WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

A QUARRY of stone of first-class quality for lithographic purposes has been discovered in Utah. Hitherto, the stone has been obtained almost exclusively from Bavaria.

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A form of ball-bearing has been applied to the spindles of textile machinery, and it is stated that, as might be expected, very high rotative speeds are practicable, up to 16,000 revolutions per minute, the usual speed being 8,000.

* *

Shortly a description will appear of an amphibious vehicle fitted to carry goods both on land and over water. The advantage of this contrivance is that goods can be carried from a factory, colliery, or elsewhere without transhipping. There is no insurmountable difficulty in the way with the present knowledge of construction.

* *

The latest invention as a war agent for troops and franc-tireurs is a vitriol gun to eject vitriol to 70 metres' distance in a dense spray. The French officer who invented it says it is not for white warfare, but to be used against African savages who are so reckless in their ugly rushes. We pity the "inventor"—not the blacks!

* *

Small electric lamps are coming largely into use. They have already been adapted to reporters' pencils, and now a Continental manufacturer supplies spectacles in the middle of which is a minute incandescent lamp shielded by a reflector; this lamp may also be had mounted on spectacle frames in which there are no lenses.

* *

Roller-bearings for railway cars are occupying attention in America. At high speeds very little is gained by the use of roller-bearings, as journal friction is a comparatively small item in the account of resistances at too great velocities. In starting a train from a standstill the roller-bearings will help, but will they stand the knocking about inalienable from railroad traffic?

Cooking by electricity may be as cheap as cooking by gas, and it is certainly more cleanly. The charge for the electric current is 3d. per Board of Trade unit, which is equivalent to gas at from 2s. 6d. to 2s. 9d. per 1,000 cubic feet. Therefore at the present price there is an advantage in favour of the electric grill and stove. A steak by electricity, however, is not within our gastronomic experience.

* *

It is said that engravers in Germany harden their tools in sealing-wax. The tool is heated to whiteness and plunged into the wax, withdrawn in an instant, and plunged in again, the process being repeated until the steel is too cold to enter the wax. The steel is said to become after this process almost as hard as the diamond, and when touched with a little oil or turpentine the tools are excellent for engraving, and also for piercing the hardest metal.

* *

It has been found that the cohesive strength of solid glue is equal to 4,000 lb. per square inch, from which we draw the conclusion that its application as a cement may be much improved. It must, however, be properly prepared, and it should be borne in mind that glue which has been stored for some time has a higher tenacity than that newly made. The newer and paler coloured glue is preferred by joiners as being less noticeable, but a good workman should so fit his work that the joint is imperceptible.

* *

For some years the superiority of mirrors backed with silver, instead of the mirror amalgam formerly used, has been recognised. A point of the greatest importance in this connection turns upon the method by which the silver is reduced. It has been found by experience that those processes which slowly reduce the metal and deposit it from the alkaline solution in cohesive masses of a leaf-like shape are most satisfactory. The old method of depositing silver gives it a bronzine tint.

* *

Japanese authorities are reopening a copper mine at Musashi, which authentic documents show to have been first worked 1,183 years ago. The galleries and levels are stated to be, in some places, in the same condition as that in which they were 700 years since. It will be of great interest to ascertain the changes wrought during this period on the ore by the access of atmospheric air to the galleries. This will be easily ascertained by comparing analyses of specimens at the gallery surfaces with others of those lying deeper in the strata.

* *

Cabmen have to pay £3 to the Government before they can drive out a cab, viz:—£2 for the number on the cab, 5s. for the badge, 15s. tax on every cab, and sometimes 1s. or 1s. 6d. for inspection of each cab at the police station before the number is granted, in addition to all of which, half a day is wasted in waiting about. It is quite time the £2 and the 15s. taxes were abolished, and the badge charged for at its value, which would not be more than 1s. Leaving the taxing offices, the cabman has to reflect upon a 100 mile drive to get his money back. This is oppressive, indeed, upon a useful and sorely-tried class.

* *

On long railway journeys great confusion arises at the stopping places from travellers, when hurrying back after taking refreshments, forgetting the number of their carriage. The Paris and Lyons Railway Company have resolved that every carriage on their lines shall have a distinctive sign, such as an animal or plant, executed in white enamel on a blue ground, so as to facilitate the finding of their carriage by the passengers. On English lines it would certainly be a boon if first, second, and third-class carriages were always recognisable by a distinctive colour, so that the search for a particular class might be easier. "First," red; "second," blue; "third," black. Why not this all the country over? Much loss of time and many accidents occur from passengers having to rush along platforms in order to find the whereabouts of the particular class carriage desired, and when seeking for this the intelligent traveller more often judges by the internal fittings of the compartments rather than by any external signs. Class sections of trains with distinguishable colours, agreeing with the tickets issued, would be a blessing for many reasons. This would, too, save much time and temper.

PHOTOGRAPHIC EXPOSURE.

BY G. P.

IMPORTANT POINTS—THE NECESSITY FOR CORRECT EXPOSURE—HOW EXPOSURE MAY BE ESTIMATED—AIDS TO EXPOSURE : WATKINS' EXPOSURE METER—THE ACTINOGRAPH—EXPOSURE FACTORS : LIGHT, SUBJECT, DIAPHRAGM, PLATE—HOW TO MAKE THE CALCULATION—TIMING EXPOSURES—RAISING THE LENS-CAP—EXPOSURE NOTEBOOK—CONCLUDING REMARKS.

Important Points.—I need not dwell on the subject of setting up the camera, or on the art of focussing; on the method of filling the dark slides, or on the necessity for keeping them from direct sunlight; on the mischief wrought by the slightest shaking of the camera during exposure, or on the advisability of covering the camera and dark slides with the focussing cloth. These points are all important, certainly, but the mere mention that care is necessary will be all that an intelligent reader—and none other need expect to become proficient in photography—will require.

The Necessity for Correct Exposure.—The novice has no doubt read and heard much about altering the proportions of the constituents of his developer to suit the exposure and the result required; and has very likely been told that he can make a wrongly exposed plate all right by careful development. From this he is led to suppose that exposure is a secondary consideration, and that his energies are to be applied to development almost entirely. No idea could be more injurious. It has been proved by Mr. Lyonel Clark in the course of his elaborate experiments on different developers, and has been confirmed by experiments of Messrs. Hurter and Driffield, and other gentlemen, that "the action of light is *absolute;* a certain amount of light will effect a certain amount of dissociation amongst the silver molecules that form the sensitive film, and any agent capable of developing will show a certain fixed amount of reduction. And whether we apply a vigorous or a weak developer, we shall never get out any more or less detail. There will, however, be a vast amount of difference in the time that will be necessary to get this amount of detail out." * This difference of time in the appearance of the image has, however, a very important bearing on the appearance of the plate as a whole : it is found to affect the gradations. That, in a word, is the nature of the difference between developers—a difference of gradation, and not in the maximum detail obtainable, provided that the action of the developer is continued for a sufficient length of time. It will thus be evident that an under-exposed plate is useless, as is also—to the beginner—an over-exposed one. By the application of bromide of potassium to an over-exposed plate, part of the exposure may be, so to speak, done away with; but the beginner can scarcely hope to cope with this successfully. The better plan is to give correct exposure, when operations are not only simplified, but more speedy success and less waste of material is assured. I cannot lay too much stress upon the importance of a correct exposure, for I believe that if this be given, no anxiety need be felt as to the resulting negative, whatever the developer, so long as it is well balanced.

How Exposure may be estimated.—That point being settled, the question comes to be : How can the correct exposure be estimated. This question is an easy one to answer, and a difficult one. Contradictory statements certainly, but nevertheless reconcilable, for, if my reader has 10s. or 15s. to spend, I can recommend to him an excellent *vade mecum;* if not, the question becomes a more difficult one, as will be seen presently.

Aids to Exposure: Watkins' Exposure Meter.—The difficulties I have referred to having become widely recognised, many attempts have been made to remove them by the publication of exposure tables, and by the designing of actinometers. Of the many that have already been placed before the public, I have no hesitation in saying that those actinometers invented by Mr. Alfred Watkins, of Hereford, and Messrs. Hurter and Driffield, and called respectively "Watkins' Exposure Meter," and "The Actinograph," are the most correct in principle and the most accurate in practice. The first of these instruments was noticed in "Our Guide to Good Things" in Vol. I. of WORK; but for the benefit of those unfortunate individuals who, owing to their procrastination, do not possess and cannot now obtain that valuable book, I will describe it here as briefly as possible. The meter consists of a brass cylinder 2½ in. long and 1¼ in. in diameter. One end of this forms a capped box, the lid of which is attached to the body by a chain 10 in. long (which packs inside), and thus when made to swing beats half seconds. At the other end is a tinted disc perforated with an aperture, across which is made to pass a strip of paper made so sensitive as in a few seconds to change colour under exposure to light, until it coincides with that of the disc. On the tube are six flat rings—two fixed and the others movable. All the rings are suitably graduated, and the four movable rings each carry a pointer which bears a letter indicating a particular exposure factor. Thus the first is marked A (actinic force of light falling on the subject); the second, P (sensitiveness of plate used); the third, S (the character and colour of the subject); and the fourth, D (the diaphragm used in lens). The sensitive paper is exposed to the light which falls upon the subject, and the time it takes to darken to the standard tint is noted, the pendulum referred to being used to facilitate counting. This done, the pendulum is replaced in the chamber and the A stop is turned round to the figure indicating the seconds; the other pointers are then set to the various factors as above, when the last pointer, E, which is joined to the same ring as the pointer, D, will indicate the exposure required. The instrument may be obtained from most dealers in photographic apparatus, or from the manufacturers, Messrs. Field & Co., Birmingham, for 15s.

The Actinograph.—This instrument is the excellent invention of Messrs. F. Hurter, Ph.D., and Vero C. Driffield, two gentlemen who have laboured hard for photography for more than twelve years, and to whom photographers owe much. The instrument is contained in a small box about 4½ in. long, 2¾ in. wide, and 1¼ in. deep, so that it is no encumbrance, and can easily be carried in the pocket. It consists of four logarithmic scales, two of which are fixed and two are movable, and which relate respectively to the *light*, the *speed of the plate*, the *lens*, and the *exposure*. The light scale is wrapped round a revolving roller, and in contact with this roller is a slide bearing the lens and exposure scales, and fixed in a particular position at the bottom is the speed scale. Sliding between the movable exposure scale and the fixed speed scale is an index bearing six marks; the five upper marks point simultaneously to five different exposures to suit five different atmospheric conditions, and the lower mark is set to the speed of the plate in use. The greatest success of Messrs. Hurter and Driffield is, I think, their method of determining the rapidity of plates, and I shall have a few words to say on this further on. The actinograph is made by Messrs. Marion & Co., and costs 10s. 6d.

It is not everyone, however, who can get cash in sufficient quantity to be able to produce 10s. or 15s. for this purpose on a moment's notice; and, so as not to leave those who may be in these circumstances in the lurch, I will, to the best of my ability, show them how a pretty accurate estimate may be got without an exposure meter.

Exposure Factors.—There are, broadly speaking, four factors that influence the duration of the exposure to give to a plate : viz., the quality of the light, the character and colour of the subject, the diaphragm in the lens, and the sensitiveness of the plate. Let us treat these in turn : a word on each.

Light.—This is at once the most important and the most difficult to overcome. The season of the year, the hour of the day, the state of the atmosphere, whether moist or dry, immediately after or before rain, clear or cloudy, even the direction of the wind—all these have an influence on the actinic force of the light falling on the subject. In December, at midday, the light is about one-fourth as actinic as at the same time in June; while at 3 p.m. in a day in midsummer the actinic force of the light is no less than sixteen times greater than at the same time in midwinter. It would be impossible to lay down any exact rule, but Dr. J. A. Scott's table may be taken as pretty accurate under ordinary circumstances :—

Hour. A.M.	P.M.	*June.*	*May or July.*	*Apr. or Aug.*	*Mar. or Sep.*	*Feb. or Oct.*	*Jan. or Nov.*	*Dec.*
12		1	1	1¼	1½	2	3½	4
11	1	1	1	1¼	1½	2½	4¾	5
10	2	1	1	1¼	1¾	3	5	6
9	3	1	1¼	1½	2	4	*12	*16
8	4	1½	1½	2	3	*10		
7	5	2	2½	3	*6			
6	6	2½	*3	*6				
5	7	*5	*6					
4	8	*12						

* More for a *yellow* sunset.

These figures may be affected in various ways. Thus, after rain or when the atmosphere is moist, shorter exposure is needed, as is also the case when there is water in the immediate foreground, or when taking photographs at the seaside; while in thundery weather or with an east wind longer exposure is necessary.

Subject.—I have prepared the following table from several standard ones, tempered by my own experience, with much care, and it may be taken as a pretty comprehensive and accurate one, containing the ratios of the exposures required for certain subjects, that required for an open landscape being the standard, and taken as 1.

* Mr. Lyonel Clark in his book "Development," which is well worth careful study.

Subject Table.

Landscape, open	1
Landscape, distant	1½
Landscape, near, and buildings	2
Landscape, close	4
Landscape with heavy foliage in foreground...	6
Sea and sky	¼
Dark subjects under trees from 100 to	300
Interiors, fairly lighted	500
Portraits in diffused light out of doors...	8
Portraits taken in ordinary room	200

By "open landscape" is meant an ordinary landscape with nothing near the camera; by "distant landscape," a panoramic view; by "near landscape," an ordinary landscape with objects of interest in the foreground; and by "close landscape," a landscape in which the principal object is in the foreground is understood.

Diaphragm.—Most of my readers are, doubtless, aware of the various uses and the mode of using the stops or diaphragms which accompany all lenses. At any rate, space forbids my going into these points at present. Suffice it to say that all lens stops are graduated either according to the uniform system introduced by the Photographic Society of Great Britain, or according to the relation between the diameter of the aperture and the focal length of the lens. The former system of numbering is based on their relative *areas, together with* a corresponding numbering based on the proportion between the *diameter* of the diaphragm and the focal length of the lens, this latter being expressed as a fraction, with f (focal length) as the numerator, and the proportion which the diameter of the stop bears to the focal length of the lens as the denominator. The latter system is the same as the second half of the uniform system alone. The following are the series, the two together constituting the uniform system, thus: $\frac{4}{f}$; the lower part constituting the other, thus: $\frac{f}{8}$:—

$$\frac{1}{\frac{f}{4}} \quad \frac{2}{\frac{f}{5{\cdot}65}} \quad \frac{4}{\frac{f}{8}} \quad \frac{8}{\frac{f}{11{\cdot}31}} \quad \frac{16}{\frac{f}{16}} \quad \frac{32}{\frac{f}{22{\cdot}62}} \quad \frac{64}{\frac{f}{32}} \quad \frac{128}{\frac{f}{44{\cdot}25}} \quad \frac{256}{\frac{f}{64}}$$

It must be borne in mind that *the exposure varies as the square of the diameter of the diaphragm.* For instance, if the largest stop of a lens of 8 in. focus be $\frac{f}{8}$ and another stop be $\frac{f}{16}$, then the diameter of these stops will be 1 in. and ½ in. respectively, and the rapidity of the stops will be as $(1)^2$ is to $(\frac{1}{2})^2$: *i.e.*, as 1 : ¼, : *i.e.*, as 4 : 1; therefore with the smaller stop the exposure required is four times that required with the larger. It will thus be seen that stops numbered according to the uniform system each require twice the exposure of the one larger.

Plate.—The subject of the relative rapidities of plates is a difficult one, and one which cannot be satisfactorily settled. Some makers advertise their plates as being so many times (twenty times, thirty times, sixty times, etc.) the speed of a wet collodion plate. Apart from the fact that the majority of photographers of the present day have no experience whatever of wet plates, that these alleged speeds are otherwise most arbitrary and unreliable, and that wet plates themselves vary in speed, the system of referring one plate to another as standard is bad. Again, other makers state that their plates register such and such a number on Mr. Warnerke's sensitometer; but this is a most crude and unsatisfactory method of judging the speed of the plates. You may purchase to-day a plate of a certain maker and with a certain label, and you will find it to be of a certain speed; but this is no criterion that if you purchase another sample of what professes to be the same plate, in a few months' time you will find it of the same speed. The best plan is to expose two or three plates under the same conditions on an open landscape with no near foreground, the light at its best, and the lens with an aperture of $f/64$. The first plate might receive an exposure of 1 second; the second, an exposure of 1½ second; the third, 2 seconds; the fourth, 2½ seconds; and the fifth, 3 seconds. When developed with the *same normal* developer, mixed fresh for each plate but in the same proportions, the correctly exposed plate may easily be found. Make a note of the exposure it received, and call it the "normal exposure" for the particular brand of plates. Supposing the correct exposure has been found to be 2 seconds, the following might be noted down: "A's—plates require an exposure of 2 seconds when the lens is worked with an aperture of $f/64$, the subject being an *open landscape* with no near foreground, and the light at its best; therefore these plates will require an exposure of $\frac{1}{128}$ second, when the lens is worked at $f/4$, the light and subject being the same."

It was in a manner similar to this that Mr. Watkins found the exposure numbers of plates for his actinometer. Messrs. Hurter and Driffield determine the speed of a plate by estimating the amount of silver deposited after exposing the plate to a standard light for a standard time; in their case the sky light. This method is based on scientific principles, but space forbids further amplification at present. Suffice it to say that at the present time their method is attracting considerable attention, and at least one firm of plate makers have adopted it.

How to make the Calculation.—Now, when about to take any photograph, after you have set up your camera and are ready to expose, look up Dr. Scott's table (you could buy an extra number of WORK, cut out the tables, and paste them in your pocket-book, to be always handy) for the relative actinic force of the light at the time of exposure; multiply the number found there by that representing the normal exposure of the plate you are using. Having done this, consider the state of the atmosphere. If the sun be obscured by light clouds, multiply the answer found as above by 2; if it is "dull," multiply by 3; if "very dull," by 4; if "gloomy," by 5. Multiply this in turn by the number to be found in the Subject Table, and this again by the number of the stop according to the uniform system. To make this clearer, let us, *exempli gratiâ*, take the following:—

We are about to photograph a landscape with some object of interest in the foreground. It is in the month of April, about 2.30 p.m.; sun obscured by light clouds. We are using stop $f/45$, and a plate which we have already found to require $\frac{1}{128}$ second normal exposure. We find in Dr. Scott's table the relative actinic force of the light to be somewhere between 1¼ and 1½. Let us take 1½. Our plate is $\frac{1}{128}$ normal exposure; therefore, so far, we have got $\frac{3}{2}\times\frac{1}{128}$; the sun being obscured, we must multiply by 2: $\frac{3}{2}\times\frac{1}{128}\times\frac{2}{1}$; on the Subject Table we find the factor 4; following instructions, we have $\frac{3}{2}\times\frac{1}{128}\times\frac{2}{1}\times\frac{4}{1}$; $f45$ requires 128 times the exposure required by $f/4$; therefore we have $\frac{3}{2}\times\frac{1}{128}\times\frac{2}{1}\times\frac{4}{1}\times\frac{128}{1}$; cancelling, we get $\frac{3}{1}\times\frac{1}{1}\times\frac{1}{1}\times\frac{4}{1}\times\frac{1}{1} = 12$, which is the exposure required in seconds.

