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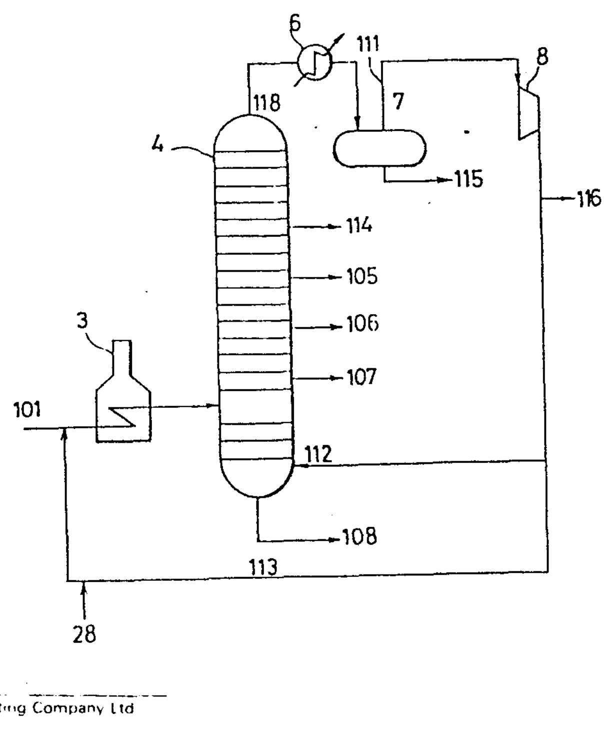
(54) Method for fractionating oil under methane atmosphere.

(57) A method for fractioning an oil under a methane atmosphere which comprises the steps of delivering a methane-containing gas included in the oil from a distillation column (4) through its top to a condenser (6), where the methane-containing gas is cooled and condensed and a methane-rich gas is then separated therefrom (7); increasing a pressure of the methane-rich gas (8); and introducing (113, 112) the methane-rich gas into the distillation column in order to recycle the methane-rich gas.

FIG.1



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The present invention relates to an improvement in a method for fractionating an oil. More specifically, it relates to a fractionation method which can be applied to fractionations of crude oils, coal tar, raffinates from apparatus for hydrogenolysis and hydrogenation refining, coal-liquefied oils, multi-component systems including inert gases, tar sand oils, shale oils and the like.

A schematic flow sheet of a conventional distillation for a crude oil is shown in Fig. 3.

In Fig. 3, a crude oil 101 being fed through a line 1 is mixed with water vapor 102 fed through a line 2 and is then delivered to a furnace 3, in which the crude oil 101 is heated up to a temperature of 350 to 400°C. Afterward, the oil 101 is introduced into a distillation column 4 in which an operating pressure is in the vicinity of ordinary pressure. Water vapor 103 for stripping is introduced into the distillation column 4 through its bottom and a line 5, and the crude oil 101 is then fractionated here into naphtha 104, kerosene 105, light gas oil 106, heavy gas oil 107 and residual oil 108. In general, the naphtha is taken out from a column top; the kerosene, the light gas oil and the heavy gas oil from a column side; and the residual oil from a column bottom of the distillation column.

The water vapor 103 introduced into the distillation column 4 through the bottom thereof is delivered through a column body and a column top to a condenser 6, in which the water vapor 103 is cooled, and is further delivered to a condensing tank 7, in which it is consensed to water. In this case, a fraction discharged from the column top of the distillation column 4 is heat-exchanged with a stream (not shown) above the condenser 6.

When a heat exchange temperature of the fraction from the column top of the distillation column 4 has reached a level near to a dew point of the water vapor 103, the latter is condensed at the column top prior to the above-mentioned condensation in the condensing tank 7. This condensed water will become a cause of the corrosion of materials constituting the column top, and thus the operation of the distillation column 4 is carried out so that the above-mentioned heat exchange temperature may be maintained at a higher level than the dew point.

Incidentally, the crude oil usually contains gases (hereinafter referred to as the methane-rich gas) such as methane and ethane, and the methane-rich gas is separated therefrom in the condensing tank 7 as an off-gas 110 which will be used as a fuel.

According to the conventional fractionation method described above, the heat exchange temperature at the top of the distillation column must be retained at a higher level than the dew point of the water vapor during operation so as to avoid the corrosion of the column top materials by the water condensed at the column top. Therefore, such a method involves the drawback that heat recovery is poor.

