adapted to remove the vapor derived from the solvent. Dilute sulfuric acid is used to remove the ammonia. (The concentrated acid causes stoppage of the tubes, due to separation of solid ammonium sulfate.)

The solution collected in *A* carries, of course, the copper oxide formed by the wet combustion in *B*. A good deal of this dissolved copper is reduced to, or remains in, the univalent state in its passage through *B*, and the reducing energy thus stored is later effectively expended upon the incoming air in the lift.

The solution, as freshly charged to the apparatus, is made by adding to a saturated solution of the "Ammonium Carbonate" of commerce its own volume of ammonia of 0.93 sp. gr. One liter of such a solution may be depended upon for approximately 75 liters of nitrogen from air before becoming exhausted. The approach of this point is accompanied by a dulling of the luster of the copper not difficult to recognize, and also by a slight foaming of the solution. One or two experiments were made which tended to show that equally good results could be obtained by substituting ammonium chloride for the carbonate, maintaining the same molal concentrations of total NH_3 and of the acid radical in each case, namely, about 8 and 2 per liter, respectively, but this has not been tried out in practice.

If the air supply is provided with a safety or reducing valve, the pressure may be left on the apparatus and the nitrogen current started, stopped and regulated by a cock on the delivery tube. The tendency of the air to back out through the reservoir on sudden starting is easily guarded against by a little care; or a check valve may be provided or a downward extension of the tubing if the added vertical extension of the system is not objected to.

In place of air, the oxygen-contaminated nitrogen commonly supplied in pressure tanks has been much used in this laboratory. Of course the life of a charge of solution and copper is greatly extended by this plan.

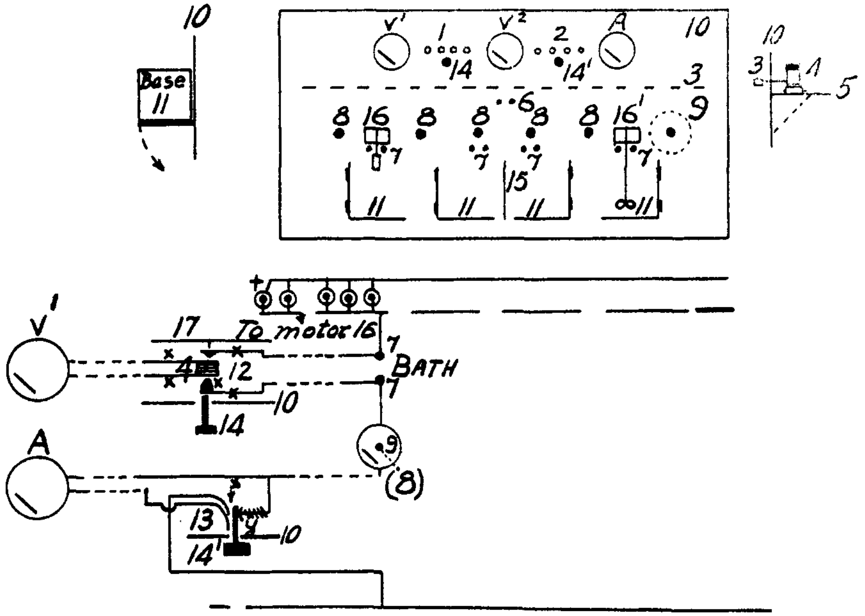
It may be suggested that the principle of the air-lift as exemplified in the above described device is a laboratory aid which has not had the attention it deserves. That it has other useful applications than the one described is manifest. In designing and adjusting apparatus embodying the principle, it is necessary only to remember that the hydrostatic pressure of the liquid in the reservoir should overbalance that of the column of mixed gas and liquid in the riser by an amount equivalent to the required "velocity head."

RESEARCH LABORATORY OF THE GENERAL ELECTRIC COMPANY,
SCHENECTADY, N. Y.

NOTE.

Panel for Electro-analysis.—The electrolytic panel, described below, embodies a number of shop kinks which may be of interest to chemists. The panel itself is of oak, 120 × 60 × 2 cm., and is fastened to the wall by four so called space or shoulder nipples of ($^3/_8$ inch) pipe. These nipples screw into pairs of flanges set on the wall and on the back braces of the panel, respectively.

The centre instrument of the panel has a range of 1 volt, and is used with



V^1. Bath voltmeter.
A. Bath ammeter.
V^2. Voltmeter for single potential measurements.
1. Holes for voltmeter connecting plug (14).
2. Holes for ammeter connecting plug (14').
3. Handles of lamp switches for cutting down 110 volt circuit.
4. Detail of lamp socket and switch (3).
5. Shelf on rear of panel.
6. Binding posts of V^2.
7. Binding posts for electrodes setting in analysis baths.
8. Twirlers for additional control of baths by means of rheostats (9).
9. Outline of one of six rheostats set on back of panel.
10. Panel board.
11. Beaker support.
12. End view of bank of four switches for voltmeter V^1.
13. End view of bank of four switches for ammeter A.
14, 14'. Plugs for connecting voltmeter and ammeter.
15. Rod for supporting calomel electrode.
16, 16'. Stirring motors with and without clutch.
17. Fiber support for back of voltmeter switch.
x. Brass.
y. Fiber.

the calomel electrode to determine "end points" and single potential differences in the analyses. For convenience the connections of this instrument are brought to the front of the panel, terminating in two binding posts.

The other two instruments have a range of 7.5 volts and 7.5 amperes respectively, and give the current and potential change through the analysis bath. The ammeter is connected through a modified "Jack" switch having four points; and the voltmeter, through a set of four double contact keys. Thus the voltage across and the current through any of the baths may be read by pressing plugs into the proper cavities. There is little sparking ordinarily, as the ammeter connection does not interrupt the current, and the voltmeter set across the bath only.

A double throw switch on the back of the panel allows the use of either 6 volt storage battery or 110 volt lighting current. To reduce the pressure of the latter, three key lamp sockets, wired in multiple, are placed in series with each analysis circuit, and two in each motor circuit. These sockets are set on a shelf attached to the rear of the panel. A neat effect is secured by employing extension keys, the handles of which only are visible on the face of the panel. When the storage battery is used, a fuse plug replaces one of the lamps in each circuit. The meter connections as noted above, are also on the rear of the panel.

Each circuit is further controlled by a nichrome rheostat set in porcelain. These rheostats are screwed to the rear of the panel, and are controlled by cheap typewriter twirlers on the front.

Artificial stirring is accomplished in the outer baths by the use of cheap battery motors with suitable stirrers of glass or platinum clutched (for PbO_2) or sealed on to the motor shafts. HENRY ZIEGEL.

BROOKLINE, MASS.

[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF THE UNIVERSITY OF CALIFORNIA.]

THE COLOR AND IONIZATION OF CRYSTAL-VIOLET.

BY ELLIOT Q. ADAMS AND LUDWIG ROSENSTEIN.

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Introduction.

The chromogens[1] derived from triphenylmethane[2] undergo, on the addition of strong acids to their aqueous solutions, a remarkable series of color transformations. The largest variety of color changes among these sub-

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[1] This term will be used to include both colored and colorless modifications.

[2] Kayser, *Handbuch d. Spekt.*, [5] 3, 87, 247, 534; H. W. Vogel, *Ber.*, 11, 622–624 (1878); *Ibid.*, 11, 913–920, 1363–1371 (1878); Berliner, *Ber.*, 1878, 409–431; Girard and Pabst, *Compt. rend.*, 101, 157–160 (1885). *J. Formánek. Unters. u. nachweis organ. Farbstoffe auf spekt. Wege.* (J. Springer, Berlin, 1908).