Feb. 9, 1937. M. H. TUTTLE 2,070,383

LUBRICANT

Filed Sept. 5, 1933

Fig. 1.

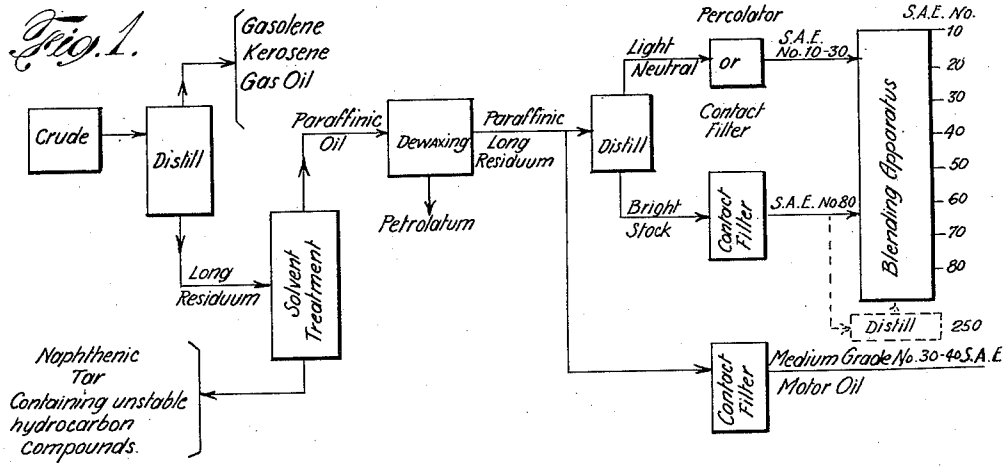


Fig. 2.

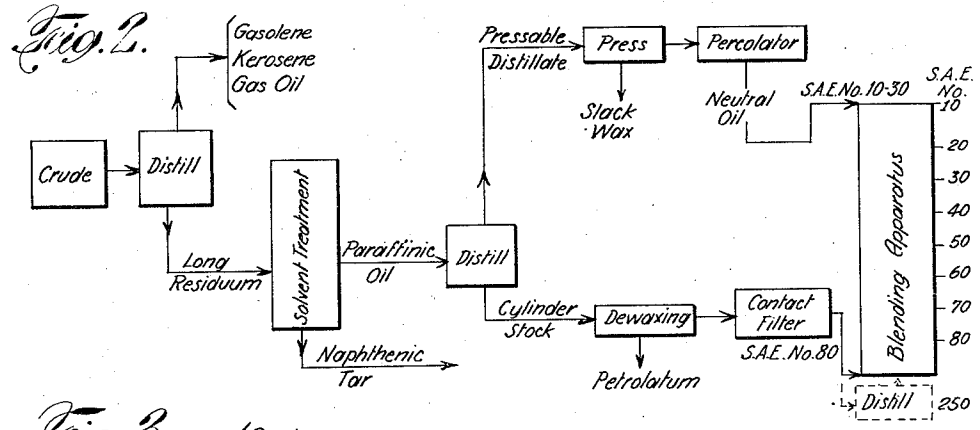
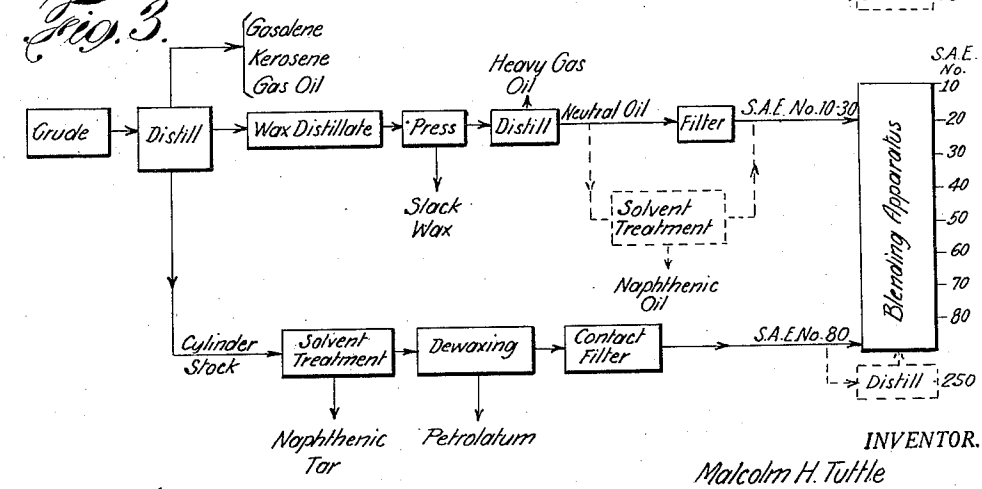


Fig. 3.



