replied to you at some length, because I feel interested in you, and would endeavour to make your personal acquaintance, were you resident in London instead of in Bristol. I feel convinced that the Editor will not condemn me for so long a reply to a struggling young fellow, nor for asking you to write and tell of your progress in a few months' time. I wish you well.—J. S.

Valve.—A YOUNG ENGINEER.—I suspect the reason why your valve face does not stick to cylinder is because the opposed faces are not scraped perfectly clean. Clean surfaces, covered with a thin layer of solder, raised to the proper temperature, but not overheated, and then pinched together and allowed to cool, cannot fail to adhere.—J.

Use of Cardboard.—A. E. R. (*Kingston*).—The variety of fancy articles which may be made from scraps of cardboard is almost endless. Among light occupations, few, perhaps, are prettier or more interesting than making architectural models in this material. The appliances needed are few, beyond scissors, a penknife, and gum. The block form of the building is usually glued together in thin wood, which is pierced with openings for windows, doors, etc.; this is coated with cardboard, bits being gummed upon it to form buttresses, pinnacles, mullions, traceries, etc. Wherever right angles occur, they are formed by scoring the card half through and bending it. Glass is fixed in the window-openings, and on this the tracery, cut out in cardboard, is gummed. Any moulding, however complicated, may be imitated by cutting out in card, and gumming one member of it over another. The effect of carving is best got by a little lining in Indian ink. With merely careful and patient work, admirable representations of buildings may be thus produced. Cardboard models may either be left white, or coloured to resemble the actual buildings. Ruins may be prettily imitated by veneering with sandpaper, marking out the stones, etc., with black or brown transparent varnish colour, and gumming on dried moss to represent ivy.—M. M.

Labyrinth Puzzle.—P. C. N. (*Shrewsbury*).—As merely application for patent has been made, there will as yet be no means of ascertaining the nature of the rival invention. P. C. N.'s idea is certainly ingenious, and, I should think, worth some little risk. In so simple a case, he might well apply for provisional protection without employing a patent agent. He would, of course, specify for "Improvements in Labyrinth Puzzles." Perhaps he might find some tougher composition in which the lines could be impressed better than the fragile one named, or some other kind of ball desirable; and would do well so to frame his specification as to include such variations. The *design* of the labyrinth should be protected by registration, fee 10s. If P. C. N. will cast his eye over the recent columns of "Shop," he will find there the address of an agent who communicates between inventors and manufacturers. Perhaps, when protected, P. C. N. might do well to put himself in communication with the rival above alluded to.—C. C. C.

Drills.—W. J. B. (*Sidbury*).—I am sorry that I cannot say certainly where the diamond drills are to be procured, not having had occasion to use them. But try Holtzapffel, Charing Cross; Pfiel, John Street, Clerkenwell; and Morris Cohen, Kirkgate, Leeds. To make and harden small drills, proceed thus: Procure the best possible steel wire; sometimes large sewing needles are used for the smallest. Draw the temper by making red-hot and cooling slowly; flatten the cutting end with a blow or two of a heavy hammer. The fewer the blows the better, because they tend to render the steel brittle. The cutting facets are then shaped with a file or on a hone. These small drills are usually hardened and tempered at once by heating them to a red colour, and plunging them into the body of a wax or a tallow candle. They may be heated on a piece of charcoal with the blowpipe, or on a red-hot iron bar. The cutting-point only should be hardened. Drills that are not very small require to be first hardened, and then tempered by the methods usual with engineers' cutting tools.—J.

Model Horizontal Engine.—F. C. (*Cardiff*).—It does not appear, definitely, of what parts you require the sizes. You say you have the "cylinder, etc." The "etc." may mean anything, or include everything. However, the following proportions may be of service to you, and any others you may require I shall be glad to give if you write again:—

Piston		$\frac{1}{8}$ in. thick
Piston-rod		$\frac{1}{16}$ " diameter

(The length must be sufficient to clear the gland by about $\frac{1}{8}$ in. at least.)

Connecting-rod, at ends		$\frac{1}{8}$ in. diameter
"	at centre	$\frac{3}{16}$ " "
"		$\frac{1}{4}$ " long
Piston-rod crosshead		$\frac{1}{4}$ " wide
"		$\frac{3}{8}$ " long and high

(Groove out $\frac{1}{8}$ in. wide and $\frac{1}{16}$ in. deep top and bottom for guide-bars.)

Guide-bars		$\frac{1}{4}$ in. wide
"		$2\frac{1}{2}$ " long
"	for $\frac{1}{8}$ in. of central width	$\frac{3}{16}$ " thick
"	for each $\frac{1}{16}$ in. of side do.	$\frac{1}{8}$ " "

(With $\frac{1}{8}$ in. diameter distance bolts at ends.)

