

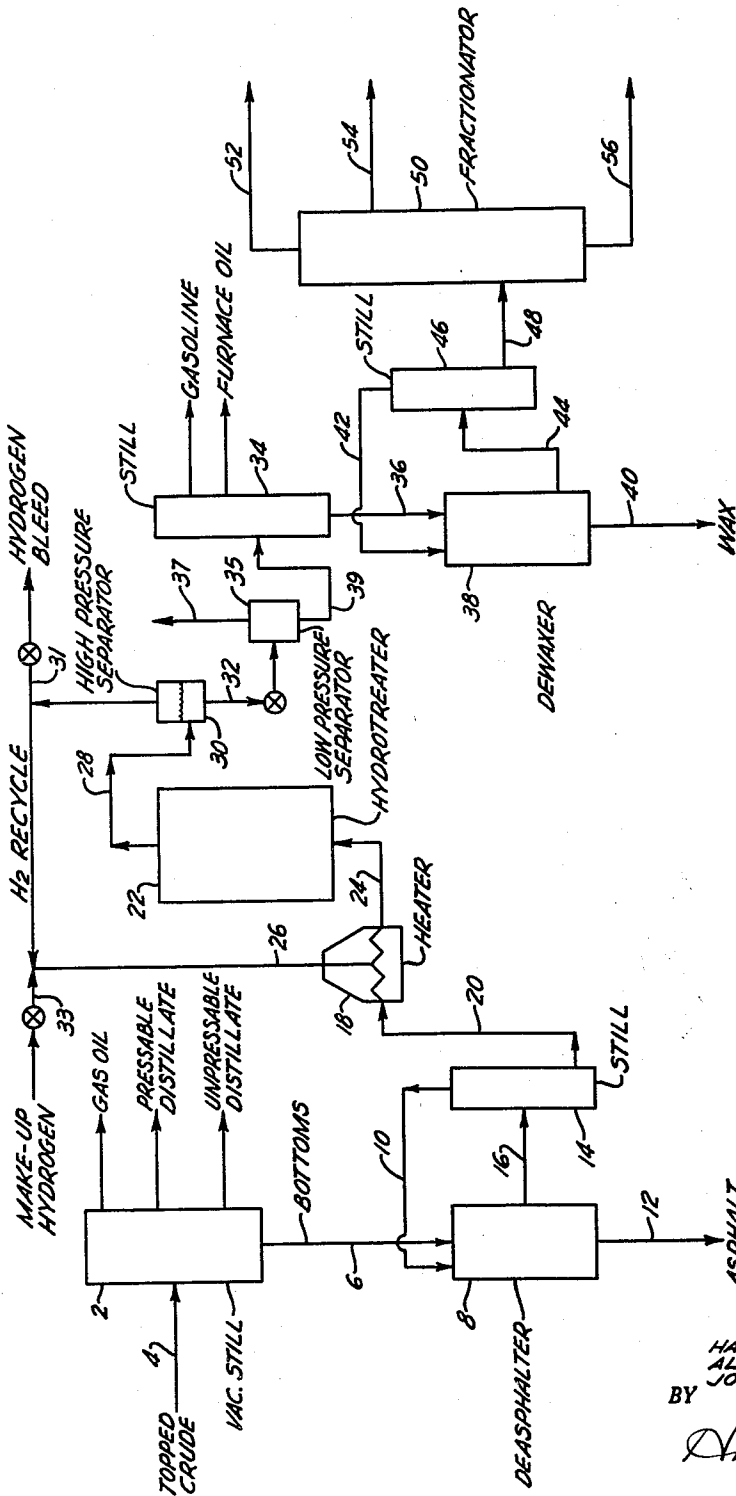
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PROCESS FOR PREPARING A MULTI-GRADE LUBRICATING OIL AND PRODUCT

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PROCESS FOR PREPARING A MULTI-GRADE LUBRICATING OIL AND PRODUCT

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This invention relates to improved procedure for preparing multi-grade or multi-viscosity grade lubricating oils and to improved multi-grade lubricating oil products.