INVENTOR.
Malcolm H. Tuttle
BY Austin & Dix
ATTORNEYS.

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2,070,383

LUBRICANT

Malcolm Harley Tuttle, New Rochelle, N. Y., assignor to Max. B. Miller & Co., Inc., New York, N. Y., a corporation of Delaware

Application September 5, 1933, Serial No. 688,108

2 Claims. (Cl. 196—151)

The present subject matter is a continuation in part of the copending application of Malcolm H. Tuttle, Serial No. 623,483, filed July 20, 1932.

This invention relates to novel methods of preparing stable, heat-resistant lubricants of paraffinic nature from mixed base mineral oil residuums.

The invention also includes the improved products so prepared and which are characterized by the presence of the high-boiling paraffinic values of the original mineral oil substantially free from sludge and carbon forming components. The novel lubricating oils of this invention may be prepared with Saybolt uinversal viscosities at 210° F. of from 45 to 250, a viscosity index of 90 to 105, and with carbon residues of 0.11% to 0.9%.

Hitherto it has been commercially impossible to separate a mixed base residuum by distillation and chemical treatment into its paraffinic and naphthenic components. Separation by distillation is impossible because of similar boiling ranges of the two components. While treatment by sulphuric acid is commonly used as an aid for obtaining oils of lighter color, the treatment promotes polymerization, sulfonation and oxidation and the oil-soluble products of such reactions are highly detrimental to the treated oil. Moreover the bulk of the naphthenic oils are not removed by acid treatment so that the carbon residue, resistance to oxidation, and viscosity characteristics are such as to seriously affect the quality of the finished motor oil.

One of the main features of this invention is to provide an improved process for securing substantially all the paraffinic lubricating oil values from a mineral oil and from such paraffinic oil produce a full range of motor oils of special characteristics.

It is a further feature of this invention to provide such an improved process in which all of the paraffinic lubricating oil values are recovered from a crude oil in a plurality of steps, the lighter hydrocarbons being removed in an initial "topping" operation and the residual oil processed without chemical treatment to produce substantially pure paraffinic oils containing the highest boiling paraffinic fractions.

It is also a feature of this invention to provide such an improved process in which still bottoms or residual oils are solvent treated whereby to separate substantially all of the paraffin values from accompanying non-paraffinic values of such residual oils.

It is a further feature of this invention to provide a process whereby the viscous fractions of a mineral oil are concentrated by distillation in a residuum and the naphthenic fractions, which are solvents for wax and which inhibit the formation of wax on cooling, are removed from the residuum by solvent extraction, whereupon the naphthenic-free fraction may be dewaxed to produce an oil free of wax and naphthenic fractions.

It is a feature of this invention that lubricating oils may be prepared from residual oils and have such characteristics as to meet the British Air Ministry General Specification No. D. T. D. 109 for Mineral lubricating oils as published November, 1928, printed and published by His Majesty's Stationery Office, London, at Adastral, Kingsway, London, W. C., 2.

It is a characteristic of the oils produced by this invention, as compared with any oils of similar viscosities at 210° F. and 100° F. to have a lower carbon residue, a higher resistance to oxidation and to the formations of sludge and acid, and to have a better and more stable color.

It is a characteristic of the oils so produced, as compared with any oils of similar carbon residue and viscosity at 210° F., to have a higher flash and lower volatility, a lower viscosity at 100° F., a higher resistance to oxidation and to the formation of sludge and acid, and to have a more stable color.

It is a feature of this invention that the residual wax-bearing oils may be dewaxed prior to filtration and without any preceding treatment resulting in a change in the molecular structure of the components.