Timing Exposures.—A word on this subject. It will be found that every five counted as rapidly as possible give 1 second; or a stone tied to a string 10 in. long will swing from one side to the other in ¼ second, and will go and return in ½ second. A watch usually ticks five times during a second.

Raising the Lens-Cap.—When exposing, the cap of the lens should be lifted slowly up from the lower side, using the upper part as a hinge, and brought to a horizontal position above the lens; it should then be replaced by a reversal of the movement. By this means considerably more exposure is given to the foreground than to the sky—a very desirable thing.

Exposure Notebook.—An exposure notebook should always be kept, and the requisite notes made at the time of exposure. This will materially assist at the time of development, and also form a useful record of successful exposures, which will be found a great help in estimating future ones. Most dealers in apparatus supply these books, but one can be made by the reader himself, which will be quite as useful, if not more so. Spaces might be made for number of plate, date, hour and light, plate, subject, lens, stop, exposure, remarks before development, remarks after development. The remarks before development might be on anything which would facilitate that operation; those after development on the most suitable printing process, etc.

Concluding Remarks.—In conclusion, I may say that the tables and data I give here are not put forward as infallible. Infallibility is impossible in any instructions in photography, although it is possible to give information which will help the novice on the road to success. This information I claim to be contained in the above; the rest is learned by experience, which, says Carlyle, "does take dreadfully high school wages, but he teaches like no other." I ask my readers to study the above instructions most carefully, when they will find that they are not so elaborate as they may appear at first sight. I may add that the exposure should be sufficient for the deepest shadows, and that it is always preferable to over- rather than to under-expose. Two plates should be exposed on any particular subject, the one receiving considerably more exposure than the other; if, then, the shorter exposed one be developed first, a clue will be gained to the treatment of the other.

HORSE-SHOES.

LIGHT shoes for horses save their legs. The heaviest horses may have fore-shoes 1 lb. weight each; hind shoes 12 oz. each. If 4 oz. are added to each shoe in weight, then, as a farm horse walks from ten to twenty miles a day—with a ½ lb. more on his fore feet—he lifts 660 lb. in a mile, or 9,900 lb., or nearly 5 tons, in fifteen miles. By using aluminium shoes, a horse would lift only half what he does now with iron shoes. The shrewd racing men are putting aluminium shoes on their racers.

SIMPLE UTENSILS FOR THE GARDEN.

BY C. MAYNARD WALKER.

A Garden Roller.

It would be superfluous to enlarge at any length upon the value or the usefulness of some sort of a roller in a garden for the purpose of keeping the walks and grass up to that degree of neatness which all lovers of gardens soon learn to aim at; but a roller is a somewhat expensive article, hence comparatively few persons possess one. Now, the making of the garden roller shown in Figs. 13 and 14 is a job which any intelligent amateur may undertake with confidence, even though he may have never touched similar work before. Figs. 13 and 14 represent a garden roller with an iron frame and a roller made of artificial stone, in making up which one can hardly go wrong, for the iron frame, to begin with, is made up with what is known as "iron barrel," and this can be bought in the required lengths, already screwed, and also the various elbows, T's, etc., so that one has only to take care to order the correct sizes to ensure a strong, true, and easily-fitted frame. This gas barrel can be obtained through any local ironmonger, or direct from Messrs. Treggon & Co. The proper sizes and fittings are given further on. The roller itself is made of artificial stone—a material which is easily made, and when properly so, is very hard, and practically of unlimited durability. The one represented in Fig. 13 has a cylinder 17 in. wide by 15 in. diameter: a size which I apprehend will commend itself to most people, the frame and handle measuring 3 ft. from the centre of the roller. Now, as part of the barrel is used in the construction of the roller, it should be ordered at once. Fig. 14 costs about 1s. 3d. less in material and a trifle in time, and although it may not look so much like the conventional roller, is every bit as effective, and really stronger: $\frac{3}{8}$ in. barrel will answer the purpose; but should it be desired extra strong, $\frac{1}{2}$ in. may be used, costing about one-third more; so that, assuming Fig. 14 to be decided upon, we shall require to get one length $18\frac{1}{2}$ in. for the centre, two ditto $12\frac{1}{2}$ in., two ditto 20 in., two ditto 9 in., one ditto 18 in., four $\frac{3}{8}$ in. equal elbows, and two $\frac{3}{8}$ in. equal T's. Fig. 14 will show the respective places for each piece: the barrel, when bought, will have a socket on one end; this must be taken off, and put aside, except one which we shall use to connect up the frame at the point C. One of the 9 in. pieces should be ordered with a long screw, or "connector," for this purpose. Now for the roller itself. The materials required will be two pecks of Portland cement and one and a-half bushels of builders' sand: it is well to get as much as this to provide against any mishap; and, moreover, if any is left over it may be used for rock-work, as described in the second of the present series of articles. The roller is to be made in a mould (Fig. 15), for which purpose prepare some rough boards and make a platform (Fig. 16), about 2 ft. square—if larger, so much the better; from the centre of this cut out a circle, $15\frac{1}{8}$ in. in diameter, with a keyhole saw, and in the centre of the circle so cut out, bore a $\frac{5}{8}$ in. hole; get a sheet of thin iron sufficient to roll up a cylinder 19 in. long by $15\frac{1}{8}$ in. diameter; insert one end of this into the hole of the platform. Two cross-pieces should be nailed upon the underside of the platform, to prevent the iron going too far through. Now plane off from the circular piece of wood about $\frac{1}{16}$ in., to enable it to fit inside the iron; push it well to the bottom. The top of the hollow iron must also be fitted with a circular piece of the same diameter, and bored with a $\frac{5}{8}$ in. hole in the centre, and must also be cut away in places to enable the concrete to be put in and rammed. Having fitted these up straight and true, tie up the iron cylinder with strong wire, and the mould is then ready for use. Before proceeding to make the stone, sift the sand through an ordinary cinder sieve, and put aside the coarser part, which will be used towards the centre of the roller in preference to the outside; mix the cement and sand up together in its dry state, in the proportion of four parts sand to one of cement, with plenty of elbow grease. When well mixed, add water until the whole mass is thoroughly incorporated, and just about the thickness of ordinary mortar, or a trifle less; put it into the iron cylinder (the barrel being in the centre) a little at a time, *and well ram it home* with a wooden rammer; neatly smooth the top, when filled, by working the top wood round. If $\frac{3}{4}$ in. boards are used, the gas barrel should be flush with the top of the board when finished, so that when the roller leaves the mould the axle will project $\frac{3}{4}$ in. at each end from the stone. The method of connecting the frame will be readily understood from Fig. 14. The threads of the ends of the axle are filed off smooth, so that they run easily, and do not bite in the sockets. Assuming, then, that the frame is put together with the exception of the cross-piece, C, we spring the sockets of the elbows over the axle ends; then, by putting in the connecting-piece, C, and screwing up the running socket, we bring the two together, and the frame is taut and rigid. Leave the stone-work for a few days before taking off the mould, and do not use it until quite *hard and dry*.

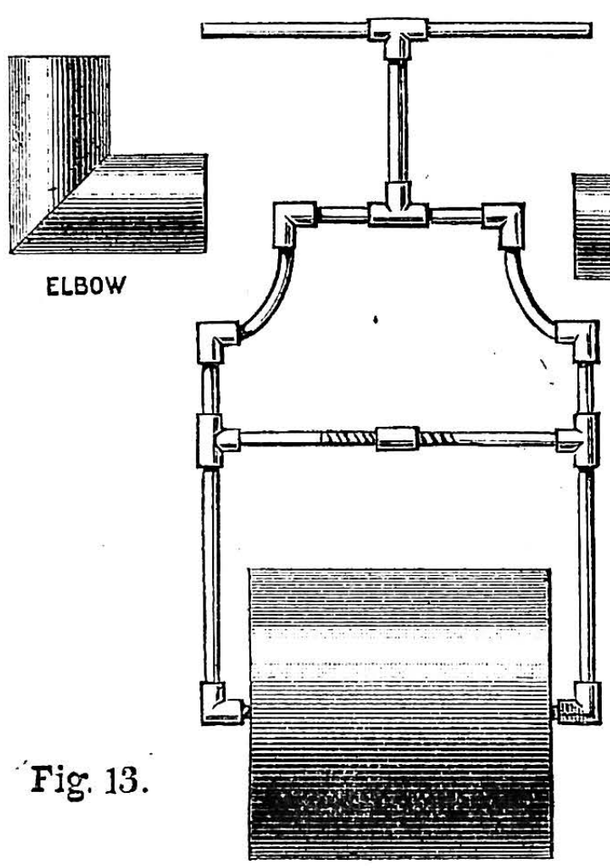


Fig. 13.

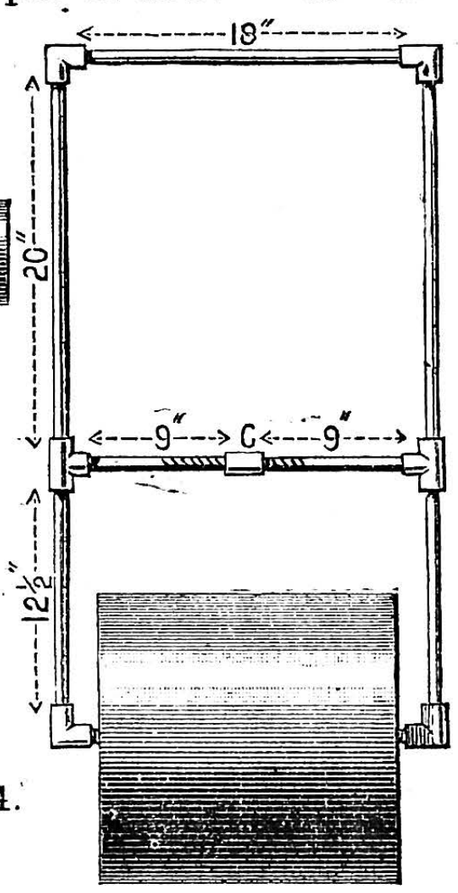


Fig. 14.

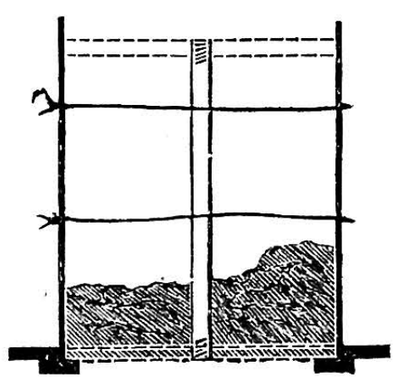


Fig. 15.

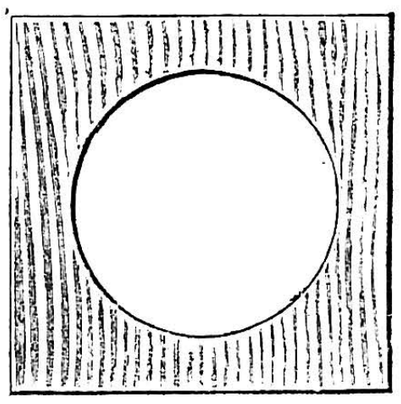


Fig. 16.

A Garden Roller. Figs. 13 and 14.—Roller complete. Fig. 15.—Showing Method of forming Concrete Cylinder. Fig. 16.—Platform.

IRON BRIDGE MODELLING IN CARDBOARD.

BY FRANCIS CAMPIN.

Composition of Arch and Tie—Of Uprights—Of Cross Girders—Of Rail-Bearers—Cover Plates—Mode of constructing the Arch and Tie.

In Fig. 6, A shows a cross section of the arch, and B a similar one of the tie, which latter is composed in the same manner as that of the former, but it is reversed in position: there are six rows of rivets. It is not to be supposed that in making a model to scale we can follow the variations of thickness in the plates; but this will not be apparent so long as we have the right number of plates represented in card. It will be seen that the sections are each made up of three horizontally placed plates 2 ft. 6 in. wide, and two vertical plates 12 in. wide, the latter being connected to the former by the 4 in. by 4 in. angle irons. Fig. 5 shows at A a cross section, and at B a front view of one of the uprights, E (Fig. 1). It is built up of four angle irons, 3 in. by 3 in., connected together by a lattice-work of flat bars $2\frac{1}{2}$ in. wide, and stiffened at the top and bottom by plates (C) riveted in between the angle irons. A cross section at the centre of a cross girder is shown in Fig. 7, and one of the longitudinal rail-bearers at Fig. 8. In these last figures the angle irons, A, A, are provided to carry the buckled plates which form the floor.

We must now decide upon the scale to which the model is to be made, and this will depend upon the room it is desired that it should occupy. If one-half of an inch to a foot is adopted, the total length of the model arch will be 52 in., and this seems a convenient size—at all events, for a first attempt—as all the parts are well within the control of one person, and yet the details will not be inconveniently small to handle, as the small angle bars will be $\frac{1}{8}$ in. wide. Should it be desired to use forceps or small pliers to put the smaller pieces in place, the insides of their jaws must be made smooth, to prevent them from making dents in the cardboard.

The flange plates are made in lengths from 16 ft. to 20 ft., and require to be connected by cover joint plates, placed as shown on the enlarged detail, Fig. 9. A single cover plate is used in making the joints in the transversely horizontal plates, and the joints in

the side plates are secured by thinner plates inside and out. The joints in the three superposed plates are near together, and each set is covered by a $\frac{5}{8}$ in. plate 2 ft. 6 in. wide, and 8 ft. 8 in. long. The inside radius of the side plate is 118 ft., and the outside radius 119 ft.; so the actual size to which these parts are to be cut will be $56\frac{1}{2\,4}$ in. and $56\frac{1}{2\,4}$ in. On account of the limited sizes in which the Bristol board is made, these plates will have to be cut in short pieces and joined—say, about 10 in. long; the outlines may be marked on with a beam compass carrying a fine pencil, and the line so made followed carefully with the knife, or a knife may be fitted to a sliding socket on the beam compass; the instrument described above is not suitable for such large arcs, or a short template may be cut out of zinc and used to cut the different pieces of the side plates by. The vertical limbs of the top angle irons will also be similarly marked and cut; the inner radius will be $\frac{1}{8}$ in. less than the outer. There exists a temptation to cut curved edges with scissors; but this should not be done, as the edges left are not so good for taking the glue or cement used for uniting the parts. The cover plates, A (Fig. 9), will be equal in depth to the side plate less the depth of the angle iron, but the covers inside will be the same depth as the side plates. The ends of the lengths of the side plates must be cut off to a truly radial line. The extreme ends of the arched side plates are to be cut off horizontally and joined to the side plates of the tie, D, with covers on each side; these covers, when used on both sides of the joint, may be made of thinner card than the pieces they join, in order to avoid the appearance of clumsiness. So that accuracy may be secured in joining up the side plates, the outline of the side should be drawn on a board, the pieces laid in position upon it and weighted, and the covers then glued on one side; when they are dry, the work is turned over, and covers are glued on the other side.

The main angle irons are 4 in. by 4 in.; the curved vertical limbs are to be cut to the full depth, $\frac{1}{8}$ in., and these fastened on to the side plates, so that the convex edges coincide. Should there be any irregularity in the edges, it may be removed by glass-paper, prepared as follows:—Get a sheet of the finest glass-paper procurable, and glue a piece of it on to a perfectly smooth flat strip of wood of a convenient size for the hand; when dry, rub this down with another piece of the glass-paper until it is nearly smooth; the instrument thus made is applied lightly as a file to remove slight inequalities. Should the cutting knife slip away from the template, and so make a bulge, it is not always easy to re-enter the line without causing a notch, and in such cases a cabinet-maker's fine chisel may be found of service; this tool is also of use in clearing out square corners, as in cutting out the centre part from a buckled plate fillet. The top and bottom members will be made in six lengths, so there will be five cover plates 8 ft. 8 in. by 2 ft. 6 in., ten covers 2 ft. 8 in. by 1 ft., and ten, 2 ft. 8 in. by 8 in.; the last come on the outside of the side plates for each member. The actual sizes of these covers in the model will be respectively $4\frac{1}{4}$ in. by $1\frac{1}{4}$ in., $1\frac{1}{3}$ in. by $\frac{1}{3}$ in., and $1\frac{1}{3}$ in. by $\frac{1}{3}$ in., but these dimensions should be taken from a properly divided engineer's scale of half-an-inch to the foot. What is called a "universal" scale, with all the scales in common use marked upon it, is very convenient, as not only does it contain any scale required, but the smaller scales are very handy, as giving sub-divisions of the larger. These scales may be had in box-wood or ivory from any dealer in drawing instruments; 1 ft. long is the most convenient size for use.

