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OIL FRACTION PUMPING APPARATUS

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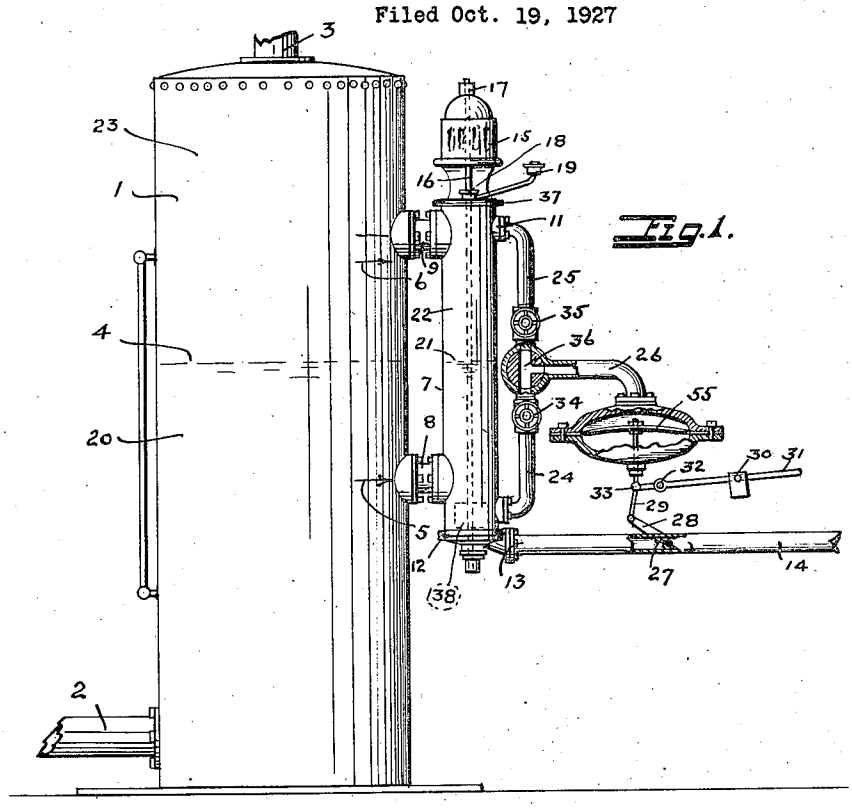


Fig. 1.

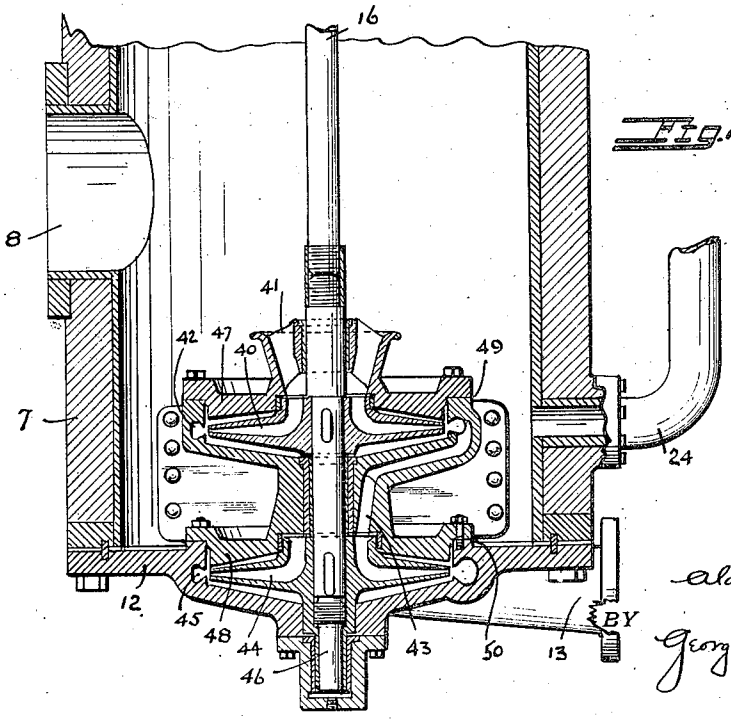


Fig. 2.

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OIL-FRACTION PUMPING APPARATUS.

