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H. S. SMITH
CENTRIFUGAL PUMP SEAL

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2 Sheets-Sheet 1

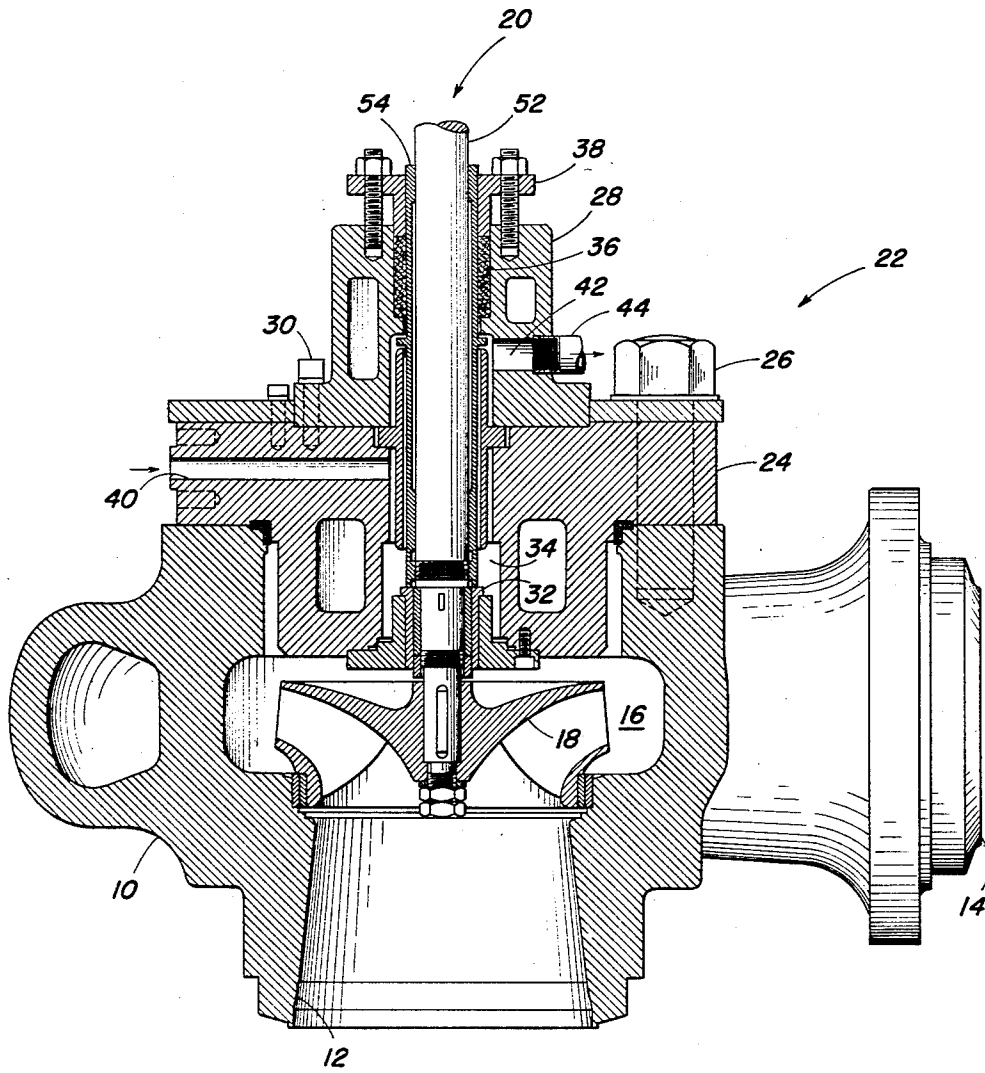


Fig. 1.