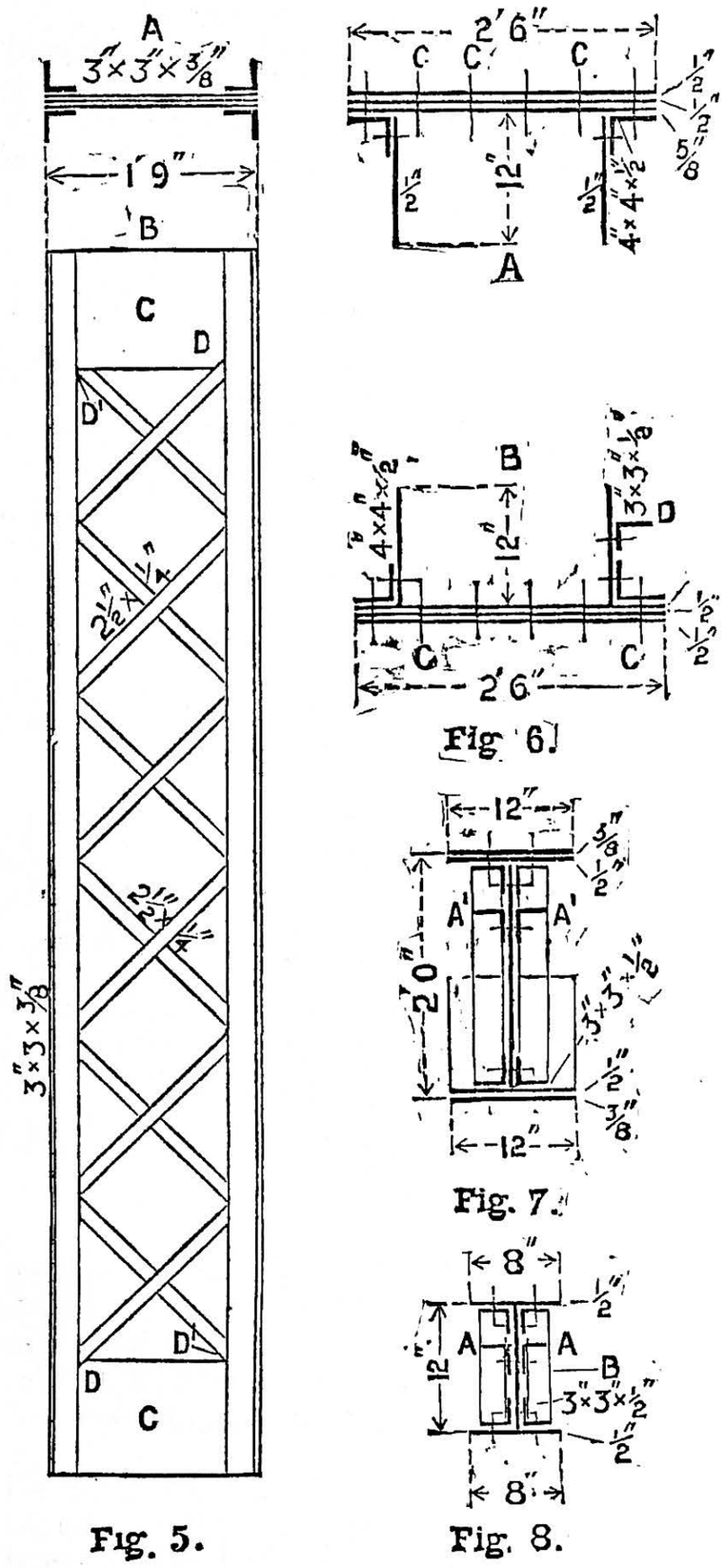
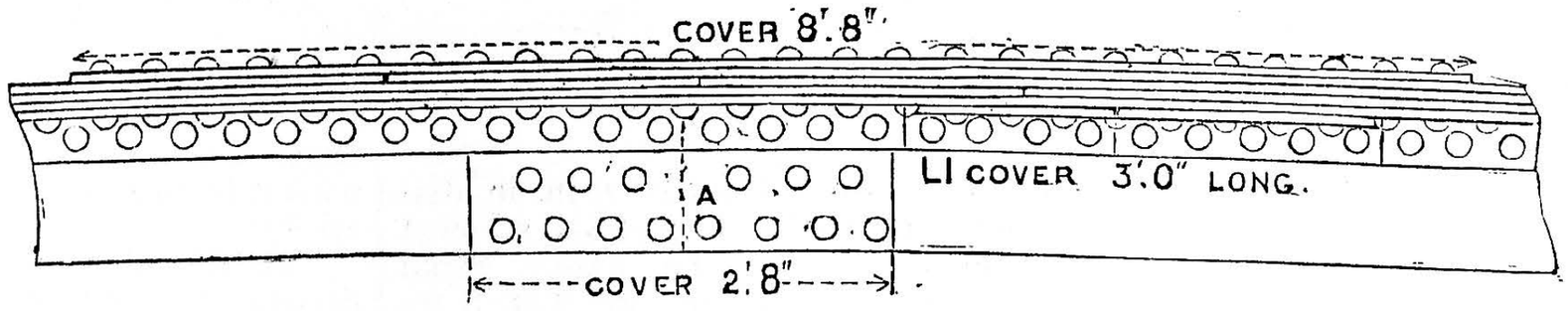


Fig. 5. Fig. 6. Fig. 7. Fig. 8.

Iron Bridge Modelling in Cardboard. Fig. 5.—A, Cross Section of Upright; B, Front Elevation of ditto. Fig. 6.—Cross Section of Arch and Tie. Fig. 7.—Cross Section of Cross Girders. Fig. 8.—Cross Section of Rail-Bearers.

While the side plates, their covers, and the vertical iron limbs upon them are drying, it is presumed that the flange plates remaining and their covers are cut out. The horizontal limb of the angle iron is narrower than the vertical by the thickness of the cardboard, whatever that may be. Lines are marked on the inner tier of plates, and the horizontal limbs of the angle irons accurately attached. In the example these run along the edges of the plates, so that no lines are requisite, the said edges forming the necessary guides; the parts thus attached are then lightly weighted for a short time; these should not have time to quite set before being attached to the side plates, as the joints may have to yield a little in bending. All remarks about the arch apply also to the tie, with the obvious exception that this member is straight. The positions of all uprights and other connections are marked upon the outsides of the side plates before the latter are joined to the top or bottom plates, and if rivet heads are to be shown, they must also be drawn on the side plates, angle iron limbs, and outside top and bottom plates. The heads in this case are $1\frac{1}{2}$ in. in diameter, and fine pliers will be found most convenient for putting them on; and great care must be taken to have very little glue on them, so that they will not slip; for although rivet heads properly placed give an excellent effect, if irregular they destroy it, and make the whole work look slovenly. The rivets are 4 in. apart, centre to centre; their positions may be indicated by small pencil circles put in with a pair of spring bow compasses; the heads are cut out of the card with a clean leather-punch of the nearest convenient size; the actual diameter on the model should be $\frac{1}{16}$ in. All the marking on the side plates is to be done before their connection with the top and bottom plates, and the rivet heads should also be put on before these joints are made. The best method of marking these places will be from a diagram showing the under side of the arch and upper side of the tie, and all the work lying between them, then the markings will coincide in all parts, and the work will be kept square and true. In marking the rivet centres from which the circles showing their positions are to be described, the dividers should not be stepped along the line the whole length with one rivet pitch—4 in.—but should first be divided off into larger spaces, corresponding with the various points and connections; otherwise, an error, microscopic at first, may become painfully apparent towards the end of the line—the grain of the card may tend to throw the points of the dividers out of the true position. In weighting parts glued together, only sufficient pressure to keep them in close and even contact should be used; any excess will almost certainly cause one part to slip upon another.

The horizontal limbs of the main angle irons having been secured to the inner flange plates, the edges of the side plates are to be touched with glue, and the inner flange plates applied to them so that the limbs of the angle irons fit, and held until the glue holds. To facilitate this part of the operation, blocks of wood may be placed between the side plates to ensure their parallelism while the glue is setting. During this part of the work it is advisable to have the member laid on its side on a flat board, the lower side plates being packed up so as to keep the flange plates at right angles to the board upon which they are laid; this will ensure the straightness of the members. The inner tier of plates having been thus secured to the side plates, the outer tiers and covers are to be superposed; of course, the first layer should be allowed time enough to become thoroughly set—in fact, if glue is



Iron Bridge Modelling in Cardboard. Fig. 9.—Cover Plates for Flange Plates, Side Plates, and Angle Irons of Arch and Tie.

used these should not be touched for twelve hours; by that time great solidity of the joints will be ensured. The arrangement of the flange-plate joints under the covers is shown at Fig. 9, where also is shown the arrangement of rivets in the side plates. The positions of the rows of rivets in the flange plates are shown by vertical lines, C, in Fig. 6. The outside rows are each $1\frac{3}{4}$ in. from the outer edges; the spaces between these are equally divided.

It may be of some utility here to point out that in angle and T irons the rivets are placed in the centre of the clear part of either limb: thus, if there is a 4 in. by 4 in. by $\frac{1}{2}$ in. thick angle iron, the clear width on either limb is evidently $3\frac{1}{2}$ in., and so the centre lines of the rivets will be $1\frac{3}{4}$ in. from the outer edges. In a T iron 6 in. by 3 in. by $\frac{1}{2}$ in. thick, the clear width on each side of the central rib is $2\frac{3}{4}$ in., and therefore the central line of rivets will be $1\frac{3}{8}$ in. from the nearest edge of the T iron. We think it as well to mention these matters, as the amateur modeller may get drawings upon which some of the dimensions are not figured, which would leave him at a loss as to the practice in this matter. While on this subject, it may be mentioned that the centre of a rivet should never be further in from the edge of the work than one and a half diameters: that would be $1\frac{1}{8}$ in. for a $\frac{3}{4}$ in. rivet; but where there is room, two diameters should always be allowed. While the arch and tie are drying, blocks of wood should be kept between their side plates, and more especially at their ends, in order that they may fit exactly together without any straining on either part. When thoroughly set, they are to be placed in exact position over a diagram, and connected by cover plates, F (Fig. 3, page 266), on the outside; when these have set, other covers may be inserted in the inside and the space between them, and enclosed by the lower edge of the arch and the upper one of the tie, filled in with a card packing of the same thickness as the side plates. The main angle irons have covers 3 ft. long.

A RUSTIC CARRIAGE ENTRANCE.

BY ARTHUR YORKE.

RUSTIC GATES AND FENCES—MATERIALS—CONSTRUCTION.

Rustic Gates and Fences.—In a former paper (Vol. I., p. 247, No. 16) I gave illustrations of various designs for rustic fences for garden purposes, and it may be presumed that it is through some such fence as those there shown that the present entrance gates will open. The intention is, of course, that the rustic archway above them shall be more or less clothed with climbing plants. It is for roses that the structure will be best adapted, though clematis or honeysuckle will look well upon it. Ivy would look too heavy, and if neglected, might even prove too heavy in other respects.

It must not, however, be inferred that the arch, under any reasonable stress, will want for strength. Light as it may appear, the four posts grouped to form the turret on either side are so tied and braced together as to be, to all intents and purposes, a solid pillar, 30 in. square, and fully equal to resisting any outward thrust of the rafters. The design is, of course, fantastic, but that it should be so is allowable, and, indeed, expected, in rustic work, to an extent not to be tolerated in more solid materials.

In the elevation (Fig. 1) I have, to avoid confusion, given no indication of the work forming the farther side of the arch, though something of it would necessarily be seen

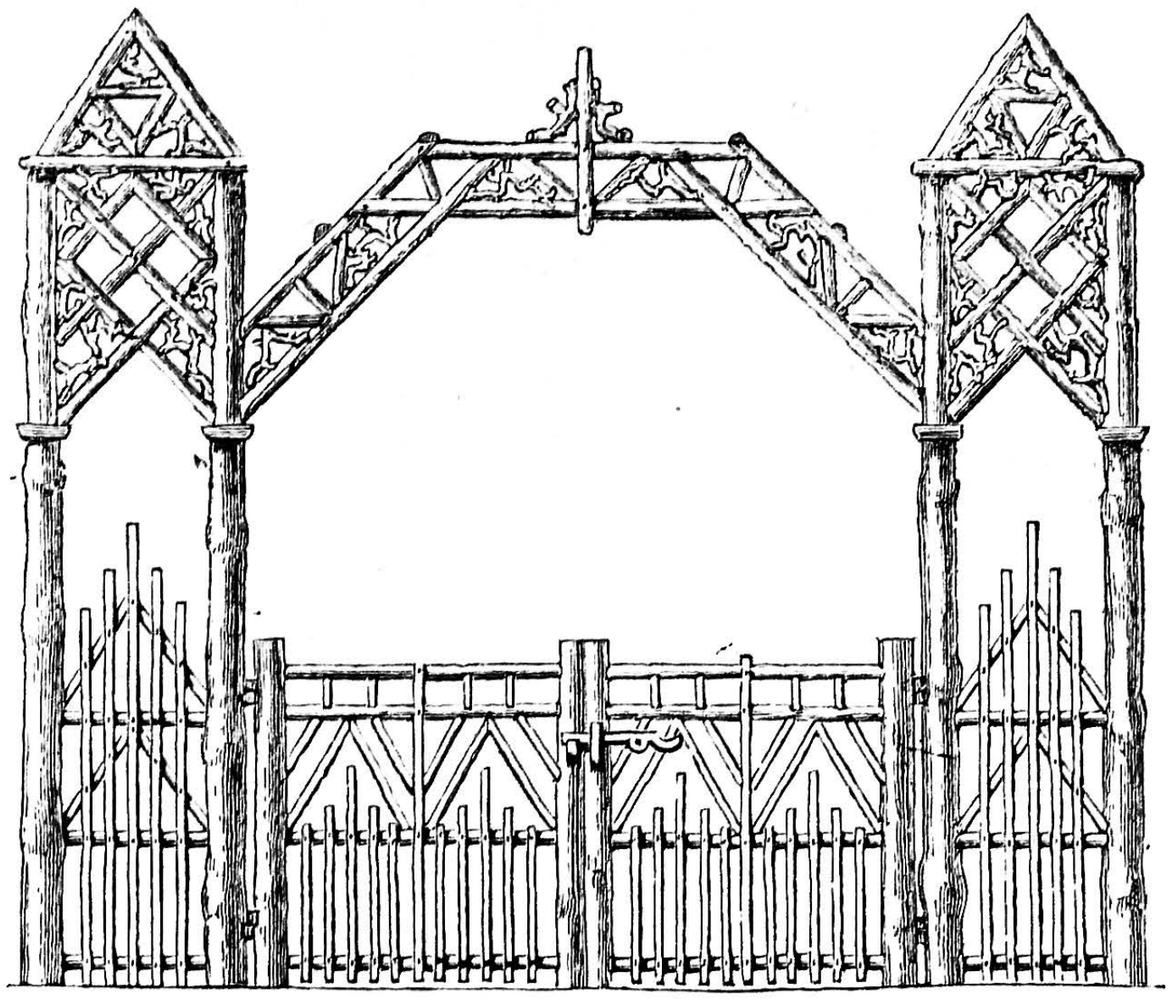


Fig. 1.—Elevation.

from the front; the two sides will be alike. Nor have I shown much of the work which connects the two sides, and which is of the same breadth as the turrets—viz., 2 ft. 6 in. The two illustrations are drawn to a scale of $\frac{1}{2}$ in. to the foot.

Materials.—The posts, and at least all the more important straight pieces, should be of larch. The particular kind of wood chosen for filling-in will not be particular, provided it has picturesque forks and contortions. Small oak bangles will, perhaps, be most appropriate.

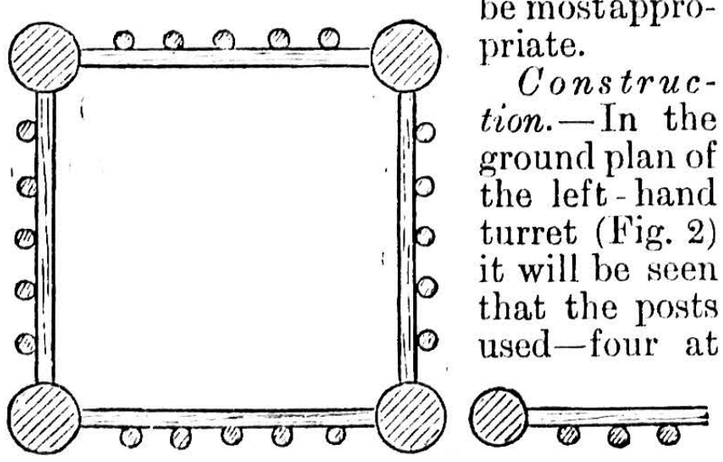


Fig. 2.—Plan of Left Side.

Construction.—In the ground plan of the left-hand turret (Fig. 2) it will be seen that the posts used—four at each end—are some 5 in. or 6 in. in diameter, and that the largest is selected as hanging-post for the gate. From centre to centre they are set 2 ft. 3 in. apart. They are 13 ft. long—that is, 10 ft. 4 in. above ground and 2 ft. 8 in. below. The rafters of the arch (if it may be called an arch) spring from them 7 ft. from the ground, and at this point each post is surrounded by a cap, formed of four pieces of quartered stuff nailed upon it. The rafters are not mortised into the post, but if, instead of being merely nailed, they are attached by a bolt and nut, a stronger joint will be made.

The upper rafters, back and front, are connected by five straight cross-pieces, of which the ends show in Fig. 1. The spaces between these are filled up very much at random with crooked stuff.

The four posts of each turret are bound together close beneath their tops by cross-pieces nailed outside them, whilst from their tops, and nailed down to them, slant four short rafters, which meet pyramid-wise in the centre. The filling up of the upper parts of the turrets, as well as of the front and back of the arch, is with a mixture of straight and crooked stuff, the arrangement of which is clearly shown in the elevation (Fig. 1).

In the lower parts of the turrets and in the gates the practical end of excluding animals has to be kept in view, and the palings are so arranged as to leave no space between them wider than 3 in. The rails of the gates should, of course, be mortised into the heads and hinge-trees.

ORNAMENTAL AND EASILY-MADE UMBRELLA STAND.

BY G. TOUT.

HALL furniture is not generally thought so much of as that of any other part of the house. All the rooms, from the drawing-room to the kitchen, have designs innumerable, both for use and ornament; but we find in many houses the hall contains only a few hat and coat hooks, and the umbrellas and sticks standing in a corner, unless the umbrellas have been brought in wet, then they are nobody knows where to dry.

I think the readers of WORK will find the umbrella stand here described useful and somewhat ornamental, and if they care to set about it, not difficult to make. I have so designed it that any ordinary carpenter or cabinet-maker, amateur or professional, can do all the work required himself (there being no turned work in it) except the zinc or tin trays, or pans, to catch the drippings from the umbrellas. These I got a plumber to make for me at a very trifling cost. Something could, no doubt, be got at an ironmonger's, ready made, for about 4d. or 6d. each. The holes in the bottom could be cut to receive any size pan. The pan should be left loose, that the drippings may be emptied.

Referring to the perspective view, you will see in the middle I have formed a small table for card or letter tray, or to rest a parcel, or stand a plant or fern pot. Under this is a drawer for brushes, gloves, etc., and each side an open space for umbrellas and sticks.

The back above the table is made in five divisions, in which are fixed ornamental tiles. If you are acquainted with a builder, he would, perhaps, give you a few odd ones. That is how I got mine. The front legs are worked out of one solid piece, on three sides only; the back outside legs are stop-chamfered, and the two vertical pieces, of mullions, are left square.

Fig. 1 shows the front elevation of front legs and part of table top, A. The top is made 1 in. thick, 12 in. wide, and 17 in. long. The drawer B, is 3 in. deep,

and as long and wide as space will permit. The rail, C, at bottom of drawer, is 1 in. thick and about 2 in. wide. It should be tenoned into the legs about $1\frac{3}{4}$ in., and well glued. The arch, D, below this is cut out of a board $\frac{1}{2}$ in. thick, 4 in. wide, and a small chamfer made round it. It is grooved into the rail and legs about $\frac{3}{8}$ in. deep. The bracket, E, is made from stuff $1\frac{1}{8}$ in. thick, $5\frac{1}{2}$ in. long, and 2 in. wide. I have moulded the top part of it, as shown in E (Fig. 2), and done a little amateur carving on the bottom. The front rail, F, for holding umbrellas, is octagon in shape, $1\frac{1}{4}$ in. in diameter, tenoned into legs at one end, and into bracket or arm (Fig. 6) the other.

