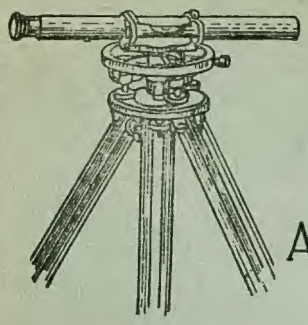

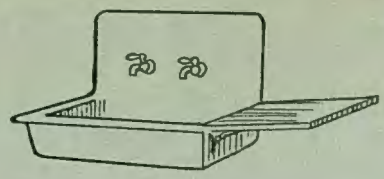

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COMMON TESTS FOR LUBRICATING OILS

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Many tests may be applied to lubricating oils for internal combustion engines. Some which are of great value to the refiner are of little significance to the user. The Federal Specifications Board, the American Society for Testing Materials, and manufacturers of automotive engines recognize some of the tests as being important to the operator. While no laboratory tests may be used as a positive guide for the value of oils in service, information obtained from some of the tests will assist in the more intelligent selection of an oil. The discussion of these will of necessity be brief.

Viscosity

The resistance of a fluid to a change in shape is called viscosity. A comparison of thickness or viscosity of oils is obtained by the use of a viscosimeter. This is essentially a cup with a tubular outlet at the bottom. The test is made by filling the cup with the oil to be tested, withdrawing the stopper underneath the outlet and determining the time required for 60 cubic centimeters of the oil to flow out. This time in seconds is used as an arbitrary scale for the viscosity or thickness. Because of the great change in viscosity with a change in temperature of an oil it is necessary to specify the temperature at which the test is made. The S.A.E. numbers as adopted by the Society of Automotive Engineers are based on the viscosity of the oils at 130° and 210° F. For example, oils indicated as S.A.E. 10 have viscosities not less than 90 but less than 120 seconds at 130° F. and those labeled S.A.E. 20 have viscosities of not less than 120 but less than 185 seconds at 130° F. These designations are being used to supersede the old classifications such as light, medium, and heavy.

Viscosity Index

Two mineral oils having the same viscosities at 130° F. may vary much at 210°. Because of this fact, it was important to establish a method for rating viscosity variation with change in temperature. Two oils were selected as standards, one with a minimum change of viscosity between 100° and 210° F., and the other with a maximum change for the same temperature range. The first oil was given a viscosity index of 100, and the other a rating of 0. From the viscosities of the chosen standards and of the oil being tested, a formula was devised which would express numerically the rate of viscosity change with temperature. This figure is called the viscosity index.

Flash and Fire Points

The flash test consists of heating a definite quantity of oil in a standard cup under certain conditions and measuring the temperature at which vapor is given off fast enough to form, with the air, a mixture which will flash if exposed to a flame. If the heating is continued, a temperature will be reached at which vapors will be given off rapidly enough to maintain continuous combustion. The temperature at which the flash occurs is called the flash point, while that at which combustion is continuous is called the fire point. The points indicate whether or not the oil will withstand the temperature to which it will be exposed in the engine under operation. They must be high enough not to evaporate. The flash point of ordinary oils is close to 400° F. and the fire point 40° to 60° higher.

Pour Point

The pour point is defined as "the lowest temperature at which an oil will pour or flow when it is chilled without disturbance under certain specified conditions." It does not necessarily mean that the crankcase oil will become congealed as soon as the temperature drops to the determined pour point. It is, however, reasonable to assume that an oil with a low pour point is less likely to give trouble in cold weather. It has been noted that "the pour point of the paraffin base oil is higher than that of the asphalt base oil. Exceptional refining methods or additions of special compounds may alter this relation."

Conradson Carbon

A carbon deposit is left in the crucible, when a lubricating oil is heated until it boils away. If this boiling is carried on at a specified rate in a porcelain crucible which is surrounded in a nest of iron crucibles, the residue is expressed as a percentage of the original oil used, and is called the Conradson carbon residue. While it has been proven that there is a relation between the carbon deposits in the combustion chamber and the Conradson test, it is difficult to interpret the relation. Large percentages of carbon residue are not considered desirable and specifications usually set a maximum depending on the viscosity of the oil.

Corrosion Test

To guard against the possibility of the presence of compounds which might attack the bearing surfaces, a corrosion test has been devised. It consists of immersing strips of polished copper in the oil and placing the container in boiling water for three hours. If, at the end of that time, the copper is not discolored or pitted, the oil is considered free from compounds injurious to the engine parts.

Gravity

When the expression "gravity of an oil" is used, almost invariably the Baumé gravity is meant. This Baumé gravity is an arbitrary scale widely used in the petroleum industry to indicate the relative gravity of petroleum products and is merely an expression of the weight per unit volume. The larger the gravity number the less the weight per gallon. Because of the expansion and contraction of oils with changes in temperature, determinations are made at 60° F. Oils from paraffin base crudes usually have higher gravity numbers.

The following are some statements from Letter Circular 298, U. S. Bureau of Standards relative to a paraffin and an asphalt base oil of the same viscosity:

1. The paraffin base oil weighs less per gallon than the asphalt base oil, i.e., the gravity number is greater.
2. The change in viscosity with temperature is less with a paraffin oil, i.e., the viscosity index is greater.
3. The Conradson carbon is greater for the paraffin base oil.
4. The flash and fire points are lower for the asphalt base oil.

While it is quite possible to make an intelligent selection of a lubricating oil from the results of laboratory tests, it does not mean that these tests may be used as absolute standards for the relative value of such oils in service. The manner in which an oil reacts under actual service conditions is the final test. About the best policy to follow in the selection of an oil is to buy from a well established, reliable company the grade of oil recommended by that company for the engine in which it is to be used.

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