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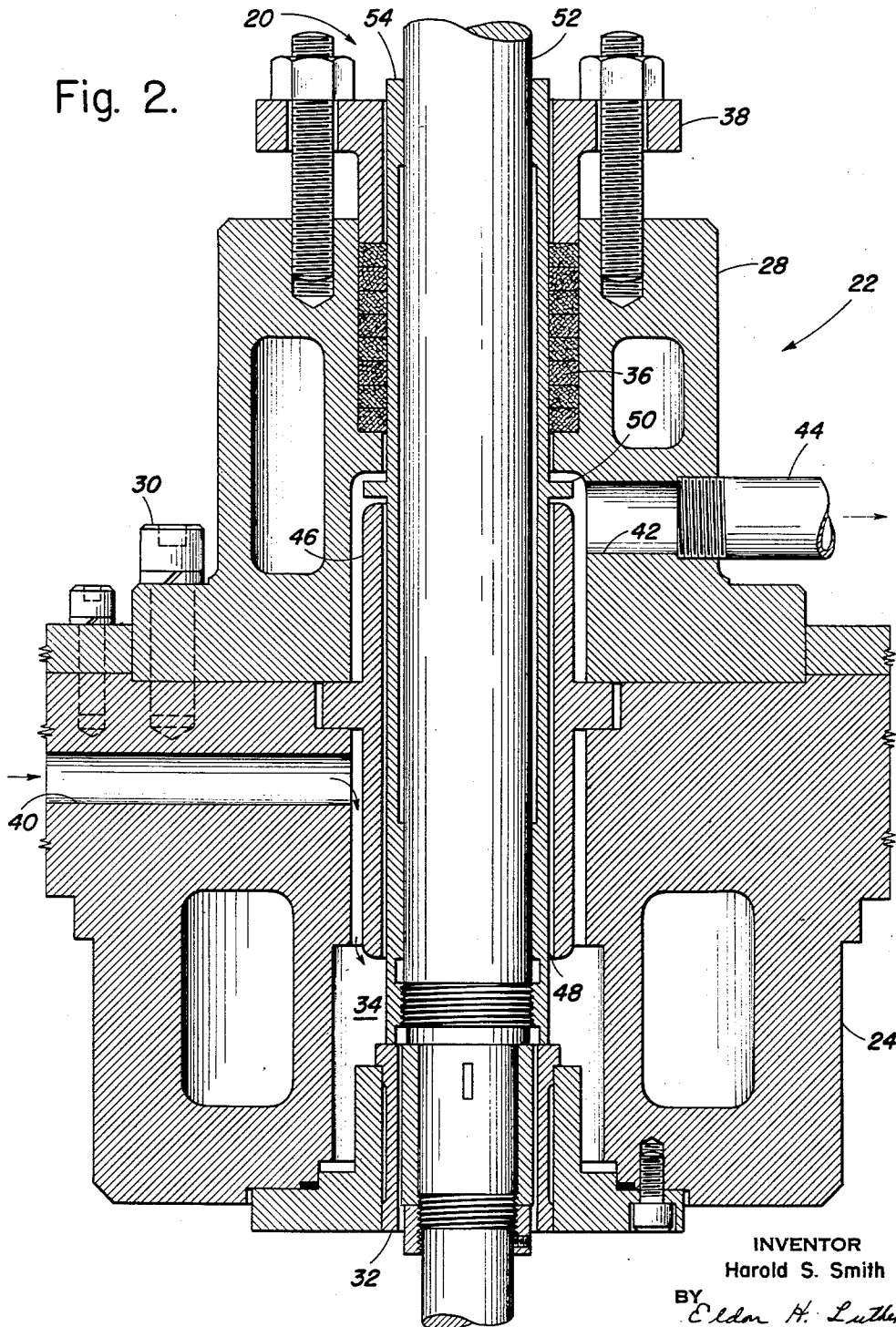
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Fig. 2.



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1

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3 Claims. (Cl. 286—9)

This invention relates to centrifugal type pumps for use with high temperature high pressure fluids and has particular relation to such a pump provided with a seal employing the use of so-called injection or sealing fluid.