It is also a feature of this invention that the residual wax-bearing oils may be divided into wax, paraffinic oil and naphthenic oil without the use of any treatment resulting in a change of the molecular structure of any component.

A feature of this invention is that residual oils having components unstable chemically and unstable at high temperature may be processed to remove such components without decomposition leaving an oil which has a high degree of stability both to high temperature and to chemical action.

It is also a feature of this invention that a mineral oil may be processed to remove components unstable at high temperature before high temperature is utilized and to remove components which react chemically without chemical reaction so that the finished oil is free of the products of thermal and chemical reaction and resistant to both.

Other features and advantage of this invention include improved and novel lubricating oils comprising substantially all of the paraffin values of a mineral oil and more especially the higher boiling fractions thereof and substantially free from contamination by non-paraffinic or naphthenic tar-forming agents.

Heretofore the manufacture of viscous lubricating oils has followed two general systems, the first being by low temperature distillation for the production of a residuum, and the second be-

ing by high vacuum, high temperature distillation for the production of heavy distillates.

The method of preparing lubricants from a residuum is practiced chiefly on Pennsylvania oils and because of such operation the Pennsylvania lubricants contain the highest molecular weight and highest boiling fractions contained in the crude. These fractions give to the finished oil a lubricating value or "oiliness" not indicated by viscosity or viscosity index. They also add to the oil a resistance to oxidation, polymerization and sludging.

The second method of preparing lubricants by vaporizing a heavy distillate came into use with the growth in demand for automobile lubricants and the discovery of crudes which contained such a large amount of asphaltic and unstable compounds that a residuum could not be processed to yield a suitable lubricant. Distillation of such crudes concentrates the bulk of the asphaltic material in this residue so that a heavy distillate can be made, which, after proper treatment, will have a viscosity at 210° F. similar to an oil produced by the first method from a "long residuum". It will normally have a better initial color and a lower carbon residue than the residual lubricant but its viscosity at 100° F. will be higher, its flash lower, its volatility higher, and because of the fractions of high molecular weight discarded in the residue, it will lack the "oiliness" inherent in a residual oil and also stability against oxidation, sludging and polymerization.

Improvement of such distillates has been made by treatment with a selective naphthenic solvent, and while this has decreased the change in viscosity with temperature, improved the flash, color and stability, it has not added to the oil the material contained only in the residual oils, namely, the paraffinic fractions of highest molecular weight and boiling point which are chiefly responsible for "oiliness" and resistance to oxidation and thermal decomposition.

Treatment of mixed-base residual oils, by naphthenic solvents alone, has been attempted and failed because it was found that, when the solvent is used in sufficient quantity to give an oil of the desired quality, a large proportion of the paraffinic oil is lost to the asphaltic tar.

This invention makes use of the fact that an original or a residual oil may be treated in a solvent system in which a paraffinic solvent is employed in conjunction with a naphthenic solvent and a sharp separation made between the paraffinic and naphthenic (non-paraffinic) components. It has been determined that the oil so produced has as low a carbon residue and as good a color as the distillate lubricant and has retained the "oiliness", stability and viscosity characteristics of the residual paraffinic fractions.

The above and other desirable features and advantages will be described in the accompanying specification, certain preferred processes and products being disclosed by way of illustration only, for, since the underlying principles may be embodied in a number and variety of different methods, it is not intended to be limited to the ones here shown, except as such limitations are clearly imposed by the appended claims.

In the drawing Figs. 1, 2 and 3 represent flow sheets of the process and certain modifications thereof.

In the practice of the present invention, the crude oil is initially distilled under such conditions of temperature and pressure as to separate the relatively easily vaporizable fractions, and may include the so-called light and medium lubricating fractions. However, the distillation is carried out, in any event, under conditions such that the oil being distilled is not subjected to so-called "cracking" or pyrogenetic decomposition, leaving a mixed-base residual oil. The heavy paraffin fractions of the residual oil are of great value as lubricants and may be recovered, as such, by suitable solvent treatment and further processed to produce motor oils of unique characteristics.