Fig. 2 shows side elevation of front leg and bracket, with part of rail which encloses drawer. This rail, G, is 1 in. thick, 4 in. wide, and tenoned into front legs and into the vertical pieces, or mullions, at back. The tenons in this case may come through back and front, and be glued and wedged, as the brackets, E, planted on the front legs will hide the ends of tenons, and the back will not be seen. It will make a much stronger job than "stump," or short tenons. The position and a section of front rail, F, are also shown.

Fig. 3 shows a vertical section through drawer and tiled panels. The top rail, H, is $2\frac{1}{2}$ in. wide by $1\frac{3}{8}$ in. thick, moulded on top edge, and grooved $\frac{1}{4}$ in. deep on bottom edge, to receive the tiles. The bottom rail, J, is 2 in. wide by $1\frac{3}{8}$ in. thick, grooved on top edge for tiles. The tiles, K, are 6 in. square and about $\frac{1}{4}$ in. or $\frac{3}{8}$ in. thick. The drawer front, M, is $1\frac{1}{8}$ in. thick, with raised front, as shown on larger scale in Fig. 9. The bottom, N, is $\frac{3}{8}$ in. thick; the back, O, $\frac{1}{2}$ in. thick. The runner, P, is tenoned into the rail, R, and screwed to the sides. The rail, R, is described in Fig. 1.

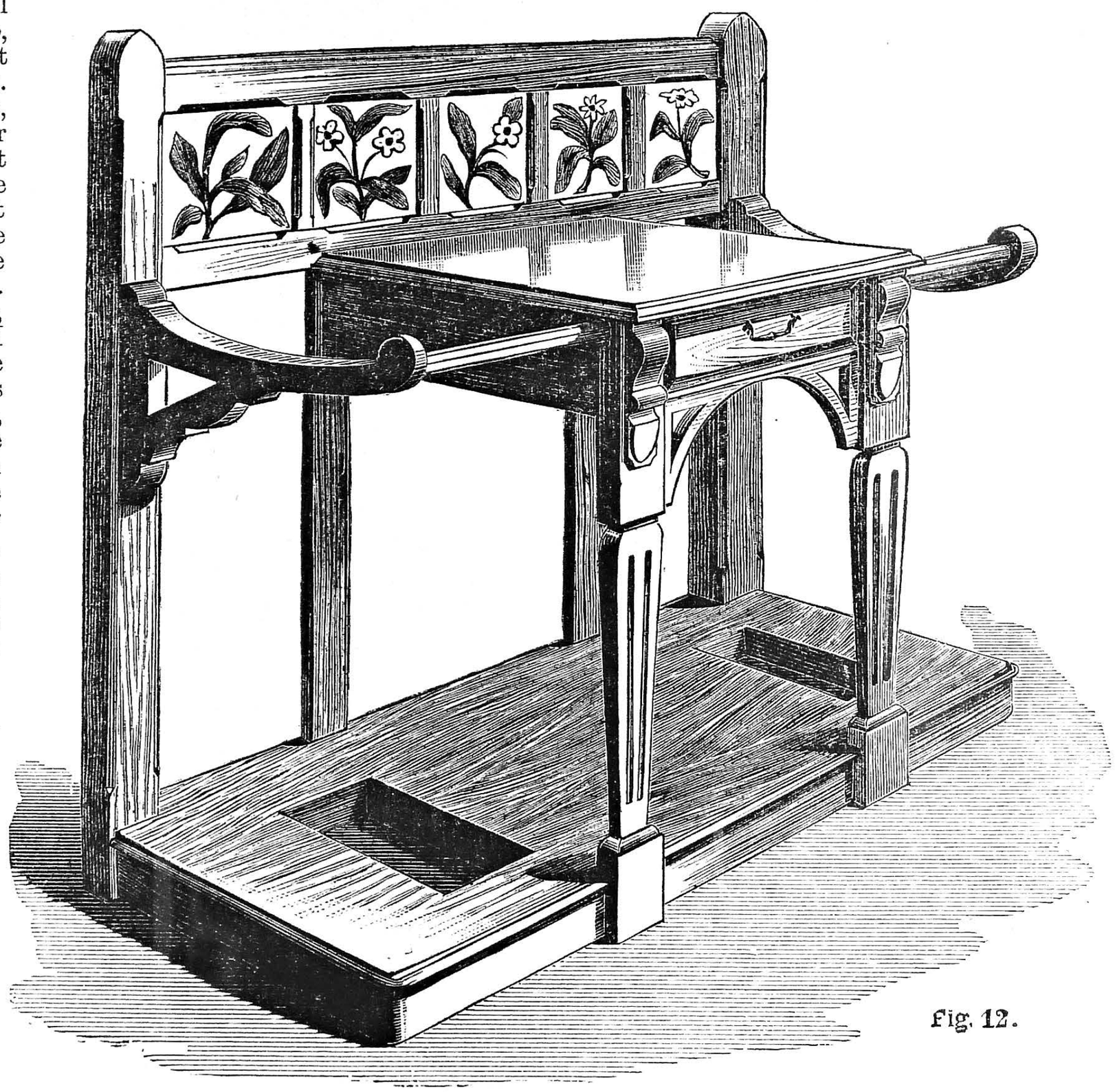


Fig. 12.

Fig. 4 shows section through lower part of stand. The front rail, S, is 1 in. thick by 2 in. wide, tenoned into front legs. The back rail, T, is same size, and tenoned into back legs, and mortised to receive the two mullions. The top, V, is $\frac{3}{4}$ in. thick, with the top front edge chamfered.

Fig. 5 shows horizontal section through tiled panels. The mullions, W, are $\frac{3}{4}$ in. by $1\frac{3}{8}$ in., grooved on each side for tiles, and the front edge stop-chamfered. The legs, X, are $2\frac{1}{4}$ in. by $1\frac{3}{4}$ in.

Fig. 6 is an elevation of the arm, or bracket, for holding umbrellas. This has two tenons through the back leg, and, well glued and wedged, makes a strong job.

Fig. 7 shows a cross section of the drawer. Most of the parts shown here have been described in Figs. 2 and 3. A is a section of runners, B of the rails enclosing drawer, C the sides of drawer, and D the blocks glued to bottom and sides to strengthen it.

Fig. 8 shows section lengthway of bottom part. The end rails, E, are tenoned into back legs and tongued into front rail, as shown in Fig. 10. The bearers, F, are tenoned into front legs and back rail.

Fig. 9 shows an enlarged section through front of drawer, as described in Fig. 3.

Fig. 10 is described in Fig. 8.

Fig. 11 shows an elevation of arch under drawer. It is a little different from that shown in the perspective view, being struck from four centres instead of two. It makes a little more work, but looks better.

I have made this stand with some good old oak, but mahogany or other hard wood would do, or even deal, if well cleaned up, and stained and varnished, or polished; but hard wood, of course, is best, and wears best. It gives more satisfaction generally.

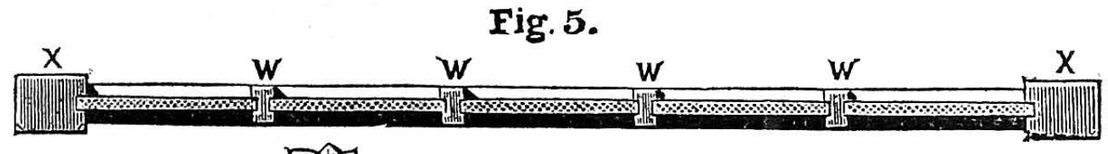


Fig. 5.

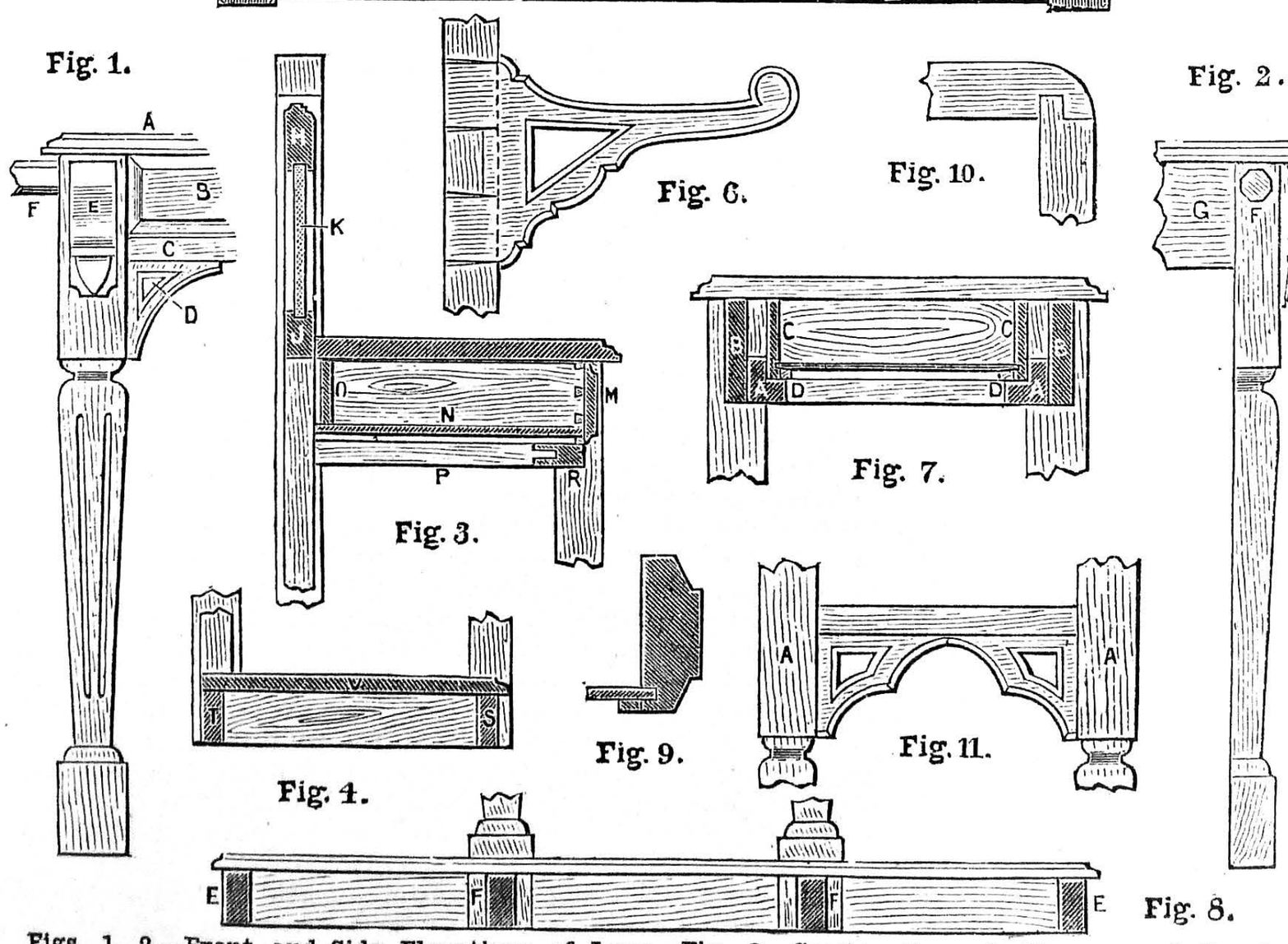


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11.

Figs. 1, 2.—Front and Side Elevations of Legs. Fig. 3.—Section through Drawer and Panels. Fig. 4.—Section through Bottom. Fig. 5.—Section through Panels. Fig. 6.—Elevation of Arm. Fig. 7.—Cross Section of Drawer. Fig. 8.—Section lengthway of Bottom. Fig. 9.—Section through Drawer Front. Fig. 10.—Angle Joint. Fig. 11.—Arch. Fig. 12.—Perspective View.

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PHILANTHROPY TOWARDS INVENTORS.—It has been said that one of the characteristics of the present day is intense selfishness, and a great indifference to the necessities and requirements of other people. Any person having heard these views enunciated would, no doubt, be considerably puzzled to reconcile this idea with what he can read in relation to inventors and intending patentees, combined with proposals to render them assistance on various terms, even so far as proffering advice for *nothing!* We have watched from time to time some of the most noteworthy, and propose here to deal with a few of them, in order that inventors and others may get an idea of the benefits as likely to accrue to them from such, and realise what such things may amount to, and thus prevent loss and disappointment. It is time some enlightenment should be given to the question, and we trust that what we shall say will be found beneficial to the interests of those who might otherwise be so unfortunate as to find them out by experience. One philanthropist will obtain provisional protection for four guineas, a second will do the same for three, a third will do it for forty-five shillings, a fourth for twenty-five shillings, a fifth for one pound! Another undertakes to give "full particulars and advice" about patents free on enclosing two stamps for pamphlet of information! And yet another will give advice free, and send pamphlet *free of charge.* Can any inventor or intending patentee be disposed, after ascertaining these facts, to admit that this is a selfish age? We trow not. Next we find "trusts" for the "benefit" of inventors and establishments for the purchase and sale of patents, but whether "limited" or not we are not enlightened. Lastly, associations have been, and are being, registered to take up inventions with a view to their development. It may be remarked that this is by no means a novelty, and so far as our knowledge of the performances of such undertakings goes, they have not been found beneficial to the interests of inventors, it generally resulting in the kind of division illustrated by the clown in the pantomime. In regard to patents and what has to be, and should be, done in preparing all that relates to them, we cannot do better than refer our readers to the article on this subject contained in No. 44, Vol. I., of WORK, p. 694, which, if carefully read and understood, should open the eyes of inventors and intending patentees to the risks and dangers they have to encounter through ignorance and want of care in occupying themselves with inventions and patents. An American writer of great experience in patent matters, and the proceedings and dodges in vogue for the "benefit" of inventors, says: "There are so many sharp schemes practised upon inventors—and it is usually those who can least afford the loss that are caught—that the only safe plan is to deal with attorneys who are recommended by people you know, or have some other equally reliable endorsement. Beware of the man who wants to sell your patent if you will only pay twenty or thirty dollars for advertising expenses. Beware of the man who, in a flaming circular, offers to do professional work for almost nothing. You can be assured he has some sinister motive in making the proposition, and before you get through with him you will find him dear enough. It would no doubt be a very valuable and useful contribution in the interests of inventors and intending patentees, if those who have "gone through the mill" would contribute the results of their experience. Forethought and common sense require to be more largely patronised by inventors and intending patentees than has yet been the case; and we hope in the interests of patent agent firms of standing and inventors alike that our remarks will receive the careful and thoughtful attention due to so important a subject. As we pointed out in the article referred to, an inventor with a good thing will have no difficulty in finding a respectable and reputable practitioner prepared to make the best of a patent at a fair remuneration for his services. Men of ability and experience do not work for amusement, but very properly request a fair return for their skill, experience, and labour. We add this in justice to many patent agents of undoubted integrity.

TRADE CLASSES AND YOUNG WORKMEN.—Continuing the remarks we made in our No. 173 issue, we would ask—What is to be expected from the young workman, and why does he not more fully avail himself of his opportunities to obtain useful and paying knowledge? We know that to join a class means, very often, choosing a troublesome but courageous course, for by electing to improve one's self against the advice of many that are too much enamoured of old and known customs, there is often great courage wanted. But should inconvenience or ridicule deter any single one from joining a class wherein he can benefit his position in his own trade? We say it should not; nor will it if there be a bit of "real grit" in the fellow. Opposition or ridicule can and does come from quarters where we should not expect it, and this opposition—on the part of so many trade members to apprentices and others taking advantage of opportunities that they did not themselves have in their young days—is a fruitful source of annoyance, at any rate, to those who allow themselves to be annoyed by it.

HOW TO LEARN DRAWING OFFICE WORK.

BY ARTHUR BOWES, A.M.I.C.E.

Pocket Compasses.—To save the inconvenience of carrying about a complete set of drawing instruments when the draughtsman is called upon to prepare or copy a design away from his usual drawing office, various descriptions of pocket sets of compasses have been introduced, combining in a portable form several of the most useful instruments, and fulfilling the purposes of a more complete set with considerable success. Some of them are remarkably compact, and serve very well for occasional necessities; but it is not to be expected that they will serve their manifold uses equally as well as an ordinary set of instruments, where each is specially designed for its own purpose and no other. The following are the principal varieties of the pocket sets:—

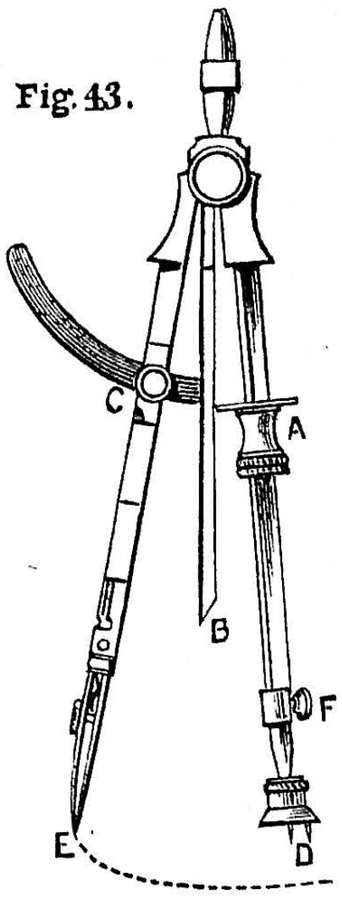


Fig. 43.

