June 17, 1930. F. LAMPLOUGH 1,765,167

CONVERSION OF HEAVY HYDROCARBON OILS INTO LIGHT HYDROCARBON OILS OR SPIRITS

Filed May 27, 1926 3 Sheets-Sheet 1

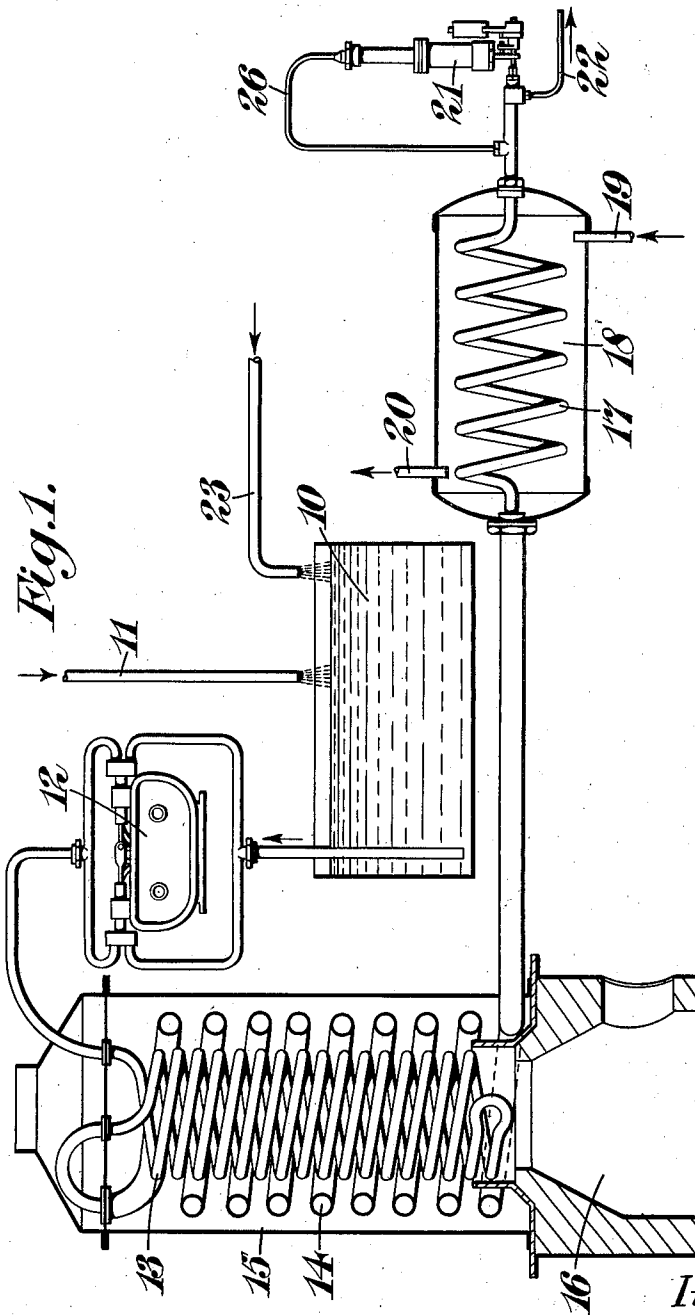


Fig. 1.