The residuum, resulting from the low temperature distillation above noted, may be subjected to selective solvent treatment by paraffinic and non-paraffinic (naphthenic) solvents, preferably as set forth more fully in my copending application No. 623,483 filed July 20, 1931, for Process and apparatus for separation of mineral oil, and my Patents No. 1,912,348, issued May 30, 1933, for Process for separation of mineral oil, and No. 1,912,349, issued May 30, 1933, for Process for separation of mineral oil, whereby the heavy paraffin values are selectively dissolved by the paraffinic solvents and separated from the asphalt-forming materials, or naphthenic values, giving rise to a two-layer system. One of the layers contains the relatively light paraffinic solvent with the substantially pure heavy paraffinic lubricating values, consisting of paraffin hydrocarbons of high molecular weight dissolved therein, while the other layer will consist of the naphthenic solvents with the non-paraffinic asphalt base or naphthenic values of the original crude oil dissolved therein. These composite layers may be suitably separated from each other and subjected to a variety of treatments for the separate recovery of the heavy paraffin hydrocarbons and the asphalt base hydrocarbons from their respective solvents and the return of such solvents to the treating system.

Through the simultaneous use of paraffinic and non-paraffinic solvents residual oils may be extracted and the following advantages of such practice are noted:

1. All of the paraffinic components are recovered from the residual oil.

2. Paraffinic oils of lower carbon residue and higher resistance to oxidation are obtained than by any other method of treatment of residual oils.

3. A paraffinic oil free of the reaction products of polymerization, oxidation, sulfonation, chlorination and nitration.

4. Paraffinic oils of high flash with respect to viscosity are obtained.

5. The paraffinic oil contains the highest boiling paraffin fractions of the crude.

6. High temperatures and resulting decomposition are avoided in preparation of the stock.

7. Dewaxing may be carried on immediately following the extraction step without a rise in cold test of the wax-free oil on subsequent filtration and without the customary acid treatment of the wax-bearing stock.

8. Tar free of paraffinic fractions is obtained.

9. High settling rates are obtained; and

10. Low extraction temperatures are not required.

The system involved comprehends appropriate further treatment of the recovered paraffin values either in dissolved condition in an appropriate menstruum, or, as such, by aluminum chloride, activated or natural clay, fuller's earth, or other agents, whereby to improve the color and other

characteristics of the oil. The naphthenic values or asphalt material recovered are adapted for a variety of uses.

Considering the flow sheets disclosed in the drawing in more detail, it is desired to first consider the process outlined in the flow sheet of Fig. 1.

A suitable raw material such as a crude oil, or any oil containing the heavier paraffinic hydrocarbons admixed with a greater or lesser amount of non-paraffinic or naphthenic hydrocarbons is subjected to a distillation operation whereby the lighter hydrocarbons, including the gasoline, kerosene and gas oil fractions, are distilled off. The residuum from this treatment, so-called "long residuum", is then subjected to solvent treatment by means of suitable solvents for paraffinics and non-paraffinics, which are adapted to form separate layers with each other, and which several solvents, together with the respective components dissolved from the residuum are substantially immiscible with respect to each other. The solvent treatment and the improved solvents adapted for use therein, are more fully set forth and claimed in my co-pending application and issued patents previously referred to.

In accordance with that invention mineral oils are separated into fractions respectively more paraffinic and more naphthenic than the original oil by subjecting the oil to the action of a solvent or extracting agent which has greater solvent power for naphthenic constituents than for paraffinic constituents, and carrying out the extracting step in the presence of a solvent having greater solvent power for paraffinic constituents than for naphthenic constituents, the treatment preferably being effected under such conditions that the solvents employed are miscible only to a limited extent.

A feature of that invention is that treatment of mineral oil with an agent having selective solubility for naphthenic constituents, in the presence of an agent having solvent power for paraffinic constituents may be effected by maintaining counterflow of said agents and introducing the oil to the counterflow agents at a point intermediate the points at which they are introduced, a further feature being that the solution of paraffinic constituents is withdrawn from the resulting mixture at a point on the same side of the point at which the oil is introduced as is the point at which the naphthenic solvent is introduced, and the solution of naphthenic constituents is withdrawn from the resulting mixture at a point on the same side of the point at which oil is introduced as is the point at which the paraffinic solvent is introduced.