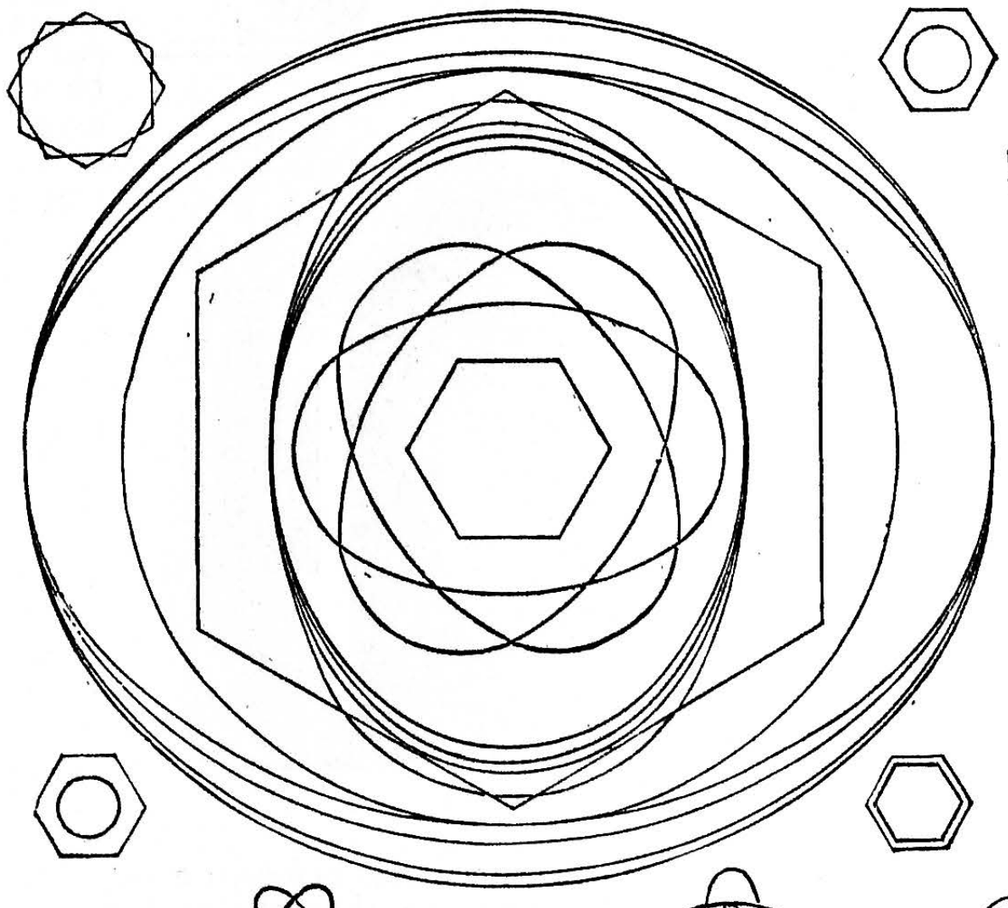


Fig. 43A.

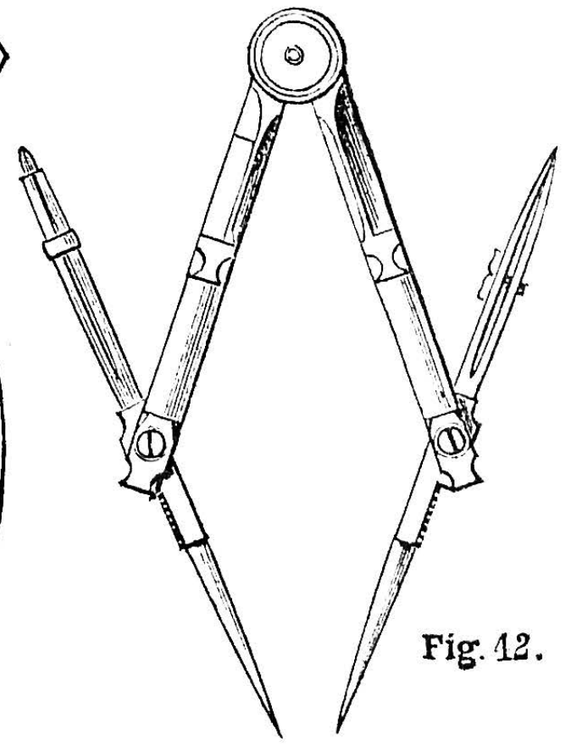


Fig. 42.

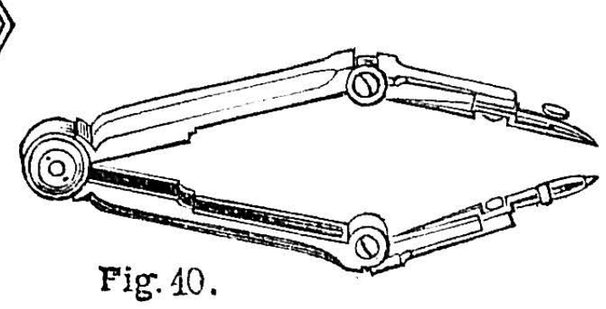


Fig. 40.

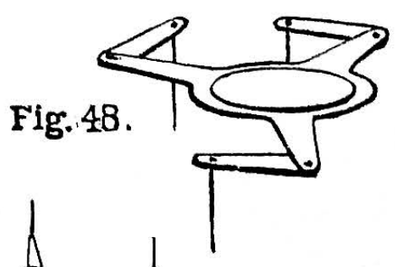


Fig. 48.

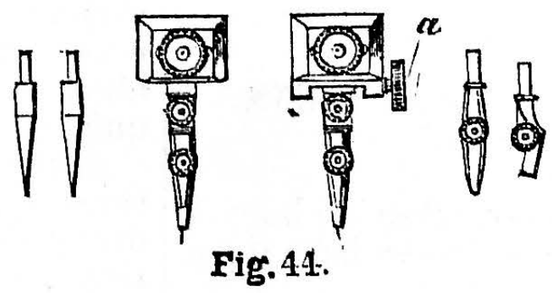


Fig. 44.

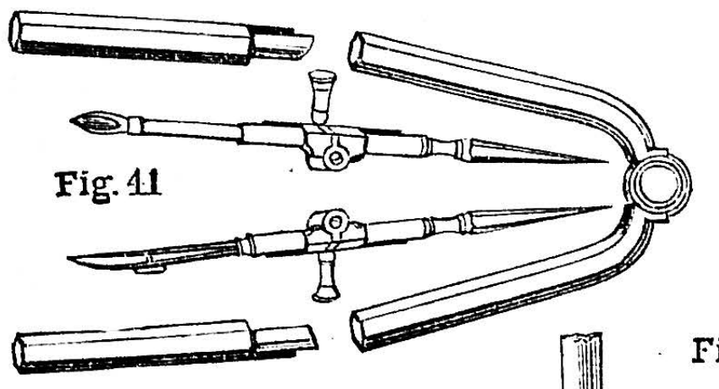


Fig. 41

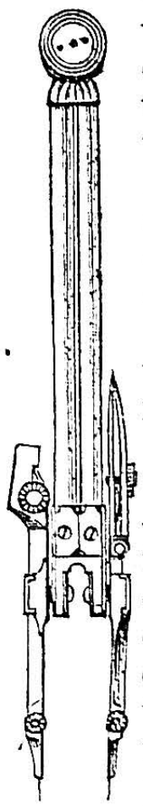


Fig. 39.

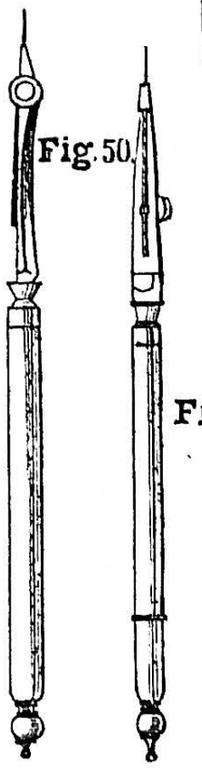


Fig. 50.

Fig. 49.

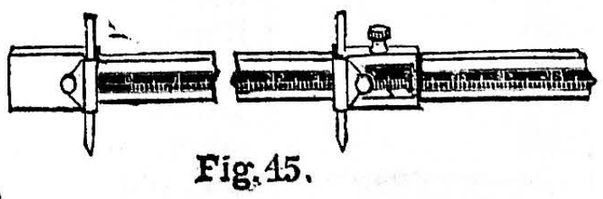


Fig. 45.

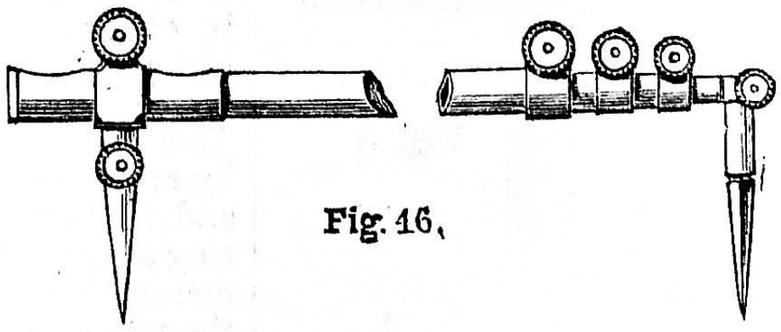


Fig. 46.

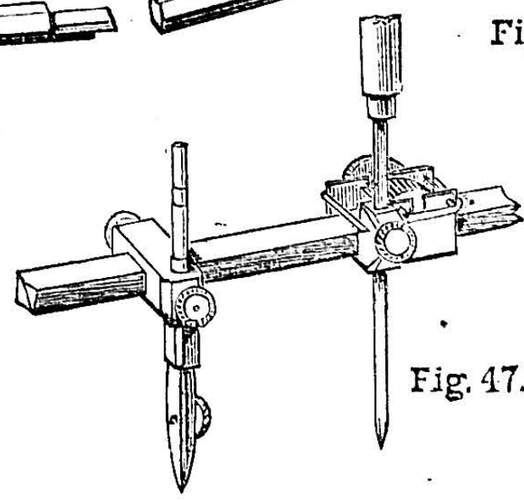


Fig. 47.

Tubular Compasses.—The construction of these will be readily understood from Fig. 39. The changes from pen to pencil-points, or to needle-points to act as dividers, are effected by reversing the revolving parts which are fitted to the tubular legs. A spring catch holds the revolving part in position when once adjusted. It is a commendable feature in this form of pocket compass that there are no loose parts to be mislaid.

Napier Compasses.—A more compact form of pocket compass is the one known as the Napier (illustrated in Fig. 40). The method of changing the instrument from pencil to pen is the same as in the tubular compass; but the addition of the joint in the middle of each leg enables the points to be folded inwards, so as to make a portable little instrument, which can be carried in the pocket without inconvenience.

Pillar Compasses.—These are illustrated in Fig. 41. The changing points in these compasses, instead of rotating, pull out from the tubular portion of the instrument, and form separate pen and pencil compasses of a smaller size. By adding the two lengthening bars shown in the figure a still larger instrument is produced, so that the various modifications produce no less than eight separate instruments—viz., pen, pencil, and dividers in the largest size, the same in the intermediate size, and pen and pencil compasses in the smallest size.

Sheath Compasses.—A very strong and useful form of pocket compass is shown in Fig. 42. In this the points rotate, and when not in use a metallic case or sheath is screwed over the lower half of the instrument to protect it.

Geometric or Bennett Compasses.—This is a novel form of instrument introduced a few years ago for the purpose of drawing geometrical outlines, such as ellipses, hexagons, and other polygonal figures. Fig. 43 shows one of the forms in which it has been produced. The leading principle on which the instrument depends is the reproduction of the outline of a template, which is slipped on to a portion of the centre leg which does not revolve. Against this template (marked A in the illustration) a central bar, B, is continually pressed by a spring, which is hidden in the joint and cannot be seen in the figure, while the leg carrying the pen or pencil is adjustable at various distances from the central leg. It is obvious that figures of the same shape as the template can be produced with this arrangement; but by raising or lowering the template, at the same time adjusting the distance of the pen point, the shape of the figure drawn can be materially altered, straight lines being drawn, convex or concave, from the same template. Fig. 43A shows some of the results obtained with this instrument.

Beam Compasses.—For drawing curves of larger radius than can be taken in the ordinary compasses, recourse is had to a beam compass fitted with trammel heads, such as are shown in Fig. 44, carrying interchangeable pen and pencil points and dividers, and secured to the beam by adjusting screws, which bear against a loose plate on the inside of the trammel head. The beam itself is usually a flat lath of hard wood, but when using this for a long radius considerable inaccuracy may be caused by the deflection of the beam sideways, and to remedy this it is advisable to make the beam of T section. In using the Beam compass the heads are adjusted approximately to the required distance and clamped in that position by the screws mentioned above; the exact distance is then adjusted by means of the

Drawing Office Work. Fig. 39.—Tubular Pocket Compasses. Fig. 40.—Napier Compasses. Fig. 41.—Pillar Compasses. Fig. 42.—Sheath Pocket Compasses. Fig. 43.—Geometric or Bennett Compass. Fig. 43 A.—Figures produced with the Geometric Compass. Fig. 44.—Heads for Beam Compass, with Loose Pen, Pencil, and Needle-Points. Fig. 45.—Graduated Beam Compass fitted with Vernier. Fig. 46.—Telescopic Beam Compass. Fig. 47.—Patent Beam Compass. Fig. 48.—Triangular Compass. Fig. 49.—Needle-Point. Fig. 50.—Needle-Point.

fine adjusting screw lettered *a* in the figure.

When the Beam compass is in constant use for accurate work the beam is graduated, and to the head which carries the fine adjustment there is also fitted a vernier scale, by which the adjustment can be made to the greatest nicety. Fig. 45 shows a Beam compass of this pattern, as used in the Ordnance Survey Department, and with which it is claimed the distance between the heads can be regulated to the hundredth part of an inch.

Telescopic Beam Compass.—In order to make the Beam compass less cumbrous when not in use, the telescopic form shown in Fig. 46 has been produced. It is made of several tubular parts sliding one within the other, and, by means of the clamping screws, can be fixed at any desired length.

Patent Beam Compass.—One of the most useful instruments in the drawing office is the Beam compass illustrated in Fig. 47. It is extremely light and convenient to handle, consisting of a square beam of hard wood, about ¼ in. square, carrying the two heads. One of these is clamped to the beam by a set-screw, and serves to carry the pencil-point, which, when reversed, forms also the pen. The other head, instead of being fixed tightly to the beam, is held in position by the pressure of the fluted roller shown above the beam in the illustration. This is constantly pressed against the beam by a strong spring, and, by turning the milled head attached to the roller, the head carrying the centre-pin is caused to travel along the beam. The beams are so simple in construction, and of such little monetary value, that two or three can be kept at hand of various lengths, ranging from 8 in. or 9 in. to 4 ft. or 5 ft., or larger if necessary.

Triangular Compass.—This appliance, also known as the "station pointer," is used for transferring various points from one drawing to another in making a copy. It consists of triangular or three-legged central portion, as shown in Fig. 48, having arms jointed to each of these projections, and a needle-point attached vertically to each arm, as shown. When two points on the drawing are obtained, and it is desired to transfer the position of a third, the arms of the compass are adjusted to coincide with the three points on the drawing that is being copied; it is removed to the incomplete drawing, two of the arms placed on the two points already obtained, and, without altering the relative position of the arms, the needle-point of the third arm is pressed into the paper, and marks the position of the third point.

Another type of this compass consists of what may be described as a pair of three-legged dividers—that is to say, it is an ordinary pair of dividers with an additional leg jointed on, so as to move at right-angles to the movement of the other two legs. The three legs can thus be spread out so as to form a pyramid, the manner of using being the same as in the compass just described.

Pricker or Needle-Point.—This is useful for marking points on the paper from a scale in work where considerable accuracy is required; also in pricking through a drawing placed over a sheet of paper for the purpose of duplicating the drawing, as will be explained in the chapter on "Copying Drawings." The best form of the instrument can be made out of a sewing-needle and the handle of a crochet-hook, or even half of a wooden penholder; but if a more showy, though not more effective, instrument be required, the instrument makers have produced several varieties to choose from. Two forms are shown in Figs. 49 and 50, in both of which the needle can be removed and replaced with another. In the pricker shown in Fig. 50 the needle is clipped between two jaws, which are pressed together by the screw. As mentioned before, some drawing-pens are made so that the steel part of the pen unscrews from the ivory handle, uncovering a short needle-point which is attached to the handle.

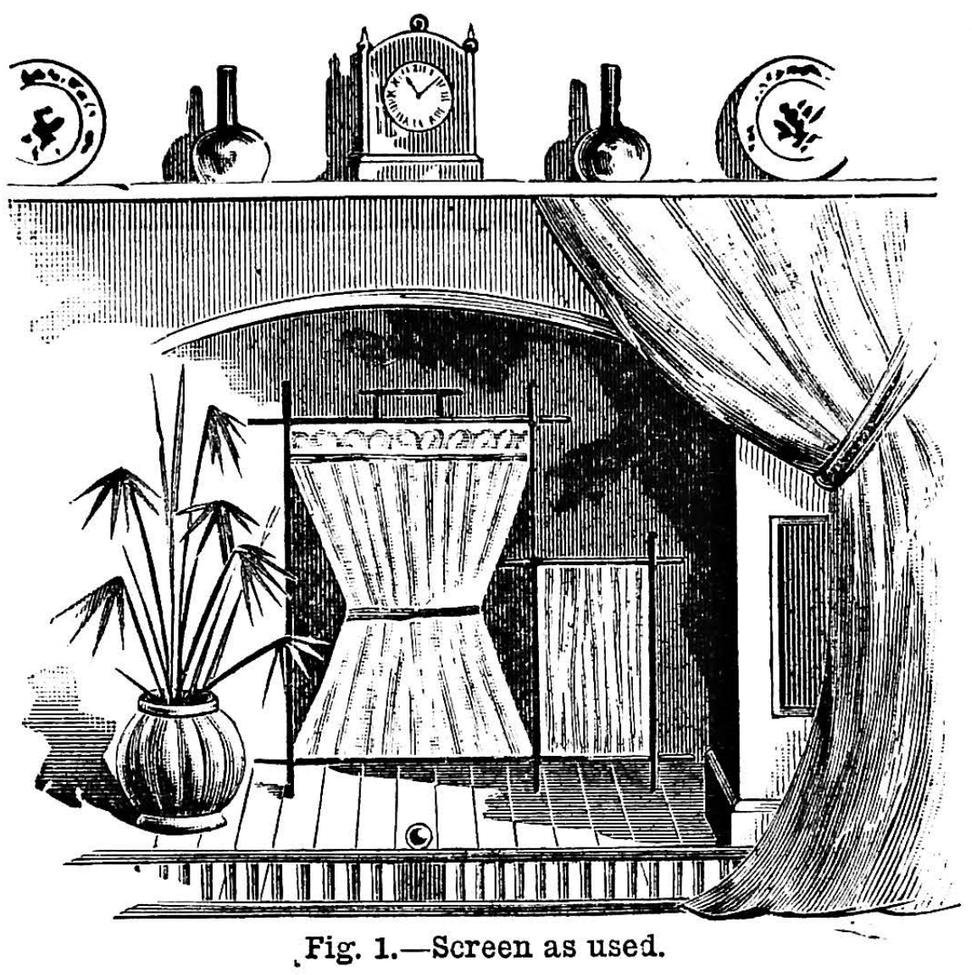


Fig. 1.—Screen as used.

SOME SIMPLE STOVE SCREENS.

BY "OMADAUN."

At this time of the year, when we hope—for some time, at all events—to have done with fires, the adornment of the fire-grate claims our attention once again. We are no longer content with the fearful and wonderful arrangements in tissue-paper and tinsel of former days, which now seem only associated in our minds as being part and parcel of seaside lodgings; and, as we aspire to something better, I trust the sketches accompanying this article may prove acceptable.

