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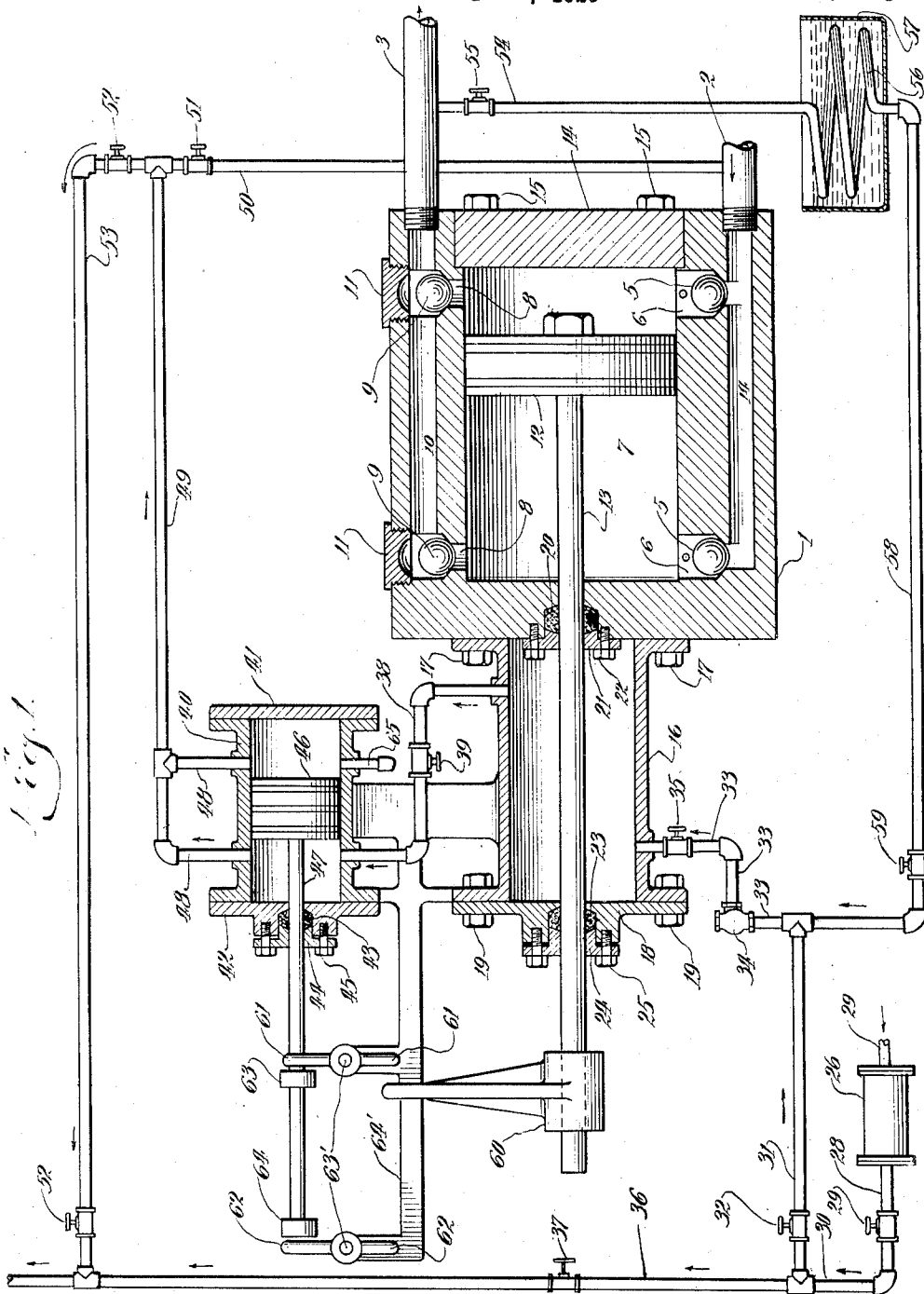
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METHOD AND MEANS FOR COOLING PACKING OF HOT OIL PUMPS