The naphthenic tar resulting from this treatment contains all of the unstable hydrocarbon compounds of the original oil. This tar fraction is removed from the system, together with its solvent, and the solvent may be separated therefrom by suitable process steps and returned to the solvent treatments of the long residuum.

The paraffinic values resulting from this solvent treatment of the "long residuum" are separated from the paraffinic solvent, which latter may be returned to the solvent treatment step.

This paraffinic oil resulting from solvent treatment of the long residuum contains substantially all of the paraffinic values of the original oil treated, including, of course, the heavy or high-boiling members of high molecular weight which are very stable at high temperatures such as are met with in internal combustion engines.

This stability of the highest boiling paraffinic fractions of the oil is coupled with a high resistance to oxidation, high viscosity index, and a high flash point with respect to viscosity. In addition, the oils treated according to this method require no acid or other chemical treatment.

The recovered paraffinic oil may now be dewaxed in the usual manner as by means of the Sharples centrifugal process, and the petrolatum separated and separately recovered. The resulting "paraffinic long residuum" resulting from this treatment may then be contact filtered to give a medium grade motor oil having an S. A. E. number of 30 to 40.

Where it is desired to separate the dewaxed paraffinic oil into a number of component parts having S. A. E. numbers ranging from 10 to 80, for the purpose of securing desired blends for various uses, the paraffinic long residuum, instead of being directly contact filtered, may first be distilled. The overhead products from this distillation, so-called "light neutral oils", may be passed through a percolator or contact filter and the resulting products passed into the blending apparatus Such oils are generally characterized by S. A. E. numbers of 10 to 30.

The bottom or "bright stock" resulting from the distillation of the paraffinic long residuum may be contact filtered to give an S. A. E. number of substantially 80. The "light neutral oils" and the "bright stock", as indicated, may be blended in a suitable apparatus and in varying amounts to give finished lubricating oils having S. A. E. numbers varying from 10 to 80. By distilling oils having an S. A. E. number of 80 or above, lubricating fractions may be obtained having Saybolt viscosities as high as 250 at 210° F.

It will be seen that by the practice of the invention as outlined hereinabove, substantially all of the paraffin values of the crude oil or any fraction thereof, can be recovered and combined, in suitable proportions, to give motor oils of varying viscosities and having S. A. E. numbers ranging from 10 to 80, and for special use, viscosities up to 250 at 210° F.

In addition, the so-recovered paraffin oils are characterized by exceptionally low Conradson carbons due to the absence of non-paraffinic or naphthenic materials which are readily decomposable. In addition, owing to viscosity and high resistance to oxidation, there is substantially no decomposition thereof in the explosion chamber of an internal combustion engine, or in any apparatus subjected to high temperature conditions. The color of these oils is good and exceptionally stable, due to the substantial freedom from the non-paraffinic or naphthenic componds normally present in lubricating oils as hitherto prepared.

The improved process here disclosed is of great commercial value not only as a result of the improved paraffinic product obtained and the separation therefrom of tar-forming values of the oil treated, but, due to the elimination of said treatment and reduction in filtration requirements, the costs resulting from high acid loss and treatment costs, as well as the costs of clay and other color-improving materials, are either minimized or eliminated.

The placing of a better lubricating oil, of any desired viscosity, upon the market, the use of which oil permits of appreciable savings and maintenance costs of automotive engines, due in one main respect to the lack of carbon formation in the various parts thereof, it will be appreciated,

does away with the necessity of removing carbon from the various parts of an engine as is now generally required, even in the most efficient or well-cared-for engines.

Where it is desired to secure the slack wax fraction from the paraffin hydrocarbons, as well as the petrolatum fraction, the processes schematically outlined in Figs. 2 and 3 are particularly adapted for such purpose.

Referring more particularly to the process outlined at Fig. 2, the crude oil is topped in the usual manner, care being taken, as already noted, to avoid temperatures sufficiently high to cause pyrogenetic decomposition of the oil, which temperatures are usually of the order of 650° to 700° F. The gasoline, kerosene and gas oil distillates are treated in the usual manner. The long residuum from this distillation is solvent treated according to the processes referred to hereinabove, whereby the long residuum is separated into a fraction containing substantially all of the paraffinic fractions of the original oil treated, including the high-boiling fractions thereof, as well as into a separate naphthenic tar fraction containing substantially all of the non-paraffinic components of the oil treated. The naphthenic tar may be distilled to produce viscous naphthenic oils having in general a specific gravity greater than 1.000 and to produce a good asphaltic residue.