It has been known to improve lubricating oils by hydrogen treatment, see for instance U.S. Patents 2,554,282 and 2,787,582. However, such procedures have not heretofore been employed to prepare multi-grade lubricating oils. It has furthermore been known to prepare multi-grade lubricating oils by adding V.I. improvers to certain lubricating oil fractions, see for instance "Industrial and Engineering Chemistry," volume 41, pages 952-959. The addition of these V.I. (viscosity index) improvers results in a product which has the necessary characteristics for a multi-grade oil. However, these products have certain undesirable characteristics among which is change in V.I. and viscosity during use. This is due to decomposition of the V.I. improver. Therefore the mixture does not have the multi-grade characteristics or lubricity during use that it had prior to use. This of course is an important defect since lowering of the V.I. and viscosity greatly modifies the value of the oil as a lubricant. As a matter of fact this change during use results in an oil which cannot properly be called a multi-viscosity grade oil.

The invention has for its object to provide procedure for preparing multi-grade oils by hydrogenation of certain petroleum fractions. Another object is to provide procedure for obtaining multi-grade hydrocarbon lubricants in relatively high yields by hydrogen treatment. A further object is to provide procedure for preparing multi-grade hydrocarbon lubricants without utilizing V.I. improving agents. A still further object is to provide improved multi-grade lubricating oils. Other objects will appear hereinafter.

These and other objects of our invention are accomplished by subjecting a deasphalted residuum having a V.I. of between about 75 and 100 and a viscosity at 210° F. of between about 90 and 200 S.U.S. to treatment with hydrogen at a temperature between about 735° and 825° F., at a pressure above about 2500 p.s.i. and at a space velocity between about 0.4 and 1.5. This treatment with hydrogen is carried out in the presence of a catalyst having both aromatic saturation and ring scission activity. The product from the hydrogen treatment is subjected to dewaxing (when necessary) and is then distilled to yield components which directly, or upon blending with each other, meet the S.A.E. specifications for a multi-grade lubricating oil and have a V.I. of 115 or above. Our invention also includes the multi-grade lubricating oil product thus produced. Furthermore we have found that the multi-grade lubricating oil product is amenable to conventional lubricating oil additives such as anti-oxidants, detergents and/or corrosion inhibitors and our invention includes the multi-grade lubricating oil product into which one or more of these additives have been incorporated.

In order to obtain high yields of multi-grade oils of the desired viscosity it is essential to employ a residual type charge stock. This is because the conditions necessary to give a multi-grade lube oil are severe and cause

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considerable ring scission with formation of lower boiling products. At the same time this ring scission is necessary to obtain the high V.I. required for a multi-grade oil. The starting material may be any residuum obtained by vacuum or like distillation of any petroleum or residual fraction thereof which after deasphalting, preferably with a low boiling hydrocarbon such as propane, propylene or butane, has a V.I. of 75 to 100 and a viscosity at 210° F. of 90 to 200 S.U.S. Thus for instance the residuum may be prepared by vacuum distillation of a Pennsylvania, Mid-Continent, West Texas, Kuwait, etc. crude. We have found that deasphalting with agents such as sulfuric acid, phenol, sulfur dioxide, etc. results in removal of components which upon hydrogenation have desirable properties for a multi-grade oil product and if these materials are employed for asphalt removal, the product produced will not be of as good quality and the yield of multi-grade oils will be markedly lower. A higher carbon residue will result in undesirable shortening of the life of the catalyst under the relatively severe hydrogen treatment conditions employed to produce the multi-grade oil. For this reason we prefer to employ charge stocks having a low carbon residue such as below about 2 (Conradson). However, higher carbon residue charge stock may be used if catalyst life is not of great importance or a rugged catalyst is used. The utilization of a charge stock having a V.I. of 75 to 100 is essential in obtaining a reasonable yield of a multi-grade oil. The high V.I. products necessary for multi-grade lubricating oil, i.e. a V.I. of above about 115, are produced in good yield only if a charging material of at least about 75 V.I. is employed. Excessive ring scission to obtain the V.I. required for multi-grade oils will drastically lower yields if a lower than 75 V.I. charge stock is used. A viscosity of between about 90 and 200 S.U.S. at 210° F. is necessary so that the multi-grade oil product will have the proper viscosity after the hydrogen treatment.

