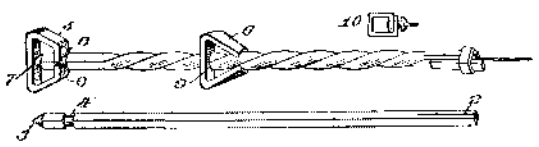
point of the sliding scale is placed opposite the reading for the principal and the amount is found on the lower scale opposite the rate per cent graduation on the sliding scale. The zero point of the sliding scale (No. 1) is opposite 500 (dollars) on the lower scale; and the readings opposite 4 per cent, 4½ per cent, and 5 per cent are respectively $520, $522.50, and $525. These amounts, which might have been obtained by multiplication, are determined by addition. For example: $500 × 1.05 = $525. By the scale the logarithm of 500 is added to that of 1.05. The same position of the sliding scale illustrates the method of determining the present value of a sum of money due at some future date. The present value of $525 at 5 per cent; of $522.50 at 4½ per cent; and of $520 at 4 per cent is $500. Each of these values is obtained by placing the percentage graduation on the sliding scale opposite the amount on the lower scale; and the reading $500 is opposite the zero point on the sliding scale.

No. 2 shows how the interest on any other sum of money is determined. The principal is $475, and the rate per cent is 4. The zero point of the sliding scale is placed opposite 475, and the reading opposite 4 per cent is 494. This example also illustrates one in discount. If the graduation 4 per cent is placed opposite 494, the reading opposite the zero end of the upper scale is the present value, viz., $475. An interest and discount scale may be advantageously constructed in segments. The desirability of doing this will be evident from Fig. 2, in which the spaces between the graduations rapidly diminish. A different unit may be assumed in each segment, provided the same unit is adopted in the construction of both scales for that particular segment. The interest and discount slide should be graduated for every rate of interest at which money may be loaned. To make it available for general use, it should also be graduated at intervals of one-half of one per cent, to include computations in interest and discount for short intervals of time. For example we will suppose that it is required to find the present value of a sum of money due three months hence at 6 per cent per annum. The graduation on the sliding scale which would be used in determining the discount would be that for 1½ per cent, or one-fourth of the rate of interest. The measurements from the zero point should be the logarithms of 1.005, 1.01, 1.015, 1.02, 1.025, etc.

SIMPLE DRIVER FOR SMALL DRILLS.

BY L. G. HANDY.

In an emergency the writer made a drill driver as follows: A piece of 3/16-inch square brass wire about 10 inches long was slit at one end with a hack saw,



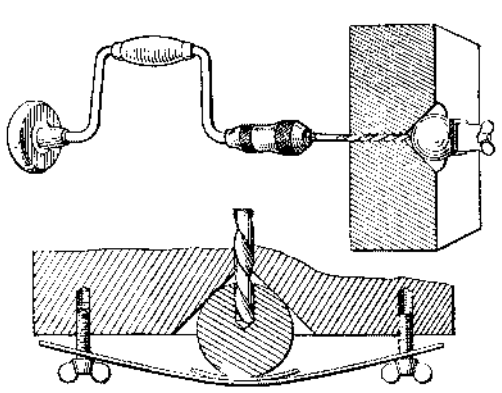
DRIVER FOR SMALL DRILLS.

as at 2. The opposite end was filed to a blunt point 3. About ½ inch from this end a round section 4 was filed. From a piece of sheet brass a swivel 5 and the slide 6 were formed. The swivel was made with a socket 7 to receive the point. Notches 8 were filed to fit the round section. The slide was formed with a square hole to fit loosely on the wire. The lugs of the slide were slightly concaved to permit displacement. By holding one end of the wire in a vise and gripping the other with a wrench, the wire was twisted. A ring and wedge, as illustrated, formed an effective grip for the drill. A more practical grip might be made, as shown at 10. The two ends of this ring should be soldered. A slot might be filed in opposite sides of the twisted wire to receive the ring and prevent it from dropping off. This driver has done good service for nearly two years.

DRILLING HOLES IN MARBLES.

BY J. O. BROUILLET.

Recently a man came to the writer and wanted a hole put through the center of some marbles. The accompanying sketch gives an idea of the way the work was accomplished. Through a piece of soft steel 2 x 3 x 1 inches a hole was drilled of the size of the



A METHOD OF DRILLING HOLES IN MARBLES.