The resulting paraffinic oil obtained from this solvent treatment is now distilled, the products being pressable distillates and so-called cylinder stock residuum. The pressable distillates may be pressed to remove the slack wax and the liquid distillate, freed of wax, is passed through a percolator to improve its color, giving a so-called "neutral oil". This neutral oil, characterized by S. A. E. Numbers 10 to 30, may be used as such or passed to the blending stage.

The cylinder stock from the distillation is also dewaxed to remove the petrolatum therefrom, the liquid obtained as the result of this treatment, if desired, being contact filtered. The product of this step is a lubricating oil having an S. A. E. number of approximately 80. This product may also be passed to the blending stage and combined with the neutral oil to give lubricating oil blends of any desired S. A. E. number ranging from 10 to 80, or it may be distilled, as above indicated, to give a lubricating portion having a Saybolt viscosity at 210° F. as high as 250.

It will be noted that by the practice of the invention, including the variations here disclosed, all of the wax values of an oil may be separately recovered as slack wax and/or petrolatum, thereby permitting the use of existing manufacturing processes while assuring resulting improved and cheapened products which have been appreciably improved in that all of the paraffinic lubricating values of a mixed-base mineral oil have been made available and the deleterious unstable non-paraffinic or tar-forming naphthenics have been removed prior to high temperature distillation of the paraffinic oil.

A further modification of the improved process of the present invention is indicated in the diagram of Fig. 3. In the practice of the invention herein as outlined in this figure, the raw stock, either crude or other mixed-base mineral oil, is distilled in the usual manner to "top" or remove the more volatile hydrocarbons, including the gasoline, kerosene and gas-oil fractions. However, the distillation is continued further to produce a wax distillate, the final residuum being identified in the trade under the name of "cylinder stock".

The wax distillate is pressed to remove slack wax while the resulting wax-free distillate is again distilled to remove heavy gas oil from the neutral oil. The neutral oil is filtered to give an oil having an S. A. E. number of 10 to 30, adapted particularly for lubricating purposes which may be used directly as such or passed to a blending stage, as shown.

Where desired, the wax distillate or the wax-free distillate may be solvent treated to remove any naphthenic compounds and the resulting substantially pure paraffinic lubricating oil used as such, or passed to a blending stage, as before.

The usual cylinder stock or residual oil from the first distillation step is, in its turn also solvent treated to remove the unstable naphthenic materials. The heavy paraffinic values of the oil recovered from this treatment are dewaxed to remove petrolatum, and the dewaxed, heavy oil, passed through a contact filter to improve its color, etc. This high viscosity oil may have an S. A. E. number ranging up to as high as 80 and may be used as such or passed to a blending stage to be used with the dewaxed oil from the wax distillate to give lubricating oil blends S. A. E. numbers varying from 10 to 80. As noted above, the high viscosity oil having an S. A. E. number of 80 may be distilled, if desired, to give lubricating fraction having Saybolt viscosity numbers varying from 80 up to 250 at 210° F.

It will now be appreciated that there have been provided new processes for securing, without decomposition, novel paraffinic lubricating oils containing substantially all of the paraffinic values of a crude oil, including the highest boiling fractions thereof. These products are characterized by substantial freedom from unstable materials such as non-paraffinic compounds which are readily decomposable and which exert a deleterious effect on lubricating oils generally. The improved products resulting from the processes of the present invention are substantially pure paraffinic hydrocarbons and include all the highest boiling paraffinic fractions of the original oil.

In addition, due to their purity and high viscosity they are particularly suited as lubricants for use in high temperature explosion motors.

Mineral lubricating oils as contemplated in the present invention and noted above, are pure, highly refined petroleum oils consisting solely of the paraffinic mineral oil fractions and free from any non-paraffinic mineral oil fractions save where the latter may be added to prepare a given type of lubricant for constant temperature work. Pure lubricating oils may be prepared clear and free from dirt, suspended matter, water, and other impurities.

