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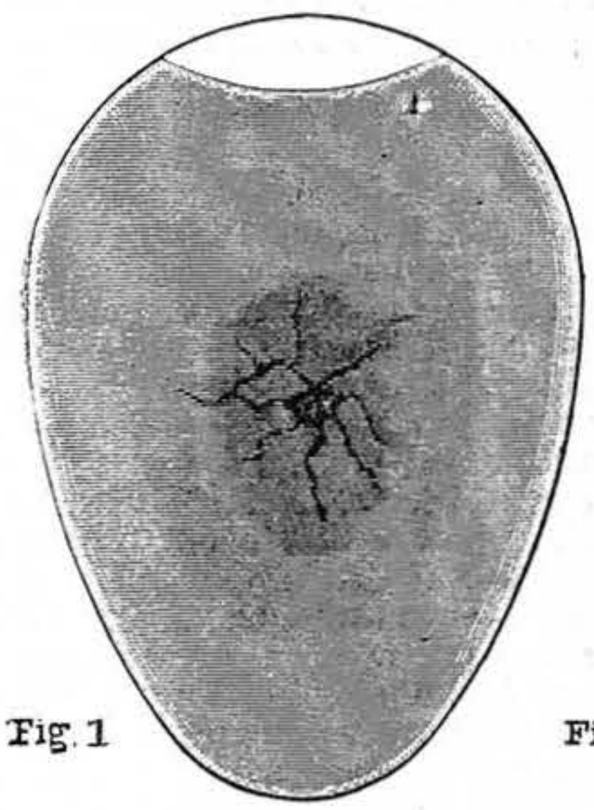


Fig. 1

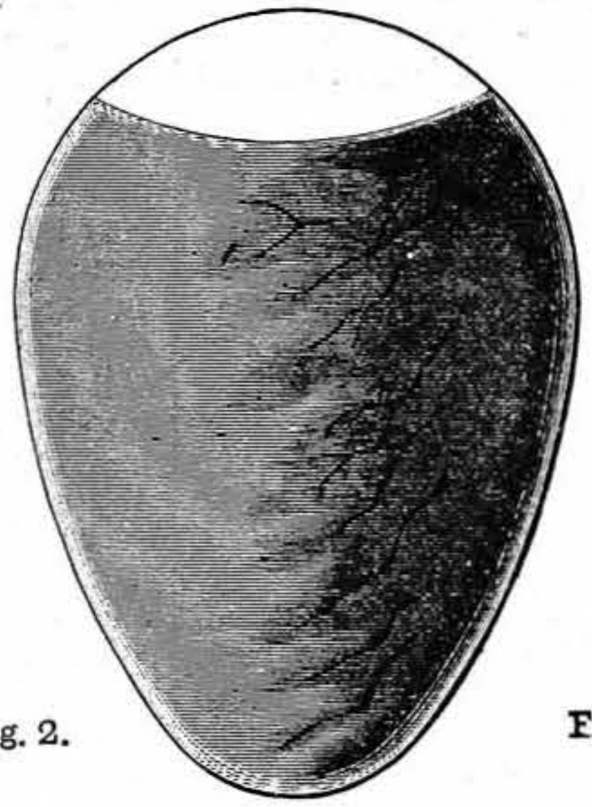
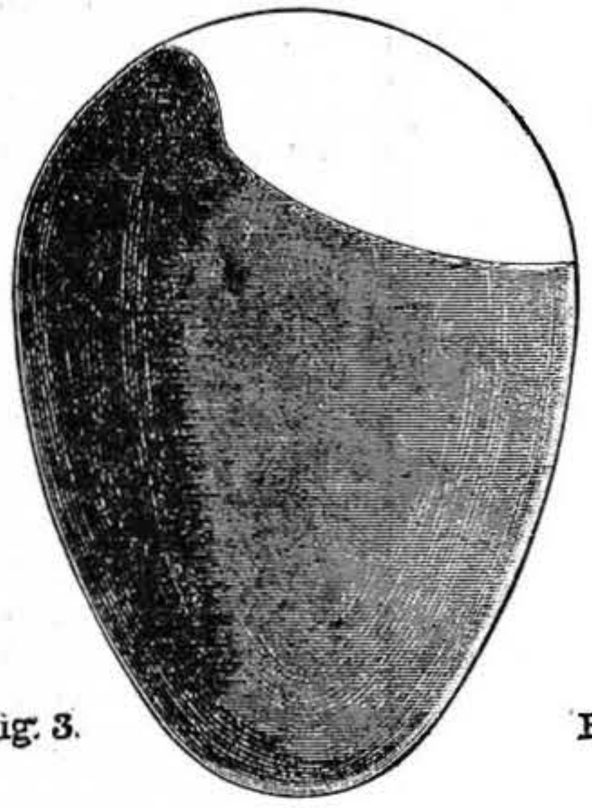


Fig. 2.



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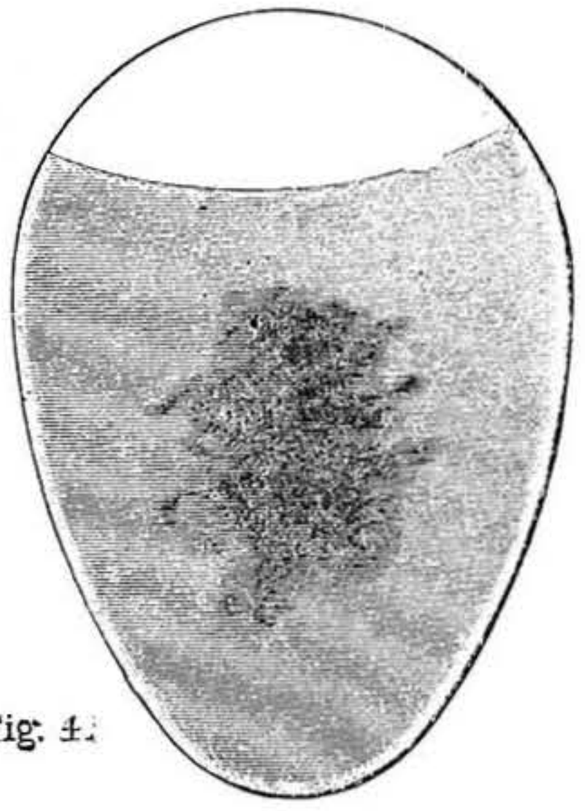

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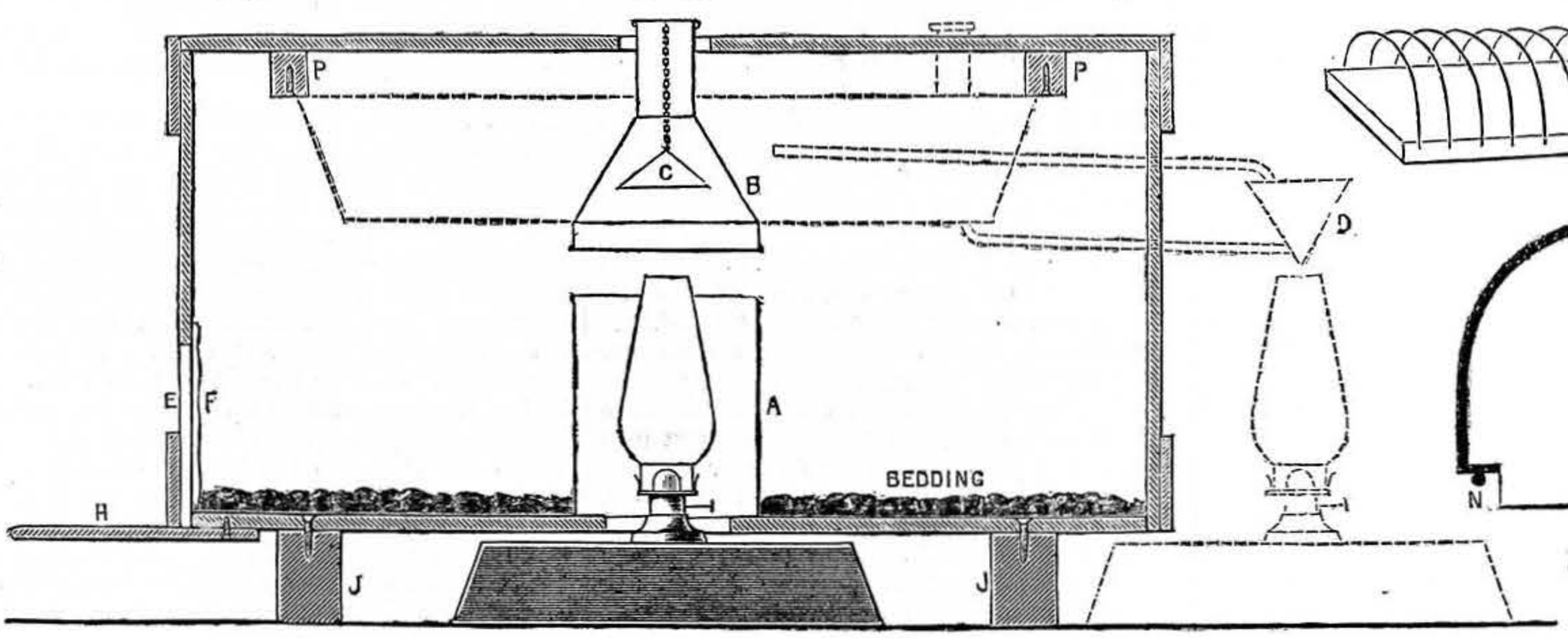


Fig. 5.

Fig. 8.

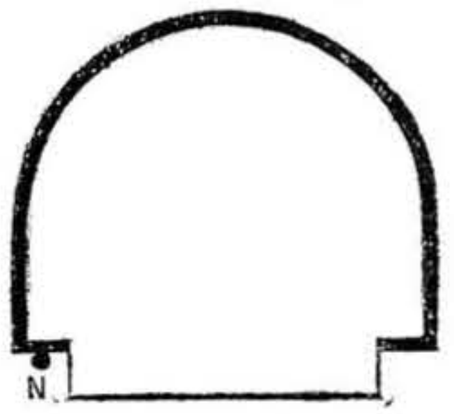


Fig. 9.

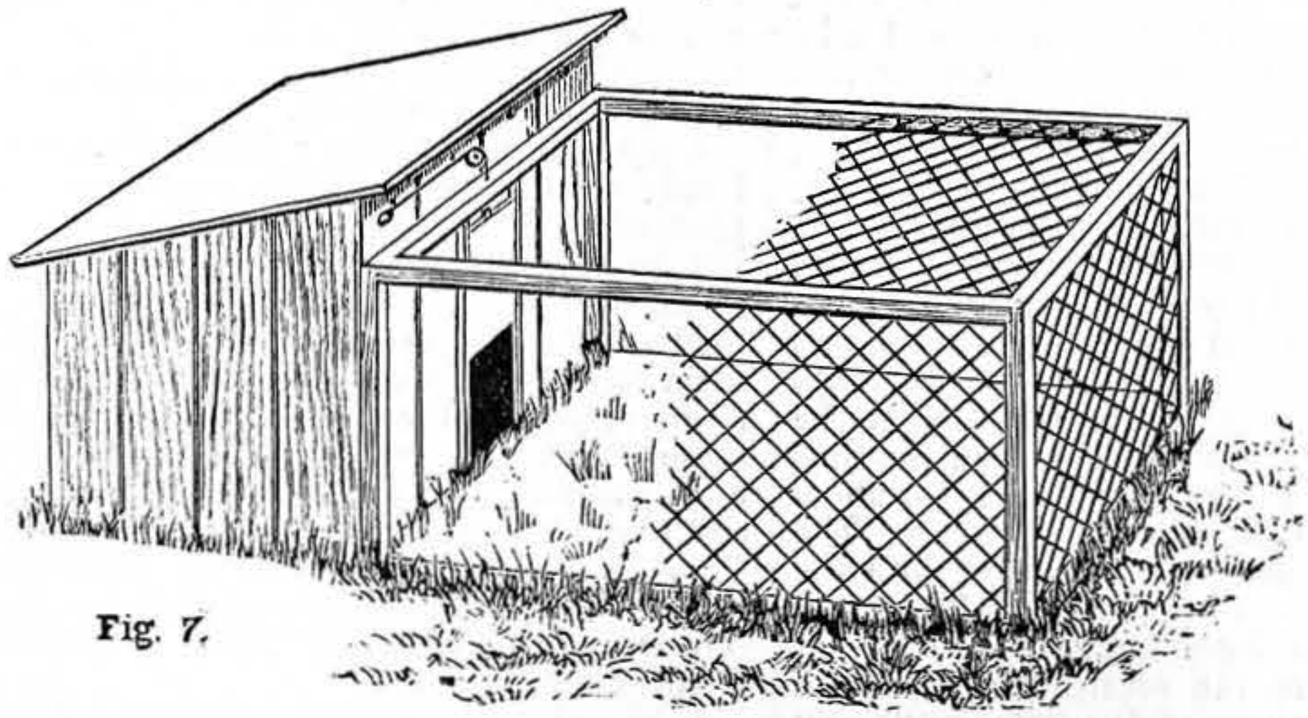


Fig. 7.

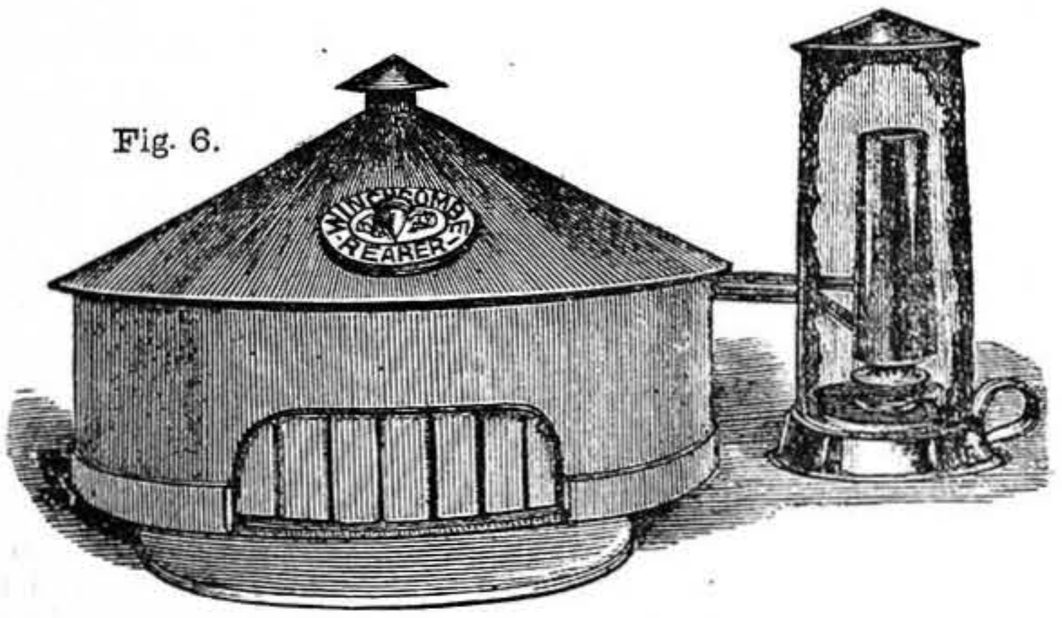


Fig. 6.

CHICKEN-REARING APPLIANCES: HOW TO MAKE AND USE THEM.

Fig. 1.—Fertile Egg after Seven Days' Incubation. Fig. 2.—Ditto after Thirteen. Fig. 3.—Ditto after Twenty. Fig. 4.—Addled Egg. Fig. 5.—Section of Rearer. Fig. 6.—Winchcombe's Rearer. Fig. 7.—Coop and Run. Fig. 8.—Guarded Feeding Stage. Fig. 9.—Block or Gauge for bending Wires.

CHICKEN-REARING APPLIANCES: HOW TO MAKE AND USE THEM, ETC.

BY LEGHORN.

TESTING EGGS—TIME OF INCUBATION—REARERS—COOP AND RUN—FOOD UTENSILS—MANAGEMENT OF CHICKS—AILMENTS AND REMEDIES.

Testing Eggs.—As promised in my last article, I will, before describing the construction of rearers, etc., give instructions for testing eggs at various periods of incubation, which will apply to both the natural and artificial methods. It will be best to test them after dark by means of a piece of cardboard or similar opaque material, in which a hole the shape of an egg, but slightly smaller, has been cut, using a strong light behind for illumination. Taking the card in one hand and the egg to be tested in the other, held (between the thumb and forefinger) over the hole previously cut, all extraneous light being now cut off, we can see almost through the egg. Experienced operators can distinguish fertile eggs from infertile or clear ones at four days, but the tyro will do well to leave them until the seventh day, when, if fertile, they will have something of the appearance of Fig. 1: a semi-opaque central spot (the germ), from which the blood-vessels, in the form of spidery arms, radiate in all directions. If this appearance is absent and any egg looks clear throughout, it should be removed and, if necessary, replaced by a fresh egg, previously warmed as before mentioned. Infertile eggs removed from the incubator are quite good enough for cooking purposes, or even for eating if anyone is partial to the taste of a "new-laid Frenchman," or may be put aside as food for the young chicks. If the eggs are dark or thick-shelled there may be some difficulty in forming a definite opinion as to their fertility, and in such case it will be well to leave them for a few days longer before discarding them. By the thirteenth day they should have the appearance of Fig. 2, at which stage the embryo chick may be said to live, and from which time development is rapid. Fig. 3 represents a good egg of twenty days' incubation, by which time it is almost entirely opaque, the head of the chick being plainly visible, and in a good many cases its chirp and tap, tap against the side of the shell can be distinctly heard. An addled egg—that is, one in which the germ had lived, but from some cause had died and putrefied—is represented in Fig. 4. A large dark central mass, shifting with every movement of the egg, and suspended in a cloudy liquid, is its characteristic.

Time of Incubation.—The egg of a hen takes 21 days, pheasant and partridge 24, duck and turkey 28, goose 20.

Rearers.—Now we come again to the constructive part. Rearers should always, if possible, be made round. If square, the chicks are very apt to crowd together into the corners for warmth, sometimes suffocating the weaker ones. With round appliances no such trouble can occur. A capital machine can be made from a cheese-box, obtainable from most provision merchants for about 2d. or 3d. Look out a sound one, with a decently fitting lid. They are of various sizes; one about 16 in. in diameter and 9 in. deep will house about five-and-twenty chicks. It is not advisable to keep a larger number than this together, and on no account should birds of various ages be put together, or it will probably be a case of the survival of the *not fittest*, but *strongest*. We have the choice of two methods of heating—by hot water and by direct heat from a lamp. I use both, but cannot claim any particular advantage for either over the other. With the first-named method there is no danger of chicks perishing through cold should the lamp go out at night, as there would be sufficient heat stored in the tank to last for some hours.

On the other hand, with a direct heating arrangement there need be no fear of drowned chicks through the tank giving way, and no bother about filling or renewing tanks. I think, perhaps, I should give the preference to "hot water" in cold weather and "direct heating" in warm. In Fig. 5 (following the thick lines only) I give a section of a direct heating arrangement, in which A is a cylinder of metal (a large tin canister, about 5½ in. in diameter and 4 in. high, will suffice) fixed to the bottom of our cheese-box, a hole sufficiently large to admit the lamp being previously cut.

Now make or procure a funnel, B, and secure same to the lid in a central position over A. The hole in lid should be cut ½ in. larger in diameter than the size of the top (inverted) of funnel, to prevent the heated metal being in contact with wood, and also to provide ventilation. Two or three ⅂-shaped straps must be riveted to top of funnel, and the latter by these fixed with screws to the lid. No "soft tommy," or ordinary tinman's solder, must be used in this funnel, but if soldered, threepenny-worth of silver solder should be procured, the soldering being done with a blow-pipe, using powdered borax as a flux. A small radiator, C, hung from the top by a wire or piece of small chain, will economise heat by radiating it against the sides of the funnel. A small burner, taking a half-inch flat wick, will serve to supply the required heat, and should be mounted on a flat reservoir, as shown in Fig. 5, and as previously described for incubator lamp. Select a burner where the flame will be as far away from the oil as possible, to minimise the chance of the lamp catching fire.

