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REREFINING USED CRANKCASE OIL

The National Bureau of Standards receives numerous inquiries concerning the rerefining of used crankcase oils. This letter circular has been prepared for the purpose of answering such inquiries. It contains a brief statement of the information available at the Bureau on the subject and lists several publications in which more detailed information is given.

The accumulation of impurities in the lubricating oil being used in an engine crankcase necessitates periodic draining of the crankcase. These impurities consist of (a) solid particles, (b) products formed by oxidation of the oil, in particular, acid compounds, (c) less volatile parts of the fuel which have worked past the piston rings and diluted the oil, and (d) water. Since a large percentage of the original constituents of the new oil still remain unchanged, adequate removal of these impurities permits the use of the oil again in the crankcase.

The process of removing the impurities so as to make oil satisfactory for replacement in the engine is called rerefining, and the finished oil after this treatment is called rerefined oil. The general process of rerefining consists of the following seven steps, some of which may be omitted if the nature and amounts of the impurities, or the use to which the rerefined oil is to be put, warrant it.

1. Removal of solid particles.

Obviously all gritty material which could act as an abrasive must be removed. This may be accomplished by settling, centrifuging, or filtering. Solid particles may also be precipitated by treating with alkalies, alkaline salts or washing powders which are mixtures of soap and alkaline salts.

2. Neutralization of acid compounds.

Treatment with alkalies will neutralize acid compounds in the oil and render them non-corrosive. Among the materials which may be used are soda ash (sodium carbonate), water glass (sodium silicate), caustic soda (sodium hydroxide), and trisodium phosphate.

3. Washing of oil.

In neutralizing the acid compounds in the oil, soaps are formed. Since both the soaps and the excess alkali are soluble in water, washing with water to remove them may be desirable.

4. Distillation.

The less volatile portions of the gasoline which have diluted the oil during use may be removed by distillation. Since cracking of the oil will occur if the temperature gets too high, the distillation may be carried out either in vacuum or by bubbling steam through the oil.

5. Decolorizing oil.

The methods most commonly used for decolorizing oils after distillation are (a) percolation through bleaching clay, such as fuller's earth, or (b) the contact process in which the bleaching clay is mixed with the oil and then removed by a filter press.

6. Blending to the desired viscosity.

If the finished rerefined oil has not the desired viscosity, it may be blended with a lighter or a heavier oil.

7. Replenishing additives.

Use in the engine and rerefining may remove part or all of the various chemical additives which may have been incorporated in the original oil by the refiner to inhibit oxidation, bearing corrosion, formation of engine deposits, etc. If the rerefined oil is to be used in service requiring such fortified oils, the proper amounts of suitable additive concentrates must be added to the oil after rerefining.

The processes outlined for rerefining oils cover only in a general way methods which have been commonly used. Many variations in the methods are possible, and in some cases two or more steps may be carried out simultaneously. There are available some compact units occupying a space such as 18' x 4' and a height of 7' or smaller which will process a 90 to 100 gallon batch of used oil in about three hours. In such an apparatus, usually several processes are taken care of in one operation. For instance, while the oil is being agitated and heated with fuller's earth or other clay adsorbing material (for removal of water, acids and other oxidation products and for decolorizing), a vacuum pump is used to effect a distillation of the more volatile contaminants such as gasoline residues. Then the oil is filtered to remove all solid particles including the bleaching clay.

The quality of the rerefined oil depends upon the quality of the new oil or oils from which it was obtained, the extent and nature of deterioration and contamination which has occurred and the rerefining process itself. The treatment necessary to produce a satisfactory rerefined oil depends upon the quality of the crankcase drainings and the proposed use of the rerefined oil. Thus the problem of preparing a marketable rerefined oil from mixtures of crankcase drainings collected from commercial filling stations is a great deal more complex than the problem of rerefining oil of one brand and grade drained from a fleet of vehicles and intended for reuse in the same vehicles under known conditions of service.

In the first case, greater differences between individual batches would be expected because of differences in the composition of the batches of drainings from which they are prepared. Also, the rerefiner may have to contend with the presence of gear oils and greases or other oily waste in the crankcase drainings and must produce a finished product suitable for use under a variety of service conditions. In the second case, the operator probably can prevent contamination of the crankcase drainings with other oily waste and it may be unnecessary to remove the gasoline residue completely or to restore the color.

The ultimate measure of the quality of a new or rerefined oil is its performance in the engine. The National Bureau of Standards does not have adequate test data to support any statements concerning the relative performance of new and rerefined oils.

Appendix I

A few of the more recently published papers on rerefining are listed below. Copies of these papers are not available for distribution by the National Bureau of Standards, but they should be available for consultation in the larger libraries throughout the country. Also, photostatic copies of these papers may be obtained at reasonable cost from the United Engineering Societies Library, 29 West 39th Street, New York, N.Y.; the Carnegie Library, Pittsburgh, Pennsylvania; and other large technical libraries that provide photostat service.

1. "Recovery of Used Lubricating Oil", J.E. Walker;
Part I, "Two Groups of Reclamation Methods",
The Chemical Age, Vol. 45, No. 1159, p. 155,
September 13, 1941.
Part II, "Operating a Central Plant",
The Chemical Age, Vol. 45, No. 1162, p. 181.,
October 4, 1941.

2. "Oil Filtration and Reclamation", C.A. Bailey,
Iron and Steel Engineer, Vol. 19, No. 5, p. 61,
May 1942.

3. "Refining Practice Paralleled in Used Oil Reclamation",
W.S. Boynton, Aero Digest, Vol. 45, No. 3, p. 99,
May 1, 1944.

4. "Oil Purification Filtration and Reclamation",
Brian Corrigan, The Iron Age, Vol. 159, No. 14, p. 56,
April 3, 1947.

Appendix II

The following manufacturers have made it known that they are in a position to furnish equipment for rerefining crankcase oils. No claim is made as to the completeness of this list, and the inclusion of any manufacturer does not imply that the National Bureau of Standards recommends his apparatus or process.

* Automatic Oil Refiners, Inc.
Orchard Park, New York

* The Hilliard Corporation
102 West Fourth Street
Elmira, New York

* Milwaukee Refining Machines, Inc.
Clintonville, Wisconsin

Mixing Equipment Company, Inc.
1024-1040 Garson Avenue
Rochester 9, New York

William W. Nugent and Company, Inc.
410-412 North Hermitage Avenue
Chicago 22, Illinois

* Refinoil Manufacturing Corporation
415 West Fifth Street
Kansas City 6, Missouri

The Sharples Corporation
23rd and Westmoreland Streets
Philadelphia 40, Pennsylvania

Skinners Purifiers Division
Bendix Aviation Corporation
1500 Trombly Avenue
Detroit 11, Michigan

Tolhurst Centrifugals Division
American Machine and Metals, Inc.
East Moline, Illinois

* Youngstown Miller Division
Walter Kidde and Company, Inc.
675 Main Street
Belleville 9, New Jersey

*These five concerns offer self-contained rerefining units; the remainder furnish only such components as agitators, filters, or centrifuges.