Additionally, since the water vapor for stripping has to be introduced into the distillation column from exterior, a drain treatment of its condensed water is required disadvantageously.

Thus, an object of the present invention is to provide an industrially useful fractionation method by which the above-mentioned drawbacks of the conventional method are overcome.

The present invention is directed to a method comprising the steps of separating a methane-rich gas included in a crude oil from the latter in a condensing tank, compressing the methane-rich gas, and recycling the same through a distillation column, instead of the use of water vapor, or alternatively a method further comprising an additional step of feeding a gas containing methane to a distillation column from exterior, whereby fractionation is carried out under a methane atmosphere to heighten an efficiency of the fractionation of a crude oil. That is to say, the present invention provides a method for fractionating an oil under a methane atmosphere which comprises the steps of delivering a methane-containing gas included in the oil from a distillation column through its top to a condenser, where the methane-containing gas is cooled and condensed and a methane-rich gas is then separated therefrom; increasing a pressure of the methane-rich gas; and introducing the methane-rich gas into the distillation column in order to recycle the methane-rich gas.

In the method of the present invention, a small amount of a gas containing methane may be further fed to the recycling methane-rich gas externally, and the gas may be fed to the distillation column and a stream above the furnace in order to obtain an identical effect. In general, the distillation column is operated at a temperature of 100 to 500°C at a pressure of 0 to 100 kg/cm^2G.

Now, the present invention will be described in detail in reference to accompanying drawings, in which:

Fig. 1 is a flow sheet of an embodiment in which a method of the present invention is applied to the distillation of a crude oil;

Fig. 2 is a flow sheet of another embodiment of the present invention;

Fig. 3 is a flow sheet of the distillation of the crude oil in a conventional manner; and

Fig. 4 shows ASTM curves of components fractionated in the embodiment of the present invention.

In Fig. 1, a crude oil 101 is introduced into a furnace 3 together with a mixture of a small amount of a methane-including gas fed through a line 28 and a methane-rich gas 113 which has been separated in a condensing tank 7 and a pressure of which has been heightened by a compressor 8. Afterward, the crude oil 101 is then heated up to 350 to 400°C in the furnace 3 and is afterward introduced into a distillation column 4. An operating pressure in the distillation column 4 is in the vicinity of ordinary pressure.

Through the bottom of the distillation column 4, a methane-rich gas 112 is introduced thereinto as a stripping material. In the distillation column 4, the crude oil 101 is fractionated into light naphtha 115, heavy naphtha 114, kerosene 105, light gas oil 106, heavy gas oil 107 and residual oil 108.

A column top fraction 118 containing methane and the light naphtha is discharged from the top of the distillation column 4, and after heat-exchanged with a stream (not shown), the fraction 118 is then delivered to a condenser 6, in which it is cooled and condensed. Afterward, the thus consensed fraction 118 is further delivered to a condensing tank 7, in which it is separated into a methane-rich gas 111 and the light naphtha 115.

The separated methane-rich gas 111 is increased in pressure by means of the compressor 8, and a part of the gas 111 is fed to the bottom of the distillation column 4 as the methane-rich gas 112 and another part of the gas 111 is fed to the stream above the furnace 3 as the methane-rich gas 113 and is then recycled. Further, the remaining part of the gas 111 is taken out from the system as an off-gas 116 which will be used as a fuel. During the operation, the heavy naphtha 114, the kerosene 105, the light gas oil 106 and the heavy gas oil 107 are recovered through the column side of the distillation column 4, and the residual oil 108 is taken out through the column bottom.

As described above, the methane-rich gas is used for stripping, and a dew point of the column top fraction in the distillation column can be lowered, because the latter is operated under the methane atmosphere. In consequence, the operation of the distillation column can be carried out at a lowered heat exchange temperature at the column top thereof without any problem of corrosion.

Moreover, Fig. 2 shows an embodiment in which an Arabian light crude oil is employed as a crude oil.

The crude oil is delivered through a crude oil duct 11 to the distillation column 4 via the furnace 3. On the other hand, the methane-rich gas is introduced into the crude oil duct 11 through a methane-rich gas duct 10 and into the distillation column 4 through the bottom thereof and a methane-rich gas duct 9 in a rate of 24 Nm^3/m^3 of the crude oil (10% of the methane-rich gas are fed to the stream above the furnace 3 and 90% thereof to the distillation column) in order to fractionate the crude oil. An outlet temperature of the furnace 3 is 346°C and an operating pressure of the distillation column is 0.8 kg/cm^{2}G.