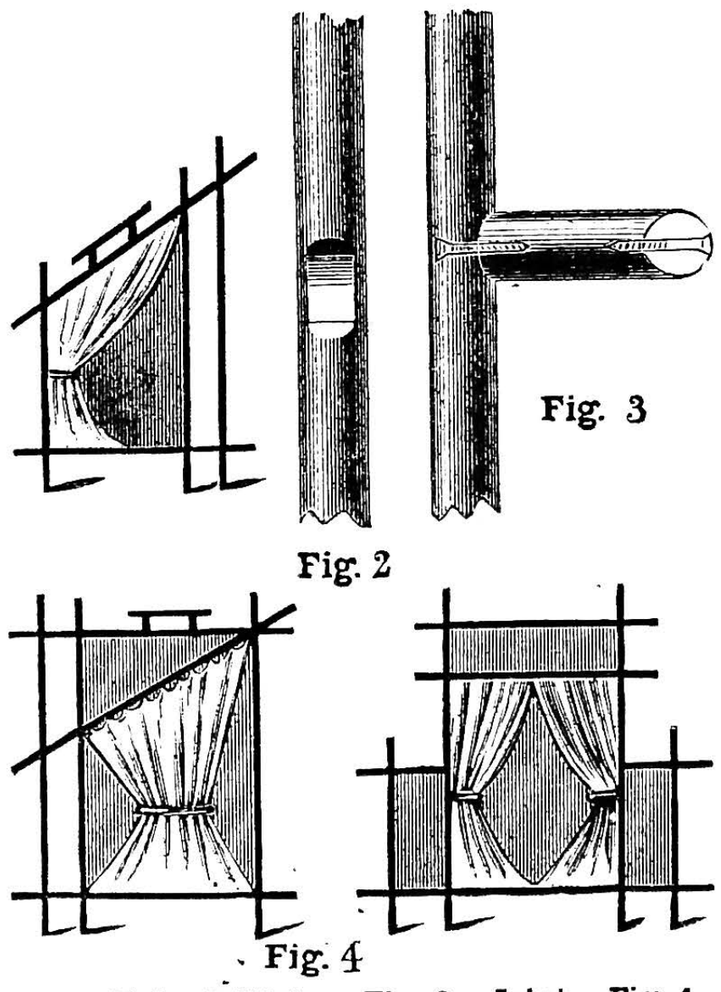


Fig. 2. Fig. 3. Fig. 4.

Fig. 2.—Halved Sticks. Fig. 3.—Joint. Fig. 4.—Alternative Drapings.

I do not propose to describe the construction of any elaborate piece of work, but rather suggest how a pretty and effective screen may be easily made, and at a price very considerably below what it could be bought for. In Fig. 1 I have endeavoured to show the effect of a screen when in use; the other sketches are only given as suggested varieties of forms.

The designs, it will be seen, all consist of a light framework, which may be constructed of various materials according to taste, such, for instance, as oak, white wood, or enamelled picture moulding; but I advise the use of rustic sticks. Very excellent ones for the purpose can be bought at one penny each, of well-seasoned ash, such as are used for "single-sticks," and when enamelled with "Aspinall," or some of the Ardenbrite metallic enamels, the result is very pleasing. The sticks should be halved where they cross one another, as shown at Fig. 2, and will be sufficiently well held together if a panel pin, or small French nail, be put through at the junction, and in some cases the parts may be wired together, and tied with a bow of ribbon. Where two of the sticks meet at right angles, but do not cross, they can be easily joined by means of a screw or nail, as shown at Fig. 3. A prop must be arranged at the back to support the frame in the same way as to an artist's easel, though in some cases this will not be found necessary. I have not drawn the sketches to any scale, as the sizes can, of course, be varied, and the sticks, which are about 3 ft. long when bought, will be found quite long enough for all requirements.

A great deal of the artistic effect of the screens will naturally depend upon the draping. I have shown one or two alternative methods, and no doubt various others will suggest themselves to the reader. Remnants of plush, silk, brocades, etc., can well be pressed into service here. Taking Fig. 1 as an example, the framework might be gilded, making the curtains of silk, old gold or lemon yellow, and the panel of a golden brown or electric blue plush: it is, of course, only necessary to cover with the plush so much of the panel as will be visible so as to economise material. There is no difficulty in fixing the drapery by means of small tacks put in at the back, and the panels are easily arranged by cutting a piece of card to the required size and tacking it to the frame after covering with the plush, etc., which can be either sewn on or fixed with a little glue and paste. A little gold tinsel twist may sometimes be stretched across a panel with effect, whilst some might like this done in the form of a cobweb. with a "Japanese" spider as a centre.

With these few suggestions, I hope some of my fellow-readers will be enabled to make a thing of beauty, which, if not a joy for ever, will, at least, be so until the chill October evenings make us glad again to replace it by a cheerful blaze.

Fig. 4 shows some alternative drapings.

[There can be no doubt that the ornamentation of the usually hideously, ugly fireplace is a subject which commands the best attention and ingenuity of the mistress of the house—especially in the summer months—and we shall hope to receive some good suggestions from the wives of workers in this direction.—Ed.]

EVERY WORKER'S WATER-MOTOR.

BY J. THOMPSON.

THERE are some cases in which a small power-motor may be of utility in driving a small lathe, fan, etc., and where there is not suitable convenience for a steam engine; if a supply of water with a fair amount of pressure be on the premises, a water-motor may be adopted.

The motor now to be described will, with a pressure of about 60 lb. per square inch, and with a $\frac{3}{4}$ in. supply pipe, develop about $\frac{1}{2}$ horse-power. It is small and compact, and only requires fixing on a level foundation, and a waste pipe or drain to carry off the waste water; it is also available at any time by merely turning on the water.

Fig. 1 is a side elevation, with a portion of the case removed, showing the water-wheel, buckets in section—which are thirty in number—and the water supply jet. Fig. 2 is an end elevation, showing a cross section of water-wheel, bearing, and driving pulley one-fourth full size. The castings consist of case, base plate, water-wheel, and driving pulley in cast iron, two bearings and water connections in brass; the price is 20s., and they can be obtained from Messrs. S. Simpson & Son. The case is in one piece, with a flange round the lower edge; this is levelled, and bolted down to the base-plate with four bolts, the joint being made water-tight. Four lugs are cast on the base-plate; these must be drilled for bolting it down on the foundation.

A steel shaft, $\frac{3}{4}$ in. diameter, must be turned for the water-wheel; it is shouldered down to $\frac{1}{2}$ in. diameter at each end at the inside of the bearings. One end is made a little longer for the driving pulley; the full length is about 8 in.

The water-wheel is 10 in. in diameter, and must be keyed on the shaft so that it runs quite true. The bearings are of brass, bored and turned, and an oil cup formed on the top of each, with a small hole drilled for lubrication; the bearings are bolted to the sides of the case, with three bolts in each. They must be lined and set so that the water-wheel runs parallel with the case inside.

The driving pulley is bored and turned, and a key-way cut in it and the shaft, and fixed on with a key. A screwed brass connection is fitted to the top of the case, as shown in Fig. 1. For a $\frac{3}{4}$ in. supply pipe a $\frac{1}{8}$ in. jet is screwed inside this connection; a waste pipe must be taken from the outlet to a drain, to carry off the waste water. The base-plate must be bolted down on a strong wooden foundation 3 in. or 4 in. thick. Paint all the parts not finished bright with two or three coats of paint.

IMPROVED STEAM-ENGINE GOVERNOR.

A GOVERNOR which is positive in operation, and designed to admit steam quickly and in proper proportion to overcome the resistance of any load carried, as well as to shut off the steam and prevent undue increase of speed after release of the load, is shown in the accompanying illustration, and has been patented in America. The ends of the engine cylinder are connected with pipes leading to a valve casing in which is a valve stem, sliding longitudinally on seats in the casing, and the latter is connected with a pipe, A, from which leads the valved pipe,

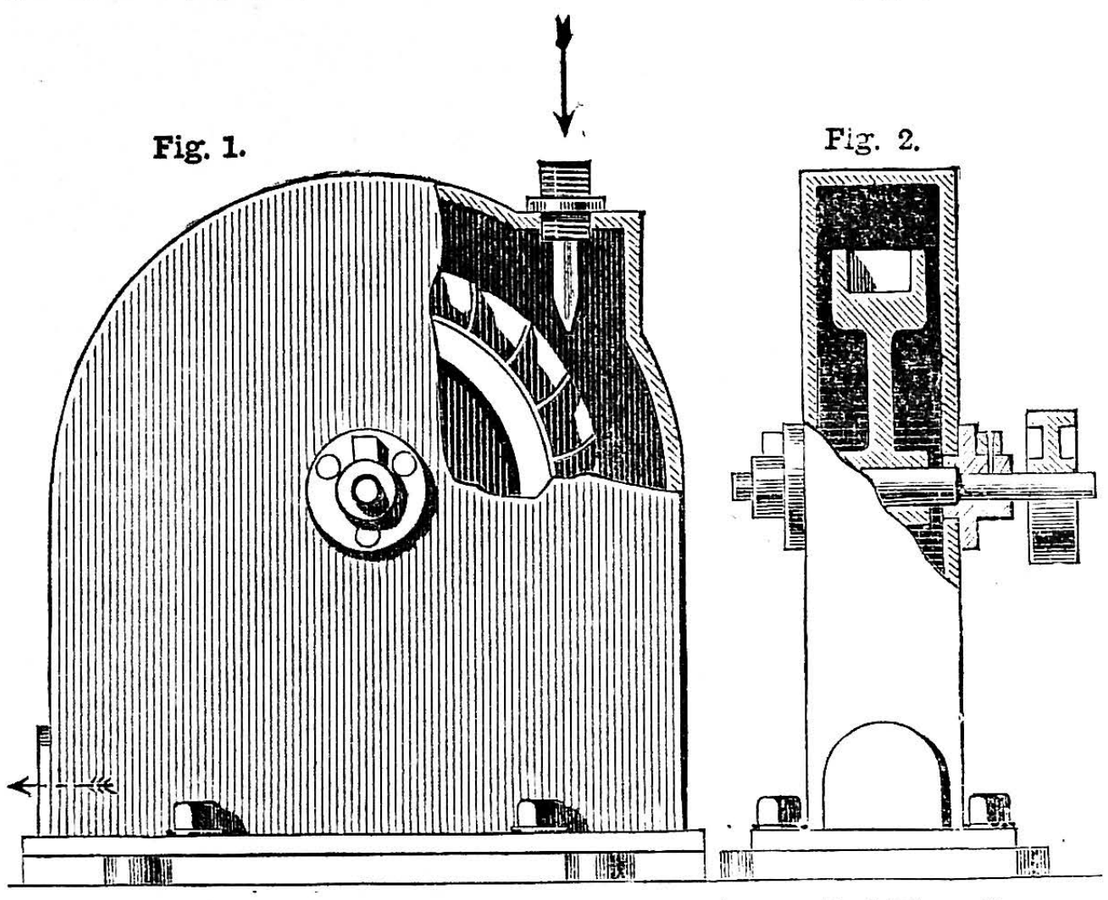
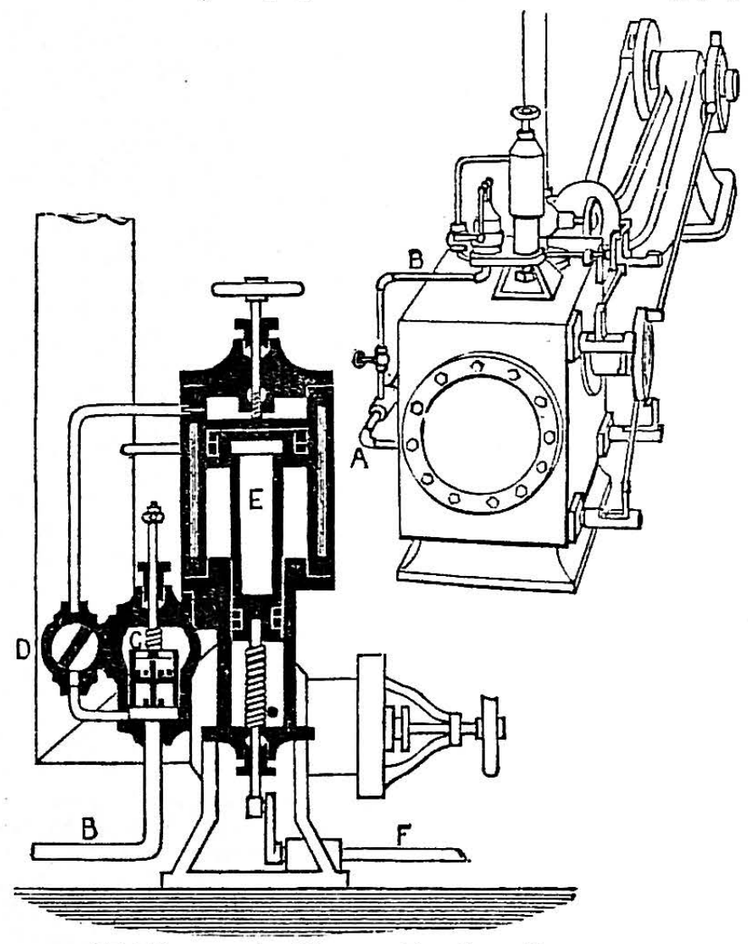


Fig. 1. Fig. 2.

Water Motor. Fig. 1.—Side Elevation. Fig. 2.—End Elevation.

B, opening into a cylinder containing an equalising valve, C. The lower end of the latter cylinder is connected by a pipe through the valve, D, controlled from the equalising valve, with the upper end of a cylinder, E, containing a piston whose upward movement is limited by a screw-rod. The piston has on its under side a piston-rod extending into a cylinder of less diameter, connected by a pipe with the steam supply



McIlhenny's Steam-Engine Governor.

pipe, while the stem of the piston-rod, extended through a stuffing-box, is connected with a crank arm on a shaft, F, carrying arms connected with valves regulating the supply of steam. The equalising valve is provided with an auxiliary valve, which permits the steam to escape from above the valve at the time the engine cuts off and steam is expanding. By this improvement the initial pressure in the engine cylinder operates a piston which controls the movement of the steam inlet valve. The cylinder of the governor is preferably steam-jacketed, as shown in the sectional view, and the governor is intended to be set on top of the engine cylinder, as shown in the small view in perspective. The device is designed to be equally applicable to high or low pressure, stationary or marine engines.

NOTES FOR WORKERS.

ABOUT 250 men and 130 girls are employed at the Vaseline works in Brooklyn, U.S.A. Vaseline was first produced by Mr. Chesebrough in 1869 or 1870, but it did not "take" till 1876, and now the demand exceeds the supply. Sixteen tons of bone-black are used every day for its purification.

THE rubber cement used by leather shoe manufacturers is unvulcanised Para rubber dissolved in benzene. It is also used by photographers, after being thinned with more benzene.

A VERY general stain for microscopic sections is hæmatoxylin, or logwood, which stains the nuclei of cells much more strongly than the other parts.

THERE should be no paint or varnish inside an aquarium, as both are injurious to the fish.

PROFESSOR ADAMS, who died early this year, shares with Leverrier the honour of discovering Neptune.

A FACTORY has been started at Ambato, in Ecuador, for the manufacture of rope from the agave fibre.

SCIENCE TO DATE.

Phosphorus Sulphoxide.—This is a new compound discovered by Messrs. Thorpe & Tutton in their researches on phosphorous oxide—P_4O_6. They find that sulphur acts very violently on this oxide at a temperature of 160° C., producing the new sulphoxide. It is a pale yellow solid, which melts at 102° C., and boils without decomposition at 295° C. When sublimed in vacuo it forms large colourless tetragonal prisms. Its vapour density agrees with the formula $P_4O_6S_4$. It is deliquescent, and is decomposed by water, with liberation of sulphuretted hydrogen gas and formation of phosphoric acid.

Great Sun Spot.—Recently one of the largest sun spots hitherto observed appeared on the eastern side of the sun's disc. It disappeared round the western side, and again passed the central meridian of the sun. Later it had assumed its greatest area, and, according to measurements made, this area reached the astounding dimensions of 3,360,000,000 square miles. Its greatest length was 150,000 miles, and its greatest width 75,000 miles. Sun spots usually cause magnetic and auroral disturbances. This was no exception.

Measurement of High Temperatures.—According to Professor Roberts-Austen, reliable results can be obtained in measuring high temperatures by means of a thermo-couple formed by twisting together the ends of two wires, one of platinum and the other of a platinum-rhodium alloy containing 10 per cent. of the latter metal. By this means an accuracy of 1° in 1,000° can be obtained. If it is required to measure temperatures between 1,000° and 2,000°, two wires of iridium and iridio-platinum with 10 per cent. of platinum may be employed. The apparatus, consisting of the thermo-couple and a D'Arsonval galvanometer, is calibrated by placing the couple in some material whose melting point is known, and noting the deflection obtained.

Glacial Drift.—Hitherto the patch of boulder clay at Finchley has been considered the most southerly representative of the glacial drift in Britain. A similar deposit has been lately discovered in Essex on the line of the Grays and Upminster Railway. This brings the drift 3 miles further south.

Flexibility of Rocks.—A microscopical examination of specimens of flexible limestone from the cliffs at Sunderland, Durham, shows that the flexibility is apparently due to minute cavities lying along the bedding planes, and accompanied by a slight interlocking of the grains of dolomite.

TRADE: PRESENT AND FUTURE.

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

COTTON TRADE.—Manchester spinners have experienced a little revival of trade, but it is still dreadfully dull. Our Rochdale and district correspondent cannot report any improvement. Many of the companies, in stock taking, are coming out on the wrong side, a state of affairs which will not be improved by the stoppage of a large firm of cotton brokers at Liverpool.

OIL TRADE.—Palm-oil, holders have had more inquiry, having accepted 5s. decline, and about 100 tons have been sold at £19 10s. per ton. Small sales of Lagos are reported at £20 15s. Tallow, a fair amount of business has been done at 23s. to 24s. 6d. for North, and 26s. 6d. to 27s. per cwt. for South, American. Olive oil, fair sales have been made at £33 to £38 per ton, and Neapolitan is offering at £35 10s. to £36, Malaga at £35 to £36, and Smyrna at £33 to £35 10s., per ton. Linseed oil meets with a moderate demand at 20s. 3d. to 20s. 6d. per cwt. Cottonseed, refined, 19s. 6d. to 20s. per cwt. Turpentine, 23s. 3d. per cwt. Rosin, 4s. to 4s. 1½d. per cwt. for common.

COAL TRADE.—Prices are unchanged. Contracts for gas coal are not all entered yet. Some of the gas companies are holding back in the hope of better prices.

SILVER TRADE.—In Sheffield there is little change to note. Paris orders are for special goods, chiefly of the cheaper kinds of Britannia metal goods.

IRON AND STEEL TRADES.—There is still a steady demand for railway material, but buyers are looking for a decline in the market. The armour-plate makers are still working full time.