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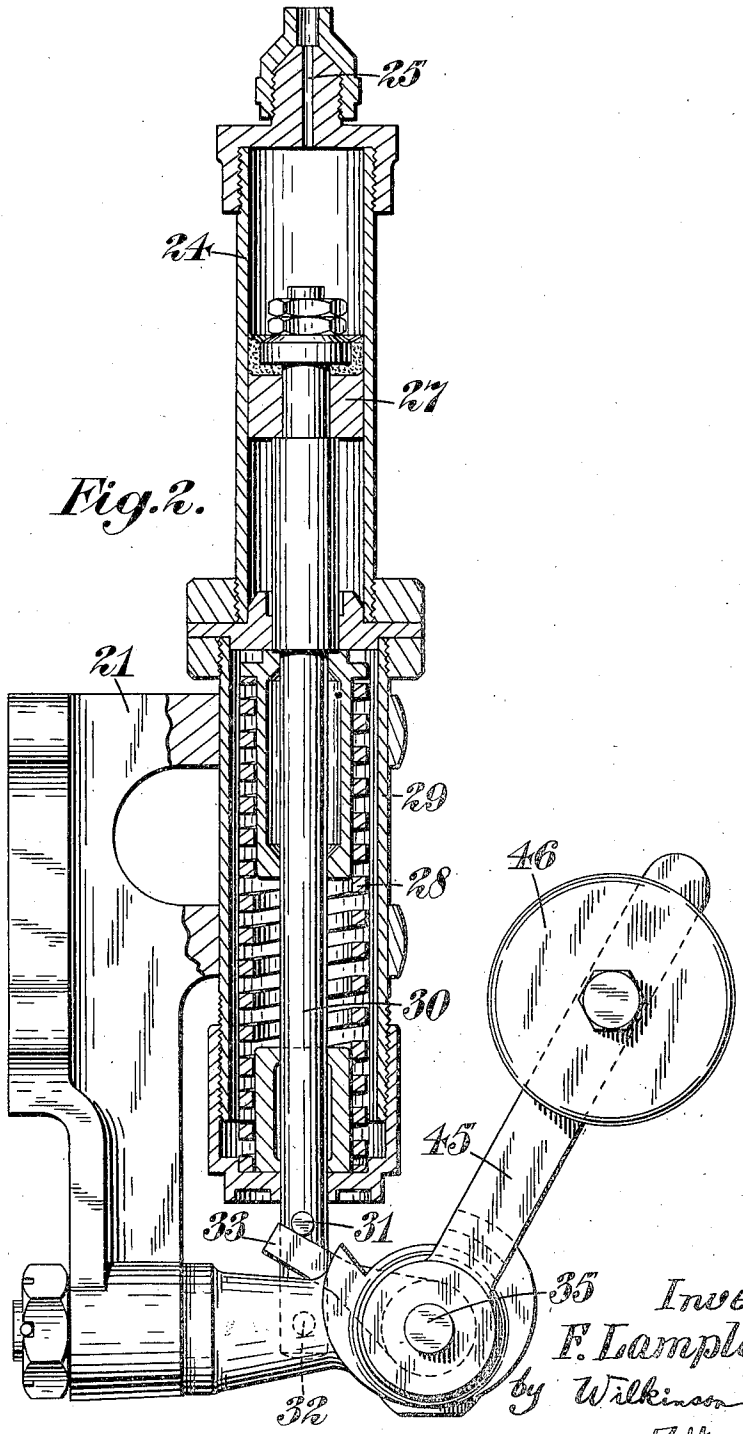


Fig. 2.

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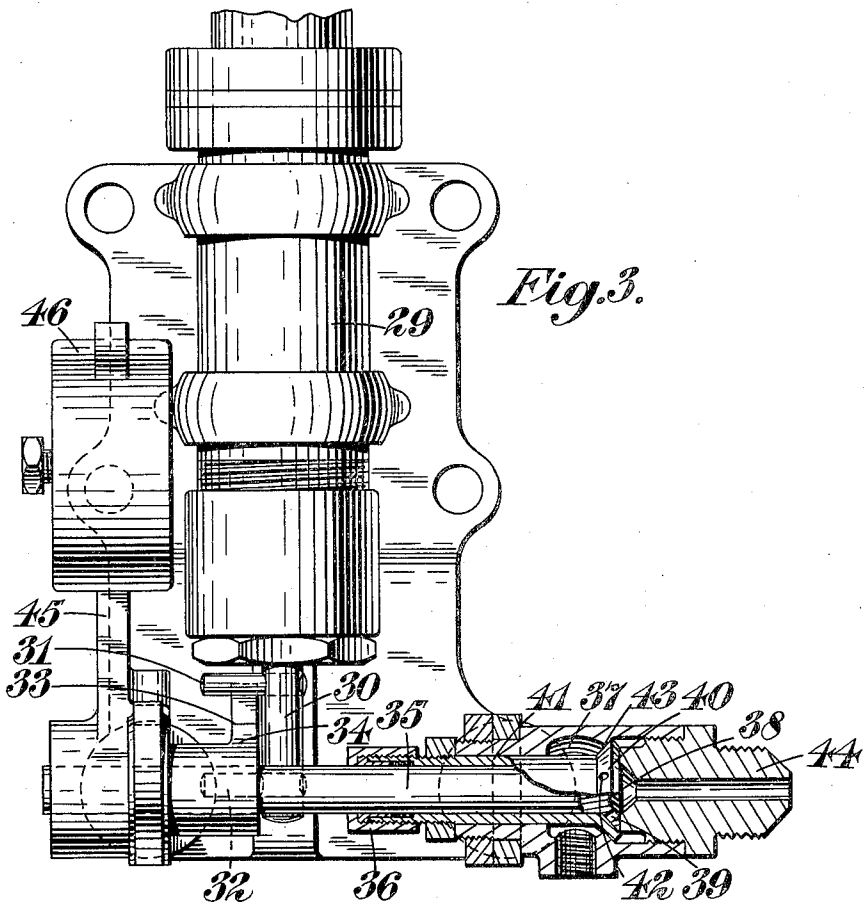


