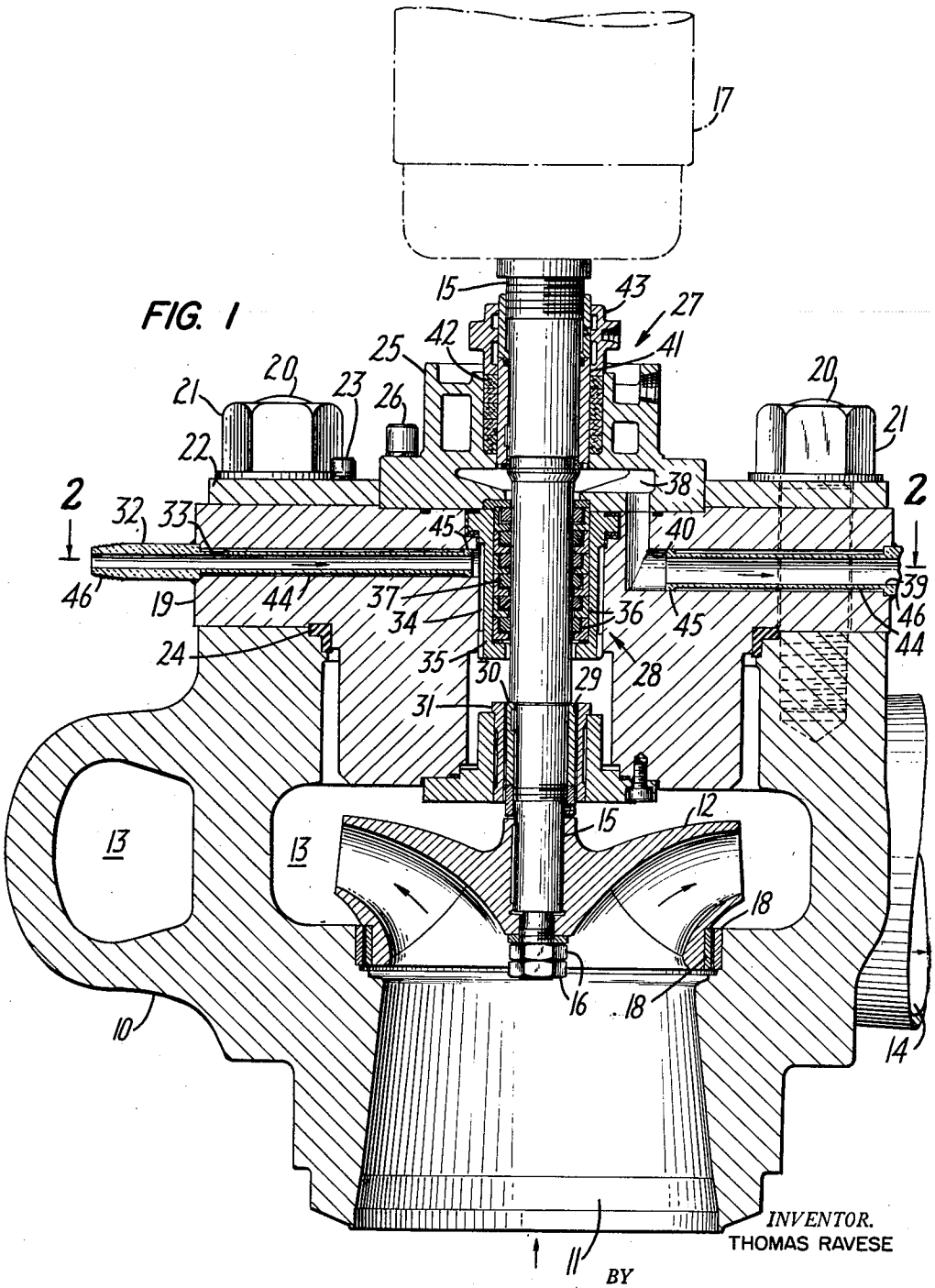
April 7, 1964 T. RAVESE 3,128,103

THERMAL SLEEVES FOR BOILER WATER CIRCULATING PUMPS

