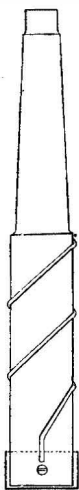


to last longer and cut better than the die treated in the usual way.

A 2 3/4-inch hole was bored through a disk of glass 12 inches in diameter as follows: It was intended to use a piece of brass or copper tubing 2 3/4 inches in diameter on the outside, but there being no tubing of that size at hand, a wooden plug 1 13/16 inches diameter and 4 inches long was turned up, and a piece of 1/16-inch sheet copper was bent around the plug and fastened so that the copper projected over the end about 3/16 inch. The shank of a broken bit was flattened out and driven into the plug. Through a board 16 inches long and 3/4 inch thick a hole was bored just large enough to permit the plug to turn in it; the glass was then fastened to the board concentric with the hole. With No. 60 emery and turpentine the hole was cut, using the board as a guide for the plug, and a brace to turn it. This worked fairly well, but with dry emery better progress was made. Care was taken not to bear down hard, nor to turn fast, for fear of generating too much heat. The plate was cut through in twenty minutes.

How to Clean a Hole While Boring

When boring a hole, the cuttings frequently clog around the bar and cause it to cut large, especially when the bar is nearly as large as the whole. The cuttings fall to the bottom of hole, and jam against the bar. The difficulty can be overcome by winding a piece of copper around the bar spirally as shown. Of course, the wire is to be wound in a right or left-hand spiral, according to the direction in which the bar is to run.



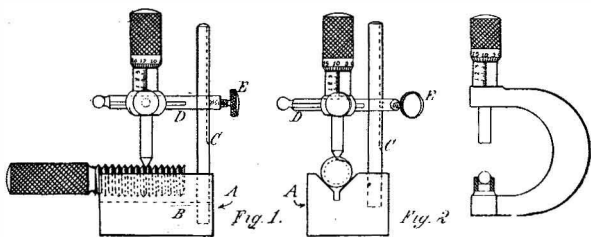
After the coil is wrapped around the boring bar, a little solder is dropped on the wire at intervals of one inch along the spiral, so as to prevent the wire from coming off. In use the wire will convey the chips from the bottom of the hole to the top. A bar fixed in this way will be found very handy for boring blind holes.

Handy Micrometer Tools

By H. D. Chapman

I have found the tool shown here in Fig. 1 of great service when measuring the depth and angles of threads. As I have not seen anything like that in any of the mechanical magazines, it has occurred to me it may be of some service to our friends interested in the gage line.

A V-block A is made of machine steel and ground to 45 degrees. A hole B is drilled in one side of the V-block, and into it is driven the rod C. A cross rod D, which carries the micrometer barrel, has a hole drilled in one end, affording a sliding fit on the rod C. A keyway is cut in rod C, so that stop screw E will keep the micrometer in the center of the V-block. When this tool is to be used, we will say to measure a 3/4-inch thread gage, the micrometer is adjusted to the zero line, and a 3/4-inch plug is laid in the V-block, and the cross rod D is dropped down until the point of the micrometer touches the gage. Then the thread gage is put in the V-block and the micrometer is screwed



Handy micrometer tools

down until it touches the bottom of the thread, as shown in Fig. 1. The micrometer is adjusted to suit the depth of thread, depending upon whatever kind of screw gage is to be made.

Fig. 2 shows a simple tool for measuring radial work. In using the ordinary micrometer for measuring radial work, it is hard to get the right measurement, as the anvil of the micrometer lies square across its face, and this prevents the anvil of the micrometer from seating itself in the arc of a radius, making it impossible to get the exact size of a job. The drawing shows the way in which a ball bearing can be used. Take a small piece of brass, about 5/16 inch in diameter and drill a 1/4-inch hole through it. The 1/4-inch hole is just the size of the anvil of the micrometer. This bushing is slipped over the anvil, which is to be a neat sliding fit. The ball is dropped into the other end, and the top of the bushing is slightly closed, which keeps the ball from dropping out. This will make a handy tool for such work; as I have been using one now for about two years and would not want to do without it.