The reaction conditions specified are necessary to obtain the conversion into a multi-grade product or to a product containing the multi-grade components. If a temperature much below 735° F. is employed, the conversion to multi-grade oil will not be commercially attractive. On the other hand if a temperature much above 825° F. is employed, the conversion into materials having too low a viscosity for multi-grade oil will be excessive. Within the ranges specified the temperature and space velocity can be interchanged to give about the same results. In other words a low temperature with a low space velocity will give about the same yield and quality of multi-grade oil as a higher temperature and higher space velocity. Pressures of below about 2500 p.s.i. do not result in sufficient conversion and give an undesirably short catalyst life. Much higher pressures such as 5000 or even 10,000 may be employed but are not commercially attractive since they are more costly to produce and maintain and do not result in much if any improvement in yields or product quality. A pressure of about 3600 to about 4000 p.s.i. is preferred since such pressures result in longer catalyst life and are most economical. The conditions specified will result in commercially attractive yields of multi-grade oils and in addition will yield products in about the ratio in which they are consumed. Thus these conditions will result in a yield of about one volume of S.A.E. 10W/20 multi-grade oil to two volumes of S.A.E. 20W/30 and/or 20W/40 multi-grade oil. These are the relative proportions of the market demand for these multi-grade oils.

The catalyst employed for the hydrogenation must have high activity for saturation of aromatics and high activity and selectivity for ring scission. Such catalysts are known in the art. For instance they may comprise a sulfide of any metal of group VI left-hand column of the periodic

system mixed with a sulfide of an iron group metal. Specifically the catalyst may be molybdenum sulfide, tungsten sulfide or chromium sulfide, etc. mixed with a sulfide of iron, cobalt and/or nickel. A particularly desirable catalyst is a mixture of nickel sulfide and tungsten sulfide. Such a catalyst in a ratio of 1 to 4 mols of nickel to 1 of tungsten (determined as metals) has especially high activity and selectivity. Other examples of satisfactory sulfide mixtures are cobalt sulfide-tungsten sulfide and nickel sulfide-molybdenum sulfide mixtures. The catalysts may be supported or unsupported. A mol ratio of 1:1 of these mixtures has been found satisfactory.

Pure hydrogen may, of course, be used. However, hydrogen of lower purity such as reformer hydrogen works very well. If an impure hydrogen is used it is recommended that part of the recycled hydrogen be bled from the recycle stream or that a recycle hydrogen clean-up procedure be used. The hydrogen may be circulated in a ratio of between about 2500 and 10,000 s.c.f. per barrel of charge. Higher or lower amounts of hydrogen can be employed. Water should not be present in the hydrogen or other materials used in the process since it has a deactivating effect on the catalyst.

The product from the hydrogenation step will contain lower boiling reaction products such as gasoline, furnace oil and gases which are unsuitable for multi-grade oils. Also if any wax-like materials were present in the charge stock they will be present in the product from the hydrogenation. It is necessary to remove these materials from the product. The gasoline and furnace oil can be removed by stripping or distillation. Removal of wax if present is then accomplished by any treatment conventionally used for dewaxing ordinary lube oils. This procedure is carried out to give a pour point of between about -5° and $+5^{\circ}$ F. An example of satisfactory dewaxing treatment is dissolving the oil in a solvent such as methyl ethyl ketone and/or toluene, propane, etc. and cooling and filtering off the wax. Thereafter the solvent is removed by distillation. If a lower pour point than that specified above is desired, it can be conveniently obtained by addition of a small amount of any conventional pour point depressant such as "Acryloid 618" which is a polymethacrylate or by addition of polyisobutylenes. It is advantageous, where a charge stock contains wax, to dewax after the hydrogenation since it is easier to remove the wax from the hydrogenated product and a better quality wax is obtained.

