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NOTES ON LUBRICATING OILS.

BY MR. FRANK H. FLOYD.

Steel manufacturers, assisted by skilled chemists, are working hard to toughen and harden the material employed in manufacturing motor cars. Their efforts are all in vain, unless manufacturers exercise the most careful judgment in selecting lubricants for their preservation.

It is a safeguard to the business to do so, for people of moderate means are swelling the sales.

Wear and tear bills should be as low as possible.

The lubricants offered the trade for motor car lubrication can practically be classified under three heads, viz.: Motor or Cylinder Oil, Transmission and Rear Axle Lubricant and Cup Grease.

MOTOR OILS FOR GASOLINE CARS.

They are usually sold under brands by a great variety of jobbers, but the name, of course, means nothing. It is the property tests of the oil that determine its value as a lubricant.

The writer finds in analyzing numerous brands of motor oil on the American market that are offered for gasoline cars that they are strictly hydrocarbon oils (no animal or vegetable oils added), that they are fractional distillates of crude petroleum separately or blended, but of various specifications. Let me explain to you that fractional distillates are the different portions that are evaporated from crude petroleum by the refiner. Gasoline from 68 to 87 gravity; naphtha, 58 to 60 gravity; kerosene, 46 to 48 gravity; miners' oils, 38 to 49 gravity; light lubricating oils, 28 to 35 gravity; medium heavy lubricating oils, from 22 to 31 gravity; heavy lubricating oils from 18 to 27 gravity are all fractions.

True, the oils are treated, filtered, etc., but in the rough they are parts of the crude. The different fractions are often blended together by the jobber in making up a certain grade of oil.

Popular impression is that crude petroleum is pretty much alike all over the United States. As a matter of fact it varies greatly, crude from Texas being entirely different from that of

Indiana or Illinois or Pennsylvania. Crude from Ohio, Illinois or Indiana is composed of entirely different hydrocarbons than that from Pennsylvania, and so on. The refined oils even under the same methods of refining show entirely different properties from different crudes, and there is therefore a choice in selecting suitable oils for cylinder lubrication.

Generally in practice the heat generated in gas engine cylinders is sufficient to cause all oils to evaporate or burn to a greater or less extent, even though air or water cooled. In evaporating and burning the hydrogen is driven off by the heat, leaving the carbon in a hydrocarbon oil to precipitate or pass off with the exhaust, hence it is desirable that a motor oil be *as free from carbon as possible*, and that the carbon be as pure as possible.

Let me dwell on the purity of carbon. Graphite is a pure carbon and would work no injury when used as a lubricant. When the crude is comparatively impure in quality—or, in other words, contains considerable asphaltum, sulphur and nitrogenous properties from the soil—the carbon in composition in the refined oil will be more or less impure and lacks the high lubricating value that a hydrocarbon oil would have that is refined from a higher grade of crude.

Hydrocarbon oils employed in gas engine lubrication are by nature composed of hydrogen and carbon. Hydrogen is lighter than air. The weight of oil is therefore controlled largely by the amount of carbon in composition. Light weight oils are then the most desirable, other properties considered.

A property to consider in conjunction with light weights (usually defined by the degree of gravity) is the flash and burn test of an oil. Let me explain that the flash test is the lowest temperature on the thermometer that the accumulated vapors will flash when a lighted taper is drawn across the surface of the oil when heated. The burn test is the lowest temperature that the accumulated vapor will burn permanently. The burn test is always higher than the flash test.

High evaporative test and light weight oils will then be less affected by cylinder heat and will therefore deposit less carbon when they burn. The desideratum.

Another property in conjunction with these other three is viscosity or body test. The viscosity of an oil I would define as its adhesiveness (or that property by reason of which an oil would

cling, penetrate or adhere to the metal surfaces), and its cohesive-ness, or that property by reason of which the atoms of the oil cling together and resist disruption under load. In cylinder, crank case and transmission lubrication the viscosity then of the oil should be most carefully considered, for the body of the oil very largely controls the thickness of the oil films between the opposing surfaces.

I may here state that in the process of refining oils it is impossible to refine oils of light weight with high evaporative tests and with little body.

Another property to consider is cold test. The cold test is the fluidity of the oil at the lower temperatures. While I would impress on the manufacturer the necessity of placing the oil tanks in such position that an even temperature can be maintained summer and winter, yet the cold test of oils varies greatly, and there is a choice in this respect.

Oils free from acid, alkali and moisture. Under this head I might state that the poorer grades of crude petroleum require special treatments of sulphuric acid and caustic soda solutions and are removed by water. The recovery is not always perfect of all three, consequently a test for acid, alkali and moisture is essential.

