WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

WORK has been begun for the utilisation of the power of the Falls of Niagara. It is intended to construct a large turbine plant on the American side. The tunnel which forms the tail-race of the turbines is built for a capacity of 100,000 h.-p. The tunnel is expected to be completed next July.

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A patent has been granted for "spider" wheels for bicycles and other light machines. An influential company in Glasgow, on being shown the details, joined the patentee in getting it through the Patent Office. It remains to be seen whether there is anything good in the invention. Already cycle wheels appear sufficiently spider-like.

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At the Globe Works, Bankhall, Liverpool, one of the largest steel-wire cables ever made in this country is now being manufactured. It will be 3½ miles in one continuous length without a joint, and will weigh about twenty tons. It is 3¾ in. in circumference, made from the finest quality of patent crucible steel wire, and having a tensile guaranteed strain of over forty tons.

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A belt is now being made for the Electric Lighting Company, New Orleans, which, it is believed, will be the largest in the world. It is to be 6 ft. wide, 169 ft. long, and will require the skins of one hundred and seventy-five animals to complete it. The weight will be about forty thousand pounds, and the cost something like ten dollars, or £2 per square foot.

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A newly designed pulley has been brought out in America. On the face of the pulley, at regular intervals, are rubber strips with rounded surface, and fastened by projections passing through the rim of the pulley. Not only do these strips do away with slipping belts, but lessen the wear on the latter and reduce the friction to the minimum. When worn out they can be replaced at a slight outlay.

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Messrs. J. Willis & Co. are producing a "self-hardening" tool steel, which is expected to be much easier to forge, twist, and form into tools than other steels of this class. It is self-hardened by the air in cooling, and does not require hardening or tempering, although for extremely hard work it may be heated to a dull red heat and plunged into hot water.

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The Ameer of Afghanistan now possesses a mint, a cartridge factory with an output of seven thousand cartridges per day, a rifle factory, a boot and shoe manufactory, and a tailoring establishment for the manufacture of English costumes: and all are driven by steam. This would point to the Ariana of the Greeks as being something of a prospective area for an emigrant settlement, *i.e.*, if the Afghans offered no resistance!

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Judging from some of the dividends recently declared, the past year cannot have been an altogether disastrous one for the Sheffield hardware trades. Messrs. Henry Bessemer & Co., Limited, have declared a dividend of 25 per cent. for the past twelve months; while Messrs. Brown Bayley and Co., Limited, gave a similar dividend, and carried £15,000 to the Reserve Fund for the same period. Messrs. J. Vickers, Sons, & Co. gave 6½ per cent., and the Midland Iron Co. distributed 5 per cent. for the past year.

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An ingenious preparative method for the transport of sulphuric acid is being carried on by an enterprising chemical company on the Tyne. Hitherto this acid has been exported in carboys, a kind of large flask fixed in a hamper and packed with straw. This kind of receptacle being of a fragile nature, great care had to be exercised in the handling on board ship; naturally the acid had to be part of a deck cargo, and at the appearance of rough weather the acid was consigned to the deep. To get over this difficulty, the chemical company have arranged a process consisting of a large cast-iron pan lined with enamel, and having a furnace underneath. The acid is here heated to a high temperature, and mixed with nitre cake, afterwards being run off into tins or drums and hermetically sealed. When cold the acid has the appearance of hard-frozen snow. There will be no fear now of the carboys being broken during rough weather; and the acid, being highly concentrated, can easily be *thawed* by being diluted with 50 per cent. of cold water.

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Old Age Pensions is the tune of the hour, but what time will transpire before practical effect can ensue, in the case of Mr. Chamberlain's or any other of the schemes set forth, is another matter. Meanwhile, a laudable step has been made by a Sheffield firm, who have set an example which every labour house in the kingdom might well follow. Messrs. Walker & Hall, the silversmiths and cutlers, have initiated a most generous scheme of long-service pensions for their *employés*, the workpeople not being called upon to contribute to the fund, the only condition being *continuous* long service, illness, or shortness of work, not to be considered as a break. The following benefits are to be derived after

	Men.	*Women.*	
21 Yrs.' service	8s. 6d. ...	4s. 3d.	per week.
25 „ „ ...	10s. 0d. ...	5s. 0d.	„ „
30 „ „ ...	15s. 0d. ...	7s. 6d.	„ „
40 „ „ ...	17s. 6d. ...	8s. 9d.	„ „

This is, indeed, a sensible recognition of labour worth, and is an improvement upon the "at death" systems of benevolence.

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"Expanded metal lathing" is about to take the place of wood laths for plasterers' work—especially in the construction of fire-proof buildings. It is made from narrow strips of steel, which are cut into strands on parallel lines at intervals of width or length desired, and between these intervals of cuts or slashes are uncut sections; then it is opened up or expanded at the lines of cuts or slashes into sheets of lathing, from 18 in. to 2 ft. wide, and is cut into lengths of 8 ft. The sheets, which are ¼ in. wide in the strands, require no stretching, and are easily and quickly fixed. They can be easily cut with a pair of ordinary shears into any necessary length or shape, and by hand pressure made to conform to any curve required for cornices or mouldings, and a very few fixings will keep it in position. The shelf-like strands provide perfect lodgment for the lime and hair, and permit of a partial connection between the keys. The lathing and plastering thus becomes a homogeneous mass, and is much less likely to crack than ordinary lath work, as warmth will not expand or cold contract the lathing. Furring strips (unless an air space is required) are not essential to the use of this lathing, as it provides ample key when secured to a flat or curved surface.

TO LEARN DRAWING OFFICE WORK.

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

In this and the following papers it is intended to deal with the work of the drawing office in as practical a manner as possible, describing in detail the methods adopted by the draughtsman in drawing, colouring, and finishing plans of every description, and dealing also with mounting, varnishing, and other processes which enter into the daily routine of the drawing office. The reader will be assumed to be familiar with the ordinary processes of mechanical drawing and geometry, so that unnecessary elaboration will be avoided. With the same object it will be taken as granted that the commoner forms of drawing instruments are known to the reader, and attention will be drawn only to such instruments or particular features as are of special interest.

The Drawing Office and its Furniture first call for our notice. The ideal drawing office is seldom found, because it is not often that it has been specially designed for the purpose for which it is used. The essential qualities which should mainly guide the choice of a drawing office are two: an abundance of daylight and freedom from dampness. Gaslight has, of course, to be used to a great extent in the confined offices of engineers and architects who are surrounded by buildings in such a manner as to block out the daylight, but there are many objectionable features in the use of gas. It is unhealthy, vitiating the air with noxious fumes; it casts strong shadows from the edges of T-squares and set-squares; and it is impossible to colour with any accuracy of tint by gaslight. So far as possible, then, an ample supply of daylight should be obtained. The windows should be large and lofty, and it is desirable to have them on both sides of the drawing office, so that no shadows shall be cast by the drawing instruments. Skylights afford an excellent means of lighting so far as the amount of light obtained is concerned; they are, however, the cause of much inconvenience when a tracing is being made on glazed tracing linen, or when a wash of colour is being laid, as the light is reflected upwards in such a manner as to make it difficult to see the work properly. They have also an unpleasant tendency to keep the office very cold in winter, as the heated air naturally finds its way to the skylight, and the heat is radiated at once through the glass. On the other hand, the summer sun pours his rays through them, and converts the drawing office into something very like a florist's hot-house. Skylights and windows should alike be provided with blinds for regulating the glare of the direct sunlight.

Freedom from damp is essential in the drawing office, or otherwise it will be found that the drawing papers and thin wooden instruments, such as T-squares and set-squares, will be injuriously affected. Fortunately, drawing offices are generally located, for the sake of the light, at the top of the building in which they are situated, and are consequently not very liable to dampness. The ordinary open fire-grate is much to be preferred before any system of heating by hot air, water, or steam in pipes. The latter cause an amount of dry dust and a stuffiness of atmosphere which are very objectionable.

Desks and Tables.—The desks should be of the firmest and most solid construction: in fact, they are best when built into the office as fixtures. The right position for them is along the walls, directly under the windows, so that each draughtsman has a window in front of him, and the advantage of the fullest possible light on his work. The tops of the desks should be made of plain, unvarnished pine, so that they are not too hard to drive drawing-pins into when it is desired to prepare a drawing too large for the drawing-board. This will also allow for the desks being scoured down occasionally with soap-and-water without doing any harm. A suitable height for the front edge of the desk is 3 ft. 3 in., with an upward slope of an inch for every foot in width. In Fig. 1 is shown an arrangement by which the draughtsman can work comfortably on the upper part of a drawing without soiling or creasing the lower part with his body. It will be seen that a rounded bar, an inch or an inch and a half thick, is fixed to the front edge of the desk in such a way as to leave a slot down which the lower half of the drawing is passed, while the bar acts as a guard to protect it from damage.

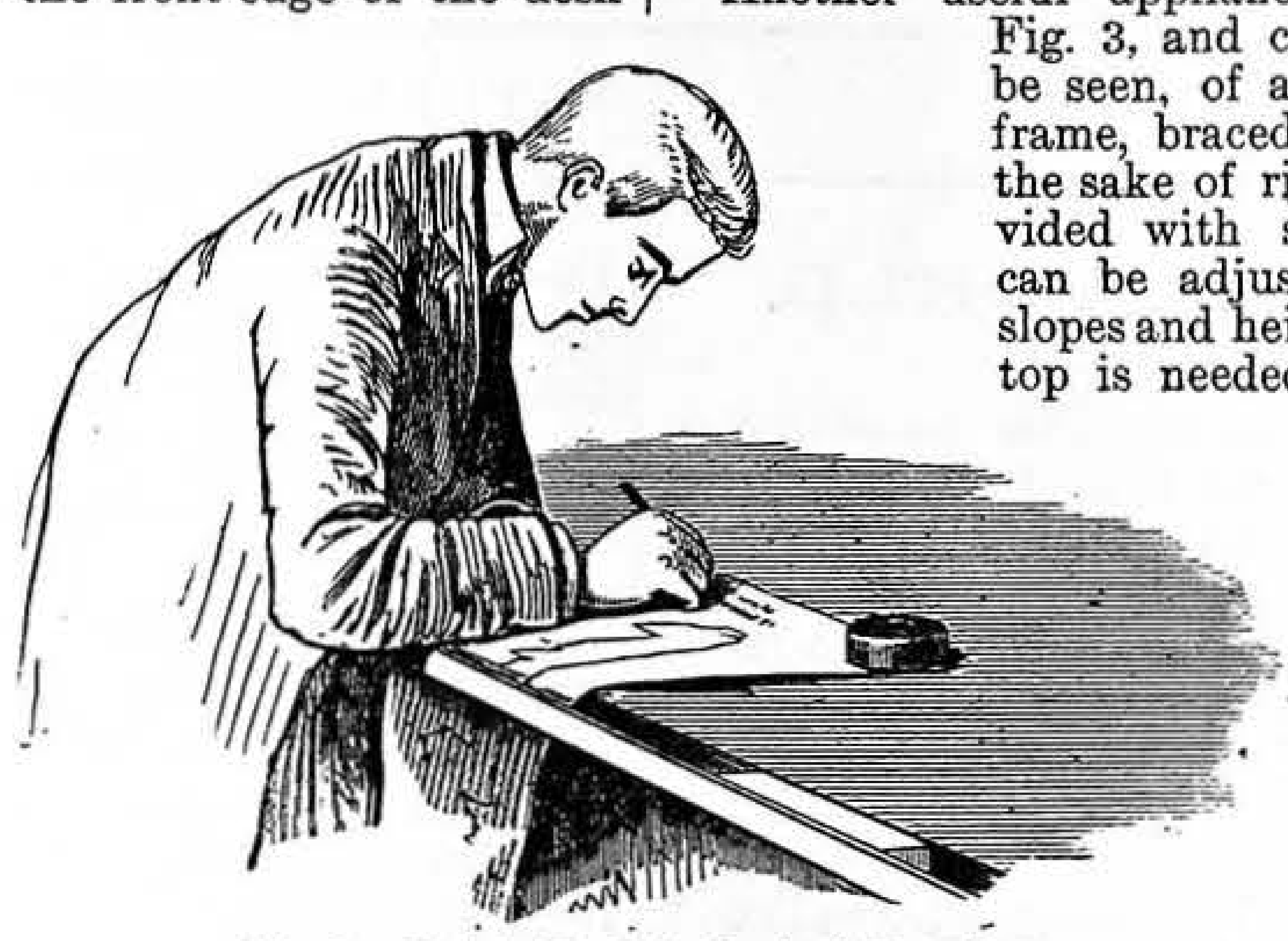


Fig. 1.—Slot in Desk to Protect Drawing.

Fig. 2.—Adjustable Drawing-Table and T-Square combined.

An excellent combination of table and drawing-board arranged almost vertically and fitted with an attached T-square is shown in Fig. 2. It has the advantage of occupying very little floor space, and is extremely comfortable to work at, as the drawing-board can be moved up or down so as to bring any part of the work under the hand of the draughtsman. A counterpoise balances the board so that a slight pressure on the handle shown at the bottom is sufficient to effect the movement. The T-square is balanced in a similar manner. Both drawing-board and T-square are provided with narrow projecting shelves on which to place the drawing instruments and colours. The flat table is useful for carrying books or drawings in use, and a drawer is fitted under the table. The whole is carried on a light cast-iron framework. The inclined struts of the framework at the back of the drawing-board are provided with recesses for taking wooden laths, on which can be displayed the drawings that it is wished to consult for the work in hand. This useful piece of furniture is of German origin, and is as yet not so well known in England as its merits deserve. In WORK (No. 69) there was given an illustrated description of an American invention of a somewhat similar kind, having a drawing-table with adjustments vertically and to various angles.

Another useful appliance is shown in Fig. 3, and consists, as will be seen, of a light cast-iron frame, braced diagonally for the sake of rigidity, and provided with supports which can be adjusted to varying slopes and heights. No table top is needed, the drawing-board resting directly on the supports. The whole arrangement is so lightly constructed that its position can be easily altered as desired, and, as it occupies very little room, it is a convenient article of furniture where space is limited.

Stools.—Most draughtsmen prefer to stand to their work, as a rule, because in the various operations of drawing and finishing a plan of any size the work is seldom confined to one part of the paper at once, and it is necessary to alter the position of the body momentarily to obtain a proper command of the work. In some classes of work it is nevertheless possible to work while seated, and in such a case the form of seat which will be found most suitable is one which is adjustable in height on the principle of a music-stool. A rather elegant development of this form is shown at Fig. 4.

Gaslights.—It is almost impossible to have too much light in the drawing office. To this end jointed gas-brackets should be fixed in such a position as to enable the burner to be brought within a foot or 18 in. of the board. An ordinary burner with naked flame will generally be considered efficient enough, but, if practicable, Argand burners with opaque shades should be

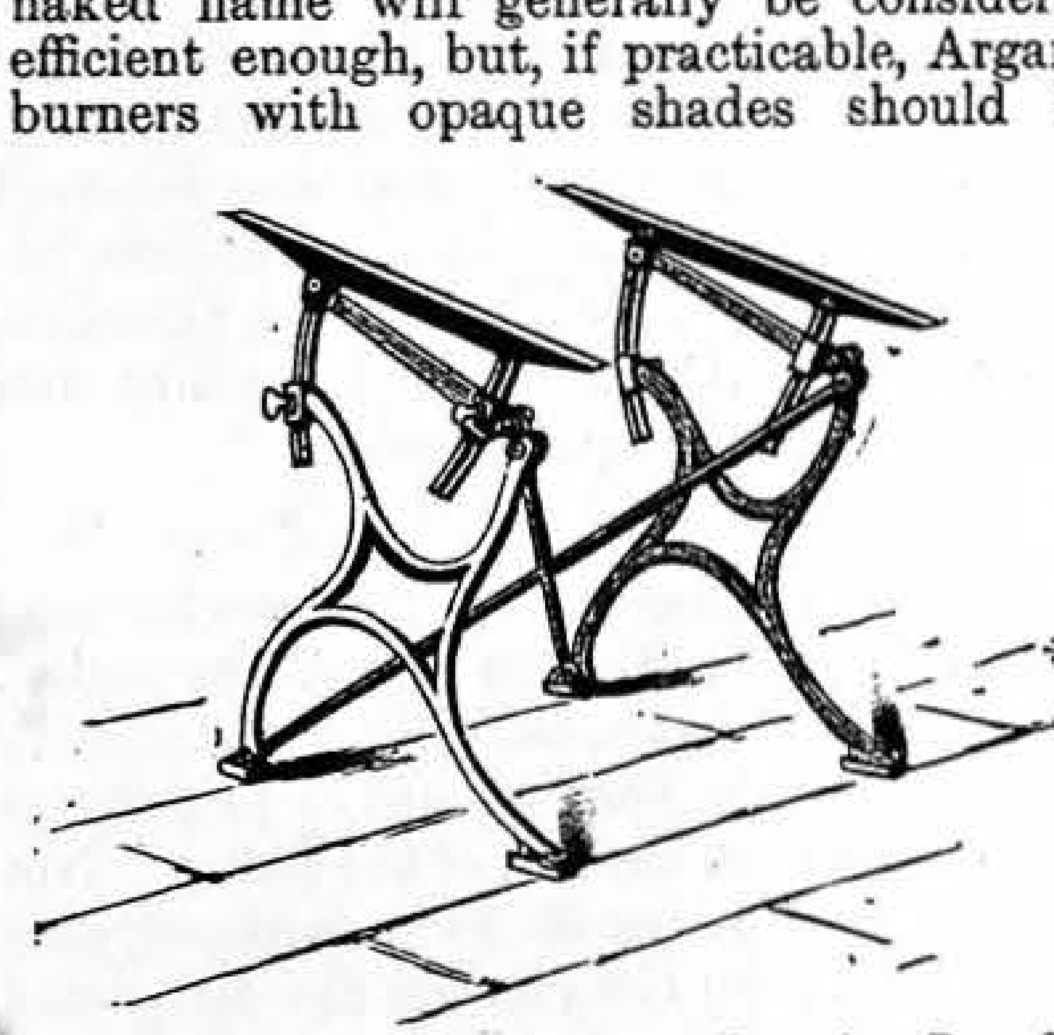


Fig. 3.—Adjustable Stand for Drawing-Board.

adopted. In this case, as the burner must be kept upright in all situations, some arrangement of parallel motion links becomes necessary, as shown in Fig. 5. One or two movable stands fitted with gas-burners and indiarubber tubing will also be of service occasionally.

ABOUT WORK AND POWER.

BY W. C. CARTER, M.I.MECH.E.

Few words are in more common use than those of our title, and their popular meaning is clear enough to everyone: Work being understood as the act of performing labour, or the produce of the labourer, and Power being used as synonymous with Strength.

