galvanometer. The sensitivity of the instrument depends largely upon the galvanometer. For measuring to one tenth millivolt the writer has found adequate a galvanometer with a sensitivity of 0.01 micro ampere per millimeter. In use, the grid is grounded, and the plate resistance adjusted until the galvanometer reads zero. The grid is then connected to the circuit under test and the potentiometer adjusted until the galvanometer again reads zero. The potentiometer reading, of course, gives the E.M.F. and polarity of the test circuit.

Some of the earlier papers upon glass electrode circuits lay unnecessary emphasis upon insulation difficulties. Only ordinary care need be used except in the grid circuit of the tube. The potentiometer reversing switch is in the low resistance portion of the grid circuit and may be of almost any material and may be outside the shield with the potentiometer. In the high resistance part of the grid circuit extraordinary care must be taken that there are no insulation leaks to shunt the tube. The wire leading from the glass electrode to the grid should be shielded (a flexible copper shielded wire has been found excellent) and the single pole double throw switch for grounding or charging the grid should be the best available. The writer used a telephone "anti-capacity" switch, in which the manufacturer's black bakelite mounting was replaced by transparent bakelite, which was used also for the roller. It was found necessary to bake this transparent bakelite for two days at 115° C. in order to make its insulation good enough. Amber might, of course, be used but is more expensive. The handle of this switch was grounded in order to avoid any body charge from the operator. When glass electrodes of extremely high resistance are used, there is an initial deflection of the galvanometer on closing the switch, due to the capacity of the test circuit. The charge due to this capacity difference leaks off in a few seconds. The 400 ohm shunt resistance for the galvanometer reduces the initial deflection, and the shunt is then opened to secure full sensitivity.

The shield for the external circuit was a cage of ¼ inch mesh iron wire, which was found adequate. Inside the iron cage, the electrodes and other apparatus were held in iron clamps attached to ½ inch bakelite rods screwed into laboratory tripods. No special treatment was needed for the bakelite rods if the clamps holding the electrodes were as much as six inches apart. The bakelite rods were occasionally cleaned with alcohol and ether. In general, greater care should be taken with the insulation and shielding of the grid circuit than with an electrometer circuit, since this is a more sensitive instrument. This vacuum tube circuit is cheaper and more portable than the Compton electrometer. The Lindeman electrometer, which is portable, has the disadvantage of a low sensitivity, and must be read with a microscope. For those unaccustomed to the use of vacuum tube amplifiers, the small amount of time required to master this simple circuit will be more than compensated for by its superiority to any other method of measuring potentials in high resistance circuits.

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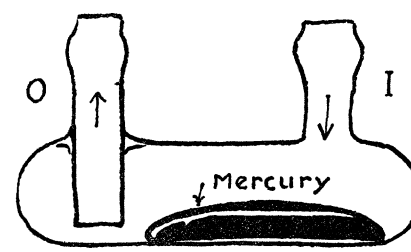
A TILTING STOPCOCK

I HAVE made and used for some time a simple stopcock which corresponds exactly to the convenient mercury switch for electric current, and which can be used in the same way for cutting positively a flow of gas under small pressure, without any danger of leak and without friction. It can be mounted like the mercury switch, that is, well balanced on a light axis, so that the slightest effort will cut off the supply of one or more Bunsen burners. I found it a great help



whenever automatic regulation of gas supply was needed. The accompanying sketch will make its construction and functioning clear. One must always connect the tubes in such a way as to have the gas enter the stopcock through inlet I. As soon as the stopcock is tilted, the mercury obstructs the outlet O, and the flow is cut off. On coming back to horizontal position, the gas resumes its flow.

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SPECIAL ARTICLES

A MOTTLED-EYED DROSOPHILA

EARLY last December a gray red-eyed female fly was found that had notched wings and an area of white facets covering the lower fourth of the left eye. The fly appeared in the F_1 generation from a cross of a treated Theta male to an untreated female