Components fractionated in this distillation column 4 (having 42 steps) are set forth in Table 1.

TABLE 1

Product	Temp. of Product Drawn from Distillation Column (°C)	Yield (Vol %)
Naphtha	60	21.7
Kerosene	187	19.3
Light Gas Oil	259	15.7
Heavy Gas Oil	312	4.7
Residual Oil	352	38.6

The above-mentioned separation state of the respective components is shown with ASTM curves in Fig. 4. The results of this embodiment indicate that the dew point of the water vapor in the column top fraction is 50°C in contrast with 95°C in the case of the conventional technique, and if a load of the condenser in the conventional case is regarded as 100, that of the condenser in the present invention is 56, which fact elucidates that the load of the conderser can be reduced remarkably. That is to say, in the distillation of the crude oil in accordance with the present invention, the fractionation can be accomplished without intoducing any water vapor, and the load of the condenser is as small as 56% of the conventional one. In addition thereto, the corrosion of the column top materials can be inhibited. Therefore, it becomes clear that usual carbon steel can be used as such materials.

According to the method of the present invention, the following effects can be obtained:

(1) Since the fractionation is carried out under the methane atmosphere, the corrosion at the top of the distillation column can be restrained, and since the operation can be accomplished at the lowered column top temperature, the heat recovery can be improved.

(2) In the conventional method, water vapor introduced into the distillation column through its bottom is condensed at the top thereof, and thus the load of the condenser is large. On the contrary, in the method of the present invention, the removal of sensible heat alone from the methane-rich gas suffices, and thus the load of the condenser can be reduced remarkably.

(3) It is not required to feed water vapor for stripping externally, and the drain treatment of condensed water can also be eased.

(4) A recycling rate of the methane-rich gas can be optionally and conveniently selected by compressing, with the aid of the compressor, the methane-rich gas which will be introduced into the distillation column through its bottom, and recycling the same.

(5) In the case that the method of the present invention is applied to the distillation of the crude oil, the methane-rich gas is separated and compressed at the column top, and is then introduced into the distillation column through its bottom. Therefore, the recycling rate of the methane-rich gas can be optionally selected, and heavy naphtha, kerosene, light gas oil, heavy gas oil and residual oil can be fractionated by the use of the one distillation column, and light naphtha can be recovered in the condensing tank.

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WHAT IS CLAIMED IS:

1. A method for fractionating an oil under a methane atmosphere which comprises the steps of delivering a methane-containing gas included in the oil from a distillation column through its top to a condenser, where the methane-containing gas is cooled and condensed and a methane-rich gas is then separated therefrom; increasing a pressure of the methane-rich gas; and introducing the methane-rich gas into the distillation column in order to recycle the methane-rich gas.

2. A method according to Claim 1 wherein a suitable amount of a gas containing methane is additionally fed to the recycling methane-rich gas from exterior.

3. A method according to Claim 1 wherein the gas containing methane is additionally fed to the distillation column or a stream above a furnace.

4. A method according to Claim 1 wherein the oil is at least one selected from the group consisting of crude oils, coal tar, raffinates from apparatus for hydrogenolysis and hydrogenation refining, coal-liquefied oils, multi-component systems including inert gases, tar sand oils and shale oils.

