May 6, 1958 R. PENNINGTON 2,833,525

CENTRIFUGAL PUMPS

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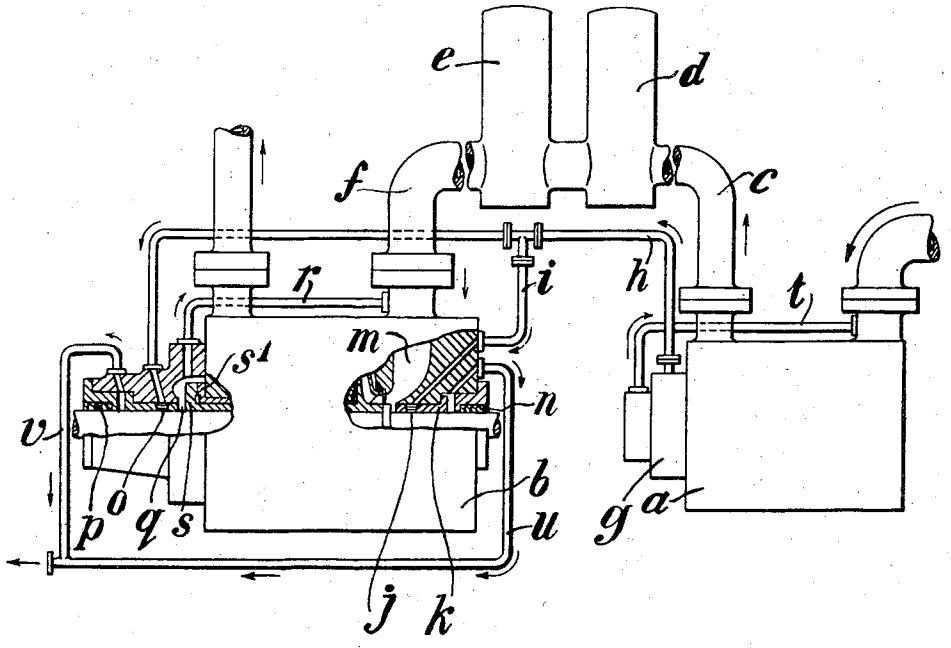


Fig. 1.

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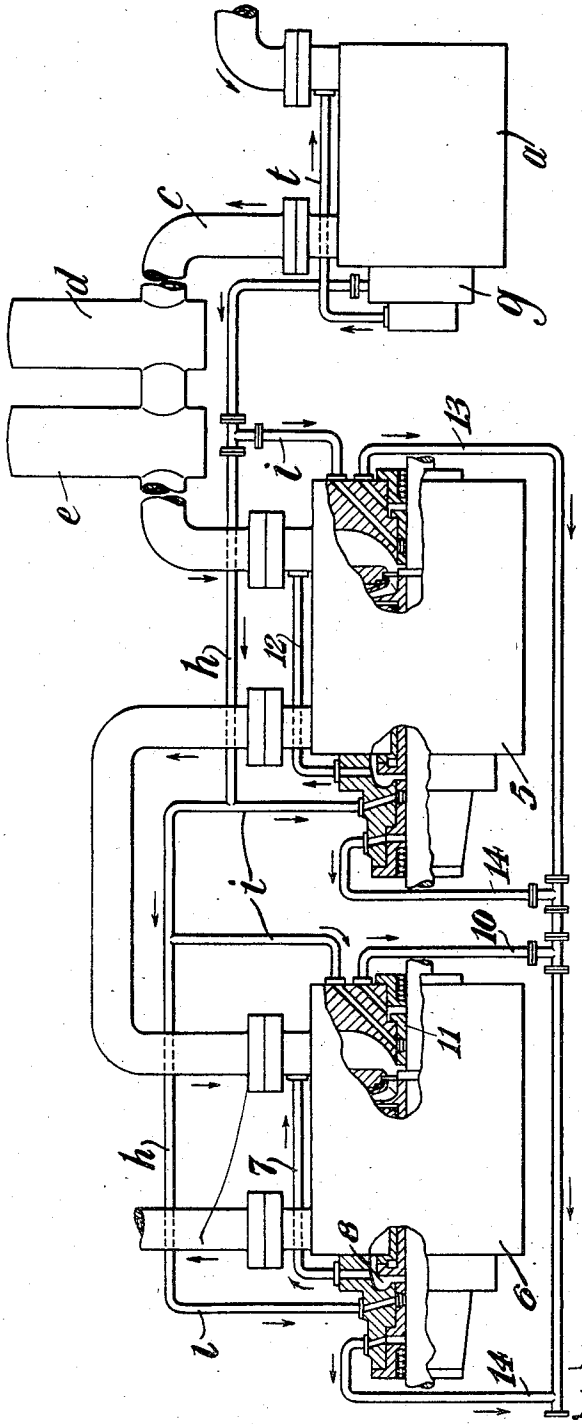