But the words have a special scientific meaning, not by any means difficult to understand when attentively studied, though they are seldom so studied, except by those whose special business it is to master such matters. Experience often shows, indeed, that, even in the case of trained men, the scientific ideas conveyed by the words in question are not as clear as they ought to be. It is not inappropriate that the columns of WORK should be utilised for the purpose of illustrating these important points, and making clear to its mechanical readers the methods of applying the Principle of Work to the common, every-day questions of machine design. Its clear comprehension will cause many apparent difficulties to melt away, and often preserve inventors, who are large readers of WORK, from attempting impossibilities, the absurdity of which is sometimes veiled under complications of detail.

We shall see, as we proceed, the connection of our second title with the first.

What, then, is the scientific meaning of the word "Work"? Let us consider a simple illustration. Suppose that we have resting upon the floor a sack of grain weighing 500 lbs. Here we have the simple idea of weight without motion, or, in more general terms, force without motion; for weight is only the force of gravitation pulling towards the earth. We may therefore extend our idea to that of force generally, in whatever direction, and by whatever agency exerted. So far, the force is inert, and only results in a dead pressure upon the floor, and a corresponding reaction by the floor resisting the pressure and supporting the sack. We might conceive this force as acting for ever without change, as no waste is taking place. Let us now suppose that the sack is to be lifted on to a platform 3 ft. high. Now to the original idea of force we have to add that of motion through a certain distance, and we obtain, by multiplying together the force (500 lbs.) and the distance (3 ft.), a compound unit (1,500 ft.-lbs), which represents—to quote Longfellow—"something done," that is—Work. Work, then, is a compound idea comprising those of force and distance, and it is measured by the compound unit, composed of the simple unit of distance (the foot) multiplied by the simple unit of force (the pound), forming the compound unit of Work (the foot-pound).

The next point is that of Power, and here another factor comes into play.

We might suppose that our corn is carried, grain by grain, by a spider in the way attributed to the pertinacious insect whose perseverance gave renewed heart to the desponding King, Robert the Bruce. In course of time the required task will be accomplished, and the grain be all lifted on to the platform. Or we might, and probably should, lift the sack at once bodily. It is clear that, in both cases, the result achieved—the Work done—is the same, and also that the difference between the agents is that between Weakness and Strength (*i.e.*, a difference of Power), the only difference between the operations being the time occupied. Time, then, is the third element that must be combined with that of Work to obtain a unit with which to measure Power.

The usual unit of Power in this country is the horse-power, which is well known to be 33,000 ft.-lbs. in one minute. It should be observed that these products always denote the same amount of Work or Power in whatever way the factors producing them may be mutually varied. For example, if

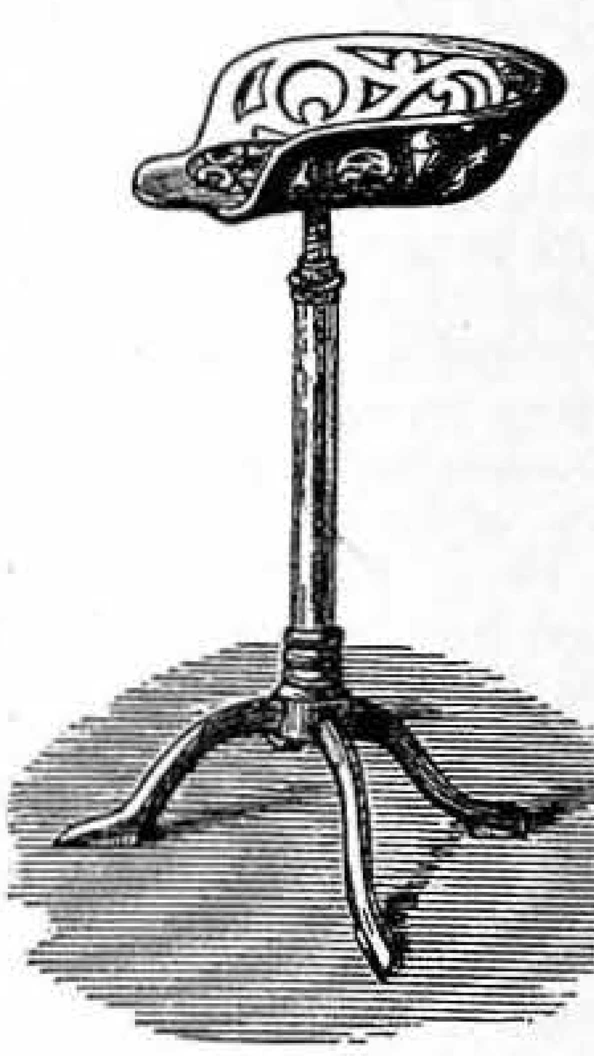


Fig. 4.—Adjustable Seat.

the weight of the grain in our illustration had been half as much (*i.e.*, 250 lbs.), and the distance had been twice as much (*i.e.*, 6 ft.), as the product (250 by 6) would still

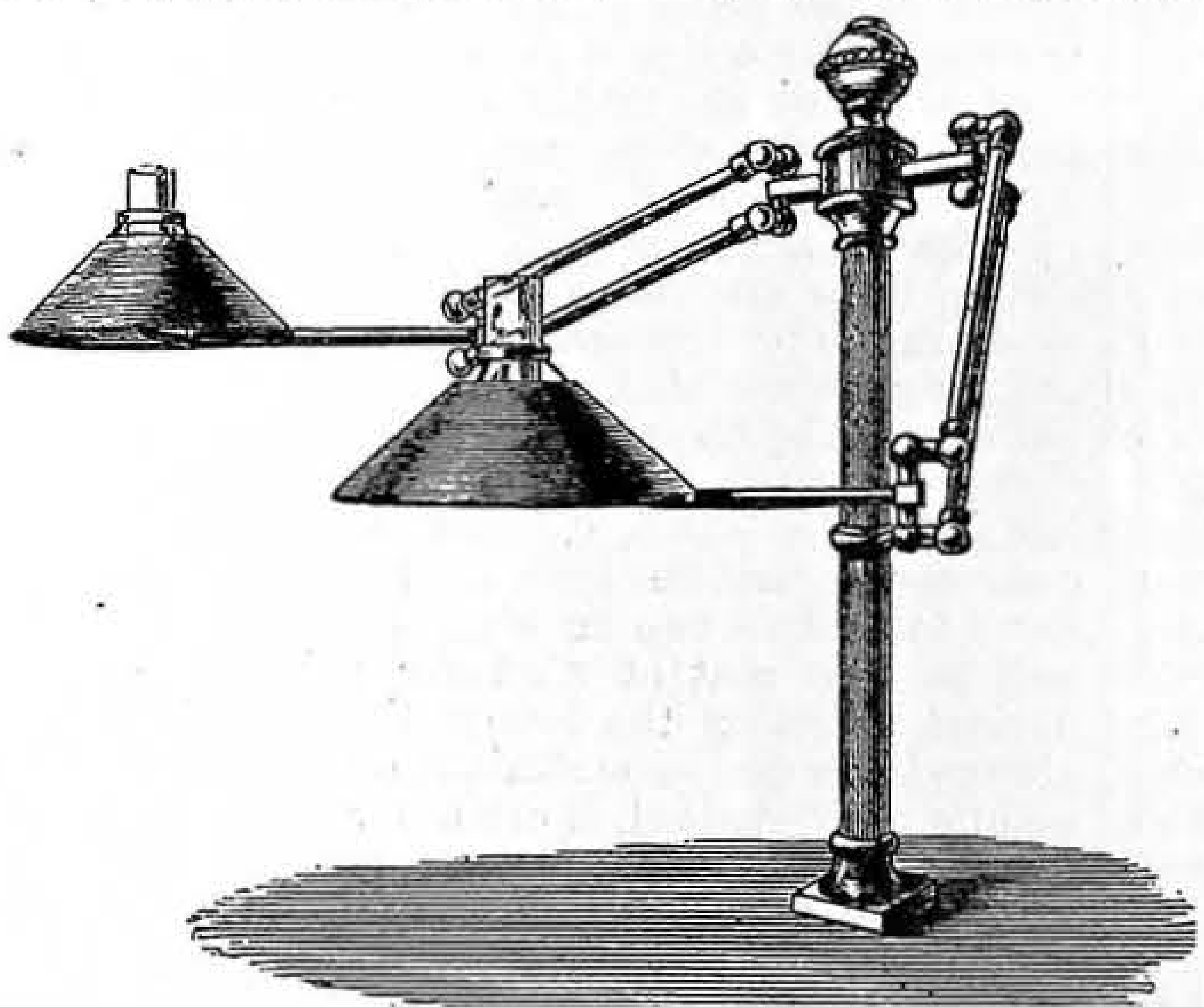


Fig. 5.—Adjustable Gas-Bracket, with Argand Burners.

equal 1,500 ft.-lbs., the amount of work represented by the operation would be exactly the same, and similar reasoning applies to quantities of Power. Having mastered thoroughly these conceptions, we will sum up our definitions thus:—

Simple units (one element) { of Force—the pound. / of Distance—the foot.

Compound unit (two elements) of Work—the foot-pound.

Compound unit (three elements) of Power—the horse-power.

We are now in a position to understand the limitations within which man exerts his constructive faculties.

Few persons in these days will need to be told that matter, so far as Man is concerned, is indestructible. Man cannot create it, nor can he destroy it. All he can do is to rearrange it in some way, or change its form. For instance, he can take a block of marble, remove certain superfluous portions, and leave a statue and a heap of chips and dust, but, were all the portions preserved and weighed, we should still find the total weight the same as the original block, as the total amount of matter cannot be altered. He may apply molecular motion in the form of heat to a pound of ice, and may thus change it to a pound of water, and, by continuing the process, to a pound of steam. The form has been changed from solid to liquid, and from liquid to gaseous, but the weight remains as before. The pound of ice makes a pound of steam, proving that the original amount of matter still remains.

It is not, however, so commonly understood that Work comes under just the same law as to its indestructibility.

Just as in the case of matter, we can change its form, but can neither increase nor diminish its total amount, and this is the Principle of Work, which it is the chief aim of these articles to explain and illustrate.

The object of all machinery is to take work, in whatever form it may be available, and transform it into a condition suitable for the purpose required. In a large factory we might have work developed in the furnace of a boiler, which is transmitted by the steam through the mechanism of an engine to the shafting, from which it is taken and transformed by each different machine to each particular purpose. The revolving shafting supplies, through belting, a continuous linear pressure as the belt passes from the pulley, and this is transformed in the lathes to a revolving action, in the power-hammers and punching machines to a succession of blows and strokes, and so on, the object of each machine being simply to change the form of the work supplied by the shop shaft.

It may perhaps have occurred to the reader that it is a strange proceeding to estimate the work as commencing in the furnace, and not in the cylinder, where the first moving parts are found. The work really exists in the furnace, but in its alternative form of Heat. Thus we come to another important truth—viz., that Heat and Work are mutually interchangeable.

This truth began to be suspected about the year 1800, and when Count Rumford made his memorable experiment of boiling water by means of the heat generated in boring out a cannon, he gave the death-blow to the many fallacious guesses that had been made as to the nature of heat, as it was seen that nothing could have produced the heat observed except the work done by the cutter, and that, in fact, work was simply another form of heat. That the two are mutually convertible may be seen on every hand. A boy who rubs a metal button upon a form and claps it upon the back of his neighbour's hand supplies a simple illustration of the conversion of work into heat; while the illustration given above of the furnace of a steam boiler producing the work given off in the engine fly-wheel is an excellent illustration of the converse action—heat into work.

George Stephenson is credited with the remark that all power comes from the sun, and, considering the state of physical knowledge in his day, the remark shows his able grasp of first principles.

It will be a useful exercise for a mechanic to trace out thoughtfully the original sources of power in different cases, and will widen and simplify the mental view. For example, we see a water-wheel, and we ask, How did the water obtain the power to do the work that we see given out? A little thought will show us that the sun, by evaporation, raised the water from the sea-level to the high ground, from which it falls, giving out work in its descent, and it is more difficult to conceive, but equally true, that if we could have weighed each particle of steam as it ascended under the sun's action, and have multiplied it by the distance it was raised, we should find *exactly* the amount of work it gave out in returning to its former level. Again, in the case of the steam-engine, the sun, by its action upon the vegetation of bygone ages, produced the coal which gives the energy to the steam. One writer has well compared coal to a coiled spring, which returns the work done upon it when the conditions are favourable.

Thus it would be found that, with a few exceptions, the sources of power with which we are acquainted are simply receptacles of the heat which is poured upon the earth by the sun, and that they will return that heat in the form of work when the conditions are suitable.

Now we will go a step further. Inasmuch as Work and Heat are the same things in different forms, if we apparently lose one of them we shall have a good idea where to look for it. For instance, we have a machine which—in spite of our statement that work is never destroyed—does not give out all the work put into it, as, of course, is the case with all machinery to some extent. Where, then, is the missing work? As it does not appear as work, we must look for it in its other form, and, on examining the bearings, we find that they are slightly heated, and this heat will be just that due to the work lost. The heat is produced by friction, and if we could measure the resistance of every rubbing surface in pounds, and multiply each by the distance it passed through in feet, we should obtain a total number of foot-pounds *exactly* equal to the missing work, and to the equivalent amount of heat produced.

The proportion of work given out by a machine compared with that put in, is called the Modulus of the machine, and is expressed as a fraction taking 1 to represent the work put in; 1, therefore, is the modulus of an ideal machine without friction, and the difference between the modulus of any given machine and 1, will represent the proportion of work lost in friction. In our next article we shall explain the method of comparing, with exactness, Work and the amount of heat corresponding to a given quantity of it.

HOW TO MAKE AN IMPROVED CAMERA STAND.

BY "DESDICHADO."

SOME time ago the author of the present paper desired a tripod stand for his camera, which while being, in the first case, perfectly rigid and efficient, should be as light as possible and close up into a small compass. Having plenty of suitable material, he decided to construct one to meet his requirements, thereby finding profitable employment for leisure and keeping a guinea or thirty shillings in his pocket. Feeling that there are many who would be willing to have a few hints on the construction of a very portable and rigid tripod, which may be most easily made, the following particulars and method of construction adopted by the author in making his stand are given and described.

When making an article of the nature of the one at present under discussion, which is intended primarily for *use*, it is not desirable to spend time in unnecessary work, and the simplest way of attaining certain objects will usually be found the best. It will be very apparent that, other things and sizes being equal, the most rigid stand will be the one in which the legs are in single pieces—not folding or closing; and the more joints there are the greater the chances of a loss of firmness, which will be greater or less according to the degree of perfection with which the joints are fitted. Having regard to this, and to simplicity and ease of construction, a stand closing in three was decided upon—a fourfold stand, although closing up shorter, being somewhat bulky, besides necessitating an extra joint; and it being often a great convenience to be able to adjust the height of the camera without unduly spreading the legs of the tripod, and also on uneven and sloping ground to regulate the length of each or any leg individually, it was decided that the lowest limb of each leg should slide within the second or middle limb, the uppermost limb folding down alongside.

Fig. 1 shows a single leg of the tripod open to its fullest extent. It will be seen that the lowest limb, which is single, slides between the two members of the middle limb, and may be clamped at any desired point by the bolt, B, and plate, A, the bolt having a base or flange on the other side similar to the plate, A, which is not seen in the figure, but which is shown at Fig. 3. In most of the stands with sliding limbs which are sold in the shops, tongues are formed on one, while corresponding grooves are ploughed in the other limb, in order that the sliding limb may maintain its true direction; in the present case the tongueing and grooving are obviated, and the proper working ensured by the plates before mentioned, which are attached to the lowest or sliding limb and the plates, C, fixed at the lower end of the middle limb, and which also serve to hold its two members together. It will be seen that at whatever point it is desired to clamp the lowest limb, it will always be in the same straight line with the middle limb—indeed, it can never get out of it—while the labour and time saved to an amateur in adopting this simple mode of construction, as against ploughing and tongueing, are very considerable items, while nothing is lost in point of neatness or efficiency; and if the stuff from which the stand is made is properly seasoned, and, after being cut, is kept in a warm room for a few days before being finished off, there will be no necessity for having a tongue working in a groove: wood in such slight scantling is very liable to go out of truth unless it is very well seasoned, and even then it will go after being cut up; and the precaution should always be taken of thoroughly seasoning such slight pieces of stuff before planing them down to finished sizes, so that any slight warping or deviation may be corrected.

The upper joint of each leg about which the top limb moves is formed by a long bolt or screw, D, with fly-nut which passes through both members of the top and middle limbs, as shown, the whole being clamped by screwing up the fly-nut; a blocking piece, E, is fitted between the members of the middle limb at the upper end, to keep them apart when the nut is screwed up. The plates F, F, on the upper part of the middle limb, project over and catch the end of the top limb, giving stability when the leg is opened out. It was at this point of the preliminary considerations that it was discovered that these plates would be a somewhat troublesome necessity, and the author tried to think of some means of dispensing with them; for it will be seen that, in order for the stand to fold at this joint, the plates must clear the lower ends of the top limb; and this appeared to raise a difficulty. This, however, was got over by forming a slot in the upper end of the middle limb through the blocking piece for the clamping screw to work in, instead of a circular hole, thus allowing the top limb to be moved endways, so as to clear the plate when being opened or closed, and to lie alongside the middle limb without projecting beyond it at either end when folded up (see Fig. 4). The upper ends of the top members have brass plates, G, with holes which fit on to pins on the head—which is hereafter described—and are strained apart by a piece of tube or rod, marked H in the sketch, which turns down into a slot when the leg is closed. (See detail sketch, Fig. 5.)

The stand opens out to 5 ft., and is 1 ft. 11 in. long when closed, the three legs making a package 1 ft. 11 in. long by 2½ in. square.

This fairly explains the action of the legs, and will enable the reader the more readily to grasp the mode of construction, which it is now proposed to discuss.

The size of the camera for which the stand was constructed was half-plate, but the dimensions given can easily be modified to suit any other size, although the legs could hardly be made much lighter; but the top might be reduced in size for a quarter-plate camera.