FIG.1

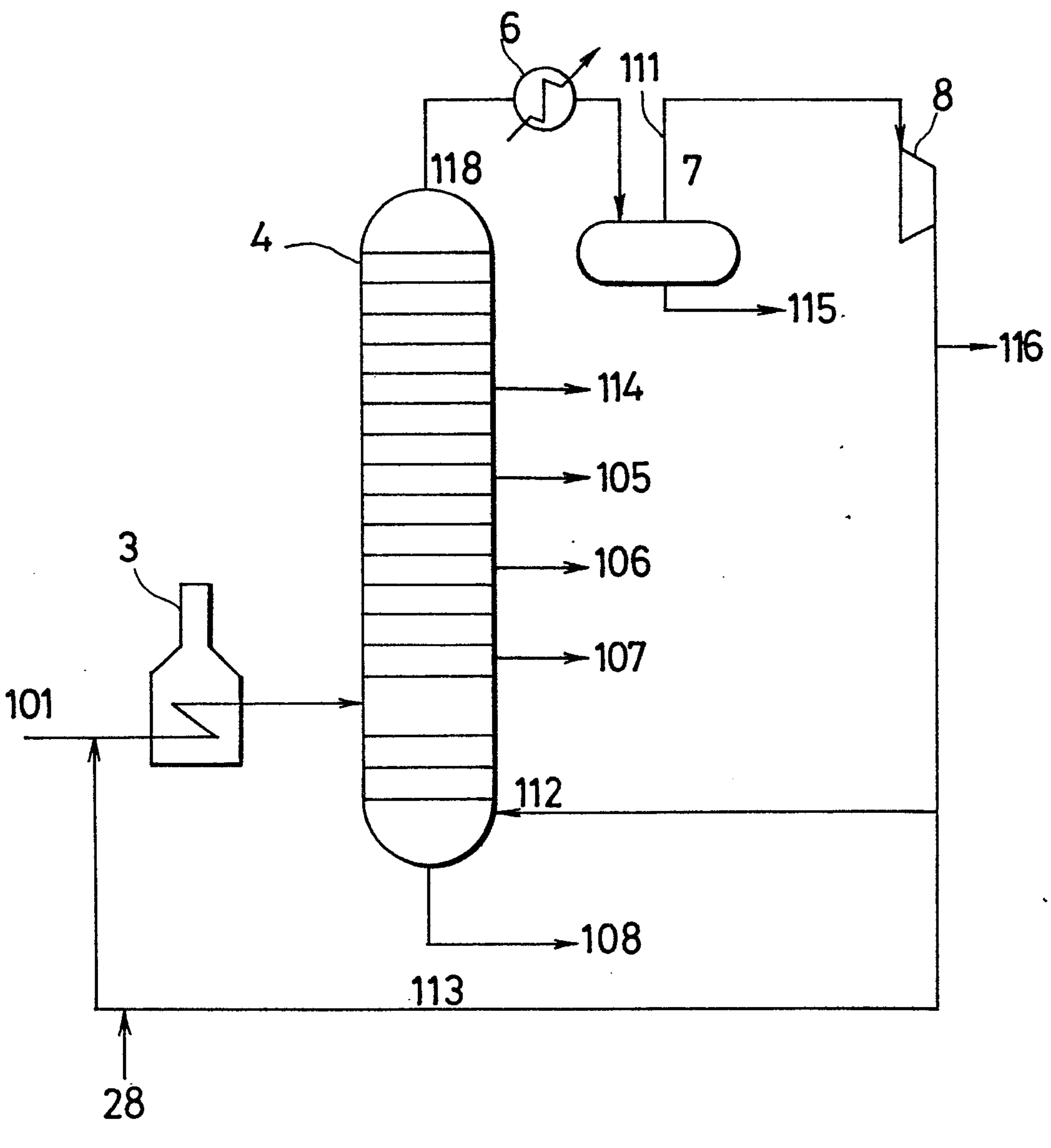


FIG.2

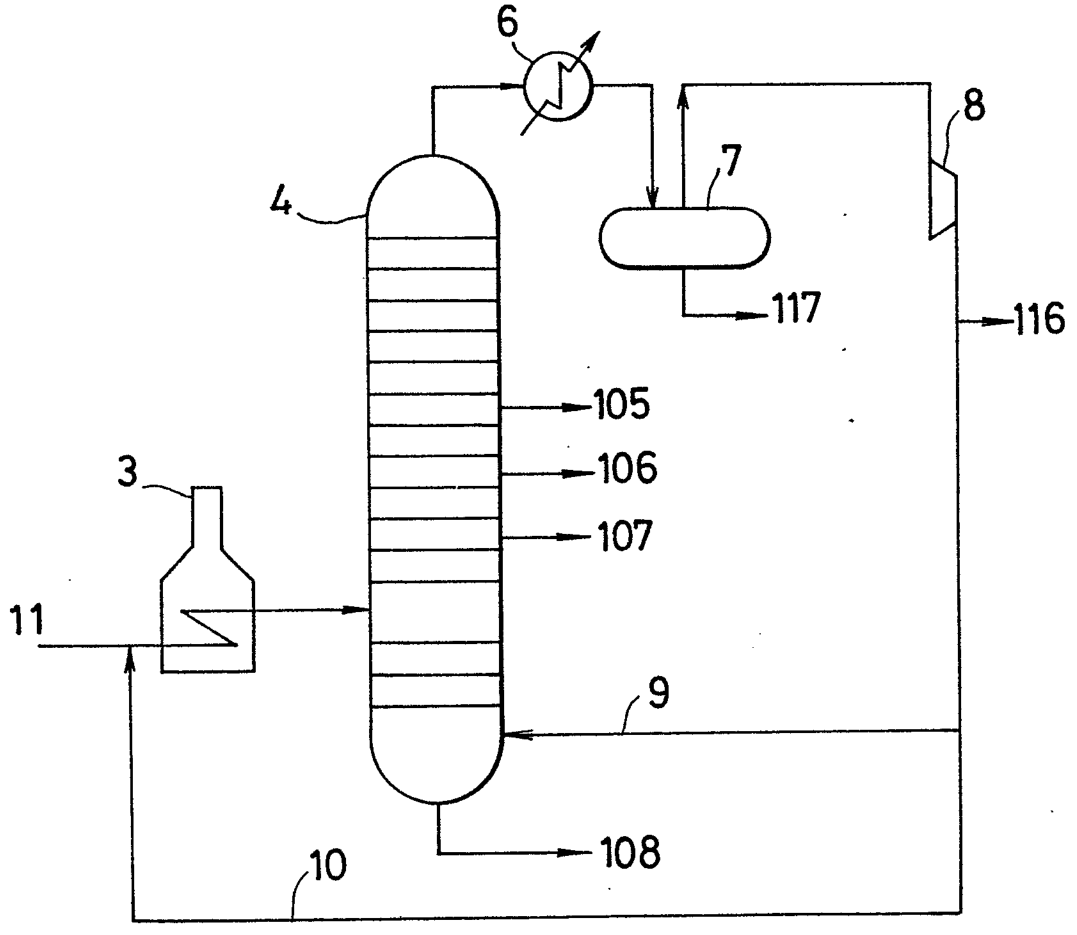


FIG.3

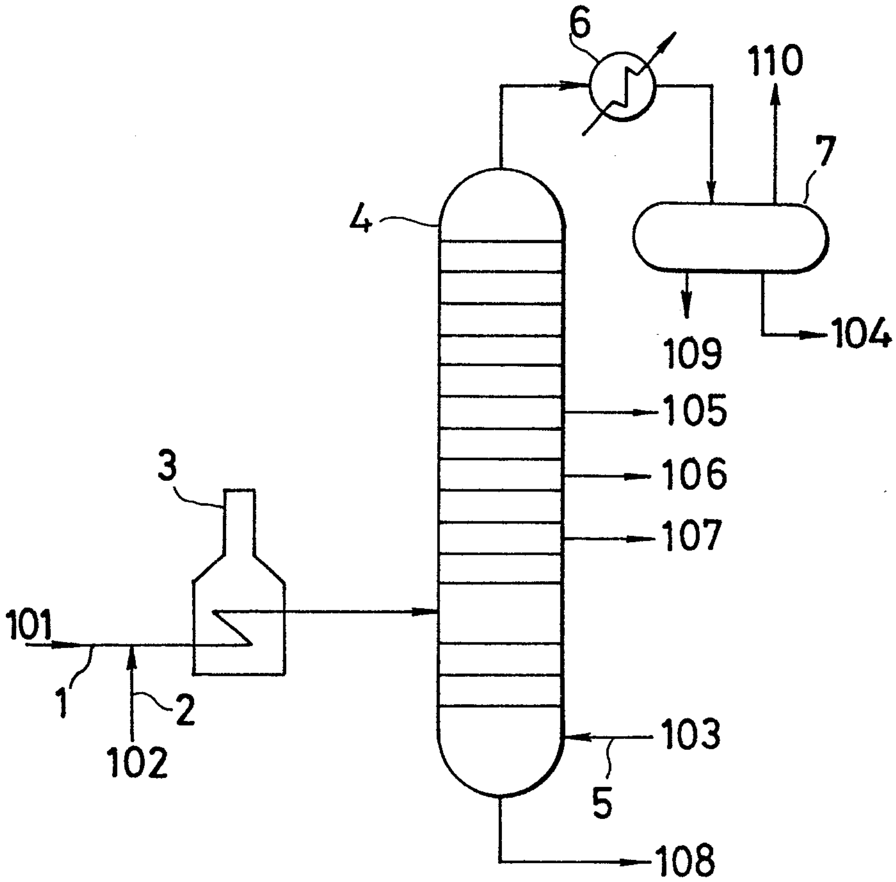
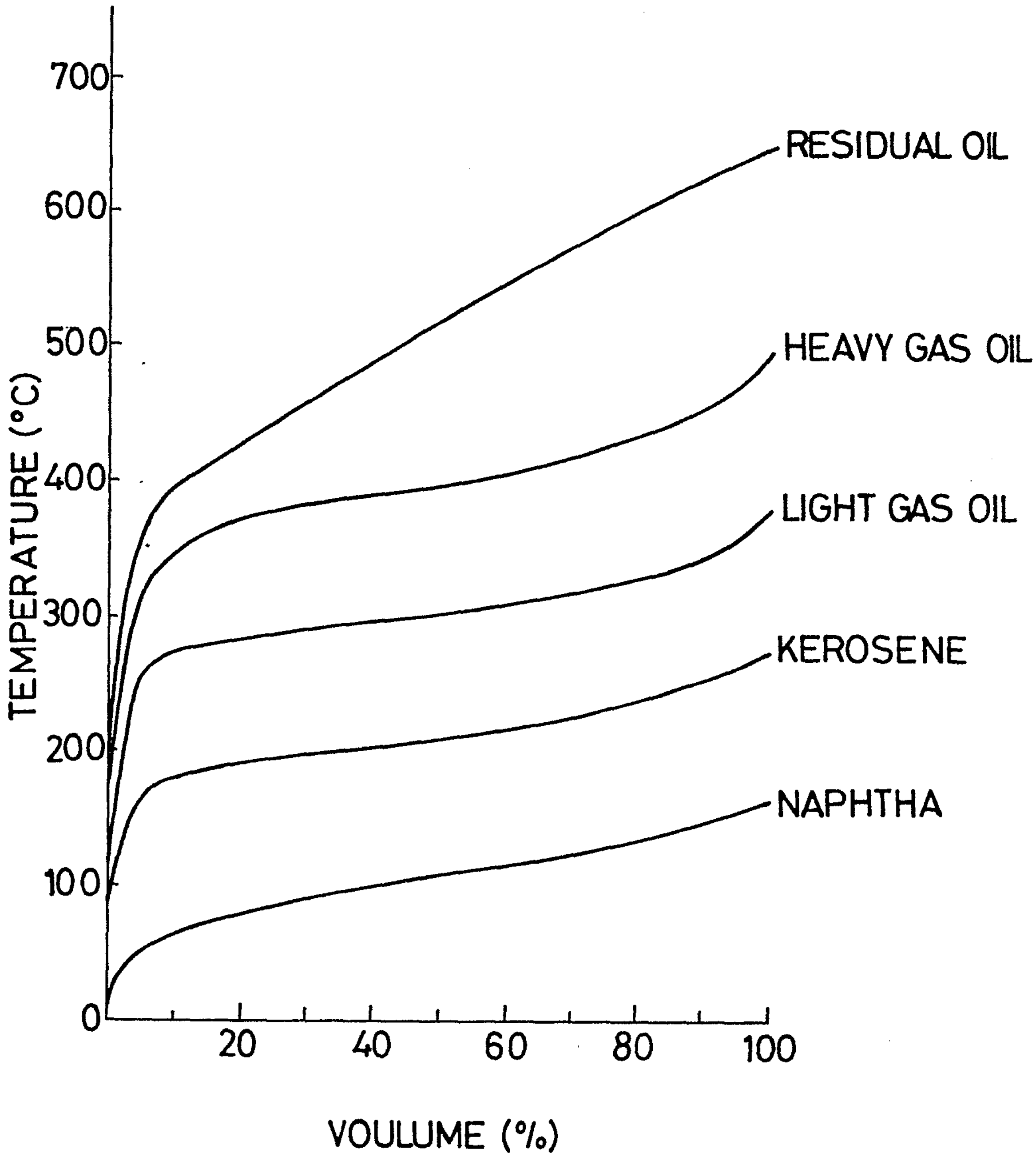


FIG.4



700
600
500
400
300
200
100
0
TEMPERATURE (°C)
RESIDUAL OIL
HEAVY GAS OIL
LIGHT GAS OIL
KEROSENE
NAPHTHA
20
40
60
80
100
VOULUME (%)

European Patent Office

EUROPEAN SEARCH REPORT

0186617
Application number

EP 85730158.4

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	SU - A - 724 558 (KHARKOV POLY) * Totality * --	1	C 10 G 7/00
A	GB - A - 1 537 581 (UOP INC.) * Claims; page 3, line 78 - page 5, line 80 * ----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			C 10 G 7/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	11-03-1986	STÖCKLMAYER

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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