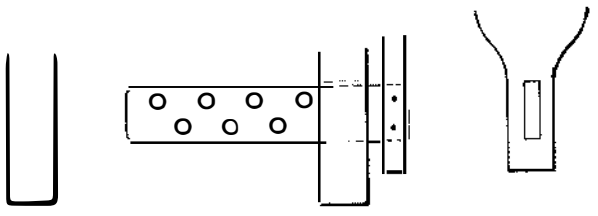
one wanted in the marbles. Then with a countersink a conical aperture was made in one side as illustrated. Two tapped holes, one above the other, below the aperture, admitted a pair of thumb screws that secured a flexible strip made from the spring of an eight-day clock. On the strip next to the marble which was seated in the conical aperture a piece of emery cloth was placed. The whole was then held in the vise and the marble was easily bored.

FURNISHING THE WORKSHOP.—I.

BY I. G. BAYLEY.

THE WORKBENCH.

In the article on the Construction of a Workshop (Scientific American, November 21, 1908) we showed a workbench attached to the wall, thus saving time and



DETAILS OF THE HEEL OF THE VISE.

labor in making it; but a stationary workbench is not always desirable, especially if there is no permanent shop for it. The standard size of a joiner's bench is 12 feet in length and 2 feet 9 inches in height and width. This size is altogether unnecessary for home purposes, and in particular for a boy or young man. From 8 to 9 feet in length, and about 32 inches high is a convenient size. Mechanics sometimes test the height by sitting on the front edge of the bench sideways, with one foot dangling over the side, which should just touch the floor.

If the planking and supports are made of yellow pine, a sound solid bench will be the result. In any case, the top front plank should be of this material, the rest can be of white pine or hemlock. The vise

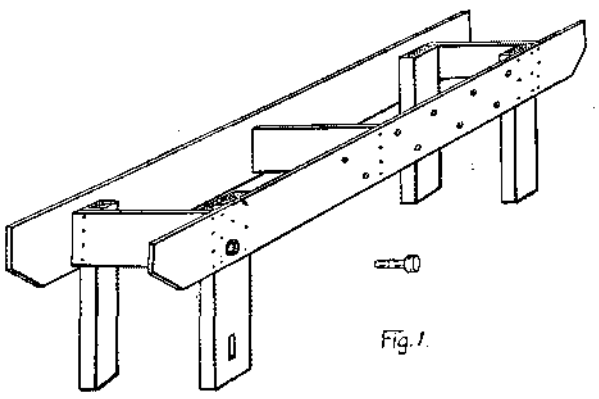


Fig. 1.

THE SKELETON FRAMEWORK OF THE BENCH.

should be of oak, the screw being purchased at any hardware store for about fifty cents.

Referring to Fig. 1, three of the supports are made of 3 by 4-inch timber, 30 inches high. The one at the vise is 3 inches by 6, of the same length. Care should be taken that the bearing surfaces are true, and the posts set up level. The slotted hole, or mortise, at the bottom of the vise post, should be cut before the post is set up, but the round hole for the screw can be made when the bench is complete. The mortise is made by boring two ⅞-inch holes 2 inches apart, vertically, and cutting out the wood between with a flat chisel. The ends, top, and bottom can be left round, or squared up with the chisel, as illustrated.

Cut three short lengths of 1 by 10-inch boards, 23

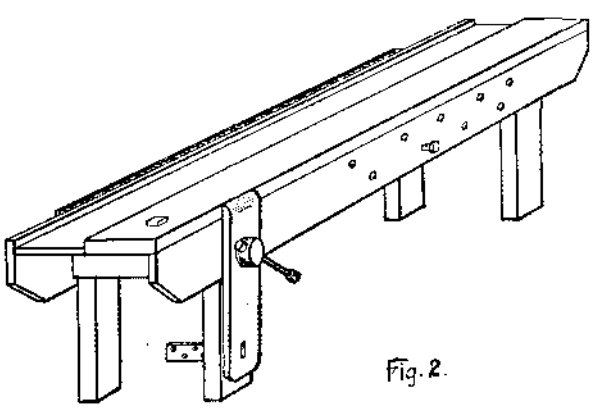


Fig. 2.

