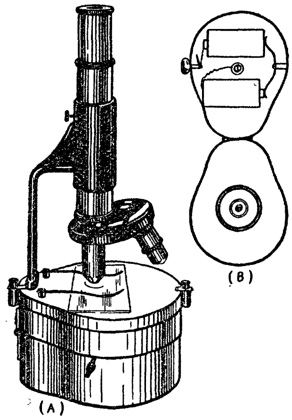

FIG. 1a. Assembled apparatus with the microscope in position on the lamp house. The hinge for the cover and screw clamp holding it in position are illustrated. The switch key is revealed well down on the side of the lamp house.

FIG. 1b. A diagram illustrating the internal construction of the apparatus. In this sketch the lamp house is opened with the hinged top lid turned down. The flash light and its center contact are shown on the inside of the lid. In the base are the two standard dry cells with their electrical connections and contact clamps with the rheostat switch and center spring contact for completion of the electrical circuit to the lamp.

is especially useful because one can view microscopic sections from any position in a room or teaching amphitheater regardless of relationship to window or other light source.

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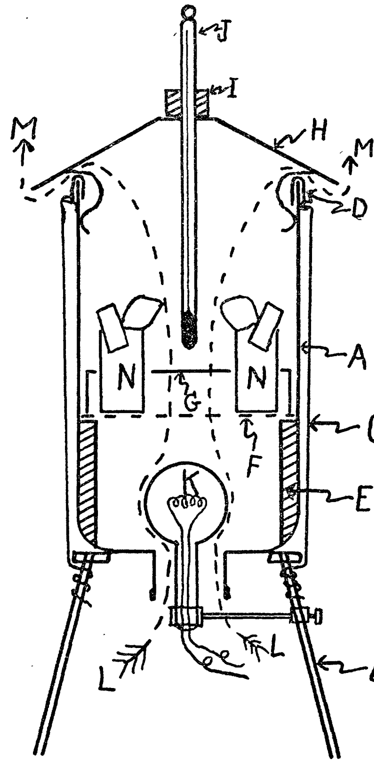
APPARATUS FOR RAPID DRYING OF SOLUTIONS

IN determining the solubility of strontium nitrate, samples of the solution were dried in ordinary weighing bottles. As the water evaporated off, a crust was formed over the top which cut down materially the rate of evaporation. Splashing resulted when heated in an oven at 100° C. At 70° in a closed electric drying oven as long a time as two weeks was required to dry a sample. An electric oven with circulating air not being available, the simple apparatus shown in the figure was devised. It consisted of material found in any laboratory. A was a 4 litre wide mouth salt bottle. The bottom was removed by placing sulfuric acid in it to a depth of one centimeter and adding a little water. The heat developed broke the bottom out. It was inverted on tripod B and firmly held in place by means of four copper guy wires C having hooks made of bent nails at D. An annular ring of plaster of Paris was constructed at E using a cylinder of thin sheet aluminium to hold



it in place. A wire gauze F was placed over the plaster to support the bottles NN. A frame of copper wire G was placed 1 cm above F. This kept the bottles from tipping over. The wire gauze permitted a free circulation of air through the apparatus. The roof H was made of a piece of a tin can. There was a space of one cm between the top of the bottle and the roof to permit the exit of air. It extended far enough beyond the sides of the bottle to prevent the access of dust. I was a rubber stopper supporting the thermometer J. K was an electric light bulb supported at such a height that air could pass freely through the mouth of the bottle. Smoke from a lighted cigarette followed the path indicated by the dotted lines L–M. A 150 watt Mazda lamp maintained a temperature of 110° C.; a 100 watt lamp, 70° C. At the latter temperature, 15 ml samples of a 40 per cent. solution of strontium nitrate (approximately saturated at room temperature) evaporated to dryness in 24 hours. This compares with the two week period in the closed oven.

A narrow strip of filter paper placed in the solution and extending above the surface of the solution facilitates evaporation without splashing. It, of course, should be dried, before being weighed with the empty bottle, in the same manner as the evaporated sample is dried before the final weighing.

