The result in Experiment I is very close to the theoretical. In the second experiment the result is good but shows a slight loss from sublimation. A higher temperature was required in the latter case to start the reaction and a naked flame was applied for a few minutes, which occasioned a faint sublimate of silver chloride just above the boat. The arsenic was found to be completely eliminated.

The above results show that it is not impossible to separate sulphides as well as oxides by means of hydrochloric acid gas. The sulphides of arsenic, antimony, and bismuth may thus be separated from lead sulphide, and the sulphide of arsenic from the sulphides of cadmium and silver. One more volatile sulphide, the sulphide of bismuth, should be included with those already mentioned. This might well be expected as the oxide volatilized in hydrochloric acid gas. This volatility of bismuth affords a method of purifying lead compounds which contain it, as its oxide or sulphide will be entirely removed by the use of hydrochloric acid gas. It is not unlikely that further separations depending upon the volatility of arsenic, antimony, tin, and bismuth sulphides may be made and the number of possible separations thus considerably increased.

The non-volatile sulphides were converted into chlorides with a variable degree of success. This in some cases depended upon the manner of their preparation. An interesting example of this was the behavior of antimony sulphide. A portion of the precipitated sulphide was heated in hydrogen sulphide to render it homogeneous, when it melted, and after cooling slowly in this gas, it crystallized nicely as stibnite. In this form it was volatilized with difficulty.

UNIVERSITY OF PENNSYLVANIA,
March 29, 1899.

THE INCANDESCENT ELECTRIC LAMP AS A SOURCE OF HEAT IN ETHER EXTRACTION.

BY C. G. HOPKINS.

Received March 20, 1899.

AS a substitute for the electric heater recently described by Sammis[1] the writer employs the ordinary incandescent lamp in extraction work. The arrangement of twenty complete

[1] This JOURNAL, 21, 42 (*1899*).

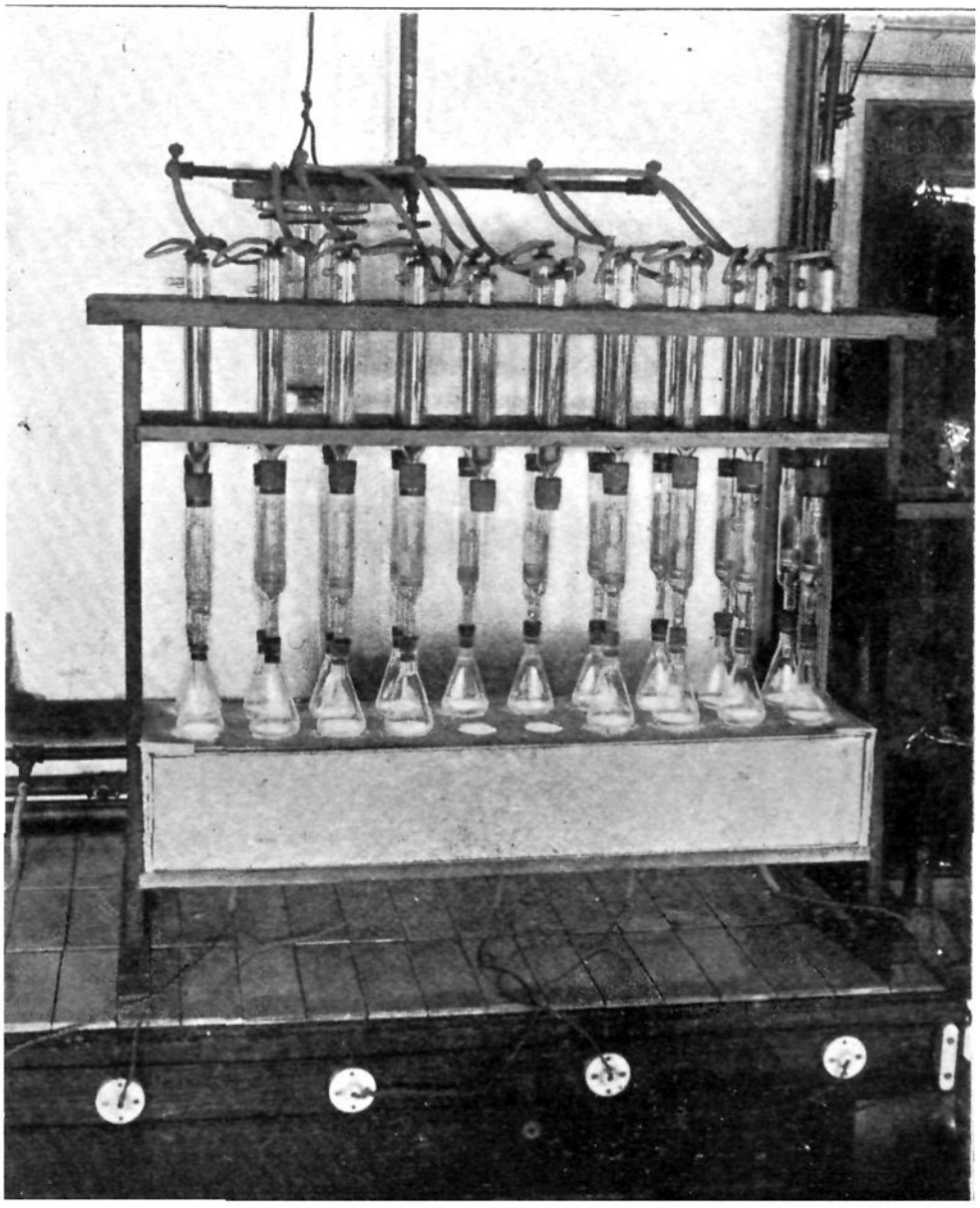
sets of Soxhlet extraction apparatus as is used in this laboratory is shown in the accompanying cut.

