

Dec. 15, 1925.

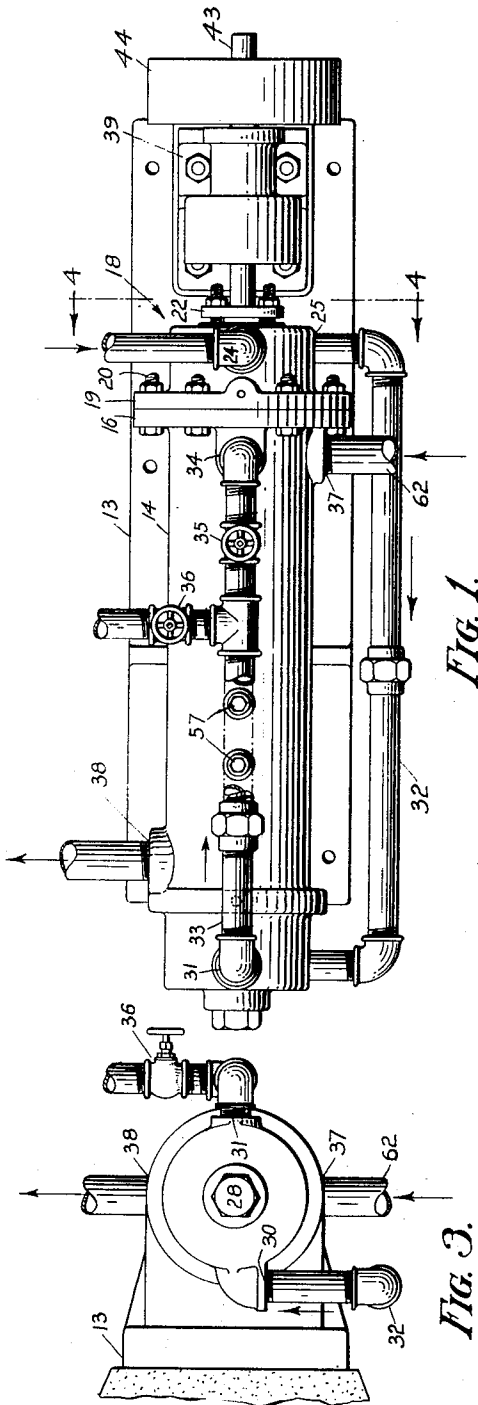
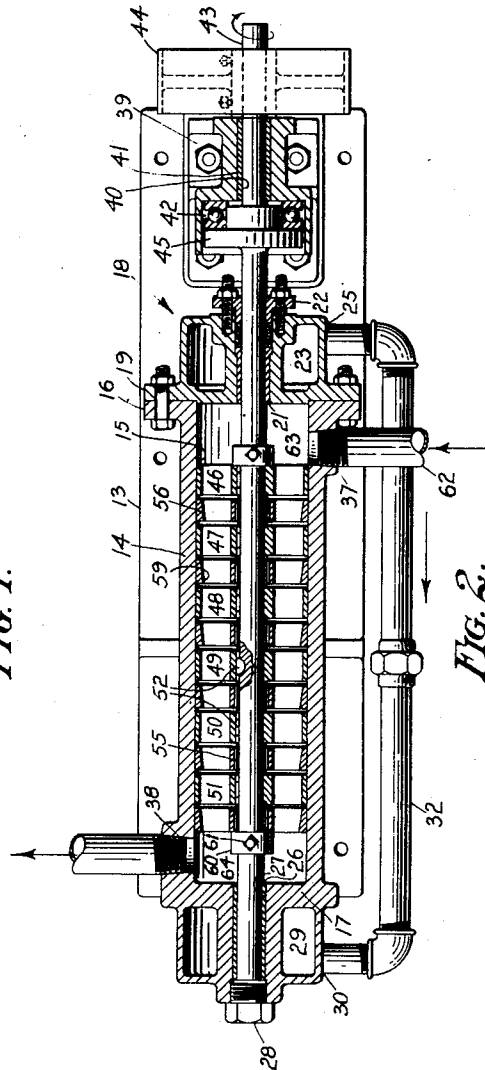
1,565,324

