Patented Oct. 13, 1942

2,298,855

UNITED STATES PATENT OFFICE

2,298,855

LUBRICANT

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No Drawing. Application October 21, 1939, Serial No. 300,565

5 Claims. (Cl. 252—56)

This invention relates to steam cylinder lubricants, and relates particularly to a new steam cylinder lubricant having superior adhesive properties to cylinder walls, and superior lubricating properties.

In the lubrication of steam cylinders, difficulty has been encountered from the washing action of the steam upon the cylinder walls which tends to remove the lubricant from the walls and permit metal-to-metal contact between the piston and cylinder. In order to avoid scoring under such conditions, it has been necessary to feed a stream of cylinder oil continuously into the cylinder, usually by way of the steam supply, to maintain the lubricant film in the cylinder, and particular difficulty has been encountered in shutting down and restarting a steam cylinder because of the fact that when the steam supply is shut off, the residual steam in the cylinder usually washes out substantially all of the lubricant leaving the metal surfaces bare, and requiring a considerable quantity of lubricant at restarting before a satisfactory coating of lubricant is obtained on the cylinder walls.

During this time there is insufficient lubrication and wear occurs. Also, the washing action of the steam on the cylinder walls carries the lubricating oil out from the cylinder in the exhaust steam. On condensation of the steam, emulsions of the oil are formed which are quite stable and for this reason, the loss of lubricant is greater than it should be. Some of the lubricating oil may be carried into the hot well and the boiler feed. In many plants where pure water is at a premium, the condensate offers a good source of distilled water and the oil content is highly objectionable.

The present invention provides a new cylinder oil comprising a lubricating stock in which there is dissolved a very small quantity of polyisobutylene. This material shows the unexpected property of firm adhesion to the cylinder walls, such that it is resistant to the washing action of the steam, and the only removal of the lubricating film is that occasioned by the rubbing movement of the piston. For this reason, the present oil is much more efficient than ordinary cylinder oils, both in respect to the quantity consumed and to the degree of engine wear.

Thus, an object of the invention is to cause a lubricating oil to adhere to the cylinder walls of a steam cylinder engine; to resist the washing action of steam. Other objects and details of the invention will be apparent from the following description.

Polyisobutylene is produced by polymerizing isobutylene at temperatures below —20° C. and preferably ranging from —40° C. to —100° C. preferably in the presence of liquid ethylene as a diluent-refrigerant by means of boron trifluoride as a catalyst. The reaction produces a substantially saturated polymer of isobutylene which may have a molecular weight ranging from about 1,000 to 250,000 or more, according to the lowness of the temperature at which polymerization occurs and the purity of the isobutylene. The polymer material used for the present purpose preferably has a molecular weight in excess of 40,000.

The mineral oil used for the present invention is a cylinder oil. It may be derived from the various crudes from which cylinder oils are normally prepared, for example, from Pennsylvania or Mid-Continent, or even naphthenic base crudes. The oil may be a steam reduced Pennsylvania or may be an overhead stock, for example as produced by distillation under vacuum. The oil will have a viscosity of at least 100 seconds Saybolt at 210° F. and more viscous oils, for example, from 150 to 220 seconds Saybolt at 210° F. are employed with increased temperature of cylinder operation.

To such an oil the polyisobutylene mentioned above is added in a small proportion. Ordinarily, the amount is less than .25 of 1% and frequently as little as .02 of 1% is sufficient. With low pressure steam larger amounts can be used, but with higher pressure, superheated steam, the amount may be in the lower end of the range indicated, because wet steam appears to give the most drastic service. With a higher molecular weight polymer, the amount of polymer is proportionately lower than with lower molecular weight products.

While the polyisobutylene is soluble in all proportions in the cylinder oil, it dissolves slowly because of the high viscosity of the oil and it is generally preferable to dissolve the polymer in less viscous lubricating oils in a 10% solution, for example to add this to the cylinder oils so as to incorporate the proper amount of polymer.