The hydrogenated and dewaxed (if dewaxing is applied at this stage) product may be distilled to directly separate fractions which have the properties of multi-grade oils. Thus the product may be distilled to separate fractions having the maximum and minimum S.A.E. viscosity requirements for the multi-grade oil to be produced; for instance for a 10W/20 multi-grade oil a maximum viscosity at 0° F. of less than 12,000 S.U.S. and a viscosity at 210° F. of between 45 and 58 S.U.S., and for a 20W/30 multi-grade oil a maximum viscosity at 0° F. of less than 48,000 S.U.S. and a viscosity at 210° F. of between about 58 and 70 S.U.S. and for a 20W/40 multi-grade oil a maximum viscosity at 0° F. of less than 48,000 S.U.S. and a viscosity at 210° F. of between about 70 and 85 S.U.S. These distillates will in each case have a V.I. of above about 115 and in most cases above 120 and as high as 135 depending upon the reaction conditions and the V.I. of the starting material. Thus the greater the severity, the higher the V.I. of the product. Also as a general rule, the higher the V.I. of the starting material, the higher will be the V.I. of the product. On the other hand it is satisfactory to distill the hydrogenated product to obtain separate fractions for blending to obtain a blended 10W/20 multi-grade oil or a blended 10W/30 or 20W/40 multi-grade oil which meet the S.A.E. specifications for these multi-grade oils. When utilizing this method of separating and recombining

portions of fractions of the hydrogenated product, it is probable that some of the lubricating oil fractions in the 20W/30 or 20W/40 S.A.E. range will be added to the lower S.A.E. range oils and vice versa to obtain a blended product having the desired characteristics. The procedure for blending is well known to lubricating oil chemists. Regardless of which distillation method is used, light non-lubricating portions of the product such as gases, gasoline and furnace oil—which are formed during the hydrogenation—should be removed or separated from the lube oil fractions. The furnace oil has good burning characteristics and the gasoline is a good stock for hydrogen reforming. The distillation should be conducted so as to avoid thermal decomposition as much as possible. Vacuum and/or distillation with an inert gas such as steam is employed.

While the process of our invention yields other multi-grade oils which can be separated by distillation, it is of particular value for preparing the 10W/20, 20W/30 and/or 20W/40 multi-grade oils. The demand for these oils is in the approximate ratio of 1 volume of 10W/20 to two volumes of 20W/30 or 20W/40 and the operation of our process under the conditions specified yields these multi-grade oils in almost exactly this ratio. While the treatment also results in conversion of the charge stock into some lighter fractions as explained above, nevertheless these light fractions can be removed during the distillation and may be used in other applications where high viscosity is not required. In view of the high yield (50–60 percent in most cases) of high quality multi-grade oils, this conversion of part of the charge stock into lighter lube fractions does not alter the favorable economics of our process.

The multi-grade lubricating oils described herein can be further improved by addition of conventional or known lubricating oil additives. The degree of improvement is equal to and in many cases greater than the improvement obtained by addition of such conventional additives to other lubricating oils. For instance a 10W/20 multi-grade lubricating oil having a V.I. of 122 prepared by hydrogenation and containing 0.3 percent of a conventional pour point inhibitor (Acryloid 618), a detergent comprising a mixture of barium thiophenate and calcium sulfonate (8.0 percent), and 0.9 percent of an antioxidant (zinc o,o,dialkyl dithiophosphate) exhibited unusual properties as compared with a conventional lubricating oil having a V.I. of 108 to 110 and containing the same amount of additives in addition to 2.0 percent of Acryloid 966 to produce a V.I. of 125. When these two oils were compared in the crankcase of internal combustion engines under identical operating conditions, it was found that the octane requirement increase (O.R.I.) of the conventional oil containing the Acryloid V.I. improver was much greater than that of the hydrogenated oil containing no V.I. improver. This is surprising in view of the fact that multi-grade oils containing V.I. improvers have been recognized as having a lower O.R.I. than oils containing no V.I. improvers. See "Some Problems Associated with the Recommendation and Use of Multi-Viscosity Oils," Withrow, presented before the Lubricating Committee API Division of Marketing, Detroit, Michigan, February 28, 1956. Our improved multi-grade oils are amenable to additives conventionally employed in lubricating oils. Examples of additives which may be incorporated in our hydrogenated multi-grade oils are the well known detergents of the type of metal sulfonates, metal phenates and metal naphthenates. Examples of other antioxidants which may be added to our hydrogenated multi-grade lubricating oils are those of the class of P_2S_5 -terpene reaction products, zinc dithiophosphates and alkylated phenols. These materials also can be added for their corrosion inhibiting effects.