This same design can be applied to the hot-water method, a tank, as shown by dotted lines, being fixed under the lid. A round stamped steel baking-dish will answer the purpose (of course, zinc or copper will be preferable, and last longer), and should have a sheet of tin plate or galvanised sheet iron soldered to the top, leaving a rim or lugs for fixing, as shown at P, P. Cut holes as required, and solder in the cone, B, and provide a pipe in the top for filling. In this case ordinary solder will answer our purpose to all parts where protected by water.

If an outside boiler is preferred, it can be arranged as shown by dotted lines on the right-hand side of Fig. 5, in which D is a small hollow cone, 2 in. diameter and 2 in. deep. This should be made of copper, and have a flow-pipe carried from the top—with the inside of which it must be soldered flush, to prevent air trapping—well into the centre of the tank, and a return-pipe at the bottom, issuing from the bottom of tank. The lamp is then placed in position under the cone, the water in which is quickly heated, and immediately passes by the flow-pipe into the tank. Colder water, entering at the bottom, is again heated and passed on, thus keeping up a continuous flow as fast as its temperature is raised by the lamp. The reason for carrying the flow-pipe into the centre of tank is to prevent the hot water issuing from it from being drawn immediately down to the return-pipe, and thus leaving a large bulk of the water cold. By arranging the pipes as shown, regular and steady heating will follow. One point I must mention: and that is, let the flow-pipe have a slight rise from the boiler and the return a fall to it. A reference to the sketch will make this clear.

Whichever plan we adopt, we shall, after selecting our box, require to cut an entrance, E, 5 or 6 in. wide and about 3 in. high, and over this, on the inside, tack a piece of felt or baize, F, large enough to cover the opening, and cut into lippets to allow the chicks ingress and egress. We now require an alighting board, H, or front doorstep, and for this we shall want a piece of ½ in. deal, about 8 in. by 5 in. Round the edges and corners, and fix it to the bottom, below the entrance, by means of screws. Two fillets, J, 2 in. by 1½ in., and about 14 in. long, fixed across the bottom will keep the rearer off the ground, and also provide space for the lamp reservoir.

If the hot-water arrangement is followed, we shall also need three or four distance pieces, P, to secure the tank to the lid, which may be about 3 in. long, and 1 in. by 1 in. in section. Holes for lamp, etc., having been cut, and all fixed in position, a couple of coats of paint will improve its appearance and durability. Before moving our family into their new house, we must provide some bedding, which may be hay, straw, chaff, or any warm material, but avoiding fabric of every kind. Straw makes about the best bedding material if cut into short lengths, and rubbed between the hands till soft. Whatever is used, it must be frequently changed, and on no account allowed to become foul, or disease will assuredly ensue. The quantity of excrement deposited by a brood of chicks in a single night is enormous, compared to their size. Cleanliness in every operation of chicken rearing cannot be too highly estimated.

Fig. 6 shows Winchcombe's patent hot-water machine for outdoor use, fifty chick size, with special wind-proof lamp. Another size, for twenty-five chicks, is made for indoor use. They answer the purpose for which they are intended as well as many of higher price. The one I use works very satisfactorily, the maximum heat obtainable with the lamp turned full up being 90° Fahr. It has a deep tank fixed to the lid and an outside boiler, the inner case of which also forms the lamp chimney, a special burner being used, which fits well into the bottom of chimney shaft, thus doing away with the trouble of broken glasses. The oil reservoir is large, holding sufficient fuel for three days' supply. The lamp burns for forty-eight hours without attention, will not catch fire, and only costs about 3d. or 4d. a week for oil.

A cold brooder to take the chicks after removal from the rearer can be made from another cheese-box (if somewhat larger all the better), and needs no internal fittings or furniture beyond bedding.

Coop and Run.—Fig. 7 illustrates a very handy coop and run, which may take the place of the cold brooder if the chicks cannot be allowed their liberty—in fact, it might be so used from the first by placing the rearer inside the coop, the run then proving a safeguard against depredations of the feline species. A range of three or four of these coops, etc., may with advantage be built together, and thus effect a saving in cost over the same number built separately. They will always be useful as pens for isolating cockerels, birds preparing for the show-pen, or suffering from infectious diseases.

A useful size for the coop will be 2 ft. square by the same height at back, and 6 in. higher in front. The run may be 4 ft.

long, 2 ft. wide, and 14 in. high. If the purse is low, and strict economy has to be studied, a suitable packing-case may often be obtained for a trifle, which can easily be adapted to suit individual requirements; but if elegance and some degree of finish are aimed at, what is known as "match-boarding" will make a comfortable house, each board being tongued into its neighbour. Draughts will be excluded, with benefit to the inhabitants.

The whole of the back should be hinged to form a door, "cross garnets" being used for the purpose; a hole cut in front for access to the run, and provided with a drop shutter for use at night, and ventilation holes must be bored at the top of front, as shown. Slate batten, 2 in. by 1 in., is just the thing for the run, costing about 2s. 6d. per 100 ft. run. After being planed, the rails should be mortised and tenoned, or halved, painted, and covered with ¾ in. galvanised netting. The roof of coop should be covered with stout unbleached calico, closely tacked under the edges, and well painted, when it will last a long time without repairs. If it is desired to cover the run as well, it will be advisable to alter the pitch of roof, and slope it to one side instead of to the back, as shown.

For coop, as shown, we shall require, say, 48 ft. of 6½ in. by ¾ in. match-boarding, and 20 ft. of batten as ledges, to secure the boards together; and for the run we shall want another 30 ft. of batten, making 50 ft. in all (these quantities allow for no waste, so allowance must be made in buying), and 18 ft. of 12 in. galvanised netting, or 10 ft. of 12 in. and 4 ft. of 24 in.

Food Utensils.—As chickens, if left to their own devices, will trample their food under foot and foul their water, it is necessary to take some special precaution that this is not done, as besides the waste occasioned, the scattered particles of food are apt to get sour or tainted with excreta, in which state they become highly dangerous. Prevention being better than cure, it will be an economy to provide a guarded feeding stage, as illustrated in Fig. 8, which consists of a base of wood, say, 8 in. long and 3 in. wide, to which wires are affixed, about ¾ in. apart. To bend these regular, a gauge will be necessary, which can easily be constructed, as shown in Fig. 9. A piece of wood is cut to shape as shown, 3 in. wide and about 3 in. high. This is fixed to another piece of handy size, and a screw or nail, N, fixed as shown. The thick black line is intended to represent the wire bent on the gauge, and is almost self-explanatory. Pieces of suitable stout wire are first cut to length, one end inserted between the gauge and the screw, then bent round to shape, giving a few taps with a hammer at the angles.

Having the bent wires ready, bore holes in the sides of baseboard, into which the wires will fit tightly. A few blows with a hammer will now make all secure. The food can (and at first should) be sprinkled on the board, or placed in a pan or trough, made of tin or zinc, to fit under the cover. Water can be protected by the same means, but I much prefer to use a small poultry fountain of glass or glazed earthenware, which can be procured for a small outlay at most china warehouses.

Management, Feeding, etc.—As soon as the chicks are hatched, they can be placed in the rearer, which should be well warmed, and kept during the first day at about 90° Fahr. It will also be well during this period to stop up the doorway. Leave them alone for twenty-four hours, during which time they will require no food, being sustained by the absorption of the yolk into the abdomen, this being the last operation before leaving the shell. One special word of advice—Don't follow the stupid and useless plan of ramming a peppercorn down their throats as soon as hatched, and don't attempt to remove the horny excrescence at the tip of their beaks. It is a natural provision to protect their soft and delicate bills, and will disappear naturally when no longer needed.

The first meal should consist of bread-crumbs, moistened with a little dripping, and mixed with grated hard-boiled yolk of egg. This course will do during the first day, after which egg should be excluded, and their diet varied as much as possible. Any of the prepared meals sold for poultry can be used, Spratt's being very good for the purpose, although somewhat expensive. From the first, for the last meal at night some grain food should be given, starting with coarse oatmeal, following with canary-seed, of which they are very fond, then bruised corn, and finally, when large enough to take it, the whole grain. A little animal food given daily is a necessity; and if only a few are kept the scraps from the table will suffice, but if a large number have to be fed something additional must be provided.

Spratt's "Crissel" (granulated meat) is very suitable, and is much relished. Green food must always be given if the chicks do not enjoy a grass run, and may take the form of chopped grass, dandelion, onion, lettuce, etc. A supply of grit is also a necessity, and a sprinkle of bone-dust over their soft food will be a preventative of diarrhœa and leg weakness. Boiled rice (get Patna), with a little milk, will also act as a check against the former, but should not be given sloppy. Never leave food about to become stale. As soon as they have finished feeding, remove the feeding vessel until the next meal-time. As to whether water should or should not be given, I will not venture a decided opinion; but if it is given, it must be pure and frequently changed, so as not to become stale. I believe that mortality among chickens could, if traced, in the largest number of cases be attributed to impure water. As the chicks grow, the quantity of food given must be increased, and the intervals between times of feeding lengthened. Every hour during the first week will not be too much, whilst at four weeks four meals a day should suffice, being further reduced to three at two months. For the first week, the heat of rearer should be about 75° Fahr., and gradually decreased until the third or fourth week, when, according to the state of the weather, it will only be necessary to supply it at night; and after the sixth or seventh, if the weather is favourable, it may be entirely dispensed with, and the brood transferred to the cold brooder or coop. I have not space to treat on the subject at length, so for additional information I must refer my readers to one or other of the numerous treatises on the subject.

Chicken Ailments.—Just a word, and I've done. With proper care and attention, illness should be unknown; but in case it should occur, I will just touch upon the symptoms of and remedies for treatment of the most common.

Gapes is a disease I have never been troubled with, but once get it among a brood, and it is difficult to eradicate. It is caused by a small worm, which infests the windpipe, causing the sufferer to gasp or gape for breath; hence the name.

Remedy: A little carbolic acid should be placed in an iron spoon and held over a candle. Into the fumes given off the head of the affected bird should be held until suffocation almost ensues. This will dislodge the worms; and, if carefully done, the chick will be none the worse—left alone, it will surely die.

Roup is a severe cold, and takes the form of a running at the nostrils, ruffled plumage, and loss of appetite.

Treatment: Isolation and warmth, and a course of Vale's or Cook's roup pills or Spratt's roup paste. A severe case is, generally speaking, incurable.

Diarrhœa.—Caused by stale and sour food, dirty water, and want of cleanliness.

Boiled rice, sprinkled with powdered chalk, will generally give relief; if severe, two or three drops of chlorodyne in a teaspoonful of water will generally prove curative.

Leg Weakness.—Heavy, fast-growing birds, especially cockerels of the larger breeds, are sometimes subject to this, but if bone-dust is used during rearing, it will rarely occur.

Treatment: A stimulating food with meat.

My task is finished. To all whom it may concern, I would say, "Go in and prosper." Poultry rearing is a profitable and interesting hobby; and these papers may, I hope, induce some who do not at present keep fowls to commence to do so forthwith. I am always ready, through "Shop," to help and advise anyone in trouble, and shall be pleased to smooth away any difficulties that may arise.

WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

GARDEN ARCHES: EFFECTIVE UTILITY OF ARCHES—ARCHES IN ONE FRAMEWORK—ARCHES COMPOSED OF TWO FRAMEWORKS—TOP UNITING IRONS—TWISTING ZINC RIBBONS OR RODS—MACHINE FOR IRON RIBBON TWISTING—THE WORKING OF THE LATTER—THE CONSTRUCTION OF THE LATTER.

Garden Arches.—These are effective and useful. I have very great admiration for the pretty effects obtained by the use of garden arches when they are covered and completely hidden from view by creeping plants, etc. A few of them fixed over a path at very short distances from each other, and entwined with Nature's adornments, will produce a pleasant shady spot for the leisure hours to be spent within; the sun or the moon peeping through the interstices above will bring up memories when one strolled through the country lanes, with the overhanging branches forming natural arches. But there is a far greater pleasure to be gained oftentimes by passing the hours away in our own gardens, as outsiders are not allowed to trespass; whereas in public walks one is always open to the intrusion of men and vehicles.

No necessity exists for a garden arch to be of elaborate construction. What is required is little more than a framework up and around which plants may be properly trained, as the latter should completely hide the former. Fig. 171 is a sketch of the most ordinary pattern made, and Fig. 170 represents one of slightly more pretentious appearance. These are sometimes made in two parts, sometimes in but one only. They are half-circular at the top. It will require very little arithmetical ability to arrive at the extreme length of one of these

articles if the height and width are given. A size they are frequently made in is 7 ft. high, 4 ft. wide, and 1 ft. deep at the sides. In these measurements I have not included the stakes at the ends; these are for the purpose of fixing them properly to the ground. I will deal firstly with those made in single pieces.

Arches in Single Frameworks.—These are formed of a pair of long rods to which are meshes used vary to a great extent. It is the endeavour of most workmen to so place the work that the junction of the meshes on one side are situated as nearly as possible against the long rods, as in Fig. 172, and also to have the stay-bars in such a position that they as well will cover junctions (Fig. 177).

When the piece of work is ready, the wires are turned over at odd intervals to for purposes named in connection with the one spoken of above, and at the other end there is a flat iron with two holes in it. They are each bent in such a manner that a proper arch results when two are placed together in a reverse position, with the two flat irons exactly in the middle of the arch, where they will be fastened to each other by means of screws and nuts, and thus make the whole a solid job. But before this

Figs. 170, 171.—Alternative Patterns of Garden Arches. Fig. 172.—Arch before being bent; not necessarily representing Arch in Fig. 170, as the latter is supposed to be in separate halves, some being made whole and others in halves.

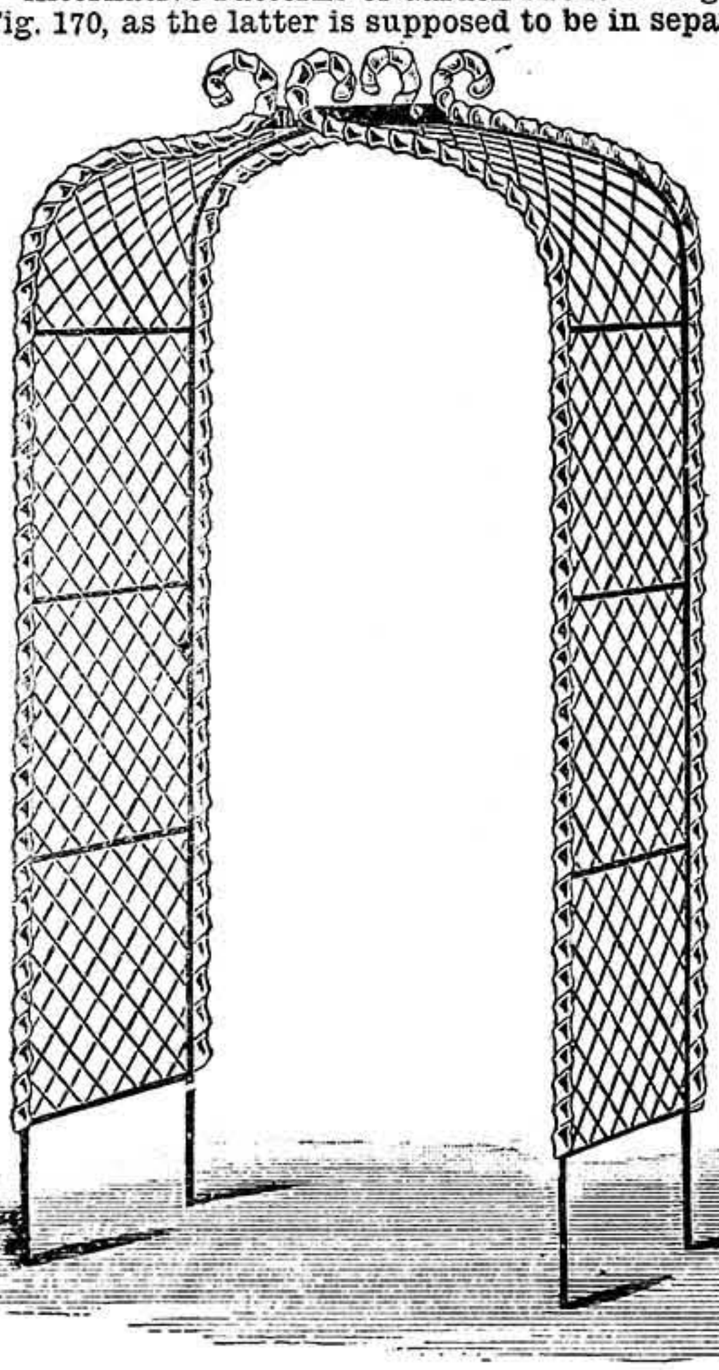


Fig. 170.

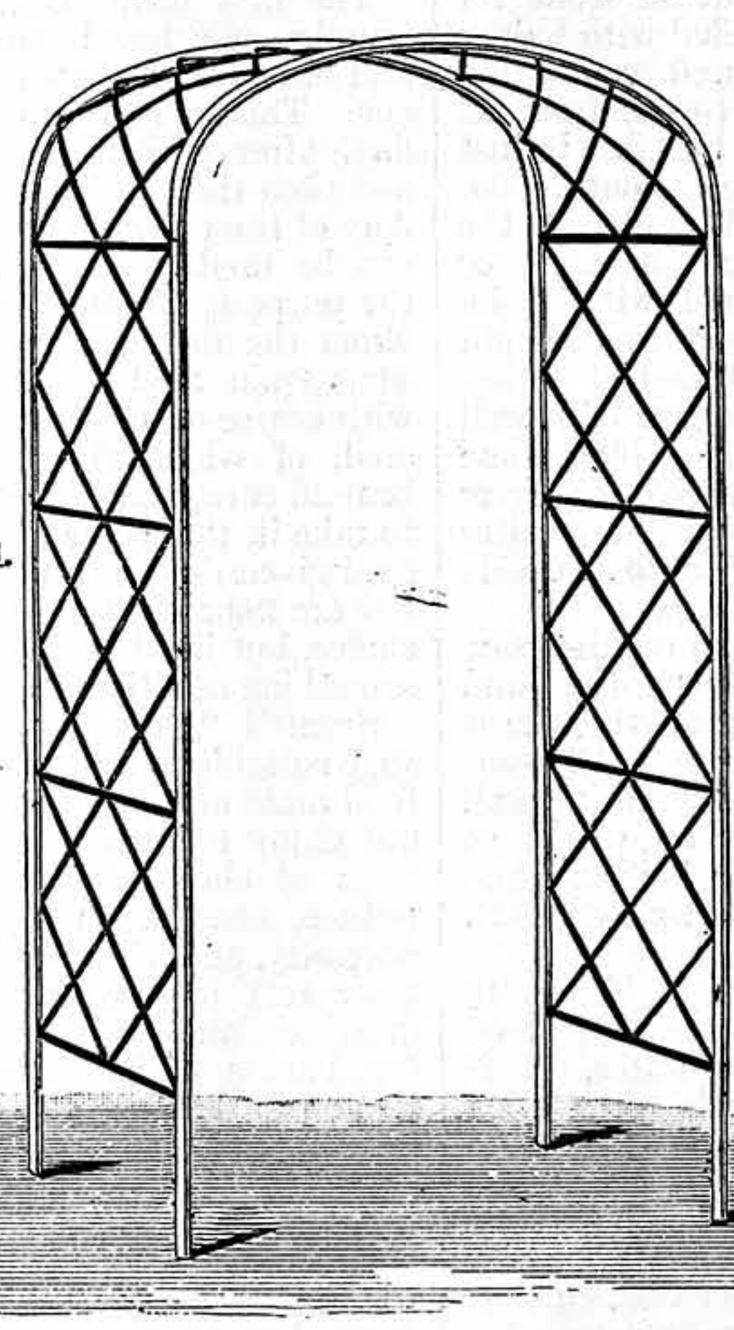


Fig. 171.

