an end point. This is accomplished by alternately adding reagent to the respective cells and observing the cycle of galvanometer deflections.

Often the last two or three titrations to reach an end point can be observed more conveniently on the auxiliary galvanometer. The connections are made by means of the manual switch, thus eliminating the necessity of waiting for a complete rotation of the automatic switch before each galvanometer reading. When all cells have reached the end point, the burets are read, the second reference electrode is switched into the circuit by means of toggle switch *J*, and the entire procedure is repeated.

Adjacent sample cells—for example, 4 and 5—often require considerably different quantities of reagent to reach an end point. If the first cell should be far removed from the end point and the second one close, the oscillation of the galvanometer needle resulting from the violent deflection caused by cell 4 may be greater than the normal deflection that would be caused by cell 5. This situation can usually be anticipated and is taken care of by disconnecting the cell far removed from the end point, by shutting off the corresponding electrode switch, *C*, as will be indicated by the corresponding green light, *D*. When this is done, cell 4 will cause no galvanometer deflection when contact is made by the automatic switch, and the observation for cell 5 can be made without hindrance.

If several cells are involved, the same procedure can be used, in which case the switches, *C*, corresponding to the cells most distant from the end points are turned off just before the automatic switch would have connected them to the galvanometer.

In case a very complicated situation arises, one cell may be observed on the auxiliary galvanometer, some cells disconnected as described above, and others observed on the main galvanometer. By means of this flexibility in manipulation, the operator can make the necessary galvanometer observations without any great difficulty, regardless of the order in which the end points are reached.

In using the apparatus for other titrations, it might often be more practical to have the reagent added dropwise continuously from the burets, shutting off each titration when the end point was reached. Such a procedure is probably what would be expected normally, on the basis of the description of the apparatus, especially where the approximate amount of reagent cannot be anticipated. However, in the case of the fish titrations, where definite minimum titration values are always encountered, experience has shown that the procedure which has been described requires much less time for completing a series.

Applications

While the apparatus was designed especially for use with fish, there is no reason why it cannot be used for numerous other titrations. It is, of course, of chief value where a large number of similar titrations are being run frequently, and can best be adapted to titrations which are fairly well buffered at the end point. Some possible applications are to the determination of total acidity of various food products, free fatty acid determinations in oils, and many titrations where a color standard is used in titrating to a definite p_T value (Kolthoff and Furman, *2*). Other electrode systems than the quinhydrone can be used if a fairly stable e. m. f. is rapidly attained. By using the 2 reference electrodes, two different types of titrations can be run simultaneously.

It is also possible to make the apparatus completely automatic, so that the burets are shut off at the end point without manual switch manipulation. This can be done by substituting a controlling potentiometer of suitable sensitivity for the central galvanometer. The output of this potentiometer would have to be connected through the rotary automatic switch to the solenoids on the burets. However, such an arrangement would greatly complicate the apparatus and add considerably to the cost.

The total expenditure for parts for constructing the apparatus as described, including the automatic buret shut-offs but not the burets, stirrers, beaker supports, or electrodes, is about $175. A considerable portion of the equipment, such as the jeweled pilot lights, the step-down transformer for the lights, the toggle switches, etc., are standard radio parts, obtainable at most radio supply stores.

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CORRESPONDENCE

Standardization of 2,6-Dichlorophenolindophenol for Ascorbic Acid Titration

SIR: Two papers appeared simultaneously in the ANALYTICAL EDITION (*1*, *3*) purporting to disclose a new method for the standardization of the redox indicator 2,6-dichlorophenolindophenol. An editor's note draws attention to the coincidence that Menaker and Guerrant publish their "improved method" virtually at the same time as the "new method" of Buck and Ritchie, and states that "priority for the published disclosure must be given to Buck and Ritchie."

Actually, this method (wherein the indophenol is caused to oxidize potassium iodide to free iodine which is then titrated with thiosulfate) was published several years ago (*4*) and appears to have been put forward by Dick (*2*) who was an associate of Tillmans. It is evident, therefore, that this method—which we have found to be thoroughly reliable—should be credited to Dick and not to the authors of either of the recent papers (*1*, *3*).

For a comparison of details, the directions given in the earlier publication (*4*) may be worth noting: "To 10 ml. of dye solution add 3 ml. of fresh 10 per cent potassium iodide solution and 2 ml. of 32 per cent sulfuric acid, mixing carefully until the blue color has changed completely through red to yellow; add 60 ml. of water and titrate with 0.01 *N* thiosulfate." It will be seen from this that Dick's method is practically identical with those referred to above.

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