In the accompanying drawing we have illustrated diagrammatically apparatus in which our invention may

be carried out. Referring to the drawing, numeral 2 designates a vacuum still into which the crude charge stock such as a topped crude is introduced through conduit 4. This charge is fractionated in conventional fashion to separate gas oil, pressable distillate and unpressable distillate as overhead fractions and a bottoms fraction for use as a charge stock in the present invention. This bottoms fraction is removed from still 2, through conduit 6 and is introduced into deasphalting equipment 8 where the asphalt is removed in known manner by precipitation in the presence of propane which is introduced through conduit 10. Asphalt is removed through conduit 12 and the bottoms fraction together with propane is introduced into still 14 through conduit 16. Here propane is separated and is recycled through conduit 10. The deasphalted bottoms fraction is introduced into heater 18 through conduit 20 together with hydrogen from conduit 26 and is then introduced into hydrogen treating reactor 22 via conduit 24.

In reactor 22 the deasphalted bottoms fraction is hydrogenated in accordance with the above description. The hydrogen and hydrogenated product are removed from reactor 22 via conduit 28 and introduced into high pressure separator 30 where the hydrogen is separated and recycled via conduit 26. To maintain hydrogen purity, impure hydrogen is bled from the system through conduit 31 and make-up hydrogen is added through conduit 33. The hydrogenated product is removed from high pressure separator 30 through conduit 32 and is introduced into low pressure separator 35 where gases are removed and withdrawn through conduit 37. The product is then introduced into still 34 via conduit 39 and subjected to distillation. Here gasoline and furnace oil are removed as overhead fractions and a bottoms fraction is removed through conduit 36 and introduced into dewaxing unit 38. The hydrogenated lube oil portion of the product is treated in unit 38 in the presence of a dewaxing solvent such as a mixture of methyl ethyl ketone and toluene at low temperature to remove wax which is precipitated and removed through conduit 40. The dewaxing solvent is introduced into dewaxer 38 through conduit 42. During dewaxing the wax-like hydrogenation products are simultaneously removed with any wax products initially present in the charge stock. The product is then removed from dewaxer 38 through conduit 44 and is introduced into still 46 where the dewaxing solvent is removed and recycled through conduit 42. The solvent-free hydrogenation product is removed from still 46 through conduit 48 and introduced into vacuum fractionating tower 50 where a light lube oil product is removed overhead through conduit 52, multi-grade lube oils or multi-grade lube oil blending stocks are removed as separate cuts or fractions via conduits 54 and 56. While removal of two such fractions are shown, a larger number of blending or multi-grade fractions can be separated if desired.

EXAMPLE 1

An Ordovician reduced crude having the properties given in Table I was charged to a propane deasphalting unit to yield a product with the specifications also given in Table I.

Table I

Charge Stock	Reduced Crude	Propane Deasphalted
Wt. Percent on Crude	9.1	4.9
Properties:		
Gravity, ° API	16.4	23.2
Vis., SUV Seconds 210° F	486	149.4
Carbon Residue (Conradson) Percent	8.6	1.6
V.I.		95
Flash, ° F	615	590
Fire, ° F	705	680
Pour, ° F	+40	+90
I ₂ Number (modified Hanus Method)		13.0

The deasphalted product was preheated to about 720° F. and sent to a hydrotreating unit similar to that illustrated in the drawing and containing a mixed nickel sulfide-tungsten sulfide catalyst in a mol ratio of 4:1. The reaction conditions were 740° F., 0.5 liquid hourly space velocity, 5000 s.c.f. of hydrogen per barrel and 3000 p.s.i.g. The product after a high pressure separation of hydrogen was topped at atmospheric pressure and yielded the following percentages of materials boiling below the specifications for lube oils: (1) gasoline (400° F. end point); 7.6% by volume of the charge to the hydrotreater and (2) furnace oil (670° F. end point); 21.3% by volume of the charge to the hydrotreater. The remaining product was dewaxed by mixing with 4 volumes of a mixture of 60 parts by weight of methyl ethyl ketone mixed with 40 parts of toluene followed by cooling to 0° F. to yield 12% by volume charge to hydrotreater of good quality wax. After removal of the dewaxing solvent the material had a pour point of 0° F. and was fractionated at 2 mm. pressure with an inert gas being continuously added to the still pot.

Two blending oils or fractions were separated having the properties shown in Table II.

Table II

Blending Oils	Cut Temp., ° F.	Yield Percent Vol. Charge to Hydrotreater
#1	725-875	20.3
#2	875+	36.5

These blending oils were blended to form 10W/20 and 20W/30 multi-grade oils in the proportions shown in Table III.

