A COMMERCIALY AVAILABLE, HIGHLY SENSITIVE CONTROL FOR POROUS-PLATE APPARATUS

The porous-plate apparatus described by Richards and Fireman (6), and Richards (4,5) is now standard equipment in many laboratories. Considerable error can be introduced into measurements with this apparatus if air pressure is not controlled accurately. Several techniques have been suggested for pressure control. Richards and Fireman (6), Jamison et al. (3), Wilcox (7), and Richards (4,5) have used liquid-filled control towers for this purpose. Blake and Corey (1) used two commercially available diaphragm pressure regulators in series. Hanks et al. (2) subjected both of these types of pressure regulators to tests and found that neither controlled pressure with sufficient accuracy for use < 0.1 atm. A homemade float-valve regulator constructed by these workers performed satisfactorily at all pressures, but was neither as simple nor as economical to build as the other regulators.

The pressure regulator described here can be assembled from commercially available components in < 1 hour, is simple to operate, and is easily capable of controlling pressure to within ±0.001 atm. It consists essentially of a Thermocap-relay which senses the level of the liquid in a manometer tube, opening a solenoid valve in the air inlet line whenever the liquid level drops below a desired point. The Thermocap relay senses differences in electrical capacitance between its case and a sensing element attached to an electrode mounted at the rear of the instrument. In this particular case, this sensing element is simply a length of bare copper wire attached to this electrode and twisted around the manometer tube at the level at which the top of the liquid is to be controlled. The instrument can be adjusted so that the capacitance change occurring when the liquid enters the sensing loop is sufficient to activate a relay switch within the instrument. This relay controls the solenoid valve.

Either a normally open or normally closed solenoid valve can be used since by means of a selector switch one can choose to have the relay switch controlling the valve either open or closed as the liquid enters the sensing loop. The Thermocap-relay operates on 110 volts and internal wiring provides 110 volts to the relay switch.

By following simple directions provided with the Thermocap-relay, and by proper adjustment of a needle valve placed in the air inlet line just ahead of the solenoid valve, the level of a water or mercury column can be controlled to within ±1 mm. The needle valve acts as a throttle to prevent sudden surges in pressure when the solenoid opens. To change the pressure of the system, the wire loop is merely slipped to a new position on the manometer tube.

As a result of its feed-back type control, the apparatus is stable under almost all conditions. An important consideration for low pressure control is its insensitivity to changes in atmospheric pressure. Since the manometer fluid is always maintained at a specific height, pressure across the porous-plate is maintained constant regardless of atmospheric pressure.

This device has been used for vacuum regulation with equal success. The only modification is that the vacuum line is attached to the low pressure side of the manometer. The Thermocap-relay also has many other uses in a research laboratory, some of which are described in its accompanying instructions. This versatility helps justify its purchase even where the porous-plate is used only rarely. The simple, trouble-free operation of the Thermocap makes it a desirable pressure regulator for porous-plate apparatus even where high precision is not needed.—


LITERATURE CITED