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My invention has for its object a centrifugal pump in combination with motor means and associated elements for attachment to oil fractioning towers or the like, for the purpose of removing the contents therefrom at a predetermined rate.

A further object is apparatus of the character described wherein the pump is enclosed within a drum of relatively simple construction whereby the establishment or maintenance of joints, packings and the like are reduced to their simplest form and number, minimizing the risk of oil leakage and flashing when coming in contact with the atmosphere under the high pressure and heat conditions ordinarily employed in apparatus of this character.

A further object is a pump of the character described, assembled entirely within a drum maintaining the pump submerged at all times within a body of fluid to be pumped.

A further object is the elimination of pump shaft packing within the oil body and providing the same entirely within a vapor chamber with an independent oil seal and under lower temperature conditions.

A further object is in apparatus of the character described an automatically controlled valve mechanism adapted to vary the pump discharge in proportion to pressure variations within the drum and therefore within the tower.

A further object is in apparatus of the character described, a drum of relatively large cross-sectional area compared with the suction inlet to the pump whereby a relatively low velocity of oil flow is maintained in the drum during the pump operation enabling the fluid within the drum before being pumped to free itself from its final vapors, which are collected and returned to the fractionating tower and thence through conventional condensing apparatus.

A further object is in apparatus of the character described, a drum having a lower cover cast with a volute passage forming the last stage of the pump and with which is assembled the pump parts and impeller on the interior side of the drum, thus bringing all joints of the pump proper or any intricate pump passages and connections entirely within the body of oil.

Other objects will appear from the drawings and specifications which follow:

Fig. 1 is a side elevation of a conventional oil fractionating tower showing my invention applied thereto, with the dimensions of the tower shown in much smaller scale relative to the other parts.

Fig. 2 is an enlarged detailed cross section through the two stage centrifugal pump and the lower part of the drum of Fig. 1.

Throughout the figures similar numerals refer to identical parts.

The numeral 1 indicates a conventional oil fractionating tower adapted to separate oil fractions, as the removal of the lighter constituents from crude oil.

This tower is supplied as through the pipe 2 with oil and the oil fractions are then removed through the pipe 3.

During operation the oil level 4 varies in its position with the tower within limits substantially between the drum inlet shown by the arrow 5 and the lower limit of the vapor connection shown by the arrow 6.

Attached to the side of the tower is a drum 7 having a fluid inlet connection 8 and a vapor connection at 9 and opposite to these on the fluid ports the upper of which is shown at 11.

On the lower end of the drum is the cover 12 forming also the volute member for the high pressure stage of the pump whereby the pumped fluid is delivered through the connection 13 and pipe 14 from the tower 1.

The pump is operated by the motor 15 through the vertical shaft 16 there being provided suitable thrust and radial bearings one of which is shown at 17, and a packing gland at 18, to prevent leakage of the vapors from the drum 7 through the shaft opening.

The gland 18 is sealed with an independent oil supply from 19, whereby the packing around the shaft is kept wet with oil at all times to prevent the vapor leakage.

In apparatus of this character the oil body within the tower shown at 20 is maintained at a high temperature whereby the oil fractions are separated from the oil body and rise through the discharge outlet at 3.

The oil entering the drum 7 through the port 8, whose level is shown at 21 is of a slightly lower temperature than the oil body within the tower 1, and because of the convection

and other heat dissipations the gland 18 is maintained at a very much lower temperature than that at which the oil fractions are separated within the tower.

The oil mass 20 is in a foaming or bubbling condition due to the separation of the constituents which is taking place and hence the oil in the drum is still giving up some remaining bubbles of these lighter constituents.

These rise and collect in the space 22 above the oil surface and return through the port 9 to the space 23 and are thence conveyed out through the delivery pipe 3.

The by-pass connection having the oil leg at 24 and the vapor leg at 25 functions in the same way to a lesser degree.

Any vapor collected from the semi-fluid mass in 24 passes upward through the vapor leg 25 and is returned to the vapor space 23.

The pressure in the tower 1 is in communication with the diaphragm 55 through the connection 26 and the movement of the diaphragm actuates the butterfly valve 27 through the lever 28 and connecting rod 29, the adjustment for different pressures being made by the weight 30 slidable on the arm 31 fulcrumed at 32 and connected at 33 to the rod 29.