Filed Oct. 2, 1959 3 Sheets-Sheet 1

FIG. 1



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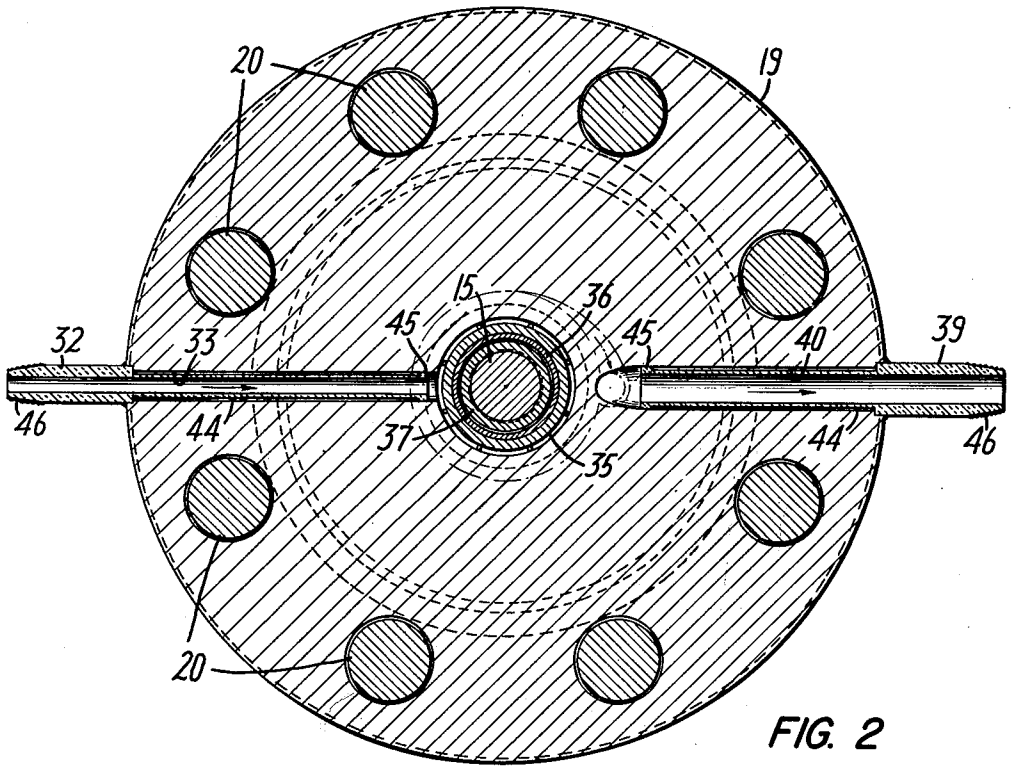