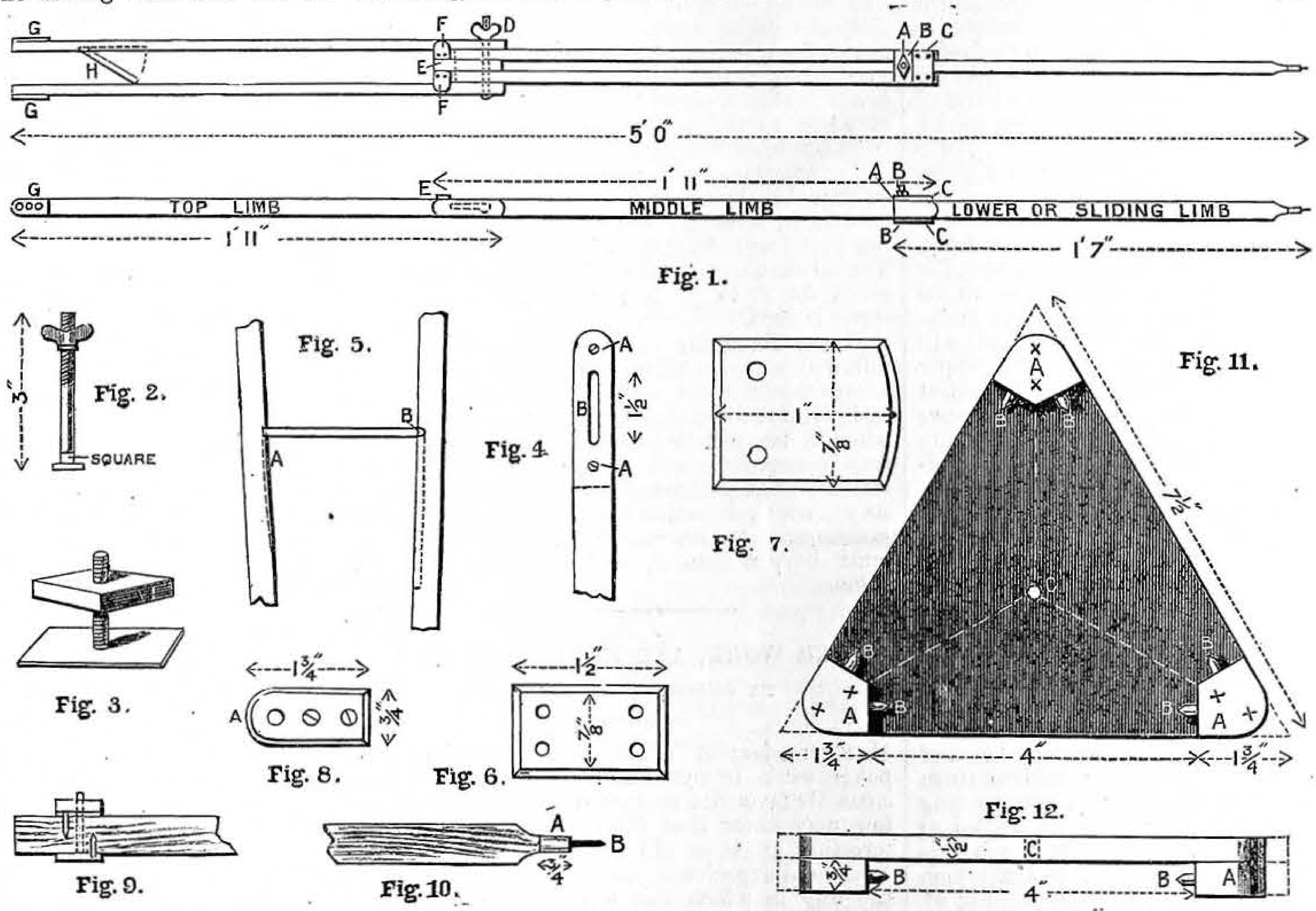
The wood most suited for the purpose is either ash, oak, mahogany, or pine. These are placed in order of suitability. The stand made by the author is of mahogany—oiled, not polished—and looks very well; but if either ash or oak is available, it is probably a better material for the purpose, being less liable to split under strain. Pine will do if none of the other materials is obtainable. Whatever is used must be thoroughly well seasoned, and the precaution previously suggested must be taken if a good result is to follow.

It has been assumed that one of the harder woods has been decided upon. By reference to Fig. 1, it will be seen that each leg consists of five pieces, each ¾ in. by ½ in. in sectional dimensions, and the four members forming the two upper limbs are each 1 ft. 11 in. long; the lowest, or sliding limb, being prevented from closing right into the middle limb by the block E at the upper end, is only 1 ft. 7 in., so that fifteen pieces are required in all: twelve pieces 1 ft. 11 in. long, and three pieces 1 ft. 7 in. long, by ¾ in. by ½ in.

The method of preparing these will be governed greatly by the material available, but if they are cut out of comparatively wide stuff, it will be well to thickness it down to ¾ in. or ½ in., according to the thickness of the stuff, and then shoot or true up one edge. Set a gauge to the other dimension—for instance, if the stuff is ½ in. thick the gauge will be set to ¾ in., or *vice versâ* if the stuff is ¾ in. thick—and mark and cut off the strips; then shoot the edge of the remaining piece again, and proceed as before until the required number of pieces is obtained; but, as has been remarked, circumstances will govern the method of procedure, and only by knowing the size of the material available could the least wasteful and best method of cutting up be decided upon. Having cut these pieces out, and while they are seasoning in a warm, dry place for a few days to "take their bearing," the required brass-work may be looked up. If none is "in stock," it will be well to get it in strips as rolled, which strips may be obtained of almost any width. Much time is saved if the pieces have not to be cut out of sheet brass. It should be $\frac{5}{8}$ in. wide, and need not be of a very heavy gauge, so long as it is sufficiently thick to enable the heads of the small screws necessary to fix the plates being sunk in it.

For each leg three plates, $1\frac{1}{2}$ in long by $\frac{5}{8}$ in. wide, will be required (Fig. 6)—one for the top of the sliding limb and two for the drawing at Fig. 8.) Messrs. Stanton's warehouse in Shoe Lane is a good place for such brass-work. The remaining fittings necessary to purchase—unless the amateur has a lathe and screwing tackle, and can make them; but even then it is cheaper and better to buy them—are three bolts and fly-nuts (Fig. 2), one for each leg, for clamping the top limb (these bolts will require to be 3 in. long), and three Assiter's flange bolts and nuts for clamping the sliding limbs (Fig. 3). All of these are specially made by Platt, Camera Maker, Dalston, and for this stand will cost but little. Three stretching pieces, which may be of light brass tube $\frac{3}{16}$ in. in diameter, will also be required; they will be 3 in. long, and will require a fine hole drilled at brass plates, $1\frac{1}{2}$ in. long, already prepared for the bottom of the middle limb, and screw it in position $\frac{1}{4}$ in. from the end with $\frac{1}{2}$ in screws, drilling and countersinking holes in the plate, as shown in Fig. 6, in such positions that the screws may be in the centre of the width of each member. All this fitting up should be done with the limbs clamped up in a hand-screw; every part will then, of course, fit too tightly to work, but the subsequent glass-papering will make it right. Then turn the limb over, and screw on a similar plate on the other side. This limb may now be set aside, and the middle limb of the other legs similarly treated.

The top plates for the head, G (Fig. 1), may now be fixed. They should have one end rounded off to a semi-circle, as shown in



IMPROVED CAMERA STAND. **Fig. 1.—Two Views of Stand opened out—A, Clamping Plate; B, Assiter Flange Bolt; C, Brass Plates holding Parts of Middle Limb together; D, 3 in. Brass Bolt and Fly-nut; E, Blocking Pieces; F, Abutment Pieces at Top of Middle Limb; G, Head Plates; H, Straining Piece. Fig. 2.—Brass Bolt for clamping Joint of Top and Middle Limbs. Fig. 3.—Assiter Flange Bolt for clamping Sliding Limb. Fig. 4.—Top of Middle Limb showing Slot—A, Screws for holding Blocking Piece and Top of Limb together; B, Slot. Fig. 5.—Portion of Upper Part of Top Limb, showing Straining Rod—A, Slot sloping from Surface and receiving free End of Rod; B, Steel Pin or centre on which Rod hinges. Fig. 6.—Brass Plates for holding Lower Ends of Middle Limbs together. Fig. 7.—Abutment Pieces for Top of Middle Limb. Fig. 8.—Head Plate—A, Hole for Pins in Head. Fig. 9.—Clamping Bolt and Plate of Sliding Limb, showing position of Retaining Screws. Fig. 10.—Toe of Sliding Limb—A, Brass Ferrule; B, Iron Screw with Head cut off. Figs. 11 and 12.—Views of Head—A, Blocks; B, Tapered Pins; C, Hole for Camera Screw.**

bottom of middle limb. One, however, will not require the four screw-holes, but will have instead a hole in the centre for screw of flange bolt; and two plates, 1 in. long by $\frac{5}{8}$ in. wide, with one end of each rounded off (see Fig. 7), will be required to form the abutting pieces for the top joint. All these plates, after being cut to the required lengths, should have their ends squared up and the edges bevelled, and if they can be lacquered, so much the better. Two brass plates for the top of each leg, G (Fig. 1), are required; these should be $\frac{3}{4}$ in. wide and $1\frac{3}{4}$ in. long, and have three holes in each in the centre of the width; the two end ones may be $\frac{1}{4}$ in. from each end, and the other in the middle. Two of these holes are for screwing the plate to the leg, and the other for the pin in the top referred to in its place. (This plate is shown in the one end of each, about $\frac{1}{8}$ in. from the end, to fit a piece of steel wire—a piece of knitting-needle answers admirably—on which they will turn.

Assuming that the preparation of the legs may now be proceeded with, they should be finished off to their proper thicknesses and cut off to their finished lengths. Three blocks for fixing at the tops of the middle limbs of each leg, as before described, may be prepared; they are to be 3 in. long by $\frac{3}{4}$ in. by $\frac{1}{2}$ in. These blocking pieces may now be fixed at the top of each pair of middle limbs by fine $1\frac{1}{4}$ in. screws, screwing from the outside of the limb, near the ends of the blocking piece, so as to leave the centre clear for the clamping bolt; the heads to be sunk. Now place the lowest limb in position between the members of the middle limb, and take one of the side view, and should be screwed on at the ends of the top members, which should also be rounded off to coincide with the ends of the plates. The hole at the semi-circular end of the plate is for the pins in the head, and need not be drilled yet; the other two holes are to be drilled and countersunk for $\frac{5}{8}$ in. screws for fixing. When these plates are all fixed, the upper members may be laid in their places, in the position they will occupy when the leg is folded or closed up, and the hole for the clamping screw, D (Fig. 1), bored right through the upper and middle limbs. This should be at a distance of $\frac{3}{4}$ in. from the extreme ends of the members, which should all be clamped properly together in a hand-screw, and the holes bored very accurately and carefully, as—it will be seen—upon this depends the subsequent working of the joint, and any departure from the true line will throw the limbs out when finished. The holes in the top of the middle limbs are to be converted into slots $1\frac{1}{4}$ in. long by another hole being bored in the leg through the block, and the intermediate piece cut out. This should be done carefully and kept central, or the working will be interfered with. It will be found that the clamping bolt has a square shank, which prevents the bolt turning when being tightened up; this must be let in on the side of the upper limb. When doing this, it will be well to open out each limb as if going to erect the stand, so as to ensure the heads of bolts being let in so that the screws shall be right-handed. The slots for the straining pieces in the top limbs should now be cut; these are shown in section at Fig. 5. They may be cut in the inside of either member. The opposite member should have a $\frac{3}{16}$ in. hole bored $\frac{1}{8}$ in. deep directly opposite the uppermost end of the slot in which the straining piece works, and a slot, commencing about 2 in. lower down the limb, should be cut with a $\frac{3}{16}$ in. chisel from the surface to the bottom of the hole, so that the straining piece may slide home when the stand is being erected (see A, Fig. 5). The plates F (Fig. 1), forming the abutments for the top limbs, are to be screwed on with $\frac{1}{2}$ in. screws. These plates have already been referred to, and will be 1 in. long, and fixed at the upper ends of the middle limbs, so as to project over $\frac{1}{2}$ in. (see Fig. 1), and the screws countersunk. The two upper limbs are now completed, with the exception of rounding off the ends, which may now be done, the limbs being folded down for the purpose. When the upper limbs of all the legs have been finished as described, the lower or sliding limbs are all that remain. These are to be placed in position in the middle limbs, and the brass clamping plates fitted. To prepare these, the diagonals should be drawn on the under-sides of the plates, and holes drilled in the centres large enough for the clamping bolts to go through; holes should be drilled in the plates and bases of the bolts for $\frac{1}{2}$ in. screws, for holding them in position and preventing them turning round. These holes should be drilled so that the screw from the base of the bolt is on the opposite side of the bolt to that which holds the upper plate in position (see Fig. 9). When the screws are turned in, the heads should be cut off, leaving a projecting pin the thickness of the plate, which, it will be seen, is all that is required to keep the bolts and plates from slipping round. When the plates and bolts are in position on the lower limb, it will be found that the leg can be clamped at any point. Nothing now remains to complete the legs but an iron toe on each. Brass ferrules, made of $\frac{5}{8}$ in. tube, $\frac{3}{4}$ in. long, should be fitted to the lower ends of each sliding limb, the leg being cut down as shown in Fig. 10; and a $1\frac{1}{2}$ in. iron screw (about No. 6 gauge) should be screwed up into the limb until only the plain shank remains to be seen, and the head cut off.

The head, or top, of stand will now occupy attention. This is shown in Fig. 11, which is a plan of the under-side, and also in Fig. 12, which is a view of one edge: A, A, A are three blocks screwed on and carrying the pins, B, B, B, on to which the upper members of the tripod are fixed, the camera screw passing through the hole C. The top can be made of oak or mahogany $\frac{1}{2}$ in. thick; a good close-grained piece should be selected, as, however it may be cut, one angle will be very much cross-grained. An equilateral triangle with $7\frac{1}{2}$ in. sides should be set out, and the piece cut to shape, a hole for camera screw being bored in the centre, which is found by bisecting two of the angles, which should be rounded off when finished, as shown, to $\frac{1}{2}$ in. radius. The blocks, A, A, A, are to be $\frac{3}{4}$ in. thick, and of the shape as indicated in Figs. 11 and 12. The pins, B, B, B, are $\frac{3}{4}$ in. screws, turned in until only the plain shank shows, and then the heads cut off with a metal saw, the projecting piece being left about $\frac{5}{8}$ in. long, which should be tapered down as shown, to ensure the legs fitting tightly. Holes for these pins must be drilled and bored in the plates and through the upper part of the legs; these holes should fit the pins in the head fairly tightly, so that there is no shake. The blocks are to be glued and screwed on from the upper side of the head, as shown, the screws being placed in the positions marked by crosses on the blocks, and the heads sunk. A piece of baize or cloth being glued on to the top, to protect the camera from scratches, completes it.

The stand may either be oiled throughout or French-polished; the latter, however, is sure to get scratched and worn by the working parts, and the former is to be preferred. The oil should be well rubbed in, and time given for it to go in and dry before the stand is used.

If the foregoing directions are rigidly followed, and care taken in fitting the joints, a convenient stand, which will be compact and portable when closed, and perfectly firm when in use, will be added to the constructor's possessions, and reward him for his labours. Badly-fitted joints mean a rickety stand, which is worse than useless, and no satisfaction to its maker; so good work must be put into it, or it is better left alone.

POKER WORK, AND HOW TO DO IT.

BY JULIE NÖRREGARD.

MANY readers of WORK are interested in poker work, or pyrography, which has become *the* favourite pursuit of the day; but few may know that this peculiar and interesting art is as old as historical times. Years and experience have greatly changed the way in which this work is executed, but the idea remains the same, and it is most interesting to go to the museums and study the various specimens, especially those of barbarian and uncivilised countries. Of course, very often amongst these collections, one only finds some clumsy attempt at poker work; but at the British Museum a great number of articles in burnt wood are to be found, which are charming examples of how much can be done out of very little, if the worker only possesses originality and an eye for form and colour. Particularly in the rooms containing industrial productions from Africa and Australia is to be found the etching with hot irons used to decorate articles in leather, ebony, and bamboo, such as boxes, spoons, and musical instruments. Some of them are only embellished with a few rough lines, which scarcely form any pattern at all; but others are beautifully finished in elaborate designs, which could not fail to astonish any modern artist. These specimens, which are especially interesting to study, are all to be found in the rooms of the Ethnographical galleries, the countries best represented in this style of work being New Zealand, New Guinea, and Borneo. In one of the cupboards one's attention is attracted by a whole row of splendid calabashes, the patterns of nearly all being very rich and effective. In cupboard No. 35, on the bottom shelf, there is an oval piece of wood, of which our sketch (Fig. 1) gives some idea; it is about 15 or 16 in. in length, and the natives used it as an instrument. A piece of string is attached to it, by which it is held, and, when swung rapidly round, it produces a whirring sound; the colour of the piece of wood is a beautiful warm brown, and the scrollic design somewhat reminds one of an old Celtic pattern. In cupboard No. 146 there are a large variety of beetle boxes, and also a very good example of a quiver, still filled with poisoned darts, for the blowpipe. Very close to this, in cupboard No. 147 and 148, are some exquisitely finished specimens of burnt bamboo, so finely done that one cannot help wondering how such work could possibly have been produced with the few and simple instruments that were known to these savages. A splendid effect is produced when the poker work is executed together with wood carving, and some large bowls in this style from West Africa are very attractive. I am sorry that the space in these columns will not permit me to dwell longer on the subject; but I would advise all "artists of the poker" to go to the Museum, and I feel sure that they will return home loaded with fresh ideas, which will enable them to do useful and artistic things for themselves.

That pyrography has been known in England years and years ago is very evident, for in some very old village churches large proofs of this work are still to be found on the altars, and in these cases the artists have traced the figures on the wood and then burnt away the background with large, hot pokers, thus leaving the figures in relief. But it was, indeed, a difficult task; for not only had the worker to attend to his picture, but, what was very necessary, he had to keep a large fire in which to heat the pokers and tools. But all these difficulties belong to a bygone age, and the artist of to-day can sit comfortably at his work table, surrounded by all the neat and practical little instruments which have been brought out by skilful inventors.

Of all these different makes of tools and necessary materials, not one has been admired as much as the small box called "Vulcan," manufactured by Messrs. Abbot Brothers. This box contains the materials sufficient for a beginner; it is practically arranged, and can be bought for a few shillings. It consists of the "poker," or pencil, the point of which is made of platinum, the only metal which can take up and absorb the benzoline gas by which the heat is obtained. This benzoline is kept in the bottle, to which is attached a piece of tubing and two indiarubber bellows. There is also a small spirit lamp and an extra bottle of benzoline, which must always be tightly stoppered to prevent evaporation. Every student must give great attention to the choice of the wood, this being one of the most important parts of the work; it should be well seasoned and free from knots. A great variety of woods can be used for pyrography, some of the best being lime, oak, and sycamore; but, as I am writing for beginners, I would recommend the American white wood, as it presents a fairly good surface for work, and one can buy it made up in useful and artistic fancy articles, such as boxes, frames, chairs, tables, etc., for very little money.

For the first attempt in burnt wood

etching it will be best to choose a piece of plain white deal, and on that to practise short and long strokes and dots, shading from a pale tint up to the deepest tone of brown; and so on. The wood is placed on a table, not fastened anywhere, so that it can be easily turned in different directions; the "poker" is then carefully attached to the benzoline bottle through the tube; the spirit lamp is lit, and the point of the poker is held in the flame while the indiarubber bellows are slightly pressed with the left hand. In a few seconds the platinum point will be red hot, and the lamp can be extinguished, and it will not be required again unless the point should get cold through any irregular movement of the bellows. This left-hand work is really the most important part of the whole process, and I have seen ladies, with plenty of perseverance and a strong desire to learn the work, let the poker drop and, with a most hopeless expression, declare that it was impossible to do. It is not, however, at all impossible, but requires some little practice in the beginning. It will seem very awkward to etch with the right hand and, at the same time, keep up a slight, regular movement with the left; but it must be remembered that, if the left hand gives up its task, the right must leave off too, because it is only the pressure of the bellows which forces the benzoline vapour down the tube, thus keeping the platinum point hot. When this difficulty is thoroughly mastered, a new one presents itself, which consists of doing the work evenly; but this, too, can easily be conquered with the aid of a little patience and practice, which are required for any sort of work.

