

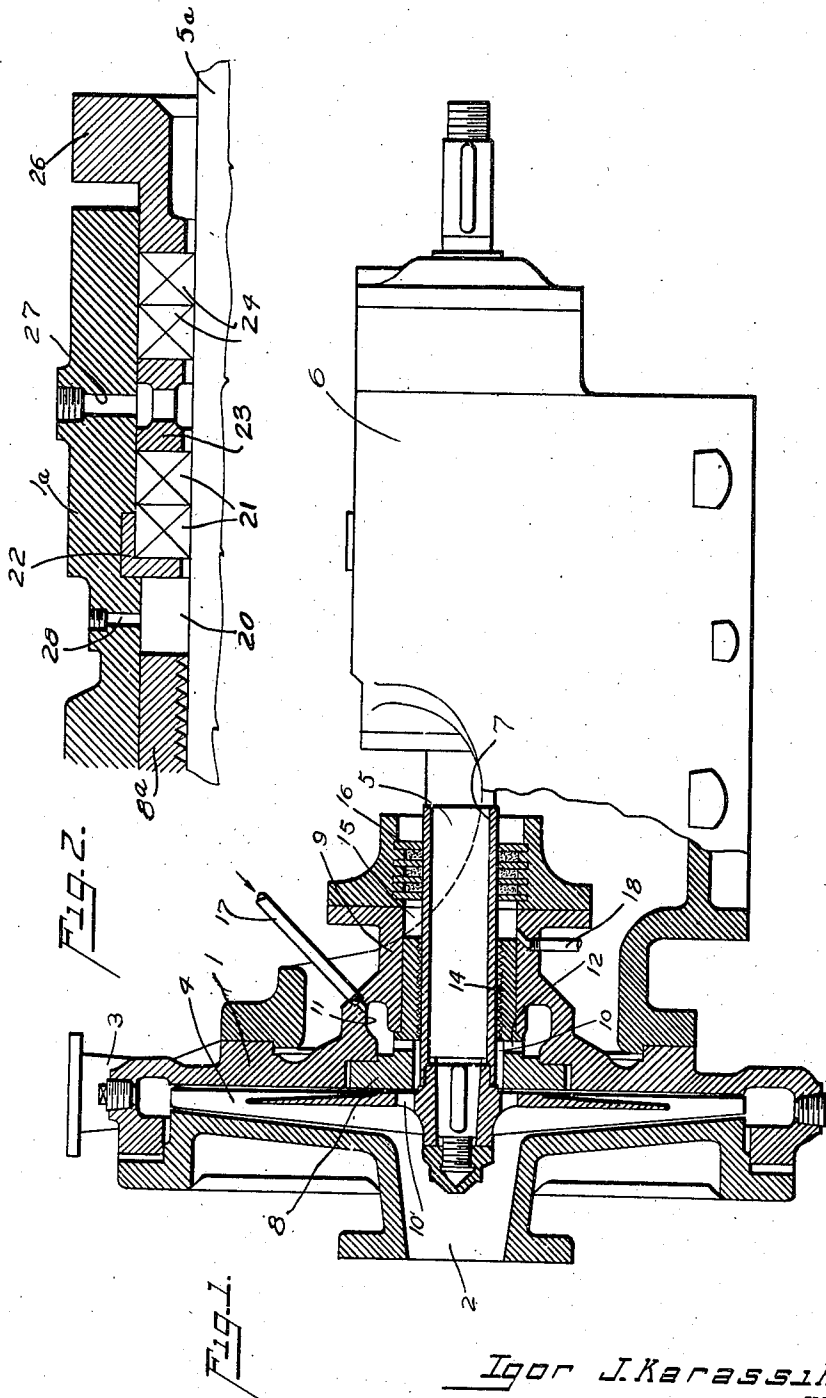
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CENTRIFUGAL PUMP

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CENTRIFUGAL PUMP

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This invention relates to centrifugal pumps and specifically to pumps for handling viscous, corrosive, abrasive, and quickly congealing liquids such as coal tars, black liquor, molasses, etc.

