A COMPACT VACUUM GAUGE FOR MEASURING PRESSURES RANGING FROM .2 MM DOWN TO .0001 MM OF MERCURY

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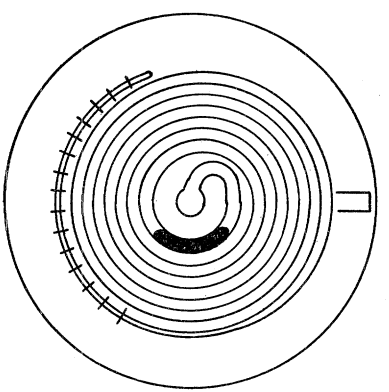
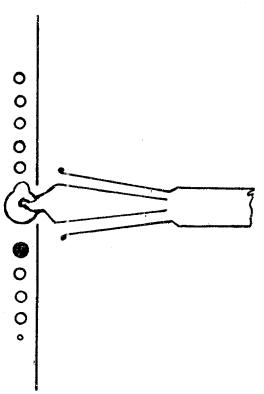
Vacuum gauges are necessary equipment in a modern vacuum laboratory. This equipment is made necessary by the ever increasing use of vacuum devices, not only in research and in the industries, but also in the home. The perfection of the mercury vapor vacuum pump is also an important factor.

Vacuum gauges measure the pressure within an evacuated system in terms of mm of mercury. There are numerous types. Some are absolute in that their readings are deducible directly from a knowledge of Boyle's law, and others must be calibrated by reference to a known standard. The most commonly used of the former type is the well known McLeod gauge. This is the only one that will be referred to in this brief note.

The McLeod gauge (when constructed for the measurement of very high vacua) requires about 20 pounds of mercury for its operation. This in itself is quite an item of expense.

The principle of this gauge is that a known volume of air (say 1 liter) is compressed into an exceedingly small volume of a few cubic millimeters and the corresponding pressure required to do this is read. From the two volumes and the pressure the actual pressure of the gas in the evacuated system is deduced in mm of mercury as previously stated. This gauge not only requires much mercury but is ungainly in shape, heavy to handle, and easily broken.





—Courtesy University of Illinois.

FIG. 1 (Left).—Front elevation

FIG. 2 (Right).—Side elevation.

A suggestion for a modified form of McLeod gauge is as follows: This takes the form of a flat spiral of glass tubing of about 1 cm internal diameter. A front elevation is shown in Fig. 1 and a side elevation in Fig. 2. The outer end of the spiral for about one-half turn is drawn out in a decreasing

diametered capillary as shown in Fig. 1. The spiral at the center terminates in a bulb which in turn is fused to an axial tube at right angles to the plane of the spiral.

This axis (and with it the spiral) turns in the ground joint shown in Fig. 2. This gauge requires but 8 to 10 cu. cm of mercury for its operation. The mercury, to begin with, is placed in the central bulb. This gauge must be calibrated. When in use the gauge is fused to the system with the ground joint horizontal. The spiral is then turned until the mercury all runs into the central bulb. In this position the vacuum connection between the spiral and the rest of the system is open. The system is now pumped out to any degree of exhaustion desired. To read the gauge it is only necessary to turn the spiral counter-clockwise (facing Fig. 1). The mercury as the turning proceeds will drop into the spiral as shown in the figure and travel along it forcing the trapped gas ahead of it ultimately compressing it in the capillary end of the spiral. The slug of mercury becomes longer as it reaches the narrower portion of the spiral and finally the reading is given when the right hand end is brought even with the stop (shown to right), and the left end to some point on the graduated scale. A calibration curve gives the pressure in mm of mercury.

Having taken the reading the spiral is now turned in the opposite direction (clockwise) depositing the mercury again in the center. Considerable care must be taken in the operation of the gauge since it too is made of glass. If the mercury is always returned to the central bulb *before* opening the stopcocks, or starting the pump, all will go well. Another manipulation difficulty may be with the ground joint. To prevent this from running dry it should be made long, very long (3 inches), and truly ground. This gauge is compact, requires but little mercury, and will give good service in the hands of a careful worker. Its range is from about .2 mm down to .0001 mm of mercury.