slider S is moved to the right the speed will rise from normal; while, if the fast-slow switch is thrown on "Slow," the same sliding operation will cause the speed to drop continuously from normal to zero. To stop the motor this switch is opened and, to stop the current through the potential divider, K is opened.

Somewhat unusual conditions occur when continuous running at or close to normal speeds or when finer gradation in regulation is required. For the first case K may be left open to reduce waste in heat, while, in the second, L is opened and a low resistance rheostat is inserted as shown by the dotted lines.

Figure 2, drawn from a photograph, shows an ex-

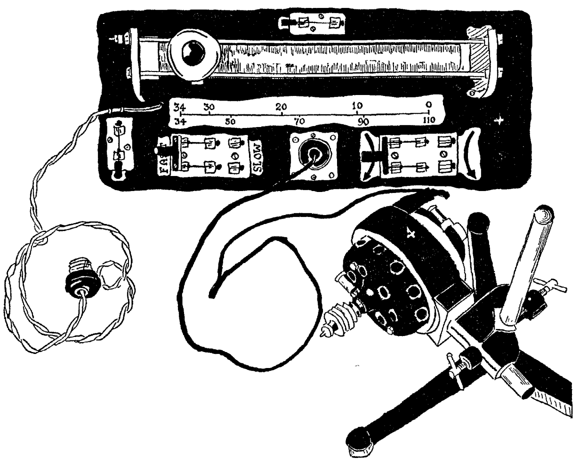

FIG. 2. Specimen assembly.

ample of a set-up where a $\frac{1}{8}$ H.P. motor is adapted for mounting in a clamp stand in a number of positions. The switches at the top and the left of the diagram are the L and K switches of Fig. 1, respectively. The remainder is self-explanatory, except perhaps for the scale. This, while little used, shows the speeds corresponding to positions of the slider and brings out, incidentally, their approximately linear relationship. The normal speed in this motor is shown as 34 revolutions per second. The effective range in speeds is from about 1 or 2 r.p.s. to around 100 r.p.s., depending upon the load. The resistance of the potential divider may be anything from 50 to 200 ohms. Two hundred ohms wastes less in heat (about 50 watts) than 50 ohms (about 200 watts), but it is better not to go much over 200 ohms, for that would probably cut down the power output of the motor to an undesirable extent. The head shown on the shaft consists of a cone of small pulleys ended off with a washer and clamp screw for mounting disks, extra pulleys, drums and the like. On the tip is soldered a small wire loop for hanging objects to be spun vertically. Direct coupling to various apparatus is effected by short lengths of rubber tubing.

In equipping our laboratory with small motors, the same size of shaft ($\frac{1}{2}$ inch) has been adhered to for the sake of interchangeability. This is easily done from the lists of dealers in second-hand "rebuilt" electrical machinery. The control boards are also interchangeable, although that is of secondary importance. The method has been applied to the $\frac{1}{2}$ H.P. size, but in the larger sizes one would have to consider the power loss. The $\frac{1}{8}$ H.P. size is most frequently employed, although a number of $\frac{1}{4}$ H.P. motors are in use. A variant on the principle is to divide the potential at the source, say, in the case of storage batteries where the intermediate potentials may be tapped off or in a 3-wire system) where both 220 and 110 volts are available. There is an advantage to be gained (not shown in Fig. 2) in the employment of a rheostat provided with a slow motion drive for the slider.

Some of the disadvantages of this design are obviously its limitation to D. C. supply, reduction in the full power output and the heat loss in the potential divider, the last named being trifling for the small sizes. On the other hand, some of its advantages are flexibility, freedom from change-speed accessories, such as gears or intermediate pulleys, and its practically fool-proof characteristic. The main precaution is to avoid stalling the armature too long, especially in the high-speed ranges. Only one motor, however, has been burned out, and that was due to this cause, although these motors have been handled by hundreds of students and others over a period of more than twelve years. I am indebted to Mr. John C. Wyllie, of the University Library, for the sketch of Fig. 2.

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