E. W. HARTMAN

ROTARY PUMP

Filed Sept. 23, 1924

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

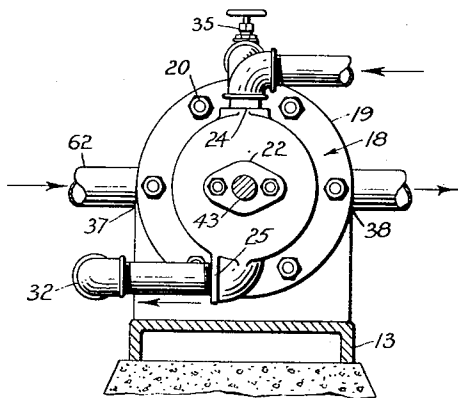


FIG. 4.

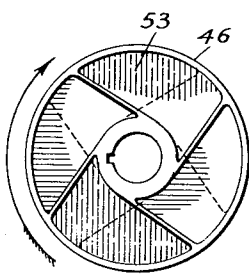


FIG. 5.

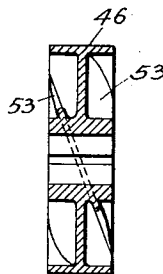


FIG. 6.

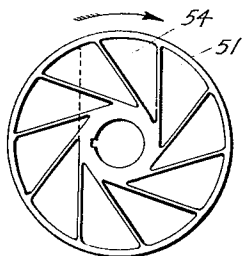


FIG. 7.

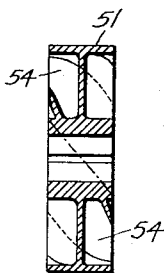


FIG. 8.

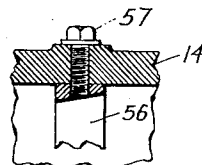


FIG. 9.

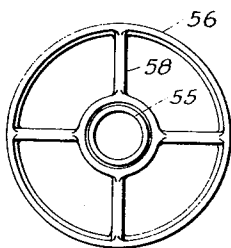


FIG. 10.

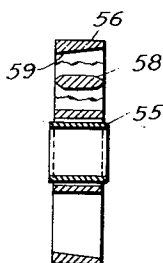


FIG. 11.

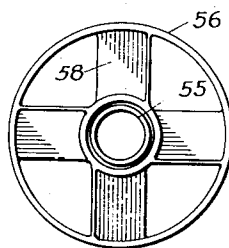


FIG. 12.

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UNITED STATES PATENT OFFICE.

EMANUEL W. HARTMAN, OF OAKLAND, CALIFORNIA, ASSIGNOR TO HARTMAN INTERESTS, INC., OF LOS ANGELES, CALIFORNIA, A CORPORATION OF NEVADA.

ROTARY PUMP.

Application filed September 23, 1924. Serial No. 739,379.

To all whom it may concern:

Be it known that I, EMANUEL W. HARTMAN, a citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented certain new and useful Improvements in Rotary Pumps, of which the following is a specification.

My present invention relates to pumps in general, and more particularly to high pressure rotary pumps for the pumping of hot oils and their vapors, and in addition, all other liquids capable of being pumped by ordinary rotary pumps.

In the refining of crude oils by the high-pressure cracking system, pumps are required to pump oil not only at high pressures, but also at high temperatures, and the present pumps on the market for this purpose which I am familiar with, are of the reciprocating type and will handle oil up to five hundred degrees Fahrenheit fairly well if the suction to the pump is under a head of pressure, but beyond this temperature they produce very inefficient results. Better results can be obtained with the said pumps if a long surge line is introduced in the suction, whereby oil is used therein in conjunction with the piston. By the latter method, oil up to six hundred degrees temperature can be pumped, but beyond this temperature the pump and surge line will knock and the oil vapors cannot be held, hence, slipping occurs and also the racing of the pump.

