sented but they will be published either in full or by abstract in the "Proceedings" of the academy. This year the academy's evening lecture was in the field of psychology, Dr. L. L. Thurstone being the speaker on the subject, "The Measurement of Social Attitudes." Dr. Thurstone also spoke to the psychologists assembled at dinner on the subject, "Modern Psychophysics."

JOSEPH C. GILMAN,
Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW HYDROGEN ELECTRODE AND APPARATUS FOR THE DETERMINATION OF pH

IT is known that, in order to measure the pH of liquids containing CO_2 in solution, such as blood, serum, tyrode solution, etc., it is necessary to prevent the escape of CO_2 which would result in an erroneous reading. Furthermore, Hasselbach and Clark have shown that it was necessary, in order to obtain reliable and stable measurements, to keep the platinized-platinum electrode successively in contact with the liquid and with the atmosphere of hydrogen. This is obtained, in the well known Clark's electrode, by shaking the vessel by means of an electric motor. This method can be considered as standard and yields excellent results. However, it requires rather large quantities of serum or blood (6 cc), and the time necessary to reach the equilibrium is long. Besides, the apparatus, entirely made of glass, incorporates four glass stopcocks, rubber tubing, clamp, and does not lend itself to an easy temperature control.

We have recently worked out an hydrogen electrode in which the equilibrium is reached in about one minute, for ordinary solutions, with less than one cc of liquid. The principle is different from that of Clark's electrode as it is based on the permanent rotation of a tilted electrode in the shape of a disk, one half of which dips in the liquid, the other half being in the hydrogen. During its rotation, a thin layer of liquid carried by the disk is constantly brought in contact with H_2 and, as the rate of rotation may be as high as 500 revolutions a minute, the saturation takes place in a very short time. The readings are taken while the electrode is in motion, and are very constant. It is useless to say that all sorts of shapes can be used for the platinum electrode: spiral, screw propeller, etc. Of course, a proper technique is used to fill the cup with the serum and introduce H_2 with the minimum possible loss of CO_2. (Fig. 1). Practically, a glass syringe is used: the platinum disk is fixed to the piston, and the liquid-liquid junction is established through a capillary tube. One or two hydrogen bubbles are sufficient.

In order to simplify the handling and to reduce the chances of breakage, we have the whole apparatus (hydrogen and calomel electrodes stand) made of metal (see Figs. 2 and 3), the only glass parts being

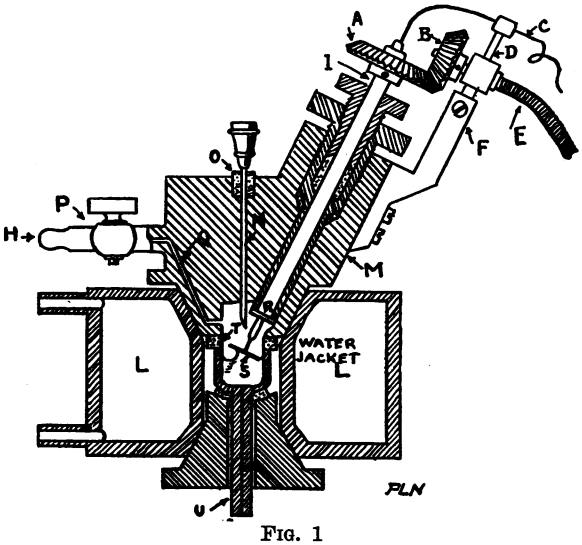

FIG. 1

the syringe and the calomel electrode. Both hydrogen and calomel electrodes are water-jacketed and may be taken apart in a few seconds. No glass stopcocks, nor expensive glass parts are used. No troublesome diffusion was observed in one hour.

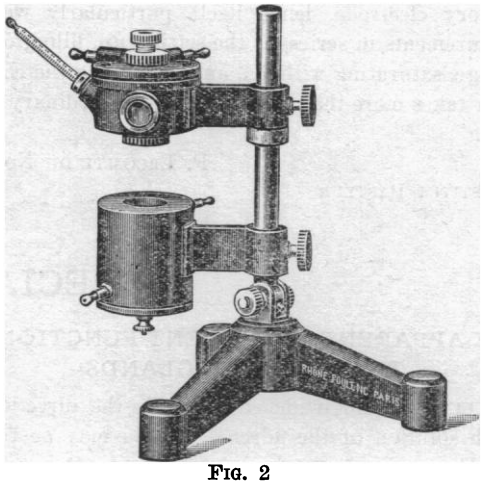

FIG. 2

When this instrument is used to determine the pH of ordinary solutions, the rotatory electrode is no longer absolutely necessary. It may then be replaced —and the change is done instantaneously—by a simple platinum tube, through which the hydrogen is allowed to bubble gently in the liquid. In this way,

the equilibrium is also attained in an amazingly short time, and the readings take place while the bubbling goes on.

