

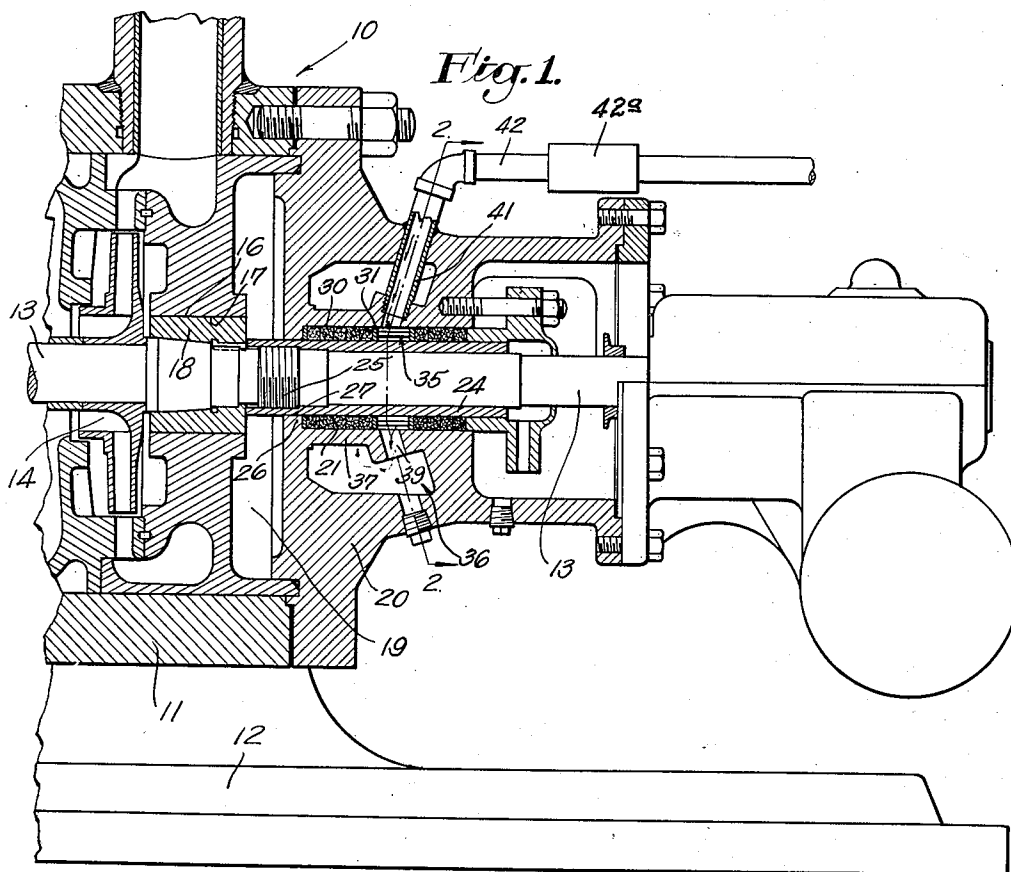
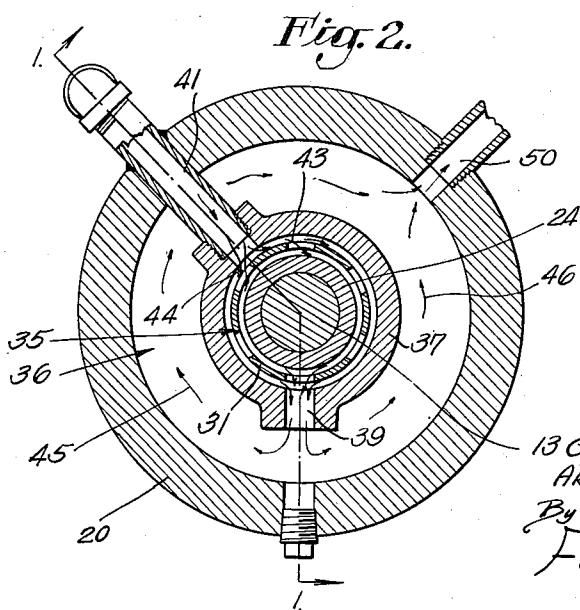
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PACKING STRUCTURE FOR HOT LIQUID PUMPS

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PACKING STRUCTURE FOR HOT LIQUID PUMPS

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Our invention relates to a novel structure for cooling stuffing boxes and seals used for sealing a rotatable member.

One method of cooling such a packing structure is to circulate a cooling liquid in contact therewith or in such a manner that heat is conducted therefrom. It has been found, however, that such a structure is unsatisfactory in the event that the cooling medium is momentarily shut off. This is especially true when installed on structures such as hot oil pumps wherein it is essential that none of the oil shall escape. In such pumps the oil is at extremely high pressures and temperatures, and if any of this oil escapes through the packing and into the atmosphere it will vaporize and constitute a very dangerous fire hazard. Such packing structures usually contain only a small body of the cooling liquid, and if the supply of this liquid is interrupted this small amount of liquid will be quickly vaporized.