As indicated above the amount of polymer added is minute, indeed less than would be expected to produce any noticeable result, but careful tests have shown that with this oil the amount fed to the cylinder may be reduced to ⅓ or ½ of the amount required with an ordinary cylinder oil.

In addition to the ingredients mentioned above, fatty oils may be added. Usually the amount of fatty material is from 3 to 20%, and for that

purpose neat's-foot oil, acidless tallow, degras, lard oil, or other fixed oils may be employed.

Furthermore, the adhering effect of the lubricant to cylinder walls occurs whether the steam is saturated or superheated; and the effect remains during shut-down periods, with the result that when the engine is re-started, there is at the beginning of the re-starting an adequate film of oil covering the cylinder surfaces which permits of re-starting under conditions of complete lubrication, and avoids the previously inescapable condition of unlubricated starting.

As an example of the composition and use of the present oil, the following may be considered. A 240 H. P. Corliss valve engine with a 15" bore and 36" stroke is ordinarily operated at 150 R. P. M. using a compounded cylinder oil containing 5% of acidless tallow. This oil has a viscosity of 144 at 210° F. and 2224 at 100° F. both in Saybolt seconds. While the lubricant had been considered satisfactory, there was, as usual, a very noticeable noise on starting, indicating that the cylinder was not properly lubricated until the engine was well in operation.

The same engine was run for several days on the same oil to which had been added 1% of a lighter lubricating oil which contained 7% of polyisobutylene of 60,000 molecular weight. It was noted that the oil consumed was only ⅓ to ½ of that previously used. The engine was then shut down but on starting again several days later, the smoothness of starting was readily noted. There was none of the customary noise even before the engine reached its normal operating temperature, indicating that the rubbing surfaces retained their lubricating film during the shut-down.

This improved oil had a viscosity at 100° F. of 2348 seconds Saybolt and 152.3 seconds at 210° F.

Thus the invention provides a new and useful and very valuable steam cylinder oil consisting of a hydrocarbon lubricant containing dissolved therein a minute amount of polyisobutylene, but sufficient to cause the hydrocarbon lubricant to adhere to the walls of the steam cylinder, to enable the lubricant to resist the washing action of steam currents. The oil preferably contains a substantial amount of a fatty oil.

While there are above disclosed but a limited number of the embodiments of this invention, it is possible to produce still other embodiments without departing from the inventive concept herein disclosed, and it is therefore desired that the normal range of equivalents be allowed to the appended claims within such limitations as are stated therein.

The invention claimed is:

1. A steam cylinder lubricant comprising in combination a steam reduced cylinder oil having a viscosity of at least 100 seconds Saybolt at 210° F., in combination with a minute quantity of polyisobutylene dissolved therein together with from 3% to 20% of auxiliary fatty material.

2. A steam cylinder lubricant comprising in combination a steam reduced cylinder oil having a viscosity of at least 100 seconds Saybolt at 210° F., with polyisobutylene in a quantity less than 0.25% dissolved therein together with from 3% to 20% of auxiliary fatty material.

3. A steam cylinder lubricant comprising in combination a steam reduced cylinder lubricating oil with polyisobutylene having a molecular weight above 40,000 dissolved therein in an amount less than about 0.25% together with from 3% to 20% of auxiliary fatty material.

4. A steam cylinder lubricant comprising in combination a steam reduced cylinder lubricating oil with polyisobutylene having a molecular weight above 40,000 dissolved therein in an amount less than about 0.25%, together with a dissolved non-acid auxiliary oil and together with from 3% to 20% of auxiliary fatty material.

5. A steam cylinder lubricant comprising in combination a steam reduced cylinder lubricating oil with polyisobutylene having a molecular weight above 40,000 dissolved therein in an amount less than about 0.25% and an acidless fixed oil in a proportion between 3% and 20%.

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