Oct. 31, 1939. F. H. MacLAREN 2,177,732

DIESEL FUEL

Filed May 27, 1937 2 Sheets-Sheet 1

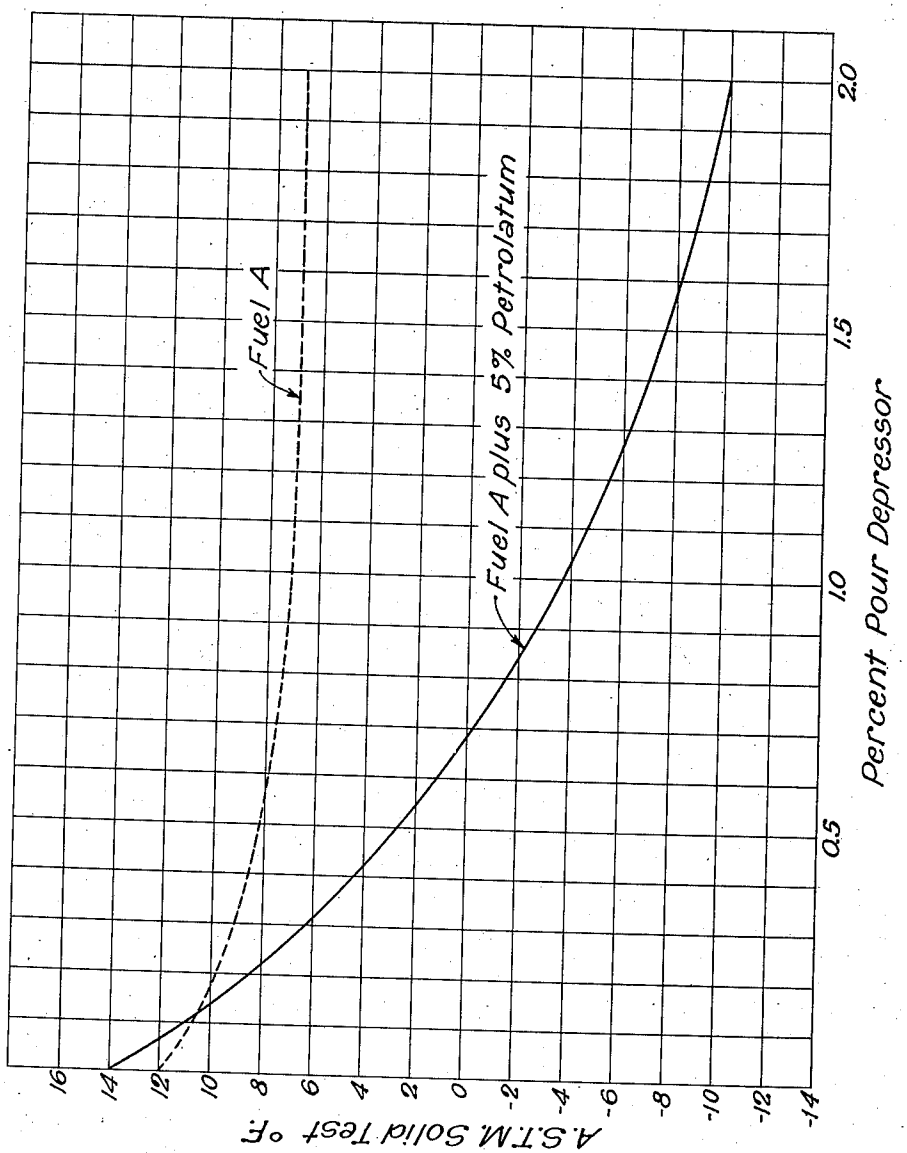

Fig. 1

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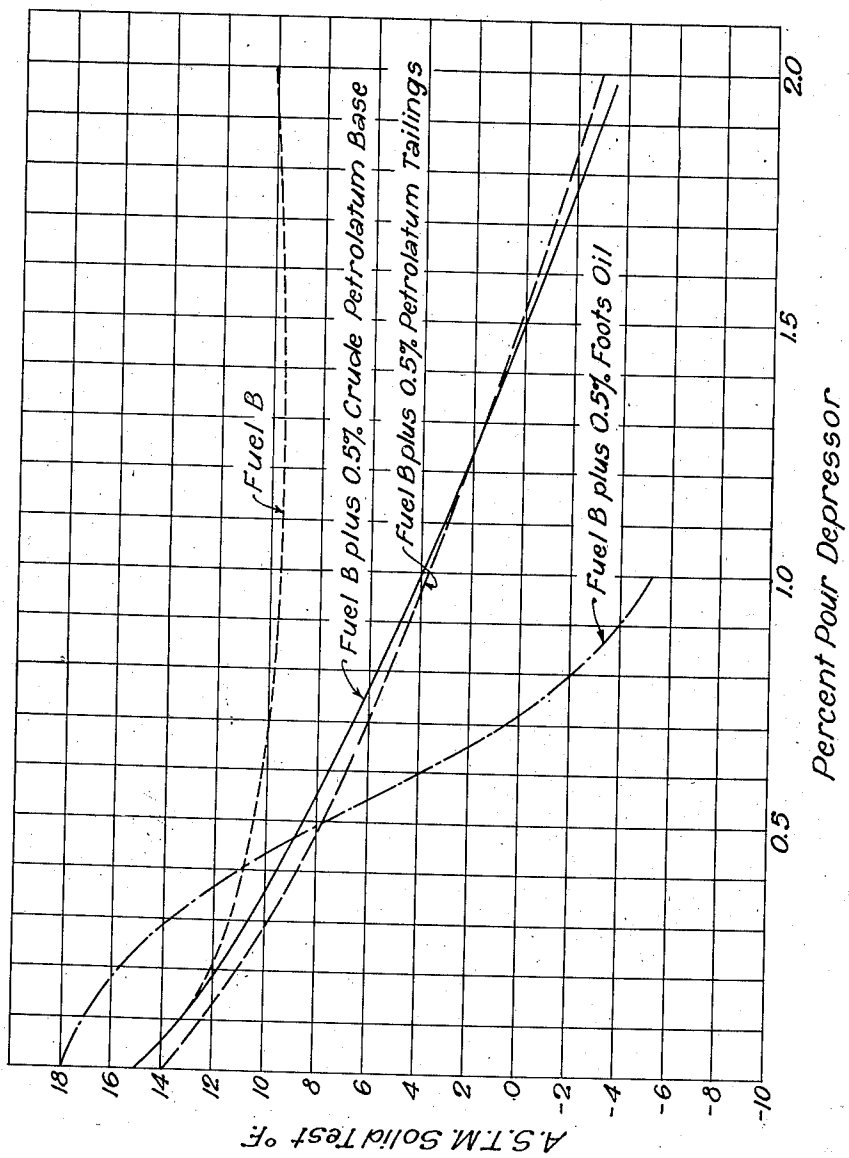

Fig. 2

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DIESEL FUEL

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7 Claims. (Cl. 44—9)

This invention relates to improvements in Diesel fuels and, in particular, to high speed Diesel fuels and the method of preparing the same.

The critical requirements of fuel oils for high speed Diesel engines, which are critically dependent upon the quality of their fuel for efficient operation, are as follows:

Initial boiling point	400–500° F.
End point	600–700° F.
Saybolt Viscosity at 100° F	35 to 45 seconds
Pour point	0° F. or below
Cetene number	50–55

In order to meet the pour point specification it is frequently necessary to add to the fuel an addition agent capable of reducing the pour point of the oil. Among such addition agents are the pour point depressors of the condensation type obtained by chemically condensing a chlorinated hydrocarbon, such as chlorinated paraffin wax, with an aromatic hydrocarbon, such as naphthalene, in the presence of a catalyst, such as aluminum chloride. Among such products might be mentioned "Paraflow" and "Pourex" described in U. S. Patents 1,963,917, 1,963,918 and 2,057,104. It has been noted that the pour points of some Diesel fuels, particularly those prepared from a narrow cut fraction can not be reduced to the zero pour point specification without the addition of relatively large amounts of the pour point depressors. Economically and mechanically this is undesirable in Diesel fuel oils.

As used herein and in the appended claims the term "narrow cut Diesel fuel oil" is defined as a Diesel fuel oil fraction in which the difference in temperature between the 90% point and the 50% point by the A. S. T. M. distillation method is about 55° F. or less.

It is an object of the present invention to provide a method of effecting a reduction in the pour point of Diesel fuel oils which are normally non-responsive to pour point depressors.

It is another object of the invention to provide a method of increasing the pour point depressor response of Diesel fuel oils.