Table III

Composition of Base Oils	10W/20	20W/30
Blending Oil #1	62.0	22.1
Blending Oil #2	38.0	77.9
Yield Percent Vol. Charge to Hydrotreater	19.8	37.0

The properties of the multi-grade oils so produced and the S.A.E. specification range for such oils are shown in Table IV.

Table IV

Product	10W/20	S.A.E. Specification Range	20W/30	S.A.E. Specification Range
Specifications:				
Vis., SUV Sec.—				
0° F.	10,000	<12,000	27,500	<48,000
100° F.	208		425	
210° F.	49.2	45-58	65.0	58-70
V.I.	122		120	
I ₂ Number	1.8		1.5	
Color ASTM Union	1.0		1.75	
Carbon Residue (Conradson) Percent	<0.01		0.04	

EXAMPLE II

10W/20 and 20W/40 multi-grade oils were produced by treating the charge stock used in Example I at a temperature of 745° F., a space velocity of 0.5, a pressure of 3000 p.s.i.g. and a hydrogen recycle rate of 5000 s.c.f. per barrel of charge. The same catalyst was employed as in Example I and the product was dewaxed to a pour point of 0° F. and fractionated in the same manner as in Example I to obtain blending oils at the temperatures indicated in Table V.

Table V

Blending Oils	Cut Temp., ° F.	Yield Percent Vol. Charge to Hydro- treater
#1-----	725-890	18.5
#2-----	890+	37.5

The blending oils shown in Table V were blended in the proportions shown in Table VI to obtain a 10W/20 multi-grade and a 20W/40 multi-grade oil.

Table VI

Composition of Base Oils	10W/20	20W/40
Blending Oil #1-----	75.0	100
Blending Oil #2-----	25.0	0
Yield Percent Vol. of Charge to Hydrotreater-----	24.8	31.2

The properties of the multi-grade oils and the S.A.E. specification ranges for these multi-grade oils are shown in Table VII.

Table VII

Product	10W/20	S.A.E. Specifi- cation Range	20W/40	S.A.E. Specifi- cation Range
Specifications:				
Vis., SUV Sec.—				
0° F. (extrapolated)-----	8,000	<12,000	38,000	<48,000
100° F.-----	173		555	
210° F.-----	46.0	45-58	74.0	70-85
V.I.-----	119		119	
Iodine No.-----	1.9		1.5	
Color ASTM Union-----	<1.0		1.75	
Carbon Residue (Conradson) Percent-----	0.01		0.03	

Analysis of typical 10W/20, 20W/30 and 20W/40 multi-grade lubricating oil products produced by the herein described process show that they have the range of properties given in Table VIII.

Table VIII

Composition:	Mol percent
Alkanes-----	1-3
Non-condensed cyclo alkanes-----	65-78
Condensed cyclo alkanes—	
2 ring-----	16-19
3 ring-----	4-7
4 ring-----	2-3
5 ring-----	1-2
6 ring-----	0-0.5
Alkyl benzenes-----	1-2
Alkyl naphthalenes-----	0-0.3
Inspections:	
°API-----	30.0-33.0
Viscosity, SUV seconds—	
100° F.-----	150-580
210° F.-----	45-85
Viscosity index-----	115-135
Iodine number-----	1.5-2.2
Mol weight-----	380-700
Carbon residue-----	0.0-0.2

We claim:

1. The method of producing a multi-grade lubricating oil by treatment with hydrogen to obtain combined hydrogenation and ring scission which comprises in combination treating a deasphalted residuum having a V.I. between about 75 and 100 and a viscosity at 210° F. of between about 90 and 200 S.U.S. with hydrogen at a temperature between about 735° and 825° F., at a pressure above about 2500 p.s.i., at a space velocity between about 0.4 and 1.5, and in the presence of a catalyst comprising essentially a mixture of the sulfides of a metal of group VI left-hand column of the periodic system and iron

group metals, dewaxing the product to a pour point below about 5° F. and subjecting the dewaxed product to vacuum distillation to separate components within the maximum and minimum viscosity limits of the S.A.E. specifications for a multi-grade lubricating oil, said components having a V.I. of at least 115.

