

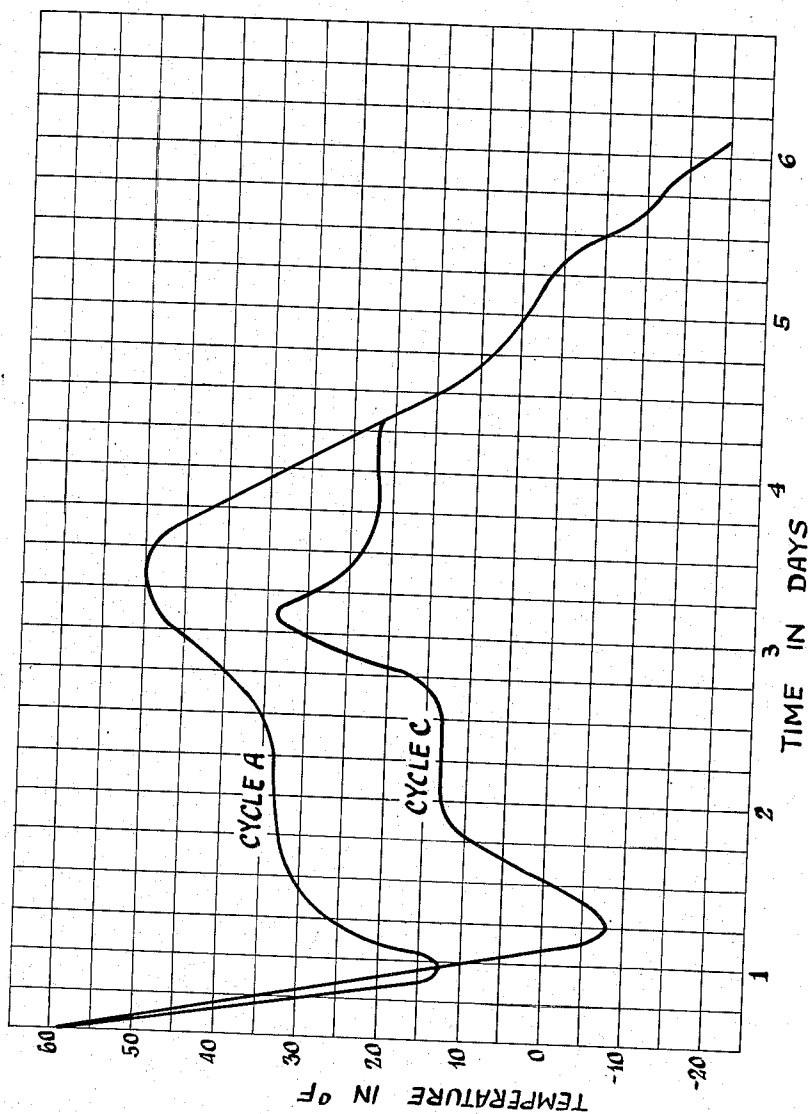
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HYDROCARBON FUEL OIL OF LOWERED POUR POINT

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HYDROCARBON FUEL OIL OF LOWERED
POUR POINT

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This invention relates to the depression of the pour point of hydrocarbon oils. It is more particularly concerned with depressing the pour point of petroleum oil fractions ordinarily used as fuels.

The hydrocarbon fuel oils contemplated herein include industrial gas oils, household fuel oils such as No. 1 and No. 2 fuel oils, heavy industrial fuel oils such as No. 6 fuel oil, diesel fuels, and kerosenes. The term does not include the lighter fuels, such as motor gasoline and naphtha. It will be appreciated, however, that such fuel oils are often produced by blending distillates with residua, or by blending various distillate stocks. For example, various distillate stocks and residual stocks are sometimes "cut" with naphtha or kerosene to achieve fuel oils with improved viscosity characteristics and flash points.

As is well known to those familiar to the art, many fuel oils have relatively high pour points, i. e., they cease to flow at relatively high temperatures. The lighter fuel oils, such as No. 2 fuel oils, usually have pour points of about 0° F. to about 15° F. It is desirable that such fuel oils continue to flow at sub-zero temperatures. The heavy fuel oils have pour points as high as about 65° F. and higher. In order to utilize these fuels, especially in cold weather, it has been necessary to resort to costly preheating systems, such as steam coils. A heavy fuel oil having a greatly reduced pour point, which will flow at lower temperatures, has many obvious practical and economic advantages.

As is well known to those skilled in the art, many materials have been proposed as additives to lubricating oils to depress the pour points thereof. However, it has been found that many of these additives are not generally effective in many fuel oils. Additionally, the initial cost of these additives is ordinarily so high that their use in fuel oils is economically prohibitive. It has been known that natural asphaltic materials will reduce the pour point of fuel oils. However, such materials are disadvantageous because the pour point reversion tendencies of the fuel oil blends are poor. In other words, after repeated cycles of warming and cooling the blend, the pour point properties thereof become much poorer. It is a matter of great importance not only that a pour point depressant reduce the pour point of a fuel oil, but also that the thus-reduced pour point remain relatively constant.