An object of the invention is to provide means for keeping the stuffing boxes of such a pump clear of the liquid being pumped in order to avoid scoring or corrosion of the shaft or shaft sleeves passing through the stuffing boxes.

Another object of the present invention is to provide means for preventing congealing of the pump at or near the stuffing box, particularly upon starting of the pump, as when the pump is idle, the congealing of the liquid about the shaft often results in "freezing" of the rotor frequently causing shaft breakage when the pump is started. Various structures have heretofore been resorted to to prevent the congealing of liquids near or in the stuffing boxes of pumps employed in pumping liquids, as above specified, such as dual jacketed stuffing boxes wherein one jacket is employed to heat the stuffing box during starting operation of the pump, and the other to cool the packing during normal operation. In starting the pump, steam is admitted to the steam or heating jacket to melt the liquor which has congealed or solidified around the shaft and in the stuffing box. Such warming up period generally takes from fifteen to thirty minutes, unless quick or sudden starting up of the pump cause breaking of the shaft. In addition, in pumps of this type, a sealing flow of clear liquor under pressure is introduced into the stuffing box by way of a lantern gland in order to prevent flow of black liquor containing salt cake into the stuffing box and to prevent impregnation of the packing with salt cake or similar substances and the resulting consequent deterioration of the packing.

The use of such structures is unsatisfactory because the relatively long period of time required for "warming up" upon starting of the pump, and also because the use of clear black liquor as a sealing means causes a shortening of the life of the packing.

Other structures of pumps have been employed to overcome the problems of pumps handling such liquids, and while in a measure they are satisfactory, they all have undesirable features and disadvantages, and it is an object of the present invention to provide a pump structure which is comparatively simple in construction and will eliminate the disadvantages of the pump structures above referred to, and one which will

keep the packing clear of the liquid being pumped.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawing, showing a centrifugal pump of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawing:

Figure 1 is a view partly in longitudinal section and partly in side elevation of the improved pump.

Figure 2 is an enlarged detail section of a slightly modified form of the pump structure.

Referring more particularly to the drawing, the improved pumps include a pump casing 1 having a suction eye or inlet 2 located axially of the casing at one side thereof, and a discharge 3. The pump impeller 4 is rotatably mounted in the pump casing 1 and as shown in the drawing is a single suction, semi-open construction, although it is to be understood that fully open or closed impellers, as well as double suction type impellers may be used without departing from the spirit of the invention. The impeller is of the overhung type being carried by the one end of the driving shaft 5. In the drawing, the driving shaft 5 is shown as rotatably supported by suitable bearings 6 and having a shaft sleeve 7 thereabout although the shaft sleeve 7 may be eliminated if desired.

A sealing sleeve 8 is carried by the casing 1 and surrounds a part of the shaft 5, extending into the sealing section 9 of the pump casing. The sealing sleeve 8 has a leakage passage 10 formed therein which opens out through the forward end of the sleeve 8 into the interior of the casing 1 at the back of the impeller 4. The impeller 4 is provided with a plurality of openings 10' extending therethrough from its suction side to the back of the impeller so that the portion of the impeller adjacent to the point where the leakage passage 10 opens into the casing will be under approximately suction pressure of the pump. The pump casing 1 has a sealing chamber 11 formed therein outwardly of the impeller containing chamber of the pump, and this sealing chamber 11 has communication with the leakage passage 10 through a plurality of openings 12 formed in the sealing sleeve 8. The sealing sleeve 8 extends outwardly from the sealing passage 10 and its inner surface may be ser-

rated as shown. A second chamber 15 is formed in the casing 1 at the outer end of the sleeve 8, and packing 16, preferably of the type used in packing steam turbine shafts, is positioned about the shaft 5 and/or sleeve 7 outwardly of the second chamber 15.