Fig. 3.

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UNITED STATES PATENT OFFICE

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CONVERSION OF HEAVY HYDROCARBON OILS INTO LIGHT HYDROCARBON OILS OR SPIRITS

Application filed May 27, 1926, Serial No. 112,056, and in Great Britain June 23, 1925.

This invention comprises improvements in apparatus for the treatment of hydrocarbon oils with the object of producing hydrocarbons of low boiling point from hydrocarbons of higher boiling point.

The invention comprises an apparatus for the treatment of hydrocarbon oils having in combination a pump, a heating chamber supplied thereby, a release valve comprising a yieldingly-controlled piston subject to the pressure of the heating chamber, a movable valve element which opens and closes the outlet from the heating chamber, operative connections including a lost-motion device between the piston and the valve element and a throw-over mechanism for the lost motion device having its centre of gravity above its pivot for the purpose to be described hereinafter.

One example of apparatus according to the invention, and a mode of operation thereof for the treatment of hydrocarbon oils, will now be described with reference to the accompanying drawing.

In the drawing:—

Figure 1 is a diagrammatic representation of the plant as a whole, certain parts being shown in section;

Figure 2 is a detail in section of the release valve, and

Figure 3 is a further detail of the same partly in section in a plane at right angles to Figure 2.

Referring to Figure 1 the numeral 10 represents a sump into which oil for treatment is delivered through a pipe 11. A pump 12 draws from this sump and delivers into a heat treatment coil 13. The pump 12 is preferably of a variable stroke type, that is to say one in which, by adjustment of the parts, the stroke of the pump can be varied whilst it is running. The heating coil consists of two sections, an inner coil 13 of smaller diameter formed of steel tube, coiled after being doubled upon itself so that the connections for inlet and outlet are both at the top of the coil, and an outer tube 14 which is connected to the outlet of the tube 13 and is of larger diameter to prevent possible choking from decomposition of carbon. The coils 13 and 14 are concentric and are placed in a casing 15 above a furnace 16. Suitable temperature- and pressure-indicating instruments (not shown) are provided. The outlet of the coil 14 is connected to a cooling coil 17 in a water chamber 18 therefor to which cooling water enters at 19 and from which it is discharged at 20. Instead of using cooling water for this purpose the oil may be circulated around the cooling coil 17 before it enters the coil 13 thus economizing a certain amount of heat. At the outlet from the cooling coil 17 is a pressure-release valve 21 from which the products of the process pass to a fractionating apparatus by a pipe 22. The fractionating apparatus, which is not shown, is of usual construction and in it the motor spirit produced is separated from the remaining portion of heavy hydrocarbons and from any carbon deposit. The heavy hydrocarbons recovered from the fractionating apparatus are returned to the sump 10 through a pipe 23.

The release valve 21 comprises a cylinder 24 the upper end of which is in communication through a port 25 and pipe 26 with the oil on the pressure side of the valve and therefore is controlled by the same pressure as that which exists in the heating coil 13, 14. The cylinder 24 contains a piston 27 subject to the oil-pressure and movement of which is yieldingly controlled by a spring 28 housed in an extension 29 of the cylinder casing. The piston 27 has a piston rod 30 which passes through the casing 29 and below it carries two operating pins 31, 32. Between the operating pins there works a tongue 33 of a lever 34 fixed on a valve spindle 35. The valve spindle 35 passes through a stuffing box 36 to a valve chamber 37. Here it has an enlarged hollow conical head 38, the sides of which are pierced with ports 39. The hollow conical head 38 makes a close working fit on its outer face against a valve face 40 formed on the inside of the conical end of a sleeve 41 which carries the stuffing box 36. The sleeve 41 is provided with ports 42 to co-operate with the ports 39 in the valve head 38 and it makes an oil-tight fit at 43 against the walls of the

valve chamber 37. It will be seen that the sleeve 41 is readily removable for renovation or replacement of the valve face. The inner face of the conical valve 38 makes a working fit against a valve face on the end of the nipple 44. Thus the valve 38 works between two valve faces and leakage of oil due to the high pressure employed is thereby effectively prevented.

