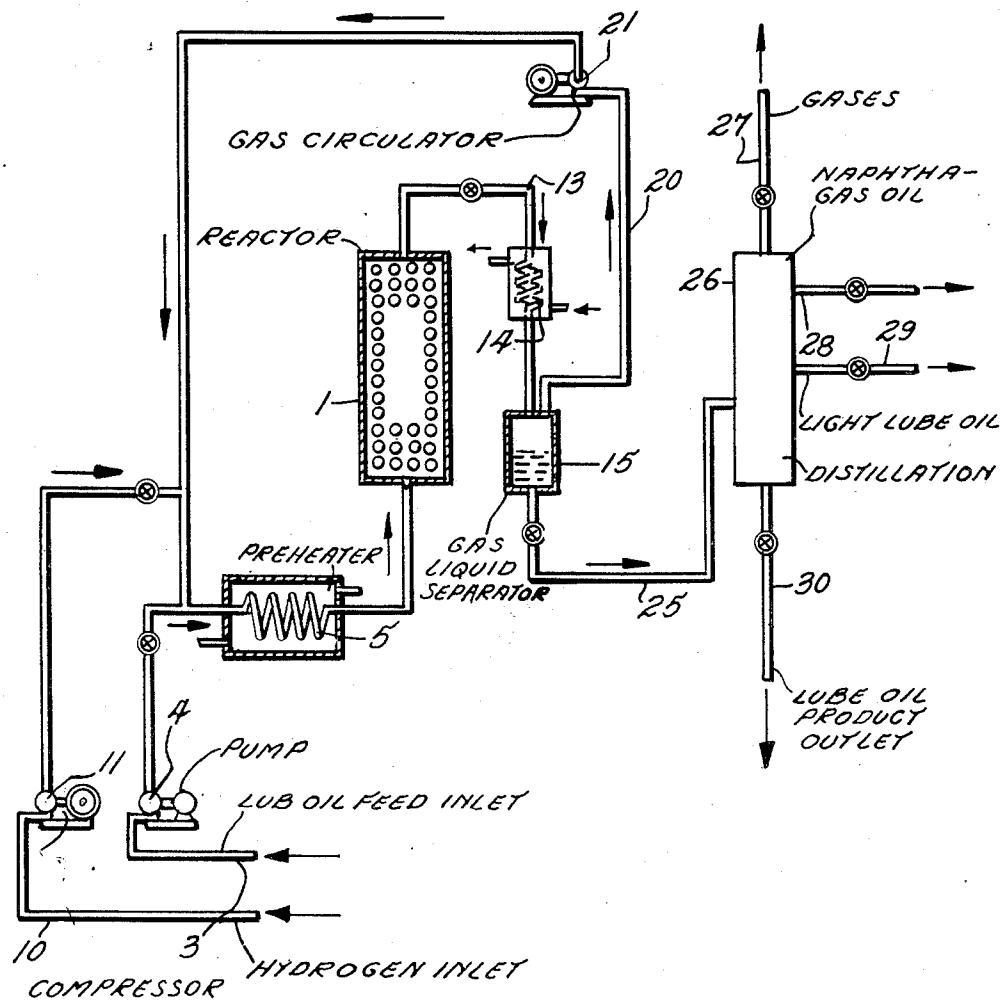
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LUBRICATING OIL MANUFACTURE

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LUBRICATING OIL MANUFACTURE

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My invention relates to improvements in the manufacture of lubricating oils and in particular it relates to correcting or improving the viscosity index of a lubricating oil and at the same time obtaining maximum yields.

Heretofore and prior to my present invention lubricating oils have been subjected to treatment with phenol for the purpose of dissolving out of the lubricating oil constituents which are detrimental thereto. For example, the ordinary crude lubricating oil stock contains aromatic compounds which render the lubricating oil sensitive to temperature change, that is to say, heating the oil causes it to lower inordinately in viscosity. Of course, this is highly undesirable because, for example, when the oil is to be used to lubricate an automobile engine, the high temperatures to which it is subjected on the bearings will cause the oil to become lower in viscosity to the extent that the oil film will be disrupted and to be of insufficient strength to prevent wear. By treating the oil with a phenolic body the oil becomes less sensitive to temperature increase. However, the treatment of a lubricating oil stock with phenol often results in rather poor yields especially if a high degree of improvement is sought, since the phenol treating process merely separates good molecules from bad molecules without effecting any chemical change. In other words the phenol treating process cannot create any new molecules of improved characteristics.

