Aug. 2, 1932. V. VOORHEES 1,869,874

SURGE PUMP

Filed Nov. 9, 1929

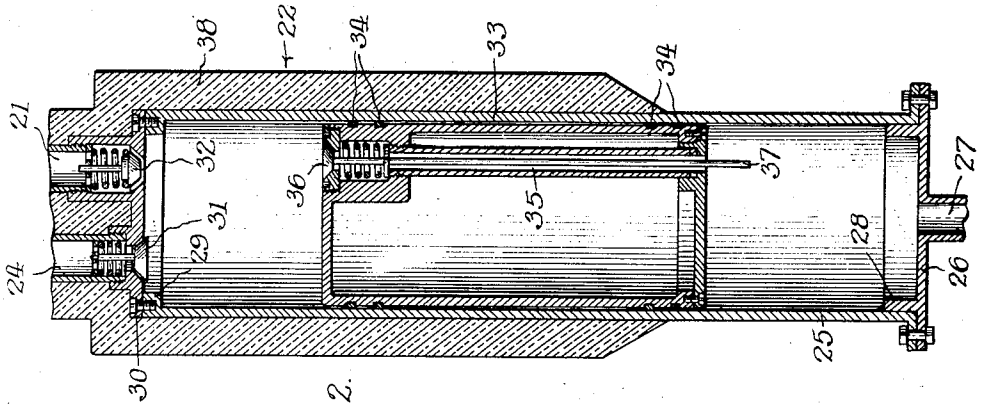



Fig. 2.

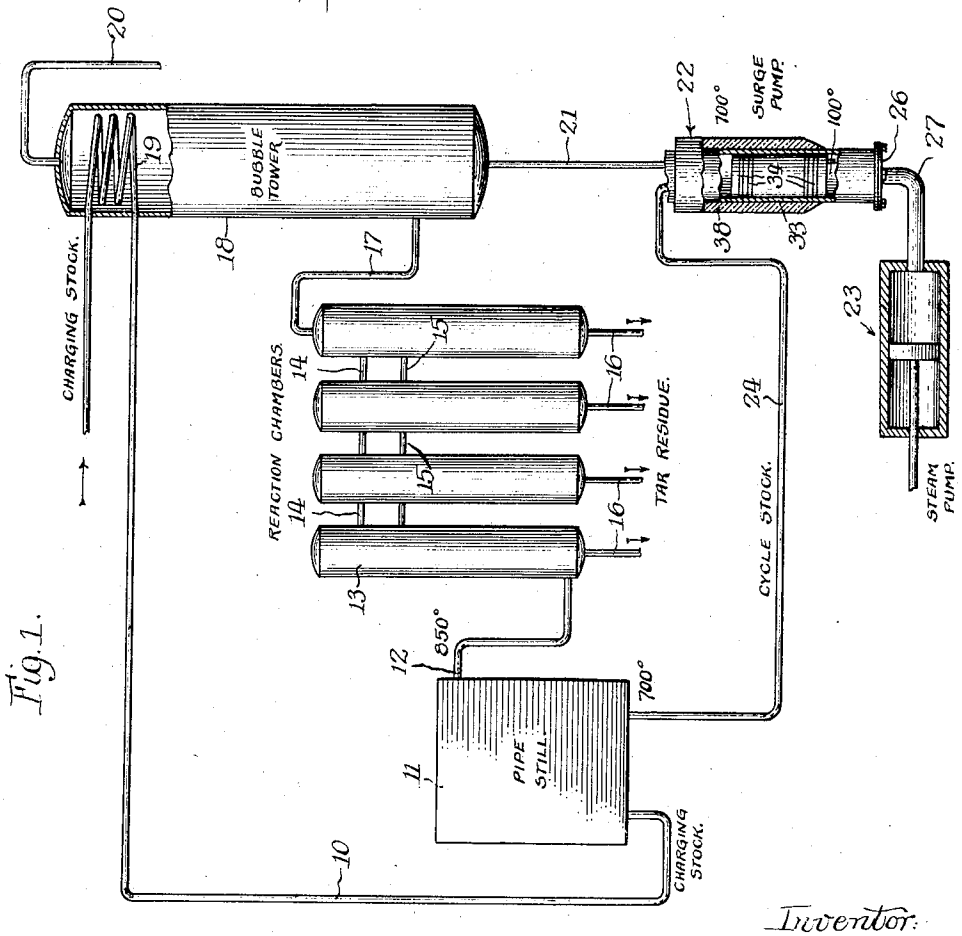



Fig. 1.