In the beginning every stroke will be a failure. Just when you are admiring a nice smooth line, the poker will make a horrible deep and dark-coloured dot, and you are obliged to start afresh. Do not lose courage, however, but remember that no workman or artist, be he ever so clever and skilful, can master his tools or brushes at once. My advice is, Do not hurry to begin etching on a nice wooden article before you have absolute control over the hot point of the poker. Practise the strokes repeatedly on a plain piece of wood, and, when you feel yourself more at ease with the work, trace a small leaf, or conventional figure, on the wood in pencil, and try to follow the line carefully with the poker, etching the pattern in the wood. When this task has been successfully accomplished, a small stool, box, or frame might be attempted. It is not wise for a beginner to choose too small an article, for the patterns are generally very fine, which, of course, presents greater difficulty than figures, where large, bold lines can be introduced.

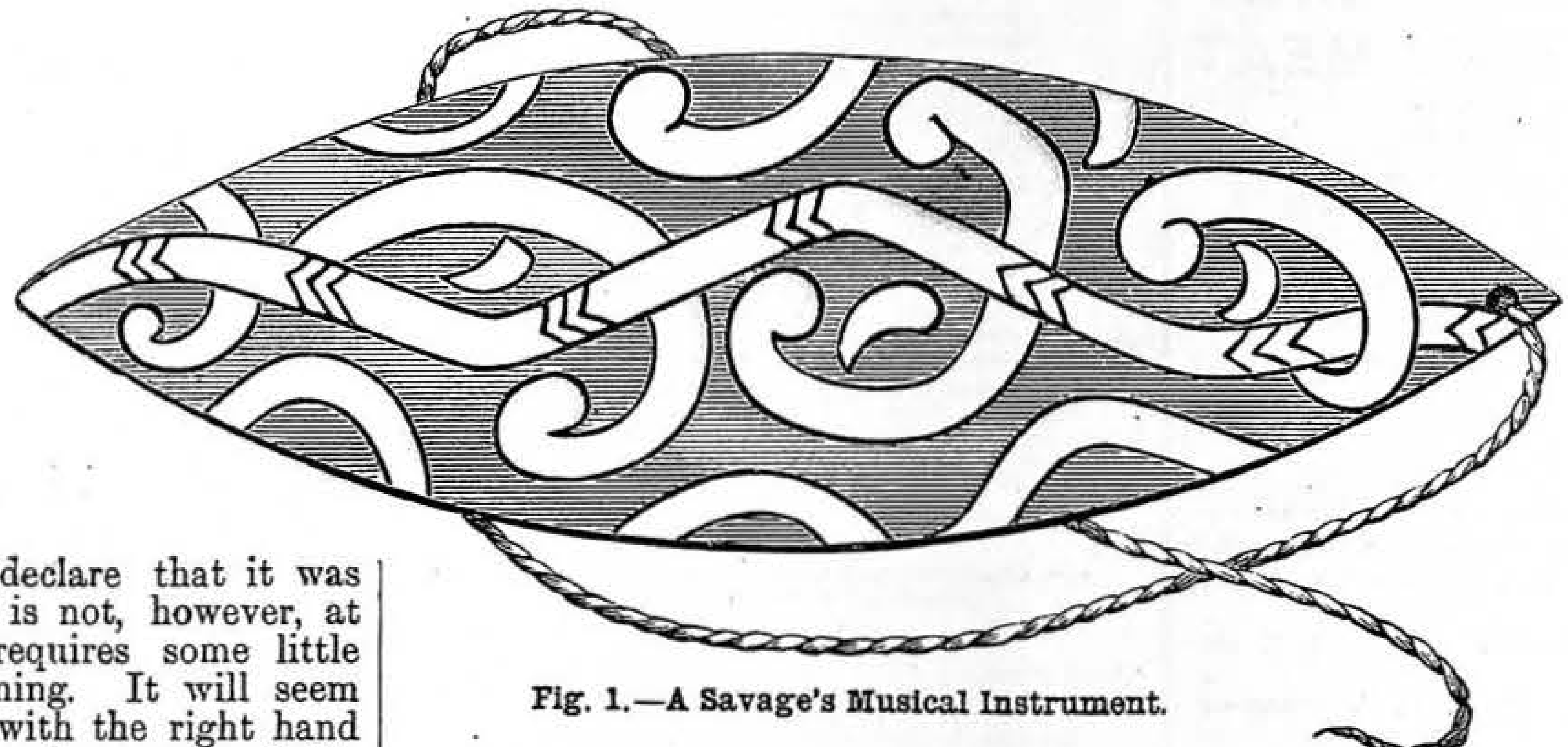


Fig. 1.—A Savage's Musical Instrument.

Choose, for instance, a small, square stool, about 20 inches high. It will come in very useful as a little stand near the fireplace, and, if made after an Eastern pattern, would go nicely with design No. 2 in the illustration, this striking Egyptian design, with its lotus flowers, being just the thing to commence with. When the pattern has been enlarged to the size wanted, trace it on to the stool, which should be first well rubbed with emery and glass-paper to make it perfectly clean and smooth. When the lines of the design stand out clearly and evenly on the wood, begin the etching by following all the outlines with the hot tool. Do not go on too fast, but try and direct the poker steadily along the lines, while blowing the bellows regularly with the left hand. It will look best to make the outline a deep brown, while the lines in the flowers should be done more softly. If you do not master the tool very well at first, I would advise you only to put a few lines on every single leaf of the lotus; but if, on the other hand, you feel that you are getting on pretty well, it would, of course, be better to shade the leaves in pale or darker shades of brown, thus giving richer colouring to the work. All the ground round the pattern will look best etched in rather coarse dots. It is the easiest part of the work, but, still, great care must be given when the ground near the edge of the figure is dotted, because this is easily spoiled.

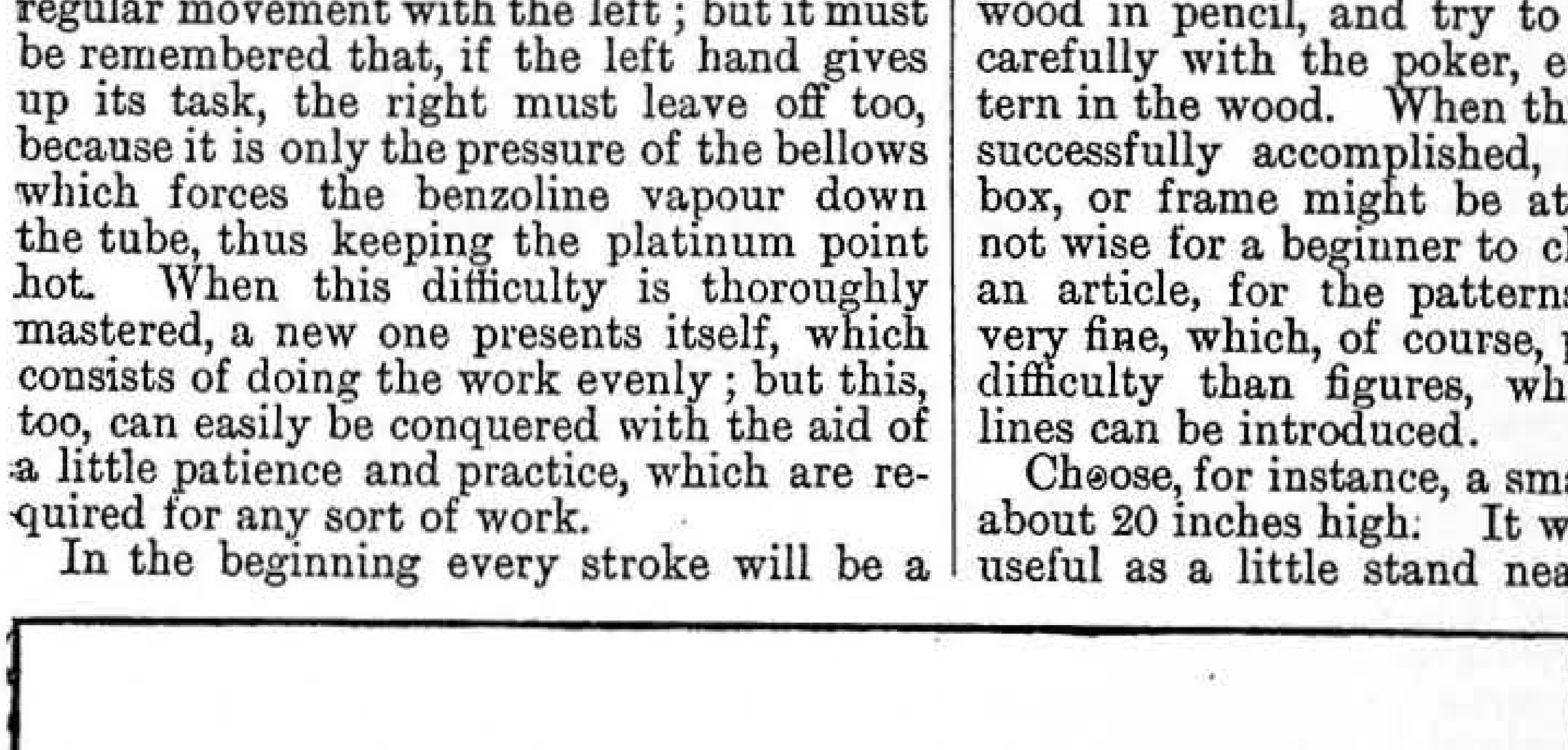


Fig. 2.—Pattern in Egyptian Style for Stool or Table.

Here I will leave the student, and in my next paper will complete the subject with some more advanced and original designs, which will be valuable to all art workers and designers.

MEANS, MODES, AND METHODS.

ISINGLASS boiled in spirits of wine will produce a transparent cement, which will join broken glass and be almost invisible at the joint. This should prove useful to our many glass-workers.

PAIN has been described as a disagreeable sense of active vitality. We try to diminish it in many ways, as it is a serious strain on the nerves, often with dreadful results. Cold and heat deaden nervous pain. Blisters sharp and mild have their potency, but as they are disfiguring for a time, a harmless pain-killer is offered for notice and trial, as it has been found efficacious in many cases:—2 ozs. of spirits of hartshorn; $\frac{3}{8}$ oz. of spirits of camphor mixed in a pint of filtered water, to which add a handful of salt; soak rags in it, and apply to part affected. Of course, the general health should be regulated by suitable harmless medicines, of which a change of air and diet stand foremost.

IRON and steel may be preserved by dissolving 2 parts of camphor and 60 parts of gum sandarach in half a pint of turpentine and half a pint of alcohol. Use as paint, but see that the iron or steel is thoroughly cleaned beforehand.

FOUL sponges may be cleaned by putting the sponge in a basin and squeezing the juice of a citron on it. Cut the citron in small pieces and lay on the sponge; pour boiling water over the whole and leave it for a day. Then rinse the sponge well in the water, and afterwards let it dry.

INK for writing upon glass or porcelain is made by dissolving 10 parts of bleached shellac and 5 parts of Venetian turpentine in 15 parts of oil of turpentine—the containing vessel being immersed in warm water. After the solution is effected, 5 parts of lamp black are incorporated.

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FREE TRAVEL.—Any idea for free travel—especially on a universal scale—will present itself to the minds of our readers as an extremely chimerical notion. Some may be bold enough to pronounce any movement with an object of securing free passage across the hemispheres as the issue of downright lunacy. All the same, the subject is beginning to attract public attention, and one of the most recent aspects of the matter is the admirable suggestion of Admiral Cochrane in a contemporary to establish a free ferry across the Irish Sea for passengers, and for certain classes of agricultural, fishery, and other goods between certain ports in Ireland and the West of England, the cost of such free ferry to be borne by the State. There is little that is really Utopian in the proposal. On the contrary, it is more rational, and if carried into effect is likely to be productive of greater good, than most of the schemes which have been propounded for remedying Irish matters. It has more to recommend it, for instance, than the plan of mopping up a part of the Atlantic and joining Great Britain and Ireland. The sister country has been so persistently sapped of its goodness that its resources now need replenishing. Recuperative processes are due to the people and country alike, and such a scheme as the free ferry for passengers and goods would mean an immediate influx of material wealth to the island, when the inevitable solution of the principles of supply and demand might reasonably, and soon, be expected to follow.

GOLF.—Again this year there is to be a Parliamentary Golf Handicap, when such knights of the "driver" and "putter" as Mr. John Penn, Mr. A. J. Balfour, the Marquis of Granby, and other M.P.'s will contest some knotty points in a better atmosphere than the St. Stephen's air. The final round has to be completed on May 28: long before which time our readers will be in possession of a novel design for a Golf Club Stand. Shall we be adjudged irreverent if we suggest the immediate tackling of this job in the event of some favourite politician winning this handicap, when it might be forwarded to him in recognition of his skill and as a token of admiration? Or the promoters of the handicap, possibly, would not object to accept the completed model as an excellent first prize!

FUEL.—How far we are removed from the time when the coal resources of this country will become exhausted, is a point which only an unwise man would hurriedly undertake to predict. The question is constantly cropping up soon to die out again, as the average mind can only be moved to look upon the supply aspect of the coal question in a somewhat complacent mood. Prices most affect the consumer, and if another element be wanting to disturb his equanimity, it is how best to deal with the dust or "small" which so largely obtains in the family coal cellar. Not a few of our readers are concerned on this score, and, having very wisely consulted our "Shop" columns, the fact has been elicited that an excellent slow-burning fuel can be made with the dust. One expedient is to water the same thoroughly and then mix it with gas coke. Another plan found to be a success is to mix the coal-dust with an equal quantity of sawdust, and well saturate the whole with water. These mixtures will not light a fire, but they will keep one going when fairly alight. With the poor this coal-dust is indeed a "burning" question; but we make public these useful methods for all our readers alike. Already the world has been told "What to do with the Cold Mutton," and now our correspondents seem to have afforded a solution to another domestic problem—How to treat the Coal-dust.

DANGER!—Not a small percentage of our readers are concerned with the many and various substances which, as imitations of, and substitutes for, ivory and bone now obtain a large market, especially since the cost of ivory has made it prohibitory for common uses. A thousand ways could be enumerated in which these imitation substances are dealt with by amateur and professional workers for ornamental and decorative purposes. Suddenly, however, comes an alarm. A learned professor tells us that these substances are, more or less, explosive; or, in other words, that we carry about with us equivalents to nitro-glycerine, and weapons as dangerous as the worst spirits of destruction could provide for us. The discovery is laudable indeed, but the information is startling—it being by no means reassuring to be informed that men and women are surrounding themselves with destructive agents quite Nihilistic in type. The mere act of warming one's coat-tails places the performer in danger of finding himself in flames; or a too heated indulgence in the latest Modern German concerto may abolish pianoforte, performer and all! There is no end to the calamitous possibilities which present themselves to the mind at the bare thought of this scientific "find." The moral of all this is, that ladies adopting the large buttons which obtain must have a care as to their security from this new danger, and workers using such substances as these imitation ivories and the like for inlay and decorative purposes should also take heed. Of course, the makers of these compounds are up in arms against the learned professor, but we prefer to encourage the value of the discovery. One thing is certain—the temporary scare will give the metal button workers another chance.

A HOPS PATTERN FOR BREAD-PLATTER OR OTHER ARTICLE.

BY FLORENCE HUDSON.

AMONG the many plants whose beauty of form or colour renders them valuable for decorative purposes the hop must ever take a foremost place. Every plant has some special beauty; it is not alone to the exotic or carefully-tended garden favourite that the "fatal gift" is given. The despised dandelion has its exquisite, feathery seed; the humble daisy, its "golden eye" and dainty touches of crimson underneath its long petals.

The hop lays claim to many beauties. The young vine pushes forward, feeling hither and thither for support; here, tightly clinging to whatever offers — often failing anything within reach, several stems will twist together round each other like a many stranded rope—there, hanging in long festoons from plant to plant in endless graceful curves.

The leaves, too, are most beautiful. A well-grown leaf is full of character, and will amply repay anyone for the time spent in making a careful study of it in sepia, for its form and surface modulations, and then afterwards in its natural green. Only a dull green apparently, and yet sorely taxing the artist's skill as it varies with the light from steely blue to vivid, almost yellow green.

The flowers, too, although individually so insignificant and colourless, have the charm of airy lightness, while the clustering hops are universal favourites, and well deserve their popularity.

As I have already said, hops lend themselves well to decorative purposes, and I venture to hope that some reader of WORK will find this design acceptable and an effective one when carved.

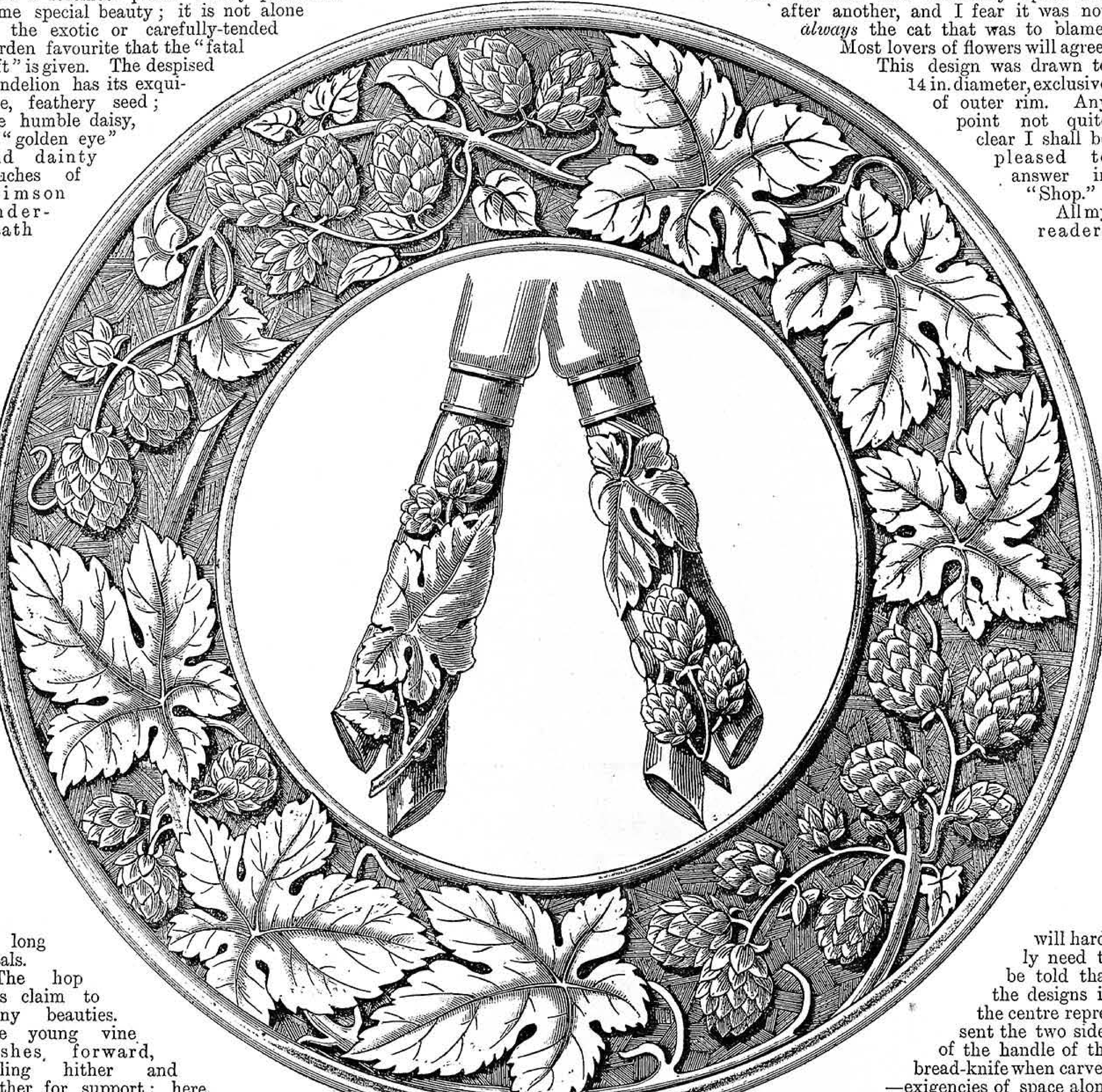
Although intended for a bread-platter, it would, I fancy, make an effective border for a brass tray in repoussé work, or would work out well in inlaid woods or stones. The ground might be done with tiny pieces to give a somewhat similar effect to that in the drawing—a patchwork ground, as one might call it.