I am aware that also prior to my present invention others have subjected lubricating oil stocks to hydrogenation in the presence of catalysts for the purpose of rendering the oil less sensitive to viscosity change during an increase in temperature. Improvement of lubricating oils by hydrogenation is a radically different process than phenol treating. Hydrogenation is essentially a chemical process; phenol extraction, a physical process. With hydrogenation, the inferior molecules can be actually upgraded in quality; so that there exists the potentialities, with a superior catalyst, of achieving higher yields at a given lubricating oil quality than obtainable by phenol extraction. The best catalyst heretofore used for improving a lubricating oil by hydrogenation is molybdenum sulfide. I have now discovered a new class of catalysts which improves the lubricating oil so as to render it less sensitive to a lowering in viscosity as the temperature increases, and at the same time, gives a higher yield of desired product. Stated briefly at first, my catalysts are mixtures of metallic sulfides, that is to say, mixtures of sulfides of metals of the sixth and eighth group of the periodic system such as for example a mixture of nickel sulfide and tungsten sulfide.

The main object of my present invention therefore is to improve the property of a lubricating oil with respect to its viscosity index or its tendency to decrease rapidly in viscosity as the temperature of the oil increases.

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In the accompanying drawing, I have shown diagrammatically an apparatus layout in which a modification of my invention may be carried into effect.

In the drawing, 1 represents a reaction zone containing a body of catalyst. The oil to be treated enters the system through line 3 and is pumped by a pump 4 through a preheater 5 and then discharged into the bottom of 1. Meanwhile, a hydrogen-containing gas enters the system through line 10, is pumped by pump 11 into line 3 where it mixes with the oil and passes with the latter through the preheater into the reaction zone 1. Under conditions which will be subsequently described by way of several specific examples, the desired conversion takes place in 1, product is withdrawn through line 13, passed through a cooler 14 and then separated in a separator 15. From separator 15 unconsumed hydrogen is separated and withdrawn through line 20 and pumped by pump 21 into line 3 for further use in the process. The oil is withdrawn from separator 15 through line 25 and then discharged into a fractional distillation column 26 where it is separated into four fractions, as follows:

(1) A gas which is withdrawn through line 27,
(2) A naphtha-gas oil fraction, which is withdrawn through line 28,
(3) A light lubricating oil, which is withdrawn through line 29, and
(4) The main product, which is withdrawn through line 30.

In order to explain and disclose my invention more fully, I set forth below several specific examples illustrating my invention and the results thereby obtained. The runs which I am about to describe were conducted in a pilot plant illustrated in the drawing. It will be understood that the specific examples I am about to disclose are merely illustrative of my invention and do not impose any limitation thereon.

Example 1

Catalyst		MoS_2	$2NiS\text{-}WS_2$
Pressure, pounds per sq. in. gauge		2,500	
H_2 Gas Rate, Cubic feet per barrel Feed		10,000	
Feed Rate, Volumes Feed per Volume Catalyst per hour		0.2	
Max. Temperature, °F		680	700
	Feed	Product	
Lubricating Oil Work-up:			
Yield on Feed, Per cent by Volume	100	48	63
Gravity, °API	26.0	34.8	34.3
Viscosity at 100° F. (Seconds Saybolt Universal)	322	165	166
Viscosity at 210° F. (Seconds Saybolt Universal)	52.4	45.3	45.4
Viscosity Index [1]	87	116	117
Pour, °F	30	40	45
Flash, °F	455	440	435

[1] A. S. T. M.—D507-41 vide Ind. and Eng. Chem., vol. 32, pp. 102-107, 1940.

Example 2

Catalyst		MoS_2	$2NiS \cdot WS_2$
Pressure, pounds per sq. in. gauge		2,500	
H_2 Gas Rate, Cubic feet per barrel Feed		10,000	
Feed Rate, Volume Feed per Volume Catalyst per hour		0.6	
Max. Temperature, °F		720	750
	Feed	Product	
Lubricating Oil Work-up:			
Yield on Feed, Per cent by Volume	100	44	65
Gravity, °API	26.1	35.1	34.2
Viscosity at 100° F. (Seconds Saybolt Universal)	287	146	143
Viscosity at 210° F. (Seconds Saybolt Universal)	50.4	43.8	43.7
Viscosity Index [1]	85	117	119
Pour, °F	30	40	45
Flash, °F	440	430	415

[1] A. S. T. M.—D507–41 vide Ind. and Eng. Chem., vol. 32, pp. 102–107, 1940.