Valve-rod	$\frac{1}{16}$ in. (full) diameter

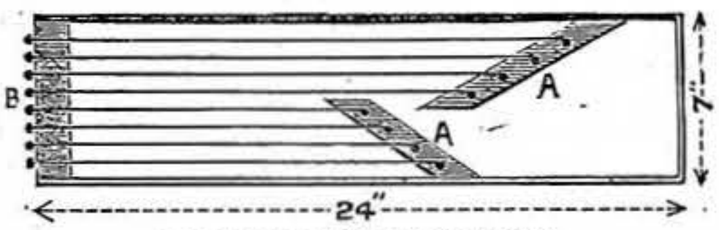
You will, of course, lay the lines down on paper before making the model. The travel of slide-valve and throw of eccentric will depend partly on width of port. I cannot give you the length of piston-rod, because I do not know length of gland or how much clearance (over the 2 in. stroke) you have in your cylinder; but you should find no difficulty in setting this out.—F. C.

Chiffonier.—A. W. M. (*Liverpool*).—The design you submit for chiffonier is not of sufficient merit to publish in WORK. If you send your full address, and a stamp, the MS. will be returned to you.

WORK Numbers.—INDEX.—The pages you require cover so many numbers, that it would be better for you to buy Vol. I. of WORK, containing a year's numbers.

Wood Screwing Tool.—W. H. N. (*Oldham*).—This is one of Peugeot Brothers' tools. Any tool-maker will procure it for you.

Fairy Bells.—CORKONIAN.—If CORKONIAN will turn to page 814, Vol. I., of WORK, he will find drawings of "fairy bells" which will help him very considerably in his construction of this instrument, which was originally known as "Oxford Chimes," and the essential character of the tone of which is the floating, waving quality imparted to it by the method of playing, viz., grasping it firmly with both hands, and swinging it about from side to side or in circles, while the notes are being plucked *with the thumbs*. This character is entirely lost by the instrument being placed on a table or fixed rest while being played, it being then, although still very sweet, very little, if any, better than the tone of a Prince of Wales's harp or toy zither. In the drawings above referred to, one of the original or eight-stringed instruments is shown; but there is nothing to prevent CORKONIAN making one of ten, twelve, fifteen, or, in fact, as many strings as his hand is large enough to cover, or his muscles strong enough to swing; bearing in mind that the more strings there are, the wider and longer must the instrument be, and the heavier and more unwieldy must it become, if the character of its tone is to be retained. The one shown in the drawing consists of a baseboard of pine, 24 in. long by 7 in. wide, and $\frac{3}{8}$ in. thick, and having sides and back end of the same material, about 2 in. deep, which thus forms a shallow box or tray. The sides are shaped as shown for convenience of grasping, and the front end is filled with a block $1\frac{3}{4}$ in. wide, and taking the shape along its length of the ends of the sides. The front or inner edge of this block is left square, and acts as a bridge for the strings. Under this is placed (so as to "sandwich" the baseboard between them) the hitch-pin block, $\frac{3}{4}$ in. thick by 1 in. wide. Two blocks, shaped and placed as shown at A, A, Fig. 1 (see page 814, Vol. I.), which, for convenience sake, is repeated



Baseboard for Fairy Bells.