A small tray is always handy, and invariably makes an acceptable present; and it is hard sometimes to find a gift that is at the same time useful and ornamental and yet within small means.

For a table top the design would be useful. A steady stone table, not easily to be upset, will save not only many a favourite plant, but also its owner's temper. I well remember how *my* treasured plants and fern-case were ruthlessly upset one after another, and I fear it was not *always* the cat that was to blame. Most lovers of flowers will agree.

This design was drawn to 14 in. diameter, exclusive of outer rim. Any point not quite clear I shall be pleased to answer in "Shop."

All my readers will hardly need to be told that the designs in the centre represent the two sides of the handle of the bread-knife when carved—exigencies of space alone compelling them to appear where they do. The design, as produced, is very clear and bold, and will be amply sufficient to guide the student and worker in carrying out his purpose. The hop season, however, is approaching, and no harm would be done in working from a piece of the natural plant. No art can reproduce the full beauty of Nature, and for this reason a well-clustered string fresh from the hop-field will be the best of all guides towards securing a good rendering of the design here presented to our art workers. Later on I will submit another bread dish design that will be out of the ordinary corn pattern order.



Hops Design for Carved Wood Bread-Platter or for Metal Work.

SIMPLE CARPENTRY: PIPE-RACKS.

BY INGENIORUM AMATOR.

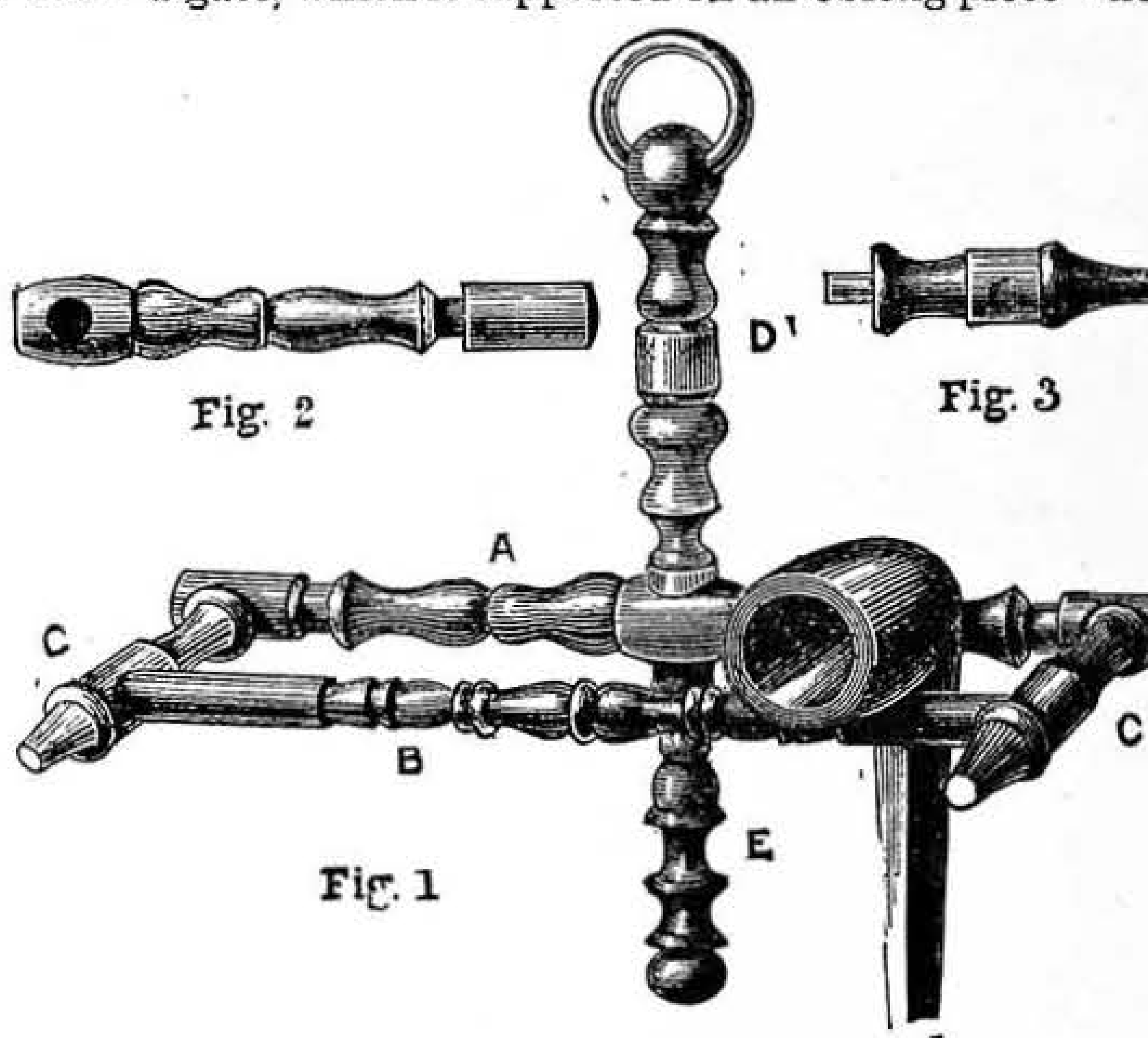
THESE two pipe-racks are simple in construction, and are very easily made at the expense of a little time and trouble. One is entirely constructed on the lathe, and the other is suitable for amateurs who go in for carpentering or fretwork.

We will explain the construction of the turned pipe-rack first. This is shown in its completed form in Fig. 1. It consists, as may easily be seen, of six pieces, four of which form a sort of frame, in which the pipes rest, and the remaining two fastened into this frame support it against the wall to which the pipe-rack is fixed. A ring of wood, brass, or nickeled iron passes through the end of the upper of the two latter pieces and is placed over a brass-headed nail fixed into the wall or other place to which the pipe-rack is fixed. The length of the frame may vary from 8 in. to a foot or more, and the greatest diameter of the various pieces varies from $\frac{1}{2}$ in. to $\frac{3}{4}$ in.

Having selected pieces of wood 1 in. in diameter, and of lengths suitable for the various parts, we will begin by constructing the piece A (see Fig. 1). The shape of this is shown in Fig. 2. It is turned in a cylindrical shape in the middle and at the ends, only one of which is shown, and the rest of it may be variously turned, but the pattern on each side of the centre should be the same. A hole $\frac{1}{4}$ in. in diameter, which is intended to receive the lower end of D (see Fig. 1), is bored half-way through the centre, as shown in Fig. 2, and a hole is bored half-way through each of the ends at right angles to the hole in the middle, as will be easily gathered from Fig. 2. When this has been done the piece may be polished and removed from the lathe.

We must now make the two side pieces, which are represented by C in Fig. 1, and by Fig. 3. One of the ends of each piece must be turned down small enough to fit into the holes which were bored at the ends of the piece represented by Fig. 2, and a hole of the same diameter must be bored half-way through near the other end. The piece B can be shaped something like Fig. 2, must have its ends turned down to fit into the hole at the ends of the pieces C, and its length, exclusive of the tenons, must be equal to the distance between the two pieces represented by Fig. 3 when they are fitted in their places. There is no need to say much about the pieces D and E. The former must be longer than the latter, and must have a hole bored through its upper end for the reception of the ring already mentioned, and the ends of both must be turned to fit into the holes which were bored through the centre of A.

It now remains to fit the various pieces together. This is best effected by first of all fitting together the four pieces which form the frame, letting them set thoroughly, and then gluing the two remaining pieces in their places. If the joints have been accurately fitted together, a very minute quantity of glue will be sufficient to make them fast, and it is always better to use as little glue as possible, since if much is used it is liable to ooze out and spoil the appearance of the work. The turned pipe-rack is now complete, so we will turn our attention to the construction of the other one. This is shown in Fig. 4. It is made in the shape of a gate, which is supported on an oblong piece



Turned Pipe-Rack. Fig. 1.—Completed View. Fig. 2.—A Piece in Detail. Fig. 3.—C Side Piece.

of wood. A strip of wood, pierced with holes for the reception of the pipes, passes across the gate near its upper end. When thus constructed it is meant to stand on a table, but may easily be made to hang up by removing the piece of wood on which the gate rests, and fixing a ring or hook through the middle. The length of the pipe-rack may vary from 8 in. to 2 ft., according to the number of pipes which it is required to contain. First of all, prepare the piece of wood

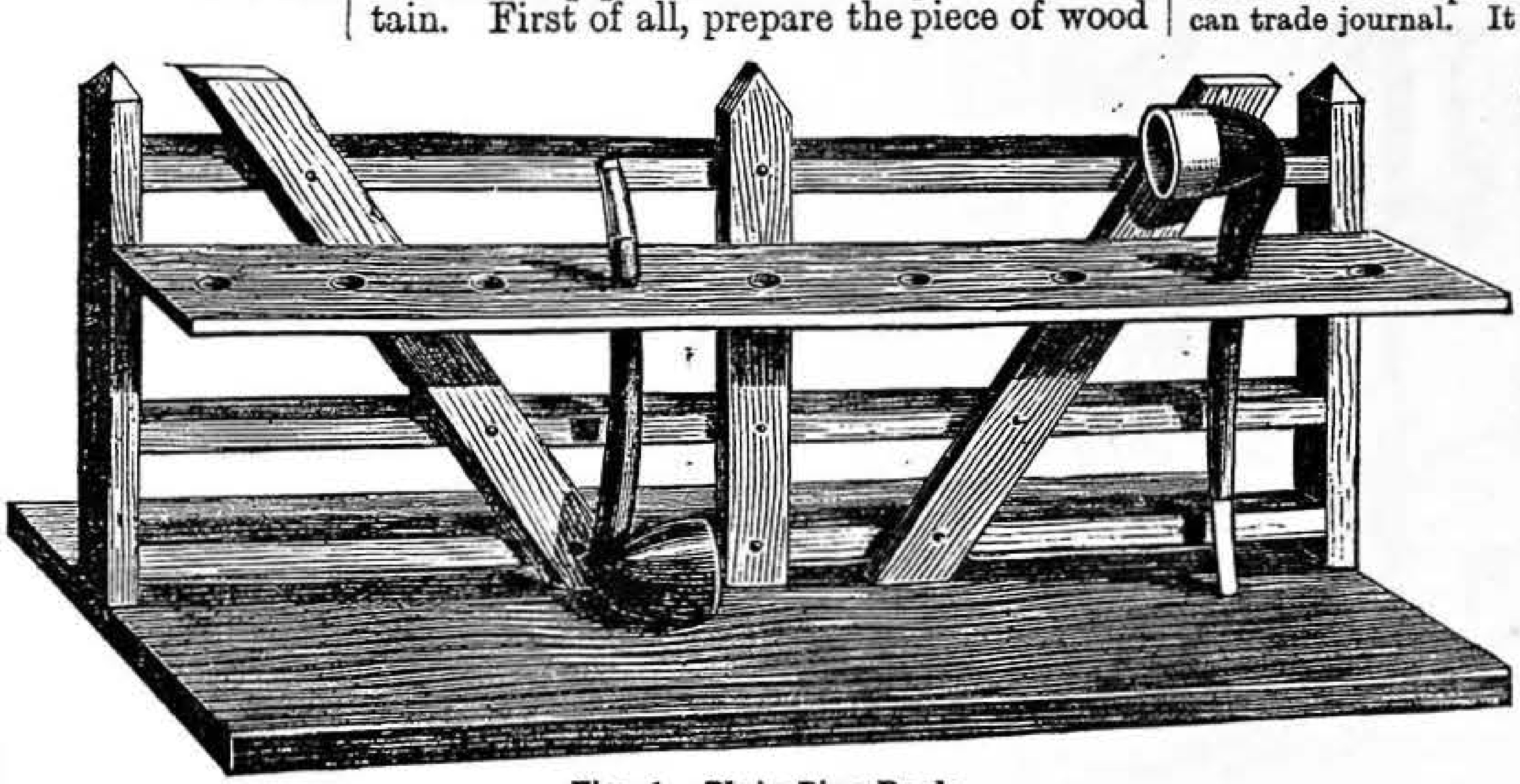


Fig. 4.—Plain Pipe-Rack.

which forms the base, and cut a notch in the middle of each end for the reception of the posts of the gate. When you have done this proceed to make the gate. This is composed of two end posts, four cross-bars, and three other bars fixed across these. The posts are made of wood about 1 in. square, and have their tops cut into a pyramidal form. The cross-bars are mortised into the posts, and the three other bars are nailed across these with brass nails having rather large heads, which add rather to the appearance of the gate. If the ends of the nails project the other side when they have been driven in, they can easily be cut off with a pair of cutting nippers. The strip of wood which holds the pipes is about $1\frac{1}{2}$ in. in width, and is pierced with holes $\frac{1}{2}$ in. in diameter at equal distances apart. It is fixed near the top of the posts by cutting a notch wide enough for it to fit into, and then gluing it into the notch. If, when thus fixed, it is found not to be sufficiently strong, it can easily be strengthened by gluing small wooden brackets underneath its ends. The necessity of the somewhat troublesome operation of mortising the cross-bars into the posts of the gate can easily be obviated by simply nailing them on to the posts, care being taken that the latter are at such a distance apart that they will fit into the notches which have been cut for their reception at the ends of the base. When the gate is finished, it must be glued on to the base, when the whole pipe-rack will be complete.

In conclusion, I will add that the ingenious reader can easily devise a fret-worked base instead of the plain one, and other additional ornamentation, which will greatly add to the appearance of the pipe-rack.

NICK-NACKS.

CEMENT AND PAINT FOR WOOD JOINTS AND MORTISES.—Mix powdered red lead and tub white lead with linseed oil; add a little gold size when mixed to the consistence of paint. Framings and mortises put together with this paint are cemented and impervious to water. It must be used as it is made, or a floating of water put in the pot to keep the air from it. Even then it will be found to thicken and dry up, so that more linseed oil is often needed to make it work. When as thick as putty in consistence, it may be used as such with a little whiting and linseed oil added thoroughly.

MINERAL RUBBER, EBONY, AND VARNISH.—The by-products of some manufactures are of more pecuniary worth than the leading manufactures. Mineral rubber asphalt is one, according to an American trade journal. It is produced during the process of refining tar by sulphuric acid, and forms a black material very much like ordinary asphalt, and elastic like india-rubber. When heated so that the slimy matter is reduced to about 60 per cent. of the former size, a substance is produced hard like ebony. It can be dissolved in naphtha, and is an excellent non-conductor of electricity, and therefore valuable for covering telegraph wires and for other non-conducting purposes. When liquefied, this mineral rubber serves as a good waterproof japan varnish. It is said its production pays the inventor or discoverer from 400 to 500 per cent. gain.

TRANSPARENT PAPER FOR COPYING.—Saturate a ball of floss cotton with pure benzine. Rub the paper lightly but regularly all over with the wad of cotton. The paper becomes transparent, so that a drawing under it may be seen and copied on to the benzined paper. With absolutely pure benzine it will evaporate from the paper without stain or smell.

INTERESTING FACTS OF MILE RECORDS.—Various rates of speed of different forms of locomotion: Railway train, $40\frac{1}{4}$ sec.; horse galloping, 1 min. 25 sec.; horse trotting, 2 min. $8\frac{1}{4}$ sec.; torpedo boat, 1 min. 50 sec.; steam yacht, 2 min. $12\frac{1}{2}$ sec.; bicycle, 2 min. 15 sec.; tricycle, 2 min. $28\frac{2}{5}$ sec.; ocean steamship, 2 min. 20 sec.; man skating on ice, 2 min. $12\frac{3}{5}$ sec.; man on snow-shoes, 5 min. $39\frac{1}{4}$ sec.; man running, 4 min. $12\frac{1}{2}$ sec.; man rowing, 5 min. 1 sec.; man walking, 6 min. 23 sec.; man swimming, 26 min. 52 sec.; man canoe paddling, 9 min. 29 sec.; ice yacht, 1 min. 10 sec.

TRADE: PRESENT AND FUTURE.

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

BRICKMAKING.—The Kent and Essex brickmakers have decided to continue the policy of limiting the output of bricks during the coming brickmaking season (which begins in April properly) by commencing the manufacture later, and by reducing the number of hands employed. They state that the condition of the market renders the step necessary, but workmen allege that the real object is, by restricting the supply, to force up the prices of bricks to a higher rate.

CYCLE TRADE.—In Birmingham, the St. George's Engineering Co. has had to run the works overtime to fill orders for the "New Rapid" machine. Many of the other Birmingham makers have had to extend their premises in order to meet the demands made upon them; and altogether the season 1892 bids fair to be a record one in the cycle trade. In Glasgow, the largest cycle factory in the world has been turning out "Safeties" during the winter at the rate of 200 a week. This factory is now under the care of a new company. The work turned out is of the best description. One notable feature of the Howe Works is that every part of a cycle, down to the balls and the minutest screw, pin, or nut, is made on the premises, as well as many ingenious tools and machines for quickly producing these parts. There are a number of makers of lesser magnitude than the Howe in Glasgow, all turning out their full share of machines. There are also numerous agents, dealers, and repairers, all over the vast city, who store the wares of most English as well as home makers. Many of these do a large hiring trade, notably the North British Machine Co., who last season, on a fine day, had on the road from 60 to 100 safeties and tricycles at one time. In Wolverhampton—a large cycle-producing centre—the ironmongers are adding machines to their wholesale and retail trade. This example has been set by Mr. Herbert, who by no means confines himself to the makers of his town.