Five 110-volt lamps of thirty-two candle-power each are placed in the air-bath, a water-bath not being used. These are sufficient to produce a distillate amounting to about sixty drops per minute in each apparatus. The constancy of the supply of heat from the incandescent lamp is of course all that could be desired, and the fact that about ninety-six per cent. of the electrical energy is transformed into heat indicates the economy of this lamp for heating. The five lamps are connected in parallel and the current turned on or off by a single switch.

The air-bath is a galvanized iron box, thirty-six inches long, eight inches wide, and six inches deep, with double side walls and triple end walls, leaving half-inch spaces in which are placed strips of asbestos paper to decrease the loss of heat by radiation. The board upon which the bath is fastened is also covered with asbestos. The cover of the bath is removable. It contains twenty holes, arranged in two rows of ten each, which are two inches in diameter and whose centers are three and one-half inches apart each way. The lamps are placed seven inches apart, one lamp under the center of the square formed by every four holes. This symmetrical arrangement and the extra precaution taken to decrease the radiation at the ends of the bath should provide practically the same amount of heat for each set of apparatus. By actual count the rates of distillation in the twenty sets varied from twenty-nine to thirty-three drops in thirty seconds.

With the extraction in operation the temperature of the cover of the bath does not rise higher than 75°; but it has been found by experiment that, with all of the holes of the air-bath covered, it is possible to raise the temperature of the lamps to a point at which ether vapor will be ignited; so that, to be assured of *absolute* safety in case one of the flasks containing ether should break, it is necessary to employ a water-bath, the bulb of each lamp being immersed in the water.

It may be noted that the condensers are connected in sets of four, so that five streams of water (each controlled by a separate stop-cock) suffice for the twenty condensers, the water for the entire apparatus being turned on or off by a single valve.



Each condenser may be moved vertically two or three inches without interfering with the flow of water. When in use the condenser is supported by the Soxhlet apparatus; when not in use the side tube resting upon the upper board supports it. (The condensers here shown have already been described in detail.)[1]

Several hundred fat extractions have already been made with this apparatus using the electric lamp as a source of heat. It is regularly allowed to run over night and has given perfect satisfaction. Wherever a suitable electric current can be had the incandescent lamp will certainly be found preferable to the gas flame for use in ether extraction, and not only on account of its safety but also because of its greater simplicity, constancy, cleanliness, and convenience.

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[CONTRIBUTION FROM THE HAVEMEYER LABORATORIES OF COLUMBIA UNIVERSITY, NO. 9.]

CLASSIFICATIONS OF THE CARBIDES: THEIR MODES OF FORMATION, AND REACTIONS OF DECOMPOSITION.[2]

BY J. A. MATHEWS.

Received April 19, 1899.

DURING the preparation of an extended "Review and Bibliography of the Metallic Carbides,"[3] the author examined with great care the literature bearing upon the chemistry of the carbides. References dating back to 1800 were examined and continuing down to the present, the bulk of the literature being confined to a portion of the present decade. It was found that a great many gaps exist in regard to the details concerning not only the methods of formation and properties, but also concerning the composition of certain compounds which have been from time to time described as binary compounds of carbon with a metal. A great deal of the earlier work seems to be inaccurate, and recent work along this line has not confirmed the existence of some of these earlier described compounds. Enough data has been obtained to warrant the preparation of a fairly thorough classification of these inter-

[1] This Journal, 20, 965 (*1898*).

[2] Read at the meeting of the New York Section of the American Chemical Society, April 7, 1898.

[3] Smithsonian Miscellaneous Collections, No. 1090, Washington, D. C., 1898.