here, occupy the interior, and are each $1\frac{1}{4}$ in. wide and $\frac{3}{4}$ in. deep. Observe, these two latter are placed in *opposite* diagonal directions, so that the shortest string may come in the centre. If they were placed in the same line, the shortest string would come on the outside, and the first part of the scale would have to be played backwards. No bridge is necessary on the front of these blocks, as the strings are wound round the wrest-pins so as to remain quite clear. All these blocks should be made of clean beech, and each should be planed perfectly true on the under side, so as to form a thoroughly good joint with the baseboard. If this is done, no screws will be necessary; although it would be safer, perhaps, to use a few in the event of the instrument being exposed to damp. Having fitted your wrest-pin blocks, mark off the length of each into four, five, or six equal parts, according to the number of strings you intend having (allowing $\frac{3}{8}$ in. in width on the baseboard for each additional string), and leaving 1 in. clear of the block at each end; and then, on these marks, bore the holes for the wrest-pins, which are ordinary piano pins, and must fit tightly. The hitch-pins are ordinary round-headed screws, $\frac{3}{4}$ in. long, and their position is determined in the block, into which they are to be inserted by dividing it into an equal number of spaces corresponding with those in the wrest-pin blocks. A cover, 18 in. long (which should be made to slide in and out *from the front*, or may be screwed on), must be provided, and should be of $\frac{1}{4}$ in. mahogany or cedar, with a brace, $\frac{3}{4}$ in. wide and $\frac{1}{4}$ in. thick, screwed and glued across its top front edge, to prevent warping or splitting. In this cover should be cut two *f* holes, which should come directly over the wrest-pins, and permit of tuning the instrument without withdrawing the cover; this latter operation being only necessary when a new string has to be put on. Previous to stringing up, size and varnish the inside with good spirit or copal varnish, and, if you wish it to look well, French polish the outside. This, of course, is optional. In stringing up, the eyes should not be twisted, but should be made thus: Fix a wire nail or peg, slightly larger than the hitch-pin, in a vice, and, taking the string in the left hand, grasp the end with the right, and take a turn round the peg, and then two turns round the string itself, close up to the peg; then cut off the free end of the wire, so as to leave a "tail" $\frac{1}{4}$ in. long. This tail comes flat on the block, and is quite sufficient to prevent slipping, and at the same time it presents no rough or jagged end to injure the hands or dress. When tuning, roughly pull up to within a note or two of the pitch required, and afterwards gradually raise to about half a note above; then, with a piece of wash-leather, rub briskly up and down each string with a moderate amount of pressure. This will stretch the wire, which should then be pulled up again to pitch and left for an hour, after which it may be put into proper tune, remembering that

the highest note is the right-hand centre one, and that the first half of the scale goes to the right hand, and the second half to the left, from the left-hand centre note. Everything necessary for the construction of these instruments can be obtained of Messrs. Chilvers & Co., 10, St. Stephen's, Norwich. —R. F.

To Mount Maps or Plans on Linen or Calico. —ONYX.—Tack, very tightly strained, on a piece of board, or, if very large, on a frame, a piece of calico or linen, of the requisite size, allowing an inch and a half margin beyond size of map. Give this a good coat of strongish size. When nearly dry, take your map; sponge the *back* with clean water. When well damped through, paste with well-strained paste, made with a pinch of alum, as before described in our columns; then lay down on canvas, pressing all over with roller or clean linen cloth. When dry, it can either be cut out and framed, or sized and varnished and mounted on rollers.—F. B.

Painting on Glass.—S. E. R. (*Rye*).—The glass used by glass painters will stand the test as recommended for silver, if you take the precaution to warm the glass gently, at first, instead of plunging direct into the fire. The very thin glass is that used for microscopic slides, but its very thinness is against its use in large pieces. Any good firm of glass merchants, such as Hetley, Soho Square, would supply you with what you require, and would also undertake to bend glass for you. The silvering can also be done by such firms; and probably the process you mention as a German one is the one used by London firms. Great improvements have been made this last few years in amalgams for silvering glass, quicksilver being more sparingly used than heretofore. Quicksilver itself will not stand a great heat, as it becomes a vapour if subjected to severe heat.—F. M.

Wood Carving Manual.—P. 2. (*Nottingham*).—P. 2. is recommended to write to the School of Wood Carving, South Kensington, enclosing 1s. 1d., and ask for the book to be sent him entitled "Hints on Wood Carving for Beginners," by E. Rowe.—W. E. R.

Wood Carving Book—Covers for WORK.—EDGAR L. R. (*Oxford*).—E. Rowe's "Hints on Wood Carving for Beginners" will be found most useful, and can be had post free for 1s. 1d. from the School of Wood Carving. If you want designs, write to B. T. Batsford, Publishers, 52, High Holborn, and ask them to send you their list of books on wood carving. They sell very good photographs in a folio of Signor Prullini's work. And from the School of Wood Carving you can get a folio containing 18 plates of photographs from carvings in the South Kensington Museum for 13s., post free, or single plates 9d., post free. F. Miller's "Wood Carving," published by Wyman & Sons, Great Queen Street, W.C., is a good, useful book on the subject. Covers for binding volumes of WORK can be had of any bookseller, or of the publishers, Cassell & Co., Limited, London, E.C.—W. E. R.

Electric Bell Failures.—A. W. S. (*Enfield*).—As your bells ring in dry weather, but fail to ring in wet weather, it shows that you have fixed some metal parts on direct to wood, instead of fixing them to a metal base. As the wood absorbs moisture from the damp air in wet weather, it swells, and alters the adjustment of the two metal parts fixed to the wood base. The defect may be on the bells, but is more likely to be in a push or a switch of bad design or construction. Such hard woods as teak or box should be employed in switches and pushes, and the contact pieces of metal must be furnished with a spring, to take up slight alterations in adjustment caused by the wood swelling or shrinking. —G. E. B.