ENGINEERING TRADE.—In the Lancashire district no improvement has taken place in the condition of the engineering industries, and the trade outlook is of a decidedly discouraging character. Boiler makers are still fairly well employed, and an average amount of new work is being secured, but otherwise the general tendency is unquestionably in the direction of diminishing activity. Several firms of machine-tool makers and many locomotive and stationary engine builders are complaining of a marked scarcity of new work, and, generally, the prospect is anything but satisfactory. The depressed state of the iron trade continues, and but little business is being done. The miners' holiday has already had a marked effect upon many Lancashire industries, the Bolton district suffering conspicuously. Several of the leading iron works have been closed—in one or two cases for an indefinite period—and some of the cotton-spinning concerns in the neighbourhood have also ceased working. About 5,000 hands have thus been deprived of employment, and it is exceedingly probable that the number will be largely augmented before very long in consequence of the closing of several other works in the district.

TIMBER TRADE.—The delivery from the London docks still shows a decrease, and the trade generally is exceedingly quiet. Prices are very low, and buyers of timber can get what they require almost at their own figure. The following quotations are based upon the Public Auction prices, and can be relied upon as a fair price to give: 3 by 9 prime pitch pine, £12 per std.; 3 by 9 1st yellow, £18 per std.; 3 by 9 2nd yellow, £14 10s. per std.; 3 by 9 3rd yellow, £13 per std.; 3 by 9 4th yellow, £10 per std.; 3 by 9 yellow, £6 10s. to £9 10s. per std.; 2½ by 7 yellow, £7 10s. to £9 per std.; 2 by 4 yellow (unsorted), £8 10s. per std.; 1 in. yellow flooring, 8s. to 12s. per sq.; ⅞ in. yellow flooring, 7s. to 9s. 6d. per sq.; ¾ in. yellow matchlining, 6s. to 8s. 6d. per sq.; ⅝ in. matchlining, 4s. to 6s. per sq. The carpenters do not seem to have got over the late strike yet, and there are rumours that another is likely to take place.

HARDWARE TRADE.—The heavy engineering and boiler-making trades in Sheffield have good prospects for the season of 1892. New orders for armour plates are confirmed by the Government for three battleships of an improved design. The file trade is still depressed, and only scanty wages are earned by the workmen. There is plenty of common cutlery work, but with a corresponding deficiency in wages.

WEAVING TRADE.—In Rochdale and district the principal topic of interest is the crisis in the coal trade, though the colliers have not yet begun to "play them" (the Lancashire term for ceasing work). Unless the crisis is soon over, the mills will be stopped, and a great number of hands thrown out of employment, which will cause misery and, in many cases, actual want. There is also a danger of the supply of gas being cut off, as, owing to the quantity required (about 300,000,000 ft. being used in twelve months), it is impossible to hold any in reserve, the supply just about keeping pace with the demand.

SCIENCE TO DATE.

New Compound of Lead, Sodium, and Ammonia.—M. Joannis has been studying the action of various metals on sodammonium. Sodammonium is a deep blue solution obtained by dissolving metallic sodium in liquefied ammonia. It has no action on aluminium, silver, zinc, and copper, but is decomposed by lead, mercury, and antimony. When lead is placed in a solution of sodammonium in water, which is reddish-brown in colour, the liquid becomes blue and then green. From this liquid an indigo-blue coloured compound can be obtained, which has the formula Pb_4Na2NH_3. It dissolves in liquefied ammonia, giving a solution of a bottle-green colour. Water converts it into metallic lead.

Combination of Nitrogen with Metals.—M. Maquenne has succeeded in preparing nitrides of the alkaline earth metals by heating an amalgam of the metal in question in an atmosphere of nitrogen. The barium compound is the most easy to prepare. They are brown powders which are decomposed by water with the production of ammonia. Magnesium nitride, Mg_3N_2, also has been obtained by Merz, in Germany, by simply heating magnesium in a combustion tube in a current of nitrogen gas. Almost the whole of the magnesium is by this means converted into nitride, a small portion reacting with the glass producing free silicon in the form of a black mirror. Magnesium nitride is a yellowish-grey substance, decomposed by water, with great rise of temperature and a hissing noise, into ammonia and magnesium hydrate.

Limits of Taste.—The following table gives the least quantity of the substances named which, placed on the tongue, will enable one to distinguish the taste: Sugar, ·0028 gramme; salt, ·0009 gramme; tannic acid, ·00008 gramme; hydrochloric acid, ·00009 gramme; saccharine, ·0000048 gramme; strychnine, ·00000048 gramme.

Bread from Sawdust.—A Bavarian chemist has patented a process for converting the cellulose of sawdust into a glucose. When the latter is mixed with corn, etc., and baked, the bread or biscuit thus obtained is easily assimilable and possesses highly nutritive properties. The inventor still further adds to the value of the bread as a nutritive material by introducing small quantities of phosphates as are necessary for the formation of bone.

Connecting Metals with Glass.—An alloy of 5 parts copper and 95 parts tin, prepared by adding the copper to the molten tin, stirring with a wooden rod, cooling, and re-melting, is stated to adhere strongly to clean glass surfaces, and to have, moreover, nearly the same rate of expansion as glass.

High Pressures by Electrolysis in a Closed Space.—M. Chabry has been making experiments on the electrolytic generation of gas in a closed space, and has succeeded in getting as high pressures as 12,000 lbs. or 18,000 lbs. to the square inch. The electrolysed liquid was a 25 per cent. soda solution. The electrodes were made of iron, one being a hollow sphere in which the gas was collected. A constant current of 1½ ampères was employed.

Constitution of Flames.—Prof. Smithells and Mr. Ingle have devised an ingenious and simple apparatus by which the inner bright cone of a Bunsen burner can be separated from the outer non-luminous cone to a distance of several inches. By drawing off the gases between the two cones thus separated, and analysing them, considerable additions to our knowledge of what goes on in a gas flame may be expected. This work is in progress.

Minerals of Vanadium.—The discovery is announced of considerable quantities of minerals containing vanadium in the Argentine Republic. One of the present applications of vanadium is that in which, in the form of vanadate of ammonium, it is combined with aniline to give a black dye. No doubt, if this substance could be found in larger quantities other applications could be found for it, but at present its price is about 6s. per grain.

NOTES FOR WORKERS.

THE intensity of the light of Eddystone Lighthouse is nominally equal to that of 5,000,000 candles, and that of St. Catherine's to 6,000,000.

ALL lighthouses are arranged so as to send out their light horizontally. Experiments were made at the Naval Exhibition of the effect of sending up the light vertically. For these the light used was of 6,500 candle-power, and was visible at Frant, thirty-four miles away, although set at an angle of 15°. If it had been quite vertical, the light would have been visible fifty miles away at the least.

THE Liverpool Electric Overhead Railway will be six and a half miles long, and will have thirteen stations, including the termini. It consists of two lines of rails, carried on pillars and girders at a height of 16 ft. above the roadway beneath.

DURING last year Victoria, Australia, produced 597,629 oz. of gold.

THE *Algerine*, 3, second-class gun-vessel, 835 tons, has been sold out of the Navy, as it is too slow. It is one of the few vessels built for the Navy in Ireland.

IT is said that severe blows on the head, causing inflammation of the brain, can be cured by lubricating all the internal membranes of the nose with glycerine. This results in an abundant flow of water from the nose and throat, and thus the brain is relieved and the headache removed.

PARIS has just produced the largest driving-belt in the world. It is 120 ft. long, 7 ft. wide, nearly 1 in. thick, and weighs 1½ tons. It will put a flywheel 22½ ft. in diameter in communication with a pulley over 8 ft. in diameter, transmitting 1,000 horse-power at an ordinary speed of 67 ft. per second.

THERE are to be fifty separate contracts for lighting the buildings and grounds of the Chicago Exhibition. This will give a good variety of illumination, as so many different firms will be able to exhibit their special methods.

THERE are about 63,500 electric lamps—incandescent and arc—in use in Paris.

TO solder together two pieces of aluminium, use silver chloride as a fuse. Put the pieces together in position, spread finely powdered chloride of silver along the line of junction, and then melt the powder with a blow-pipe.

THE total output of anthracite coal during last year from the Pennsylvania mines (U.S.A.) was 40,448,336 tons.

ANTHRACITE is less easily combustible than other coals, and burns with very little flame or smoke. It is not suitable for ordinary grates, but is valuable for furnaces, as it gives off more heat on combustion than any other coal.

NEXT to camphor, sugar is the chief product of Formosa, an island off the coast of China.

PLANETS can be, and have been, discovered by taking two photographs of the same region of the heavens at different times. Upon comparison, a planet will betray itself by the movement with regard to the fixed stars it has made during the interval.

BORAX-CARMINE is a good general stain for microscopic preparations. It is prepared by dissolving 2 parts carmine and 4 parts borax in 100 parts of water, adding an equal volume of 70 per cent. alcohol, allowing to stand two or three days, and filtering.

ELECTRIC lighting is being adopted in flour mills, for the absence of naked flames makes it much safer than gas. It has long been known that anything in the state of very fine powder is explosive when mixed with air.

BY the aid of a telephone, singers at four different towns, twenty or thirty miles apart, were able to rehearse together the music they intended performing at a concert to follow some days later. Everything was distinctly heard.

PAPIER-MACHÉ is made by boiling paper cuttings in water, beating them in a mortar until reduced to a paste, boiling with gum or size, and then pouring the resultant mass into oiled moulds. It is then pressed, and when dry, varnished and polished.

CUNSEY BECK, a little stream running into Windermere, is the first that has been ever employed as the prime motor of electric boats. The power generated by its fall over a rocky ledge to the level of Windermere turns a turbine, which directly works a dynamo. The current thus produced is carried on telegraph poles to the lake side, and charges the storage cells which propel the boats.

SHOP:

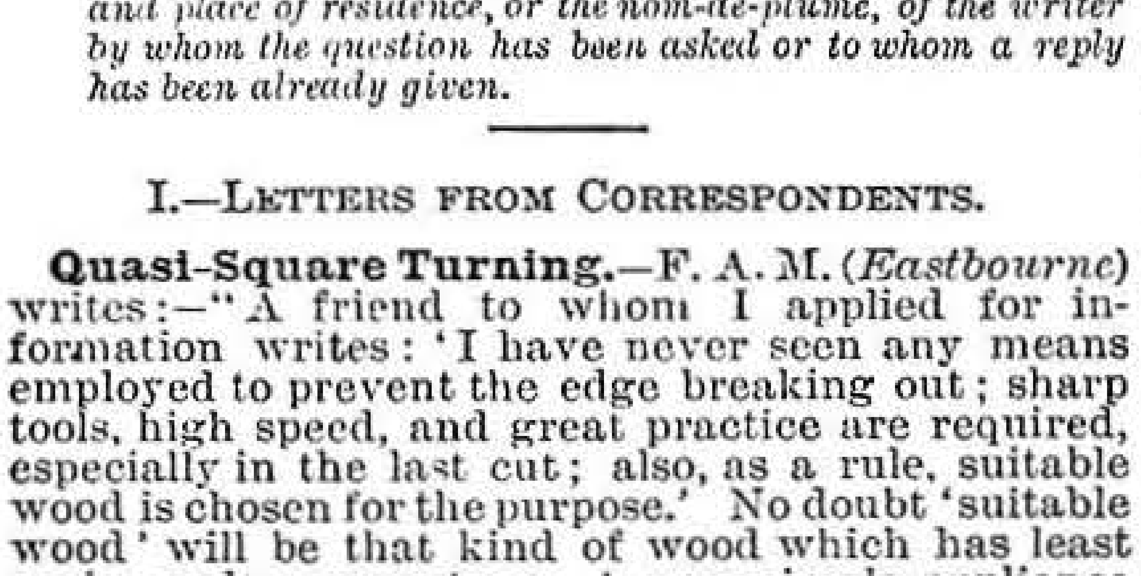
A Corner for Those who Want to Talk It.

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

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

I.—Letters from Correspondents.

Quasi-Square Turning.—F. A. M. (*Eastbourne*) writes:—"A friend to whom I applied for information writes: 'I have never seen any means employed to prevent the edge breaking out; sharp tools, high speed, and great practice are required, especially in the last cut; also, as a rule, suitable wood is chosen for the purpose.' No doubt 'suitable wood' will be that kind of wood which has least grain, such as pear-tree. A very simple appliance for doing this work is described in the Britannia Co.'s book, 'Turning Lathes,' which need not cost more than three shillings, or may be home-made. This consists of a square bar of iron (say ¾ in. square) carefully centred to run in the lathe. On this slide two iron flanges, each with its boss and set-screw to fix it on the bar, the flanges to be, say,



Lathe Parts.

4 in. diameter and ½ in. thick, and drilled for wood screws. On these would be screwed discs of wood as large as the lathe will swing over the sole of the rest; these are then fixed on the bar and turned true. In Fig. 1, A, A, are the wooden discs; B is the square bar; C, C, are the iron flanges fixed by set-screws; and D is the catch-plate, or driver chuck. In the discs square or triangular notches are formed, as *b*, *b*, according as the work is to be of square or triangular section; they must be exactly opposite to one another, and there may be a dozen or more, according to the size of the discs. The work will be planed up square or triangular, to fit the notches, and secured by a ring, or by wood screws or other means. Now, as to the second question. Your hot-air engine burnt through in a fortnight, and you wish to know how long they ought to last, but you do not say whether yours is only a model, or whether you over-heated it. A properly-made heater ought to last three years. Of course, everything depends on the make, the thickness of metal, the method of heating, and the degree of heat required; with gas heating it will probably last longer than with a coke or coal fire."

Testing Accuracy of Framework.—F. C. (*Leytonstone*) writes:—"With regard to J. S.'s paper in Work, No. 125, and subsequent letters on the above subject, it may interest some of your readers to know that the method of testing frames by measuring the diagonals is the one used by railway-carriage, tramcar, and waggon builders for setting their axle-guards and framing true; and it will be seen, on referring to the two sketches, that it is by far the simplest method, and may be used where the 3, 4, 5 method could not. Take, for instance, Fig. 1—an outline of the end of a carriage. When the diagonals are of equal length, it is said to

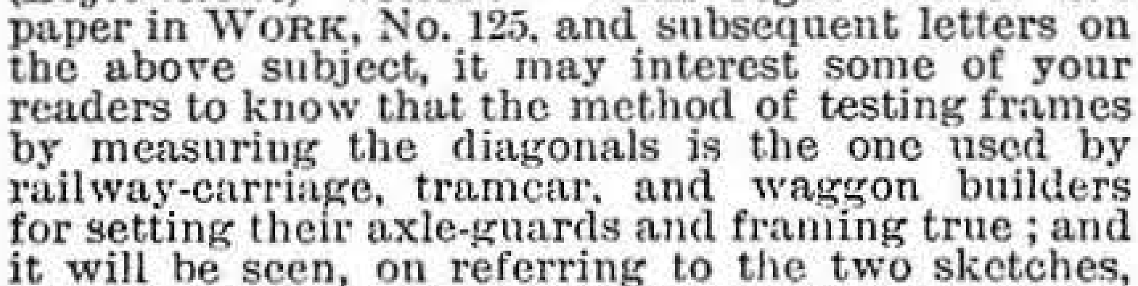


Fig. 1. Fig. 2

Framework Tests.

be square; but whether the term square should be applied to a frame in which none of the angles are right angles might be made the subject of a long and profitless debate. Again, take the case of a bottom, Fig. 2, a frame about 7 ft. 6 in. wide, and varying in length from 14 ft. to 50 ft. When you are dealing with long pieces of timber, it is very seldom that you get them straight; so if you set one corner by the 3, 4, 5 method, it would throw the others out, as shown by the dotted line; and a number of other instances might be noted. Of course, the frames are tested for being out of winding, and to see that the sides are of equal length, before trying the diagonals. You could not get a frame square by any method without first taking this precaution. I do not question the accuracy of the method given by J. C. K. (p. 427), as it may be easily proved by Euclid I., 47—a principle said to have been discovered by Pythagoras, so undoubtedly of great antiquity, and very useful if you are dealing with straight lines; but when you are dealing with frames, the simplest plan is to test by measuring the diagonals, and in a great many cases it is the only one you can use."

Bicycles.—P. B. H. (*Southport*) writes:—"A reference is made in 'Bicycle Patent' (see p. 717, No. 149, 'Shop'), telling C. M. (*Liverpool*) something which the original answer of mine gave, and A. S. P. certainly adds nothing new. My answer to F. S. appeared on p. 524, not 394, No. 137, Vol. III. of Work. The drawings may be right or wrong, as A. S. P. states; they were traced, however, from the specification drawings."

Sash Making.—G. le B. writes to B. R. H. (*Cardiff*):—"In my papers on 'Sash Making,' I did not say that the forms given were the *only* forms in which windows were made, but I distinctly stated that 'every locality, and, in fact, every builder, has different ways of doing the work.' As to the sizes I have given for the sills, I am very well aware that they vary, and have made them myself 4 in. thick at the front edge; but I can tell you where to see tens of thousands of soles of the sizes I gave, and not one of them warped—in fact, in the particular city I have in view it would be extremely difficult to find a sole of heavier dimensions. As to my calling the head of the sash a 'lintel,' it is a common term in many parts of the country. If I had called it a 'head,' some other critic would have probably inquired why I had not termed it a 'lintel.' The lead casing, I may say, is also very often omitted, and the window can be made as shown. As to the meeting bars, I think that, if you read my paper *carefully*, you will see that I do explain the 'difficulty,' as you term it; and also that I say that a little *thought* on the beginner's part ought to enable him to comprehend the instructions given. As to your statement about the half-tenon of the lower meeting bar, I can only imagine that you can have seen very little good work, or else must not have travelled far from one locality, or you could not have failed to have seen this mode of construction. I do not say that your way is wrong; I have seen so many ways of doing things that I would be very chary to tell anyone his way was not the right one. As to your last objection—the size of the mouldings in Figs. 12 and 13—it is apparent to the merest novice who looks at the drawings that they are not drawn to scale, but are simply intended to convey to the student the mode of construction. This, I think, sufficiently explains the discrepancy in size, which is, in reality, of not the slightest account, as the various sizes are correctly given in the matter. I did not know before that Work was 'intended for the amateur'; I fondly imagined it was for both *amateur and professional*, as stated on the front page every week. As for myself, I scarcely come under the designation 'amateur.' I have worked on sashes in all parts of the country, from the Island of Harris, in the far Hebrides, to the coast of Cornwall. I regret that, instead of carping criticism, you did not give us the benefit of *your* method. We are all willing—nay, anxious—to learn from everyone; so hurry up, and tell us your way. And next time do not write anonymously: give us your name and address, 'not necessarily for publication, but merely as a guarantee of good faith.'"

II.—Questions Answered by Editor and Staff.

