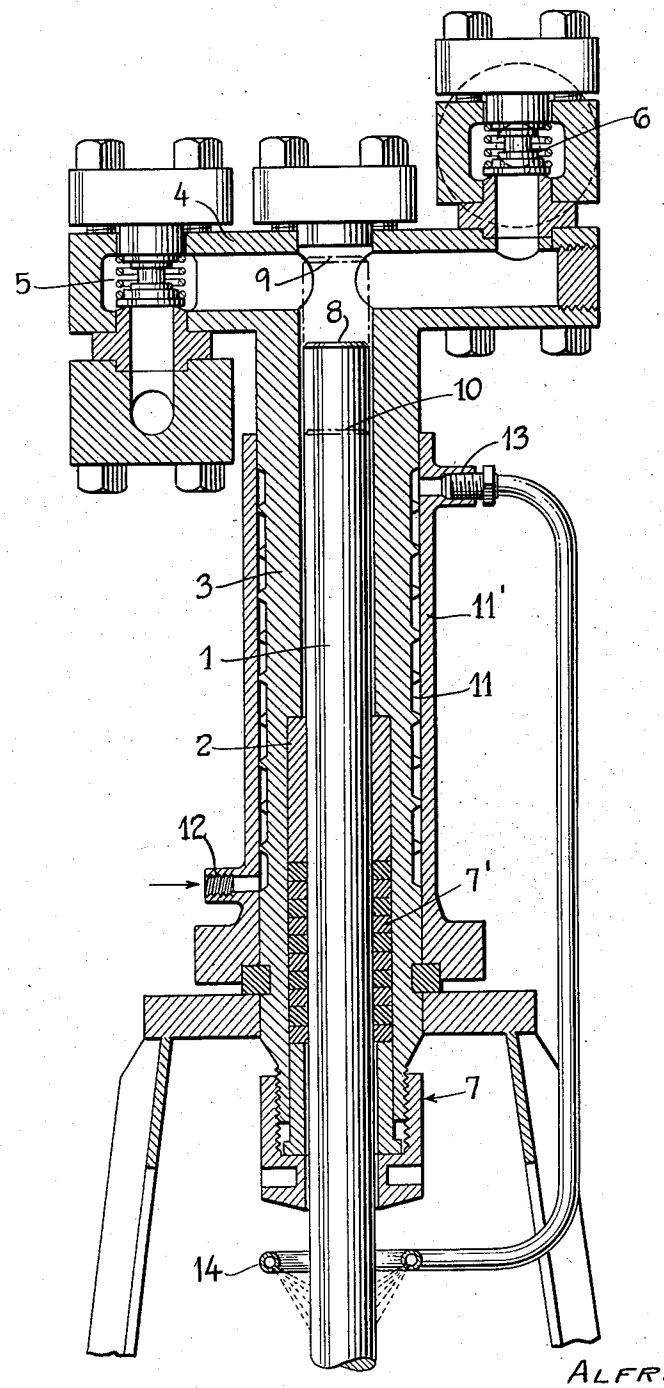
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PLUNGER PUMP FOR HOT LIQUIDS

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PLUNGER PUMP FOR HOT LIQUIDS

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The present invention relates to a plunger pump for pumping a hot liquid in which there is a clearance between the plunger and the pump cylinder except where the plunger is guided, the pump having a stuffing box which is protected against harmfully high temperatures.

Conventional stuffing boxes of pumps for hot liquids frequently fail because the packing material is exposed to too high temperatures whereby the material, which is usually composed of rubber, cotton fibre, or leather, becomes ineffective. For example, the temperature of the liquid fed by a pump into high pressure boilers is quite often 180° to 220° C. Conventional packing material becomes useless at temperatures between 120° and 150° C. The stuffing box must therefore be protected against excessive heating. It has been proposed to provide cooled conduits between the valve box and the plunger to prevent harmful heat transmission. This arrangement, however, increases the clearance reducing the output and increasing the operating noise of plunger pumps working against high pressure and at a high temperature. The compressibility of water increases greatly at higher temperatures and the absolute value of the compression at a great difference between the suction pressure and the discharge head increases accordingly.

In the pump according to the invention, no hot liquid is allowed to flow past the stuffing box packing, and the distance between the stuffing box packing and the head face of the plunger, when the latter is in the middle of its stroke, is a multiple of the pump stroke. This distance may be as much as three times the pump stroke. The diameter of the plunger is smaller than that of the cylinder in which it reciprocates. The resultant cylindrical space between the piston and the cylinder is filled with relatively stagnant liquid whose temperature is between that of the plunger and that of the surrounding cylinder. It is recommended to surround the cylinder with a cooling jacket whose length in the direction of the axis of the pump cylinder is 0.8 to 1.2 times the distance between the head face of the piston in the middle of its stroke and the stuffing box packing. The plunger may be provided with cooling channels. It may also be advisable to provide means for cooling the plunger outside of the stuffing box.