FIG. 2

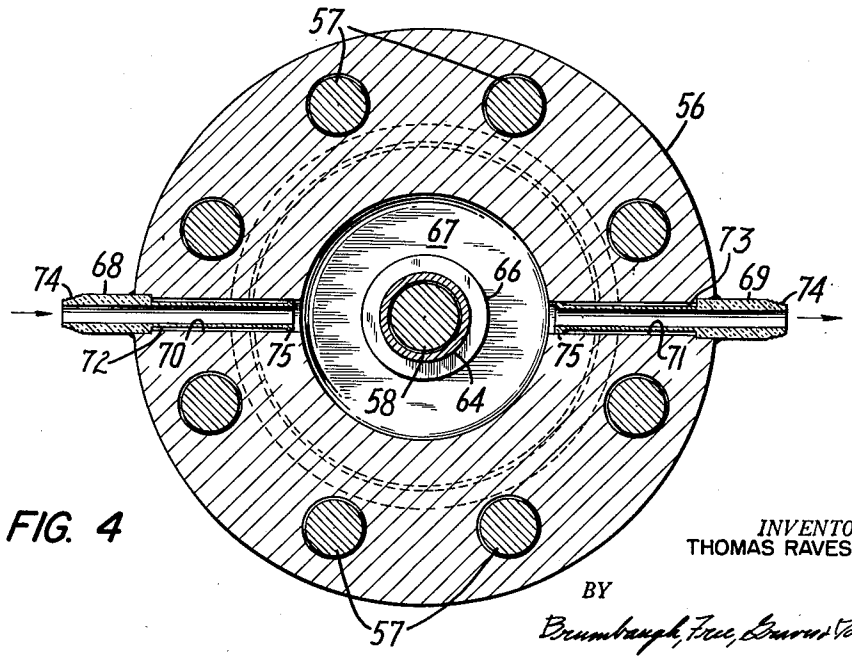


FIG. 4

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THERMAL SLEEVES FOR BOILER WATER CIRCULATING PUMPS

Filed Oct. 2, 1959 3 Sheets-Sheet 3

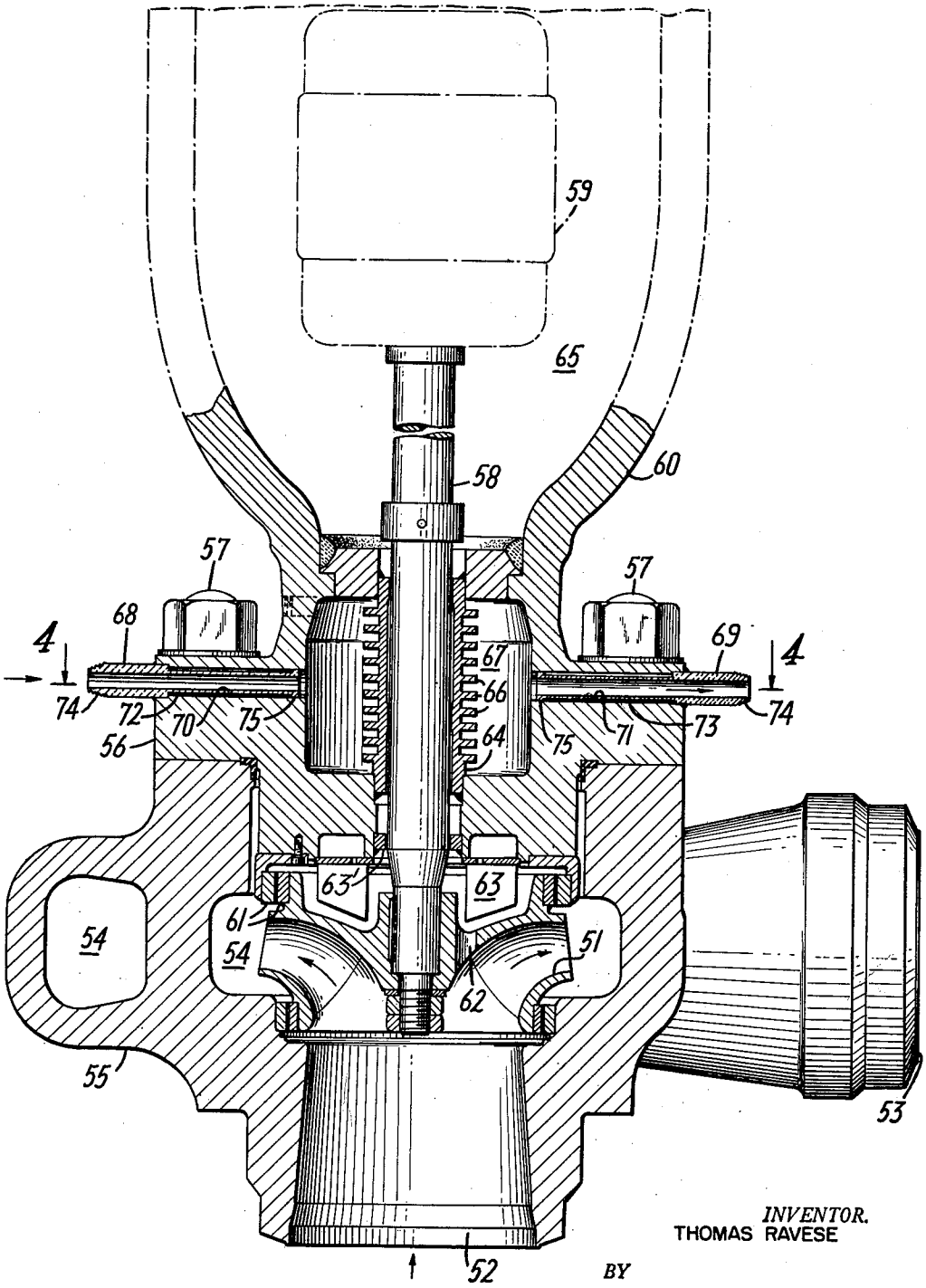


FIG. 3

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THERMAL SLEEVES FOR BOILER WATER CIRCULATING PUMPS

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7 Claims. (Cl. 277—32)