CUTLERY TRADE.—The workmen employed by Messrs. Joseph Rodgers & Sons are on strike upon a reduction of wages question. This firm has never before been at issue with its workmen on the subject of wages. To the United States the value of steel and cutlery exported in 1889 (March to June) was £144,678, while from March to June of 1892 the value only reached £122,427, showing a steady decline to the lowest on record.

ENGINEERING TRADE. — Although, generally speaking, the condition of the Lancashire engineering trade is showing no signs of improvement, yet there are one or two firms of machine tool makers who have recently booked orders of some moment, and it is considered that the prospects of a change for the better in this branch of the industry are slightly greater than have obtained of late. Stationary engine builders have very little work on hand, however, while boiler makers are not nearly so well off for work as they have been for months past. Locomotive builders report no improvement, and, generally, the manufacturers of railway plant of all kinds are becoming exceedingly slack. No move has yet been made in the Mersey shipbuilding trade, but in the Barrow district both engineers and shipbuilders are busily employed on new work and repairs, and have also some good orders in prospect. The iron market has for a time been disorganised by the elections, and the small amount of business that was being done a week or two ago is now still further restricted. Independently of this, however, there is a marked want of tone in the iron market, and buying is, for the most part, confined to immediate requirements. The belief is general that rates must fall, but as the present prices are certainly not remunerative, it would appear that any reduction must be accompanied by a substantial decrease in wages and in the price of fuel, and of this there is at present no indication. Lancashire boiler makers are almost as badly off as the rest. Our Rochdale correspondent writes:—Engineering trades are in a bad state. One large works has shut up lately, and others are short of orders.

GOLD THREAD TRADE.—The gold thread trade is in a depressed condition. Latest advices from Madras, Bombay, Delhi, and Rangoon report the markets stocked with threads of French and German manufacture, of high and of low qualities. The purchasing value of the rupee has fallen concurrently with the price of silver, and this has intensified the poverty of the people of India. Prices have had, in consequence, a downward tendency for several years, and continental manufacturers have been closely competing with each other in a falling market, with the result that it is now overstocked. Prices have also a downward tendency in the home market, where only a limited quantity of gold lace threads are in demand. Scarcely anything is being done in imitation gold threads, warps, and braids, of which home manufacturers hold large stocks.

PLUMBING TRADE.—This trade is very quiet, most of the firms working short hours, and many men are "playing" them.

FLANNEL TRADE.—This is not doing well, though better than the cotton trade.

BUILDING TRADE.—The building trade of Bolton is at a complete standstill, as the whole of the men are locked out, owing to a strike of plumbers, which has already extended over nine weeks. The points in dispute are as to the time of starting in winter and the allowance for country money. Lancashire building trades are fairly busy. A strike of the Sheffield masons has thrown out the bricklayers. Stone used in the erection and extension of the New Central Board Schools is brought from quarries in the neighbourhood of Huddersfield, where it is dressed and trimmed. The masons urge that this is against the understanding with their employers. In the Rochdale district the trade is fairly busy, principally on speculative buildings. Liverpool bricklayers are busy. This is one of the towns where almost everything is built of brick. The wages for bricklayers are 8½d. per hour, but as much as 9½d. is offered for North Wales.

CYCLE TRADE.—Trade is still flourishing, although, the season being well advanced, most riders have provided themselves with machines, new or old. Very many are taking to cycling by means of the hiring system. The use of the tricycle has been somewhat in abeyance since the Safety became so popular. It is gratifying to notice that the three-wheeler is again coming to the front. About Berwick-on-Tweed numbers of ladies are taking to the tricycle, and the formation of tricycle clubs is talked of.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTER FROM A CORRESPONDENT.

Destruction of the Broad Gauge.—CIVIL ENGINEER writes:—"The world has lately been favoured with an unparalleled exhibition of wilful destruction of property, and a useless waste of money, for the achievement of an assumed benefit, but to extenuate which there cannot be the shadow of a reasonable justification advanced. We allude to the wilful destruction of the broad gauge system, which for so many years has been the delight and comfort of travellers who have had to proceed to the West of England and Cornwall. There can be no doubt that the existence of the broad gauge was a great impediment and drawback to all through traffic to other lines which had to pass from it to the narrow, and if a simple and ready means of overcoming the evil could not have been devised, it would have been quite right that it should disappear. However, some years since a ready means of overcoming the difficulty was arrived at by inserting a third rail between the two broad gauge metals, so as to enable the traffic passing on to other lines to be worked over it; and this has been done for many years with perfect success. The total length of the broad gauge from London to Penzance was 226 miles 24 chains, and it has been considered by the 'enlightened Board' that it would be a cheaper proceeding to destroy the broad gauge than continue the addition of the third rail over the entire system below Exeter, by means of which all goods, coals, and other minerals, etc., could be carried in narrow gauge trucks, and so the evils of break of gauge avoided, whilst the direct western passenger traffic and goods, etc., loaded at and to be delivered at broad gauge stations, would have gone on as before, and the enormous waste of money and sacrifice of expensive and costly rolling stock avoided. It seems, however, that the 'bump of destructiveness' became strongly excited in the heads of these 'enlightened directors,' and a most interesting and important link in the history of railways has been ruthlessly destroyed. Having, as it were, both systems of their own, and to make both complete only needed the third metal to be extended to the points not then reached by it—which common sense would show was the cheapest step to be taken—they prefer the more wasteful and expensive one of destroying the existing road, and sacrificing a vast quantity of rolling stock, in the shape of engines, tenders, coaches, trucks, etc. Their conduct can only be compared to that of the man who, because he had *two* coats, thought one would be enough, and therefore tore up the other! What the shareholders can have been about to allow these directors to saddle them with nearly a million of expenditure, to gain nothing, is more than can be conceived; but there is no doubt the names of these 'enlightened' and 'enterprising' individuals will descend to posterity with anything but an unqualified approval; and justly so. We saw the last of the fast through trains to Penzance leave the station at Paddington, consisting of seven vehicles drawn by an engine built in 1846—the 'Great Western'—and it is to be questioned if any other railway in the kingdom could put on an engine designed and built so long ago to take such a train at express speed over the distance, and keep time. It is to be hoped that reflection and experience will not cause directors and shareholders to repent of this unreasonable performance."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Speed of Saws.—F. W. G. (*Poplar*).—Your questions are not so explicit as they should be, but perhaps I can help you out. The speed at the points of the teeth of your circular saw should be from 8,000 ft. to 9,000 ft. per minute. As your saw is 13 in. in diameter, this accords with from 220 to 250 revolutions of saw per minute. The pulley on the saw-spindle should not be less than one-third of the diameter of the saw—say, therefore, 5 in. in this case. Your engine runs 180 revolutions per minute, so the ratio of the pulleys on the engine-shaft and saw-spindle must be, for the lower speed, $\frac{220}{180}$ =1·222. This would give for the pulley on the engine-shaft a diameter of 6 in. If you have a 12 in. pulley on the engine-shaft, you must put a 10 in. pulley on the circular saw spindle, unless you have an intermediate shaft. If you are going to cut hard wood—such as elm, ash, beech, etc.—your surface speed should not exceed 6,000 ft. per minute. The band saw should run at a slightly higher speed than the circular saw.—F. C.

French Timepiece.—H. J. G. (*No Address*).—The spring at the back of the clock is to hang the pendulum on; it is usually two strips of steel ribbon, with a little piece of brass fixed to the ends, through which is passed a pin on which the pendulum is hooked. If the clock will not go when the pendulum is hung on this pin, it may be that it is not in beat, or that the spring is bent or buckled, or one of the ribbons is broken. See that the spring is perfect and that it beats or ticks level, and that it swings to and fro with a smooth, steady action; if it wobbles, throw the spring away and get a new one fitted: any clock-maker will do it for a few pence. If it still refuses to go, something more is wrong, but as it goes without the pendulum, I am inclined to think it is one of the foregoing faults.—A. B. C.

Woollen Machinery.—KERRY LAD.—We know of no periodical of the kind you require.

Re-graining Woodwork.—W. G. G. (*Hornsey*).—If the old work is very rough or blistered, this must be removed by "burning off" or "pickling off" with a paint solvent. If in good condition, rub down the surfaces with pumice-stone and water. Paint one coat of "sharp" colour, then stop holes and crevices, and "ground" with the desired colour. The paint had better be mixed for you at any oil and colourman's to the required shade; have it made up thick, and then dilute a portion with turpentine only for the first or "sharp" coat; then for the "ground" use the remainder with equal parts oil and turps. Upon this ground you spread the semi-transparent graining colour. This you must also purchase, and it is possible you may be able to decently spread it, and then "plain comb" it with steel or leather graining combs. A coat of varnish is the last operation. If you are in earnest, study the exhaustive series of articles on Graining in Vol. II. If you want a hobby requiring as much study and practice as the violin, you will find such in the art and practice of graining.—DECORATOR.

Limewash.—TYRANYRE.—Russian tallow, beer washings, raw linseed oil, and boiled oil are amongst the many articles used in different localities for adding to limewash for exterior walls. The simple addition of the first-named—say, 1 lb. to the gallon of colouring—is a useful and inexpensive combination. Another recipe is the addition of alum and soft soap, 1 lb. of each dissolved and well mixed into two gallons of wash, or in these proportions. Two good coatings of this should give you a pleasing and fairly durable exterior finish. For cream or buff tones add dry ochre to the lime before the addition of the other ingredients. This colour, combined with dry umber, makes a series of soft drab tints; ochre alone makes a rather harsh and "staring" tint. For neutral grey or slate colours, add the pigment termed "blue-black." All these colours are cheap, the two former about 1½d. per lb., the latter from 4d. to 6d.—F. P.

Marine Engineer.—J. F. (*Appleton, Widnes*).—If our correspondent will refer to WORK, No. 125, Vol. III., page 331, and also to No. 126 of same vol., page 349, he will there find the information he seeks, which he should carefully read and consider to see how he is situated in regard to being able to meet the required conditions. If this does not give him the information he seeks, if he will let us know his difficulty, perhaps we may be able to put him right.—C. E.

Heraldic and Inscription Engraving.—W. J. B. (*Londonderry*).—This subject is coming on in WORK.

Electrical Engineering.—SUSPENSE.—At present the prospects of this profession are good, as it is certain there will be a development of this branch of engineering in the near future for purposes of traction as well as lighting. If a man is already working in the engineering shop of a firm as an ordinary workman, he may, by showing exceptional ability, be able to rise to higher grades; but the usual mode of entering the profession is as a pupil to an electrical engineer. Pupils pay down a sum varying from £100 to £300, and sign an agreement for three years. Your best plan will be to write to several of the most eminent firms, stating your requirements, and ask them to give you a chance when a vacancy occurs.—G. E. B.

Oxygen Generator.—OXY.—I cannot oblige you with detailed instructions on the way to make an oxygen generator and accessory apparatus for

magic-lantern work. The necessary illustrations and details would take up too much space in "Shop."—G. E. B.

Stitch for Texts.—INDOMITABLE.—If you want to give a good effect to your work without spending too much time over it, I would advise you to embroider the letters in the style shown in Fig. 1. Outline the letters in gold, and fill in with fancy stitches. Many different sorts of gold can be used, but the most inexpensive is the Japanese gold, which can be purchased at any art needlework shop, the price for each skein varying from 3d. to 2s. It is laid on the material like a cord, fastened down with overcasting stitches in thin yellow silk at a nice distance from each other. Then fill up the space between the gold with herring-bone or feather-stitches in four or five threads of filoselle silk. Letters in this style are very quickly worked,

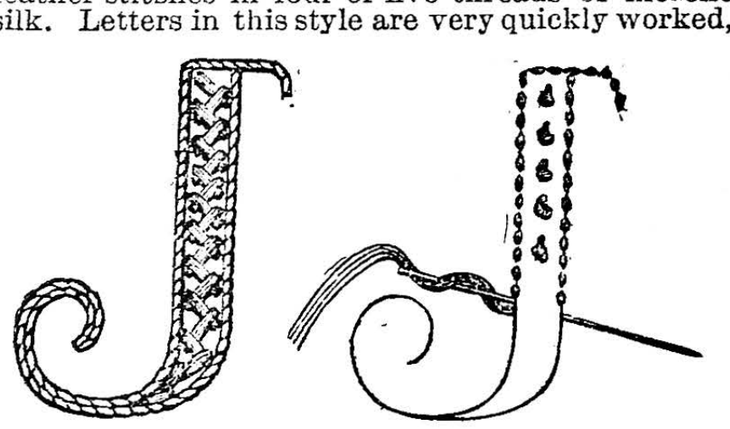
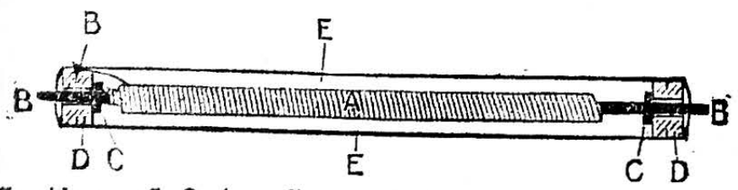


Fig. 1.—Gold-bordered Lettering. Fig. 2.—Dotted and Cross-backed Stitching.

and give a good effect; but great care must of course be given to the colours. Bright gold with silk in a shade of "old rose" would look very well on your satin. If you find it difficult to obtain the gold, or prefer to vary the style of work, another easy way of embroidering the letters is to do them in crossed back stitches, as shown in Fig. 2, and then work a row of French dots down the centre. If this style is chosen, I should advise you to do them in two shades of silk: for instance, a dark terra-cotta for the outline, a pale tone of the same colour for the dots. With good taste for colouring, and with a little fancy in the way of choosing the stitches, a good result can easily be gained; but you must remember that if the letters are to look really well, the tracing must be firm and clear, and, above all, every line must be perfectly straight.—J. N.

Automatic Model Engine.—A LEEDS FITTER.—You will require clockwork in the box to work the engine; and I suppose you will regulate it to run a certain fixed time for a penny—say one minute. Then if you get a clock movement with a seconds hand arbor, and put on it a wheel with one pin on its face, this pin may be held by an ordinary detent with a long tail beneath the slot at which the coin enters. The penny falling on the detent-tail raises its point and releases the wheel, but immediately returns—by a light spring, if necessary—and arrests the wheel when it has made one revolution, and so remains until another penny is introduced. The engine will require a pulley on the shaft driven by a cord which passes down into the box and round a pulley on one of the motion spindles. The clock movement must be regulated by a conical pendulum—not by one that swings—or its speed may be controlled by the friction of the model, to drive which you will require a powerful spring. If you want the model to run for longer periods, the stops must be put on slower-moving wheels; thus, if you wish it to run five minutes at a time, twelve stops on the minute arbor wheel would control it. I do not know of any book on this subject; but it is very simple, the detent being the only addition to the clock movement.—F. C.

Faulty Blind Rollers.—E. C. S. (*Stoke Bishop*).—You would never make a satisfactory job of a spring blind with elastic. What you want is a proper "spring roller blind." These are made with a double spiral spring on a round iron rod going through the whole length of the roller, and squared at each end to fit into the blind brackets. One end of the spring is secured to the iron rod; it then winds up the rod to within about 4 in. of the other end. Another and larger spring is then secured to



Section of Outer Case of Spring Roller Blind, showing Double Spiral Spring.

this end of the spring, and winds back over it, as it were, and the remaining end is fixed in a turned wood block, turning freely on the iron rod at the same end from which the spring started. Another corresponding wood block is then passed on to the other end, and a brass washer is jammed tightly on the iron rod at each end to keep the wood blocks at the proper distance apart. A tin tube is then passed over the whole, and secured to the wood blocks at each end. A brass cap is then fastened to the ends of the wood blocks for the sake of appearance. The blind material is sewn tightly round this tin tube, and the action of pulling the blind down winds up the spring. It is then secured at the bottom, and when released, of course, springs back again. The sketch given shows the roller, with the outer tin case partly removed to show the spring: A, double spiral spring; B, iron rod squared at ends; C, brass washers jammed on iron rod; D, wood blocks; E, inside of tin case. When a spring blind is used for an ordinary window, there is a small lever arrangement, catching on a cog-wheel attached to that end of the iron rod where the spring is held, and this prevents the blind springing up when it is pulled down until the lever is raised by means of a cord. If the spring of the blind does not quite roll it up when it is released, it must be "charged"—that is, you roll the blind once or twice round the centre iron rod in the same direction that it goes when it is pulled down, and this, of course, winds the spring up, in addition to the winding it gets when the blind is pulled down. Spring blinds for an ordinary window working with a cord always require "charging," but this is done in a slightly different way on account of the lever before mentioned. I think I have said enough to convince you that it would be cheaper to buy a blind of this description than attempt to make one, unless you are used to this class of work, for you would have to buy nearly everything separately before you could make it, and you would find that you had paid more for the different parts than the whole blind would cost you. There is a cheap class of spring blind roller, sold for about 1s. per foot run, at nearly all large ironmongers. I think it is made in America, and, although it is not to be compared with the sort I have described, I fancy it would be just the thing for the inside or outside of your doors. The only thing is, it might not be possible to get the exact length you want, but I have no doubt it could be shortened. If you watch the "How to Do It" series, in Vol. IV., there will be an article on all kinds of blinds.—E. D.

Enginewright.—C. E. C. C. (*Chesterfield*).—To be a qualified enginewright—*i.e.*, a man capable of setting out and executing the work required in the making of steam engines—he should have served a regular five or seven years' apprenticeship to an engineer or firm engaged in work of this kind, and his certificate is the *indenture* under which he served his time, and by means of which he is distinguished from the mere "handy man," driller, cock-turner, or shovel man, who, though perhaps capable at what they have been accustomed to, are *not mechanics*, nor capable of using the tools on jobs of this kind. We see no way by which "an engineman of twelve years' experience" can be qualified as a mechanic, and he would be too old to serve his time to make him one. The term "nominal horse-power" is of no significance in regard to the power an engine will or can be made to develop, inasmuch as it takes no account of pressure, speed of piston, number of revolutions, or length of stroke, and, amongst engineers, is considered obsolete. There is no fixed rule by which every maker abides on this question. One will reckon 10 circular inches of piston as equal to one nominal horse-power; another, less; another, more. Some years ago we completed a set of drawings for a horizontal engine with a 12 in. cylinder by 2 ft. stroke, which would be called a 12 or 14 horse-power; but when she was set to work with 80 lbs. steam, and running at 200 revolutions per minute, gave by indicator exactly 100 horse-power! Where was nominal horse-power in this case? Some makers also calculate so many square inches of piston per horse-power in place of circular inches. To calculate the square inches in a piston, multiply the number of inches in the diameter by itself, divide the product by fourteen, and multiply the quotient thus obtained by eleven, which gives the number of square inches in the piston; and this number, divided by the number of inches allotted to the horse-power, will give what you want, but which is of no use as regards the actual horse-power.—C. E.