In the art relating to centrifugal pumps that are used to pump high temperature fluids at relative high pressures, such as the circulating pumps used with forced or controlled circulation boilers, an injection or sealing fluid is often employed to insure that the high temperature fluid being pumped does not contact the pump seals because of the deleterious effect that this high temperature would have on these seals. This injection fluid is generally introduced into a cavity in the pump housing and through which the pump shaft passes with this fluid being at a pressure slightly higher than the pump pressure. This cavity is generally located between the innermost bearing of the pump, which is preferably constructed to act at least as a partial seal, and the relatively soft seal packing which is located outwardly of this bearing along the pump shaft whereby the high pressure seal fluid prevents leakage of the fluid being pumped outwardly along the pump shaft. In order that the soft packing will not be subjected to the high pressure of the sealing fluid as it is introduced into the cavity a so-called breakdown seal is provided to insure that the pressure of this sealing fluid is greatly reduced before the fluid contacts the packing, with this fluid then being conveyed from the cavity at a location adjacent this packing and at this reduced pressure. It has been found that in organizations wherein the breakdown seal is so constructed as to produce at its outer end a very high velocity jet of the injection fluid immediately adjacent and in parallel relation with the pump shaft that this jet rapidly destroys the soft packing and it is the purpose of this invention to overcome this problem.

It is therefore an object of the present invention to provide an improved centrifugal pump organization.

Other and further objects of the invention will become apparent to those skilled in the art as the description proceeds.

With the aforementioned objects in view, the invention comprises an arrangement, construction and combination of the elements of the inventive organization in such a manner as to attain the results desired as hereinafter more particularly set forth in the following detailed description of an illustrative embodiment, said embodiment being shown by the accompanying drawing wherein:

Fig. 1 is an axial sectional view of part of a centrifugal pump embodying the present invention.

Fig. 2 is an enlarged axial sectional view of the seal organization of this pump.

Referring now to the drawing, wherein like reference characters are used throughout to designate like elements, the centrifugal pump illustratively disclosed therein comprises a volute or body 10 into which water or other fluid is admitted at inlet 12 and discharged through out-

2

let 14 with this water, in the case of a boiler circulating pump being at a high temperature and pressure. Positioned within central chamber 16 of body 10 is the impeller 18 which is secured to the lower end of pump shaft 20. This shaft extends upwardly through the cover portion 22 of the pump casing with this cover portion being made in two sections the lower section 24 of which is secured to body 10 by bolts 26 while the upper portion 28 is secured to this lower portion by bolts 30. It will be appreciated that pump shaft 20 extends upwardly from cover 22 and is received within suitable thrust and radial bearings and is connected at its upper end to a driving motor with this mechanism being conventional and accordingly not shown in the drawing.

The lower end of pump shaft 20 is received within bearing 32 which is positioned at the inner end of cavity 34 provided in cover 22 and is constructed so as to provide sufficient sealing to prevent excessive leakage from this cavity into the chamber 16. At the upper end of cover 22 there is provided a soft packing 36 positioned within a suitable counterbore in the cover and effective to prevent the escape of fluid from cavity 34 outwardly along pump shaft 20 with the adjustable packing gland or nut 38 being operative to compress this packing 36 as desired.

Injection or sealing fluid is introduced into cavity 34 through passage 40 at a pressure that is slightly higher than the outlet pressure of the pump or the pressure existing in chamber 16 with this injection fluid being conveyed from cavity 34 by passage 42 and conduit 44. Thus the pressure in cavity 34 immediately above bearing 32 is slightly greater than that existing in pump chamber 16 so that any leakage that takes place will be into and not out of the pump chamber. In order to reduce the pressure of this injection fluid before it contacts packing 36 a suitable breakdown seal is provided and which, in the illustrative organization, comprises flanged sleeve 46 which is positioned in coaxial relation with pump shaft 20 and has its flange secured between the upper and lower portions 28 and 24 respectively of cover 22 in a fluid tight manner. This sleeve has an internal diameter which is slightly larger than the external diameter of pump shaft 20 at the location of the sleeve so that a restricted annular passage 48 is formed through which the injection fluid must flow in passing from inlet passage 40 and the inner end of cavity 34 to the outlet passage 42 with this restricted annular passage being effective to greatly reduce the pressure of the sealing fluid so that the pressure acting against packing 36 is much less than that existing in the inner end of cavity 34.

To illustrate the conditions that may be encountered in such a pump as herein contemplated the pump outlet pressure may be 2000 p.s.i. with the temperature of the water being pumped being in the order of 600° F. The injection fluid introduced into cavity 34 through conduit 40 may be 2050 p.s.i. and 300° F. In passing through the restricted annular passage 48, which may have a radial dimension of .055", this pressure is reduced to 300 p.s.i. so that it is this 300 pound pressure that packing 36 is subjected to and which it is to retain within the confines of the pump housing.