Example 3

Catalyst		MoS_2	$2NiS \cdot WS_2$
Pressure, pounds per sq. in. gauge		2,500	
H_2 Gas Rate, Cubic feet per barrel Feed		10,000	
Feed Rate, Volume Feed per Volume Catalyst per Hour		0.6	
Max. Temperature, °F		720	750
	Feed	Product	
Lubricating Oil Work-up:			
Yield on Feed, Per cent by Volume	100	47	77
Gravity, °API	26.0	34.4	33.0
Viscosity at 100° F. (Seconds Saybolt Universal)	520	225	230
Viscosity at 210° F. (Seconds Saybolt Universal)	64.3	50.9	51.1
Viscosity Index [1]	96	125	123
Pour, °F	120	115	120
Flash, °F	480	475	450

[1] A. S. T. M.—D507–41 vide Ind. and Eng. Chem., vol. 32, pp. 102–107, 1940.

Example 4

Catalyst		MoS_2	$2NiS \cdot WS_2$
Pressure, pounds per sq. in. gauge		2,500	
H_2 Gas Rate, Cubic feet per barrel Feed		10,000	
Feed Rate, Volume Feed per Volume Catalyst per Hour		0.6	
Max. Temperature, °F		750	775
	Feed	Product	
Lubricating Oil Work-up:			
Yield on Feed, Per cent by Volume	100	25	48
Gravity, °API	26.0	36.1	36.0
Viscosity at 100° F. (Seconds Saybolt Universal)	520	168	159
Viscosity at 210° F. (Seconds Saybolt Universal)	64.3	47.0	46.4
Viscosity Index [1]	96	133	135
Pour, °F	120	110	95
Flash, °F	480	440	460

[1] A. S. T. M.—D507–41 vide Ind. and Eng. Chem., vol. 32, pp. 102–107, 1940.

It can be seen from the foregoing specific examples that for the same quality of lubricating oil I am enabled by my process employing my catalysts to obtain a much higher yield of desired product. For example, in Example 1 the yield is increased from 48 volume per cent to 63 volume per cent for the same quality oil. In other words, a yield increase of nearly one third. Obviously this is very important from the standpoint of economics. It is not intended herein to limit the catalyst composition to the single formula shown above, but rather to embrace the range of mixed sulfide catalysts commonly employed for effecting saturation of aromatic rings without concomitant excessive destructive hydrogenation. For example I may employ various mixtures of NiS and WS_2, such as 0.5 to 50 mols of NiS per mol of WS_2. Also I may use 0.5 to 50 mols NiS per mol MoS_2. Similarly other mixtures may involve 0.5 to 50 mols "A" per mol "B" in the compound $AS \cdot BS_2$ where "A" is an element of the eighth group of the periodic system and "B" an element of the sixth group. Such mixed sulfides have been employed in the past for selective simple hydrogenation of comparatively low boiling hydrocarbons, but so far as I am aware have not been employed for lubricating oil improvement.

Numerous modifications of my invention may be made by those who are familiar with this art without departing from the spirit thereof.

What I claim is:

1. The method of upgrading a lubricating oil stock which consists essentially in subjecting said stock to the influence of hydrogen and mild hydrogenation conditions of temperature and pressure in the presence of a catalyst which consists essentially of a mixture of two mols of nickel sulfide and one mol of tungsten sulfide for a sufficient period of time to effect the conversion of a major portion of said stock to a lubricating oil of improved viscosity index and thereafter recovering said improved lubricating oil.

2. The method of upgrading a lubricating oil stock which consists essentially in subjecting said stock to the influence of hydrogen and mild hydrogenation conditions including temperatures of about 700°–750° F. in the presence of a catalyst consisting of a mixture of nickel sulfide and tungsten sulfide in the approximate molar ratio of 2:1 for a sufficient period of time to effect the conversion of a major portion of said stock to a lubricating oil of improved viscosity index and thereafter recovering said improved lubricating oil.

3. The method of claim 2 in which said conditions include pressures of about 2500 lbs. per sq. in. and a lubricating oil stock feed rate of about 0.2–0.6 volumes of feed per volume of catalyst per hour.

ALEXIS VOORHIES, JR.

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