Latin Inscription.—DEVONIAN.—"Merito, non gratia:" By merit, not by favour; "Non gratia sed merito:" Not by favour, but by merit; or "Meritum ante gratiam": Merit before favour. Any of these three will do.—F. B. C.

Cheap Electric Lamps.—C. J. (*Redhill*).—Lamps of 10 c.-p., with holder complete, at 6s. 6d. each, cannot be said to be cheap. They ought to be obtainable for half that sum, and could be profitably produced at the lower figure if healthy competition was not strangled by selfish monopolists. I cannot recommend the 5 c.-p. lamp at 3s. without seeing and testing a sample lamp. If your friend (Mr. Wells) will send me a sample, I shall have pleasure in reporting to the Editor my opinion of its value.—G. E. B.

Organ Building.—T. D. (*Liverpool*).—Write to Messrs. Beales & Son, Organ Builders, Limes Road, Croydon, Surrey.

Silver-plating Solution.—H. E. (*Eastbourne*).—The best solution for silver-plating is that of the double cyanide of silver and potassium dissolved in distilled water. The solution should contain 5½ oz. of the double salt in each gallon of water. Double cyanide of silver is formed by adding cyanide of potassium to a solution of silver nitrate as long as a precipitate is formed, washing this in water, and dissolving the wet salt in a strong solution of potassium cyanide. Full directions were given in No. 112, page 118, Vol. III. of WORK, and may be found in the "Electro-plater's Handbook," advertised on page 8, Vol. IV. of WORK.—G. E. B.

Electric Tricycle.—CYCLIST.—I am not yet in a position to describe an electric tricycle. Another electric tricycle has just been made and patented by a young man of Crewe. If CYCLIST could procure his address, possibly he might be disposed to give him some information on the subject.—A. S. P.

Mechanical Escritoire.—D. B. (*Ayrshire*).—You display considerable mechanical ability in your invention, and as the details may prove useful to some of our readers, I will reproduce them, adding lettered references and a further explanation as I deem correct. In the present sketches, A is a door, to which is attached a bar, B, that in turn being secured to bar C. Bar C is pivoted to the side of the escritoire within. To the top of this last-mentioned bar is fastened the ends of two cords, one passing over a reel, D, under reel, E, connected to one end of spring, F, and finally passing from the other end of the spring to the bracket, G. The remaining cord passes from the bar, C, over reel D, down the back of the job; then a spring intervenes, and finally it passes under reel H and to the foot, I. Another cord passes from the lower end of bar C, over reel J, under reel E, then turns in a diagonal direction horizontally, and finally to the end of bar K (plan, Fig. 3), which bar is pivoted under the board, L, its opposite end travelling in a quadrangular groove formed by a bent wire, as in Fig. 4, the wire being

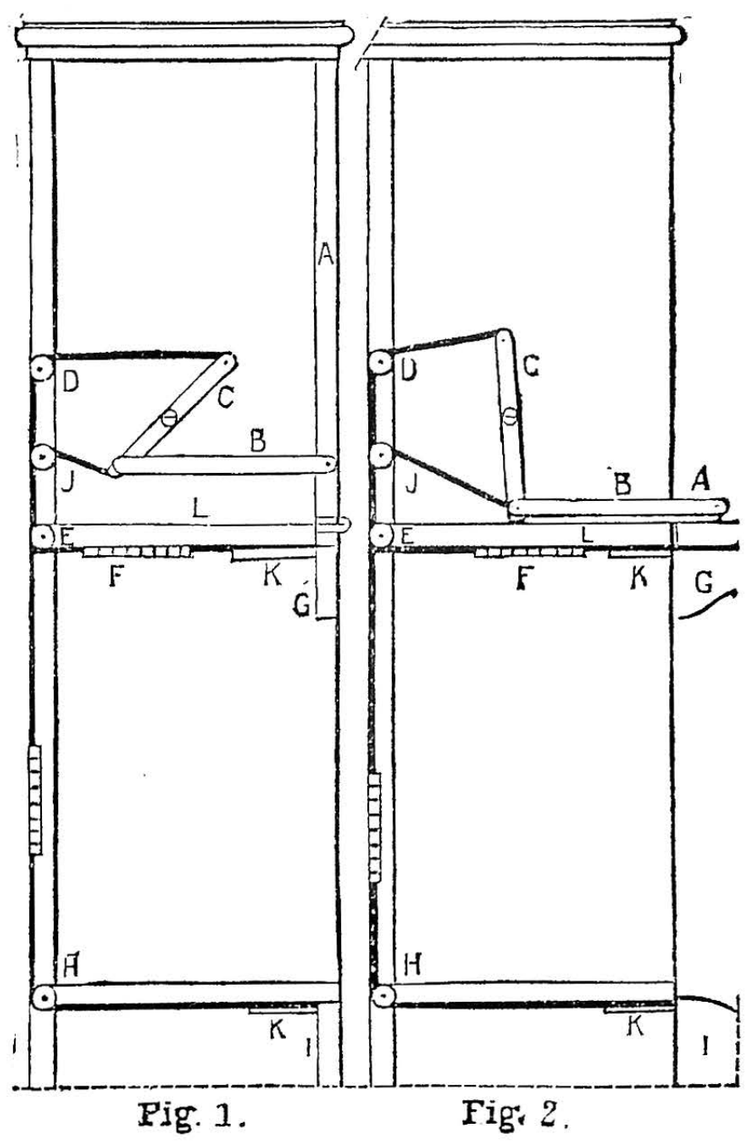


Fig. 1. **Fig. 2.**

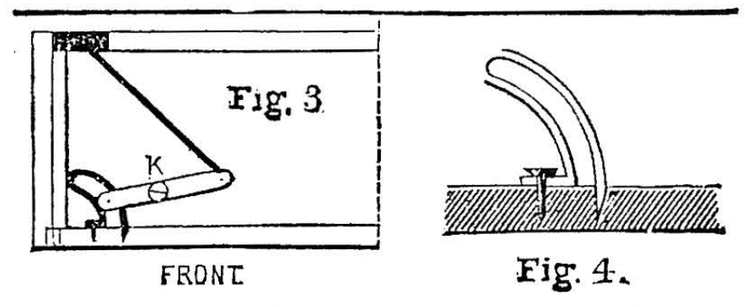


Fig. 4.

Fig. 1.—Door and Parts. Fig. 2.—Door and Levers. Fig. 3.—Cord Plan. Fig. 4.—Bent Wire, ⅛ in. thick, with Eye for Screw, the other end penetrating the Wood.

attached to the bracket, G. Another cord passes from the lower end of the lever, C, over reel J, down the back of the job, under reel H, and is finally secured to parts exactly resembling those just described in Fig. 3, and connected to the feet. Upon opening the door, A, the levers are adjusted as shown in Fig. 2 (which, you will observe, is an added diagram to facilitate explanations), and cords are pulled which move the upper and lower bars, K, they opening brackets and feet to support the door and maintain the job's stability respectively. You say that the brackets and feet are pulled back by the spiral springs, but I do not quite understand their utility. I will tell you why. When the job is opened, the brackets and feet would pull the cord attached to them and the top of the bar, C, respectively, and as bar C gives way at its top, I should have thought that upon replacing the door in its vertical position—the top of the bar, C, then returning to the position shown in Fig. 1—the cords themselves would be sufficient to withdraw to the carcase the brackets and feet. I have tried your arrangement by means of cut-out pieces of cardboard, and should say that it proves very effective for its purpose.—J. S.

Paint-grinding Machine.—PATENTEE.—I much regret my inability to assist you, since the ordinary

paint mill is probably of the kind you are acquainted with. At the same time, I see no reason why *paste* paint could not be ground in such. Are you certain it would "set before you received it"? I think not, unless you add a strong drier to the oil and red lead. In any case, you would get a *finer* product from a grinder than any home milling. Write Wilkinson, Heywood & Clarke, Caledonian Road, N., varnish and colour makers, for a quotation; or to Crowden & Garrod, Borough, London, S.E., if you *must* mill at home. They may be able to help you get a machine. Mention WORK if you write them.—LONDON DECORATOR.

Philomela.—ANXIOUS ONE.—If you will refer to the article in No. 161, you will see that I indicate approximately the size of the instrument. Roughly speaking, you have only to consider the pitch of the open strings, and if you follow my directions and take your chief measurements from a tenor (or viola), you will not be far out. I think I am correct in saying that the proper dimensions for the latter instrument were given in the admirable papers on Violin Making which have already appeared in the pages of WORK, but not having the volumes at hand at the moment, I cannot refer you to the specific number or page. As regards the *outline* of the body of the philomela, much remains in the way of scope, and you may make it any shape you please, *provided you make provision for boxing*, in the shape of a "waist." For this reason, common sense will tell you that the mandoline shape you suggest would not answer. You may certainly make it guitar shape if you wish—indeed, many violins are made of that form in Italy—but you will, in doing so, escape very little, as the ribs have still to be formed, and it is as easy to make them to one shape as to another; a mould must, in any case, be first made. I shall be pleased to hear that you have succeeded, and shall be glad to answer any questions you may find it necessary to put to me.—OLD TEACHER.

Shorthand.—H. E. H. (*Bridgnorth*).—You are right; it would not be wise to throw up a certain situation for an uncertainty. I should advise you to write and state your case to the Emigrant's Information Office, 31, Broadway, Westminster, London, S.W. This office has been established by Her Majesty's Government for the purpose of supplying useful and trustworthy information on the subject of emigration to the British Colonies, and it is under the direction of the Colonial Office.—F. B. C.

Improvement on a Patent.—F. C. B. (*Blandford*).—In reply to the question of our correspondent, we cannot do better than place before him what the law has laid down on this subject. Justice Tindal has said:—"When a party has obtained a patent for a new invention made by his own ingenuity, it is not in the power of any other person, simply by varying in form or in other immaterial circumstances the nature or subject matter of that invention, to obtain either a patent for it himself or to use it without the leave of the patentee, because that would be in effect and substance an evasion of the right." Vice-Chancellor Malins has held that "No doubt a man may make an invention which is partly covered by an existing patent, but he cannot use it *without the licence of the patentee*. He may wait for the expiration of the patent, and take out one himself if his invention be novel, and the patent will be valid"—assuming, of course, that it possesses all the points required to make it one. The only course we can advise our correspondent to follow would be to ascertain if the patentee would grant him a licence to use an improvement or to apply it to the apparatus, and on what terms, taking care *not to describe the improvement* so that the patentee would know as much about it as the inventor, and then, when he had ascertained this fact, he might put his matter in the required shape to apply for a patent.—C. E.

III.—QUESTIONS SUBMITTED TO READERS.

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

Magic-Lantern Sheet Frame.—B. N. (*North Seaton*).—Could any of the correspondents of your valuable paper inform me how to make the above, so that it can easily be fitted together, and at the same time be light to carry about?"

Hairdressing.—T. D. (*Newcastle-on-Tyne*) will thank any reader to be so kind as to give him the address of some firm who would supply what is necessary for fitting-up and opening a hairdresser's shop, and who would tell him exactly what would be required.

Racing Cutter Yacht.—F. C. B. (*Glasgow*) writes:—"Will any reader oblige by giving me instructions how to make and rig, from a solid piece of wood, a racing cutter yacht, about 3 ft. 6 in. long?"

Gondola.—CONSTANT READER writes:—"Will any reader kindly give me a design, with parts, for building a gondola for a small stream of water?"

Plate Chest.—COUNTRY CARPENTER will thank any fellow-reader of WORK for particulars and diagrams for constructing a plate chest.

Type-Writers.—CLERK writes:—"I want to purchase a type-writer, and shall be glad of opinions as to the best machines."

Banner.—E. M. S. (*Brighton*) will be obliged to any reader who will give her the design for a Purity League banner.

Half-Plate Camera.—A. G. (*Lambeth, S.E.*) writes:—"I wish to make a good half-plate camera, folding tripod stand, dark slides, printing frames, and other requirements for a photographic outfit such as a carpenter could make. A few practical hints would be gladly accepted; also the best book of instructions suitable for a beginner."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Bird Kite.—J. W. B. sends H. N. (*Ipswich*) (see No. 164, page 126) the following directions on how to make a bird kite which will fold up like an umbrella, viz.: Procure a thin piece of calico 2 ft. 8 in. by 3 ft. 9 in., and cut into the shape of a bird, as in Fig. 1, and paint it as you desire. Fig. 2 shows the framework on which the calico is stretched. Procure a stick of common deal an inch square (A A) 2 ft. 8 in. long, and split it up middle from bottom 1 ft. 9½ in. (A to B); then tie it there with fine twine, to prevent it splitting any further. Place a small piece 1 in. long 3½ in. below the tie at C, to keep it open and form the tail. Now get two pieces of cane 2 feet 2 in. long and 1 in. in circumference or ½ in. in diameter (D to D and E to E). Cut a shaving off whole length of each, to allow them to lay flatter. Rivet both canes to centre stick 8 in. from top at F, and 4 in. from the ends of each cane, so that they may overlap each other 4 in., as shown in Figs 2 and 3. Shave them down at overlapping sides so that they may lay flatter, and to secure them from slipping, as in Fig. 3, get two rings of cloth elastic, and slip them round the cane ends, as shown at D¹ E¹. Next make two canvas pockets; sew one to each end of wing of bird to hold ends of crossed canes. At the widest parts of wings place a strip of thin cane; glue it to calico, and glue over it a narrow piece of calico (H H, Fig. 4). To attach it firmly to wings, fasten a piece of string between ends of wings and top of kite. Shape the head and beak of bird with some small wire, making a little notch in centre stick for it to fit neatly into, and tie it to the centre stick with fine twine. In cutting out the calico, remember to leave about 1 in. over to glue and lap round the wire of head frame, as indicated in the diagram—Fig. 4. The tail portions of kite are fixed to uprights by pieces of thin canvas about 8 in. long and 2 in. wide glued over them, and also over the split parts and wedge, as shown by the marks in Fig. 4. The loop to which the string is attached is passed through centre stick 3½ in. from top and 11 in. from each tip of tail. Tail cups are best for this kite, as shown in Fig. 5. They are made of thin calico 3 in. in depth and 3 in. in diameter, like jelly-bags; a piece of thin wire forms the ring. Fasten them 6 ft. apart, and four cups will be sufficient for this kite. Square, folding, or other kinds of kites may be made in a similar way with a few alterations."

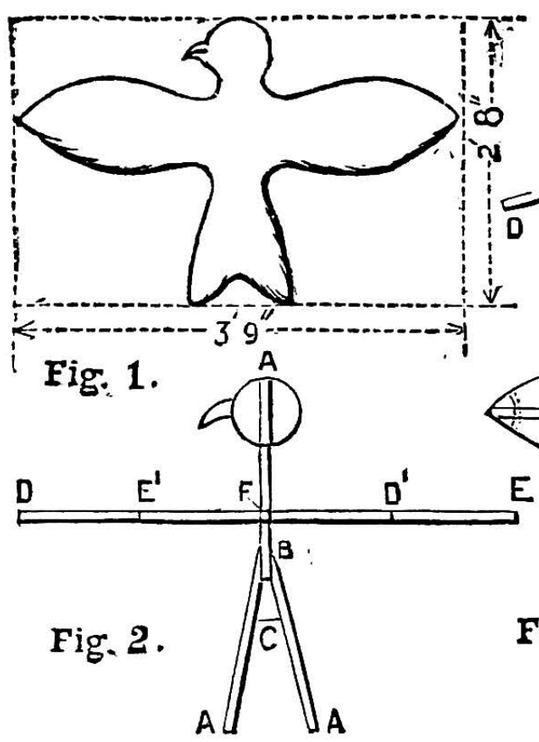


Fig. 1. Fig. 2.

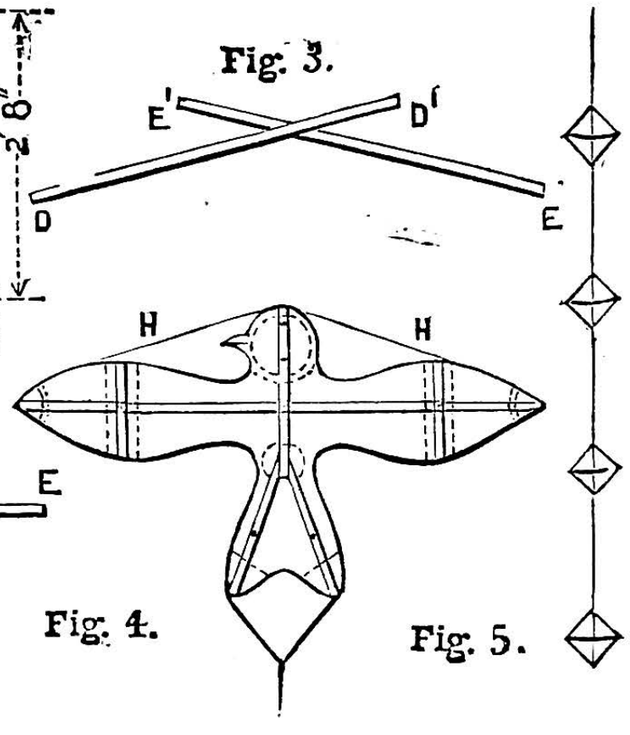


Fig. 3. Fig. 4.

Fig. 5.

Fig. 1.—Bird Shape. Fig. 2.—Framework. Fig. 3.—Cane Pieces. Fig. 4.—Gummed Calico Arrangement, etc. Fig. 5.—Tail.

Pitch.—M. (*Bishop Auckland*) writes to J. J. (*Barrow-in-Furness*) (see No. 171, page 238):—"The following recipe is given in Vol. I. of WORK: 9 lbs. of emery or fine brick-dust and emery in equal parts, 2 lbs. pitch, 1 lb. resin, 1 candle, or its equivalent in tallow."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—READER OF "WORK"; J. B. (*Manchester*); A. F. (*New Ross*); H. K. (*Hulme*); E. B. (*Bexhill-on-Sea*); D. W. H. (*Dukestown*); W. G. (*Leeds*); A. M. (*Glasgow*); T. W. D. (*Glasgow*); R. G. (*Neath*); J. W. B. (*Huddersfield*); H. R. H. R. H. (*Ashby-de-la-Zouch*); W. C. (*Harlow*); J. B. (*Glasgow*); J. G. (*Edinburgh*); D. G. (*Wallsend-on-Tyne*); W. H. S. (*Southampton*); R. D. T. (*Marylebone*); S. (*Lower Clapton*); R. A. R. (*London*); A YOUNG READER; G. & G. (*Southport*); R. W. B. (*Harebell St.*); READER OF "WORK"; S. R. (*Nottingham*); J. H. A. (*Southwark*); H. T. H. (*Thirsk*); DYNAMO; G. P. (*London*); BIRKBECK COMPANY; HEATHFIELDS; J. L. (*Wimborne*); J. W. N. (*Glasgow*); E. E. (*Northampton*); A. F. (*Halifax*).

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