Soldering Gongs.—Tinsmith.—It is very little use soldering gongs, the vibration of them very soon loosens the solder. You might manage to braze them, however, if you have a good powerful gas blowpipe. I would not advise you to try to braze them on a forge fire, or you might very possibly spoil them, as the metal of which they are composed melts very quickly, so that to make a good job you will want to get some quick-running spelter.—R. A.

Wheelwrighting.—Cymro.—I am glad that Work has proved so useful to you and others. I will bear in mind with regard to articles on wheelwrighting, but I cannot promise until my articles on cart and carriage wheel making are finished—subject to the Editor's approval—on which at present I am engaged. In the meantime, I shall be pleased to answer any query about same in "Shop."—W. P.

Peroxide of Manganese.—One in a Fix.—This is the chief ore of manganese, being a compound of that metal and oxygen. It is also called pyrolusite (from Greek "pur," fire, and "luein," to wash), in allusion to its use in "correcting" the green and brown tints of glass. It occurs in massive black lumps, and is sold either as powder or granulated. For a Leclanché battery it is better to use the granular, which you can obtain from all chemists and dealers in electrical apparatus for from 3d. to 6d. per lb. Ask for "granular manganese dioxide."—F. B. C.

Formulæ Collection.—E. H. B. (*Manchester*).—Purchase a well-bound pocket-book of any stationer. Let it have an alphabet cut for index purposes. Then collect your formulæ under subjects, page the book, and index it yourself accordingly.—Ed.

Cost of Model Electric Light.—Young Reader.—A 5 c.-p. incandescent lamp will cost 5s. The holders cost from 1s. upwards, according to material and workmanship. Round double cells with porous compartment, zinc and carbon elements, and binding screws complete, will cost about 3s. each, and you will require four such cells to light an 8-volt lamp. If you make the battery yourself, following the hints and instructions given in my article on the subject, under the head of "Model Electric Lights," in No. 89, Vol. II. of Work, the materials will probably cost less than the above-named sum. I cannot tell you "the best place to buy the requirements, lamp, etc.," but I know that Mr. Bottone will supply all these or any other electrical fittings required by amateur electricians. Mr. G. Bowron, Praed Street, Paddington, will also supply them, but there are few other dealers who care for such small orders. Consult also the advertisements in Work.—G. E. B.

Electric Bell Fitting.—M. D. (*Blackburn*).—You will do well to learn how to fit electric bells and electric lights. The knowledge will be useful to you in your trade, for you can as well combine electric bell and electric light fitting with plumbing as many do gas-fitting. I know a first-class plumber who is equally good at electric bell fitting. Some of those who are now in practice at this work picked up the knowledge in little bits at a time from such periodicals as Work, in which the subject has been treated, and used those little bits as occasion offered. Four hand-books on electric bells and their fittings are now on sale. These are: "Electric Bell Construction" and "Practical Electric Bell Fitting," by F. C. Allsop, price 3s. 6d. each; "Electric Bells, and all about Them," by S. R. Bottone, price 3s.; and "The Bell-hanger's Handbook," by F. B. Badt, price 4s. 6d. These will be useful to you. At present there are only two cheap hand-books published on electric light fitting: one by F. B. Badt, price 4s. 6d., and one by J. W. Urquhart, price 5s. F. C. Allsop and S. R. Bottone have books on the subject in course of preparation, and you should learn much thereon from the articles published in Work. Purchase the indexes, and then get the back numbers.—G. E. B.

Technical Magazine.—F. S. (*Exeter*).—We know of no such magazine as you refer to.

Jobbing Sheet-Metal Work.—W. L. R. (*Rochdale*).—Sympathising with your misfortune, and being desirous to help you all that I can, I have carefully thought out a list of tools that I think will be the least that you will require for the above. You will, I suppose, utilise the fire in the room you work in to solder with; if not, a fire pot will be wanted; next, two soldering irons or copper bits of a medium and a light weight; a strong pair of snips (12 in. or 14 in.); a mallet; two hammers, ordinary shape, one small for riveting, etc., and the other considerably heavier; a block and two block hammers. A paning hammer and a stud hollowing hammer will also be necessary; two rivet sets; two groovers, several punches of various sizes, a chisel or two, a square, a pair of compasses, a scoring or brad-awl, a pair of round and a pair of flat-nosed pliers. With regard to heavy tools, such as stakes, etc., you will want a crease-iron, a hatchet stake, and half-moon stake; and a funnel stake would be very useful, but that is a side stake you could get later if you found you got on at it. As you have all the numbers of Work, I must refer you to them for price and description of tools named. You will find these on pp. 240 and 301, Vol. II.; and if you take the trouble to look up my other articles, you will find there a lot of information that will be useful to you. I might say that second-hand tools may often be bought cheaply. Try the ironmongers' shops in your town. I know from experience that there are often surplus tools that have been thrown aside that would do very well for your purpose, though, perhaps, not thought good enough for a regular tinsmith. Do not be persuaded to buy a lot of antiquated stakes and tools. If you cannot pick up what I have mentioned in your town, try an advertisement in Work, and failing that, you must perforce buy new ones. I think you will find all about materials, solder, etc., in my articles, so I need not go into that; but if there is any point I have not made clear, or any further information required, I shall be pleased to give it. For china and glass riveting, see p. 4, Vol. II. of Work.—R. A.

Enlarging Camera.—Ilford.—Of course; read it in the singular. The size of the enlargement is dependent on the distance of the lens from the negative. The *nearer* the negative to the lens, the greater the extension of camera required, and the larger the image, and *vice versâ*. It is quite necessary that the *surface* of the ground glass should occupy *exactly* the same position as the sensitive surface in order to obtain definition. Ascertain that both the ground glass and sensitive surface do so by actual measurement. Both the apparatus and plates mentioned are excellent. You cannot do better.—D.

Incandescent Lamp.—Kallitype.—The marks on your incandescent lamp are to be interpreted as follows: "Swan," made by the Swan Electric Lamp Company; "16," the lamp is of 16 candle-power; "100," it takes a current with a pressure of 100 volts to light the lamp; "J.K.," the reference letters used in grouping lamps in an installation of electric lights. The lamp will be of no use to you unless you have a dynamo capable of giving a current of electricity at a pressure of 100 volts. It is altogether unsuitable to a small installation worked with current from a battery.—G. E. B.

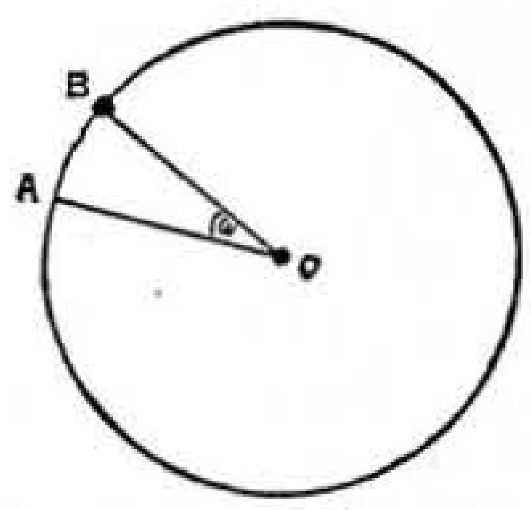
Cycle Enamel.—W. A. J. (*Tamworth*).—The best enamel for cycles is stoving enamel, baked in by the heat of a stove, or even at a temperature of 300 degrees. The next best is put on with a brush. Any good hard drying enamel will do. If three or four coats are put on, every part alike getting the same number of coats, it will resist damp. It is not the enamel that rusts by exposure to damp, but the want of it—that is, only the parts of the machine where the enamel is chipped or worn off are affected by damp. So a stove-enamelled machine, even of the very best, gets chipped or rubbed, and these parts are affected by rust immediately. The reason the stoved machine is best is that the enamel so treated stands more knocking about without chipping than that painted on with a brush. A stove-enamelled machine, if it gets but one coat (and cheap machines usually get no more), is not much, if any, better than one well done with the brush. If you do not wish to send the machine to a stoving works, get the "Club" hard drying black enamel: it is a spirit varnish; give three coats carefully. Keep some of the enamel for future use, and give any worn or chipped parts a touching-up, and you will not be much troubled with damp. You will get the "Club" enamel in most of the cycle shops, or of the makers, the Silico Enamel Company.—A. S. P.

Magnetic Field of Dynamo.—C. F. C. (*Lincoln*).—The relative position of the poles in the magnetic fields of the Gramme and Manchester dynamos has often been a puzzle to students of electricity. Many, like yourself, hold pre-conceived ideas of the position of magnetic poles, based on their knowledge of the position of the two poles in ordinary permanent horseshoe magnets, where the magnetism is self-contained and the poles are only surrounded by air. But the arrangement of the electro-magnets to form the magnetic fields of the Gramme and the Manchester dynamos does not resemble a horseshoe magnet. In the Siemens and Simplex machines the arrangement is that of a horseshoe with the magnetic field between the two poles; but in the Gramme the arrangement is that of four bar magnets in pairs—one pair at the top with their like poles touching each other, and one pair at the bottom similarly arranged. The block of curved iron on top is therefore one pole of the upper pair of magnets—that is, the two like poles united—and the block beneath is the pole of the other pair. The direction of the electric current flowing through the wire wound over the cores determines the poles of an electro-magnet. In the Manchester dynamo there are two vertical electro-magnets parallel to each other, with like poles at the tops and like poles at the bottoms of the magnets. The pole-pieces in this machine are merely iron bridges, and as each bridge spans two like poles of the magnet, the bridges become magnetised with the same magnetism—N or S—as that of the poles which they span. Hence there is a strong magnetic field in the space between the two bridges, and each bridge has the same magnetism as that of the poles of the cores to which it is attached. I hope you will now clearly understand the position of the poles in these machines.—G. E. B.

Flat Brass Tube.—W. C. (*London*).—The section of tube that you send is rather unusual—in fact, I have never seen any like it—but if it is to be procured, I think you would most likely get it at Messrs. Tonks, Limited, brass founders, Birmingham; or Townshend & Co., Ernest Street, Birmingham.—R. A.

Casting in Plaster.—PLASTER PARIS.—You ask (1), Can anything be mixed with plaster to harden it? Nothing is needed if the plaster is fresh and properly mixed. If your casts do not harden, it is owing either to stale plaster or to the proportion of water being too large. (2) What is best to make a piece of mould leave? Hog's lard, used sparingly; this has more body than oil, and does not discolour. (3) What is used for polishing the figure when finished? Many things have been used to take off the chalky look of plaster and to give it something of the creamy softness of ivory, that most in favour having been white wax. This must not be applied till the cast is perfectly dry. Melt the wax in a vessel big enough to hold the cast. Heat the cast, and lay it in the bath. The wax should not be high enough to cover it. Watch till the wax rises to the surface, which will show that the plaster is saturated; then remove the cast. PLASTER PARIS should by all means get Vol. II. of WORK: he will find articles on "Casting in Plaster" at pp. 349, 398, 500, 578, 659 (Nos. 74, 77, 83, 88, 93).—M. M.

Gravitation.—H. R. (*Colne*).—If you draw a circle on a sheet of paper, and then cut a piece of string the exact length of the diameter of that circle, you will find, on measuring, that the circumference of the circle is a little over three times (really 3·014,159,265 . . . etc.) the length of your string: *i.e.*, of the diameter. This is universally true, that whatever may be the size of a circle, its circumference is 3·1416 (this is near enough for practical purposes) times the length of the diameter of that particular circle. Now, if this figure were a simple one (as 3 or 4), then it would be easy to use and speak about; but as it is not so, and yet is a factor which is continually used in every branch of work and science, for convenience it is written π (the Greek letter "pai"). Thus the circumference (c) of a circle is π (or 3·1416) times the diameter (d): *i.e.*, $c = \pi d$. For many reasons it is always preferable to use the radius (r) of a circle, and not its diameter. The radius (r) is any line drawn from the centre of a circle to its circumference, and is consequently half the length of the diameter, or $d = 2r$. Thus, our formula becomes $c = 2\pi r$. By higher mathematics it is also known that the area of a circle (*i.e.*, the amount of space enclosed by its circumference) is $\pi r \times r$ or πr^2. Now, if we come to a solid circle or a sphere, it is found that the size of its whole surface is given by the formula ($2\pi r \times \pi 2r$) or $4\pi r^2$, and its solid contents by ($\frac{2}{3} \times 2r \times \pi r^2$) or $\frac{4}{3}\pi r^3$. Now, the radius of the sun is about 426,450 miles, and therefore the solid contents of the sun amount to $\left\{\frac{4}{3} \times 3{\cdot}1416 \times (426{,}450)^3\right\}$, which equals in round numbers 325,725,000,000,000,000 cubic miles. One cubic mile of the sun weighs 5,769,230,769 tons, and therefore the weight and mass of 325,725,000,000,000,000 tons will be in round numbers 200,000,000,000,000,000,000 tons. I do not understand what you mean by "the mass of the sun or planet = $4\pi^2$ (or 39·48)." Besides, the mass of one planet differs from the mass of another planet, and from that of the sun. As regards the second part of your query, a body (B) set in rotation will describe a circle; and if we imagine a line (B C) joining that body to the centre of the circle, then the angular velocity of B is the angle B C A that B C makes in one second with any chosen radius (such as A C) of that circle. This angle is not expressed in degrees, but in circular measure. If the rotation is uniform, then the distance moved through in one second will always be the same wherever B may be: *i.e.*, B will move a distance = to A B in each second. But all lines drawn from the centre to the circumference are radii of that circle, and therefore equal to one another. Thus the ratio $\frac{AB}{AC}$ is always the same for that circle, and this ratio $\frac{AB}{AC}$ is the circular measure of the angle B C A, and is often represented by the Greek letter ω (omega). Now, the linear velocity (*i.e.*, the velocity in a line in one second) of the body, B, is A B. If we call the linear velocity v and the radius r, then $v = AP$ and $\omega = \frac{AP}{AC} = \frac{v}{r}$ and therefore $v = \omega\ r$. This explains some of the symbols, although I do not at all understand your figures, or what they are intended to prove. If you require further explanations, write again, and state clearly what you wish to find out.—F. B. C.



Gravitation. Fig. to show Angular Velocity — C, Centre of Circle; B, Position of Rotating Body one second after leaving A; A C, Any chosen Radius of Circle; B C A, Angle of Rotation represented by ω.

Timber for Yawl.—G. H. (*Stoke-on-Trent*).—Any timber merchant can supply the wood for building a canoe or canoe yawl. If of spruce or white pine, it should be selected very carefully, so as to be free from knots and shakes, and is usually cut into six cuts or planks from a 3 in. deal, but the scantling will depend on the size of the boat to be built, and the work she may have to do. If she is to be built of cedar, then the planks, when finished, should be from $\frac{1}{4}$ in. to $\frac{5}{16}$ in. thick, and about the same if of spruce; but if of oak, then somewhat thinner: but oak is rather heavy, though very strong and almost indestructible. As your correspondent lives in the country, his best course will be to get his "grown trees" from wood he can purchase at any cart and waggon builder's, where it will be well seasoned. It may be of either oak, Spanish chestnut, or ash. He will find the branches so shaped as to admit of the knee, or timber, being cut out of it, the grain following the curve or shape of the required part, as shown in Figs. 1 and 2. A good way of proceeding is to work the branch into a 3 in. plank, and then cut it into three planks, from which the knees for the stem and stern can be cut, and any other of the larger knees. For the timbers, as light a plank as possible should be cut—say, $\frac{1}{4}$ in. to $\frac{5}{16}$ in.—and the grain being in a correct curve suitable for the timber required, the template or mould should be laid on it and pencilled out; then it should be cut out with the compass-saw, the planing being done next. Any other questions on the above subject will at once be answered with pleasure. Timber for canoe yawl and fittings, and kinds wanted: Keel, red pine, free from knots and shakes; stem and stern-posts, knees and timbers, oak, carefully cut with the grain; deck of $\frac{1}{4}$ in. cedar, the water-ways thicker; inside gunwale of white pine or spruce; planking of cedar or spruce; upper strake of mahogany; carlines and inside fittings, white pine or spruce; coaming of well, oak or ash; breast-hook of oak; decks to be screwed with brass screws firmly to the inner gunwale. The firms in London from whom cedar, etc., can be obtained: Messrs. Joseph Sandell & Co., Waterloo Road, S.E.; Messrs. Wm. Bloore, Bond Street, South Lambeth, S.W.; Messrs. B. J. Hudson and Sons, Millbank Saw Mills, Grosvenor Road, S.W.—L. Y.

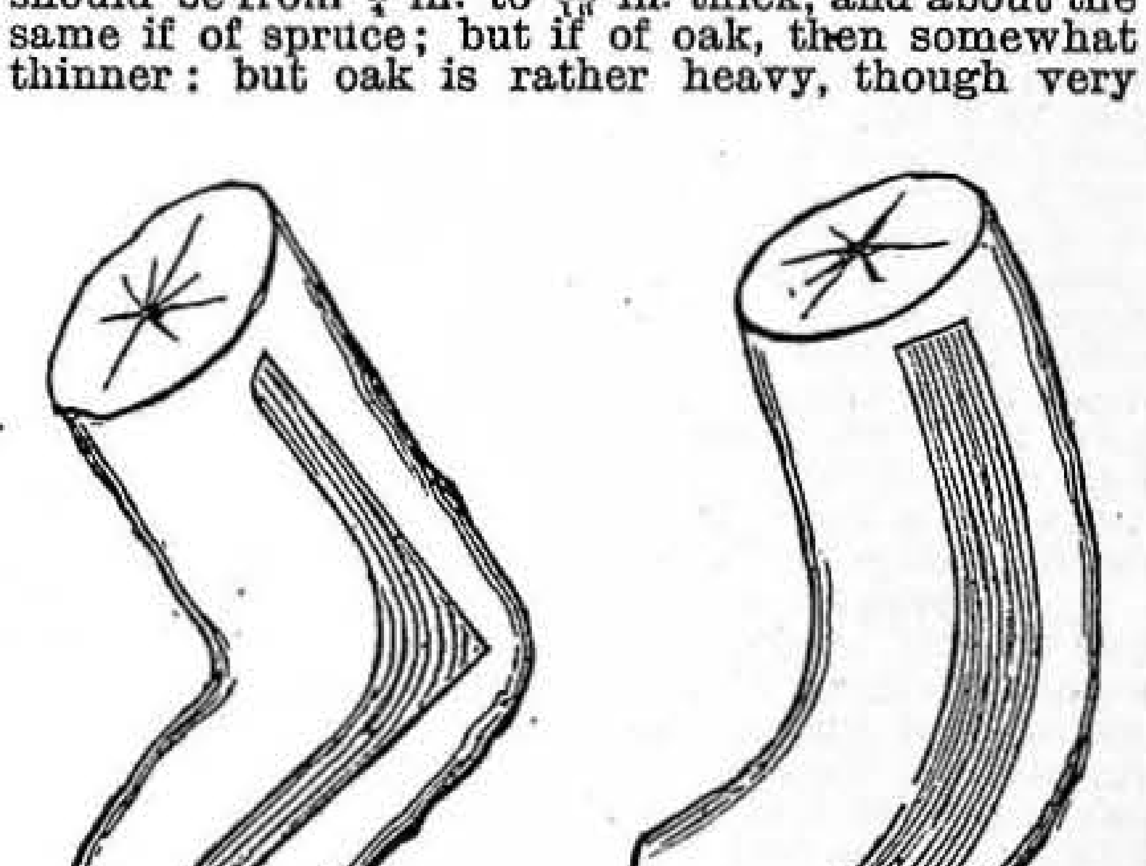


Fig. 1. Fig. 2.