Netting Needles, Twine, Cotton, etc.—G. T. (*Old Shildon*).—Ironmongers, dealers in fancy goods, and drapers, will generally supply or get for customers all the requisites for netting. Oiled twine, as used in making herring nets, may be got through any dealer in fishing tackle, of which there are generally one or two in each town.—G. E. B.

Electrical Matters in Back Numbers of WORK.—J. S. (*Kirkcaldy*).—As a mere list of the back numbers wherein papers on electrical matters have appeared would fill one column of "Shop," I hope you will be so kind as to excuse me the task of writing it. An index to Vol. I. will show you that there have been very few numbers in which there has not appeared some paper on electrical matters, or some useful reply in "Shop" on the same subject.—G. E. B.

Galvanic Battery.—J. S. (*Kirkcaldy*).—After all this time, I learn from your last letter that the thing you desire is not a galvanic battery but a medical coil. It is true that a coil must be worked by a galvanic battery, just as a steam boiler will be needed to work a steam-engine; but the battery will be useless without the instrument named a coil, as you could not get a shock from the battery alone. Instructions and illustrations showing how to make such an instrument as you require will take up too much space in "Shop."—G. E. B.

Patent Agent.—A. W. G. (*Jersey*) will probably, since the date of his letter, have read in "Shop" the address of a firm of London patent agents whose professional reputation is, we believe, beyond question. If not, we must ask him to refer to our answer to W. G. S. (*Bristol*) in a recent issue.—C. C. C.

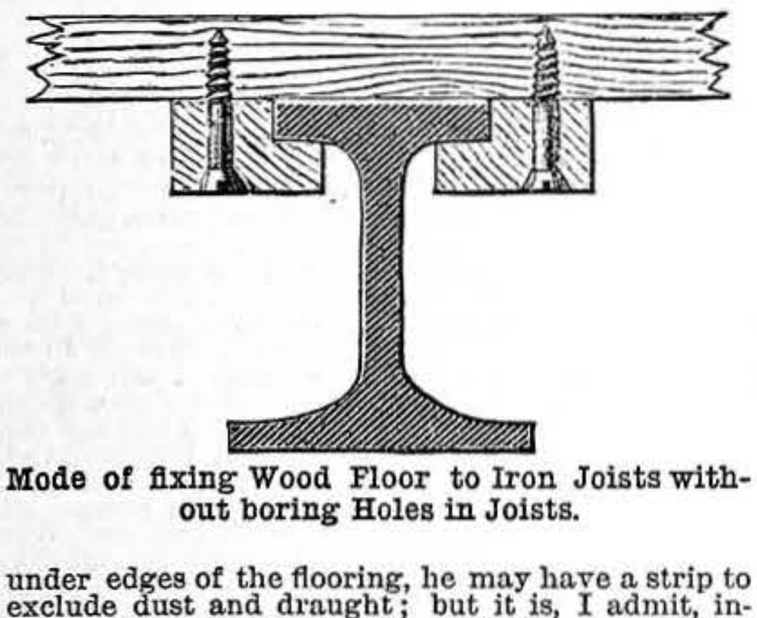
Sample of Red Wood.—E. L. H. (*Liverpool*).—The sample sent is a piece of padouk wood, and comes from India, most of it being brought from Calcutta. It is much used in the place of mahogany, being richer in colour, and, if grown on a favourable soil, of splendid figure. It is imported in planks of about 4 in. thick, and up to about 24 in. wide. It is very hard working, but gives great satisfaction when finished. The price is about the same as mahogany, and can be bought at many of the London yards.—A. J. H.

Book on Locks.—C. H. C. (*Pimlico*).—I do not know of any book published relating to locks and keys. The steel wire used for picks is usually about 11 or 12 W. G., tapering towards the end. It would be better to purchase them than attempt to make them. The cost is about 6d. each.—T. W.

Stationery Holder.—M. A. (*Suffolk*) asks for a full-size design for the Stationery Holder given in "Shop" supplement of No. 66. It is impossible for contributors to accede to such requests as these, involving, as they would, an expenditure of much time and trouble.

"Shop" Insertions.—L. B. (*West Bromwich*).—No charge whatever is made for any communication appearing in "Shop." You and others may make any remarks which are likely to be of service to readers of WORK, and, if of value, your communication will be printed, as a gratuitous contribution, in Sections 1 or 4.