Various alterations suggest themselves. A heating coil supported on a mica frame in the mouth of the bottle can be substituted for the lamp. This gives a more uniform temperature distribution. Different materials might be used in the construction. Dried air might be passed through the apparatus. This would be advisable if working at room temperatures. However, at 70° C. the difference between the moisture holding capacity of the air and the actual moisture content of the air of the room is so large that drying the air would hasten the evaporation only slightly.

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SPECIAL ARTICLES

THERMOELECTROMOTIVE FORCES PRODUCED BY A MAGNETIC FIELD

IN studying the effects of mechanical strain and of magnetization on the thermoelectric qualities of metals, Sir William Thomson[1] saw, with characteristic insight, that these two agents affecting thermal emfs were only special cases of a more general condition. He says, "Physical agencies having directed attributes and depending (as all physical agencies we know of except gravitation appear to do) on particular qualities of the substance occupying the space across or in which they are exerted, are transmitted or permitted with different degrees of facility in different directions if the substance is crystalline." Continuing, he enlarges upon this point of view and says, "Another very general principle is, that any directional agency applied to a substance may give it different capacities in different directions for all others."

The interpretation to be put upon these statements appears to be something like this; suppose two pieces of the same metal as in Fig. 1 are joined at A. If

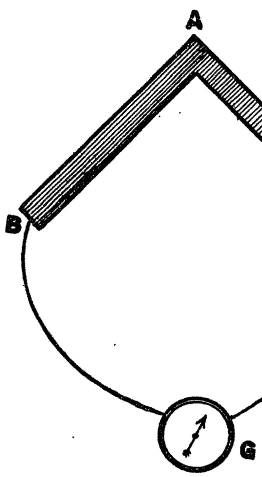

FIG. 1

AB shows properties along its length different from those along AC, they will serve as a thermocouple. For instance, if AB is crystalline with its axis extended along the length and AC has the same structure cross-wise, then if AB conducts heat, electricity or any other agent along its length differently from what AC does, these two elements will serve as a thermocouple, even though they are the same chemically.

By any means whatsoever, therefore, if we can give to AB and AC different structures so that they behave differently when placed in the path of some physical agent, we shall be able to find a thermal emf set up between the two elements. Either by stretching or by magnetizing a substance we accomplish just this effect. Thus we find a thermal emf between a stretched and an unstretched portion of a conductor.[2] We also discover a thermal emf between a permanently magnetized and an unmagnetized section of the same piece of ferromagnetic wire.[3]

A variation of this is shown in Fig. 2 where a con-

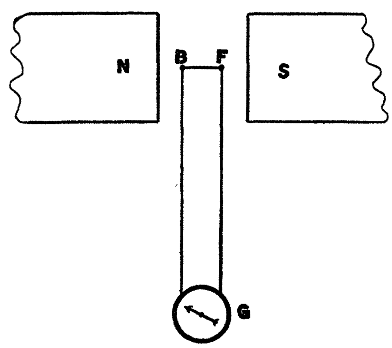

FIG. 2

tinuous iron or nickel wire is bent into a U-shaped form and placed between the poles of an electromagnet. Let one bend of the wire B be kept at the temperature of steam while the other F is maintained at freezing temperature. When the electromagnet is excited an emf occurs and a deflection of the galvanometer ensues. One may look upon this arrangement of the thermocouple as a condition in which the two elements consist of longitudinally and transversely magnetized portions. While the transversely magnetized sections, due to the very large demagnetizing factor, are not so strongly magnetized as the longitudinally magnetized portion, yet there is developed in each element a structure different from that of the other. They may, therefore, serve as a thermocouple. This was all clearly set forth by Sir

[1] Mathematical and Physical Papers, 2: 267.

[2] *Phys. Rev.*, 12: 243, 1918.

[3] *Math. and Phys. Papers*, 2: 286.