Fig. 3.

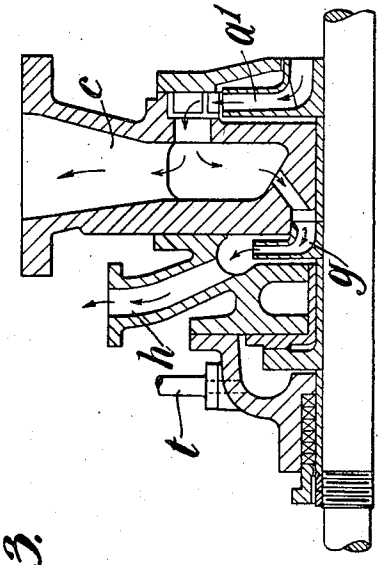


Fig. 2.

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United States Patent Office 2,833,525 Patented May 6, 1958

2,833,525

CENTRIFUGAL PUMPS

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Application December 4, 1953, Serial No. 396,250

Claims priority, application Great Britain December 15, 1952

4 Claims. (Cl. 257—215)

This invention relates to centrifugal pumps for high temperature operation and is concerned with the stuffing-box sealing means of such pumps.

In connection with boiler feed centrifugal pumps where the feed water being pumped is at a higher temperature than stuffing-box packing of known types can withstand, it is known to provide a sleeve which is a close running fit on the pump shaft with an annular chamber therein (across which extend bridging pieces integral with the sleeve) to which is connected a supply of sealing water at a pressure sufficient to overcome the pressure at the pump end of the sleeve and to ensure a restricted flow through the sleeve clearance into the pump and to the stuffing-box packings, the sealing water being at a temperature which the packings can withstand.

In order to obtain a supply of sealing water at the necessary temperature and pressure, a separate pump has heretofore been required. Such a pump has to be suitable for high pressures but is required to deliver only a small volume of water and so is exceptional in design, expensive to make and troublesome to install and maintain.

The object of my invention is to simplify the means for providing sealing water when two or more centrifugal pumps are connected in series and when intermediate water heaters are provided.

The invention consists in a centrifugal pump installation for high temperature operation comprising in series a low pressure centrifugal pump and one or more higher pressure centrifugal pumps, in which the delivery from the low pressure pump passes through a water heater, characterised in this, that the low pressure pump has an additional stage which gives to its delivery an additional pressure and such delivery is taken without heating to the annular chambers in the usual sleeves around the higher pressure pump shaft or shafts adjacent to the shaft packings to give a restricted flow through the sleeve clearances to the said packings to protect them against excessive temperature, and to the pump suction.

Referring to the accompanying explanatory drawings:

Figure 1 is a diagrammatic view showing a centrifugal pump installation constructed and arranged in one convenient form in accordance with this invention. Certain parts are shown broken away to disclose internal construction.

Figure 2 is a sectional view showing the last stage of the low pressure pump and the additional or booster stage of said pump. The figure shows the upper half only of the said stages.

Figure 3 is a view of a pump comprising low, intermediate and high pressure stages, with the additional or booster stage on the low pressure pump as in Figures 1 and 2.