The novel features which are characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, and additional objects and advantages thereof will best be understood from the following description of an embodiment thereof when read in connection with the accompanying drawing which shows a schematic longitudinal section of a pump according to the invention.

There is a clearance forming a cylindrical space between the pump plunger **1** and the bore of the cylinder **3** except where a guide sleeve **2** is provided. When the pump is in normal operation the aforesaid space is filled with liquid which is relatively stagnant. In order to avoid a cooling conduit, the valve chamber **4** having an inlet valve **5** and an outlet valve **6** for the liquid is

directly connected with the cylinder. During the working stroke the space between a packing **7'** forming part of a stuffing box **7** and the valve chamber is substantially taken up by the plunger. The clearance between the suction and the discharge valve and the plunger is thereby reduced to a minimum. The plunger is so long that the distance between the head face of the plunger in the position marked by numeral **8** in the middle of the plunger stroke and the packing **7'** of the stuffing box is a multiple of the plunger stroke. The plunger is, for example, so long that this distance is three times the stroke of the plunger. The extreme positions of the plunger are indicated by dash-dot lines **9** and **10**. The guide sleeve **2** is located in the cylinder **3** inside of the packing **7'** and has an outer end abutting against the packing, the inner end of the guide sleeve being disposed farther outside of the outer dead center position of the head face of the plunger than the length of the piston stroke. The particular length of the plunger and of the pump cylinder results in a greater cooling surface effectively preventing transmission of heat from the liquid to the stuffing box. The cylinder is surrounded by a cooling chamber or jacket **11** into which a coolant is supplied at **12** and from which the coolant is discharged at **13**. Depending on the length of the cooling jacket measured in the direction of the cylinder axis, which length preferably amounts to 0.8 to 1.2 times the distance between the head face of the plunger in the middle of its stroke and the stuffing box packing, the plunger moves in a cooled zone of the cylinder and the liquid in the space between the plunger and the cylinder is therefore relatively cool and prevents transfer of heat from the plunger to the cylinder. The cooling jacket may be formed by a spiral groove or by annular grooves interconnected by longitudinal grooves in the outside surface of the cylinder **3**, the grooves being covered by a tubular member **11'**. The coolant which is discharged at **13** and whose temperature is much lower than that of the hot liquid to be pumped is used for cooling the plunger outside of the stuffing box by a special device **14** which may, for example, spray the coolant onto the plunger. For better cooling, the plunger may be provided with cooling channels, not shown. Depending on the temperature of the pump, the same coolant is used for all places to be cooled or fresh coolant is supplied to each place. The pump according to the invention is particularly suitable for pumping hot boiler feed water. It can also be used for pumping other hot liquids, for example in the chemical industry. The pump can be used in vertical as well as in horizontal position.

What is claimed is:

1. A plunger pump for hot liquids comprising a cylinder having a bore, an inlet valve and an outlet valve for the hot liquid, both said valves being located at the same end of said bore, a plunger reciprocable in said bore and having a diameter smaller than that of said bore to form a cylindrical space between the plunger and the inside of the bore, said pluner having a head face, a stuffing box disposed at the end of said cylinder opposite to the end at which said outlet valve and said inlet valve are located and including a packing tightly surrounding said plunger and fitting into the cylinder for preventing passage of hot liquid past said packing, a solid guide sleeve snugly surrounding said plunger and being disposed in said cylinder and having an outer end abutting against said packing, the inner end of said guide sleeve being disposed substantially farther outside of the outer dead center position of said head face than the length of the piston stroke and forming the bottom of said cylindrical space, said cylindrical space containing relatively cool and stagnant liquid, preventing entry of hot liquid and

heating of the plunger thereby and preventing transfer of heat from said plunger to said cylinder.

2. A plunger pump as defined in claim 1 in which the distance between said packing and said head face, when the plunger is in the middle of its stroke, is substantially three times the length of the piston stroke.

3. A plunger pump as defined in claim 1, including a cooling jacket surrounding said cylinder substantially between said stuffing box and the outer dead center position of said head face, the length of said jacket in the direction of the longitudinal axis of said cylinder being between 0.8 and 1.2 times the distance between said head face, when said plunger is in the middle of its stroke, and said packing, and means for supplying a coolant to said jacket.

4. A plunger pump according to a claim 3 in which said plunger has a portion extending outside of said stuffing box and of said cylinder, additional cooling means being provided which surround said portion of said plunger extending outside of said cylinder for supplementally cooling said plunger.

5. A plunger pump according to claim 4, said additional cooling means being connected with said cooling jacket for receiving coolant therefrom.

6. A plunger pump according to claim 1 in which said plunger has a portion extending outside of said cylinder and of said stuffing box, an annular coolant spray device surrounding said portion of said plunger extending outside of said cylinder for spraying a coolant onto said plunger.

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