I have stated that all "Motor Oils on the American market are hydrocarbon oils." Animal and vegetable oils are undesirable, for they are nonvolatile oils. Under the action of intense heat they char before they vaporize, leaving a hard carbon scale behind. There is no temptation to the jobber to use them as an adulterant to a Motor Oil, for they are usually higher in price.

In the process of refining or compounding Motor Oils from the highest grades of crude there are limitations. You should carefully consider all of the property tests of an oil in purchasing and not pick out one as an index of a good oil. The color of an oil is no index of its value. A light colored oil might be refined from the very lowest grade of crude petroleum.

I have stated that "oils are usually sold under brands." I believe that large companies should purchase their oils under specifications. There are chemists who will assist you. Mr. Henry Souther, of Hartford, Conn., chemist for the Licensed Association, has gone very elaborately into oils, making all tests, and has drawn up a set of specifications that is fairly well suited for water-

cooled cars, and if followed would compel any jobber to give you high-grade Motor Oils.

TRANSMISSION LUBRICANTS.

Practically 80 per cent. of the lubricants offered the trade to-day are semi-fluid greases, sometimes called non-fluid oils. The other 20 per cent. usually consists of a mixture of oils and greases or residuum from crude petroleum. Fluid greases are manufactured with a view of securing the product that will follow the gears without permanently adhering to the sides of gear cases when the car is at rest; that will retain its consistency in hot and cold weather; that will deaden the sound in the gear case and sufficiently high in viscosity to sustain the loads between the metal, thus preventing abrasion.

Pretty much all of the above is accomplished except the last, namely, the prevention of wear of pinion and gear.

This, I believe, is not accomplished in as satisfactory a manner as is desired, judging from the life of pinion and gear under ordinary wear.

Apparently the lubricating film produced from a non-fluid oil or grease is not of sufficient viscosity to sustain the load. I believe that if the adhesiveness of a fluid grease could be greatly increased it would assist in preventing the wear that now takes place in gear cases. A pure petroleum product has recently come to my notice that apparently combines all of the desirable properties of a fluid grease with the greatly increased adhesiveness. The writer is making some practical tests to determine the value of the same.

At the present time I believe that the fluid greases of the right consistencies that properly reach all parts of the gear cases have the call to-day. Steam cylinder stocks are often recommended. From the fact that they lose their viscosity very quickly under heat I hardly think that they are as serviceable as the fluid grease.

CUP GREASES.

Cup Greases or hard oils, as they are sometimes called, are made up of different consistencies (better defined by melting points) to meet varying conditions under which machinery is operated. In places where there is considerable heat to contend with the higher melting point grease should be employed. In

lubricating ball-bearings it is essential that a grease be employed of consistency sufficiently soft enough to follow the balls without throwing off to the sides, and of a quality that will not corrode the metal.

Cup greases contain more or less animal or vegetable oils saponified. Manufacturers of grease should be exceedingly careful in selecting these oils free from free fatty acids that develop from oxidization. Liberal quantities of acids as a rule have a corroding influence. Ball-bearing lubricants I believe should be pure petroleum products, free from sulphur and well refined.

I do not think that enough care is exercised by manufacturers in selecting greases of suitable consistencies. A soft grease used in a grease cup where a high melting point grease is desirable is about as bad as using none, for it soon leaves the bearings dry unless constantly replenished.

GASOLINE.

I make the broad statement that gasoline is responsible for many of the troubles laid to lubricating oils, carbon troubles particularly. Let me define what quality means.

A suitable gasoline should be free from moisture, from sulphur, from nitrogenous property, from acids and alkali and from any trace of oil and of the gravity demanded as an index of evaporative, combustive and carbon tests.

A poor gasoline will corrode metals when it burns, will fail to ignite, will deposit low grades of carbon. It must be borne in mind that gasoline is a light fraction from crude petroleum and is a hydrocarbon product.

In using probably fifteen more times gasoline than lubricating oil in operating a car it is possible to see that the specific gravity (indicative of the weight) should be very carefully considered.

Again, acids and alkali solutions with water are agents used in sweetening or refining gasoline. They are not always removed perfectly. Without going into detail I will state that the poorer grades of crude petroleum do not produce as high a grade of gasoline as do the better grades of crude petroleum, and there is a choice.

The refiner can do much toward eliminating troubles by filtering and otherwise exercising considerable care in the removal of the clarifying agents.

THE PRESIDENT: Instead of proceeding to the discussion on the individual paper, we will take the next paper in order and discuss the papers that we have this morning altogether. The next paper is a very short one. We will take Mr. Churchward's Energy Consumption of Commercial Vehicle.