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# UNITED STATES PATENT OFFICE

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## SURGE PUMP

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This invention relates to a surge pump and it pertains more particularly to a pump for transferring hot liquids such as the cycle stock transferred from the bubble tower to the pipe still of a Holmes-Manley cracking unit.

The cycle stock at a temperature of 700° F. has such a low viscosity that it cannot be directly handled by an ordinary reciprocating steam pump. It is therefore the custom to provide a surge chamber between the reciprocating pump cylinder and the inlet and outlet valves, the surge chamber being connected to the pump cylinder by a long conduit of relatively small cross section which acts as a cooler to lower the viscosity of the oil so that it will not leak past the packing in the pump. The hot oil becomes mixed with oil in the surge chamber and a large bulky cooler is required between the surge chamber and the steam pump so that the arrangement is both thermally inefficient and mechanically objectionable. The object of my invention is to overcome these difficulties.

A further object is to provide a surge pump in which the pressure transmitting fluid is effectively sealed from the hot circulating fluid so that intermixture of these fluids will be reduced to a minimum.

A further object is to minimize heat transfer in the surge pump by preventing the hot fluid from contacting with the surfaces with which the pressure transmitting fluid is contacted.

A further object is to provide a pump with a fluid actuated piston which is altogether free from mechanical connections.

A further object is to provide an improved surge pump structure.

Other objects will be apparent as the detailed description of my invention proceeds.

The invention may be briefly characterized as an elongated chamber containing a seal at least one-half as long as the chamber, said seal being reciprocable by a pressure transmitting fluid from a conventional steam pump or pulsator. On the back stroke of the pump piston, the pressure fluid pulls the seal to the end of the surge pump opposite the intake and exhaust valves, sucking in a charge of hot liquid. On the forward stroke of the piston, the seal in the surge chamber is forced toward the valves, closing the intake valve and forcing the hot fluid out of the exhaust valve. Since the fluid on both sides of the seal is under substantially the same pressure there will be practically no leakage of hot fluid past the seal, and since the seal is at least half as long as the chamber, the hot fluid will never come in contact with the same surfaces with which the pressure transmitting fluid comes in contact. Thus I have eliminated the necessity of a cooler between the surge chamber and the steam pump and I have increased the thermal and mechanical efficiency of the pump.

A better understanding of my invention will be obtained from the description of the preferred embodiment, which is illustrated in the accompanying drawing, wherein similar parts are designated by similar character references throughout the several views and wherein:

Figure 1 diagrammatically illustrates a cracking unit for which my surge pump is particularly designed, and

Figure 2 illustrates my surge pump in vertical section.

In Fig. 1, I have shown a Holmes-Manley cracking unit wherein preheated charging stock is introduced by a pipe 10 to pipe still 11 and heated to a temperature of 850° F. under a pressure of about 300 pounds. The hot oil is then conveyed through a conduit 12 to reaction chambers or soaking drums 13 which are either heavily insulated or supplied with additional heat to maintain the reaction temperature. The vapor passes from chamber to chamber through conduits 14, the liquid level is maintained in the chambers by conduits 15, and tar is withdrawn from the base of the chambers through conduits 16.

The hot vapors are conducted by pipe 17 to the base of bubble tower 18 which may be provided with a reflux exchanger 19 for heating incoming charging stock. The pressure distillate is removed through conduit 20 and the hot reflux oil or residue is removed from the bottom of bubble tower through pipe 21. The hot reflux oil, which is commonly called cycle stock, passes

through a surge pump 22 which is operated by a steam pump 23 to force the hot cycle stock through conduit 24 back to the pipe still where it is mixed with fresh charging stock which has been elevated to approximately the same temperature.

The cycle stock which must be transferred from the bubble tower to the pipe still is at a temperature of about 700° F. and at this temperature its viscosity is so low that it cannot be handled by an ordinary steam pump. The empty surge chamber heretofore used has been thermally inefficient and objectionable because the hot oil was mixed with the pressure transmitting fluid in this chamber and finally found its way to the steam pump cylinder. In Fig. 2, I have shown a means for avoiding this trouble.

My surge pump comprises a cylindrical casing 25, having an outer flange at one end to which is secured end plate 26. This end plate is provided with a conduit 27 leading to the steam pump and is also provided with an annular shoulder 28 which fits snugly inside casing 25, and acts as a stop to limit the movement of the seal as will be hereinafter described.

The other end of casing 25 is provided with an inwardly extending annular shoulder 29 which acts as a stop for the seal and to which is secured end plate 30.