My present need is a pump for use in such an oil cracking system as above mentioned, that will draw and pump hot oils up to 1000 degrees or more in temperature, and in the refining process, draw fresh oil into the suction in conjunction with the hot oils, and discharge the oils at pressures up to about 1000 pounds.

Therefore, from the above statements, my prime object is to produce a pump capable of receiving oils or other liquids and their vapors at low or high temperatures, or combinations of both, and under or not under a suction head, and discharge the liquid and vapors at a high pressure head.

Another object is to construct the pump as a simple, durable and efficient unit and

of the high-speed rotary type, having long bearings and a compact train of varying impellers separated by deflectors.

Another object is to surround the bearings by chambers, to effect the cooling thereof by the introduction and passage therethrough of fresh and cold oils or cold water.

A further object is the utilization of the said chambers as heat exchangers, whereby the oil passed therethrough has been raised in temperature and introducing this heated oil into the suction end of the pump cylinder, the passages for the said oil forming a part of the circulatory suction system.

Certain grades of oil when cold are not adaptable for pumping and hence must be preheated by passing them through heaters of some kind, then fed into the hot-oil pumps by feed pumps, and a further object of my invention is to eliminate the said preheaters and feed pumps by the just-mentioned heat exchangers combined as a part of my improved pump.

A still further object is to dispense with packings in the bearings at the discharge end of the pump, a constant source of trouble and annoyance in hot-oil pumps.

I attain the above and other objects by the novel construction of my pump, and on the accompanying two sheets of drawings I show an exemplification of it as best suited for my present needs, and throughout the detailed description of the drawings which will follow presently, I will describe the invention in relation to hot oils and their vapors as used in the oil-cracking system referred to, but it is to be borne in mind that the said pump may be put to other uses and with other liquids wherever it may serve to advantage.

The figures of the said drawings are briefly described as follows:

Figure 1 is a plan of the pump constructed in accordance with my invention; and Fig. 2 is a sectional plan taken along the horizontal center-line thereof, the shaft and pulley being shown in full.

Fig. 3 is an end elevation of the discharge end of the pump; and Fig. 4 an end elevation of the suction end and along the line 4-4 of Fig. 1.

Fig. 5 is a face view, on an enlarged scale, of the first impeller of the pump looking in the direction of its normal rotation; and Fig. 6 is a mid-section of it showing to advantage the pitch of the blades.

Figs. 7 and 8 are views similar to Figs. 5 and 6, but are of the last impeller and show the same as having a great many more blades and of steeper pitch.

Fig. 9 is a fragmentary view in section of the pump cylinder and a deflector ring attached thereto.

Fig. 10 is a face view of a deflector ring and spacer sleeve therein; and Fig. 11 is a mid-section thereof.

Fig. 12 is a face view of a deflector ring showing the vanes angularly positioned.

I will now describe the embodiment shown of my invention in detail, and throughout the drawings similar numbers of reference will indicate corresponding parts.

The number 13 indicates the base of the pump, and mounted thereon, and in this instance cast therewith, is a cylinder or casing 14 having preferably a straight cylindrical bore 15 and is here shown of small diameter compared to its length. One end of the casing, the suction end, is open and has a coupling flange 16, and the other end, the discharge end, is closed and the metal thereat is of an increased thickness, as at 17, to withstand the high discharge pressures of the pump.

The open end of the casing is provided with a closure or cover 18, having a flange 19 adapted to mate with the casing flange 16 and be held in removable attachment thereto by the bolts 20 properly spaced. The closure is provided with a central bearing, consisting of a wearing bushing 21, stuffing box and the usual gland 22 therefor. Surrounding the said bearing is a chamber 23 constituting a part of the cover, and the same is provided with two openings 24 and 25, preferably diametrically opposed, the former opening being the inlet to the chamber and the latter the outlet.