Upon the end of the spindle 35 there is fixed a lever 45 having a weight 46 such that the centre of gravity of the lever is well above the spindle 35 which forms its centre of rotation. A certain amount of lost-motion is provided between the tongue 33 and the pins 31, 32.

In operating the apparatus above described, the sump 10 is first filled with oil and into this there is introduced a small quantity (say about 0.4%) of a suitable aromatic hydrocarbon, preferably naphthalene, which dissolves in the oil. The pump 12 draws oil from the sump 10 and delivers it to the coil 13 at a predetermined rate which, if a variable stroke pump is employed, may be adjusted by varying the stroke of the pump. Otherwise the quantity may be regulated by a bye-pass valve or other device. In the coil 13 the oil is raised to the required temperature and in the coil 14 it is maintained at this temperature.

The pressure gradually rises as the pump 12 continues to deliver oil until the pressure-release valve 21 is subject to such a pressure that the piston 27 is depressed against the spring 28 sufficiently for the pin 31 to force the tongue 43 downwards by the amount necessary to bring the ports 39, 42 into register with one another. The lever 45 is so adjusted that at the moment the ports begin to open it falls over and rapidly opens them completely, the lost-motion device 31, 32, 33, permitting this to take place. A considerable quantity of oil is immediately discharged along with the lighter hydrocarbons produced, and any permanent gases that may have been evolved.

By regulating the rate of flow of the cooling medium through the chamber 18 it can be arranged that the oil is discharged at a temperature such that the lighter hydrocarbons desired are immediately vapourised while the heavier hydrocarbons remain in the liquid form. The separation in the fractionating apparatus is thereby facilitated and no additional supply of heat becomes necessary for fractionation.

As soon as the pressure is released to a sufficient degree, the spring 28 raises the piston 27 enough to close the valve ports, the weighted lever 45 again serving to render the movement, when it occurs, sudden and complete. Owing to the lost-motion connection 31, 32, 33 there is a considerable difference between the pressure at which the valve opens and that at which it closes, and this is the main purpose of the lost-motion connection. The effect is that the valve may be made to remain closed for a considerable time during which the oil is being treated and remains at rest in the coil 13, 14. Thereafter the pressure is raised sufficiently to operate the valve and a batch of treated oil all runs out together. The velocity of discharge is sufficient to ensure that any carbon deposit in the cooling coil 17 is carried out with the liquid. The capacity of the cooling coil 17 is adjusted so that it holds about the amount of oil which is discharged during each cycle of operations, and thus batches of oil are regularly fed forward to the cooling coil, there cooled to the required degree and thence discharged. The pressure during each stage of the cycle can be regulated by varying the stroke of the pump, or by providing a relief valve on the outlet of the pump or in any other desired manner.

It will be noted that the lever 45 constitutes a throw-over mechanism for ensuring the complete operation of the valve 44. Any other type of throw-over mechanism could be employed. For example, it might be spring-operated instead of gravity-operated.

I claim:—

1. In an apparatus for the treatment of hydrocarbon oils the combination of a pump, a heating chamber supplied thereby, a release valve comprising a yieldingly-controlled piston subject to the pressure of the heating chamber, a movable valve element which opens and closes the outlet from the heating chamber, operative connections including a lost-motion device between the piston and the valve element and a throw-over mechanism for the lost motion device having its centre of gravity above its pivot for the purpose described.

2. An apparatus for the treatment of hydrocarbon oils as claimed in claim 1 wherein the movable valve element consists of a hollow cone, rotatable between inner and outer valve faces and pierced by ports to register with ports in the valve faces for the purpose described.

In testimony whereof I affix my signature.

FREDERICK LAMPLOUGH.