Filed Aug. 20, 1925

2 Sheets-Sheet 1



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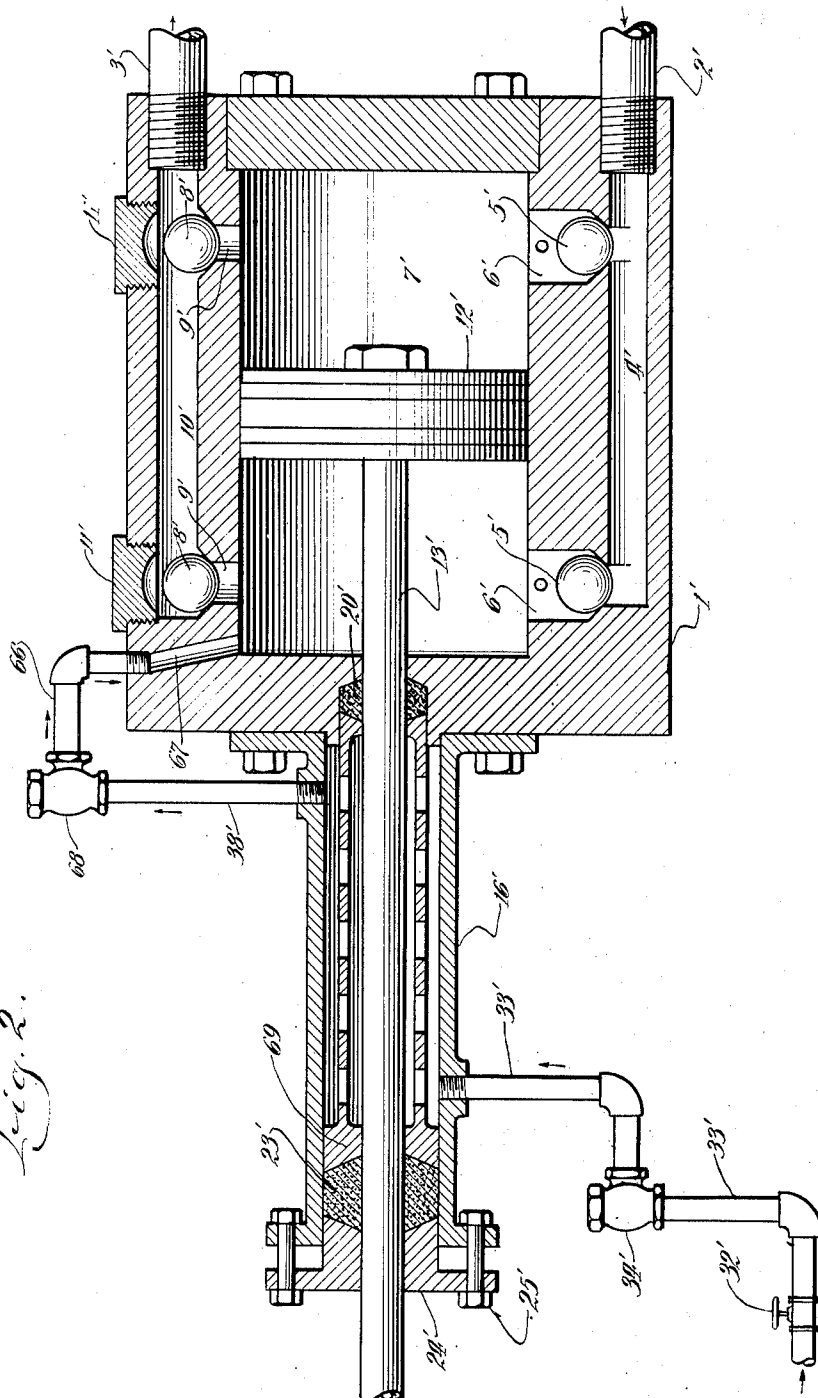


Fig. 2.

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UNITED STATES PATENT OFFICE

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METHOD AND MEANS FOR COOLING PACKING OF HOT-OIL PUMPS

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This invention relates to the idea of cooling the packing gland of a hot oil pump, and refers more particularly to the idea of so regulating the pressure on the cooling oil that it can be automatically adjusted by both the suction and discharge stroke of the pump, thus maintaining a substantially balanced pressure across the inner gland of the pump and preventing excessive leakage either way and also eliminating severe temperature strains.

One of the present commercial methods of cooling the piston rod and stuffing box of a hot oil pump is to circulate cooling oil by means of an extra pump through an enclosure around the piston rod at a pressure equal to or greater than the pressure existing on the hot oil discharged from the pump.