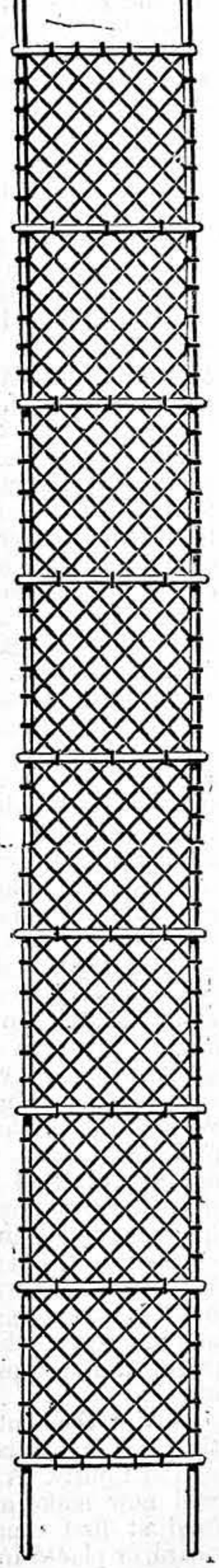


Fig. 172.

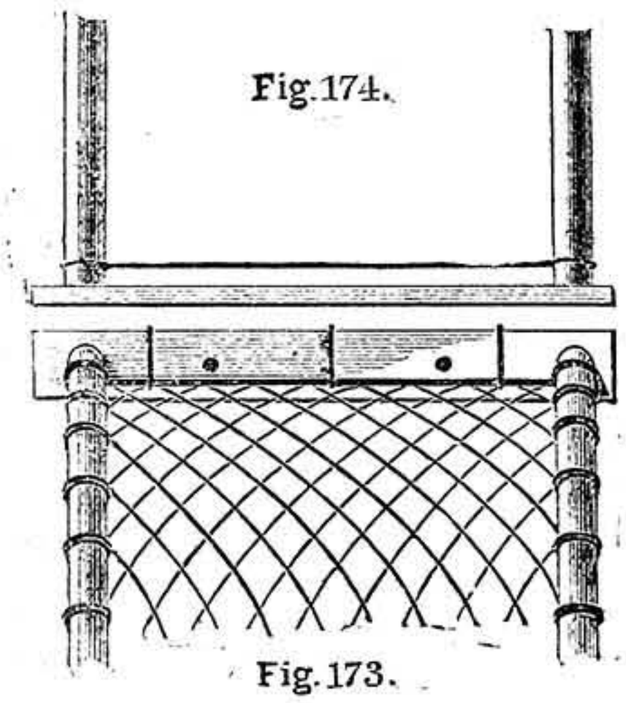


Fig. 173.

Fig. 174.

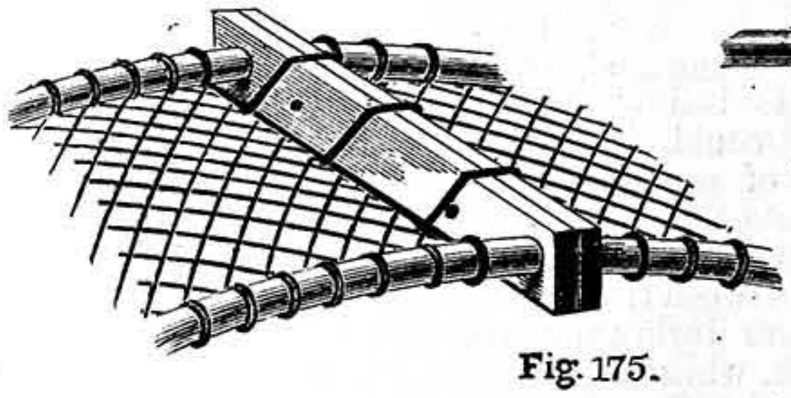


Fig. 175.

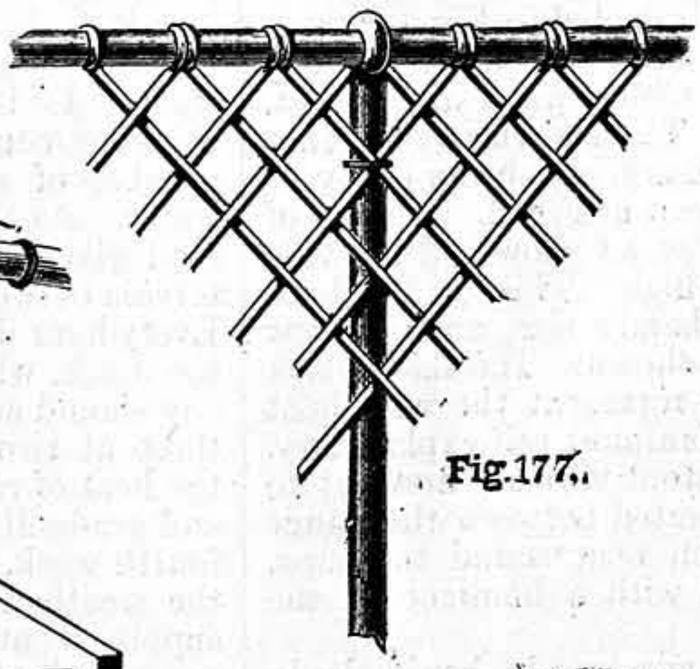


Fig. 177.

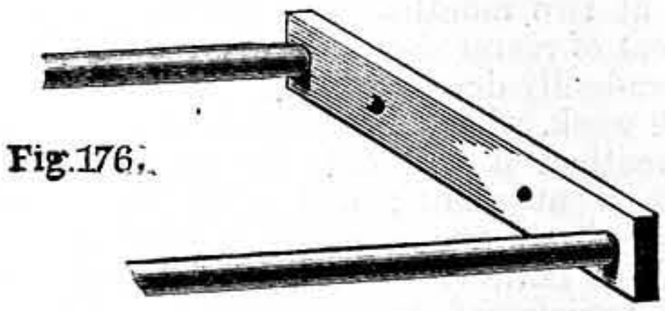


Fig. 176.

Fig. 173.—Appearance of Fig. 175 when viewed in Elevation. Fig. 174.—Plan of Framework of Fig. 175. Fig. 175.—Perspective View of Top of Arch when made in two separate halves. Fig. 176.—Perspective View of Fig. 174 minus the Cross-Wire. Fig. 177.—Enlarged Portion of Fig. 172, showing how Cross-Bars are attached.

secured stay-bars of the required length, as shown in Fig. 172. There are usually about nine of these. A portion of each long rod is left free to act, as before said, as a stake. The longer these free portions are, the stronger will be the hold they will afford the arch when the latter is fixed; but 1 ft. lengths will be very suitable.

When more than one arch of the same description is to be made, the number of meshes contained in the first one is noted, and taken as a guide for cutting out pieces of work for after use. The number of hold it in position for the final turning over. The wires are then secured to the stay-bars by being tied to them in about three places each. When thus far ready, the whole is carefully bent in the middle round a cylindrical object, and the arch is finished, with the exception of the galvanising, painting, or whatever process it is intended it shall undergo.

Arches composed of Two Frameworks.—Frequently these articles are made in two separate halves. Each half is at first a flat frame; each has two projections at one end point is reached I must say more concerning the turning over of the wires.

Top Uniting Irons.—It will be understood that at the ends where the flat irons are the wires cannot be turned over on to them. To overcome this, a wire of the same gauge as those composing the meshes of the arch is fastened to that end of the frame, leaving a small space between itself and the flat iron. Over this the wires can be conveniently turned. After this operation, the single wire is bound to the flat iron in two or three ties by a piece of wire being bent over

both at each point, as in Fig. 173, in which diagram it is supposed a side elevation is shown of the frame when arched.

The same particulars as those dwelt upon above will apply also to the arch shown in Fig. 170. The difference is that the meshes are smaller and the article is ornamented by having twisted iron rods or ribbons fixed to it by means of wire ties. These are made in various degrees of twists.

Twisting Iron Ribbons or Rods.—A method of twisting these rods, which are originally flat, is by fastening one end in a vice and one end between a pair of pincers, and turning it regularly and carefully. But the machine which I show in Fig. 178 will be acceptable to the workman using it, both on account of the advantage of performing the work much quicker and much more symmetrically than could be accomplished by hand.

Machine for Iron Ribbon Twisting.—One end of the iron ribbon is passed through a pair of catches on the wheel (Fig. 180), while the opposite end is held firmly between the jaws of a vice. The wheel is turned sharply, and the ribbon is consequently gradually twisted, as represented in the drawing. It is obvious that at each twist or turn the distance occupied by the iron between its two ends proportionately diminishes. Therefore, allowance must be made for this shrinkage. This is accomplished by permitting the machine to travel within a couple of grooves in the bench. Thus, when being used, the iron as it diminishes in length draws the machine nearer and nearer to the vice, thereby making all necessary allowance. To retain the appliance continually in direct contact with the bench, it will at once be seen that dovetail grooves, as in front elevaton, Fig. 179, will be advisable, in which may travel the bottom dovetails of the machine. Something also is needed to keep the device always perpendicular, and this something is found in the shape of two pairs of brackets, attached in such a manner that their bottom edges are in loose or free touch with the surface of the bench.

The Working of the Machine.—It will be expedient that the jaws of the vice meet and hold the end of the iron ribbon *exactly* opposite to the catch in the wheel, otherwise the twist may be irregularly made.

Space necessarily confines the piece of imaginary iron supposed to be undergoing the operation of twisting, in Fig. 178, to a very short piece; but it can, of course, be understood that any length may be turned by it, provided sufficient accommodation is supplied.

While using the machine, it will be well to hold it by one hand at the top, in order that it may not be drawn too quickly in the direction of the vice, for it will be noticed that frequently the ribbon will present symptoms of following a "barber's-pole" appearance—that is to say, instead of twisting as it should, it will appear inclined to bend to the same shape that it would be seen the red line of a barber's pole does if the same could be taken bodily off the pole.

It will be observed that there is a recess in the bench to accommodate the vice, so that the ribbon may stretch away from the machine precisely at right angles to it, thus allowing the vice end to be opposite to the catch.

In Fig. 182 a section of the ribbon is shown twisted to a certain degree, and in Fig. 183 it is represented after having further undergone that operation. It is not an essential matter concerning the degree of the final twisting, as workmen use their own opinions of the effects to be obtained. Many would deem that in Fig. 183 quite satisfactory; many would consider a closer twist preferable.

The Construction of the Machine.—Perhaps I may now particularise the details and construction of the machine. It needs no telling that it will be best if made in metal; but hard wood, lined with metal on those parts where friction will result—and there will be plenty of it occasioned by the revolutions of the wheel—may be used with comparative utility as substitutes. In Fig. 184 is shown the main portion of it. It matters little whether this consists bodily of one piece, or is formed by two uprights dovetailed at the bottom, and joined together by a cross-piece shaped half-circular on its upper edge.

Around the half-circular portion of the inner edge should be fixed a runner or a projection. This ought in all reason to be of metal. At the top of each upright is a deep notch or mortise, into which will be pivoted one end of a top rail. The outside surfaces of this rail should be flush with the surfaces of the portions to which it is pivoted. It will therefore be necessary to have small tenons on the ends of the top rail. To retain the free end when required, it will only be needful to run a pin through the holes in the upright and through the particular tenon between them. Along the middle of the top rail, at the bottom of it, will run a projection of the same depth as that upon the inner edge of the standard.

The wheel is grooved completely around its circumference, as in section, Fig. 181. This wheel is then fitted over the projection on the inner parts of the main portion of the machine, and is retained thus when the top rail is lowered into position and secured. The handle will, of course, penetrate the wheel through the centre. The larger the handle, the easier and quicker will the use of it be found; but it will be unnecessary, perhaps, to say that it must not be too large, otherwise it will be prevented from revolving by colliding with the bench. It is on this account that I have shown the machine as of rather large dimensions proportionately compared to the drawing of iron ribbon, etc.; for, no doubt, it can be comprehended that a very tall machine will permit of the introduction and use of a deep handle.

Exactly outside the centre hole of the wheel there will be a catch, simply consisting of a piece of iron bent and driven into the wheel in such a manner as to allow the zinc to pass underneath it, as does a strap under a buckle. Parallel to this, at a short distance from it, will be another catch exactly similar to it, to permit the iron to have a firmer security by being bent around it in addition to the first mentioned.

If the grooves in the bench are open completely to the end of the latter, the whole of the machine may, when not required for use, be taken from its position, in order that it may not by its presence be an impediment in the way of jobs which do not need its aid; whereas, if the ends of the groove are closed in, it must be apparent that the machine must always remain and be a source of inconvenience upon the bench.

In another paper or two my subject must be brought to an end here, although much yet remains to be said about machines, appliances, processes, ways and means used and resorted to in wire-working. The art is a useful one, and deserves to be known and practised far more widely than it is, and especially by amateurs who have a turn and liking for practical work.

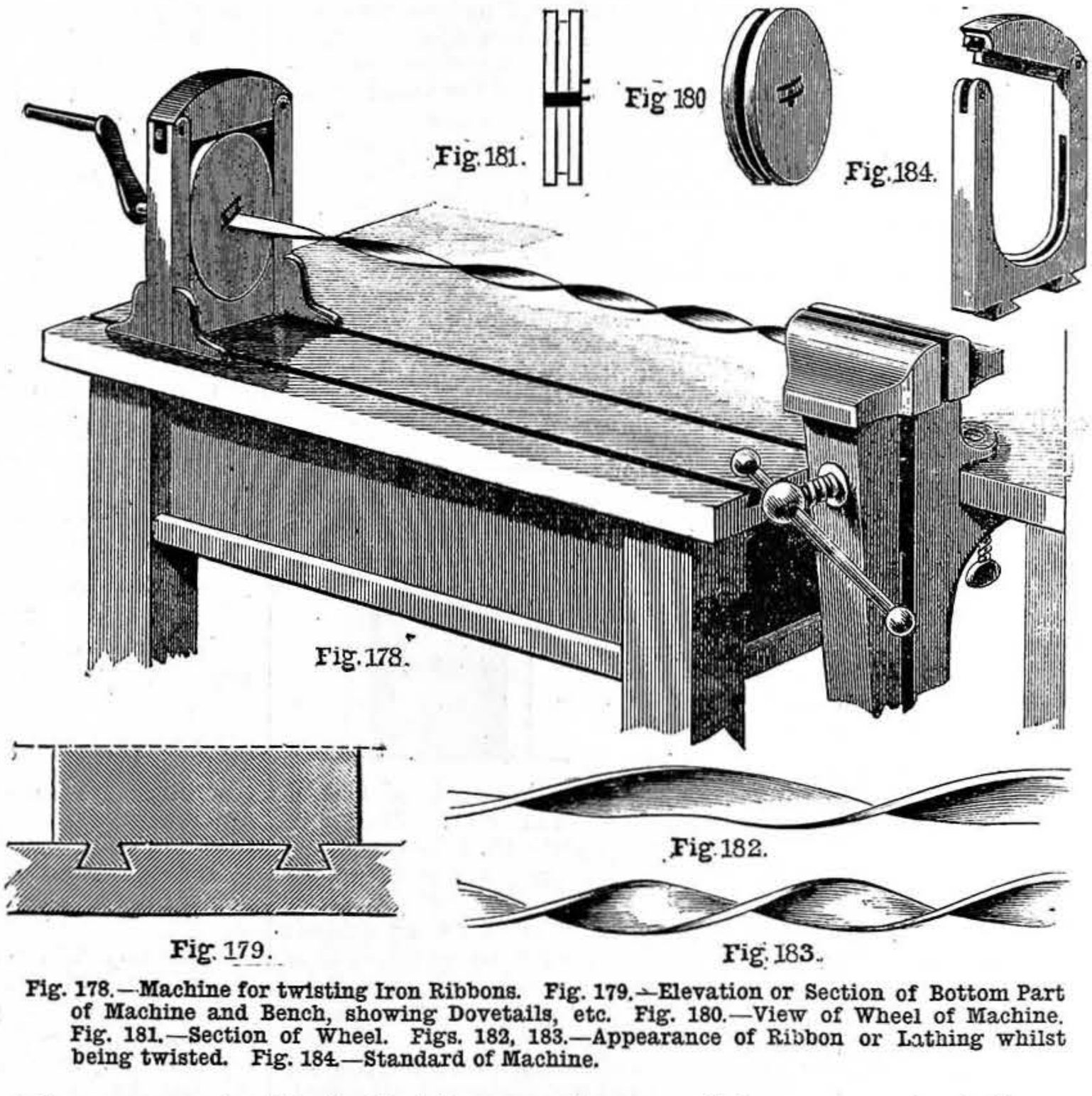


Fig. 178.

Fig. 181.

Fig. 180

Fig. 184.

Fig. 179.

Fig. 182.

Fig. 183.

Fig. 178.—Machine for twisting Iron Ribbons. Fig. 179.—Elevation or Section of Bottom Part of Machine and Bench, showing Dovetails, etc. Fig. 180.—View of Wheel of Machine. Fig. 181.—Section of Wheel. Figs. 182, 183.—Appearance of Ribbon or Lathing whilst being twisted. Fig. 184.—Standard of Machine.

SIMPLE HEATING APPARATUS.

BY THOMASO.

A CORRESPONDENT, J. D. (*Arran*), wrote for information on a subject which could not be given intelligibly within the limits of a "Shop" answer. It has therefore been necessary to put it in the form of an article. But as the answer (while it may be useful to other readers) has special reference to the needs of that one correspondent, it has been judged advisable to let the article retain the phraseology of a "Shop" answer, otherwise it would scarcely be apparent to the general reader why one particular case was treated of and other contingencies merely glanced at.

Our correspondent wants to warm a bird-room which has no fireplace, by means of oil, without vitiating the air, and he says he has tried the ordinary paraffin stoves, but they fail in that one particular. I must assume that, there being no chimney, the ventilation is provided for in another way. Now, there are two ways in which the room can be warmed. The first is to have an oil warming stove in the room with a sheet-iron pipe over it, to carry away the fumes to the outer air. I expect the pipe was omitted, hence the vitiation complained of. This arrangement is very simple, particularly as there are windows in the roof. The pipe can be bought ready-made in lengths. One end of the pipe rests on the top of the oil stove and the other goes straight up, and out through one of the windows. A pane of glass must be removed, and a piece of sheet iron, with a hole through it large enough to admit the pipe, substituted. On the top of the pipe a large cone is placed, to prevent rain or snow beating down, and if the other end of the pipe is too small to cover the top of the stove where the heated air escapes, it must have a funnel-shaped piece attached to it large enough for the purpose. The different pieces of the pipe are joined by tapping the end of one inwards until it is small enough to enter the end of another piece, when it is riveted in place. By this method the iron pipe is made the heating agent. It gets hot, and gives out its warmth to the air in the room, none of the heated vitiated air or smell from the lamp escaping. Heated iron always gives out a more or less close smell; but in the present case it will be slight enough to be disregarded. The pipe is of course unsightly; but it cannot be helped. Blacklead it if it is not galvanised. Use no paint or varnish, or it will smell for a long time.