In operation, steam under a pressure in excess of the pressure existing in the pump casing behind the impeller 4 is delivered to the sealing chamber 11 through a suitable inlet pipe 17. The steam entering the sealing chamber 11 will pass through the openings 12 into the clearance space or leakage passageway 10. Because of the difference in pressure between the steam and the suction pressure of the liquid being pumped, steam will flow inwardly into the pump casing where it will condense and mix with the liquid being pumped. The second chamber 15 has an outlet connection 18 connected thereto which opens out at any suitable disposal point where the pressure is substantially below the steam pressure in the sealing chamber 11. Because of the pressure differences in the sealing chamber 11 and the second chamber 15, a certain portion of the steam flow into the chamber 11 will leak through the serrated clearance space 14 into the second chamber 15 and proceed outwardly therefrom through the outlet opening 18 after its accumulation in the second chamber. Thus the pump stuffing box 16 is packed against steam only instead of against the pumped liquid, and the steam flowing to the pump will prevent any leakage of the liquid being pumped into the stuffing box or into the space about the shaft thereby eliminating the need of preheating of the stuffing box before starting the pump, and also eliminating the detrimental effects upon the packing of the liquid pumped.

Because the thermal properties of the liquids which are pumped in pumpings of this type are such that the liquid does not vaporize or flash even in the event that its pumping temperature is raised somewhat by the admixture of steam, this admixture will have no harmful effect upon the pumping action such as by vapor binding the pump. Also because of the higher heat content of steam, its use is superior to that of hot or warm water, since the amount of steam required to maintain liquid flow in the pump is less than would be the case with water, and, consequently, the resulting dilution of the pumped liquid is materially reduced.

In Figure 2 of the drawing, a modified construction of the pump is shown wherein an approximately conventional stuffing box such as used in centrifugal pumps is employed in lieu of a steam sealing arrangement as disclosed in Figure 1.

In the modified form shown in Figure 2 of the drawing, a leakage sleeve 8a similar to the sleeve 8 is carried by the pump casing 1a and this sleeve terminates short of the packing structure so as to provide a chamber 20. Suitable packing 21 is placed within the casing 1a about the shaft 5a

outwardly of the chamber 20 and is held in place by a throat bushing 22. A lantern gland 23 is placed at the outer end of the packing 21 and at the inner end of the packing 24. The packing 21 and 24 is held tight in the stuffing box by means of an approved stuffing box gland 26. An opening 27 is provided which opens into the lantern gland 23 and is provided to permit a supply of clear water at a pressure slightly in excess of the pressure prevailing in the chamber 20, into the lantern gland. The sealing water admitted to the lantern gland will flow inwardly into the chamber 20 and outwardly from the chamber through a suitable outlet 28 to any suitable disposal point. In this modified construction, leakage of the liquid pumped into the packing is obviously prevented by the flow of sealing water from the lantern gland to the chamber 20.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a centrifugal pump, a casing having a sealing extension thereon, an impeller in said casing, a driving shaft for said impeller, a sealing sleeve in said sealing extension and about said shaft, said casing provided with a sealing chamber outwardly of said sealing sleeve for receiving a fluid under pressure, said sealing sleeve provided with a longitudinally extending leakage space opening into the pump casing and with a plurality of radial openings opening into said sealing chamber and into said leakage space, and a packing about said shaft outwardly of the outer end of said sealing sleeve and spaced from the outer end of the sleeve to form a second chamber, said sealing extension having a leak-off opening therein opening into said second chamber.

2. In a centrifugal pump, a casing having a sealing extension thereon, an impeller in said casing, a driving shaft for said impeller, a sealing sleeve in said sealing extension and about said shaft, said casing provided with a sealing chamber outwardly of said sealing sleeve for receiving a fluid under pressure, said sealing sleeve provided with a longitudinally extending leakage space opening into the pump casing and with a plurality of radial openings opening into said sealing chamber and into said leakage space, a packing about said shaft outwardly of the outer end of said sealing sleeve and spaced from the outer end of the sleeve to form a second chamber, said sealing extension having a leak-off opening therein opening into said second chamber, and said sleeve having its inner surface outwardly from said longitudinally extending leakage space serrated to form a pressure reducing communication between said longitudinally extending leakage space and said second chamber.

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