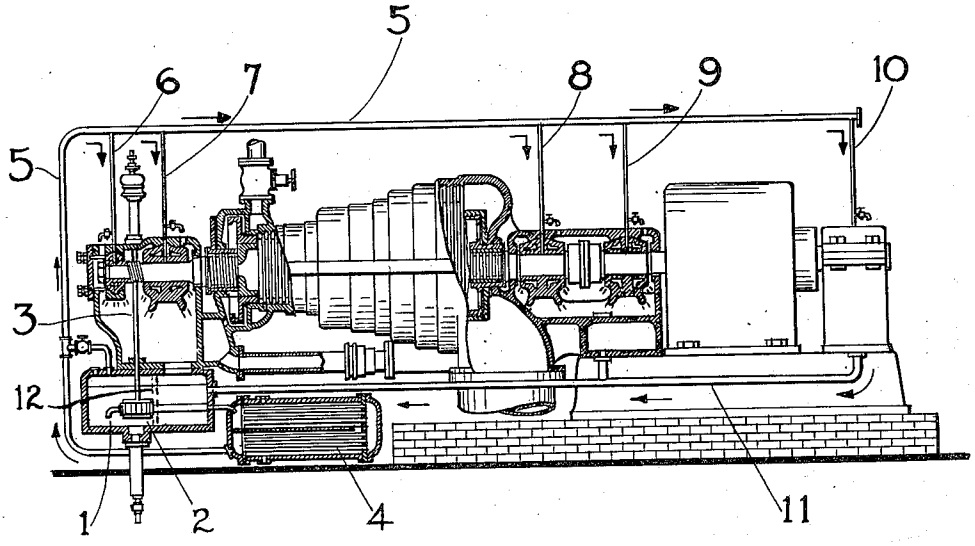
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J. W. SAYBOLT

TURBINE LUBRICATION

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JOHN WALTER SAYBOLT Inventor

By

Attorney

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# UNITED STATES PATENT OFFICE.

JOHN WALTER SAYBOLT, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO STANDARD DEVELOPMENT COMPANY, A CORPORATION OF DELAWARE.

## TURBINE LUBRICATION.

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This invention relates to improvements in the lubrication of turbines and analogous machines in which the lubricant is subjected to relatively high temperatures under oxidizing conditions. The invention comprises using for this purpose a purified petroleum oil fraction having lubricating properties and consisting almost completely of hydrocarbons of the naphthene and paraffin series. The improvements described herein follow from my discovery that such oils deteriorate in use much more slowly than the turbine oils now generally employed.

My invention is particularly useful in connection with the lubrication of steam turbines having a circulatory system for the lubricant. In the accompanying drawing the figure is a diagram of such a turbine having an oil reservoir 1 from which a rotary pump 2 driven by the governor shaft 3 forces the oil through a cooler 4. From the cooler the oil passes through pipe 5 and its branches 6, 7, 8, 9, 10 to the bearings of the turbine. The oil returns to the reservoir 1 through pipe 11. A screen 12 may be provided in the reservoir to remove solid particles picked up by the oil in its passage through the system. It will be understood that a particular type of turbine is illustrated merely for facilitating the description, and that the invention is equally applicable to analogous machines of other types.

In turbines and the like the conditions imposed upon the lubricant are particularly severe. For example, the speed of rotation is ordinarily so great that the temperature of the bearings is relatively high. The adverse effects of heat are aggravated by the unavoidable leakage of steam, which mingles with and condenses in the oil. Under these conditions the best oils at present used in turbines rapidly oxidize with formation of sludge and undergo other deterioration.

I have discovered that white oils are much more resistant to oxidation and the like than the present standard turbine oils, such as Manchester spindle oil. By white oils I mean highly purified petroleum oils of viscosity between about 100 and 375 seconds Saybolt at 100°F. The specific gravity of the oil is generally relatively low, as compared with other lubricating oils of similar viscosity.

The following comparative tests are illustrative. Samples of white oil and of Manchester spindle oil were oxidized at temperatures of 300° F., 350° F., and 400° F. by blowing 10 cubic feet of air through 200 grams of each oil during a period of one hour. To avoid evaporation losses the oxidation was performed under reflux condensers. The white oil showed little color change as a result of the oxidation at 300° F. The color increased somewhat as the oxidation temperature was raised. Nevertheless, the color of the white oil sample oxidized at the highest temperature was not so pronounced as that of the original Manchester spindle oil. The latter oil darkened much more rapidly than the white oil, when subjected to the oxidation described. The sample of spindle oil blown with air at 400° F. was practically black. The darkening indicates the formation of compounds that produce sludge in turbine lubrication. These compounds are highly detrimental.

The experiments referred to show that while white oils are affected to some slight extent by oxidation at high temperatures, they are relatively so stable that under practically all conditions sludge formation is precluded. This is not the case with ordinary turbine oils. They contain compounds that are directly oxidizable to produce sludge. In white oils, sludge forming compounds do not exist as such, and are formed, if at all, only after long subjection of the oil to oxidation at high temperature. The duration of effective service to be obtained from white oils is therefore much greater than that of the turbine oils now employed. Having in mind the fact that shut-downs for cleaning of turbine lubricating systems are time-consuming and expensive, it will be seen that the use of white oil is amply justified, although its initial cost may be higher than that of inferior oils.

The experimental results referred to have been verified in actual practice by operating a 1000 kilowatt turbine with white oil as a lubricant. The white oil gives effective lubrication for a much longer period than the standard turbine oils heretofore used.

I have found that white oil has other highly advantageous properties as a lubricant besides that of resisting oxidation. Among these one of particular importance is the ease with which water may be sep-

arated from the oil. As noted above, in the operation of turbines the lubricant unavoidably becomes mixed with water. While commercial turbine oils now ordinarily used may show a good initial emulsion test, after a relatively short use they tend to form stable emulsions with water. This difficulty does not occur to an appreciable extent when white oils are used.

The white oils which I prefer have a viscosity between 125 and 350 seconds Saybolt at 100° F. The proper viscosity may be determined by the well-known considerations governing the selection of various grades of turbine oils now commercially used. The white oils should consist substantially exclusively of hydrocarbons of the naphthene and paraffin series. That is, the combined percentage of olefines and aromatic compounds, as indicated by the decrease in volume when 50 cc. of the oil is extracted at room temperature with 50 cc. of 100% sulfuric acid, should not usually exceed about 2%.

I claim:

1. Method of lubricating turbines, which comprises maintaining in the lubricating system thereof a circulating body of a petroleum white oil having lubricating properties and substantially free from compounds that tend to form sludge when exposed to high temperatures under oxidizing conditions.

2. Method of lubricating turbines, which comprises maintaining in the lubricating system thereof a circulating body of a petroleum white oil having a viscosity between about 100 and 375 seconds Saybolt at 100° F., and containing not substantially in excess of 2% of olefines and aromatic compounds.

JOHN WALTER SAYBOLT.