The other arrangement is more ship-shape, and consists of a simple portable (or otherwise) hot-water heating apparatus, which you can easily make yourself if you can use the soldering-iron. The general arrangement is shown in Fig. 1. A is a small boiler of stout tinned plate, which is shown in section in Fig. 2. The chimney is 2 in. in diameter, and after rising a short distance above top of boiler, it is bent sharp back and taken out through a hole in the wall, then turned up for a little distance, and the end covered with a cone. The other dimensions of the boiler are unimportant. Height may be a foot, and outside diameter 7 in. or 8 in. One thing must be kept in mind: viz., the object to be attained is to expose the greatest amount of surface to the heat of the lamp, and at the same time have as little water space as possible. I do not expect your warming-stove lamp will do for heating the boiler. Get a small oil cooking lamp having a double-wick burner, if possible, or at any rate one with a wick as wide as possible. See that it is not too far away from the level of the bottom of the boiler, or it will not warm the water sufficiently. Support the boiler on anything uninflammable which has a hole in the top large enough to expose the boiler to the heat of the lamp. Into the side of the boiler solder two tubes of tin plate, to the ends of which brass flanges have been soldered. These flanges are subsequently screwed or bolted (with red lead between) to corresponding flanges connected with the hot-water pipes. If you do not anticipate having to move the concern, it might be soldered together instead of using the flanges. The pipes are made of thick tin plate or sheet zinc, and may be 3 in. diameter. I think a total length of 9 ft. or 10 ft. (excluding the uprights) will be enough for your purpose. You may divide this length into three or four, if more convenient. Zinc is an unusual metal to use for hot-water pipes, but I cannot see any objection to it other than the corroding of the metal where it comes into contact with iron or copper, owing to galvanic currents being set up. Zinc is freely used for toilet jugs and cans meant for hot water, and an old zinc-worker

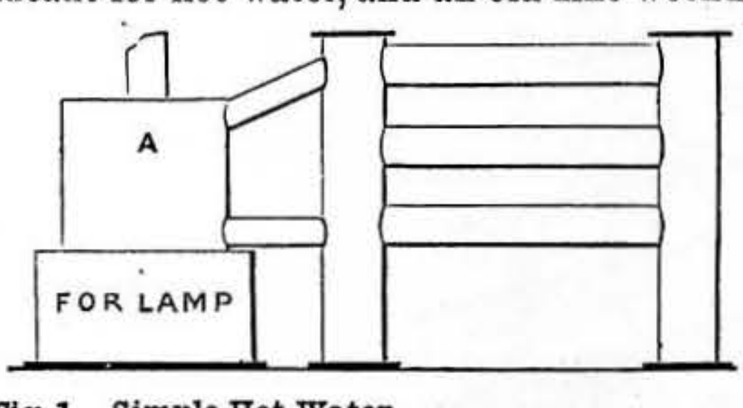


Fig. 1.—Simple Hot-Water Heating Apparatus, complete.

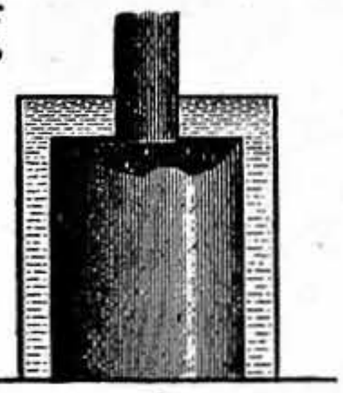


Fig. 2.—Section of Boiler.

tells me he has made hundreds of feet of zinc hot-water pipe in his time. Zinc is to be preferred to tin plate, as it does not rust. It must not, of course, be used for the boiler.

The uprights may be round or square: round is easiest. They must be larger than the other pipes, as a matter of convenience when joining them together. One upright will be wanted about every 3 ft. On the top and bottom of each solder a flat piece of metal, the bottom one projecting all round, to allow of the apparatus being screwed to the floor. You can put the pipes at any height you like, bearing these rules in mind—no part of the lowest pipe is to go below the level of the bottom of the boiler, and no part of the highest is to go below the level of the top of the boiler, the principle of the thing being this: hot water is lighter than cold, and therefore ascends to the highest point of the apparatus, while the cold water rushes in to take its place at the bottom, and is in turn heated and goes up aloft. And so the circulation of the water is kept up.

In the top of the upright, farthest from the boiler, make a round hole, and fit a sort of flat kettle-lid to it. The little steam that escapes will serve to keep the air from getting too dry. If it is objectionable, let the steam escape to the open air by way of a small pipe. For a greenhouse, for instance, the steam would be rather an advantage than otherwise.

The heat is of course regulated by turning the lamp up or down and opening ventilators. The water must always be kept high enough to entirely fill the top pipe. Examine it frequently.

Paint the whole appliance with some dull black paint, such as vegetable black and gold size diluted with turps. A dull black surface radiates heat better than a bright shining one. Before painting zinc, roughen it all over with coarse emery-cloth, or the paint will peel off.

If you increase or decrease the size of the pipes, increase or reduce the total length correspondingly. If preferred, you can have only two long pipes, and carry them along one side of the room on supports fixed to the wall, and thus save the trouble of making uprights. Of course, the two pipes must be joined at the end farthest from the boiler, and they should gradually rise so as to have the highest point of each as far from the boiler as possible. A very slight rise is sufficient. If you like, you can, of course, put lamp and boiler outside under a small shed, and carry the pipes through the wall. There is no possible chance of air vitiation then.

Whatever warming apparatus you decide on, be sure and have plenty of water about the room in shallow bowls or trays, otherwise the air will get so dry that the birds will suffer. You might put their drinking water in shallow zinc trays. They like to paddle in it, and it would thus be—

"Contrived a *triple* debt to pay."

SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

MOULDINGS, CHAMFERS, AND BEADS.

WE have hitherto dealt with the plainest of construction, but as nothing is made without some effort to please the eye, we will consider mouldings as a relief lesson, for mouldings are themselves a relief to the squareness of construction, which becomes tiresome to the spectator if too unbroken. Moulding in wood-working is a misnomer; but as the term is well understood, we will not trouble ourselves on that point. A dictionary definition is: anything cast in a mould, or as if so; a projection beyond a wall, column, wainscot, etc. Clearly this meaning supposed something built up, whereas our mouldings are produced by wasting the superfluous wood.

The simplest moulding is that known as a chamfer, which is merely the removal of the external angle (called by the workman the arris) to any desired extent. Chamfers, however, are not confined to the removal of the external angle of the stile or rail; when boards are intended to meet together, sometimes to form panels, the edges in contact are often chamfered, forming what is called a V joint. A chamfer can be made with any plane, but in order to obtain regularity of angle and distance, special planes are often used.

When the chamfer does not extend from end to end of the piece of wood, it is called a stop chamfer; and these stops may be of various patterns, and often give a very ornamental character to the article, as may be seen in the well-known Oxford frames. In making stop chamfers, a special plane is often used, but with care the amateur can do very good work with a well-sharpened chisel. A very good plan to make stops of an

ornamental character is to make a template of wood or sheet zinc, or even a piece of cardboard cut to the worker's fancy, and used to mark the work with. Vertical mouldings of the ordinary types are often terminated by a stop, or chamfered horizontal rail; the intersection of the stop with the moulding frequently develops beautiful curves. Examples may often be seen in Gothic stone-work as well as in wood-work.

The next simple mouldings are beads. These are of varied kinds, and have divers uses. The beaded edge, which is the reduction of the square edge of a board to a semi-cylindrical contour; the "stuck" bead, generally made with a bead-plane, but it can be made by a suitable scraper. This consists of a groove called a quirk, about one-tenth of the width of the bead, while the other nine-tenths of the nominal size consist of a semi-circular outline. Bead-planes are to be had in various sizes, from $\frac{1}{8}$ in. upwards. A bead-plane having a cutter set at a certain angle, shaped to fit the figure of the plane, cannot have all parts of its edge formed in the most favourable way; the ends of the semi-circle must be formed more by scraping than by cutting the wood. Hence there is a limit to the size of bead-planes, and this will be an explanation of the difficulty found by learners in handling moulding-planes; the plane-maker has set the iron so that it is in its best average position to cut the entire moulding, and that involves the need of the plane being held at an angle often very inconvenient to the beginner. Beads are often applied to flat surfaces and margins, to break up the surface and give variety of effect.

PADS TO OPEN AND RELEASE A FALLEN HORSE.

BY JOHN CHARLES KING.

"ANOTHER horse down!" This ejaculation is heard often in damp weather when horse traffic is on asphalte roadways; less frequently on wood pavement, less still on stone pitching, and rarely on macadam roads. As the system of using asphalte pays some of the interested parties well, the roadways are made of it, to the serious harm to horses, harness, and vehicles, besides stopping for a time the onflow of the road traffic.

The trouble when a horse is down is to keep him down until his harness is unbuckled, about which there is plenty of help and suggestions, and sometimes the knife is used to divide a stubborn strap that cannot be unbuckled. Even carters and coachmen are sometimes puzzled which strap or chain to undo first. A moment's glance at a horse harnessed to any vehicle will show that the traces have two attachments: one to the vehicle and one to the horse. As the horse often lies upon one trace, and has a free kicking leg over or under the other uppermost one, the unhooking is awkward to effect, and a lot of pulling and hauling is the result, with muddy clothes, caused by kneeling on the road, to do that which it is a mistake to attempt to do. At the ends of the traces attached to the horse's collar is the proper place for detachment, as it is done in an instant easily, by unbuckling the bottom hame-strap; then the hames and both traces can be lifted back along the back of the horse to the vehicle out of the way.

The next fixing is a tug on each side of the back-band in which each shaft goes. The best chaise-harness has a buckle on each side that fastens the back-band, so that either one releases this part of the harness from the horse, but the tags, being still on the shafts, have to be got off somehow; the best plan is to pull the vehicle back: this draws the shaft points out of the tug-loops. This part of the harness has been improved to facilitate rapid detachment of a fallen horse from a vehicle; and as it is simple, inexpensive, and self-fastening, and may be of service to WORK readers who are carriage users, it is given to them.

The illustration shows a hinged saddle-top to the pad, which, when unlatched and open, shows the crupper strap holding the back-band strap in its looped end; both are held by a short spike standing up at A. Now it is obvious that if the back-band buckle is undone the shafts are free to be lifted up away from the horse till checked by the pad through which the back-band slides. If the pad-top opens, as is shown, and the back-band and crupper be lifted off the spike, the whole of that part of the harness with tug-loops still on the shafts, and kicking and breeching straps still fixed to the shafts, can be lifted clear of the horse, and the horse can rise without breaking any of his harness. He will still have on his collar without harness, his pad and girth without back-band, crupper, or breeching, and his bridle, which will not have been interfered with. Replacing the harness and back-band by lowering the shafts, fastening the hame buckle and back-band buckle will be all that is needed to make the horse ready for a start again.

Pad to open and release Fallen Horse.

At a "horse down" scene on asphalte, amidst shouting, straining, and even vainly trying to unhook traces from a kicking horse, a lady, driving a gig, reined in, and, handing the reins to her groom, said: "If you will all look on I will get the horse free of his harness." All was silence: they did look on. A bystander held the horse's head; the lady unbuckled the hame-strap; the harness sprang back out of the collar "wale"; she unbuckled the crupper-strap from the pad—this was to release the breeching from the horse. "Pull back the cart now," she said. It was done, and she stepped into her gig and drove off as the horse rose free of his traces and breeching, and quiet, by the steady, quick handling of one who knew.

From this it appears that practical knowledge of their business is not to be found in all who have the care of animals, and especially of horses. This is shown far too frequently by the brutal treatment to which horses are too often subjected by their drivers who use the lash, at times without reason, and when it is in no way required. It has been well said that more is done by patting than by scratching any day, and this is pre-eminently true with reference to horses.

SCREWING TACKLE.

BY "DAMON."

TAPS—TAP-WRENCH—SOCKETS.

IN my last paper, which appeared in Vol. III., page 343, of WORK, I endeavoured to describe a method of grooving taps so as to give them the section which is now universal among tap-makers. Before proceeding, I must make a brief digression to explain why this section has been adopted, to the exclusion of the rest. Various methods of producing the cutting faces have been followed at different times. Originally, the ordinary method was to file four flats or faces on the thread, giving four cutting faces at right angles to each other. A tap of this kind is shown in section at A, Fig. 1. This form is a very bad one, especially for tapping cast iron. The cutting angle is 135°, which is far too great—in fact, it hardly cuts at all, but acts more by squeezing the metal into the form of a thread. Cast iron crumbles to pieces under the pressure, and the resulting thread is very poor. Great exertion is required to turn a tap of this kind, and it is necessary to make the shanks extra strong, or they would be twisted off with the strain. Owing to the power used in turning them round, they are more readily broken than taps of a weaker section which cut more freely.

A great improvement on this form is the triangular one (B, Fig. 1). In this case the cutting angle is 120°. It does not, however, leave much room for the cuttings, and if much thread is left between the faces it is hard to turn. Backing off the thread a little improves this, but the clearance thus given must not be excessive, or the points will dig in and be broken off.

The half-round section (C, Fig. 1) has also been advocated. This gives a cutting angle of 90°. It cuts freely, and is said to stand well in spite of its apparently weak section. It, however, has only one cutting face, and is easily displaced from its true direction when in use, which is a great drawback.

In the fluted form having a radial face (as at D, Fig. 1), the cutting angle is also 90°. It has three cutting faces, which lessens the exertion required to turn it, and it is readily kept true in the hole being tapped. If the grooves are made as at E, Fig. 1—as is usual with some makers—the angle approximates to 90°, and the taps are easier and safer to harden. Of course, if the cutting faces are made as at F, Fig. 1, the angle is keener, but when the forward motion of the tap is reversed so as to withdraw it, the extreme points of the thread are apt to break off. However, as I have previously explained, the larger sizes of taps are often made this way, because the thread being stronger they stand better. A great deal depends, too, upon the hardening—it is so easy to burn the points of the threads when they break off at once.

Patents have also been taken out for taps having loose or, rather, detachable cutters, but this is only available for the large sizes, while the fitting is quite beyond the skill of the ordinary amateur.

It would seem, therefore, that the three flutes as usually cut give the best results, and have the fewest disadvantages. Now, to resume our tap-making. The style of grooving shown (D and E, Fig. 1) can be cut with ordinary care on taps down to $\frac{1}{8}$ in. diameter. In the case of smaller ones the operation becomes more difficult, and calls for more skill on the part of the operator than the amateur usually possesses, although

I have seen three spiral grooves cut in a ⅛ in. tap by an amateur on a double-geared milling machine, capable of driving 6 in. cutters; but this, of course, required great care and skill. However, for taps from ¼ in. downwards, it is better not to cut grooves, but to file flats on the screw. The obtuseness of the cutting angles is not so great an objection in the small sizes. It is better in all these small taps to make the square on the shank stronger than usual, so as to avoid the risk of breaking from the torsion.

Machine taps for tapping nuts are generally made as shown in Fig. 2, so that one tap only is required to cut a full thread. From the point a portion of the tap is turned down to the bottom of the thread. This part is inserted in the hole in the nut, and acts as a guide to the tap while the thread is being formed. As the tap revolves the nut is moved forward until the tap starts cutting. At the top end of the tap a portion about equal in length to the diameter is left parallel. The rest of the body is tapered. The tap is passed right through the nut, and the thread is thus cut at one operation.

When the tap is intended to be used for cutting dies, etc., more flutes are usually put in. The flutes are cut with an angular cutter, just leaving a round at the bottom of the grooves. About nine flutes may be put in a 1 in. tap of this class. These taps are commonly called "hobs," and are used to cut worm wheels, chasers, and similar work. As space cannot be given in this paper, I will not attempt to describe the manufacture of dies and chasers now. The hob for cutting a worm wheel is made the counterpart of the worm, being the same diameter and same shape of thread. The flutes are then cut parallel to the axis of the worm. The threads are backed off a little, and the hob is hardened in the usual way.

In drilling holes for tapping, a little clearance is generally allowed in excess of the diameter of the screw at the bottom of the thread. This allowance should really be greater for wrought iron than for cast iron, but in practice the same drill is used for both. A short time ago I gave in the "Shop" columns of WORK a list of the sizes of tapping drills I use. I will, however, make out a fuller list, and, if I am permitted to do so, give it in a future paper, as it may be of use to some readers.

Although the hole intended to be tapped may be drilled quite square and true, the tap, owing to unskilful usage, may not follow the hole, and so get out of its true direction. To avoid this, steady, even pressure should be exerted on both ends of the tap-wrench while the tap is being started. Care should also be taken to watch the progress of the tap, and if the eye is not a sufficient guide, a small square should be applied in two different directions as a test.

The tap-wrench, or lever used for turning a tap round, is shown in Fig. 3. The square hole in the middle is to receive the squared part of the tap shank. The corners of the hole are generally relieved, so that the corners of the shank will not get the pull. The handles are round, and generally tapered. Their length varies according to the diameter of the tap. The wrenches are generally stamped with the diameter of the tap they fit.

The socket shown in Fig. 4 is used when some obstruction prevents the wrench being turned round. The square hole A at the one end fits the shank of the tap. The end B is made square to fit the wrench, which by the length of socket may be lifted clear of the obstruction. In fact, the socket is just like an ordinary "box-key," and answers a similar purpose.

In tapping wrought iron and steel, oil should of course be used as a lubricant, but it is not necessary for cast iron and brass.

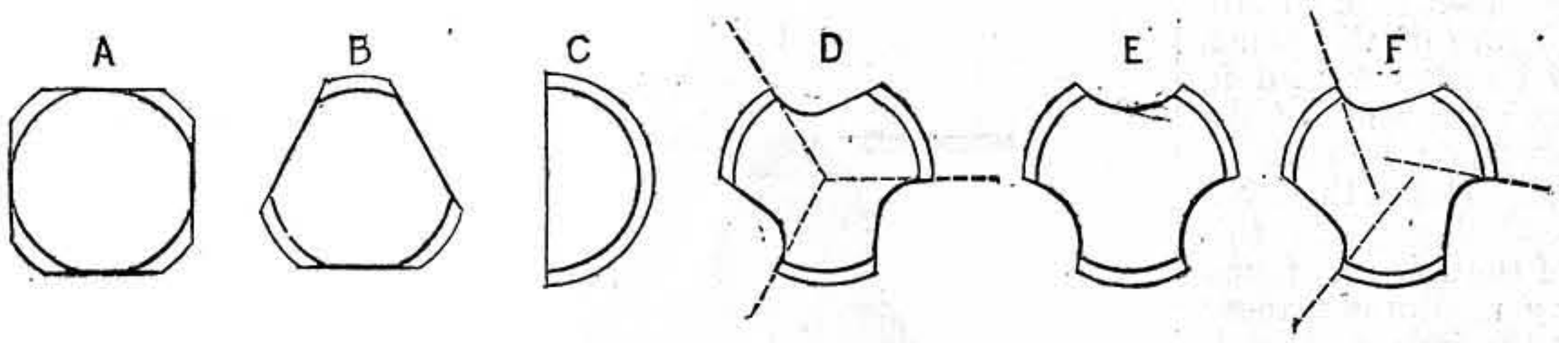


Fig. 1.

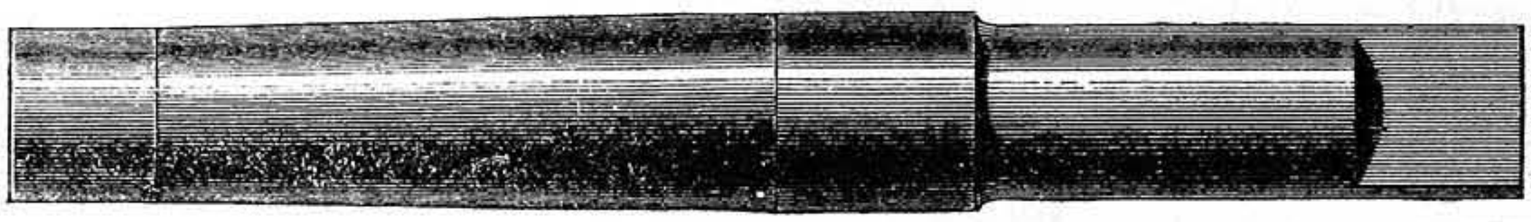


Fig. 2.

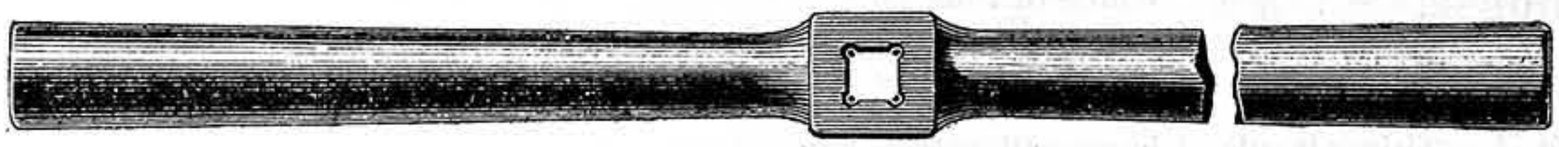


Fig. 3.