Where a pump is operating with a larger pressure increase across the pump, say, for illustration, 100 pounds in a two hundred pound pressure system, thus making three hundred pounds on the discharge side, the pressure used on the cooling oil surrounding the piston rod would be say three hundred and ten pounds in order to hold out the oil on the discharge stroke and if anything create a slight leakage of cool oil into the pump cylinder. Now on the return stroke when the pump cylinder is filled with hot oil, and the system pressure, which, as before set forth, may be say two hundred pounds, the pressure drop across the inner gland would be three hundred and ten pounds minus two hundred pounds or one hundred and ten pounds instead of ten pounds as on the discharge stroke. This high pressure difference causes a large quantity of cool oil to leak into the pump cylinder, setting up temperature strains which tend to open the joints.

The present invention overcomes these various objections and has many other advantages which will be apparent to those skilled in the art. The present invention may be operated by withdrawing a portion of the hot oil discharged from the pump, cooling it and using it as the cooling oil by introducing same to the chamber surrounding the piston rod of the hot oil pump, using the difference in pressure between the discharge and suction

of the pump to cause the cooling oil to flow from the discharge of the hot oil pump through the cooling coil, through the chamber surrounding the piston rod into the suction of the pump. The present invention will substantially eliminate the necessity of pumping cooling oil against a higher pressure to balance that in the discharge of the pump, as well as reduce leakage across the inner packing gland and consequential pressure strains which tend to loosen joints and connections.

In the drawings:

Fig. 1 is a diagrammatic layout partly in vertical section of a device suitable for carrying out the present invention.

Fig. 2 is a vertical cross sectional view of a modified form of construction.

Referring in detail to the drawings, 1 designates the hot oil pump cylinder which has the inlet 2 and outlet 3. The inlet 2 communicates with the channel 4 and valves 5, said channel 4 discharging through communicating apertures 6 into the interior hollow chamber 7 of the cylinder 1. There are similar communicating apertures 8 and valves 9, communicating with channel 10, which latter channel communicates with the discharge 3. It is to be noted that the valves 5 in the suction line to the pump seat against the direction of fluid pressure, and are so arranged that they open on the suction stroke. The valves 9 in the discharge communications are closed on the suction stroke and open on the discharge stroke. This is more or less standard equipment and need not be further described. Removable nuts 11 are provided adjacent the valves 9 for the purpose of inserting new valves or repairing the valve seats.

A piston 12 connected to piston rod 13 is adapted to reciprocate horizontally in the interior chamber 7 of the pump cylinder 1. The interior chamber 7 may be opened by the removal of the closure head 14 by loosening and removing screw bolts 15. On the other end of the pump there may be removably mounted a hollow chamber 16 connected to the pump cylinder 1 by means of the screw bolts 17. The opposite end of this latter

chamber may be provided with closure plate 18, connected to the chamber 16 by means of screw bolts 19 or the like. In the closed end of the pump cylinder 1 and surrounding the piston rod 13 may be positioned the flexible packing 20, held in place by means of the gland nut 21, which latter is connected to the casing of the cylinder 1 by means of the screw bolts 22. Gland nut 24 may be positioned at the outer end of the closed plate 18 for cylinder 16, if desired, being held in place by the screw bolts 25.

Describing now the means for introducing cold oil to the chamber 16, the pump 26 may draw cooling oil from any source through the line 27 and into the line 28, controlled by throttle valve 29. The line 28 transfers the oil into the line 30, and thence into line 31, controlled by valve 32. The oil passes through the line 31, and into the short connecting pipe 33, in which is mounted the check valve 34 and throttle valve 35. The oil is introduced into the interior of the chamber 16 entirely surrounding the piston rod 13. The pump 26 may be the pump which charges the system with the oil to be treated through line 36, controlled by valve 37, communicating with the dephlegmator or the like.