It has now been found that fuel oils having relatively low pour points and good pour point reversion properties can be produced easily and economically. It has now been discovered that,

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by the addition of small amounts of certain residual petroleum stocks to fuel oil, the pour point thereof can be materially depressed, along with good pour point reversion properties.

Accordingly, it is an object of the present invention to provide fuel oils having relatively low pour points. Another object is to provide an easy and economical method of reducing the pour points of fuel oils and of achieving good pour point reversion properties. A specific object is to provide fuel oils having lowered pour points and good pour point reversion characteristics, containing small amounts of certain residual petroleum stocks. Other objects and advantages of the present invention will become apparent to those skilled in the art, from the following detailed description.

The present invention provides a hydrocarbon fuel oil containing a small amount, sufficient to depress the pour point and to improve the pour point reversion properties thereof, of a residual petroleum stock having an A. P. I. gravity of between about 15.0 and about 16.0, a Saybolt Universal Viscosity of between about 150 seconds and about 225 seconds at 210° F., a flash point of between about 355° F. and about 365° F., and a Conradson carbon number of between about 4.0 and about 5.0.

The additive which has been found to be effective in imparting lower pour points and good pour point reversion characteristics to fuel oils, is a residual petroleum stock which may be reduced in viscosity by addition of a distillate lube oil fraction from the same crude oil source, in order to fall within a relatively narrow range of specifications. The physical characteristics of such an additive oil must be as follows:

A. P. I. gravity	-----	15.0-16.0.
Saybolt Universal Viscosity at—		
130° F.	-----	About 1,950 sec.
210° F.	-----	150-225 sec.
Flash point	-----	355-365° F.
Conradson carbon number	-----	4.0-5.0.

A typical residuum which meets these specifications, and which is especially preferred herein, is a residual stock obtained from crude petroleum produced in the Smackover field, which residuum has been "cut back" in viscosity with a distillate lubricating oil fraction from the same crude oil. It must be strictly understood, however, that other residual stocks which meet the foregoing specifications are contemplated within the scope of this invention. The important consideration with respect to the residuum utilized is that it must conform to the specifications set forth hereinbefore.

The amount of the residual petroleum stock which is sufficient to impart improved pour point characteristics to the fuel oil will vary somewhat with the particular fuel oil involved and with the degree of pour point depression desired. In general, a concentration of between about 0.05 per cent and about 7 per cent is effective. When working with the lighter fuel oils, weight concentrations of between about 0.05 per cent and about 2 per cent are adequate. However, for heavy fuel oils, weight concentrations ranging between about 2 per cent and about 7 per cent are required.

The following specific examples are for the purpose of demonstrating the efficiency of the present invention in lowering the pour points and in imparting good pour point reversion characteristics to fuel oils. It must be strictly understood that this invention is not to be limited to the particular fuel oils or to the residual petroleum stocks utilized in the specific examples, or to the operations and manipulations set forth therein. As will be appreciated by those skilled in the art, a wide variety of other fuel oils and residual stocks, as set forth hereinbefore, can be utilized.

The pour point determination used herein is the Standard ASTM Pour Test Method D97-27T, page 37, U. S. Bureau of Mines Technical Paper 323-B.

The Pour Point Reversion test is a laboratory method in which the test oil is subjected to a definite temperature cycle of alternate heating and cooling. Two cycles have been utilized herein. They are plotted graphically in Figure 1, as "Cycle A" and "Cycle C." The solid point, or maximum pour point, is reported as a temperature five degrees higher than the greatest pour point observed at any time during the test. This method is described in the 1945 ASTM Committee D-2 Standards on Petroleum Products.

In obtaining the data for the following examples, two different batches of residual oil from the Smackover field were used. These two oils are distinguished for convenience of identification in the present examples by calling them "Oil A" and "Oil B." Oil A is a Smackover residuum having the following properties:

A. P. I. gravity.....	15.5
Viscosity, S. S. U. at 210° F.....	150-200
Pour point.....° F.....	10
Flash point.....° F.....	360

Oil B is a Smackover residuum having the following properties:

A. P. I. gravity.....	15.4
Viscosity, S. S. U. at 210° F.....	200
Pour point.....° F.....	15
Flash point.....° F.....	365

The Conradson carbon number of these oils also meets the specifications set forth hereinbefore. Blending of these oils in the fuel oils was accomplished by heating the fuel oil to about 120° F., adding the desired amount of residual oil, and stirring at about 120° F. until a homogeneous blend was obtained.

EXAMPLE 1

Several blends were prepared by incorporating various amounts of oil A in a fuel oil consisting of about 90 per cent cracked Mid-Continent distillate stock and about 10 per cent naphtha. The base fuel oil had the properties set forth

in Table I. The resulting blends had pour points as follows:

Conc., weight percent	Pour point, ° F.
0.0.....	10
0.05.....	5
0.1.....	0
0.2.....	-5
0.5.....	-15
1.0.....	-35
2.0.....	-35

EXAMPLE 2

To a sample of fuel oil similar to that used in Example 1, and having the properties set forth in Table I, was blended 0.5 per cent, by weight, of oil B. The pour point of the resulting blend was -20° F. In the pour point reversion test, using "Cycle C," this blend had a solid point of -20° F. The blank, unimproved fuel oil showed a solid point of 0° F. in the same test.