The viscosity of the pure paraffin lubricating oils will vary according to the treatment as will be explained in more detail hereinafter and the absolute viscosity may be described as meeting in all respects the following requirements:

Summer grade	*Winter grade*
At 100° F. not more than 2.9 poise.	At 100° F. not more than 1.7 poise.
At 200° F. not less than 0.183 poise.	At 200° F. not less than 0.133 poise.

The improved mineral lubricating oils of pure paraffinic constitution as prepared by the processes of the present invention may have an "open"

flash point of not less than 390° F. when the oil sample is heated on a sand bath and the naked flame passed over the heating cup. Such oils will not contain more than a trace of mineral acid and no more organic acid than corresponds to 0.01 gm. KOH per 100 gm. of oil.

A particular feature of the improved oils prepared by the processes of the present invention resides in the fact that the ash content does not exceed 0.01%.

On oxidation after blowing for twelve hours the viscosity at 100° F. will not be greater than 2.0 times the original viscosity at the same temperature.

The residual carbon or Conradson carbon or so-called "coke number" shall not exceed 0.6. The coke number of an oil after 12 hours blowing shall not exceed the original coke number plus 1.

The paraffinic lubricating oils prepared according to the present invention shall not cease to flow when exposed for one hour to the following temperatures:

	Degrees centigrade
For summer oil	0
For winter oil	10

The oils prepared in accordance with this invention readily meet, as has been noted, the requirements, conditions and characteristics just above cited.

Heretofore in the preparation of mineral lubricating oils to meet these conditions and to approximate the oils resulting from the practice of the invention herein, it has been necessary to subject the oils to refining practices which involve distinct losses of the paraffinic values of those oils, and those results showed inclusion of appreciable portions of paraffins in dissolved condition in the non-paraffins, or naphthenics, resulting from desire to eliminate tar-forming materials.

Examples of the oils produced in accordance with this invention are given in the following table:

Run	Source	Raw stock			Extracted, dewaxed, and contacted oil						
		Gravity	Vis. 210	V. G. C.	Gravity	Vis. 210	Vis. 100	V. I.	V. G. C.	Flash	C. C.
	Long residuum stocks:										Pct.
A	Oklahoma pipe-line	18.8	161	.8675	27.4	75	740	94	.815	450	.22
B	Hendricks	16.8	147	.886	27.5	67	580	94	.817	440	.20
C	Ranger-Burbank	24.7	71	.837	28.7	60.5	435	100	.8115	435	.18
D	Tonkawa-Marshall	22.3	100	.847	28.2	69	561	103	.811	440	.18
E	Oklahoma pipe-line	19.9	144	.861	28.1	76	744	96	.810	460	.20
F	Ranger-Burbank	23.5	84	.848	28.8	65	509	100	.807	440	.17
G	Coastal	16.6	202	.884	24.9	81	1,070	70	.832	435	.24
H	East Texas	18.9	153	.868	27.7	80	846	94	.8115	490	.13
	Cylinder stock:										
J	Bolivar	24.0	227	.821	27.1	168	2,450	107	.8015	590	.71
	Reduced and blended oils from F:										
	S. A. E. 10				30.3	47	190	105	.819	415	.01
	S. A. E. 20				29.3	58.6	370	105	.808	430	.11
	S. A. E. 30				28.5	68.4	565	101	.809	445	.18
	S. A. E. 40				28.5	72.0	632	100	.808	445	.18
	S. A. E. 50				28.0	82.4	795	102	.808	470	.25
	S. A. E. 60				27.2	106.0	1,293	101	.809	490	.31
	S. A. E. 70				26.9	126.0	1,806	98	.808	520	.34
	S. A. E. 80				26.5	151.0	2,466	97	.808	555	.36
	250 S. U. at 210° F.				25.7	250			.807	625	.49

Vis. = Viscosity. V. I. = Viscosity index. S. U. = Saybolt universal.
V. G. C. = Viscosity-gravity constant. C. C. = Conradson carbon.

The S. A. E. 50 oil prepared by reducing the Ranger-Burbank extracted, dewaxed and contacted oil in Example F, meets the British Air Ministry General Specification No. D. T. D. 109, above referred to, for Winter grade oil and the S. A. E. 60 oil prepared in similar way meets the specification for Summer grade oil.