2. The method of producing a multi-grade lubricating oil by treatment with hydrogen to obtain combined hydrogenation and ring scission which comprises in combination treating a vacuum tower residuum which has been deasphalted with a low boiling hydrocarbon and which after deasphalting has a V.I. between about 75 and 100 and a viscosity at 210° F. between about 90 and 200 S.U.S. with hydrogen at a temperature between about 735° and 825° F., at a pressure above about 2500 p.s.i., at a space velocity between about 0.4 and 1.5 and in the presence of a catalyst comprising essentially a sulfide of a metal of group VI of the periodic system mixed with a sulfide of an iron group metal, stripping and dewaxing the product to a pour point between about -5° and +5° F. and subjecting the product to vacuum distillation to separate a fraction within the maximum and minimum viscosity limits for a member of the group consisting of S.A.E. 10W/20, S.A.E. 20W/30 and S.A.E. 20W/40 multi-grade lubricating oils and having a viscosity index of at least 115.

3. The method of producing a multi-grade lubricating oil by treatment with hydrogen to obtain combined hydrogenation and ring scission which comprises in combination treating a vacuum tower residuum which has been deasphalted with a low boiling hydrocarbon and which after deasphalting has a V.I. between about 75 and 100 and a viscosity at 210° F. between about 90 and 200 S.U.S. with hydrogen at a temperature between about 735° and 825° F., at a pressure above about 2500 p.s.i., at a space velocity between about 0.4 and 1.5, and in the presence of a catalyst comprising essentially a sulfide of a metal of group VI of the periodic system mixed with a sulfide of an iron group metal, stripping and dewaxing the product to a pour point between about -5° and +5° F., subjecting the product to vacuum distillation to separate a plurality of fractions having a V.I. above about 115 and blending these fractions to produce a multi-grade oil having the maximum and minimum viscosities for S.A.E. 10W/20, S.A.E. 20W/30 and S.A.E. 20W/40 multi-grade lubricating oils in the approximate ratio of one volume of S.A.E. 10W/20 to two volumes of S.A.E. 10W/30 and 20W/40 multi-grade lubricating oils.

4. The method of producing a multi-grade lubricating oil by treatment with hydrogen to obtain combined hydrogenation and ring scission which comprises in combination treating a vacuum tower residuum which has been deasphalted with propane and which after deasphalting has a carbon residue below about 2.0 percent, a V.I. between about 75 and 100 and a viscosity at 210° F. of between about 90 and 200 S.U.S. with hydrogen at a temperature between about 735° and 825° F., at a pressure of about 3600-4000 p.s.i., at a space velocity between about 0.4 and 1.5 and in the presence of a catalyst comprising essentially a mixture of nickel and tungsten sulfides and subjecting the product from the hydrogen treatment to dewaxing to a pour point below about 5° F. and to distillation to separate fractions within the maximum and minimum viscosity limits for S.A.E. 10W/20, S.A.E. 20W/30 and S.A.E. 20W/40 multi-grade lubricating oils and having viscosity indices of at least 115.

5. The method of producing a multi-grade lubricating oil by treatment with hydrogen to obtain combined hydrogenation and ring scission which comprises in combination treating a vacuum tower residuum which has been deasphalted with propane and which after deasphalting has a V.I. between about 75 and 100 and a viscosity at 210° F. of between about 90 and 200 S.U.S. with hydrogen at a temperature between about 735° and 825°

F., at a pressure of about 3600-4000 p.s.i., at a space velocity between about 0.4 and 1.5 and in the presence of a catalyst comprising essentially a mixture of nickel and tungsten sulfides, distilling the product to remove materials boiling below lube oil fractions, stripping and dewaxing the product to a pour point between about -5° and $+5^{\circ}$ F., subjecting the product to vacuum distillation to separate fractions having a V.I. above 115 and blending at least two fractions to obtain a blend having the maximum and minimum viscosities for a member of the group consisting of S.A.E. 10W/20, S.A.E. 20W/30 and 20W/40 multi-grade lubricating oils.

