Westinghouse

Contact-Making Pressure Manometer

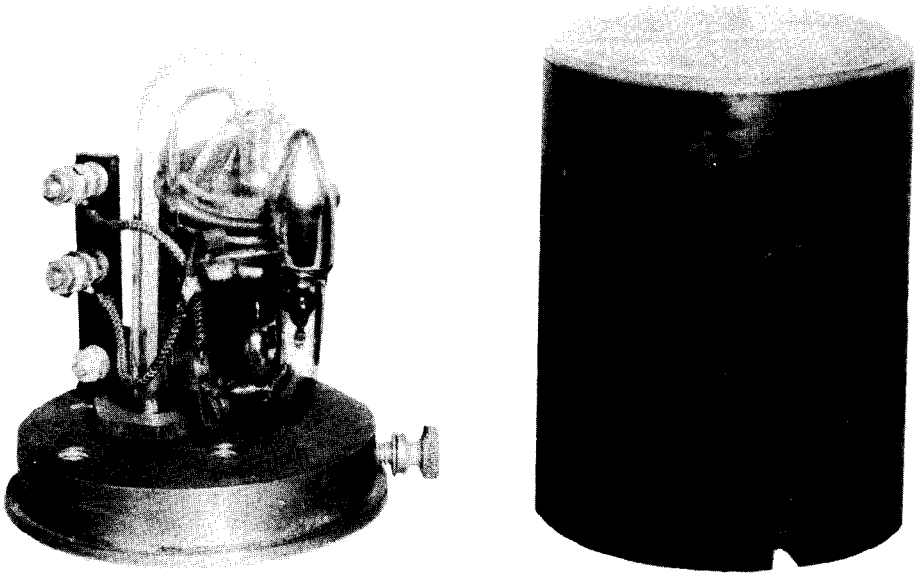

FIG. 1 – CONTACT MAKING PRESSURE MANOMETER

GENERAL

The contact making manometer functions from the pressure in the vessel to which it is connected and is designed to make and break an electrical contact. It is designed specifically to operate in conjunction with the rectifier vacuum system, and is used to provide intermittent operation of the rotary pump. The assembly is shown in Fig. 1 and cross section in Fig. 2.

PRINCIPLE OF OPERATION

The construction of the manometer bulb, as shown in Fig. 2 below, consists of a closed small bulb connecting, through an inverted U-tube, with a larger bulb which is further connected to the volume from which the manometer is to be operated. The connecting tube projects into the closed bulb forming an annular pool. A sealed-in lead connects with the pool and another with the connecting tube. The small bulb is thoroughly evacuated and filled with mercury. The amount of mercury is such that, with the manometer in a vertical position, and the level of mercury in the small tube at the rim of the projecting tube, the mercury in the large bulb is at nearly the same level.

Since there is practically zero pressure in the small tube, the difference in levels of the mercury in the small and large bulbs is a

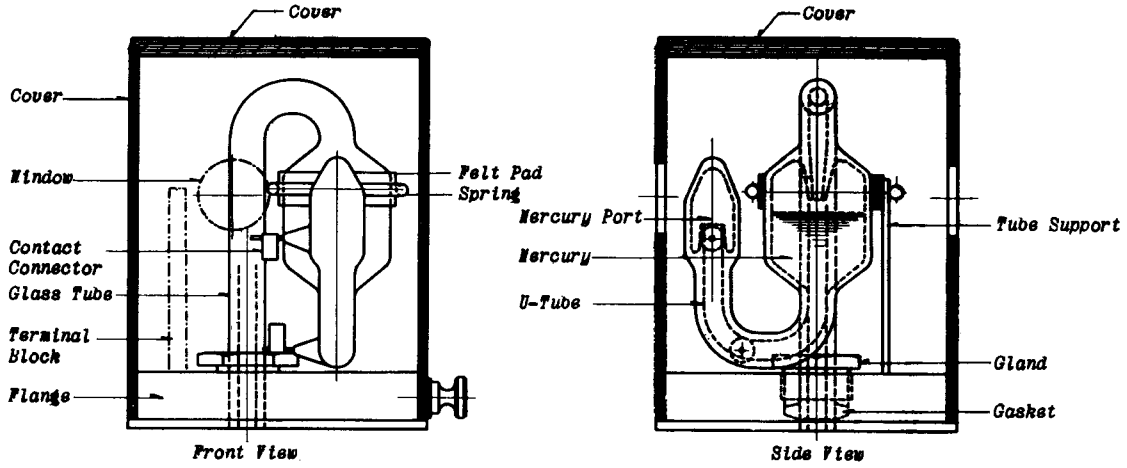

FIG. 2 – FRONT AND SIDE CROSS SECTION VIEWS OF CONTACT MAKING PRESSURE MANOMETER

measure of the pressure in the large bulb and in the reservoir to which it is connected. When the pressure is reduced so that the mercury in the small bulb drops below the rim of the projecting tube the mercury connection between the contacts is broken. As the column rises again to that point the mercury connects and the contact is made. Due to the surface tension of mercury the "make" and "break" are rapid, and the difference of pressure between "make" and "break" is of the order of 3 to 4 millimeters.