The cooling oil introduced through the pipe 33 passes out of the cooling chamber through the pipe 38, controlled by valve 39, into an auxiliary piston chamber 40, which is provided with removable heads 41 and 42, the latter being provided with the packing 43, gland nut 44, held in place by screw bolts 45. A piston 46 mounted on piston rod 47 is adapted to reciprocate horizontally in said piston chamber. The oil passes out of said piston chamber through either of the lines 48 into the line 49. The oil may be diverted into the line 50 by opening valve 51, and closing valve 52, in line 53, or valve 51 may be closed, and valve 52 opened, thus diverting the oil into the line 53, which line 53 eventually merges with line 36, thus introducing the oil to the dephlegmator or other heating means. In case the oil is diverted through the pipe 50, it may be introduced into the line 2, which is the charging line for the hot oil pump.

As a feature of the present invention it may be found desirable, due to the fact that the charging oil used for cooling purpose may be dirty or unfit to use as cooling oil, to divert a certain portion of the hot oil discharged through the pump discharge 3 into the line 54, controlled by valve 55, in which line 54 may be interposed, the cooling coil 56 mounted in box 57. This cools the hot oil down to the point where it may be utilized to the best advantage and discharges same through line 58, controlled by valve 59, which line 58 communicates with the cooling oil inlet pipe 33. Fixedly mounted on the piston rod between the end on which the piston

12 is mounted, and the steam cylinder of the pump, is an upwardly projecting bracket 60. The upper end of this bracket 60 is adapted to contact the lower ends of pivotally mounted arms 61 or 62. These arms 61 and 62 are pivoted at 63' on the supporting bracket 64'. The upper ends of these arms 61 and 62 are adapted to contact lugs 63 and 64, respectively, fixedly attached to the piston rod 47. The purpose of this arrangement will be hereinafter described.

As an illustration of one method of operation, cooling oil may be taken from any source of supply and introduced through lines 27, 28, 30, 31 and 33, into the interior of the chamber 16, flowing through the check valve 34, the valves 29, 32 and 35 being opened, and valves 37 and 59 closed. On the forward stroke of the piston 12, the cooling oil flows unobstructed through the chamber 16, and out through line 38 into the interior of the piston chamber 40. From this piston chamber 40 it passes out through either of the lines 48 and into line 49. From line 49 it may be diverted through lines 50 or 53, as desired, and as heretofore described. If it is diverted through the line 50, it will be introduced into the hot oil pump chamber through line 2, forming part of the feed going into the system. On this forward stroke the pressure on the oil in the chamber 16 is only slightly greater than the pressure in the suction to the hot oil pump. Consequently there is very little leakage of cooling oil through the inner stuffing box arrangement 20 and 21 into that part of the pump cylinder which is filling with hot oil from the suction line. Just before the piston 12 reaches the end of the forward stroke, the upwardly projecting arm 60 on the piston rod 13, contacts the lower end of the pivoted arm 61, which causes said arm 61 to rock on its pivot, the upper end thereof contacting the lug 63 which causes the piston rod 47 to be pulled outwardly, and the piston 46 to close the outlet from the pipe 38, thus stopping the flow of cool oil through the cooling chamber 16.

The cooling oil is therefore trapped in chamber 16, as it cannot flow back into the line 33 on account of the check valve 34, at a time when the piston is on the return stroke and a higher pressure is built upon the oil because of the slight leakage of hot oil through the inner stuffing box arrangement 20 and 21. This entrapped oil therefore prevents excessive leakage of hot oil through said stuffing box arrangement 20 and 21, and at the same time absorbs the heat from the hot piston rod 13, thereby cooling it before the hot surface of the rod comes in contact with the outer packing 23 and 24.

The pressure on both sides of the inner stuffing box arrangement is therefore substantially balanced on the return stroke of the pump when the piston is forcing the oil

out of the end of the cylinder adjacent to the cooling chamber 16 against whatever pressure at which the pump is operating.

When the piston 12 nearly reaches the end of its travel on the return stroke, the upwardly projecting arm engages the lower end of the pivotally mounted arm 62, thus rocking it on its pivot and causing its upper end to contact the lug 64 on the piston rod 47, and thus causing the piston to have an inward movement, whereby it uncovers the outlet of the pipe 38 and allows cooling oil to flow there-through and into pipe 49 as heretofore explained. This permits the oil in cooling chamber 16 to be withdrawn and replaced with fresh, cool oil. This cycle of operation is continuously repeated, the amount of cooling oil being regulated by valves 32 and 35.