Laying Warehouse Floor.—A. F. R. (*Birmingham*).—The question put has attached to it very difficult conditions, which, for the benefit of other readers, ought to be stated: Boards, 11 in. × 3 in., not to be reduced; no nails on surface; provision made for repairs; and to be ploughed and tongued; joists of iron, 3 ft. between centres, and 5 in. wide on top flange; and no bolt-holes are to be made in the joists. I fear that A. F. R. will have to modify one of these conditions, for there is to be provision for easy repair, which is impossible with ploughed and tongued work, especially as the tongue generally used is iron hooping. If A. F. R. will *rebate* the



Mode of fixing Wood Floor to Iron Joists without boring Holes in Joists.

under edges of the flooring, he may have a strip to exclude dust and draught; but it is, I admit, inferior to an inserted strip in a groove, as in the usual manner. Seeing, however, that the floor is 11 in. × 3 in., I should not insist on easy repairing. Few warehouses survive fire-risks long enough to require repairs to so stout a flooring. If the load on the floor is fairly uniform, fixing might be dispensed with; but fixing adds to the strength of a floor very much, and the simplest plan, without making holes in the joists, would be to make some rebated strips (3½ in. × 2 in. would do), and screw them underneath. Of course, I am assuming room enough to admit of this, which is probably the case. The strips sketched might be put on every or on alternate joists.—B. A. B.

Thermometer and Barometer.—IN DOUBT.—Your difficulty arises from the circumstance that the imprisoned air varies in volume, not only in proportion to its temperature, but also in proportion to the pressure to which it is subjected from time to time, one of these factors—the temperature—being under your control, the other not so. Your letter shows that you are unacquainted with the laws which govern the volume of gases, one of which is that the volume is directly proportional to the pressure acting upon the gas under observation. For instance, a volume of air—which is a mixture of gases—measuring exactly 1 cubic ft. at the normal pressure of about 15 lbs. per sq. in., would only occupy one-half that space under a pressure of 30 lbs. per sq. in.; whereas it would occupy double the space were the pressure decreased to 7½ lbs. per sq. in. The pressure of the atmosphere is constantly varying, and, consequently, the bulk of imprisoned air contained in your apparatus varies also, independently of the temperature; hence the corrugated disc—the most yielding part of the chamber—rises to different heights on different days. You might overcome your difficulty by filling the chamber with some liquid, such as water or alcohol, or a mixture of these if the boiling-point of the liquid chosen be in excess of the greatest temperature required; but you must not lose sight of the inflammable nature of alcohol. Would a metallic thermometer suit you? If so, such an article may be readily made and adjusted to act at any desired temperature, it being only necessary to take two long thin strips of brass (or zinc) and steel—one of each—say, 1 ft. long, ½ in. wide, and $\frac{1}{32}$ in. thick, and carefully rivet them together at intervals of half an inch. Such a compound bar will *bend* under the influence of heat, and if it be fixed by one end in a vertical position, the fixed end uppermost, the free end will move to and fro as the temperature varies; and you could readily arrange matters so that contact would be made at any desired temperature. If the heat required be not sufficient to melt the solder used, the two strips may be soldered together throughout their entire length; but in this case you will have a curved instead of a straight combination, on account of the unequal expansion caused by the heat applied whilst soldering. The curvature may, however, be corrected by placing the strip, hollow side uppermost, on a block of hard wood, and applying the "pene" of a light hammer in a succession of light blows across the strip, the entire length being submitted to this hammering, until the strip has been sufficiently straightened, when the hammer-marks should be erased by the application of a fine-cut flat file. You will, of course, understand that the entire length of the compound metallic strip must be submitted to the temperature to be measured.—QUI VIVE.

Perfect Safety Bicycle.—E. G. F. (*London, W.*).—A machine similar to Fig. 3 (see WORK, No. 66, Vol. II.) is manufactured by Humber & Co., Limited, of Holborn Viaduct. There must be other makers, but I cannot call to mind any others.—H. B. P.

Micro. Mounting.—J. P. (*Brighouse*).—The thin metal caps referred to for securing cells for mounting semi-opaque objects, as used by Mr. Enoch, may be obtained from most of the leading opticians who deal in micro. specialities, or from Messrs. Thompson & Capper, 4, Lord Street, Liverpool.—A. T. S.

Incubator.—L. G. W. (*Barnsbury*).—I should strongly advise you to send for Hearson's little manual, entitled "The Problem Solved," price 1s. As you have one of their incubators, the manual would be of special service to you. As to making a regulator to suit Hearson's Incubator, I have no doubt that it is beyond the abilities of an amateur. If I could be certain of the exact ingredients of the capsule, I would not advise anyone to make one, unless certain as to the ability of the worker to do the necessary soldering. Probably, the liquid used is some volatile spirit, or ether; in any case, its use is the special subject of Mr. Hearson's patent, and the company sell all the fittings at very moderate prices.—B. A. B.