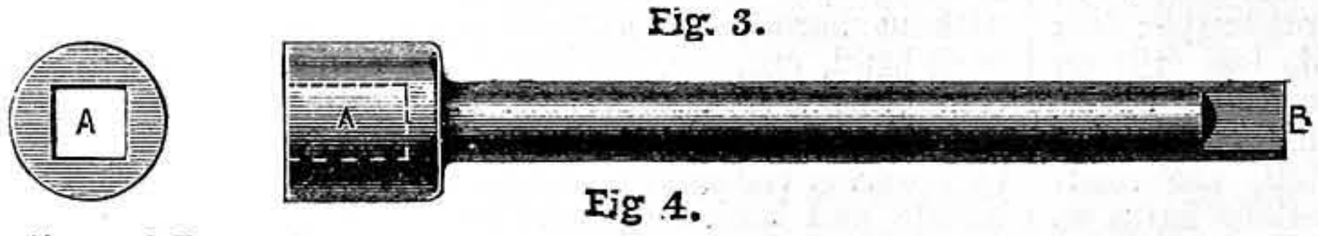


Fig 4.

Fig. 1.—Sections of Taps. Fig. 2.—Representation of Machine Tap for tapping Nuts. Fig. 3.—Tap-Wrench. Fig. 4.—Socket.

After use, taps should always be wiped clean before being put away. They should not be allowed to knock against each other, as it spoils the thread.

PHOTOGRAPHY AS A MEANS OF HOUSEHOLD DECORATION.

BY WALTER E. WOODBURY.

THE method of mounting prints, described in the preceding paper, can also be utilised in various other ways; mounted in plush they form very handsome wall plaques. I once saw a very pretty card-table made with a number of photographic prints. Fig. 7 will give some idea of the manner in which it was constructed. A piece of deal is cut to the shape shown, and a piece of glass also; to this the photographs are mounted as described, a black paper strip being pasted in front of all the joints. A brass edging to hold the glass and wood firmly together completes the top.

Many amateurs work with a small quarter-plate or detective camera; with these photographs a very pretty chess- or draught-board can be constructed. Fig. 8 shows the idea. A piece of white cardboard is marked out into sixty-four squares of the size required, and the photographs pasted on. Thirty-two will be required to form the usual black squares. After mounting, the whole can be varnished with several coats of a good protective varnish, and the board stiffened with wood or stout boards.

A much better plan, however, is to mount the pictures in optical contact, as already explained, to a sheet of thick plate glass. The position of the pictures is obtained by laying the glass on a sheet of paper, previously ruled, with the correct-sized squares. A piece of white paper is then mounted on the back, and the whole attached to a wooden frame or table-top. The glass thus forms the top of the table, and the constant moving of the chessmen cannot injure the views.

This method of mounting prints to glass may often be employed for improving unsightly objects. To give some idea of what I mean, I will give a case that recently attracted my attention. A friend had a rather handsome mirror standing over his dining-room mantelshelf, but by some accident, or by the effect of dampness, the silvering of the glass in a portion of the centre had completely left it in places, forming a very unsightly spectacle. My friend, however, removed the mirror from the wall and carefully scraped away a portion of the silver, leaving an opening about 8 in. by 14 in. All the affected parts were thus removed, and he then backed the opening up with a carefully selected artistic photograph gelatinised and squeezed on. The effect surpassed his expectations. The unsightly portions were removed, and the presence of the picture much improved the appearance of the mirror.

We now come to a very important process, *i.e.*, the transferrotype. With this, photographs can be transferred to almost any substance. The Eastman Company and their agents supply a transferrotype paper which they manufacture. This is briefly a paper coated over with a soluble gelatine, and afterwards with an insoluble gelatine sensitive emulsion. With this paper, prints are first made as with bromide paper; they are then transferred to any substance by squeezing them into contact and laying in warm water, which dissolves the soluble gelatine film and releases the paper support, leaving the insoluble gelatine image upon the new support.

I, however, much prefer a transferrotype collodion process, with which I have had much success. Briefly described, this process consists in the preparation of a collodio-citro-chloride emulsion, which is coated over paper previously treated with gum arabic. The sensitive paper thus prepared is printed

in the ordinary manner. To remove the collodion film from the temporary support, after the image is printed on it, it is only necessary to immerse the print in cold water. The gum substratum is then dissolved away, leaving the film attached to any suitable material or object.

The first thing to be considered is the preparation of the collodion emulsion. For this we first of all require a plain collodion. This can best be prepared by mixing equal parts of ether and alcohol, and adding from two to three per cent. of English pyroxyline. I find that the best proportions of the latter are two per cent. during the summer, and three per cent during the winter months. A thin collodion will always be found preferable to work with—it gives an evener film; and if it be afterwards found to lack density, it is not a very difficult matter to coat the paper twice or to allow the emulsion to remain a little longer on the paper before pouring off the superfluous fluid. It is a well-known fact that collodion likewise improves with age. An old collodion should always be preferred to one freshly made, as it works clearer and cleaner. It is, therefore, advisable to prepare the collodion some little time before it is required for use, and

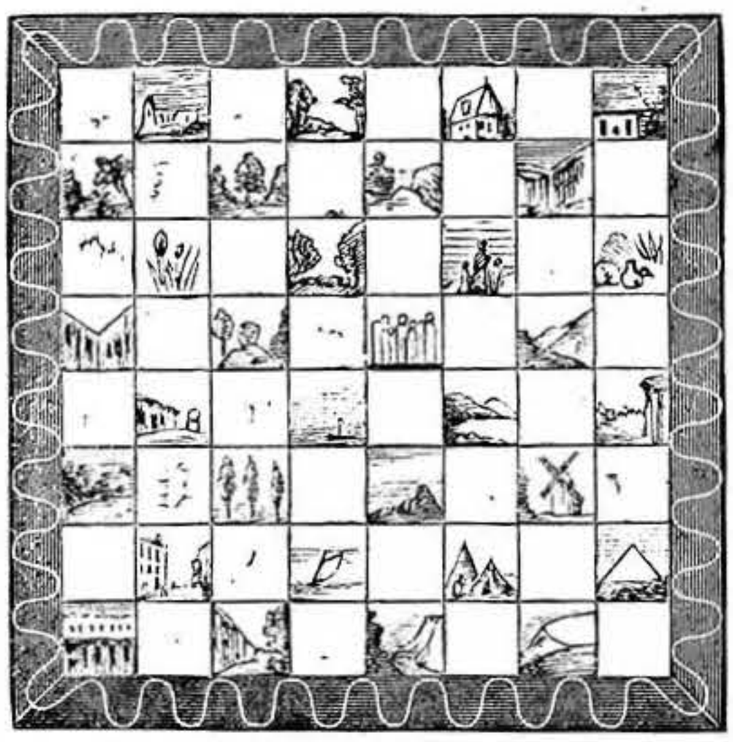


Fig. 8.—Chess- or Draught-Board.

to carefully decant it into another bottle without disturbing the sediment at the bottom of the bottle. The addition of a half per cent. of castor oil gives a wonderful finish to the glaze of the picture, and also improves the tone.

Into a glass measure capable of holding about 100 c.c.,* place about 13 grammes of silver nitrate, and 15 c.c. of water. Thoroughly dissolve the silver, and add 50 c.c. of alcohol—the addition to be made very slowly—rapidly stirring the solution the while. Into another small measuring glass dissolve 3 grammes of citric acid in 50 c.c. of alcohol, and in another 3 grammes of chloride of strontium are dissolved in 50 c.c. of alcohol.

We now have four vessels, one containing the collodion, one the citric acid solution, another the silver solution, and one with the strontium chloride. When all the ingredients have been dissolved, the citric acid and the strontium solution are added together, stirred up well, and placed in another vessel containing 100 c.c. of the plain collodion. We have now two solutions, *i.e.*, the collodion containing the chlorine and the acid, and the silver solution. We must now remove to the dark-room, or to a room lighted by gas or yellow light. The two solutions are now added together by gently pouring the silver solution into the other. The whole must be rapidly stirred and shaken up. As soon as the two solutions are added together, the sensitive emulsion is formed, the silver combining with the chloride to form sensitive silver chloride held in suspension by the collodion. The next operation is to filter the collodion; this can be accomplished by means of a tuft of cotton-wool placed in a glass funnel. It is then ready for use.

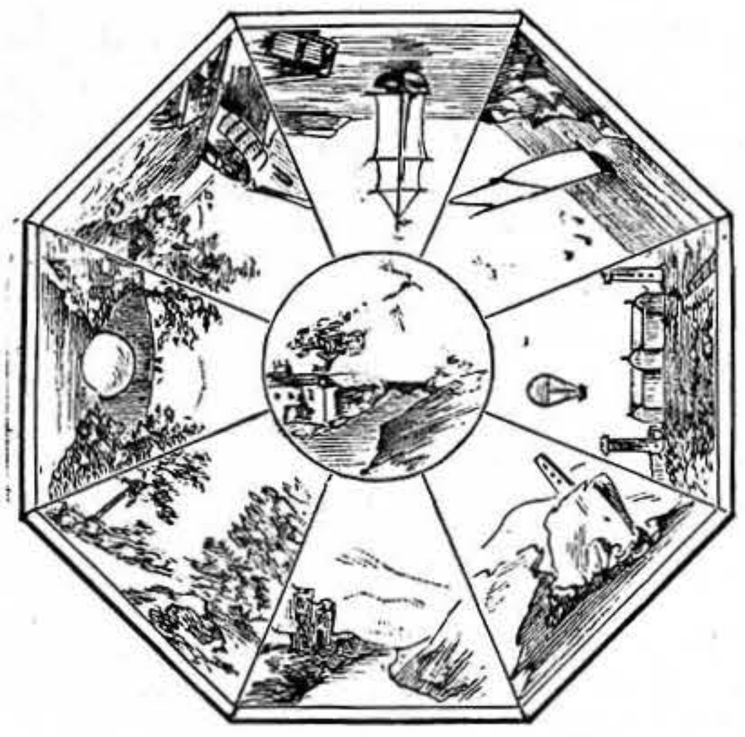


Fig. 7.—Octagonal Card-Table.

The paper to be used can be obtained at any large stationer's. It is best gummed paper doubly coated with gum arabic. A sheet of this paper is laid on to a sheet of glass and coated with the collodion. Those who have not had much experience in collodion work had better turn up the edges of the paper for about $\frac{1}{16}$ in. all round to prevent the collodion overflowing. A little of the collodion is poured on to the upper right-hand corner of the paper and worked all round till it covers the sheet. The superfluous collodion is then poured off, and the paper hung up to dry. When quite dry it is ready for printing upon. It is cut up to size, placed in the printing frame behind the negative, and printed out in the ordinary manner. If required to be transferred to glass for transparencies, it will be necessary to print very darkly indeed.

The surface to which it must be transferred is now thoroughly cleaned and treated with a ten per cent. solution of gelatine, either by coating or by means of a brush. The print is then trimmed to the size required and squeezed into close contact, the gelatine, while damp, causing it to adhere very firmly. The next process is to tone and fix. The print attached to its support is laid in cold water, when the gum layer dissolves, and the paper will float away. It is then treated with an ordinary gold-toning bath, and afterwards fixed in hypo. I prefer, however, to do these two operations with one solution—a combined toning and fixing bath. This is made up as follows:—Solution No. 1: distilled water, 36 ozs.; sodium hyposulphite, 8 ozs.; sulpho-cyanide of ammonium, 1 oz.; acetate of soda, 7 drachms. Add to this—water, 6 drachms; sodium chloride, 2 drachms; silver nitrate, $1\frac{1}{2}$ drachms. After this mixture has been allowed to stand for about twenty-four hours small flakes of insoluble compounds will be seen. These must be removed by a double filtration. While this is proceeding make up solution No. 2: distilled water, $3\frac{1}{2}$ ozs.; gold chloride, 15 grains; ammonium chloride, 1 drachm. Add solution 2 to solution 1, and, after well shaking and allowing impurities to settle, the bath is ready for use. After toning and fixing, the prints are well washed in a running stream of water.

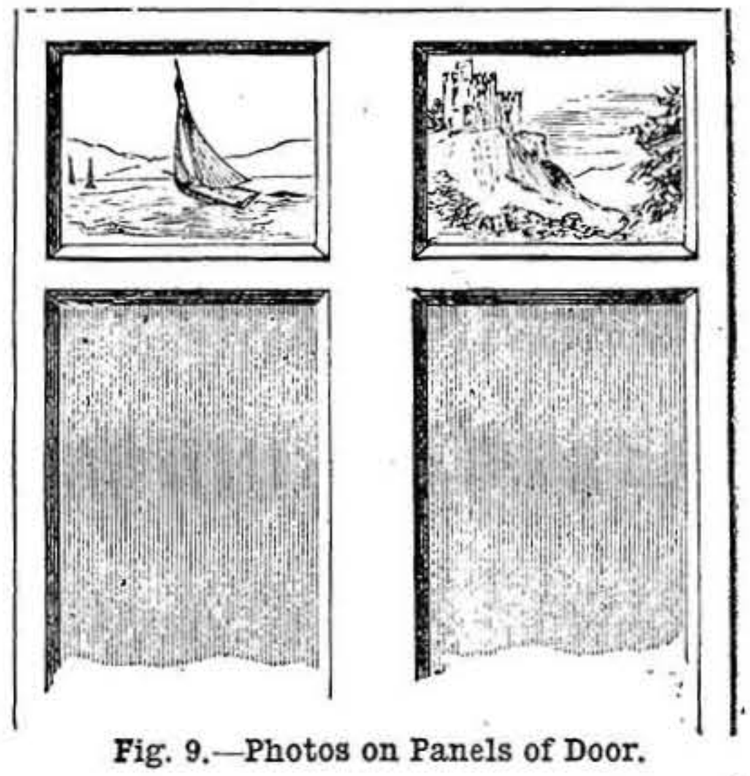


Fig. 9.—Photos on Panels of Door.

It will often happen that the object to which it is required to transfer the photographic image is not of a nature to stand this treatment with the various solutions. In this case the print is first immersed in water, when the collodion film containing the image will leave the paper. By very careful manipulation the loose film can be toned, fixed, and washed, and afterwards transferred to the object.

With this power of transferring the pictures to any substance, the number of pretty objects that can be made is at once apparent—card and cigar-ash trays, paper weights, etc. etc.; and the number of ornaments, vases, plates, etc., that can be improved by a well chosen photograph is unlimited.

The next process we have to describe is that known as the Diazotype or primuline process of printing

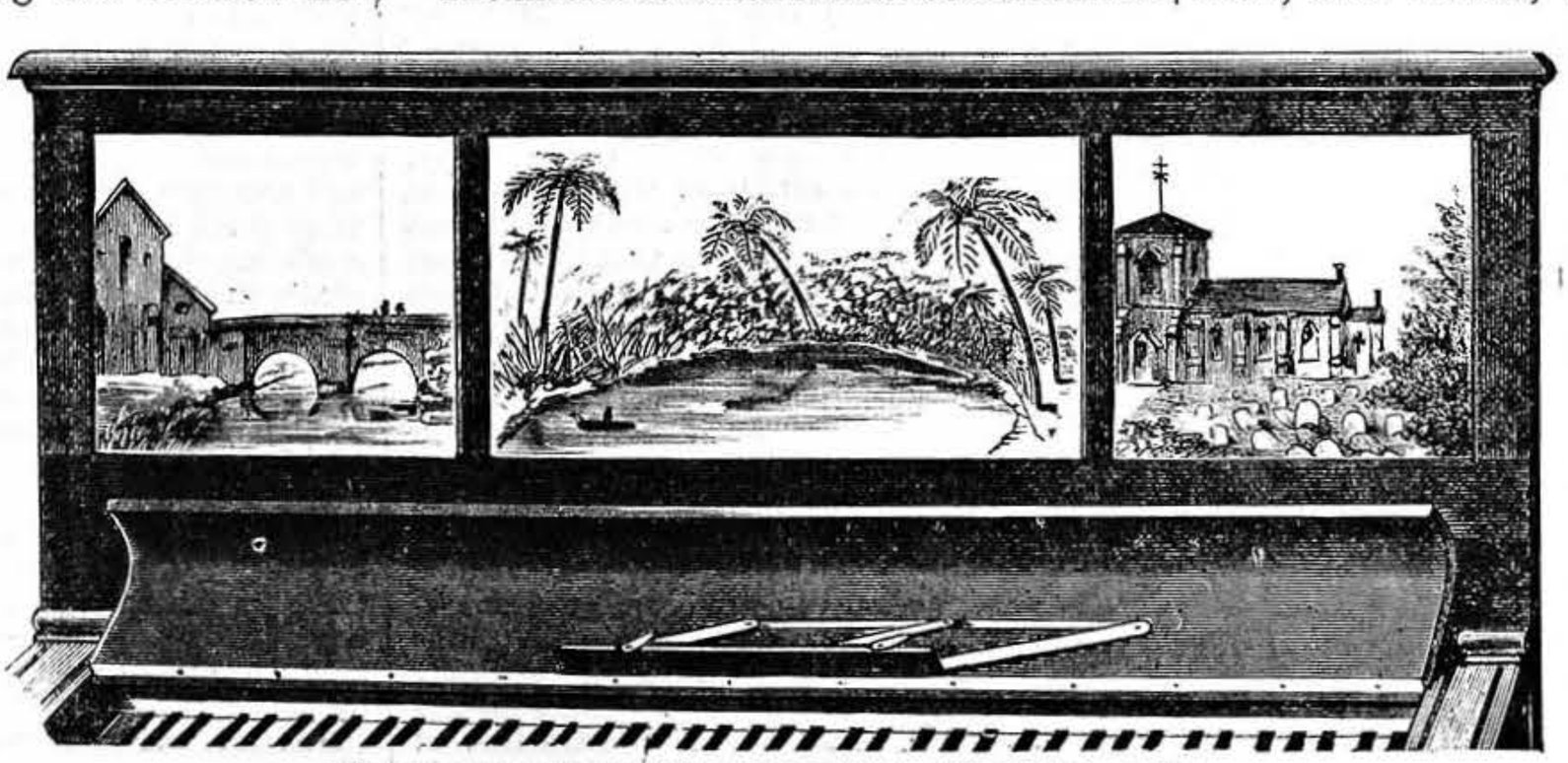


Fig. 10.—Top of Pianoforte decorated with Photographs.

* Those unaccustomed to the metric system of weights should read the figures as "parts."

upon silks, wool, cotton-stuffs, by which very pretty ornaments can be made. Photographs can be reproduced in a variety of beautiful colours upon the silk, and then handed over to the ladies to be made up into some fancy article.

All the materials for working this beautiful process can be obtained from Messrs. Green, Cross, & Bevan, who are the inventors and patentees of the process. In this process the material is first dyed with a hot solution of primuline, to which a small quantity of common salt has been added. About 15 to 30 grains of primuline are added to about a gallon of hot water. The addition of the common salt increases the affinity of the colour, and hastens the operation. For silk and wool the water must be nearly boiling, and twice the quantity of primuline used. In this solution the fabric acquires a primrose-yellow colour. It is then wrung out and well washed in cold water. If necessary, the material can be dried and kept until required for use.

The next operation is to diazotise by immersion for about half a minute for cotton, and two or three minutes for silk and wool, in a cold solution of sodium nitrite, ¼ per cent., sharply acidified with hydrochloric or sulphuric acid. The material is now sensitive to light, and is well washed in cold water, dried, and stretched out on a level white surface and exposed to light beneath a photographic positive. The exposure varies, of course, with the actinicity of the light. In sunlight about half a minute will be required, while in dull weather half-an-hour's exposure may be necessary. The image is faintly visible, orange-coloured on a light yellow ground. The next process is to render the image visible by development. This is done with a weak solution (about ¼ per cent.) of a suitable phenol or amine. The following have been found to give very good results, each developing the image in a different colour :—

For red.—An alkaline solution of β-naphthol.

For maroon.—An alkaline solution of β-naphthol-disulphuric acid.

For yellow.—An alkaline solution of phenol.

For orange.—An alkaline solution of resorcin.

For brown.—A slightly alkaline solution of pyrogallol, or a solution of phenylenediamine hydrochloride.

For purple.—A solution of α-naphthylamine-hydrochloride.

For blue.—A slightly acid solution of amido-β-naphthol-β-sulphonate of sodium (eikonogen).