Figures 1 and 2 illustrate the application of my invention to two centrifugal pumps (a low and a high pressure pump) connected in series, with intermediate water heaters, *a* indicates the low pressure pump and *b* the high pressure pump. The delivery from the low pressure

pump *a* passes by the branch *c* and heaters *d* and *e* to the high pressure pump *b* by the branch *f*. The low pressure pump *a* has beyond its normal last stage *a'* an additional stage at *g* at its delivery end and the delivery therefrom passes by the pipes *h* and *i* to the annular chamber *j* in the sleeve *k* without passing through the heaters *d*, *e*. The extra pressure created by the additional stage *g* of the low pressure pump is greater than the pressure in the suction branch *m* of the high pressure pump, so that the stuffing box packing *n* of the high pressure pump is subjected to the low temperature delivery of the additional stage *g* of the low pressure pump.

The extra pressure created by the additional stage *g* of the low pressure pump is relatively small but is sufficient to overcome pipe friction and the pressure at the suction end of the high pressure pump.

The additional stage *g* of the pump *a* also delivers water to the annular chamber *o* at the delivery end of the high pressure pump to protect the packing *p*. The space *q* at the said delivery end of the high pressure pump is in communication by the pipe *r* with the suction branch *f* of the high pressure pump so that, as with the suction side of the pump *b*, the pressure in the chamber *o* is higher than in the space *q*, which ensures that the relatively cool delivery from the additional stage *g* dominates at the packing *p*. *t* is a balance water pipe for the pump *a* and *u*, *v* are drain pipes for water delivered at the packings *n* and *p*.

The two components *s* and s^1 of the usual balance valve of the high pressure pump are normally slightly out of contact and there is a small flow of water between said components which passes to the space *q* and so to the pump suction branch *f*. This is known practice. The sealing conditions at the delivery end of the pump *b* are therefore similar to those at the suction end.

It will be further appreciated that the delivery from the additional stage *g* of the low pressure pump may be used to protect the packings around the shafts of more than one high pressure pump in a series.

The pumps may deal with liquids other than water.

In Figure 3, the complete pump comprises a low pressure pump *a*, an intermediate pressure pump **5** and a high pressure pump **6**. There is an additional or booster stage *g* on the low pressure pump. The delivery from the said booster stage passes direct to the packings at the suction and delivery ends of the intermediate pressure and high pressure pumps **5** and **6** by the pipe *h* and its branches *i*. There is a connection **7** between the delivery end **8** of the high pressure pump **6** and the high pressure suction branch **9** and a drain connection **10** deals with any water delivered at the inlet end of the high pressure pump **6** past the packing **11**.

The intermediate pressure pump **5** is arranged similar to the high pressure pump in respect to the delivery from the booster stage *g*, to the suction and delivery ends of the said pump **5** and with respect to the connection **12** between the delivery end of the pump and its suction pipe. There is also a drain pipe **13** for any water which may pass the packing at the inlet end of the pump.

There is a drain connection **14** from the delivery ends of both the high pressure and the intermediate pressure pumps.

It will be seen that each of the pumps **5**, **6** is arranged similarly to the pump *b* of Figure 1 with respect to the delivery from the booster stage *g*, and the drain connections and the balance pressure connections between the pump delivery end and its suction side.

What I claim is:

1. A centrifugal pump installation for high temperature operation comprising in series a low pressure centrifugal pump and a higher pressure centrifugal pump, a water heater, means passing the delivery from the low

pressure pump through the heater to the higher pressure pump, an additional booster stage on the low pressure pump taking suction from the low pressure pump casing at a point under a higher pressure than the suction of said low pressure pump to give an additional pressure to part only of the low pressure pump delivery, shaft packings at the inlet and delivery ends of the high pressure pump, means passing the booster stage delivery without heating to the said shaft packings to give a restricted flow through said packings to protect them against excessive temperatures.

2. A centrifugal pump installation as claimed in claim 1 in which there are a plurality of high pressure pumps in series, and means passing the booster stage delivery without heating to the shaft packings at the inlet and delivery ends of each high pressure pump.

3. A centrifugal pump installation as claimed in claim 1, in which means lead the flow from the shaft packing at the delivery end of a pump to the suction inlet of such pump.

4. A centrifugal pump installation as claimed in claim 3, in which a drain leads the flow away from the shaft packing at the suction end of a pump.

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