CONCLUSION

The flask experiments showed nothing contradictory to the theory of foaming advanced.

The custom of associating foaming with a high concentration of sodium salts is justified because a high concentration of almost any soluble material creates the fundamental condition for the existence of films, and since film-stabilizing material in the form of sludge and loosened scale is nearly always present in a boiler, foaming will occur if the concentration of the sodium salts becomes high.

The contradictory statements found in boiler water papers concerning the relation of sodium salts to foaming can easily be harmonized in the light of the theory advanced. Heretofore the two conditions for foam formation, (1) film production, and (2) film stabilization, have not been looked upon as separable in boiler water chemistry. Now, by considering that the sodium or other soluble salts make possible the formation of films, but that these films because they lack viscosity to give them strength are capable of a momentary existence only, it is seen that such salts alone cannot cause a troublesome foam because the bubbles will not last long enough to fill the steam space above the water. If, however, a stabilizing agent, such as finely divided solid matter, is also present, a persistent foam will result. Since in boiler practice any one of the three conditions, sodium salts without solid matter, solid matter without sodium salts, or both sodium salts and solid matter together may occur, it is easy to see how confusion has arisen in tracing the relations of cause and effect without the guidance of a general theory.

For the prevention of foaming of the sort caused by mixtures of dissolved substances and finely divided solid matter, castor oil is preëminent. No general theory of foam prevention can as yet be advanced.

Continuous Extraction Apparatus for Large Quantities of Plant Materials[1]

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QUITE frequently in the laboratory it is necessary to make continuous extractions of relatively large quantities of dried plant materials, for which purpose the ordinary Soxhlet apparatus is inadequate because of its smallness. Large Soxhlet extractors, especially if made of glass, are rather expensive and perhaps cumbersome to handle. Consequently it seemed desirable to construct a convenient extractor by using, to a large extent, materials usually found in every laboratory. Such an apparatus is shown in Fig. 1. This arrangement has been used for several years in the Plant Pigment Laboratory of the Bureau of Plant Industry, U. S. Department of Agriculture, and has been found satisfactory in many ways.

The apparatus, as illustrated, consists of an electric heater, *A*, a round-bottom flask, *B*, for the solvent, an aspirator bottle, *C*, to hold the plant material, and a condenser, *D*. The size of the bottle and the flask naturally determines the quantity of material which may be extracted in this apparatus. An aspirator bottle of the approximate dimensions 17 × 26 cm. and a 5-liter flask are suitable sizes for the extraction of about 1 kg. of dried plant material. Inasmuch as the ordinary type of electric heater has a flat surface, it is desirable to have an adapter whereby a round-bottom flask can be used in conjunction with such a heater. This consists of a slightly beveled soapstone ring, *E*, which is placed on the surface of the heater. The advantage of such an arrangement is evident, since the modified heater, when not being used in connection with the extraction apparatus, may be employed for other purposes by simply removing the soapstone ring. The employment of a rubber stopper at *F* is associated with a number of disadvantages, especially when either petroleum ether or ether is used as the solvent. It seems best, therefore, to use a ground-glass connector such as *G*, which may be attached to the remainder of the apparatus by means of short pieces of rubber tubing.

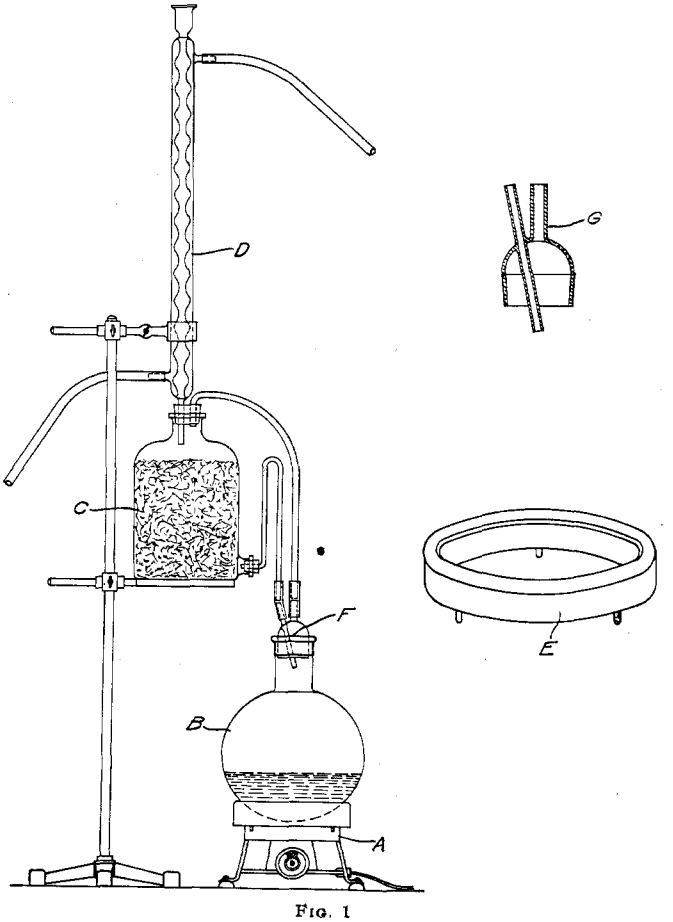

FIG. 1

The apparatus as shown in Fig. 1 is set up mainly for the use of alcohol as the solvent and for cold extractions. To insure warm extractions it is necessary to cover the bottle and flask with towels or other material. When using petroleum ether or ether as the solvent, it is desirable to increase the condensing surface and also to immerse the flask containing the solvent in water maintained at the proper temperature.

[1] Received September 27, 1924.