Tabulated below are the tests on the S. A. E. 50 and S. A. E. 60 oils with the coresponding British Air Ministry specifications.

	Winter grade		Summer grade	
	S. A. E. 50	B. A. M.	S. A. E. 60	B. A. M.
A. P. I. gravity	28.0		27.2	
Specific gravity	.8871		.8916	
Abs. viscosity at 100° F. poises.	1.55	1.75 (max.)	2.5	2.9 (max).
Abs. viscosity at 209° F. poises.	.164	0.133 (min.)	.231	0.183 (min.).
Flash °F	470	390 (min.)	490	390 (min.).
Free acid:				
Mineral	Nil	Trace (max.)	Nil	Trace (max.).
Organic	.002	0.01 (max.)	.002	0.01 (max.).
Oxidation test ratio.	1.56	2.00 (max.)	1.30	2.00 (max.).
Coke No.:				
(a)	.28	0.65 (max.)	.31	0.65 (max.).
(b) After oxidation.	.94	1.28 (max.)	1.15	1.31 (max.).
Color N. P. A	4		4½	

It is to be noted that these oils were prepared from residual oils without any kind of chemical treatment and are the first oils of this character meeting these rigid specifications.

The finished oil from the Ranger-Burbank long residuum, Example F, was tested in accordance with the British Air Ministry General Specification No. D. T. D. 109 to determine resistance to oxidation and decomposition. The coke number before oxidation was .17 and after oxidation .94. As a comparison, a well-known airplane engine lubricant having the same viscosity at 210° made from Pennsylvania crude was found to have a coke number before oxidation of .66 and after oxidation of 1.89. By this improved process lubricants can be made from mineral oil residues meeting the specifications of the British Air Ministry, which has hitherto been considered impossible.

Moreover, oils made according to the present invention may be used in aeroplane engines, for instance, for upwards of two hundred and often as much as three hundred hours without the formation of substantial sludge, which would

tend to clog the oil lines, with resultant danger of engine failure.

It will now be appreciated that there has been provided improved processes for preparing paraffinic lubricants containing all of the high-boiling paraffinic values of a residual oil and more particularly of a topped oil residuum which has been subjected to no chemical or mechanical treatment adapted to cause decomposition of any of the original components thereof. The improved processes herein disclosed further include solvent-treatment steps of such undecomposed residuals to separately recover all the paraffinic values in substantially pure state, as well as all of the non-paraffinic or naphthenic values in similar pure state. In addition to these desirable results the improved processes herein permit the recovering of all the paraffinic values of a mixed-base oil in lubricating fractions having S. A. E. numbers ranging from 10 to 250, which lubricating materials contain all of the highest boiling lubricating paraffinic fractions of the original oil. Further, the novel processes of the present invention also permit the separate recovery of the several wax values of the oils treated. The processes herein permit the recovery and preparation of mixed-base lubricants, i. e., substances containing both paraffinic lubricants and naphthenic or non-paraffinic materials for use in lubricating certain types of machinery, which are usually run under constant temperature conditions.

It is to be understood that this invention is not to be limited by any theory of operation expressed or by any example given, and that it include modifications and variations falling within the appended claims.

What is claimed is:

1. A lubricating oil produced from an asphaltic base residue and containing at least the major portion of the high-boiling lubricant hydrocarbons present in the crude, and having a viscosity-gravity characteristic in the order of .815, a viscosity index in the order of 100, and a Conradson carbon of less than of about .36, said oil being substantially free from constituents produced by treatment with sulphuric acid, and said oil being substantially free of constituents produced by distillation of a residual oil.

2. Lubricating oil of viscosity suitable for internal combustion engines produced in commercial quantity by solvent extraction from an asphaltic base residue and containing lubricant hydrocarbons extracted from the highest boiling portions of said residue, and having a viscosity gravity characteristic of about .801 to .819, a viscosity index of about 94 to 105, and a Conradson carbon of about .11 to .36, said oil being substantially free from decomposition products resulting from distillation of a residual oil and free from sludge-forming constituents over ordinary periods of use.

MALCOLM HARLEY TUTTLE.