This invention relates to boiler water circulating pumps and, more particularly, to thermal sleeves for certain water passageways that are formed in boiler water circulating pumps.

Steam generating systems of the type described in the patent to W. H. Armacost No. 2,781,028, issued February 12, 1957, employ pumps to circulate the boiler water through the steam generating tubes and the other components of the system. Certain types of these circulating pumps require that a stream of relatively cool water be passed through the pump for proper operation. For example, the so-called injection pumps require a supply of water that is relatively cool in comparison with the boiler water to prevent the hot boiler water from flashing through a pressure breakdown device in the pump. In another instance, the so-called wet motor pumps require a supply of relatively cool water to carry heat away from the shaft that couples the motor to the impeller of the pump.

In each of these instances, passageways for the cool water are formed in the pump housing. The cool water flowing through these passageways has frequently been a source of trouble in conventionally constructed pumps because, while most of the pump housing is heated to approximately the temperature of the boiler water, the portions of the housing adjacent the passageways are at a considerably lower temperature. This temperature difference sets up thermal stresses in the pump housing which have caused damage to the pumps. This damage has usually consisted of a gasket failure or a failure of stud bolts that fasten two sections of a pump together.

It is the purpose of the present invention to obviate these difficulties by providing an insulating layer that separates the cool water from the pump housing. In a preferred embodiment of the invention, inlet and outlet conduits are inserted into the passageways formed in the housing and sleeves of a material whose thermal conductivity is low as compared to the materials forming the conduits and the housing are disposed between the conduits and the walls forming the pasageways. In this manner, the cool water conduits are prevented from contacting the portion of the relatively hot pump housing where thermal stresses could cause damage.

The invention may be more completely understood from the following detailed description of representative embodiments taken in conjunction with the accompanying figures of the drawings, in which:

FIGURE 1 is a vertical section of a boiler water circulating pump constructed in accordance with one embodiment of the invention;

FIGURE 2 is a view in cross-section taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a view partially in vertical section of a boiler water circulating pump constructed in accordance with another embodiment of th invention; and

FIGURE 4 is aview in cross-section taken along the line 4—4 of FIGURE 3.

In FIGURES 1 and 2 is illustrated an injection type boiler water circulating pump that includes a casing 10 having an inlet opening 11 through which the boiler water enters. An impeller 12 forces the water through a volute passageway 13 formed in the casing and out of the pump through an outlet opening 14. The impeller 12 is keyed

to a shaft 15 and secured thereto by a pair of nuts 16 which are threaded on the end of the shaft. The shaft 15 and the impeller 12 are caused to rotate by a drive motor 17 which may be a conventional electric motor. A pair of wearing rings 18 are mounted on the impeller 12 and the casing 10 and prevent unnecessary wear on the impeller as it rotates.

The pump further includes a housing 19 which is fastened to the casing 10 by a plurality of symmetrically arranged stud bolts 20 which are threaded into the casing 10 and have a plurality of nuts 21 threaded thereon. A gasket 24 is positioned between the casing and the housing and normally provides a leakproof seal. The stud bolts 20 also fasten a plate 22 to the housing 19 which may serve as a portion of a support for the drive motor 17. A plurality of bolts 23 are further employed to fasten the plate 22 to the housing 19. A head 25 is fastened to the top of the housing 19 by a plurality of symmetrically arranged bolts 26 and supports a stuffing box arrangement 27 which, along with a pressure breakdown device 28, prevents water from leaking out of the pump around the shaft.