A further object of the invention is to provide a method of reducing the pour point of narrow cut Diesel fuel oils which are normally non-responsive to pour point depressors.

Still another object of the invention is to provide a narrow cut Diesel fuel oil having a low pour point.

Other objects and advantages of the invention will become apparent from the following description thereof and the accompanying charts in which:

Fig. 1 is a chart showing the effect of the invention on the pour point depressor response of a narrow cut Diesel fuel oil; and

Fig. 2 is a chart showing the effect of the invention in increasing the pour point depressor response of another narrow cut Diesel fuel oil.

I have found that narrow cut Diesel fuel oils can be made responsive to pour point depressors of the condensation type by adding to such narrow cut Diesel fuel oils small amounts of amorphous waxes or amorphous wax-bearing materials. More specifically I have found that the addition of 0.2% to 0.8% of amorphous wax or amorphous wax-bearing materials and 0.2% to 2% of a pour point depressor of the condensation type to a Diesel fuel in which the difference in temperature between the 90% point and the 50% point by the A. S. T. M. distillation method is about 55° F. or less will produce a Diesel fuel oil having a pour point of 0° F. or lower, whereas the pour point of the same Diesel fuel oil without the addition of amorphous wax cannot be reduced to 0° F. even upon the addition of much higher quantities of a pour point depressor of the condensation type.

Examples of amorphous waxes and amorphous wax bearing materials which can be used effectively are petrolatums, petrolatum base stocks, wax tailings, "foots oil" (oil obtained from the sweating of paraffin wax) and other paraffins of non-crystalline structure.

The invention is clearly illustrated and the effectiveness thereof fully demonstrated in the following examples:

Example 1.—A narrow cut high speed Diesel fuel oil identified as Fuel A having an A. S. T. M. distillation as shown in Table I and a solid test of +12° F. when admixed with 0.5%, 1% and 2% of a pour point depressor of the condensation type such as "Pourex", had a solid test of +8° F., +7° F. and +7° F. respectively, indicating poor pour point depressor susceptibility.

TABLE I

NARROW CUT HIGH SPEED DIESEL FUEL OIL

A. S. T. M. distillation

	Degrees Fahrenheit
Initial B. P	501
10% off	534
20% off	544
30% off	552
40% off	559
50% off	565
60% off	570
70% off	580
80% off	590
90% off	608
Max	636

To the same high speed Diesel fuel oil was added about 0.5% of a petrolatum base stock having a melting point of about 137° F. The A. S. T. M. solid point of this mixture was about +14° F. The mix after the addition of 0.5%, 1% and 2% of the same pour point depressor used in the above

test had an A. S. T. M. solid test of +2° F., −4° F. and −10° F. respectively. The data of the above tests are tabulated for comparison in Table II.

TABLE II

POUR POINT DEPRESSOR SUSCEPTIBILITY

Percent depressor	Solid test	
	Narrow cut Diesel fuel oil	Narrow cut Diesel fuel oil + 0.5 percent 137° F. M. P. pet. st.
	° F.	° F.
0.0	+12	+14
0.5	+8	+3
1.0	+7	−4
2.0	+7	−10

The effectiveness of a small amount of an amorphous wax in increasing the pour point depressor susceptibility of narrow cut Diesel fuel oils is strikingly shown by the above data and in Fig. 1 in which these data are graphically presented.

Example 2.—The effect of amorphous waxy materials on the pour point depressor susceptibility of narrow cut high speed Diesel fuel oils was tested on another narrow cut high speed Diesel fuel oil identified as Fuel B having an A. S. T. M. distillation shown in Table III and an A. S. T. M. solid test of +15° F.

TABLE III

NARROW CUT HIGH SPEED DIESEL FUEL OIL

A. S. T. M. distillation

	° F.
Initial B. P.	519
10% off	534
20% off	543
30% off	548
40% off	555
50% off	563
60% off	572
70% off	582
80% off	596
90% off	617
Max.	656

To this fuel oil were added 0.5%, 1% and 2% of the pour point depressor of the condensation type such as "Pourex" and the A. S. T. M. solid points are found to be about +10° F. for all three concentrations. To this Diesel fuel oil fraction was added 0.5% of a crude petrolatum base stock of about 137° F. melting point. The A. S. T. M. solid test of this mix was about +15° F. The addition of 0.5%, 1% and 2% of the pour point depressor reduced the A. S. T. M. solid tests to +8.6° F., +4° F. and −3° F. respectively. The comparative data are presented in Table IV.