Piano Making.—J. M. (*Midhurst*).—You seem to be in a little difficulty, but I think I shall be able to set you right. The lines made on p. 452 are not intended to show the setting-out of the strings, but are merely the bracings. The measurements are for a 7-octave piano. The back is quite wide enough if you have made it 4 ft. 2 in. Take the measurements on p. 502, second column, 41st line. Your first note will be 2½ in. from the treble end, and your last note 47½ in. This will leave you 2½ in. from the last bass note to the outside edge of your b[illegible]ck. I expect your compasses have gained a little with moving them. Contract your compasses a shade, until you get the 85 notes within the limit of 2½ in. from each side of the back. Be careful to put your scale to the bottom edge of wrest-plank (see p. 565, third column). I think you will surmount your difficulty with a little patience. If you have got on so far, I am sure you will be equal to this. You will see on p. 502, second column. Glue all edges, except the bottom. This will answer your other question.—T. E.

Cassell's "Popular Educator."—W. B.—Vol. III. is now complete, and can be had of any bookseller, or of the publishers, Cassell & Company, Limited, London, E.C.

Camera.—I. T. W. (*Tamworth*).—The camera you name is very good, considering the price. The material and workmanship in the higher-priced instruments by the leading makers are, of course, superior, and will stand very much more wear and tear. *Any* plates may be used in *any* ordinary camera, provided they are the right dimensions. The make of plate has nothing to do with it. The detective camera mentioned is little better than a toy, and the work obtained by it must be judged accordingly. Occasional articles appear in WORK on this subject.—D.

Camera.—I. H. (*London, E.*).—Make a pattern in paper as a guide. If the measurements of the two ends are correct, lines drawn from the extreme corners of the larger to those of the smaller end will be quite right to fold by. The zigzaging of the bellows is, of course, horizontal. The principal difficulty, which is soon mastered, is pinching the corners into form, to make the bellows work smoothly. It must not be forgotten to allow a little for overlap in joining up.—D.

Tempering Axes.—J. S. (*Longsight*).—You must heat the axe to a low red, and quench in salt water. Then let down to a brown or a blue, according to the steel, and quench for tempering. If you find the temper is soft, gradually experiment with lighter tints, ranging between dark straw and brown.—J.

Pipe over Plinth.—J. G. (*Glasgow*).—I have looked at your model, and there is no way of getting at the angles except by drawing out the pipe in elevation and in front view, and bisecting the angles. You need not seek for any other way, for there cannot possibly be one better or more accurate. It is one of the commonest and simplest jobs in practice. —J.

Ready Reckoner.—J. G. (*Bradford*).—Try "Quantities and Measurements," by A. C. Beaton; price 1s. 6d. Published by Crosby Lockwood & Co., 7, Stationers' Hall Court.

Connecting Rod Brasses.—BRASS.—Such brasses are not usually lined out, but are centred tentatively in the lathe, so that all parts shall hold up to size. If lined out, you will simply clip the two halves with packing pieces between, insert a temporary centre, and from it strike the required circle.—J.

Slide Rule.—F. W. (*Worcester*).—The best book is "The Theory and Practice of the Slide Rule," by Campbell. Published by Spon, 125, Strand, London, W.C.—J.

Small Iron Castings.—S. & B. (*Bristol*).—The only way is to use very soft pig—No. 1 Scotch, with no admixture, or very little, of scrap.—J.

Designs of Working Cardboard Models.—C. W. S. (*Northallerton*).—Inquiries made by me fail to elicit any information as to where these are to be obtained. Probably some reader may know whether they are supplied, and if so, by whom. I should advise you to ask at the shops where working models are exposed for sale.—J. S.

Triple Expansion.—KIDDERMINSTER.—To give our correspondent the particulars he requires, and explain them clearly so as to be of any use to him, would take up far too much of our already limited space; as the subject is not of sufficiently general interest to our readers or the public, we cannot feel ourselves justified in so doing. The best thing our correspondent can do is to refer to "Seaton on the Marine Engine," where he will find the subject fully gone into, and all the necessary information fully set forth.—C. E.

Gold Paint.—W. H. F. (*Kingston*).—You say you have tried several ways of using bronze powder as a gold paint, but you do not state how you used it. Have you tried mixing it with gold size? This is what the majority of gold paints consist of. Gold bronze should be protected by a coat of varnish, or it will turn black.—R. A.

Embossing Dies.—C. S. (*Manchester*).—I do not think you need trouble about allowing for the thickness of the metal. The metal used with these dies for stamping name-plates, trade-marks, etc., is usually very thin, and if you get your two dies to fit nicely together, the result (for thin metal) will be satisfactory.—R. A.