How to Compute the Velocity of a Bullet

By Frederick B. Gilbert

The velocity of a rifle bullet is found by means of a large wooden pendulum, against which the bullet is fired, and the displacement of the pendulum measured. The pendulum, as illustrated, consists of a block of wood about 8 x 12 x 12 inches, from the middle of one side of which a long board, say 4 inches x 3 feet, projects horizontally. If the rifle to be used is a heavy one, it may be advisable to insert a block of iron in the wood,

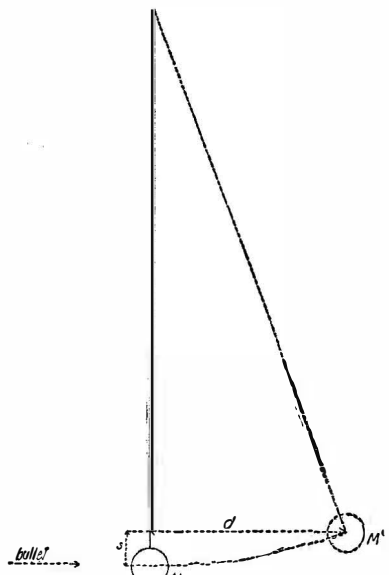


Diagram showing the vertical lift!

to prevent the bullet from passing all the way through. About in the middle of the board is attached a lug, which presses against a slider on a scale. The block and the bar are suspended as shown in the figure by two fine wires, which loop through hooks and are fastened to the ceiling or a support, allowing about one foot between the two lengths of each wire, to prevent a lateral movement of the pendulum.

Before setting up the apparatus, the pendulum and the bullet must first be carefully weighed. Then the pendulum being suspended so that it is horizontal, the vertical length of the wires must be measured. The slider and the scale are placed underneath, so that the slider is just in contact with the lug, and the reading on the scale noted.

In placing the gun in position, care should be taken to see that it is at a sufficient distance away from the pendulum to keep the sudden rush of gases which follow the bullet from acting on the face of the block. The bullet must strike directly in the middle of the block, and the axes of the gun and of the pendulum must be parallel. Fire the gun several times, observing the displacement of the slider each time, and finally averaging the results.

Before computing the velocity from the data, let us first consider what has happened. The bullet with a mass, m , moving with a velocity, v , strikes the pendulum, and burying itself in it, causes it to move with it as one body. By the law for momentum, the momentum of the bullet is equal to the product of its mass and velocity, mv , and the momentum of the pendulum is equal to the product of its mass, M , plus the mass of the bullet, m , and the velocity of the pendulum V , i. e. $(m + M)V$. Now, according to the principle of the Conservation of Momentum,

$$(M + m)V = mv,$$

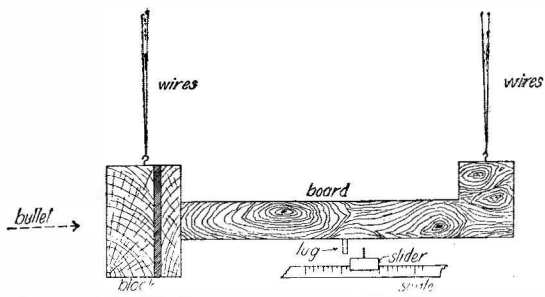
that is, the two momentums are equal.

$$V(M + m)$$

$$\text{Transposing, } v = \frac{V(M + m)}{m} \quad (1)$$

From this equation we are able to calculate v if we can find V , M , and m . We know M and m already, it but remains to find V .