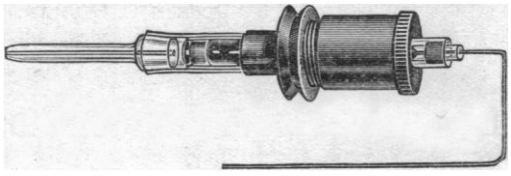

FIG. 3

As will be seen on the figure, the contact between the two half cells is established by raising the lower (calomel) cell until the capillary end of the syringe dips into the KCl.

The calomel element consists simply of a short test-tube, about 18 mm in diameter, with a platinum wire sealed at the bottom. When slipped in place in its water-jacketed stand, it rests on a rubber ring, the platinum wire touches a drop of mercury and the contact is established. The saturated cell may be replaced by others (Normal, 1/10th Normal), in two seconds.

Of course, the principle of the tilted rotatory electrode can be applied in different ways. For example, a simple model can be made by having the electrode and the vessel containing the liquid and H_2 connected through a rubber stopper, the whole being then rotated around its axis at such an angle that will allow the liquid to cover about one half of the electrode.

This apparatus, whether used with the simple tubular electrode for ordinary solutions, or with its tilted rotatory electrode, lends itself particularly well to measurements in series, as the setting up, filling of the syringe, saturating with H_2, and measuring the E.M.F. never takes more than five minutes with ordinary solutions.

P. LECOMTE DU NOÜY

INSTITUT PASTEUR

A METHOD OF RELACQUERING THE STEMS OF LIVINGSTON ATMOMETER BULBS[1]

IN the course of certain ecological work in the Hawaiian Islands, it was found that the lacquer on the stems of some Livingston atmometer bulbs began to peel off after about six months' service in the field, and the writer was requested to make repairs on these bulbs. The exact cause of this peeling was not determined, but it was believed to be due to over-liberal use of alcohol, used to sponge off the bulbs to prevent algal growth.

Attempts to relacquer with ordinary white shellac proved quite unsuccessful, but after several trials with various mixtures, the following proved very satisfactory.

To 100 cc of prepared white shellac (already dissolved in alcohol), add 30 to 35 cc of absolute alcohol, and shake. To this stock add 30 to 35 cc of fresh Canada Balsam (not the histologist's preparation dissolved in xylol, but the fresh liquid balsam as purchased from a druggist) and mix well.

The bulbs to be repaired are then thoroughly dried out, and all old lacquer removed from the stems with a razor blade. In effecting this removal some care must be used not to damage the surface of the stem more than necessary, since such abraded patches are very absorbent and difficult to relacquer.

The stems are then painted with a thin coat of the above mixture and allowed to dry in a warm room, but *not in an oven*, and when dry are given a second or even a third coat, until when dry, the whole stem has a shiny and polished appearance.

SUMMARY

A method of relacquering the stems of Livingston atmometer bulbs by the use of a mixture of white shellac and Canada Balsam is outlined, together with certain precautions to be observed in the process.

JOHN STANLEY

SPECIAL ARTICLES

THE APPARENT PREPOTENT FUNCTION OF THE ADRENAL GLANDS[1]

ACCUMULATING evidence indicates the direction in which solution of the adrenal enigma may be found. The Harvard school of workers led by Cannon have in the last decade delivered a veritable broadside of reports on medulliadrenal activities, and almost universal support of their findings has been forthcoming. Emergency functions which are subserved through medullary agency appear to be established.[2] Observations by Cori and his colleagues direct attention to the importance of carbohydrate changes wrought particularly through the influence of adrenalin.[3] Early work by one of us on the adrenal

[1] Reported *in extenso* at a meeting of the University of Virginia Medical Society, January 18, 1932.

[1] Published with the approval of the director as Miscellaneous Paper No. 12 of the Experiment Station of the Association of Hawaiian Pineapple Canners, University of Hawaii.

[2] W. B. Cannon, "Bodily Changes in Pain, Hunger, Fear, and Rage," 1929.

[3] C. F. Cori, *Physiol. Rev.*, 11: 143, 1931.