Sheet Metal Working.—J. H. B. (*Norton*).—For instructions in sheet metal working, get the numbers of WORK that articles on the above subject have appeared in, and look out for others that have yet to appear. Cassell's "Drawing for Metal-plate Workers" is a useful book at a low price (3s.). "Millis' Sheet Metal Work" (Spon) is also a first-class work, but high in price (9s.).—R. A.

Engines.—J. E. (*Cardiff*).—¾ in. bore by 1⅜ in. stroke would be about correct for such a boiler.—J.

Sanitation.—A. Y. (*Deptford*).—The following are good books:—"Sanitary Engineering," by Baldwin Latham, price £1 10s.: published by Spon, 125, Strand; and the "Municipal and Sanitary Engineers' Handbook," price 12s. 6d., same publisher.—J.

Cover and Advertisements.—W. N. H. (*Bradford*).—Thanks for your suggestions, which shall have consideration.

Waterproof Glue.—F. B. (*Aldershot*).—If you are thoroughly assured that no remissness exists on your part by way of address or postal delivery, why not take the advice of a solicitor?

Saws.—F. C. (*Belfast*).—Please state your trouble more definitely, and say whether it is a circular, frame, or band saw. If also you couch your question in a becoming way, you may rely upon a civil answer.—A. R.

Refrigerator.—DOUBLE GLOSTER.—From the sketch you send of an American refrigerator which you are using, but "find in practice an utter failure," it appears to be constructed upon sound principles, the only thing omitted is that of a small ventilator in the top—which you have probably left out of the sketch: you further say "that the heat to be kept is that of frozen New Zealand mutton." Does it not strike you that this is expecting too much? The temperature of your refrigerator, and, indeed, any refrigerator short of an *ice making* machine, will be *below* freezing point, since the cooling depends upon the *melting* of the ice, so that the work power you put in is 32° Fahr. at its best; the work done must be something less, useful enough for ordinary purposes, but insufficient to arrest the thawing of frozen meat; clearly, it would be of no use to introduce any mechanical means of moving the air.—C. M. W.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Ready Reckoner for Timber Trade and Glass Trade.—J. G. (*Bradford*) writes:—"Could some kind reader oblige me with title of book and publisher for joiners' and builders' tables, showing number of superficial feet in any given measurement of wood or glass?"

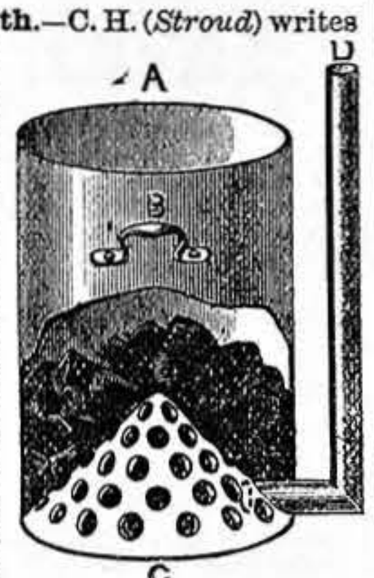
Water-Colours.—J. P. (*Belfast*) writes:—"Will any kind reader of WORK inform me how to make moist water-colour paints? I have made some, but find they get as hard as stone in a day."

Ivory Tablets.—SEA GULL writes:—"I should be glad to be informed where I can get ivory or xylonite name tablets as used by makers of cameras and dark slides. I want some wholesale maker."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Tuck Pointing.—M. (*Bishop Auckland*) writes, in reply to SLATER (see page 462, No. 133):—"If you refer to No. 72, Vol. II., of WORK, you will find instructions for tuck pointing brickwork; and to No. 121, Vol. III., instructions for tuck pointing stonework. If you require any more information than is there given, if you will write again I shall be glad to assist you."

Heating Water for Bath.—C. H. (*Stroud*) writes in answer to ROUND O (see page 414, No. 130):—"The only way of heating cold water in a bath is by using a charcoal heater, similar to sketch, in which A is round sheet-iron cylinder; B, handle on either side for lifting; C, perforated cone grating; D, pipe reaching under perforated cone, the air rushing down pipe and up through the perforated cone, acting as a blower, and keeping the charcoal in a lively state. Place apparatus in bath of cold water and let it remain until water is sufficiently heated, then remove from bath room."



Charcoal Heater for Bath.