Yawl. Fig. 1.—Shape of Tree for Knees, so that the Grain will follow the Curves. Fig. 2.—Shape of Tree for Timbers, so as to have the Grain follow the Curves.

Combination Patent.—IGNORAMUS II.—Our correspondent sends us a question to which we can give him no satisfactory reply on the scant data afforded. He may rest assured that the *grant* of a patent is not the *slightest* proof of its *validity*, and in the case of a *combination* patent its validity depends on the following points: Is the combination novel? Is there sufficient invention? Is it the subject matter of a patent? Is the application of any part of the combination an "analogous use" of the parts which have been employed for the purpose? And, lastly, how the claims are set out. It would take up too much space in "Shop" to go into the details relating to patents—of which the public, as a rule, are too generally ignorant—to make all the points clear; but if our correspondent will refer to the celebrated trials in the case of the "fish-plates" on railways (Heardor Wilde *v.* G.N.R.), and the case of Bamlett *v.* Picksley, he will there learn more on the subject of combination patents than can at present be acquired in any other way. If he visits the Patent Office Library, the obliging librarian will put him in the way to refer to them. Without examining and studying the specification, we cannot give any opinion or advice calculated to be of any use to our correspondent.—C. E.

Elephant Tusk.—W. F. Z. (*Liverpool*).—In few places can such a choice of tusks be seen as at the docks of your own port—nowhere else do we remember seeing such piles of ivory. As you are particular in the one you want, why not go there? Of course there would be difficulties in getting a single tusk from an importer, but should you fail in obtaining this as a matter of favour, you could surely learn from an *employé* the name of a customer through whom you could buy the tusk selected.—M. M.

Half-Plate Camera.—KODAK.—It is out of the question to reply to your request in these columns. In the first volume of WORK, several articles of some length were given, and fully illustrated with working drawings, which were carefully made out in all details, so that anybody with constructive ability could make the apparatus. It was for whole-plate size, but by reducing the principal measurements to half-plate dimensions, they would be equally useful for that size. Why not advertise your wants? The probability is somebody will have a first volume of WORK to part with.—D.

Striking Clock.—A. R. R. (*Yarmouth*).—New winding squares cannot be purchased so far as I know, and the only way to get them would be to make them yourself, or get a clock-jobber to do it; and the latter I should think would cost you nearly as much as a new clock, from the description you give of it; but I see no reason why you could not do it yourself if you have a few tools. Carefully take your clock to pieces, letting the springs all the way down before taking the plates or frame apart; now get a piece of rod-iron, a trifle larger than the old broken arbor or square, and turn in a lathe, or file up by hand if you have not got a lathe, and fit it up, using the old pieces as a guide. The arbor is fixed to the winding ratchet by simply driving it through, having previously tapered it by filing or turning. Having knocked the old one out, it should be a simple and easy job to put a new one in, as it does not matter much if the fit is not exactly, as these American clocks allow a little for being out of truth.—A. B. C.

Gas.—A. D. (*Blackburn*).—Coal consists chiefly of carbon, and when burnt, this carbon combines with the oxygen of the air to form carbonic acid gas. But as in an ordinary fire there is not sufficient air to properly burn all the carbon, the carbonic acid gas and heated air carry off some of this unburnt carbon with them in the form of smoke, which is carbonic acid gas and air so heavily ladened with solid carbon in a very fine powder that, on meeting a cool surface, this carbon is deposited as a black layer. Supposing you have a bright red fire, and you put coal on to it, the air entering at the bottom of the grate is deprived of much of its oxygen whilst passing the red-hot portion of the fire, and thus cannot properly burn the fresh coal, and yet, being hot, it can burn the coal sufficiently to carry off some of its carbon as smoke. Coal, too, often has gases enclosed in it, and these gases, when they escape, take fire, and burn with a smoky flame, because they contain more carbon than the air can properly burn as the gas rushes out.—F. B. C.

Bending Lead Pipe.—W. H. C. (*Homerton*).—You state in your query that you want to bend the pipe to an angle of 45°, but your sketch shows the pipe bent square, which is an angle of 90°—a great difference. Try this way: Place a strong piece of ash stick in each end of the piece of pipe, place the pipe in a vice with just enough pressure to hold it, get someone to take one stick and you the other, and both lift up. Bend up about half what you want, then take out and work it a bit with a round stick; then put in vice again, and bend to correct angle required.—R. A.

Dry Batteries.—C. B. (*Keighley*).—(1) Of course, the term "dry battery" is slightly aside the mark. There must be some moisture in the cells, but there is not enough to be noticed. If you were to break a cell of a dry battery, you would not find any liquid. The battery is, therefore, safe to use wherever there is any danger to be apprehended from spilling the liquids employed in the general run of batteries. It is eminently suitable as a generator of electric current for a bedroom electric night-light. (2) I cannot tell you the exact composition employed in any of the dry batteries, as they are the subjects of unexpired patents, and their makers keep the relative quantities of the ingredients or their method of mixing them a profound secret. (3) I am not able to furnish you with a statement comparing the relative value of the Gassner and the E. C. C. dry cells as electric light batteries. I have tried the Gassner and the E. S. dry cells for this purpose, and am inclined to think the latter superior in point of constancy; but none of these dry batteries are suitable to continuous electric lights. They do very well indeed for portable electric night-lights. I have had an E. S. portable lighting set in use as an occasional night-light for nearly three months, and find it very useful when I wish to see the time by my watch. I have only to press a button under my pillow to light the lamp and illumine the face of the watch, besides lighting a room 12 ft. by 12 ft. by 10 ft. I think this very good.—G. E. B.

Leclanché Battery.—C. B. (*Keighley*).—(1) The inside cell of a Leclanché battery contains a mixture of peroxide of manganese and carbon, both broken to the size of peas and sifted free from dust. This mixture is packed closely around a carbon plate, which forms the negative element of the battery. The peroxide of manganese furnishes oxygen to combine with the hydrogen formed by the electric current, and thus prevents the negative element from being coated with a film of hydrogen. (2) The agglomerate Leclanché battery has the above-named mixture combined with a cement, and compressed into blocks. A block of the agglomerate mixture is placed on each side of the carbon plate, and kept in contact with it by a rubber band. This does away with the necessity of having a porous cell, and consequently lowers the internal resistance of the cells. (3) The Leclanché cell can only be employed in electric lighting where small incandescent lamps of low candle-power are required to be kept glowing for a few minutes at a time, with long intervals of rest between. When used continuously, the store of oxygen gets used up, and the cells are then said to be run down. The same may be said of "dry cells;" but these have their peculiar properties and advantages apart from those of the Leclanché series. The six-block agglomerate Leclanché is the most durable cell of the series. In this there are six blocks of agglomerate arranged around a fluted carbon rod, which forms the negative element of the cell.—G. E. B.

Electric Subjects in Work.—C. B. (*Keighley*).—We are always pleased when rendering assistance, by means of advice, to all our readers, and generally manage to answer all questions of a reasonable character; but your last exceeds the bounds of reason. We have repeatedly given notice in "Shop" that we *cannot answer questions in our next issue* from the date of correspondents' letters. We have several times printed a list of the numbers you inquire for. When you ask us to give you a list, in our next issue, of "all the numbers of Work that treat on electric lights, dynamos, accumulators, electro-motors, and batteries," we must refer you to the three indices of Work, which cost one penny each.—G. E. B.

Tailoring, Cutting, Fitting, etc. — S. W. (*Ashton-under-Lyne*).—These subjects shall receive proper treatment as soon as a competent, practical man can be arranged with to write a series of papers.

Induction Coils. — A. B. (*Leytonstone*).—An excellent series of papers have been commenced in the fourth volume of Work. Purchase No. 157.

Electric Lamps.—C. B. (*Keighley*).—You are in error in supposing that it takes sixty-five times more current to light one 5 c.-p. lamp than it does another of the same candle-power. It may, and does frequently, require sixty-five times more pressure to force the requisite current through the resistance of a lamp's filament, but the quantity of measured current expressed by the unit of current measurement denominated the watt is nearly the same for all lamps of the same candle-power. This quantity ranges from 3½ to 4 watts per candle-power. A 5 c.-p. lamp, for instance, will take, say, 20 watts of current to bring out its full light. If it is an 8 volt lamp—that is, if its filament can be made to glow with a 5 c.-p. light under a pressure of 8 volts—it will take a current volume of 2½ ampères, since $2\frac{1}{2} \times 8 = 20$. But if the filament is very long and very thin, so as to offer a high resistance, it may take 65 volts of pressure to make it glow; but the capacity of the filament will only allow of $\frac{3}{10}$ths of an ampère of current to be forced through it, and $\frac{3}{10} \times 65 = 19\frac{1}{2}$, or nearly 20 watts, as before.—G. E. B.

III.—Questions Submitted to Readers.

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

Kiln for Burning Lime.—J. McJ. (*Capetown*) writes:—"(1) Would some reader kindly give me, through 'Shop,' the rough drawing of a lime-kiln, known as a running kiln: and what is the best lining, as fire-bricks are very expensive out here? (2) How long will the stone require to remain in the kiln to be burnt? (3) What is the best simple test to know a good limestone? (4) I should like to know also any good work on this subject."

Damp Ceiling.—J. W. S. (*Guernsey*) writes:—"I have a boarded ceiling, which is damp through the sweating of the tiles. Would Willesden paper—the one-ply brown—be suitable for tacking to it, and then paper over it in the usual way?"

IV.—Questions Answered by Correspondents.

Model Ship Building.—Thornhill writes, in reply to Cutter (see No. 150, p. 733):—"Cutter will find all the information he wants in 'Model Yacht Building and Sailing,' by E. Biddle, published by Norie & Wilson, Minories, London, E.C., the best work on the subject that has come under the eyes of an amateur of 1822 down to date."

Fret Inlaying.—J. B. (*Carrick-on-Suir*) writes, in reply to J. T. S. (*Sheffield*) (see No. 149, page 718):—"I enclose rough sketch showing how to manage holes. As you see, they come through waste wood only. I suppose you understand how to get correct angle for table. I used to try a few waste pieces first until I got it right. I can recommend 'Fret-sawing for Pleasure and Profit,' which you can get at any dealer's. I think it costs 2s. 6d. In inlaying, you must be careful not to go back on the cut, else the saw will cut bevels on both sides, and destroy the stuff. Personally, I don't think fretwork worth the trouble. In veneer inlaying, a fine saw is used, quite upright, and the burr of saw on under-side, on being pressed into the cut, quite hides it. The under-side must be the right side when finished."

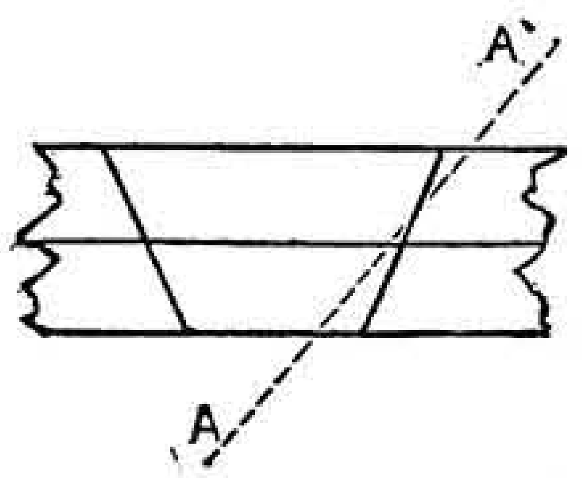


Diagram showing Line of Awl.

Paper Making.—F. G. (*Gravesend*) writes, in reply to J. W. (*Plumstead*) (see No. 148, p. 702):—"There are several directories published annually giving the addresses of the various paper mills in the United Kingdom. A very reliable one is that published by Marchant, Singer & Co., St. Mary Axe, E.C. The selection of site is a very important matter in building a paper mill, as it is necessary to have a good water supply, and also to have such advantages as to keep carriage of raw material, etc., as low as possible. The price of rags depends upon their grade. New white cuttings are quoted at 23s. per cwt., whilst light prints sell at 6s. In the manufacture of paper, esparto has superseded rags to a very large extent. It may be mentioned that there is a paper mill on the Wandle, at Wandsworth, for many years worked by Mr. Wm. McMurray. Here large quantities of esparto are used, and doubtless J. W. has noticed the watermark 'McMurray' on the *Times* newspaper. Another fibre which is fast growing in use is that made from wood, treated by various chemical and mechanical processes, and known as sulphite, soda, and mechanical wood pulps. The chemical pulps average in price from £10 to £16 per ton, and mechanical pulps from £1 17s. 6d. to £7 10s."

Lathe Work.—Brum writes:—"On page 798, No. 154, Vol. III. of Work, Lathe asks for the name of a good book on screw-cutting. I can confidently recommend him to study Shedden's 'Mechanical Rules and Tables,' price 1s. 6d., and when he has mastered that, to get 'Screws and Screw-cutting,' price 3s., both from Calvert, of Manchester. On same page, Young Turner asks for information as to kit, etc., for outfit, but does not say whether he means taking up iron or wood turning, or whether he can afford a good outfit or not; but if he will be a little more explicit, I will try to help him. But either way, I would advise him to go to some good library and study (not read) 'Holtzapffel's 'Mechanical Manipulation'; also Northcott's 'Lathes and Turning,' which are the best books on the lathe."

Overshot Water-Wheel.—G. E. C. L. (*Ipswich*) writes, in reference to F. T. C. (*Finchley*) (see No. 149, page 718):—"I should advise a small hydraulic ram in preference to an overshot water-wheel. The efficiency of a wheel is seldom more than 25 per cent., while the ram is frequently 80."

Blowing Fan.—G. E. C. L. (*Ipswich*) writes, in reference to Warehouseman (see No. 151, page 750):—"The Blackman air propeller is the best thing on the market, which can be obtained from the Blackman Ventilating Co., Limited, 63, Fore Street, E.C."

Maguay Electric Lamp.—G. E. C. L. (*Ipswich*) writes, in reference to electric lamp (see No. 150, page 733):—"These can be purchased, and lists can be obtained free, from the Maguay Electric Light Co., 9, Frith Street, Soho, W.C."

Coal Dust.—J. H. B. (*Pendleton*) writes, in answer to Householder (see No. 151, page 750), *re* coal dust:—"If he will water the same thoroughly and mix it with gas coke, he will find it an excellent slow-burning fuel."

Glass Cement.—R. W. (*Liscard*) writes to A. S. (see No. 154, page 798):—"For an adhesive for glass to stand continued wet, I do not think he can use anything better than the fluid waterproof glue manufactured by the Waterproof Glue Company, Dale Street, Liverpool, which will stand any amount of wet. I presume the dark colour of this glue would be no detriment to its use; if so, he might try the same company's 'Glu-Krystal,' which is a strong adhesive for glass, but as to whether it will stand continued wet I cannot say."

Qualification for C.E. — Civil Engineer writes to Young Engineer (see No. 154, page 798):—"There is no 'examination' or 'competition' which qualifies a person to become a C.E. To become one, it is necessary that he should serve a three to five years' articled apprenticeship to a qualified engineer, either in an engineering factory or works, and when out of his time, and been in charge of, or superintended, the carrying out of such works, he may apply for admission as an Assoc. Ins. C.E., or a member, if of suitable age, and his credentials are satisfactory. There is no 'royal road' to position in this profession."

V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—A. M. (*Hastings*); E. P. (*Southampton*); H. E. (*Glazebrook*); Canary; G. E. C. L. (*Ipswich*); M. F. (*York*); Poor Tinker; Brum; G. H. (*Oldham*); J. W. (*West Brighton*); J. H. L. (*Newport, Mon.*); L. C. (*Maidstone*); Snap; Never Satisfied; Junior Engineer; W. D. (*St. Helens*); Dynamo; F. T. (*Stoke Newington*); A. J. W. (*Battersea*); J. M. (*Leith*); A. E. G. (*Leicester*); Constant Current; R. H. B. (*Newport, Mon.*); T. L. (*Leicester*); J. W. (*Collessie*); J. M. P. (*Nottingham*); W. J. D. (*Montgomery*); A. W. (*Manchester*); J. G. L. (*Sheffield*); J. S. (*Holcombe*); T. W. (*Harpurhey*); D. (*Portsmouth*); S. J. C. (*Swindon*); W. H. H. (*New Delph*); E. B. (*Southsea*); W. C. M. (*Stanningley*) Nitrate; J. H. M. (*Longsight*); C. H. L. (*Falmouth*); J. McD. R. (*Leith*); G. S. W. (*Dewsbury*); D. B. (*Glasgow*); T. A. (*York*); Miller; F. J. H. (*Tufnell Park*); W. M. (*Stechford*); W. R. (*Clitheroe*); W. S. (*Woodbridge*); Thrums; J. C. (*Stratford New Town*); W. H. (*London, E.C.*); E. A. T. (*Burnham*); S. P. (*Durris*); G. J. M. (*Liverpool*); W. B. (*Wirksworth*); H. A. W. (*Holt*); G. M. (*Brighouse*); A. F. (*New Ross*); D. J. K. (*Roscommon*); J. P. (*Hull*); C. P. (*Old Trafford*); T. M. (*Birmingham*); Guilielmus; F. F. (*Deptford*); H. W. H. (*Bath*); Electric Lamp; R. W. (*Perry Barr*); R. C. R.; White Wood; C. E. C. C. (*Chesterfield*); A. C. C. (*Rochford*); A. C. (*London, W.C.*); A. H. D. (*Marylebone*); Raw Material; W. T. (*Northwich*); Indiarubber; J. T. V. (*Bournemouth*); J. C. L. (*Greenwich*); C. J. F. (*Eastbourne*); H. J. (*Nottingham*); J. T. (*Blantyre*); J. H. M. (*Beau Parc*); Mac; A. O. (*Tettenhall Wood*); Emarf; J. W. (*Birstall*); A. B. (*York*); Young Pattern Maker; A. B. W. R. (*Normanton*); F. W. R. (*Harting*); W. St. J. (*Castlefield*); Young Electrician; J. J. (*Everton*); Shears; Auto.; A. G. P. (*London, N.W.*); Nimrod; W. J. G. (*Holloway*); J. U. (*Bournemouth*); W. F. C. (*Coventry*); W. E. R. (*East Grinstead*); N. W. A. (*Durham*); J. J. (*Bristol*); A. F. (*New Ross*); W. C. L. (*Owens College*); J. L. (*Hull*); W. R. (*Manchester*); W. H. (*Kirkdale*); J. J. (*City Road*); R. S. C. (*Newcastle-on-Tyne*); J. H. (*West Leigh*).