It is an object of the invention to provide a novel cooling structure in which a relatively large amount of cooling liquid is maintained in the vicinity of the packing at all times, thus preventing such a vaporization of the cooling liquid in the event that the supply of this cooling liquid is interrupted.

It is a further object of the present invention to provide a novel form of packing in which the cooling liquid exerts a dual cooling action.

By such a structure as herein disclosed it has been found possible to obtain a much greater cooling effect without the sacrifice of valuable space.

It is a further object of the invention to provide a novel form of cooling means for a packing or other sealing structure in which concentric passages are utilized, the cooling liquid flowing first through one passage and then the other.

Further objects and advantages will be made evident hereinafter.

Referring to the drawing,—

Fig. 1 is a sectional view of one end of a pump including the packing means of our invention.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1, Fig. 1 being taken on a line indicated by the line 1—1 of Fig. 2.

We have illustrated the invention as being utilized in conjunction with a hot-oil centrifugal pump 10 including a shell 11 supported on a base 12 by means forming no part of the present invention. A shaft 13 extends into the shell 11 and carries one or more impellers 14 positioned therein. These impellers are adapted to pump an extremely hot liquid such as oil. The impeller 14 illustrated in Fig. 1 is positioned at the dis-

charge end of the pump shaft so that a very high pressure is developed in the shell 11 at this point. This pressure is somewhat reduced through the action of a throttle space 16 defined between the wall of a bore 17 and a drum 18 rotating with the shaft 13. However, the pump provides a high pressure region 19 at one end thereof, and the packing structure of the invention is designed to seal this region from the atmosphere.

The end of the shell 11 is closed by a body 20 in the form of a head suitably retained in place. This head provides a bore 21 through which the shaft 13 extends. A sleeve 24 closely surrounds the shaft 13 and cooperates therewith in defining a rotatable member, this sleeve being threaded to the shaft as indicated by the numeral 25 and bearing against the drum 18. At the inner end of the bore 21 is positioned a shoulder 26 which provides a bore which is only slightly larger in diameter than the sleeve 24 whereby an annular space 27 is provided therethrough. The hot fluid in the high pressure region 19 can reach the bore 21 through this annular space 27.

Positioned in the bore 21 is the sealing structure of the invention shown as comprising a plurality of packing rings 30. Positioned at an intermediate section of these packing rings is a lantern ring 31 of conventional construction, this lantern ring cooperating with the sleeve 24 and with the walls of the bore 21 in defining an inner passage 35 surrounding the rotatable member.

An outer passage 36 is formed in the body 20 surrounding the bore 21 but spaced therefrom by an annular wall 37. The inner and outer passages 35 and 36 are in communication through an intercommunicating means 39 in the form of a bore opening on the lower portions of these passages 35 and 36.

The cooling liquid is preferably delivered directly to the inner passage 35, this being accomplished by the use of a nipple 41 extending through the upper portion of the outer passage 36 and communicating with the upper portion of the inner passage 35. The cooling liquid may be supplied by a pipe 42 which may comprise a source of high pressure liquid. In the form shown I have illustrated a pump 42^a interposed in this pipe to force the liquid through the cooling structure. Other sources of cooling liquid may be used without departing from the spirit of the invention. This liquid entering the upper portion of the inner chamber 35 moves around the rotatable member in two directions as indicated by the arrows 43 and 44, thus cooling the rotatable member by direct contact. This cool-

ing liquid also cools the packing 30 through heat conducted through the lantern ring or through the rotatable member.

When the cooling liquid has reached the lower portion of the inner passage 35 it moves downward through the inter-communicating means 39 and enters the lower portion of the outer passage 36. This downward flowing stream divides at this point, a portion thereof rising around the wall 37 as indicated by the arrows 45 and another portion moving around the opposite side of the wall 37 as indicated by the arrows 46. The cooling liquid is withdrawn through a discharge means 50 comprising a pipe communicating with the upper portion of the outer passage 36.

This type of flow is of particular advantage in view of the dual cooling action obtained. The central portion of this structure is of course the hottest, and it is preferable to directly introduce the incoming liquid into this portion. However, an additional amount of heat is conducted away due to the jacketing relation of the outer passage 36. Tests have indicated that this type of cooling structure is much more efficient than types previously utilized.

It will also be clear that this type of cooling means retains a much larger body of liquid than does the conventional type. Thus, if the supply of cooling liquid is momentarily cut off through some accident, the high temperatures will not immediately vaporize the body of cooling liquid. In fact, this type of sealing structure will continue to operate successfully until substantially all of the liquid has been evaporated therefrom. The large mass of metal surrounding the packing is also advantageous in this regard in that it more equally distributes the heat and provides a relatively cool body. This body must itself be raised in temperature before the cooling liquid can be evaporated so that the larger mass of metal also acts to prevent quick vaporization of this cooling liquid.