The closed end of the casing likewise has a central bearing, consisting of a wearing bushing 26 secured within the bore 27 and the latter is closed by the screw plug 28. This bearing is similarly surrounded by a chamber 29 having an inlet opening 30 and an opposed outlet opening 31.

Between the two chambers is a piped communication 32, and leading from the outlet 31 is also a piped communication 33 to an inlet 34 in the suction end of the casing 14. The latter communication has a pair of valves 35 and 36 adapted to by-pass the suction inlet 34, when desired, as will be set forth later. The said suction end of the casing, the low-pressure end, has an additional opening 37; the main suction inlet; and the opposite end of the casing, the

high-pressure end, has an opening 38, the discharge outlet of the pump.

At the end of the base 13 adjacent the low-pressure end of the pump, is mounted a bracket 39 having a bore 40 for the securing therein of a wearing bushing 41. The bracket is counterbored to receive the thrust ball-bearing 42.

All the aforementioned bearings are in alignment, and are adapted to receive and support a shaft 43. The extremity of the shaft has any suitable driving means secured thereto, such as a pulley 44. The shaft is collared as at 45 to transfer the shaft side-thrust to the said thrust bearing 42 when in service.

On the shaft and in the casing between the main suction-inlet 37 and discharge outlet 38, is secured a series of impellers 46, 47, 48, 49, 50 and 51 by any well-known means, such as by Woodruff keys 52. Each impeller has a different number of blades 53 and 54 extending from face to face thereof, Figs. 5 to 8 inclusive, and pitched at varying angles. In the present construction of the pump I employ six impellers the one (46) nearest the suction inlet has the least number of blades, namely, four and each has a pitch of twenty degrees. The impeller 51 furthest from the said suction inlet has ten blades, the greatest number, and each is pitched at an angle of forty degrees. In Fig. 7, the dotted line and the lines parallel therewith indicate the width of a single blade. Intermediate the said two impellers, the other impellers are bladed and pitched in direct proportion; each impeller being designed to boost the pressure of the fluid to be pumped its proportion of the ultimate pressure desired.

In some cases I may employ more impellers and in some cases less. Also the number of blades to each and their respective pitches, I may vary to suit conditions.

Loosely mounted on the shaft and between each impeller is a sleeve 55 for spacing the said impellers an equal distance apart.

Surrounding the sleeve but spaced out of contact therewith, is a series of deflector rings 56 snugly fitting within the casing bore and each rigidly secured to the casing at its inside top by fine-thread tap bolts 57, Figs. 1 and 9. These rings have vanes 58 therein extending from face to face, and may all be pitched at a suitable angle to insure a uniform rate of increase of velocity head through each impeller. The rings are of less width than the spacing sleeves 55, as shown to advantage in Fig. 2, to permit clearance all around the rings except at the contacting surface with the casing bore. The inside peripheral surface of each ring is sloped toward the center of the ring as at 59, Fig. 11, to direct sand and any other for-

eign matter in the pumped material to the center region and along the shaft and thence out through the discharge.

The impellers are held positioned on the shaft and between the suction and discharge, mainly by the collars 60 secured to the shaft by the set-screws 61, and which collars snugly hold the impellers and spacing sleeves in contact with each other and out of contact with the deflector rings 56.

In operation, and in the high pressure oil-cracking system referred to, hot oils and vapors from the stills, for example, are fed through the pipe 62 to the suction chamber 63 of the pump, thence are received by the first impeller 46 and the pressure head created by it is converted into increased velocity head by the deflector ring adjacent the said impeller, so that the oil and vapors enter the second and any successive stages at about the same velocity they enter the first or lower stage. At the discharge chamber 64 the pressure and temperature of the products is exceedingly high, and the said products are then directed to the cracking chambers or to the superheated coils (not shown) of the refining system.

