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PROCESS OF LOWERING SULPHUR VISCOSITY AND RESULTING NONVISCOUS SULPHUR COMPOUND

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This invention relates to a process of lowering the melting point of sulphur and reducing the viscosity of the same when molten, to the resulting non-viscous sulphur compound or compounds, and to a method of using a non-viscous sulphur compound.

The invention has for its main object the provision of a process of the character indicated which is accomplished by admixing with sulphur relatively small amounts of certain substances which may be readily added to sulphur and are relatively inexpensive.

Another object is to provide sulphur compounds which have relatively low viscosity at temperatures above 320° F. while retaining other properties of pure sulphur for application in the arts.

Still another object is to provide a method of using a sulphur compound with a non-viscous characteristic in the drilling of wells by the rotary method so that aqueous muds, heretofore employed, may be replaced with a sulphur drilling fluid.

It is well known that when ordinary sulphur is melted, it is a liquid with a viscosity approximately the same as that of a light lubricating oil. However, when the temperature of liquid sulphur is increased to about 320° F. the viscosity increases very rapidly and from this temperature to about 650° F. sulphur is very viscous. For example, the viscosity of liquid or molten sulphur, as compared with water at 68° F., is about 10 at 250° F.; about 80 at 315° F.; about 50,000 at 340° F.; and about 52,000 at 360° F. The temperature range over which this exceptionally high viscosity occurs is somewhat variable and is affected by the presence of small amounts of various impurities in the sulphur. The range over which sulphur has an exceptionally high viscosity will hereinafter be referred to as "the viscous range".

It has long been recognized that this high viscosity above 320° F. limits the uses of sulphur, and causes considerable inconvenience in handling liquid or molten sulphur. This high viscosity makes it impractical to pump, pour, stir, or carry out any similar operation on sulphur in this viscous range. This is particularly disadvantageous when it is desired to pump liquid sulphur for long distances without reheating. Since ordinary sulphur must be pumped at temperatures below 310° F. and the melting point of sulphur is about 240° F. the heat losses while pumping are likely to cause the sulphur to freeze in the lines.

Another example of a case where it is desirable to lower the viscosity of sulphur at elevated temperatures is when it is desired to cause liquid or molten sulphur to react with some compound or element. With ordinary sulphur these reactions must be made to take place below the viscous range, or if it is necessary to have the reaction take place about 320° F. considerable difficulty is experienced in stirring and mixing the sulphur and the reacting compound.

Moreover it has been proposed to use liquid or molten sulphur as a substitute for the drilling mud used in the rotary method of drilling wells for oil, gas, and the like. The ordinary methods of rotary drilling using an aqueous mud have numerous disadvantages. Among those may be mentioned the difficulty which is experienced when drilling through the anhydrous shale formations commonly referred to as "heaving shale" by reason of its characteristic swelling and subsequent "heaving" which results when the shale comes in contact with the water in the drilling mud. Another disadvantage is that experienced when drilling in ordinary formations where it frequently happens that the aqueous drilling mud does not have enough strength to keep the sides of the hole from caving in.

These advantages could all be avoided if it were feasible to substitute sulphur for the aqueous drilling mud. Numerous additional advantages would also follow. One of these would be the elimination of any reaction between the liquid sulphur and the anhydrous shale that would cause swelling or "heaving" of the shale. Another would be the solidification, when drilling, of a part of the liquid sulphur by cooling on the sides of the hole. This solidified sulphur, in such instance, would form a strong casing on the inside of the hole drilled that would prevent the sides of the hole from caving in and would make it unnecessary to set metallic casing in the hole as often as by the old method. In addition, the metallic casing set would be protected from corrosion by the solidified sulphur and such sulphur would act as a cement that would make unnecessary and avoid the expense of cementing the casing with Portland cement, as is done in the old practice. However, in spite of the many advantages of using sulphur as a drilling fluid, both in the decreased cost of drilling and in the possibility of obtaining new and greater mineral resources by drilling through heaving shale, it has not been practical to use sulphur in this connection. This is due very largely to the fact that ordinary sulphur cannot be pumped above 310° F. except with extreme difficulty and at great expense. To pump pure liquid sulphur