

AUTOMATIC POTENTIOMETRIC TITRATION APPARATUS.

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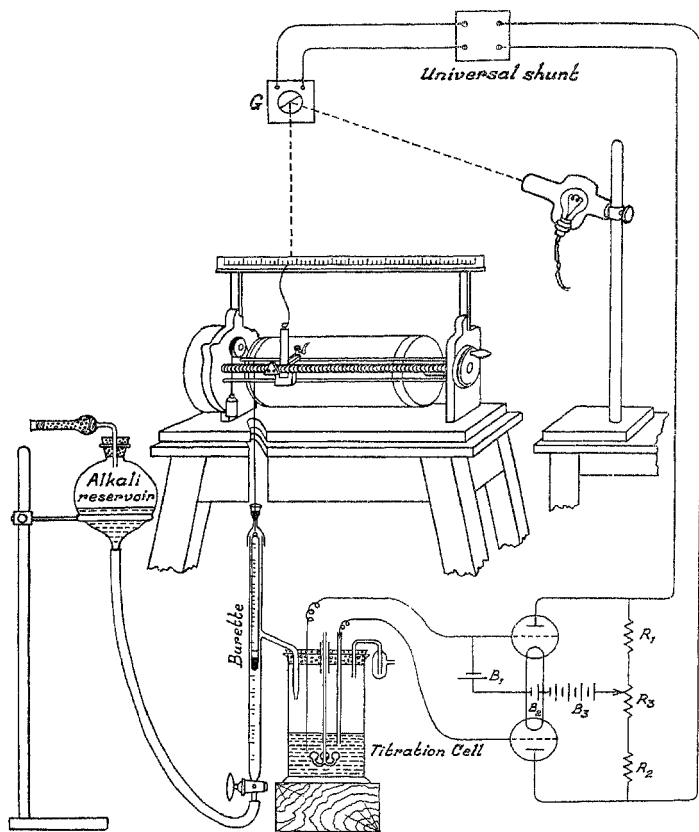
In view of the long time taken by electrometric titrations and the consequent tediousness of the operation, it is necessary to develop an automatically recording apparatus. In this investigation an automatic apparatus for recording the titration curves is described.

It is well known that if a pair of metallic electrodes is immersed in the solution under treatment, a certain E.M.F. is developed between the two, which when applied to a sensitive mirror galvanometer causes the deflection of the spot of light, the magnitude of which depends on the applied E.M.F. Such a system can be best used with a thermionic valve circuit, so that no current is drawn from the titration cell. It has been observed previously (*This Journal*, 1938, **21A**, 345) that an electrode system consisting of tungsten and silver is suitable for potentiometric work. This couple has been employed for the present apparatus. The obvious advantage of a suitable bimetallic system of electrodes over the hydrogen electrode is the rapidity in attaining equilibrium whereas the latter takes about two to three hours.

The arrangement of the apparatus is given in Fig. 1. The titration cell used was the same as the one used previously.

A glass tube 70 cm. long and 1.25 cm. inside diameter was used as a burette. The lower end of the tube was connected to the alkali reservoir and from the upper end, a glass sinker of uniform diameter weighted with mercury was introduced. A side tube was joined to the burette about 30 cm. from the lower end, which served as a delivery tube for the standard reagent. The top end of the sinker was attached to the drum of the recording device by No. 30 enamelled copper wire. This wire passed through a mercury seal attached to the top of the burette to exclude carbon dioxide from air. A mark was etched round the lower end of the sinker and the position of this mark was read on the scale attached to the burette.

A thermionic valve circuit with two P_2 valves in push pull, was used with a shunted mirror galvanometer as an indicating instrument. The electrodes were directly connected to the respective grids of the two valves and the current drawn from the titration cell was minimised.



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FIG. 1.

A Cambridge curve tracer was used as recording device. The drum of the curve tracer, while rotating, released the singer in the burette and displaced the standard alkali solution in the titration cell. The

E.M.F. between the two electrodes increased, which caused an increasing deflection of the galvanometer. The movement of the spot of light was followed by the pointer attached to the recording pen and the curve traced on the graph paper wrapped round the drum. The approach of the end point was marked by a sudden increase in the deflection of the galvanometer. The burette and the galvanometer readings were calibrated. The galvanometer deflection showed a linear relationship with applied E.M.F. and a successive unit movement (movement of one division of burette scale) displaced a fixed quantity (0.075 gram) of the solution.

In this manner 10 c.c. of N/10 HCl were titrated against standard alkali and the experiment was repeated three times. The graphs were recorded and found to be reproducible (Fig. 2). The quantity

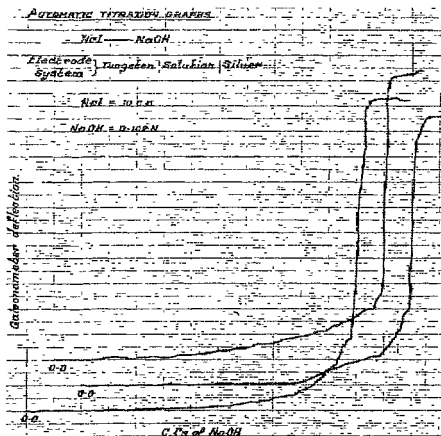


FIG. 2.

of the alkali required could be read off from the graph. The curves could also be photographed on a sensitive paper if desired. This method can also be easily extended to differential titrations described previously (*This Journal*, 1938, 21A, 363), with the addition of an automatic magnetic squeezer for the medicine dropper.

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