The hot circulating oil and vapors through the pump tend to heat the bearings, and the latter are cooled by the previously mentioned bearing-chamber circulatory system, whereby cold oil from a remote source, such as from a crude oil storage tank, has heat imparted thereto by the exchange of heat in the cooling of the bearing in the low-pressure bearing chamber, thence the circulating crude oil becomes further warmed in the high-pressure bearing chamber by the exchange of heat thereat, thence the said circulating and heated crude oil may enter the suction chamber 63 of the pump at the auxiliary inlet 34, and there merge with the main hot oil and vapor suction supply; or the said circulating crude oil may be bypassed from the pump by closing the valve 35 and opening the previously closed valve 36.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the construction and method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is the following:

1. In a pump of the character described, a

cylinder having a bore with an open end and a closed end, a cover for the open end, a shaft adapted to be supported in the said ends, a series of spaced impellers supported on the shaft between said ends, and a series of deflector rings adapted to be supported in and to the cylinder and between the impellers; said closed end and the cover for said open end each provided with a bearing for the said shaft, a chamber surrounding each bearing and each chamber having an inlet and an outlet and a communication between the chambers for the passage of a liquid to effect the cooling of the said bearings; and the said cylinder having near its open end a suction inlet and near its closed end a discharge outlet, and a communication leading from the outlet of the chamber at the closed end to the said suction inlet whereby the cooling liquid may be circulated through the pump.

2. In a pump of the character described, a cylinder having a bore with an open end and a closed end, a cover for the open end, a shaft adapted to be supported in the said ends, a series of spaced impellers supported on the shaft between said ends, and a series of deflector rings adapted to be supported in and to the cylinder and between the impellers; said closed end and the cover for said open end each provided with a bearing for the said shaft, a chamber surrounding each bearing and each chamber having an inlet and an outlet and a communication between the chambers for the passage of a liquid to effect the cooling of the said bearings; and the said cylinder having near its open end a suction inlet and near its closed end a discharge outlet, and a communication leading from the outlet of the chamber at the closed end to the said suction inlet whereby the cooling liquid may be circulated through the pump; and the said cylinder further provided with an additional suction inlet near the first-mentioned suction inlet for the reception of a liquid of higher temperature than the aforementioned cooling liquid received through the other suction inlet.

3. A rotary pump for hot fluids comprising a base, a pump casing mounted thereon having a cylindrical bore with a closed end and an open end, a closure for the open end, the latter end being the suction end of the pump and an inlet provided thereat in the casing, and the former end being the discharge end of the pump and an outlet provided thereat, the closure and the closed end each provided with a bearing and a chamber surrounding each of the same, and the chambers further provided with a communication therebetween and each with an additional opening, the opening in the closure chamber being the inlet therefor and the opening in the other chamber the outlet

therefor, a communication from said last-named outlet to an additional inlet in the suction end of the casing, power means including a thrust bearing mounted on said
5 base adapted to support a drive shaft extending through the casing and the said bearings thereof, said shaft carrying a series of impellers spaced apart by sleeves, deflector rings surrounding the latter and fixedly se-
10 cured to the casing, the hot fluid to be pumped adapted to enter the first-named casing-inlet and a cooler fluid adapted to enter and pass through the closure-chamber to cool the bearing therein, thence through the first-
15 named communication to and through the other chamber to likewise cool the bearing therein, thence through the last-named com-

munication to the said additional inlet in the suction end of the casing or to some other receiver, and means on the latter communication to by-pass the casing when desired.

4. The combination as set forth in claim 3, and in which the deflector rings are made of less width than the sleeves and the bore thereof of greater dimension than the outside diameter of the sleeves, to provide a continuous clearance space from one impeller to the other for the passage of sand and other foreign matter through the central region of the casing and away from the inside surface of the casing bore.

In testimony whereof, I affix my signature.

EMANUEL W. HARTMAN.