In operation, the boiler water, which normally has a pressure and temperature on the order of 2100 p.s.i. and 600° F., respectively, is free to pass from the passageway 13 upward through a narrow opening 29 between a throttling sleeve 30, which is keyed to the shaft 15, and a throttling bushing 31, which is fastened to the housing 19. To prevent the hot boiler water from flashing through the pressure breakdown device 28, relatively cool water at a pressure slightly higher than the pressure of the boiler water is injected into the pump around the device 28. This injected water enters the pump through an inlet conduit 32 that is positioned in a passageway 33 formed in the housing 19. This water flows downward through an opening 34 between the housing 19 and a sleeve 35 which surrounds a plurality of retaining rings 36 and a plurality of seal rings 37. Since the injected water pressure is slightly higher than the boiler water pressure, a portion of the injected water flows downward through the opening 29 and keeps the hot boiler water away from the pressure breakdown device 28. Most of the injected water passes upward through the narrow openings between the seal rings 37 and the retaining rings 36 which reduce the pressure of the injected water from approximately 2200 p.s.i. to approximately 150 p.s.i. The water then enters a chamber 38 that leads to an outlet conduit 39 that is positioned in a passageway 40 formed in the housing 19. Since the water in the chamber 38 is at a relatively low temperature and pressure, the stuffing box arrangement 27 is able to prevent the water from leaking out of the pump around the shaft 15. The stuffing box arrangement includes a sleeve 41 that is keyed to the shaft 15 and stuffing material 42 that is disposed between the sleeve 41 and the head 25. A gland 43 is employed to force the stuffing material 42 downward between the head and the sleeve.

In operation, most of the housing 19 is heated to nearly the temperature of the boiler water which is well above the temperature of the injected water. The portions of housing adjacent the passageways 33 and 40 are, in conventional pumps, at a considerably lower temperature. To prevent this temperature difference in the housing from existing, which could set up thermal stresses and cause the pump to leak or cause a stud failure, thermal sleeves are provided for the inlet and outlet conduits 32 and 39. In the embodiment of the invention shown in FIGURES 1 and 2, the conduits 32 and 39 are formed with undercut portions 44 intremediate the coupling ends 46 and shoulders 45 formed on the conduits. The shoulders 45 are formed so that water can enter the spaces between the conduits and the walls of the passageways and act as

insulating or thermal sleeves around the conduits 32 and 39.

It is apparent that materials other than water could be employed as an insulating material, the only requirements being that they be able to withstand the high temperature and pressure in the pump. For example, a layer of wood or other material having a low thermal conductivity could be disposed in the undercut portions of the conduits 32 and 39 between the conduits and the walls of the passageways.

The invention may further be applied to so-called wet motor circulating pumps of the type shown in FIGURES 3 and 4. This type of motor is similar to the injection circulating pump previously described in that it also includes an impeller 51 that draws boiler water into the pump through an inlet opening 52 and discharges it through an outlet opening 53. The boiler water flows through a passagway 54 formed in a casing 55 and a housing 56 that are coupled together by a plurality of stud bolts 57. The impeller 51 is keyed to a drive shaft 58 that is coupled to a drive motor 59. The impeller 51 and the drive shaft 58 are conventionally mounted in the casing 55 and housing 56.

This type of pump differs from the type previously described in that no provision need by made for preventing the water from leaking out of the pump around the shaft 58 because the shaft and the drive motor 59 are entirely container within an upper portion 60 of the housing 56. As can be seen from FIGURE 3, the boiler water is free to pass upward through a pair of wearing rings 61 and an aperture 62 formed in the impeller 51 and into a chamber 63. From this chamber the water flows between the shaft 58 and a bushing 63' and a sleeve 64 and into a chamber 65 formed in the upper portion 60 of the housing 56.

Even though the motor 59 is immersed in the boiler water, the motor isn't heated beyond safe limits by the water because it is not circulating and water is a relatively poor heat conductor. However, there is a danger, when using conventional pumps, that the shaft 58 will carry heat from its lower end up to the motor 59 and damage it. To prevent this from happening, the sleeve 64 is formed with a plurality of extended surfaces 66 that act as cooling fins and cooling water is injected into a chamber 67 that contains the sleeve 64. The cooling water is directed through the pump by an inlet conduit 68 and an outlet conduit 69 that are disposed in passageways 70 and 71, respectively.

