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A simple sensitive mercury manometer

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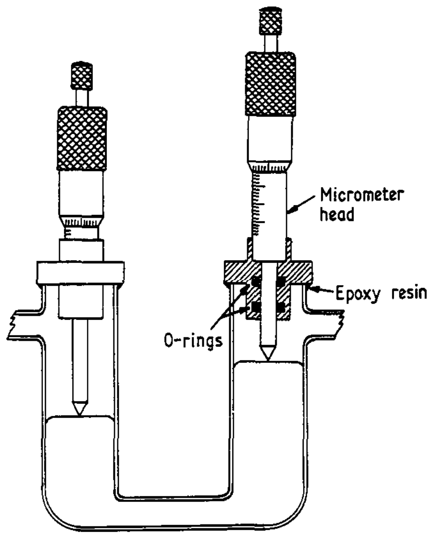
Abstract. A dual micrometer manometer is described in which the mercury height is determined by observing the coincidence of the micrometer point with its reflection in the mercury surface.

In vacuum work the mercury manometer is often rejected in favour of the oil manometer when high sensitivity is needed, but the latter has serious outgassing disadvantages and is normally a sluggish device. Use of a microscope cathetometer to increase the sensitivity of the former usually causes considerable difficulty in illuminating the surface to obtain consistent results, as well as having other disadvantages noted by Meyer and Wade (1962). They have overcome these disadvantages by an ingenious but somewhat complicated device which consists of a micrometer in one arm of the manometer and a heating device, involving an electronic relay, to maintain the other arm at a constant height. Contact of the micrometer point with the mercury surface is determined by another electronic relay.

Their manometer may be considerably simplified if a micrometer is placed in each arm of the U-tube. Instead of determining contact electronically, it may be determined with surprising accuracy simply by observing by eye the coincidence of the point on the micrometer spindle with its reflection in the mercury surface. A jeweller's eyeglass facilitates the operation. Readings repeating to 10^{-2} mm have been made regularly, an accuracy which is nearly as good as that claimed for the Meyer–Wade instrument. The range depends on the length of travel of the micrometer heads used; these were Moore and Wright type No. 897B, which have half-inch travel and are calibrated to 10^{-4} in.

The drawing shows the essentials of the device. The micrometer heads were fastened to the U-tube with a suitable epoxy resin, and the use of a pair of O-rings to seal the micrometer spindle, as described by Meyer and Wade, was found satisfactory. Care is needed to ensure that the two spindles are accurately parallel if the device is intended for absolute work. A wide bore U-tube (> approx. 25 mm) is necessary to ensure that capillary depression is essentially the same in each side, since meniscus height is not measured. The effects of vibration on the mercury surface, due perhaps to a nearby backing pump, can be a serious disadvantage, and a vibration-free support is necessary.



Dual micrometer manometer. The position of contact is determined by observing the coincidence of the micrometer point with its reflection in the mercury surface.

Reference readings are taken at the beginning and end of the experiment with both arms at the same pressure. If there is any possibility of a change in instrument level during a protracted experiment when it is not possible to take reference readings, then a second device, attached to the manometer and identical to it, but with both arms open to the atmosphere, would enable level changes to be measured.

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