6. As a new composition of matter a multi-grade lubricating oil which is substantially devoid of any added viscosity index improving material and comprising essentially a mixture of hydrogenated hydrocarbons having the characteristics of a multi-grade oil selected from the group consisting of S.A.E. 10W/20, S.A.E. 20W/30 and S.A.E. 20W/40 multi-grade oils, the S.A.E. 10W/20 multi-grade oil having a V.I. of at least 115, a viscosity at 0° F. of below about 12,000 S.U.S., a viscosity at 210° F. of between about 45 and 58 S.U.S., a pour point of below about $+5^{\circ}$ F. and an iodine number below about 2, and the S.A.E. 20W/30 multi-grade oil having a V.I. of at least 115, a viscosity at 0° F. of below about 48,000 S.U.S., a viscosity at 210° F. of between about 58 and 70 S.U.S., a pour point of below about $+5^{\circ}$ F., and an iodine number below about 2 and the S.A.E. 20W/40 multi-grade oil having a V.I. of at least 115, a viscosity at 0° F. of below about 48,000 S.U.S., a viscosity at 210° F. of between about 70 and 85 S.U.S., a pour point of below about $+5^{\circ}$ F. and an iodine number below about 2, said composition being obtained by hydrogenation of a deasphalted residuum and distillation of the hydrogenated product to separate a member of the group consisting of fractions which upon blending yield these S.A.E. multi-grade oils and fractions having the properties of these multi-grade oils.

7. As a new composition of matter a multi-grade lubricating oil which is substantially devoid of any added viscosity index improving material and comprising essentially a mixture of hydrogenated hydrocarbons having the characteristics of an S.A.E. 10W/20 multi-grade oil, said composition having a V.I. of at least 115, a viscosity at 0° F. of below about 12,000 S.U.S., a viscosity at 210° F. of between about 45 and 58 S.U.S., a pour point of below about $+5^{\circ}$ F., an iodine number below about 2 to which has been added at least one lubricating oil additive.

8. As a new composition of matter a multi-grade lubricating oil which is substantially devoid of any added viscosity index improving material and comprising essentially a mixture of hydrogenated hydrocarbons having the characteristics of an S.A.E. 20W/30 multi-grade oil, said composition having a V.I. of at least 115, a viscosity at 0° F. of below about 48,000 S.U.S., a viscosity at 210°

F. of between about 58 and 70 S.U.S., a pour point of below about $+5^{\circ}$ F., an iodine number below about 2 to which has been added at least one lubricating oil additive.

9. As a new composition of matter a multi-grade lubricating oil which is substantially devoid of any added viscosity index improving material and comprising essentially a mixture of hydrogenated hydrocarbons having the characteristics of an S.A.E. 20W/40 multi-grade oil, said composition having a V.I. of at least 115, a viscosity at 0° F. of below about 48,000 S.U.S., a viscosity at 210° F. of between about 70 and 85 S.U.S., a pour point of below about $+5^{\circ}$ F., an iodine number below about 2 to which has been added at least one lubricating oil additive.

10. The method of producing a multi-grade lubricating oil by treatment with hydrogen to obtain combined hydrogenation and ring scission which comprises in combination treating a deasphalted residuum having a V.I. between about 75 and 100 and a viscosity of 210° F. of between about 90 and 200 S.U.S. with hydrogen at a temperature between about 735° and 825° F., at a pressure above about 2500 p.s.i., at a space velocity between about 0.4 and 1.5, and in the presence of an unsupported catalyst comprising essentially a mixture of the sulfides of a metal of group VI left-hand column of the periodic system and iron group metals, and subjecting the product to vacuum distillation to separate components within the maximum and minimum viscosity limits of the S.A.E. specifications for a multi-grade lubricating oil, said components having a V.I. of at least 115,

11. The method of producing a multi-grade lubricating oil by treatment with hydrogen to obtain combined hydrogenation and ring scission which comprises in combination treating a deasphalted residuum having a V.I. between about 75 and 100 and a viscosity at 210° F. of between about 90 and 200 S.U.S. with hydrogen at a temperature between about 735° and 825° F., at a pressure about about 2500 p.s.i., at a space velocity between about 0.4 and 1.5, and in the presence of a catalyst comprising essentially a mixture of the sulfides of a metal of group VI left-hand column of the periodic system and iron group metals composited with a catalyst support, and subjecting the product to vacuum distillation to separate components within the maximum and minimum viscosity limits for a multi-grade lubricating oil, said components having a V.I. of at least 115.

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