When the oil in the cooling chamber 16 is diverted through the line 50 into the line 2, there is only a slight difference in pressure between chamber 16 and the cylinder 7 of the pump. The pressure difference across the inner stuffing box arrangement 20 and 21 therefore will be only equivalent to friction of the oil going through the various lines which would cause no appreciable leakage of cooling oil into the pump cylinder 7 through the inner stuffing box and packing glands.

When the cooling oil from line 48 is diverted into line 53, the pressure difference across the inner stuffing box and packing gland would be somewhat higher due to the head of cool oil in the line 53. This would be partly offset by whatever liquid head there was on the suction to the hot oil pump aside from the system pressure.

It is to be understood that the invention is applicable to any type of pump, including Duplex pumps. In its application to Duplex hot oil pumps, the piston 46 is so arranged that it also controls the outflow of oil from the cooling chambers on both pistons. The connection 65 is provided for the other cylinder of a Duplex pump and may be opened alternately with the cylinder 1.

Where it is not desired to use a portion of the cool charging stock or raw oil as a cooling medium, on account of dirt, carbon and the like, as heretofore explained, the supply might be taken from the discharge line 3, through line 54, and cooled before being heated. The pressure in the discharge line being higher than in the suction line would cause oil to flow through the cooling coil into the chamber 16 and into the suction line of the pump.

Therefore it will be seen that according to the present invention, I have provided a means for regulating the flow of cooling oil through a cooling gland or through a stuffing box or other arrangement on a hot oil pump, and regulating the pressure thereon while in the cooling chamber, so as to more nearly

balance the pressures across the inner stuffing box or similar arrangement, regardless of whether the pump piston is taking suction or discharging liquid. Thus I reduce to a minimum the leakage or flow of either hot or cool oil through the inner stuffing box, thus eliminating severe temperature changes in the metal parts of the apparatus, particularly the joint where the cooling chamber is fastened on the pump cylinders.

This invention also contemplates the withdrawal of a portion of the hot oil being discharged through the line 3, and after cooling it using same for cooling the piston rod and stuffing boxes. This oil may be then discharged into the line 2 of the pump. The arrangement just described provides a supply of clean cooling oil, using the difference in pressure between the discharge of the pump and the suction to cause said oil to flow through the cooling chamber in regulated quantities.

Referring now to the modified view shown in Fig. 2, the oil may be introduced through the line 33', controlled by valve 32', and check valve 34', into the interior of the cooling chamber 16'. The cooling chamber 16' at its outer end may be provided with a closure cap 24', held in place by the screw bolts 25', and adjacent the closure cap 24' may be interposed the packing material 23'. The oil may flow from the chamber 16' out through the line 38'. The pump cylinder 1' may be provided with the suction inlet line 2', channel 4', valves 5', and communicating passageways 6', which communicate with the interior 7' of the pump cylinder. Similarly, the chamber may be provided with a discharge line 3', channel 10', valves 8', communicating ducts 9', and removable caps 11'. Piston 12' is adapted to reciprocate horizontally in the chamber, being connected to the piston rod 13'. The cooling oil introduced into the interior of the chamber 16' may circulate around the piston rod 13' in the same manner as heretofore described, but instead of being returned to the suction side of the pump or sent to the dephlegmator or other heating medium, it may be discharged through the line 66 into the duct 67, which introduces it into the interior 7' of the pump cylinder 1'. A check valve 68 is interposed in the connection between the lines 38' and 66, for the purpose of allowing the oil to flow into the line 66 but preventing the oil from flowing backward into the lines 38'. The piston rod 13' may be connected to a steam cylinder of any kind. An annular perforated packing retainer 69 may be inserted between the outer packing 23', and the inner packing 20' for the purpose of securing maximum benefit from the packing material and allowing for readily adjusting the tightness of said packing. In other words, if the closure cap 24 is forced inwardly, the packing 23' will give slightly, but will

also cause the packing retaining member 69 to be forced inwardly, thus tightening the packing 20. The operation of this device will be instantly apparent. The cooling oil will be alternately discharged into the pump cylinder through the line 66 on the suction stroke of said pump on account of the lower pressure therein.