Because of this large reduction in pressure the annular stream of fluid issuing from the upper end of passage 43 is jet-like in that it is traveling at a very high velocity such as 70 or 80 feet per second and since this annular stream is located immediately adjacent to the pump shaft 20 it tends to continue along this pump shaft and impinge upon the packing 36, which must necessarily be relatively soft, usually being made of an asbestos composition with the jet action of this stream damaging this packing. In order to prevent this from happening there

3

is provided on the pump shaft 20 an annular collar 50 against which this fluid stream issuing from the end of annular passage 48 impinges thereby dissipating the kinetic energy of the jet and preventing it from contacting packing 36. This collar 50 may be integral with pump shaft 20 or may be a ring shrunk on or otherwise secured to the shaft. It will be noted that the end of the pump shaft that extends through cover 22 is comprised of two parts having an inner or solid member 52 about which is positioned sleeve member 54 which is secured at its inner end to the member 52 in a fluid tight manner as by threading or other suitable means and which may be replaced when it becomes unduly worn. However, as employed in this application members 52 and 54 are together intended to comprise the pump shaft of the centrifugal pump.

While I have illustrated and described a preferred embodiment of my invention it is to be understood that such is merely illustrative and not restrictive and that variations and modifications may be made therein without departing from the spirit and scope of the invention. I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes as fall within the purview of my invention.

What I claim is:

1. In an organization of the type described the combination of a housing, a shaft mounted therein, a stuffing box having a compressible packing in engagement with the shaft, a high pressure breakdown seal disposed about said shaft and spaced from the packing, means for introducing a high pressure sealing fluid in the housing at the end of the breakdown seal remote from the stuffing box, said breakdown seal including means forming a restricted passage concentric with the shaft and operative to reduce the pressure of said fluid prior to its reaching the stuffing box and constructed and arranged so that at its outward end a high velocity stream of the fluid is produced in parallel relation with and immediately adjacent to said shaft, a deflector provided on and secured to said shaft between the breakdown seal and the stuffing box, spaced from the breakdown seal and disposed outward of said restricted concentric passage, said deflector comprising a generally radial annular shoulder in the path of said stream, said shoulder having a greater radial dimension than that of the outer end of the concentric restricted passage.

2. In an organization of the type described the combination of a housing, a shaft mounted therein, a stuffing

4

box having a compressible packing in engagement with the shaft, a high pressure breakdown seal disposed about said shaft and spaced from the packing, means for introducing a high pressure sealing fluid in the housing at the end of the breakdown seal remote from the stuffing box, said breakdown seal comprising means forming an annular passage of restricted area concentric with the shaft with the outer end of the passage being immediately adjacent said shaft so that a high velocity stream of this fluid is produced in parallel relation with and immediately adjacent said shaft, a deflector for said high velocity stream comprising a collar formed on and secured to the shaft between the breakdown seal and the stuffing box and spaced from the breakdown seal and disposed outward of said restricted concentric passage, said deflector presenting a generally radial annular shoulder in the path of said stream, said shoulder having a greater radial dimension than that of the outer end of the concentric restricted passage.

3. In an organization of the type described the combination of a housing, a shaft mounted therein, a stuffing box having a compressible packing in engagement with the shaft, a high pressure breakdown seal disposed about said shaft and spaced from the packing, means for introducing a high pressure sealing fluid in the housing at the end of the breakdown seal remote from the stuffing box, said breakdown seal comprising a stationary sleeve concentric and coaxial with said shaft and forming therewith an annular passage of restricted area through which this fluid is forced to pass before reaching the stuffing box so that an annular high velocity stream of fluid issues from the end of the passageway in parallel relation with and immediately adjacent said shaft, and a deflector disposed on and secured to said shaft in spaced relation with the outer end of said sleeve and disposed outward of said annular passage, said deflector including a generally radial, annular shoulder disposed in the path of the fluid stream issuing from the end of the restricted passage, said shoulder having a greater radial dimension than that of the end of the restricted passage.

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