In the preferred embodiment it is preferable to introduce the cooling liquid into the upper portion of one or the other of the passages. This allows the intercommunicating means 39 to be positioned at the lower portions of these passages. The advantage of this construction will be apparent when it is considered that any hot fluid moving through the annular space 27 and through the packing 30 will tend to vaporize as the pressure thereon is reduced. This material entering the inner passage 35 will in some instances comprise a vapor. This vapor is immediately condensed by the cooling liquid. However, even if the supply of cooling liquid is cut off, it will be clear that this vapor must move downward through the intercommunicating means 39 and bubble upward through the entire body of liquid in the outer passage 36. During this bubbling action the vapor will be condensed, thus preventing the escape of vapors into the atmosphere.

While I have disclosed the delivery means 41 as communicating with the inner passage 35, and the discharge means 50 as communicating with the outer passage 36 this construction is not in all events essential. If desired the delivery means may communicate with the outer passage and the discharge means communicate with the inner passage. However, the results obtained by such a combination are inferior.

So also, while we have disclosed the inter-communicating means 39 as being positioned on the opposite side of the rotatable member from either the delivery or discharge means 41 and 50 re-

spectively, it is possible to modify the invention so that this structure is not utilized. A maximum cooling effect will, however, be obtained if these passages are disposed opposite to the intercommunicating means 39.

We claim as our invention:

1. In a packing structure for sealing against hot fluids, the combination of: a body providing a bore; a movable member extending through said bore; packing means in said bore and engaging said movable member; walls forming an inner passage around said movable member, said walls separating said inner passage from said packing whereby said inner passage is in cooling relationship with said packing; walls forming an outer passage around said inner passage; intercommunicating means communicating between said passages; delivery means communicating with one of said passages at a section on the opposite side of said movable member from said intercommunicating means for delivering cooling liquid thereto, said liquid then flowing through said intercommunicating means and into the other of said passages; and discharge means for conducting said cooling liquid from the other of said passages and communicating therewith at a section on the opposite side of said movable member from said intercommunicating means.

2. In a packing structure for sealing against hot fluids, the combination of: a body providing a bore; a movable member extending through said bore; packing means in said bore and engaging said movable member; walls forming an inner passage around said movable member, said walls separating said inner passage from said packing whereby said inner passage is in cooling relationship with said packing; walls forming an outer passage around said inner passage; intercommunicating means communicating between said passages; delivery means communicating with an upper portion of one of said passages for delivering cooling liquid thereto, said intercommunicating means interconnecting the lower portions of said passages; and discharge means communicating with the upper portion of the other of said passages for conducting said cooling liquid therefrom whereby any hot fluid leaking past said packing means must move upward through one of said passages to reach said discharge means.

3. In a packing structure for sealing against hot fluids, the combination of: a body providing a bore; a movable member extending through said bore; a packing in said bore around said movable member; a lantern ring in said bore and defining an inner passage around said movable member; walls defining an outer passage in said body around said lantern ring and around said packing but separated from said inner passage; intercommunicating means communicating between said passages at a section on one side of said movable member; delivery means communicating with one of said passages at a section on the other side of said movable member; discharge means communicating with the other of said passages at a section on said other side of said movable member; and means for forcing a cooling liquid through said delivery means, said intercommunicating means, and said discharge means whereby said cooling liquid flows circumferentially around said movable member while flowing through said inner and outer passages.

4. In a packing structure for sealing against hot fluids, the combination of: a body providing a bore; a movable member extending through said bore; a packing in said bore around said

movable member; a lantern ring in said bore and defining an inner passage around said movable member; walls defining an outer passage in said body around said lantern ring and around said packing but separated from said inner passage; intercommunicating means communicating between said passages at a section on one side of said movable member; delivery means communicating with said inner passage at a section on the other side of said movable member; discharge means communicating with said outer passage at a section on said other side of said movable member; and means for forcing a cooling liquid through said delivery means, said intercommunicating means, and said discharge means whereby said cooling liquid flows circumferentially around said movable member while flowing through said inner and outer passages.

5. In a packing structure for sealing fluids at such high temperatures that a reduction in pressure thereon will effect vaporization thereof, the combination of: a body providing a bore; a movable member extending through said bore; packing means in said bore and engaging said movable member, one end of said packing means communicating with a high pressure region contain-

ing said high temperature fluid; walls forming an inner passage around said movable member and communicating with the other end of said packing whereby any escaping fluid or vapor enters said inner passage, said inner passage being disposed in cooling relation with respect to said packing means through heat conduction through said walls; walls forming an outer passage around said inner passage; intercommunicating means between said passages; and delivery means communicating with said inner passage and supplying a cool liquid directly thereto, said liquid being cool enough to condense any vapors in said inner chamber, the condensate and said cooling liquid then moving through said intercommunicating means and into said outer chamber, said intercommunicating means opening on the lower portions of each of said chambers whereby any uncondensed vapors reaching said intercommunicating means upon a supply of insufficient cooling liquid will move into the lower part of said outer chamber and bubble upward through the cooling liquid retained therein.

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