Intake pipe 24 leads into end plate 30 and is provided with a valve 31 which opens on the suction stroke of the pump and closes on the pressure stroke. Discharge pipe 21 also communicates with the surge pump through end plate 30 and is provided with a valve 32 which is opened on pressure stroke and closed on the suction stroke of the pump.

In the cylindrical casing 25, I provide a slidable seal 33 which in the present instance is in the form of a hollow cylinder with closed ends, said cylinder being provided with piston rings 34. Through this hollow closed cylinder, I provide an equalizing pipe 35 closed at one end by a spring pressed valve 36, the stem 37 of said valve extending beyond said seal far enough to act as a trigger to open the valve when the seal gets too close to end plate 26.

That portion of the surge pump which contains hot oil and all conduits through which the hot oil is transferred are protected by heavy insulation 38.

The operation of my improved surge pump is as follows: When the piston of the steam pump makes a suction stroke, it pulls the pressure fluid out of the surge pump through pipe 27 drawing the cylindrical seal 33 toward end plate 26, closing valve 32 and pulling hot oil through valve 31.

On the reverse or pressure stroke, the cylindrical seal 33 is forced by the pressure fluid to the opposite end of the surge pump, closing valve 31, and forcing the hot liquid through valve 32 and pipe 21 back to the pipe still.

If any oil should leak past the piston in the steam pump and thereby diminish the volume of the pressure transmitting fluid, it will be obvious that trigger 37 will strike end plate 26 causing the valve 36 to be opened for replenishing the pressure fluid. When the cylindrical seal strikes shoulder 29, valve 36 is unseated by fluid pressure to again automatically proportion the volume of oil on each side of the seal.

By making the length of the cylindrical seal 33 at least one-half the length of cylindrical casing 25, it will be seen that the hot oil never comes in contact with that portion of the casing which comes in contact with the pressure transmitting fluid. The steam pump necessarily exerts a pressure of 400 pounds per square inch, but since it operates against a cold pressure transmitting fluid, there is little danger of leakage around the piston. The pressure differential between opposite ends of cylindrical seal 33 is very small so that under normal conditions the hot oil and the cold fluids will be effectively separated.

While I have described a preferred embodiment of my surge pump, it will be understood that this description has been by way of example and I am not limited to the details therein set forth. Instead of a hollow cylidrical seal, I contemplate the use of spaced disks mounted on a rod or other equivalent devices. Other expedients will be obvious to those skilled in the art.

I claim:

1. A hot oil pump comprising a surge chamber, a reciprocating seal slidably mounted in said chamber, said seal being at least one-half the length of said chamber, means whereby said seal is reciprocated by a cool fluid and means whereby the reciprocation of the seal forces hot liquid into and out of said chamber.

2. A hot oil pump comprising a cylindrical casing, a cylindrical seal mounted in said casing, the length of said seal being about one-half the length of said casing, cool fluid means for reciprocating the seal in either direction, and means for limiting the movement of the seal and means for transferring fluid from one side of the seal to the other when it reaches an extreme position.

3. In combination, a cylindrical casing, a cylindrical seal slidably mounted in said casing and substantially one-half the length thereof, fluid means for reciprocating said seal in either direction, means for limiting the movement of the seal in either direction and means to transfer fluid from one side of the seal to the other when said seal reaches an extreme position.

4. In combination, a pulsator, a surge pump spaced therefrom, a conduit of rela-

tively small cross section between said pulsator and said surge pump, a reciprocating seal in said surge pump, liquid means for transferring force from said pulsator to one side of said seal in said surge pump, hot oil pipes leading to and from said surge pump on the other side of said seal, valves in said pipes whereby the reciprocation of the seal draws hot oil in from one hot oil pipe and forces it out through another hot oil pipe, and means for restricting the movement of the seal to an extent substantially not exceeding its length.

5. In a hot oil surge pump, inlet and outlet conduits for hot oil and a conduit for cool liquid, a surge chamber connected at one end to the conduit leading to a supply of cool reciprocating liquid and at the other end to the inlet and outlet conduits for hot oil, said conduits being provided with inlet and outlet valves, an elongated, free floating piston, actuated only by the said reciprocating liquid, said piston having a length equal at least to the length of its travel when oscillating within the piston, thus preventing the cool reciprocating liquid from coming into direct contact with parts of the surge chamber heated by direct contact with the hot oil.

Signed this 6th day of November, 1929, at Chicago, county of Cook, State of Illinois.

VANDERVEER VOORHEES.