The connection tube is vacuum-sealed to the steel connection flange with a rubber gasket compressed with a gland nut as shown in Fig. 2.

MAINTENANCE

If a leak appears at one of the seal-in conductors admitting air into the small bulb, or a crack in any part of the glass, a new glass bulb must be installed.

If a leak appears at the gland this may be corrected by tightening the gland nut, or by dismantling gland and renewing gasket.

If air is admitted into the small bulb, either through a leak or through improper handling, the calibration of the manometer will be affected. If this is suspected the contacts of the manometer should be shorted - at the terminal post - and the rotary pump caused to operate several minutes. If the pump is in satisfactory condition and air exists in the small bulb the mercury level in this bulb will drop lower in the tube, and below that in the large bulb. Air in the small tube is quite evident after atmospheric pressure has been admitted to the large tube. In this case, the bulb must be thoroughly evacuated. In removing the manometer from a reservoir which is under vacuum, care should be taken to admit air gradually, as a sudden rise in pressure might drive mercury into the small tube with sufficient force to rupture the glass. Air may be admitted by loosening the flange bolts, inserting a screw driver between the flanges and separating them slowly.

INSTALLING MANOMETER

When it is necessary to replace the manometer bulb, a factory sealed-off manometer should be installed. The advantages of a sealed-off manometer is that mercury cannot be lost during shipment and if properly installed, there is no need for further evacuation and calibration.

To install a sealed-off manometer, first slip the gland nut, washer and gasket on the straight end of the glass tube. Then insert the tube into the flange. Adjust the felt and spring around the larger diameter of the bulb to hold the manometer against the tube support. Then adjust the tube in the flange so that the position of decreasing diameter of the tube (i.e. the first decrease in diameter of the tube beginning at the large bulb and moving toward the sealed-off end) is even with the gasket seat on the under side of the flange. Tighten the gland nut to form a vacuum seal between the flange and glass tube.

NOTE: If the straight portion of the tube does not extend past the seal, the rubber gasket will flow through the bottom flange opening, causing a leak around the tube.

After the manometer is adjusted and tightened, scratch a file mark on the tube approximately around 1/4 of its circumference and as near the lower side of the flange gasket seat as possible. This mark can be made with a small triangular file. Tilt the manometer in such a manner that the small bulb is completely filled with mercury. All the mercury in the manometer should be in the small bulb, the connecting tube between the large and small bulb and in the large bulb. No mercury should be in the tube that leads from the large bulb to the flange.

Then pull and bend the portion of glass below the flange. The glass will snap off evenly at the file mark.

Turn the manometer so that the flange is horizontal, being careful to maintain the manometer in such a position that air cannot get into the small bulb.

NOTE: Care should be taken to see that the tube is broken so that sufficient clearance is maintained between the broken end of the tube and the interstage reservoir flange when the two flanges are bolted together.

EVACUATION

At times it may be necessary to fill and evacuate a manometer in the field. If so, the following procedure should be carried out. First pour in the amount of mercury marked on the glass - it will be approximately 19 cc. - and connect with a flexible vacuum hose connection to a source of nearly perfect vacuum. A convenient source is a rectifier with vacuum system in operation. If this is used, close the spigot valve to the gauges, remove hot-wire gauge, connect flexible connection from the manometer and open the valve. Of course, rubber vacuum gaskets must be used throughout.

When the connections are made, tilt the manometer so that the passage into the small bulb is clear and allow to evacuate for four hours. Then tilt the manometer so that the small bulb completely fills with mercury, (see method of admitting air to sealed-off manometer) close the spigot valve and remove the connection, being careful to admit air slowly.

CALIBRATION

Due to variations in the glass dimensions the amount of mercury required varies, and the correct amount is marked on each glass. In filling, it is better to use too little than too much as it is much easier to add than to remove. With the correct amount, the contact will "make" at from 5 to 6 mm. and "break" at 2 mm. If the "make" pressure is too high, the "break" pressure will also be too high, and there is too little mercury. By careful movements of the manometer, mercury may be added through the flange without admitting air into the small bulb. Care should be exercised not to add too much as it is difficult to remove, practically impossible without admitting air to the small bulb. If the "make" and "break" pressures are too low the rotary pump will not be able to reach the "break" point, it will operate continuously and some mercury must be removed.

The operation of the manometer should be checked periodically in conjunction with the rotary pump, by shorting the contacts to determine if the rotary pump will lower the mercury in the projecting tube by an appreciable amount.

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