A spring or other well known equivalent may be substituted for the weight.

Conventional valves are shown at 34, 35 and a three-way valve at 36.

The drum 7 is provided with a cover 37 which may be removed together with the motor 15, shaft 16, carrying with it the pump mechanism generally shown by the numeral 38.

Referring particularly to Fig. 2 wherein is shown a detail of the two stage pump construction, a low pressure impeller is shown at 40 having a suction inlet at 41 and a volute casing at 42 wherein the first stage pressure is established.

This latter pressure is conveyed through the port 43 to the suction inlet of the impeller 44, which latter is positioned within a volute chamber 45, formed within the flange 12 and having the discharge outlet 13.

A guide bearing for the shaft 16 is shown at 46 and I prefer to support the weight of the rotating element from one of the motor bearings as 17 in the well known way.

A cover 47 for the volute 42 and a cover 48 for the volute 45 establish joints at 49 under the pressure of the first stage and at 50 under the pressure of the second stage of the pump and these joints are entirely within the oil body contained in the drum 7. The oil being pumped is at a high temperature and pressure and any leakage of high pressure oil into the atmosphere flashes at once into flame.

This my invention avoids. One of the primary objects of my invention is a construction of the parts maintaining the high pressure oil joints of these intricate volute and pump castings submerged entirely within the oil body so that should any leakage occur it is discharged into the oil body instead of into the atmosphere.

It is to be understood that the cover 12 and the top 37 are bolted about their periphery to the drum 7 with suitable packing. These joints are of simple construction and easy to maintain tight.

It will now be seen that the pump is at all times submerged in a body of oil and that the discharge from the pump as through pipe 14, is under the control of the valve 27 actuated by the diaphragm 55, the movement of which in turn is controlled by the pressure within the fractionating tower; thus should the pressure rise above the desired point the diaphragm 55 is depressed, the valve 27 opens a little more and the discharge from the pump through the pipe 14 is increased until the pressure is proportionally relieved.

Likewise should the pressure reduce below the desired amount in the fractionating tower the diaphragm 55 will rise slightly closing valve 27 until the pressure is re-established in the tower.

A discharge from the centrifugal pump through the pipe 14 will therefore be automatically maintained to sustain a constant pressure within the tower 1.

The oil being pumped within the centrifugal pump 38 is freed to a maximum degree of its low boiling fractions which in their foaming condition continue to settle out in the drum and pass thence into the vapor space 23 of the tower mingling with other previously freed constituents.

Any vapor collected through the connections 24 and 26 is likewise returned through the vapor leg 25 thus preventing the trapping of vapors in any portions of my apparatus.

The shaft 16 passing through the gland 18 establishes a running joint of minimum temperature in the apparatus, and leakage otherwise occurring by this gland is sealed by the independent oil supply at 19, and any leakage which might occur under accidental conditions is of vapor only and not high temperature high pressure liquid oil.

I claim:

1. A submerged centrifugal oil pump having a vertical shaft and positioned entirely within a drum, said drum having an open top, a flange cover for said open top, motor means mounted on said cover, a shaft gland and an oil seal therefor in said cover, a discharge outlet for said pump through the bottom portion of said drum, an inlet port near the bottom and an outlet port near the top of said drum.

2. A submerged multistage sectionalized centrifugal oil pump having a vertical shaft and positioned entirely within a drum, said drum having an open top, a flange cover for said open top, motor means mounted on said

cover, a shaft gland and an oil seal therefor in said cover, a discharge outlet for said pump through the bottom portion of said drum, an inlet port near the bottom and an outlet port near the top of said drum, said bottom portion comprising a flange member bolted to said drum and having formed therein the volute chamber of the high pressure stage of said pump.

3. Apparatus as set forth in claim 1 and a valve controlling the discharge of said pump and pressure actuated control means to close said valve when the pressure in the drum falls and to open said valve when the pressure in the drum rises.

4. Apparatus as set forth in claim 2 and a valve controlling the discharge of said pump and pressure actuated control means to close said valve when the pressure in the drum falls and to open said valve when the pressure in the drum rises.

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