TABLE IV

POUR POINT DEPRESSOR SUSCEPTIBILITY

A. S. T. M. solid tests

Percent depressor	Narrow cut high speed Diesel fuel oil	Narrow cut high speed Diesel fuel oil + .5 percent 137° F. M. P. pet. base stk.
	° F.	° F.
0.0	+15	+15
0.5	+10	+8.6
1.0	+10	+4
2.0	+10	−3

The marked improvement in pour point susceptibility of narrow cut high speed Diesel fuel oils to which is added a small amount of an amorphous wax material, as shown by the above data, is graphically shown in Fig. 2.

Example 3.—The effect of other amorphous waxy materials on the pour point depressor susceptibility of narrow cut high speed Diesel fuel oils was determined by adding to the narrow cut high speed Diesel fuel oil "B", used in Example 2, 0.5% of petrolatum tailings and 0.5% of "foots oil". The results obtained are tabulated in Table V.

TABLE V

POUR POINT DEPRESSOR SUSCEPTIBILITY

Percent depressor	Solid test		
	Narrow cut high speed Diesel fuel oil "B"	Same fuel oil + .5 percent "foots oil"	Same fuel oil + .5 percent pet. tailings
	° F.	° F.	° F.
0.0	+15	+18	+14
0.5	+10	+8	+8
1.0	+10	−5	+4
2.0	+10		−3

The marked improvements shown by the above data are graphically presented in Fig. 2.

In the above examples the solid tests were determined by the A. S. T. M. method (A. S. T. M. D97–34).

In the foregoing description of my invention, and in the appended claims by the term "pour point depressor susceptibility" I mean the ability of an oil to respond to the pour depressing effect of a pour point depressor added to said oil. To illustrate: An oil has a pour point of about +25° F. Upon the addition of about 0.25% of a pour point depressor the pour point of the oil is reduced to +20° F. The "pour point depressor susceptibility" of this oil is poor. Another oil having a pour point of +25° F. upon the addition of about 0.25% of a pour point depressor has a pour point of about −10° F. The "pour point depressor susceptibility" of this oil is good.

While I have described my invention in connection with preferred embodiments thereof the same are to be construed as merely illustrative, and not as a limitation of the scope of the invention, except as defined by the appended claims.

I claim:

1. The method of increasing the pour point susceptibility of a narrow cut high speed Diesel engine fuel oil having an initial boiling point between about 400° F. and about 500° F., an end point between about 600° F. and about 700° F. and characterized by a difference in temperature between the 50% distillation point and the 90% distillation point of less than about 55° F., the pour point of which is normally not materially reduced by the addition of a pour point depressor thereto, which comprises adding to said Diesel engine fuel oil from about 0.2% to about 2% of a pour point depressor and from about 0.2% to about 0.8% of an amorphous waxy material, whereby the pour point of said Diesel engine fuel oil is substantially reduced.

2. The method described in claim 1 in which the amorphous waxy material is a petrolatum base stock.

3. The method described in claim 1 in which the amorphous waxy material is a product selected from the group consisting of petrolatum, petrolatum base stocks, wax tailings and "foots oil."

4. The method described in claim 1 in which the pour point depressor is obtained by chemically condensing a chlorinated hydrocarbon with an aromatic hydrocarbon in the presence of a catalyst.

5. The method described in claim 1 in which the pour point depressor is a depressor obtained by chemically condensing a chlorinated paraffin wax with naphthalene in the presence of aluminum chloride.

6. A high speed Diesel engine fuel having a pour point below about +10° F. comprising a narrow cut high speed Diesel engine fuel having an initial boiling point between about 400° F. and about 500° F., an end point between about 600° F. and about 700° F., a cetane number of at least about 50 to 55 and characterized by a difference in temperature between the 50% distillation point and the 90% distillation point of less than about 55° F. and further characterized by being substantially unresponsive to pour point depressors, from about 0.2% to about 2% of a pour point depressor of the condensation type and from about 0.2% to about 0.8% of an amorphous waxy material selected from the group consisting of petrolatum, petrolatum base stocks, wax tailings and "foots oil".

7. A high speed Diesel engine fuel oil as described in claim 6 in which the pour point depressor is obtained by chemically condensing a chlorinated paraffin wax with naphthalene in the presence of aluminum chloride.

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