If the design is required to be produced in two or more colours, the respective developers, suitably thickened with starch, must be applied locally with a brush.

After development is completed the material is well washed in cold water, and should then be dried and ironed. If the purple or blue developers are to be used, the material should be finally washed in a very weak solution of tartaric acid.

Instead of printing from a photographic picture, images may be made from leaves, flowers, ferns, insects, or other designs upon paper.

I will conclude this article with a description of the dusting-on or powder process. With this, images in all colours can be produced upon glass, wood, paper, etc. The method is as follows. The substance which is to form the support is coated over with the following solution :—Gum arabic, 30 grains ; white loaf sugar, 30 grains ; ammonium bichromate, 20 grains ; distilled water, 1 oz. After drying, this is placed under a photographic transparency. The exposure varies from five to twenty minutes. An actinometer should be used as in carbon printing. The image is then developed by dusting over powdered graphite or other coloured powders which adhere to those parts of the gelatine film unexposed to the light. It is then coated with collodion, well washed, and varnished. If a dark-coloured ground, and a light-coloured powder such as ivory dust, barium sulphate, silver dust, etc., be used, the image can be made from a photographic negative. Very effective pictures may be thus made ; for instance, if done upon wood, and inserted in the panel of a door or cupboard, they improve its appearance wonderfully (see Fig. 8).

I have recently had suggested to me, by a young lady, the idea of improving the appearance of the pianoforte top by the insertion of artistic photographs (see Fig. 10).

I am well aware that the subject I have taken up is so inexhaustive that I have only been able to give a small percentage of the number of ornamental articles, but I think I have been able to at least show how useful photography could be made to become as a means of household decoration.

OUR GUIDE TO GOOD THINGS.

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

111.—"THE ART AND CRAFT OF CABINET-MAKING."

WITHIN the last ten or fifteen years marked advances have been made in what may be called "practical literature," and at the present time there are but few trades that have not as a *vade mecum* a text-book treating of the means, modes, and methods. With reference to furniture making, the above-named manual has only just made its appearance, but I may safely say that among the various technical books that have been recently published by Messrs. Whitaker & Co., there is not one, perhaps, that is possessed of such value, or is likely to command such a steady and continuous sale as a "stock book," as "The Art and Craft of Cabinet-Making," which purports to be, and really is, "a practical handbook to the construction of cabinet furniture, the use of tools, formation of joints, hints on designing and setting out work, veneering, etc., together with a review of the development of furniture." My reason for speaking in such positive terms as to its worth is that it is written by Mr. David Denning, whose name and intimate acquaintance with the subjects on which he writes are well known to every reader of WORK. Its purpose, aim, and scope may, perhaps, be best set forth and explained by an extract from the preface, which shows in plain and unequivocal terms that, in writing this work—and I know of no one who is better capable of doing it, either by reason of his power of imparting information by pen and pencil, or through his intimate knowledge of every branch of cabinet-making—the intention of its author has been, and is, "to supply amateurs and young professional cabinet-makers with a reliable guide to the construction of cabinet furniture. No attempt has been made to teach the thoroughly experienced artisan, and no new fads are advocated, either in style or processes. The ordinary reliable methods of the workshop, and nothing more, are explained, and on this account the book will, no doubt, be of greater use to those for whom it is intended than if new theories of 'construction as it ought to be,' according to many of those who presume to teach the skilled mechanic, had been advocated."

Having thus given, in Mr. Denning's own words, his apology for the existence and appearance of the volume now under consideration, let me endeavour to show the readers of WORK not *how* the writer has handled his subject, for that goes without saying, as the phrase runs, but in what way he has commenced and gone through his subject, which is one that covers a wide field and demands, in order to write on it with effect, a general knowledge which but few possess. The book consists of twenty chapters or component parts in all, and is well illustrated with two hundred and nineteen engravings of tools, appliances used in cabinet-making, diagrams explanatory of joints, parts of pieces of furniture, and processes, and sketches of many articles of furniture, useful and ornamental, most of which bear evident marks of originality—or, in other words, of having been supplied by Mr. Denning himself. Reverting to the subject-matter of the work itself, and its general arrangement, the writer first takes the opportunity to show the difference, not always clearly understood, between joinery and cabinet-making, and to show what is the special and acknowledged work of the cabinet-maker. From this he proceeds to a review of the development of furniture, giving a sketch of its progress from the Tudor period to the present day, and showing that good modern work is much to be preferred to that of bygone times, however much it may be the fashion to cry it up. After a brief chapter devoted to an account of the woods chiefly used in making furniture, Mr. Denning comes to an important section of his subject, in which he dwells at length on glue and its preparation, nails with which screws—or screw-nails, as they are sometimes called—and other fasteners are considered ; tools used in cabinet-making, wooden appliances that may be, and indeed are, for the most part, made by the user, and grinding and sharpening tools, with general directions. The six chapters devoted to these matters may be regarded as forming the second section or part of Mr. Denning's book.

In the third part he touches on the joints used in cabinet-making, various decorative and minor structural details in furniture, and the construction of parts, such as drawers, doors, cornices, plinths, etc. Following these in due sequence, he tells the reader all that is necessary to know about many indispensable adjuncts to modern furniture, such as glass, which is now very extensively used, and cabinet brass work, and he sandwiches these—if I may be permitted to use the term—with a chapter on drawing and designing and another on the process known as veneering, or putting, as may be said, a good face on a material of inferior value. The fifth and last portion is devoted entirely to the consideration of construction, and the four chapters of which it is composed touch respectively on tables, bedroom furniture, library and office furniture, and sideboards and cabinets. Now this is all desirable and necessary, but I am compelled to say that if there is not a "missing link," there is certainly a missing chapter, in which the construction of chairs and couches should have met with respectful comment and treatment ; and when "The Art and Craft of Cabinet-Making" reaches a second edition, as I trust it very soon will, it may be enlarged and improved by the addition or interpolation of such a chapter. I know that in taking a bird's-eye view of any wide and comprehensive subject it is a matter of the utmost difficulty to think of everything, and that something or other that should have appeared has been accidentally crowded out ; but this is the only "one thing wanting" that I have been able to detect in this otherwise complete, carefully considered, and well-written book.

THE EDITOR.

SHOP:

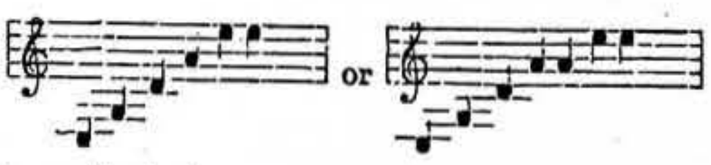
A Corner for Those who Want to Talk It.

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

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

I.—Letters from Correspondents.

Hints on the Stringing of the Zither.—T. G. M. (*Camberwell*) writes:—"Chancing to see No. 139, p. 550, of your valuable publication, Work, I found in it an article concerning the zither, as to its setting and tuning, with general remarks appended; but it contains inaccuracies and misleading information, to which I feel constrained to call your attention. The zither is not an easy instrument, and this is the true reason why the majority of lovers of the same fail to attain to any kind of perfection in their play, and also why so many who have not been debarred from starting the acquisition of zither-playing finally break down and give it up altogether. I am much afraid that inferior teachers are responsible for this state of things. I was fortunate myself in obtaining in London a perfectly practical instructor, who never digressed into irresponsible statements, and who thought more of his zither and pupil than of the 'main chance.' Let me first correct the following: 'Schlacht' zither should be 'Schlag' zither, because it is struck in contradistinction to the 'Streich' zither, which is the 'bow' zither, or Alpine violin. The Elegie, or alto zither, tuned to E one-fourth below the outer, or A, string (which, in effect, is one octave below the fifth above the same A string), is, *par excellence*, the correct instrument for accompaniments to the voice, and also plays sentimental solos more feelingly, having a much sounder tone and longer vibration. The instrument which, however, is in general use amongst players of even mean capacity is the so-called 'Concert' zither. The 'Prim' zither is used by the peasantry of the Tyrol, when they have one at all, on account of its cheapness and handiness, and being well suited for the simple airs and dance music affected by them. The remark made that the zither can be taught in one week is ridiculous; and the statement that 'all hands' play it in the Tyrol is false. I travelled in the Tyrol two summers ago, and in the Bavarian Highlands, and made searching inquiry as to players, and always met with the same reply, 'There is only So-and-so near here;' and to the query as to what kind of music was played, the invariable answer was, 'You cannot get anybody in the country to play aught save *ländlers* (country dances) and kindred music; they do not even rise to marches and superior dance music.' It is in the towns of Germany that the zither is cradled and made much of. On no account let anyone buy metal strings, except for the fret-board. No one uses them, all that has been said to the contrary notwithstanding. The great tension of this class of string ruins the grip of the tuning pegs, and so ruins the instrument. Their tone is harsh and clanging, and turns a sympathetic medium of music into a 'tin pot.' Metal strings 'hold up' well, but this is their only recommendation. The various methods of tuning the fret-board are not correctly given. The Stuttgart school has two methods; these are C, G, D, A, E, E from below up, entailing a sixth string, or C G, D, A, A, E, E, composed of seven strings:



The method given as the Viennese is really the Munich method, the Viennese being C, G, G, D, A, which, to be correct, must have the G between the G and D tuned one octave above the other. The Munich method is the only correct one harmonically, and is C, G, D, A, A, the two A's being tuned alike, the others being each one-fifth above one another. All the other strings of the zither are tuned in fifths, and as stated. The information given as to what there is to learn on the accompaniment and bass strings is not true; the statement being that it is only necessary to learn the position of one major chord, as all others are the same, there being nothing more to learn. One moment's consideration will show the fallacy of this. How about minor chords, augmented chords, diminished ditto, as well as incomplete progressions? Then, how about broken harmony and the various mechanical and harmonic methods not mentioned? It is due to such random statements that a beautiful instrument is depreciated by the public, and it is put down as only capable of playing 'Tum, tum, tum' music. Let me impress upon your readers that the zither well repays learning, because it is capable of such infinite variety; it is, indeed, on this account that old and experienced players are always studying—there is ever something new. To form some opinion of zither-playing, do not go to listen to 'Ländlers et hoc genus omne,' but take every opportunity of hearing good music—as solos, duets, trios, or quartettes. Ensemble or club pieces are, as a rule, too much of the 'Thrum, thrum' pattern, and not good music. As a parting word, I can also say, 'Be not afraid'; but say it as encouragement to persevere, and overcome the various obstacles lying before the student. His reward, if he has any music in his constitution, will be ample, and he will soon attain to some satisfaction."—["It is hardly kind of Dr. M. to 'slate' me so unmercifully, especially as I am a member of his own profession—which, however, is notoriously one in which 'dog' is addicted to a canine diet. Now, let us analyse the 'misleading information,' the 'inaccuracies,' and the 'irresponsible statements' contained in the article in question. The doctor will not allow that the zither is an easy instrument, in spite of my solemn assurance that I can teach, and have repeatedly taught, it in the space of a few weeks. Well, all I can say is that in the case of our critic it may, indeed, have been difficult of acquirement; while the general tone of his letter goes to prove that he would be rather sorry than otherwise to see the zither popularised—wants, in fact, to 'keep it select,' as it is, up to the present time, essentially an aristocratic instrument in this country. Nevertheless, braving the scorn and contumely of the doctor, I venture again to assert most emphatically that the zither is not only easy, but the easiest of all stringed instruments of its type. In proof that I did not at all exaggerate when I affirmed that I could enable anyone who cared to play within a very limited period, I may adduce the case of another doctor here, who, six weeks or so ago, had never touched a zither, but who is now able to play fairly well several airs, including some which embrace the very modes of accompaniment which Dr. M. says cannot be acquired by learning one major chord. That this gentleman has had no tuition other than from me, Dr. M. can easily satisfy himself, as I shall be very pleased to forward his name and address—I know Dr. M. has mine. It is ridiculous to suppose that the article assailed was ever intended as a complete compendium of the zither; nor was it intended for *virtuosi*, but for such as were open to accept simple instructions or hints at the hands of one who was perfectly competent to impart such information, and also perfectly disinterested in offering it. As to the 'inferior teachers' upon whom the learned licentiate has sat so unmercifully (and I am, by implication, included in the category), I am afraid I can only speak for myself. But in all my experience as an inferior teacher, I never yet knew of a case of relapse when once the study of the zither had been seriously undertaken; my innate inferiority, no doubt, prevented such instances from cropping up. Certainly, I was at a distinct disadvantage in every way—my practice as a teacher lying in an obscure Hampshire village called Bournemouth, of which the doctor may possibly have heard, and which, we all know, is peopled by Boors. Unkind, oh doctor! to cavil at the teacher's eye to the 'main chance.' Why, man, it was my only inducement to teach at all; yet I do not class myself as inferior to anyone in love of the zither, or as insensible to its capabilities. I am willing to believe that you are an infinitely better performer on it than I am, or than I am ever likely to be; but you surely might let experience go for something, even if only that of an 'inferior teacher. As I am always willing to admit it when in the wrong, I cry 'Peccavi' *re* the word 'Schlacht.' I simply perpetuated another man's error, as I am no German scholar; but surely no mortal in his senses could ever confound the zither proper with the Streich zither, which is an instrument of the viol family? Dr. M. is also good enough to tell us that the élegie zither is the best as an accompaniment to the voice and for slow *tempi*, which is perfectly accurate; but not so his assertion as to the concert zither being the one in most general use. As a matter of fact, the concert zither is tuned in 'G,' the prim, or ordinary, zither being in 'A;' while the élegie is pitched in 'F,' and the bass zither in 'E.' With the latter the good doctor is presumably unacquainted, or he would certainly have mentioned it in his very comprehensive letter. He also asserts that the prim zither is used by the very 'inferior' zitherists of the Tyrol, as being 'cheaper' and 'handier' than his favourite instrument — the concert zither. Now, in some German lists I have seen the two priced alike, while in an English one, which lies before me as I write, I notice that prim zithers are quoted as kept in stock up to ten guineas, and that the limit for concert zithers is £4 10s.—conclusive proof that the doctor's argument is *right*, and that the prim is invariably the 'cheaper' instrument. As to its being the 'handiest,' I don't know where it comes in, if by the term the doctor means portability, etc. This very captious gentleman also takes exception to my remark as to the universality of the zither among the peasants of the Tyrol. Now, in 'Grove's Dictionary of Music and Musicians'—a reliable and standard work, I think—under the article 'Zither' will be found the following: '. . . . as constructed about half a century back, when it became a favourite among the peasantry of the Styrian and Bavarian Alps.' I have not enjoyed the advantage of bearding the zither in its native lair—so to speak—as has the doctor; but I think it is extremely possible that the natives were shy of performing before him, as his fame must inevitably have preceded him; and, indeed, if they had any suspicion of the contempt in which he holds their beautiful 'Ländlers,' it is not to be wondered at. Now, whether these poor unfortunate zitherspielers have degenerated or not, it is a significant fact that Petzmeyer, the father of the zither in its present form (as well as Gusicow, Picco, and other world-famed players), was a perfectly self-taught player, and was not only ignorant of even the rudiments of musical science, but was also otherwise illiterate; yet he was appointed Kammer—*virtuoso* to the king—which proves that it does not follow that a man must be acquainted with music at all to be a good performer. That the *dilettanti* consider this the worst of heresy I am well aware. The doctor's moan because he could not find exponents of a class of music to which the Tyrolese were not accustomed is about as ludicrous as if one were to quarrel with a Scotch piper because he could not render an oratorio! In the towns of Germany, the doctor says, the zither has been developed. Quite so; as, even in benighted Germany, the talent flocks to the bricks and mortar. But Munich—which he gives as the seat of a distinct school—has no performer of international fame, whereas Vienna has several. There are many obsolete or little used methods of stringing besides the ones he cites, and really, whether the one I gave was Munich or Vienna, is a matter of very little practical importance. Now, so far I have followed the doctor with great interest, if not always in accord with him; but when he assails the metal strings in cold blood, it is too bad. They are infinitely superior in all respects to those of silk and gut. In the hands of an 'inferior teacher' or a player 'of mean capacity,' the former might, perhaps, be found harsh and clanging; but for great delicacy of touch, and an infinitely greater resiliency, commend me to the metal strings. It is sheer nonsense to talk of their destroying the grip of the pegs. Look inside a piano. Furthermore, they are very accurately balanced as to tension, whereas with silk and gut there are scarcely two strings alike in this respect. Which, then, is likeliest to conduce to a delicate and sympathetic touch? It is not considered gentlemanly in this town to give anyone the lie direct, which is what Dr. M. has done when he says that my remarks on the accompaniment are 'not true;' he should have added, 'in my opinion' or 'in my experience.' Our friend has probably acquired the zither, 'through much tribulation,' in the orthodox manner, and cannot believe that he has really wasted much valuable time. But, be that as it may, I hereby reassert all what I have said on the subject of the accompaniment. Minor chords, etc., I must venture to submit, do not come within the scope of elementary instruction; but all the graces enumerated by the doctor are to be accomplished when the pupil is once familiar with the positions of the strings, and this latter may easily be acquired by practising the major chords, only one of which need be taken until the stretch, etc., is mastered. Having thus vindicated the truth of most, if not all, of my 'random statements,' I may add that our English players have done nothing for the popularisation of the zither, and for this reason: each appears to be actuated by the same carping spirit which is so manifest in every line of the doctor's letter, and most so-called zither clubs are—well, 'select assemblies'—hem! We are warned not to set strong spiritual food before the catechumens, and the same is true with regard to the intending learner of the zither; so let every reader of Work peg away by the light of the few hints embodied in the article attacked, and I will undertake that there need be neither lapses nor failures. *Vale, Doctor carissime!*"—An Old Teacher.]

Ancient and Curious Watches.—F. C. (*Nunhead*) writes:—"I have recently had an opportunity of examining a curious watch in the possession of a well-known alderman of a southern town. This watch is three hundred years old, and is contained in an oval or egg-shaped case about 2½ in. long by 1¼ in. wide. The front of the case is missing, but the remaining part is about ¾ in. thick. Over the dial is one hand only, to mark hours (like the clock on Westminster Abbey), and the watch is so constructed that this hand can be set to time, which is not the case in all similar watches. The movement is English verge, and the only defect in the watch at present is that the teeth of the 'contrate' or crown wheel are bent. Between the spring barrel and the fusee a piece of catgut supplies the place occupied in modern watches by a flat-link chain. The same gentleman owns another watch, the hall-mark in which is one hundred and twenty-eight years old. It is enclosed in a tortoise-shell and gold case, and has a verge movement. At the present time this watch runs with a variation in time of less than two minutes per diem. While speaking of watches, I may mention a curious repair effected by a Japanese workman. An English gentleman travelling in Japan found that the main-spring of his watch had snapped, and sent it to a native artisan. The watch was returned to him apparently in perfect condition, and its performance was satisfactory until he reached a damp district. On examination, it was found that the new main-spring was made of thin bamboo."

Fairy Bell Pegs (or Pins).—G. H. M. (*Bristol*) writes:—"Noticing a reply in 'Shop' offering to supply above at 1s. per dozen, it struck me as being a somewhat exorbitant charge, in proof of which I may say I shall be pleased to supply either of the enclosed three sizes at 6d. per dozen, postage 2d. extra, or for not less than three dozen, post free;

and wire at 4d. per ring (see 'Sale' column)."—[These pins are all that could be desired.—ED.]

Xylonite and Fret Saws.—H. B. (*Leeds*) writes that "he supplies xylonite in small quantities in its best forms—viz., ivory, ebony, coral, and tortoise-shell; also a new 'Lightning' fret saw' (see advertisement)."—[The samples sent are certainly to be commended.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Boot and Shoe Repairing.—NOVICE.—The articles on "Boot and Shoe Making and Repairing" appeared in WORK, Nos. 112, 117, 122, 126, 130, and 137.