THE BENCH COMPLETE WITH VISE AND TOOL RACK.

inches long, and nail two of them across the tops of the posts or supports as shown. Set them up on end, and nail the front board, or apron, which is 9 feet in length, to the forward posts, spacing the latter 1 foot from each end. The top edges of the front board and the three cross pieces are brought up exactly level with each other, but the back board, which is 12 inches deep, is nailed to the posts, with the top edge 2 inches above. The top of the bench consists of two planks, 12 inches wide by 9 feet in length. The front plank is 2 inches in thickness, and should bear evenly along the top edge of the front board, or apron, which supports it. The board at the back is only 1 inch thick, and like the rest of the bench, can be made of cheaper and lighter timber. With the exception of the tool rack, the bench can be put together with 8-penny or 2½-inch wire nails. The 2-inch thick plank should be nailed down with 10-penny flooring nails, or nails having finished heads, which must be driven in below the surface with a nail set or punch.

The tool rack can be made from ½-inch stuff, about 2 inches wide, running the full length of the bench, or cut off within a foot or so of each end. Partitions can be made of the same wood, spaced from 1 to 3 inches apart, to suit various sized tools. A strip of wood nailed across the top edge of the back, and furnished with a number of different-sized bored holes, will answer the purpose just as well.

While there are many different kinds of vises on the market, it is safe to say the old style, as shown in cut, is very generally used, and it has the advantage of being easily rigged up and inexpensive. Procure a piece of oak, 1½ inches thick, 7½ inches wide, and about 30 inches in length, for the movable jaw of the vise. A hole for the screw is bored in the middle, 9 inches from the top, and a mortise for the guide is made in the lower end, after being marked off from the one in the 3 by 6-inch post of the bench. Corresponding holes for the vise screw are to be bored through the apron and the post, a trifle larger than the screw. The guide is made from hard wood, 18 inches in length, cut to easily fit the hole in the bench post, but having a driving fit in the vise jaw, to which it is secured by toe-nailing. Sometimes the jaw of the vise is tapered at the lower end, as shown in the detail view, when the guide can be secured by driving nails through the sides. The guide is furnished with holes evenly spaced, as shown, and a peg provided, similar to the one shown in Fig. 2, for the apron or front board of the bench.

The apron is provided with holes and a peg, to rest the free end of a long plank upon, when being worked in the vise. A suitable bench stop is put in the planing board of the workbench. Various designs are on the market, which can be easily attached, but a very good one can be made by using a 2 by 2-inch piece of oak, a foot in length. A hole is cut about 9 inches from the end of the bench, and the stop must have a driving fit, being raised or lowered by hitting it with a hammer. This is much better than the metal stops, since there is no possible chance of injuring the tools. The nut of the vise screw is secured to the inside face of the 3-inch by 6-inch post, to prevent its revolving when adjusting the vise.

When the vise is set up, the top can be planed true and level with the working face of the bench, slightly rounding off the corners. The 2-inch plank should be planed up true, and no work done upon it which will break up the surface. Any rough work should be done on a board placed on top of the bench.

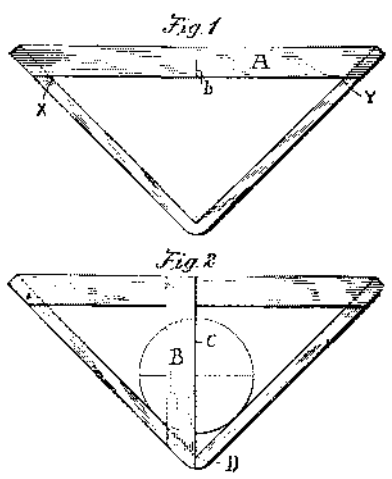
The workbench is now complete. It is a convenient size, and can be easily taken out through an ordinary door, and when it comes to moving, there will be no necessity to leave it behind, or knock it to pieces to get it out of the shop.

(To be continued.)

DEVICE FOR FINDING CENTERS OF ROUND WORK.

BY F. D. SWEET.

This little device if carefully made will enable one to accurately determine the centers of round bars, disks, and in fact any object of a circular form. A piece of 3/16-inch square brass rod about eight inches long is bent to form approximately a right angle, both legs being of equal length. A strip of brass, *A*, about ⅜ inch wide and 1/16 inch thick is soldered to the ends of the legs. Equidistant between points *X Y* make a mark *b*. Another brass strip *B* of same size as *A* is soldered in place as shown, being careful to have edge *C* exactly on the line *b* and over the angle *D*. Fig. 2 shows method of using the device. Simply place it on the end of the bar or shaft; make a mark with scratch awl; give a quarter turn, and make another mark. The intersection of the lines will give the exact center.



DEVICE FOR FINDING CENTERS OF ROUND WORK.