Wicker Stains.—L. S. L. (*Kirkcaldy*) writes to A. B. (*Westminster, S.W.*) (see page 462, No. 133):—"Wash the wicker, after being thoroughly cleaned, with a solution of cutch (catechu). The solution may be about 1 cutch to 20 boiling water. Allow to dry, and coat with solution of bichromate of potash of about same strength. Expose to the light until dry, and repeat the bichromate coating until the desired shade is produced. The colour is permanent, and can be left unvarnished if you like. I think you will like this method. Your chair was very likely coated with common brown varnish—not stain."

Heating Room.—RUSSELL writes to C. J. P. (*Derby*) (see page 462, No. 133):—"If you have domestic hot-water apparatus, I should carry pipes from them, you would find it cheaper than any other method. I shall be pleased to send you drawing for same if you can show existing pipes."

Dry Battery.—H. E. (*South Norwood, S.E.*) further writes in reply to J. A. M. (*London, N.W.*) (see pages 14, 110, and 203, Vol. III.):—"I must apologise for not noticing your letter before, but have been very busy for some time, and have not looked at some numbers. Going through this evening I came across yours, and hasten to reply. I am sorry to hear you could obtain no result after following my instructions, which I have re-read. I had not tried the first recipe, but gave you what I believe to be Gassner's mixture. I culled it from a reliable source, and have no doubt as to its correctness. This being so, I cannot account for your failure. The second recipe (with agglomerate Leclanché) I have tried, and found to work well. Here are some more which you might try. (1) Permanganate of Potash Dry Cell.—Get a pint jar, line inside with sheet zinc, allowing lug for connection, and well amalgamate all except the lug. About three parts fill the jar with a saturated solution of sal-ammoniac, add an ounce of permanganate, and well mix, then stir in sufficient plaster of Paris to make a thick cream. Insert a good-sized carbon plate in centre, and as soon as set, seal over the top with melted paraffin wax. (2) Meserole Dry Battery.—The mixture for filling the dry cells, prepared by M. A. V. Meserole, is said to consist of the following solid ingredients in the form of powder: charcoal, 3 parts; mineral carbon or graphite, 1 part; peroxide of manganese, 3 parts: lime hydrate, 1 part; white arsenic (oxide), 1 part; and a mixture of glucose and dextrine or starch, 1 part; all by weight. These are intimately mixed dry, and then worked into a paste of proper consistency with a solution composed of equal parts of a saturated solution of chloride of ammonium (sal-ammoniac) and chloride of sodium (salt) in water, to which is added one-tenth volume of a solution of bichloride of mercury (corrosive sublimate), and an equal volume of hydrochloric acid (spirits of salts). The fluid is added gradually and the mass well worked up. Elements and sealing as before. No. 1 should give a capital cell; of No. 2 I know nothing, but if fond of experimenting you might try it. I shall be pleased to know how you get on. A letter addressed to me through the Editor will reach me. I will also experiment a little if I can find time."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—B. B. (*Deptford*); F. H. J. (*Angelica*); E. P. S. (*Hanley*); H. T. M. (*Acton, W.*); H. C. (*Birmingham*); F. S. (*London*); DOWLAIS; R. A. B. (*Carmarthen*); C. H. (*Liverpool*); H. J. (*Rochdale*); W. D. (*Belfast*); BENCH; CONSTANT READER; A. R. (*Scorrier*); C. H. M. (*Portsmouth*); F. M. (*Bristol*); V. L. (*Newcastle-on-Tyne*); J. S. (*Peterboro'*); A. H. B. (*Staleybridge*); G. P. (*Elgin*); WOODWORKER; T. H. L. (*Dublin*); E. R. S. (*Gloucester*); G. A. S. M. (*Birmingham*); WEEDLESS; W. C. (*Deptford*); MUGGINS; W. L. H. (*Swindon*); GAMESTER; S. S. (*Grantham*); G. I. S. H. (*Coventry*); S. T. (*Wednesbury*); A. L. (*No Address*); C. W. C. (*Stockton*); R. W. M. (*Elgin*); LOVER OF MUSIC; E. G. (*Aigburth*); J. D. (*North Wales*); C. W. S. (*Lower Sydenham*); F. W. G. (*Glasgow*); J. T. S. (*Reading*); W. B. (*London*); J. S. (*Keighley*); W. E. (*Bristol*); G. B. H. (*Leeds*); W. E. T. (*Burton-on-Trent*); J. H. (*Leeds*); LOVER OF "WORK"; E. E. S. (*Cromer*); H. M. (*Keighley*); A. T. (*Canonbury*); J. S. (*London, N.*); E. AND S. (*Blackburn*); CONSTANT READER; WATERPROOF GLUE CO.; OSCAMAW; A. R. (*Birmingham*); S. J. W. (*Ystalyfera*); G. A. S. (*Edinburgh*); A. B. (*York*).