Self-acting Fountain for Garden.—A. L. (*No Address*).—The principle upon which the fountain works, as described in No. 69 of WORK, is undoubtedly the best for your purpose. If you read the article carefully in connection with the sketch now given, you will see the necessary alteration which will have to be made to make it an effective and convenient apparatus. The sketch will then need little explanation—the question of size is one which you must decide for yourself—but as the vessels are out of sight, and therefore cannot look clumsy, I would advise you to have them sufficiently large to play a small jet for. say, two to three hours

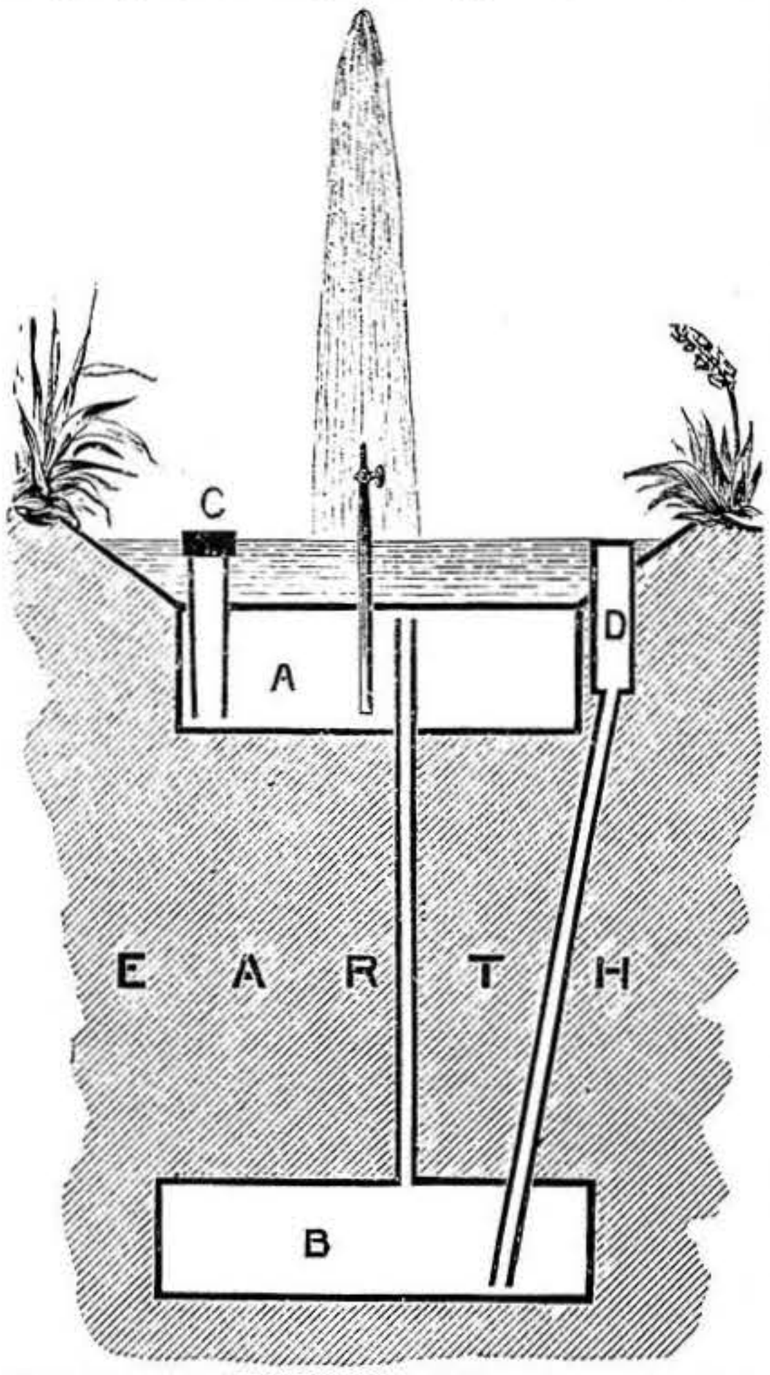


Diagram showing Buried Self-acting Fountain for Garden.

—thus: top vessel, A, 20 in. × 20 in. × 4 in. deep; vessel B, 21 in. × 21 in. × 4 in. deep; and as in the open air a feeble jet is disturbed by a very light breeze, it would be well to have a considerable force behind the jet. The latter itself need be no larger in thickness, but driven out with greater force, and hence—being much stiffer and better able to bear the wind—this force can be obtained to any extent by *increasing the distance between* the vessels A and B; the size and shape of the vessels have nothing to do with it. I would recommend not less than a clear 4 ft. between the vessels. The earth would have to be excavated to accommodate these dimensions, and when the fountain is made up, *thoroughly tested* for leakage, and filled up, a zinc cone somewhat like a milk-pan should be soldered to top of vessel to form basin, and the edge neatly built up with rustic rock-work. To use the fountain, pour water into the basin until no more will run down the pump-hole, D, and the basin is also conveniently full; then, to make it play, unscrew the plug, C, and work the pump up and down, when water from B will be sucked up into the basin, and drawn down the plug-hole, C, into A. When B becomes empty, air will come up instead of water, accompanied by a gurgling sound; then restore the plug, and *afterwards* cease from pumping, when the water will instantly rise from the jet and continue playing until A becomes empty. It is essential that the vessels and joints should be air-tight, and they should be tested to a higher pressure than they will be used at. With regard to price, this will vary very much in localities. As you do not give any address, I am unable to surmise.—C. M. W.

Cyclometer.—W. W. (*Stamford Hill*).—I am unacquainted with the interior mechanism of the cyclometer. It is not a job for a novice, however, but for a practical optician. I am sorry I cannot supply a drawing, as I have not the article by me. It would be cheaper and better to buy one of the makers or cycle dealers. Consult WORK advertisements.—A. S. P.

Fitment for Small Harmonium.—A COUNTRY CABINET-MAKER.—It would be beyond the scope and purpose of WORK to give instructions as to how to play any particular instrument, the construction of which is set out in the journal.

Pneumatic Tires.—A. S. (*Glasgow*).—The repair of these tires requires initiation, and no novice should attempt it without first seeing it practically done, and repairers are not fond of showing the process to everyone.—A. S. P.

Clay Modelling.—M. J. C. (*High Wycombe*).—The articles on "Clay Modelling" appeared in WORK, Nos. 56, 60, 64, 68, 71, 74, 77, 83, 88, 93, and 98.

Suggestions for WORK.—W. N. (*Homerton*).—Thanks for your suggestions. I am always glad to have these from any reader. Your efforts to make WORK better known among your friends, and your introduction of it into your school, will no doubt be productive of good all round. As to tools, you will see that B. A. Baxter is already dealing with carpentering tools, and no doubt he will treat the subject exhaustively. Your required information as to enamelling a coal vase only awaits its turn in "Shop."—ED.

Collodion Wet Plate Process.—AMATEUR.—Your best plan would be to purchase an elementary shilling handbook on photography, which will give you more detailed information than it is possible to do in the limited space of these columns. All the necessary materials may be purchased of almost any photographic material dealer, such as Fallowfield; or Adams, Charing Cross Road, W.C., will supply you.—D.

Enamel.—J. R. G. (*London, S.E.*).—You cannot do better than use the Foochow or Aspinall enamel advertised in WORK.

Architecture.—WOULD-BE.—Before wasting any money in buying books, I should advise you to write to the Secretary of the Royal Institute of British Architects, 9, Conduit Street, Hanover Square, London, W.; or to the Secretary of the Glasgow Institute of Architects, 115, St. Vincent Street, Glasgow, plainly stating your case, and asking their advice.—E. D.

Bell Telephone.—N. D. (*Sheffield*).—I am pleased to learn that you have succeeded in making your telephone so well from my instructions given in WORK. It shows that my labour has not been in vain. The further information which you require regarding transmitters and switch-board has been written out fully with drawings, and is in the hands of the Editor. Perhaps, if you and others use some persuasion, he will be induced to publish the same at an early date.—W. D.

Sawing.—A STUDENT.—Sawing against the grain, especially in curly or knotty wood, is, of course, more difficult than sawing along the grain of a straight and regularly grained piece of timber. From A STUDENT'S letter I should think his saw is not in good order, for sometimes "the saw seems to refuse to move altogether." Is this so? For a correct and complete answer to this, read J. H.'s article in WORK, Vol. I., p. 161, dated June 1, 1889, then examine the saw carefully in the light of the knowledge gained.—B. A. B.

Safety Bicycle.—ERIC.—Your correspondent is quite right in his remarks in reference to the adjustment of pedal-shaft, and I am not wrong. It is this way: As to wheels, the hubs revolve round a fixed axle. These hubs always have the spindles made with a right-hand screw, and if made with a fast and loose cone, the loose cone is always on the *left* side as described, and as ERIC says. With regard to a pedal-shaft, the hub, so to speak, is a fixture, and the shaft revolves. If the pedal spindle has a fast and loose cone—the fast cone being, as it always is, next the chain wheel, and the shaft or spindle a *right*-hand screw—then the chain wheel would be on the *left* side, and the loose cone on the *right*—just the reverse of the wheel spindle; the operation of driving would then wind a loose cone *outwards*. But nearly every safety that I have handled in the last two years for repairs had the pedal-shaft made with a *left*-hand screw, and the loose cone, consequently, on the *left* side, and it was one of these brackets I had by me when I wrote the description, which is correct when applied to the *left*-hand thread, as it was meant to be. Your correspondent, who evidently knows what he is talking about, will see that my description applies, as he mentions, to a left-hand, threaded shaft, which fact I ought to have mentioned when writing the description.—A. S. P.

How to Make a Hot-Air Engine.—S. T. (*Oughtibridge*).—You ask how to make one, but without saying what size. I don't know whether you mean a model or a large one. I think an amateur could not well do more than a model, because the cylinder of a hot-air engine is necessarily large, and the heater big and bulky. What could you do towards making a hot pot and displacer 12 in. or 14 in. diameter? You might make the patterns if you have a large lathe, but most of the work is done in the foundry. Then the cylinder requires a power-lathe to bore it, and so does the fly-wheel and crank; then what remains for you to do? You might make a model, and before this appears you will have seen a drawing and description of Mr. Seal's simple little engine, sent in answer to another inquiry, which plan you might follow, taking a pipe of some kind as the foundation for the furnace below the heater in the middle, and to carry the crank-shaft above. I would make the cubic space moved through by the working piston one-quarter that moved through by the displacer; and if you have a 5 in. working cylinder, you may drive a sewing-machine, fret-saw, or 3½ in. lathe.—F. A. M.

Cabinet Making.—SIRINO.—I cannot call to mind a book such as you require. Messrs. Cassell and Co. publish "Drawing for Cabinet Makers" (3s.). Read my reply in "Shop," No. 140, Vol. III., headed "Advice to Draughtsmen;" you may find some books therein mentioned of service, if you are not already acquainted with them.—J. S.

Cheval Screen.—N. M. (*Norwich*) may, it is hoped, find in the annexed sketch the hints he requires for making up his tapestry as a cheval screen. The uprights and cross-pieces should be about 1½ in. square. The fret (Fig. 2) must also be cut from stuff of the same thickness. The pieces A and B (Fig 1) should be of ¼ in. board. For mounting the tapestry, a stretcher should be made like that over which an artist's canvas is strained, cut from ¾ in. lath, 2 in. wide, and the tapestry should be tacked tightly over it. N. M. proposes protecting his needlework both at front and back with glass. If

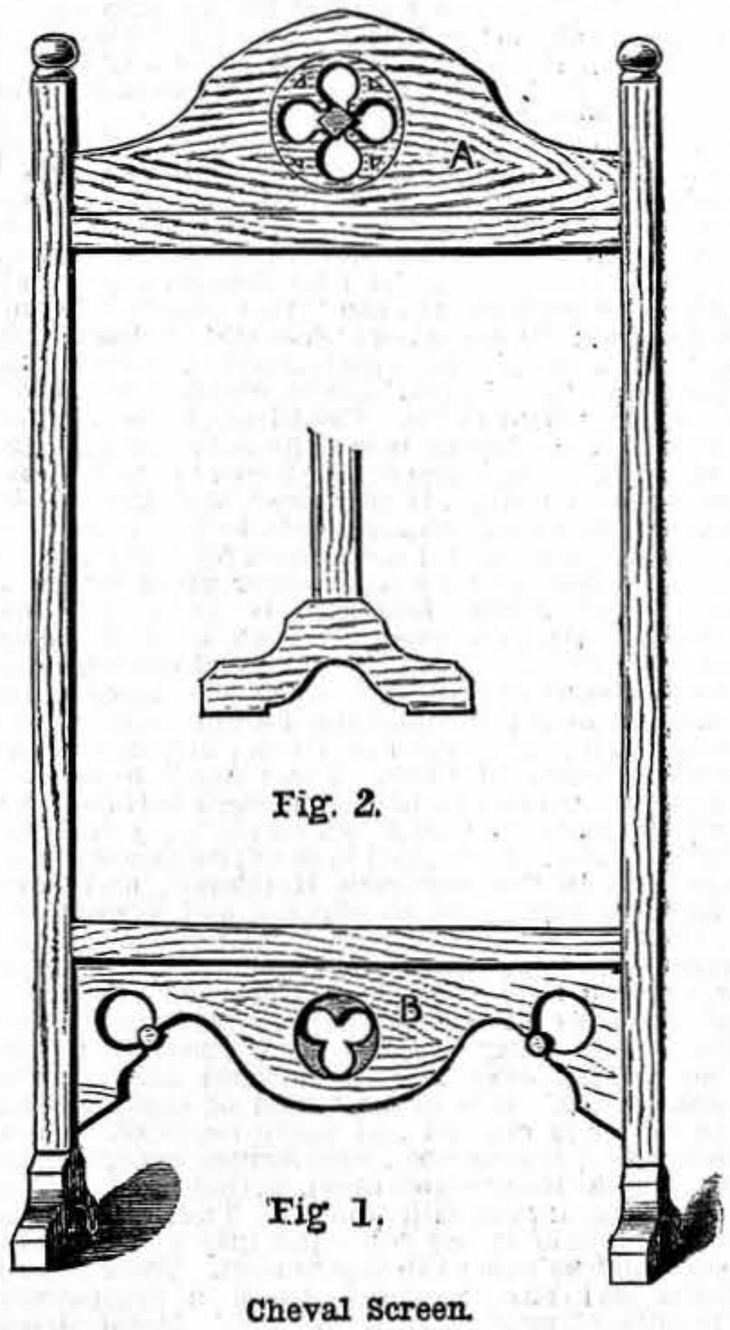


Fig. 2.

Fig 1.

Cheval Screen.

he does so, his simplest and most effective way of fixing it in will be with a narrow gold moulding, fastened to the frame with needle points. If his material is—as it most probably will be—soft wood ebonised, the gold will look especially well. I do not, however, see the necessity for glass: it will make the screen heavy and clumsy, and will always be exposed to danger, whilst the introduction of it will greatly increase the maker's difficulties. I advise him to do without it. A few dowels will then serve to keep the panel in place, and when the framework is tightly brought together round it and pegged, the whole will look solid and workman-like. The boards A and B will be fixed in shallow mortises in the uprights, and may run in V-shaped grooves in the cross-pieces.—M. M.

Oxide of Cobalt.—WORKITE.—You can dissolve black oxide of cobalt very easily in hydrochloric (muriatic) acid; but if you have any difficulty, warm it. Use the hydrochloric acid mixed with an equal volume of water. You might get out most of the yellow colour from the clay by warming the clay with dilute hydrochloric acid, allowing the clay to settle, and decanting the liquor. Wash well with water till free from acid.—F. B. C.

Glass for Fountain.—A. B. (*Aberdeen*).—You can obtain the above from Messrs. J. & W. Smith, of Farringdon Road, E.C. Ask for a 10 in. glass consumer with a hole in centre, as used for hall lanterns.—C. M. W.

Small Engine.—INQUIRER.—This is *too much* to ask for in a correspondence column. The drawings would take two days to make, and fill a page of the paper. Wait for some short paper on a small engine to work your 2½ ft. long model with a propeller.—F. C.

Zinc Fern Case.—J. D. (*Glasgow*).—An illustrated article on the construction of a Wardian case in zinc and glass is in the hands of the Editor. If the design is not just what you want, you can, of course, modify it to any extent; the general instructions, pattern of metal, etc., will hold good.—C. M. W.

Gas Matters.—W. H. B. (*Southsea*).—You will find on p. 541 of Vol. I. a similar question to yours answered under the heading of "How to Read the Index of a Gas Meter," with illustrations or diagrams. There is a misprint in the sentence in brackets; it should read 1,000, and not 1,090, as printed. You will find, on p. 422 of Vol. II., another answer to a question under the heading of "Gas Meter." There are also various other answers on the above subject, which you will find very useful; so you see that, although you have been a subscriber from the beginning, you have hardly been a constant reader. Your query as to "Why a consumer should pay so much for the hire of the meter when he does not have to pay a tradesman for the use of weights and scales and measures he uses?" only wants a little explanation, and I think you will acknowledge that the two cases are not analogous. For instance, the cost of a pair of scales and weights with which a tradesman can supply, say, five hundred customers would mean the cost of five hundred meters to the gas company before they could supply a like number of consumers—that is to say, it would cost the company about five hundred times as much for scales or measures as it would a tradesman. It would seem, at the first glance, that as the purchase of meters costs the company so much, and therefore must be paid for either directly or indirectly, the fairest way for them to charge would be to add so much on to the price of their gas or commodity, and get paid for them in this way, as in the case of the tradesman, though to a much greater extent. But this would hardly be right, for say the price of gas was raised 5 per cent. to pay for the purchase and repair of meters, then A, who burns, say, 1,000,000 ft. a quarter and has only one meter, would be paying out of all proportion to B, who only burns, say, 1,000 ft. a quarter and has one meter likewise; and yet A is a far better customer than B, and really is more entitled to a reduction than an increase in comparison to B, whose custom hardly pays for the initial expense of laying on the gas and fixing the meter. Therefore, in paying so much a quarter for the hire of a meter, the customer who burns the least gas pays more for it on the average than the one who burns most, and this, I think you must own, is the fairest way. We now come to your next point—viz., "That there is sometimes a considerable decrease in the consumption of gas for a certain time, through the fact of not having used it so often as usual; that, on the inspection of the meter index by the inspector appointed for that purpose, it has created a suspicion that something must be wrong with the working of the meter; but, on the other hand, if the meter registers ever so much more than the usual average of consumption, there is no remark made, no matter how one watches and economises the consumption." This cuts both ways. For example, if it is wrong for the gas inspector to doubt the meter when it does not register as much as usual, it is almost as wrong for you to doubt it when it registers ever so much more, but you both have your remedy. If the inspector doubts the meter, he has it tested; this puts you to little inconvenience, and costs you nothing if it is right and he wrong. If, on the other hand, you doubt the meter, you can have it tested by the Government inspector, and this would cost you nothing if you were right and the meter found to be wrong. Of course, if you have the meter tested and it is found to be all right, it is only proper that you should pay the expenses, and this would be but a very small sum but some inconvenience. But the improved way meters are now made and periodically inspected makes the remark, "To lie like a gas meter," practically speaking, an untruth, especially in the case of dry meters. You can get a very good idea if the meter is working properly by lighting one or more burners whose burning capacity you know. For instance, suppose you light four burners that are supposed to burn 5 cubic ft. each per hour—20 ft. per hour—then if, at the expiration of two hours, the meter has registered about 40 ft., you know that the meter is not far out. I have generally found, in practice, that a burner burns more than the amount stated. You can generally tell the number of feet an ordinary burner is supposed to burn by a number stamped on it or the number of rings chased round it near the earthenware top. A detailed description of the construction and working of a gas meter, with illustrations, would be far too long a subject for the columns of "Shop." I quite agree with you that it would be interesting to a number of readers, and, with the Editor's permission, I will write an article on it later on.—E. D. ["How to Control the Gas Meter" will shortly appear in WORK.—ED.]