I claim as my invention:

1. A device of the character described, comprising, a piston chamber having inlet and discharge openings, a piston and piston rod adapted to reciprocate in the piston chamber, a cooling chamber adjacent the piston chamber in which the piston rod moves, an inlet for introducing cooling liquid under pressure to the cooling chamber, an outlet from said cooling chamber and automatically operated means for maintaining the outlet open during the forward stroke of the piston and for maintaining the outlet closed during the return stroke.

2. A device of the character described, comprising, a piston chamber having inlet and discharge openings, a piston and piston rod adapted to reciprocate in the piston chamber, a cooling chamber adjacent the piston chamber in which the piston rod moves, an inlet for introducing cooling liquid under pressure to the cooling chamber, an outlet from said cooling chamber, a check valve in said inlet, a valve in said outlet, and automatically operated means for maintaining the outlet open during the forward stroke of the piston and for maintaining the outlet closed during the return stroke.

3. A method for cooling the piston rod and packing joints of a pump for hot liquids, which consists in introducing a cooling medium to a cooling zone surrounding the piston rod and in communication with the packing joints of the pump, in discharging the cooling medium from the cooling zone during the forward stroke of the piston pump and preventing the passage of a substantial amount of cooling medium into the pump cylinder, in precluding the normal escape of the cooling medium from the cooling zone with each return stroke of the pump piston, to maintain a substantially balanced pressure between the cooling zone and the pump cylinder during both the suction and compression strokes of the pump piston.

4. A method for cooling the piston rod of a pump for hot liquids, which consists in introducing a cooling medium to a cooling zone surrounding the piston rod of the pump, in discharging the cooling medium from the cooling zone during the forward stroke of the piston pump, in precluding the normal escape of the cooling medium from the cooling zone with each return stroke of the pump piston, to maintain a substantially balanced pressure between the cooling zone and the pump cylinder during both the suc-

tion and compression strokes of the pump piston and during both strokes preventing the passage of a substantial amount of cooling medium into the pump cylinder.

5. A method for cooling the piston rod and associated packing of a pump, which consists in forcing a portion of the material passed through the pump under the pressure imparted thereto by the pump through a cooling zone in communication with the parts to be cooled.

6. A method for cooling the piston rod and associated packing of a pump, which consists in forcing a portion of the material passed through the pump under the pressure imparted thereto by the pump through a cooling zone in communication with the parts to be cooled, and in returning the material, subsequent to its passage through said cooling zone, to the inlet of the pump.

7. A method for cooling the piston rod and associated packing of a pump, which consists in intermittently admitting a portion of the material discharged from the pump and under the pressure imparted thereto by the pump to a cooling zone in communication with the parts to be cooled.

8. A method for cooling the piston rod and associated packing of a pump, which consists in intermittently admitting a portion of the material discharged from the pump and under the pressure imparted thereto by the pump to a cooling zone in communication with the parts to be cooled, and in controlling the discharge of the material from the cooling zone by the stroke of the pump piston.

9. A method for cooling the piston rod of a pump for hot liquids, which consists in passing a portion of the hot liquid discharged from the pump under the pressure imparted thereto by the pump through a cooling zone, from which the liquid, at a relatively low temperature, is conveyed through a zone, surrounding the piston rod, to lower the temperature thereof.

10. A device of the character described, comprising in combination, a piston chamber having inlet and discharge openings, a piston and piston rod, adapted to reciprocate in said piston chamber, a cooling chamber, adjacent the piston chamber, in which the piston rod moves, means for conveying a portion of the liquid which has passed through the pump under the pressure imparted thereto by the pump to said cooling chamber.

11. A device of the character described, comprising in combination, a piston chamber having inlet and discharge openings, a piston and piston rod, adapted to reciprocate in said piston chamber, a cooling chamber, adjacent the piston chamber, in which the piston rod moves, means for conveying a portion of the liquid which has passed through the pump under the pressure imparted thereto by the pump to said cooling chamber, an

outlet from said cooling chamber, and means, operated by the stroke of the piston, for opening and closing said outlet.

5 12. A device as specified in claim 1 further characterized in that said automatically operated means is adapted to close said outlet at the end of the forward stroke of the piston and to open said outlet at the end of the return stroke of the piston.

10 13. A device as specified in claim 2 further characterized in that said automatically operated means is adapted to close said outlet at the end of the forward stroke of the piston and to open said outlet at the end of the

15 return stroke of the piston.
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