EXAMPLE 3

To a straight-run distillate fuel oil derived from an asphaltic crude oil, and having the properties set forth in Table I, was added 0.5 per cent, by weight, of oil B. The resulting blend had a pour point of -45° F. In the pour point reversion test, using "Cycle C," this blend had a solid point of lower than -20° F. The blank fuel oil had a solid point of -20° F. in this test.

EXAMPLE 4

A fuel oil consisting of 80 per cent cracked distillate stock and 20 per cent straight run stock derived from a Mid-Continent crude, and having the properties set forth in Table I, was blended with 0.5 per cent, by weight, of oil B. The resulting blend had a pour point of -10° F. In the pour point reversion test, "Cycle C," this blend had a solid point of -10° F., as compared with a solid point of -5° F. for the blank fuel oil.

EXAMPLE 5

To a straight-run distillate fuel oil derived from Middle-Eastern crude, having the properties set forth in Table I, was added 0.5 per cent, by weight, of oil B. The resulting blend had a pour point of 5° F.

EXAMPLE 6

One per cent, by weight, of oil B was blended with a coke still gas oil having the properties set forth in Table I. The resulting blend had a pour point of 5° F. In the pour point reversion test this blend had a solid point of 0° F. on both "Cycle A" and "Cycle C."

EXAMPLE 7

Portions of an industrial gas oil, having the properties set forth in Table I, were blended with oil A in various amounts. The blends obtained had the following pour points:

Conc., weight percent	Pour point, ° F.
0.0.....	40
0.3.....	20
0.5.....	10
0.7.....	-5

EXAMPLE 8

Five per cent, by weight, of oil A was added to a heavy fuel oil having a flash point of 192° F., a viscosity of 720 seconds Saybolt at 100° F., and a pour point of +65° F. The resultant blend had a pour point of 45° F.

Table I

PROPERTIES OF BASE FUEL OILS

Property	Fuel oil of Example No.—						
	1	2	3	4	5	6	7
Gravity, A. P. I.	32.9	35.6	40.5	38.1	37.1	-----	30.9.
ASTM dist., ° F.:							
IBP	456	332	320	311	459	-----	396.
5% rec.		401	369	358	497	-----	
10% rec.	492	424	385	377	507	-----	489.
20% rec.	504	477	400	416	521	-----	524.
30% rec.	513	483	422	451	531	-----	549.
40% rec.	526	501	446	439	539	-----	574.
50% rec.	538	516	471	511	549	-----	595.
60% rec.	551	532	497	526	559	-----	618.
70% rec.	566	546	525	540	571	-----	643.
80% rec.	583	568	564	554	587	-----	670.
90% rec.	606	595	597	574	607	-----	707.
EP	653	644	674	618	650	-----	
Percent rec.	99.0	98.5	98.5	98.0	98.5	-----	97.0 at 760° F.
Aniline pt., ° F.		144	155	148	171	-----	153.
Diesel index		51	61	56	63	-----	
Sulfur, weight, percent.		0.30	0.59	0.21	0.32	-----	0.61.
B. S. & W., percent.	None	Trace	Trace	0.1	Trace	-----	None.
Flash, ° F., P. M.	225	146	138	130	220	-----	174.
Viscosity at 100° F.:							
S. S. U.	37					-----	44.
Centistokes							
Pour pt., ° F.	+15	2.61 +10	2.15 -10	2.26 0	3.85 +10	+45	+40.

It will be apparent from the foregoing data that, by the addition of small amounts of a residual oil having the properties described hereinbefore, the pour point of a fuel oil can be lowered appreciably. It will also be noted that the pour point reversion characteristics of such fuel oils are excellent. In addition to the pour point depressant of this invention, the fuel oil can also contain other additives for special purposes, as those skilled in the art will readily understand.

Although the present invention has been described with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of this invention, as those skilled in the art will readily understand. Such variations and modifications are considered to be within the purview and scope of the appended claims.

What is claimed is:

1. A hydrocarbon fuel oil containing between about 0.05 per cent and about 7 per cent, by weight, of a residual stock obtained from crude

petroleum produced in the Smackover field, which stock has the following properties:

A. P. I. gravity 15.0-16.0.
Saybolt Universal Viscosity at 210° F. 150-225 sec.
Flash point 255-365° F.
Carbon number (Conradson) 4.0-5.0.

2. The composition defined in claim 1, wherein said hydrocarbon fuel oil is a straight-run distillate fuel oil.

3. The composition defined in claim 1, wherein said hydrocarbon fuel oil is a cracked distillate fuel oil.

4. The composition defined in claim 1, wherein said hydrocarbon fuel oil is a coke still gas oil.

5. The composition defined in claim 1, wherein said hydrocarbon fuel oil is a heavy industrial fuel oil.

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