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## APPARATUS FOR PURIFYING SULPHUR

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10 Claims. (Cl. 23—264)

This invention relates to apparatus for the purification of sulphur, and in particular to apparatus for purifying sulphur in accordance with the process of our copending application, Serial No. 70,572, filed March 24, 1936, when the sulphur is contaminated with a hydrocarbon impurity; this application being a continuation in part of our said application.

The object of the invention is generally to provide suitable apparatus for removing hydrocarbon impurities, particularly the difficultly removable small quantities of such impurities, in an efficient manner and on a commercial scale.

Specifically, an object is to provide apparatus including a boiler-type unit adapted for the distillation of sulphur containing one or more hydrocarbon impurities in a manner which effects the desired heating of the sulphur and avoids the difficulties arising by reason of the foaming of and the reactions in the liquid sulphur while being heated.

Another object is to provide suitable apparatus for distilling sulphur containing one or more hydrocarbon impurities, in a manner which avoids the formation of highly viscous sulphur, for example, such as is generally encountered when sulphur is slowly raised to the temperature of vaporization.

Another object is to provide suitable apparatus for distilling sulphur containing one or more hydrocarbon impurities in a manner yielding hydrogen sulphide and a carbon residue as a result of the reaction of sulphur with a hydrocarbon, while at the same time avoiding intermediate tarry products which generally consist of sulphur, carbon, and hydrogen in various proportions.

Another object is to provide a distilling unit for molten sulphur containing hydrocarbons, as indicated, which is constructed to effect substantially complete removal of the hydrogen sulphide and the carbon residue, that are formed by the reaction in the vapor phase of sulphur with hydrocarbons and normally go over with the distilled sulphur product, by utilizing the principle of countercurrent flow between the crude sulphur being introduced for treatment and a portion of the vaporized sulphur.

Still another object is to provide a distilling unit for molten sulphur containing hydrocarbons, as indicated, with means for delivering the system, when desired, of a portion of the liquid sulphur that contains carbon particles so as to maintain the percentage of carbon residue, present in the liquid sulphur, below a predetermined value,

for example, below that at which high viscosities would prevent the efficient transfer of heat and the operation of a thermal siphon in the distilling unit.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary view, partly in section and partly in elevation, showing apparatus with a boiler-type distilling unit constructed in accordance with the invention;

Fig. 2 is a top plan view, parts being broken away, showing the arrangement of the top drums employed in the distilling unit illustrated in Fig. 1; and

Fig. 3 is a fragmentary sectional view showing details of the bottom drum, illustrated in Fig. 1.

According to the process set forth in the aforesaid application, the hydrocarbon impurities initially present in the molten sulphur, produced by mining by underground fusion, are reduced as far as practical by the initial contact of the crude molten sulphur with sulphur vapor. The resulting reaction, however, may leave a residue and generally does not sufficiently remove the hydrocarbon impurities. Hence, in the subsequent heating in the distillation unit, the unreacted hydrocarbons are volatilized along with the sulphur vapor, leaving a carbonaceous residue, so that, unless removed, the resulting sulphur product, upon condensation, is somewhat discolored by reason of the presence of carbonized material.

If the temperature of sulphur containing an impurity of the character indicated is slowly raised from a value near the melting point to the temperature of vaporization, two important events occur, viz.: (1) a reaction between the hydrocarbon and sulphur which evolves hydrogen sulphide gas and precipitates the carbon as a tarry material consisting of carbon, sulphur, and hydrogen in varying proportions; and (2) an increase in the viscosity of sulphur to an order that may be from five to twenty fold, such as the viscosity in the neighborhood of 370° F., over that exhibited near the melting point, or that near the