Lantern Microscope.—S. C. W. (*Bristol*).—Microscopic slides, unlike ordinary lantern slides, require to be placed close to the objective in a lantern microscope. In this manner the small 3 in. by 1 in. slide is brought close up to the apex of the cone of light emitted by the condenser, which should be about four to six inches distant from the slide. The ordinary form of lantern microscope is generally supplied with two objectives, for the purpose of exhibiting slides having a diameter of 1 in. and ½ in., these lenses usually having a focus of 1½ in. and ¾ in. respectively. The objectives may take the form of a pair of plano-convex lenses of short focus mounted in a tube with the crowns of the lenses close together (as in an ordinary condenser), the foci varying from ¼ in. to 3 in., according to the power required; or, if preferred, the low power may be a pair of short focus bi-convex lenses, and the high power the ordinary achromatic form made to pass plenty of light. It is not always advisable to utilise microscopic objectives for lantern purposes, as lenses of this description are not always suitable for the purpose, and, moreover, they do not pass sufficient light. The body tube of the lantern microscopic, which is illustrated in Fig. 1, is made to screw into the draw tube of the lantern front in place of the ordinary objective, which is removed for the purpose. This body tube is provided with an inner spring tube, which retains the microscopic slides in position when they are inserted through the opening at the front end of the tube. This inner spring tube takes the form of a short length of tubing covered with a disc of brass at one end, which is pierced with an opening 1 in. in diameter, in order to admit the rays of light to the slide. A strong spiral of wire is coiled round the interior of the tube, and acts as a spring by forcing the tube towards the outer opening. In the better class of instruments this spring tube is held back while the objects are being inserted by the action of one or two milled screws. The objectives are mounted in separate tubes, so that they may be readily slid into a short adapter, or jacket, which is made to screw into the diminishing collar attached

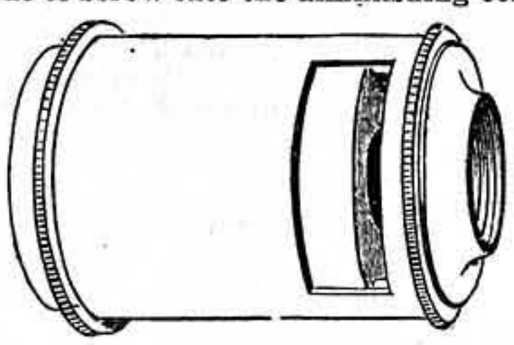


Fig 1.

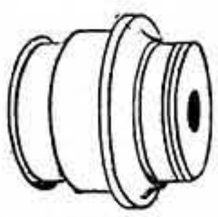


Fig. 2

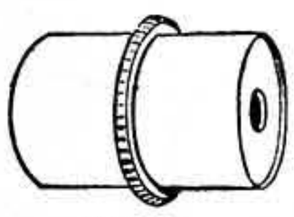


Fig. 3.

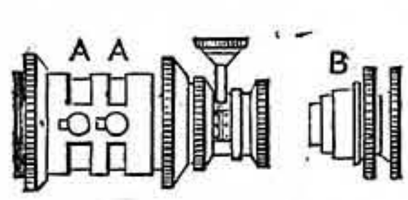


Fig. 4.

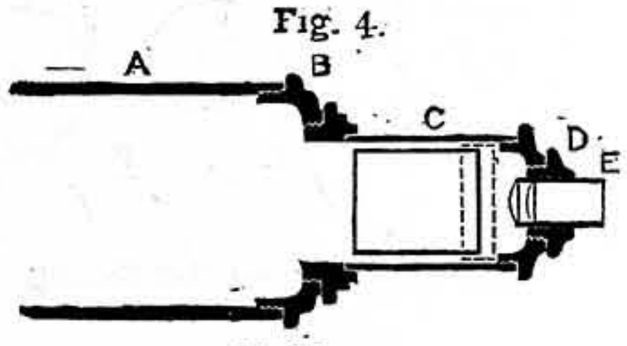


Fig. 5.

Lantern Microscope. Fig. 1.—Body Tube of Lantern Microscope, showing Inner Spring Stage. Fig. 2.—Objective to screw into Diminishing Collar of Body Tube. Fig. 3.—Extra Power to slide into Objective Mount. Fig. 4.—Microscope with Double Stages shown at A, A; B, Objective. Fig. 5.—Section of Microscope—A, Draw Tube of Lantern Front; B, Collar of Draw Tube; C, Body Tube of Microscope; D, Objective Mount; E, Objective Tube fitted with Lenses.

to the front end of the body tube. The focal adjustment is secured either by simply sliding the tube containing the objective in and out of the jacket, or by means of a rack and pinion attached to the latter. In Fig. 2 the high power is shown inserted in the jacket or adapter; and Fig. 3 represents the low power mounted in the short tube. Fig. 4 represents a better form of lantern microscope provided with double stages (shown at A, A) and clamping screws for the same; also an objective working with a rack and pinion adjustment, B representing the extra power which can be inserted in the rackwork tube when required. Fig. 5 is a section of the lantern microscope illustrated in Fig. 1, showing the disposition of the various portions. In the better class of lantern microscopes the light emitted by the large condensers of the lantern is received by a supplementary achromatic condenser, which reduces the pencil of light to a proper size; then follows an alum trough and the object holder for 3 in. × 1 in. slides; and in front of this the magnifying apparatus as in a tube microscope, consisting of a special achromatic objective, and an eye-piece giving considerable amplification and a wide field. The pencil of light is adjusted by means of rackwork attached to the small condenser, and the image is received upon a tightly strained paper screen, the adjustment being completed by means of a rack and pinion in connection with the objective. The lime-light alone should be employed with the lantern microscope, as no other form of illumination is capable of supplying a light of sufficient intensity to produce good results. As the heat rays emitted by the source of light are very nearly brought to a focus upon the small microscopic slide, it becomes necessary to interpose a small tank, filled with a solution of alum, between the condensers and the object, in order to absorb the heat rays, and thus protect the object from damage. There are many other matters to be dealt with in the construction of a lantern microscope that render it impossible to properly treat the subject in the form of a reply. A paper may possibly appear at some future date. In the meantime, you will find some additional information in Mr. A. A. Wood's manual, entitled, "The Magic Lantern: How Made and How Used." A description of a superior form of lantern microscope for use with the lime-light appeared in No. 29 of *The Magic Lantern Journal*. Several papers on Lantern matters will appear in the next volume of WORK.—C. A. P.

Receipt of Deposit.—GARTON.—Our correspondent is quite in error in assuming the receipt of the *deposit* of the application for the grant of a patent is provisional protection. When the papers he has lodged have been examined and accepted, he will then receive the grant of provisional protection. As, however, he states that he is "his own agent," he may pretty surely count upon the return of his specification for correction or alteration, as it is quite impossible for anyone who has not had a practical training and experience in patent matters to produce a document which shall meet the needed requirements. The Comptroller of Patents stated in his evidence before the Committee that "the *bad* specifications, as a rule, will be entirely those made by the applicants themselves; and the *very bad* ones are undoubtedly made by the poor inventors. It is clear that, nine times out of ten, it is *impossible* for the poor inventor to draw up his own specification in English!" In a late case before Mr. Justice North, where it seems the inventor had prepared his own documents, the learned judge said, "The plaintiff *not having been wise* in preparing his own specification, the defendant was equally *unwise* in preparing his own defence." Mr. Justice Field has said, "We all know the *sad difficulties* in which inventors are placed by reason of *want of care*, and sometimes *want of knowledge*, in preparing their specifications and drawings. It is a branch of learning which I have never yet succeeded in acquiring, and probably my life will not be long enough to enable me to do so. Many and many a perfectly good and perfectly valuable invention has been *absolutely defeated* by some *little mistake* of the *most trifling description* in a claim which was, perhaps, of no value at all." It may be taken as a positive fact that an inventor is about the *worst* person to be entrusted with the unaided preparation and completion of the documents required for obtaining a valid patent, inasmuch as there are such a great number of points requiring careful attention, wide experience, extended practical knowledge and skill, and the power of expressing, in a correct and significant manner, *what* the invention is, and *how* it is to be practically carried out, and *what* has to be protected, with the knowledge of *how* this should be done, which very rarely, if ever, is found in an inventor, and nearly as seldom in not a few of the professed "obtainers" of patents; that every inventor and intending patentee cannot be too careful in his proceedings in this direction. It is quite true that the inventor or intending patentee *must* know better than anyone else *what* his invention is, *what* he wants to do, and *how* he proposes to do it; but it must not be forgotten that the mere fact of this being the case does not, therefore, qualify him for those duties which can alone be properly carried out by those who have devoted their time, thoughts, abilities, skill, and experience *specially* to this object. It might as well be argued that, because a man is owner of a steamship, he is therefore able to navigate her or to fulfil the duties of chief engineer, and take charge of the engines and machinery. An inventor who has received provisional protection for his invention should be very careful in his proceedings, for there may be a prior application for the subject-matter of his invention, the provisional specification of which may be wide enough to admit of the comprehension of his plan in the complete, and for this he has no remedy; unless he can prove that his invention came to the knowledge of the party, and was appropriated by him, he is nowhere. We should advise our correspondent not to treat with anyone until he has filed his complete and received notice of its acceptance, especially if his invention is novel, useful, and likely to be of public benefit. Why will inventors with no knowledge of patent matters, or experience in the required proceedings, meddle with what they know nothing about? Can they expect for one moment to achieve a successful result? or can they think that the existence of a mass of invalid, useless patents will cause the capitalist public to look with favour on what is always a ticklish kind of security to have to do with? It should not be forgotten that every *penny* saved (?) in having the documents *properly prepared* will generally be found to result in requiring the expenditure of a great many *pounds*, and, in nine cases out of ten, ending in the loss of the patent. It is to be hoped that increasing intelligence and understanding upon patent matters will convince

inventors and intending patentees that the possession of an invalid and useless patent is no advantage to the owner nor any security for a capitalist, and that in future they will see that it would be wiser to abstain from meddling in matters of which they are entirely ignorant and have had no practical experience.—C. E.

Buying Lathe Heads.—A. V. S. (*Westbourne Grove*).—You can buy a head-stock, poppit, and rest at a tool shop; they are regularly sold for carpenters, cabinet makers, etc., who wish to make wooden bed and frame themselves. You can also get them at shops where they sell second-hand machinery, or by watching the advertisements in WORK. Try Caplatzi. £2 should buy a fairly good set second-hand.—F. A. M.

III.—QUESTIONS SUBMITTED TO READERS.

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

Blowing Fan.—WAREHOUSEMAN writes:—"Will any reader of WORK enlighten me as to the best fan or air propeller for clearing a large warehouse of its vitiated air?"

Rubber Rings.—INDIARUBBER writes:—"I shall be glad of information as to machines for cutting rubber in rings."

Coal Dust.—HOUSEHOLDER writes:—"I have—in fact, have long had—large quantities of coal dust in my cellars and outhouses. Will any reader tell me of the best means of utilising it, and what to cement it with, if I wished to do so?"

Galvanised Iron.—COLONIST writes:—"Will some reader of WORK mind explaining the process of galvanising iron—the pickling, spelter, galvanising, and corrugating?"

Hollow Stay Bolts.—ENGINEER will thank any experienced in the work to explain the rolling of hollow stay bolts.

Rock-Boring Drills.—MONT CENIS will feel obliged to any reader who will acquaint him with the best rock-boring drills—hand or steam—upon the market.

Corrosion in Steam Boilers.—AJAX writes:—"Will any expert give me the cause and remedy for this?"

Phonograph.—RALPHO writes:—"Will some practical reader oblige by giving full particulars and drawings of a phonograph? I think there are a great number of readers who are clever enough to make one."

Enamelling Fretwork.—G. F. R. (*Bournemouth*) writes:—"Will any reader give me any hints through 'Shop' as to the best way to enamel fretwork? I have tried a good many things, but they are not quite a success. I find that the enamel brings the wood out rough, especially cross-grain, no matter how smooth I make it first."

Cutting Clothing.—DODO writes:—"Would any subscriber to WORK give information as to cutting out men's clothing, or where a treatise can be purchased? A system such as the Cosmopolitan, which ladies use for cutting their dresses, would answer."

Whip Handles.—G. L. (*Westminster*) writes:—"Could a worker in the trade kindly tell me how to prepare holly-sticks for whip handles?"

Venetian Blinds and Glass Mending.—H. R. (*Chacewater*) writes:—"Will some kind reader tell me the best material for mending glass or china; also where I could get Venetian blind laths, punched or unpunched, wholesale?"

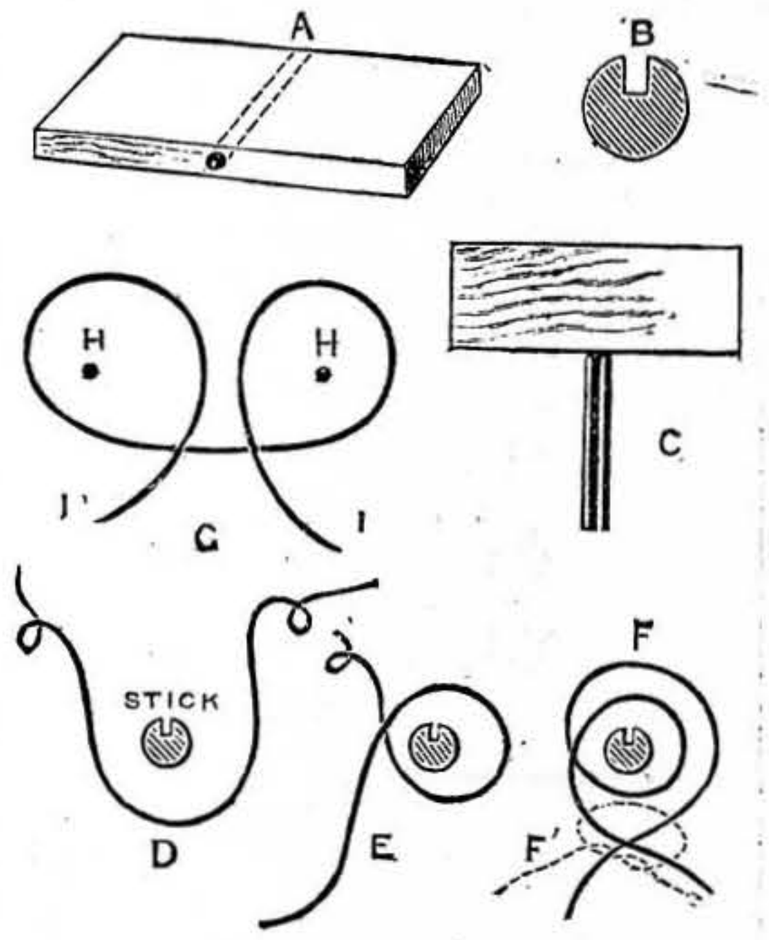
IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Brass Lacquering.—L. L. H. (*Falmouth*) writes:—"As I understand L. M.'s query (see p. 637, No. 144), he wishes a pair of iron hames to appear as if they were of brass. This is practically impossible. If they are already covered with brass, and merely want re-lacquering, he could get it done through any good ironmonger, or even do it himself by polishing the brass-work thoroughly with Putz pomade, and then giving it a coat of the Silico Enamel Company's brassoline. If he is in any further difficulty about the matter, I should recommend him to write to one of the harness-making firms at Walsall, who would put him in the way of getting exactly what he wanted."

Luminous Paints.—EDDIFRA writes, in answer to R. R. (see p. 137, No. 144):—"Orange: 46 parts varnish are mixed with 17·5 parts prepared barium sulphate, 1 part prepared Indian yellow, 1·5 parts prepared madder lake, and 38 parts luminous calcium sulphide. Green: 48 parts varnish, 10 parts prepared barium sulphate, 8 parts chromium oxide green, and 34 parts luminous calcium sulphide. Yellow: 48 parts varnish, 10 parts prepared barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide. Blue: 42 parts varnish, 10·2 parts prepared barium sulphate, 6·4 parts ultramarine blue, 5·4 parts cobaltous arsenate, and 36 parts luminous calcium sulphide. Violet: 42 parts varnish, 10·2 parts barium sulphate, 2·8 parts ultramarine violet, 9 parts cobaltous arsenate, and 36 parts luminous calcium sulphide. Grey: 45 parts varnish, 6 parts barium sulphate, 6 parts calcium carbonate, 0·5 parts ultramarine blue, and 6·5 parts grey zinci sulphide. Yellowish-brown: 48 parts varnish, 10 parts prepared barium sulphate, 8 parts auripigment, and 34 parts luminous calcium sulphide."

Besom Makers.—H. M. S. writes, in answer to L. S. D. (see p. 635, No. 144), asking for address of besom makers:—"I might say that they can be obtained from the Liverpool workshops for the Outdoor Blind, Liverpool, where they make them."

Rope Door Mats.—E. P. B. (*Penge*) writes, in answer to J. A. (*Southwark*) (see p. 590, No. 141):—"There are many varieties of mats made from old rope, but from your correspondent's statement that he has 'tried pricking a hole through canvas, and putting rope through,' I imagine he means the kind known as 'thrummed mats,' in the manufacture of which a thrum board is used. It is constructed by boring a hole through the edge of a piece of 1 in. board (size of board may be about 18 in. by 6 in.), A, and driving into it a stick about 18 in. in length, of which B is a transverse section. C is plan of board complete, and *modus operandi* is as follows: Having unlaid the strands of a piece of rope—preferably coir, but alternatively hemp or manilla—and again unlaid these strands into their constituent yarns, the board is placed upon a chair—groove up—and used as a seat by the operator, with the stick projecting between his legs. He then, taking a length of yarn about a yard from its centre, and holding it in both hands, dips the bight under the stick, as at D; one end is then taken over and down (E); the other follows in same way (F). All is hauled taut, and an assistant—who sits facing the operator—with ordinary seaming twine ties an overhand knot at each crossing, as shown by dotted lines at F', keeping same tight up under stick. This is continued until stick is full, when a sharp knife is drawn along the groove in stick, cutting each bight, and leaving a stick-length of thrum sennit, which



Diagrams for Rope Mat Making.

is sewn into mats with palm, needle, and twine. The yarns, after unlaying, should be made up into lengths of, say, about 20 yards for convenience sake, with a split overhand knot. When only very short lengths of old rope are available, they may be used by stretching two yarns parallel to each other, and then (having previously cut all yarns to exactly the same length—about 3 in. or 4 in.) taking a hitch round the stretched yarns, as at G (where H, H, are yarns and I thrum), hauling well taut, and, in progress of work, driving yarns well together. There are also paunch, sword, sennit, and canvas mats, of which I could send description, but fear it would be too lengthy for 'Shop.' The latter, however, is simply made by threading a large roping-needle with yarn (working on the bight), and, having folded canvas into a ridge, sewing yarn through it over a round stick with groove in it, along which a knife is passed to cut bights of stitches, and thus form thrumming."

Copying Apparatus.—C. R. (*Ealing*) writes, in reply to C. F. C. (*Oldham*) (see p. 637, No. 144):—"The address of the Auto-Copyist Copying Apparatus Company is in London Wall, E.C."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—E. A. M. (*Stockwell*); N. R. W. (*Colne*); BLUE EARTH; W. C. (*London, W.C.*); S. S. (*London, W.*); N. B. (*Wallington*); R. T. W. (*Leicester*); S. C. T. (*Knutton*); S. J. (*Stockport*); H. R. (*Colne*); N. J. N. (*Birkenhead*); MODEL S. L.; A. R. (*Scorrier*); C. T. (*Bradford*); J. J. (*Park*); W. M.; C. G. M. (*Penistone*); R. M. (*Croydon*); A YOUNG BEGINNER; R. G. (*Settle*); LEARNER; P. E. J. (*Tipton*); W. H. (*Bradford*); S. E. C. (*Warrenley*); KALLITYPE; W. H. B. (*Hastings*); D. P. (*Birstal*); J. P. (*Jubbulpore, East India*); G. H. B. (*Horsham*); S. D. (*Harmondsworth*); W. S. (*Cambridge*); A. R. R. (*Yarmouth*); W. S. A. (*London, N.W.*); F. R. (*Stapleford*); K. L. (*Leeds*); H. E. L. (*Stockton*); W. J. R. McG. (*Sale*); G. E. B. (*Ipswich*); RUBBER; E. H. (*Bethnal Green*); W. H. C. (*London, S.E.*); J. W. (*York*); G. P. O. (*Clapton*); W. W. (*Brentford*); CORKSCREW; C. B. S. (*New Wortley*).