This may be determined by a consideration of the diagram. The distance s , through which the pendulum



Block and slider for measuring the displacement of pendulum

risks, is the same as if the velocity V were vertically upward. Hence we may use the familiar formula

$$V = \sqrt{2gs} \quad (2)$$

g being the acceleration of gravity, or 32.2 feet per second, or 980 centimeters per second. The value of s , as may readily be seen from the figure, is determined by the formula

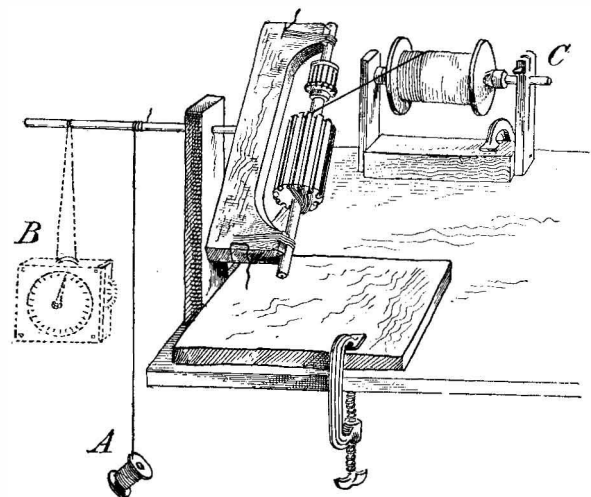
$$s = l - \sqrt{l^2 - d^2} \quad (3)$$

l being the vertical length of the wires measured, and d the displacement of the slider. Solving formula (2) for V , and substituting the proper values in (1), the velocity is determined in feet or centimeters per second. Care should be taken to employ the same units of measure throughout.

Suggestions for Rewinding Armatures

By A. F. Bishop

A swivel holder for rewinding magneto armatures may be made as follows: Saw out a yoke-shaped piece of wood 3/4 inch thick, and long enough to carry the armature, as in the illustration. Cut a half-round groove in each end for the armature shaft to rest in. Make two saw cuts in each end of the yoke to receive the string with which the armature is bound to the yoke. A small 1/4-inch rod is driven into the center of the yoke. This journal fits tightly in the hole of an upright piece that is fastened to the base. It is necessary to have an indicator to register the number of turns of wire when winding an armature. A piece of thread attached to the yoke journal, and allowed to wind as the armature revolves, is a simple method of



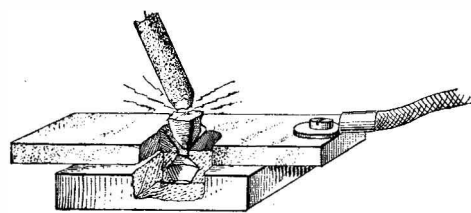
Swivel holder for rewinding magneto armatures

keeping count. But if one is to wind several armatures, it is better to rig something a little better, which is made by taking the works of an old clock, attaching a paper dial and pointer, and revolving this by means of a very small cord or belt, which should run over a small pulley on the escapement wheel shaft, as shown by dotted lines in the drawing. The reel for holding the wire, which should have a resistance on its centers to give a good tension on the wire, is easily arranged as indicated in the illustration.

Casts Made with the Electric Arc

By G. Worts

Owing to the great amount of heat that is developed in any form of the electric arc, it has been commercially adapted for a number of devices where excessive heat is necessary. In cutting metals in manufacturing silicon and such products, it is found invaluable. A method is suggested below for making small casts in which the electric arc is used as the heat source. Casts in brass, zinc, aluminium, silver, gold, etc., can be



Making a cast with the electric arc

made. Preparations for the casting should be made in the ordinary manner. Form the mold of sand or plaster as advisable, and then over the pour hole place a tablet or slab of carbon about 1/4 inch thick. This should have a round tapering hole, the small end of which opens above the pour hole of the mold. A terminal should be bolted to one side of the carbon slab and lead to the current source through a series of heavy resistances. The carbon slab comprises one electrode of the arc, the other being a 3/4-inch hard round carbon fitted with a fiber or wood handle.

A small block of the metal to be melted is placed in the depression of the carbon surface, and touched by the other electrode to form an arc. The metal will flow into the mold quickly, dependent on the amount of current supplied to the arc. Casts obtained by this method are very smooth and regular. It is necessary to wear a hood fitted with dense blue lenses, or the fumes and dazzling light will prove detrimental to the operator's lungs and eyesight.