Since the cooling water is at a relatively low temperature in comparison with the temperature to which the housing 56 is heated by the boiler water, the conduits 68 and 69 are formed with undercut portions 72 and 73, respectively, intermediate their coupling ends 74 and shoulders 75. The spaces between the conduits and the walls of the passageways become filled with water which acts as an insulating or thermal sleeve in the manner previously described.

From the foregoing, it can be seen that a novel and useful thermal sleeve for a boiler water circulating pump has been provided. The thermal sleeve may be adapted to any circulating pump that requires the injection of water that is relatively cool as compared to the boiler water that is being circulated. In the two types of pumps described and in others to which the invention may be applied, a thermal sleeve is disposed around the inlet and outlet conduits for the relatively cool injected water which prevents these conduits from contacting the pump housing in the areas where thermal stresses could cause damage. In the embodiments of the invention described, the sleeves comprise a layer of water, which is advantageous because provision for this type of sleeve can be made easily and inexpensively. But it should be understood that sleeves of other materials having relatively low thermal conductivities could just as well be provided.

While the foregoing discussion has assumed that water is being circulated by and injected into the pumps, it is apparent that the invention will operate just as well with other fluids, such as those that have been considered for use in plants that employ nuclear power.

While particular embodiments of the present invention have been shown and described for purposes of illustration, it is apparent that the embodiments are susceptible of change and modification without departing from the invention in its broader aspects.

Therefore, the invention described herein is not to be construed as limited to the specific embodiments described but is intended to encompass all modifications thereof coming within the scope of the following claims.

I claim:

1. A pump adapted to circulate boiler fluid at a relatively high temperature and pressure comprising a housing having first passageway means formed in and defined by said housing adapted to convey said boiler fluid, second passageway means formed in and defined by said housing, fluid conveying means disposed in said second passageway means adapted to be connected to a source of fluid that is relatively cool as compared to said boiler fluid being circulated by said pump, said fluid conveying means including a sleeve mounted within the second passageway means having, at least in one portion, an outside dimension smaller than the inside dimension of the second passageway means so as to provide a space therebetween, means providing fluid communication between the space and the interior of the sleeve to permit fluid flowing through the sleeve to enter the space, and means forming a relatively fluid-tight seal between the sleeve and the housing to maintain the fluid in the space in a relatively stationary condition so as to provide a heat insulating layer between the sleeve and the housing.

2. A pump adapted to circulate fluid at a relatively high temperature and pressure comprising a housing having first inlet and outlet passageway means formed in and defined by said housing for said boiler fluid, second passageway means formed in and defined by said housing, fluid conduit means disposed in said second passageway means and adapted to be connected to a source of fluid that is relatively cool as compared to said boiler fluid, said fluid conduit means including a sleeve mounted within the second passageway means having, at least in one portion, an outside dimension smaller than the inside dimension of the second passageway means so as to provide a space therebetween, means providing fluid communication between the space and the interior of the sleeve to permit fluid flowing through the sleeve to enter the space, and means forming a relatively fluid-tight seal between the sleeve and the housing to maintain the fluid in the space in a relatively stationary condition so as to provide a heat insulating layer between the sleeve and the housing.

3. A pump for circulating boiler water at a relatively high temperature and pressure comprising a housing having first passageway means formed in and defined by said housing for said boiler water, a drive shaft mounted on said housing, a pressure breakdown device that is mounted on said housing and surrounds said shaft, second passageway means formed in and defined by said housing leading to a chamber surrounding said drive shaft, and conduit means positioned in said second passageway means, said conduit means comprising a sleeve mounted within the second passageway means having, at least in one portion, an outside dimension smaller than the inside dimension of the second passageway means so as to provide a space therebetween, means providing fluid communication between the space and the interior of the sleeve to permit fluid flowing through the sleeve to enter the space, and means forming a relatively fluid-tight seal between the sleeve and the housing to maintain the fluid in the space in a relatively stationary condition so as to provide a heat insulating layer between the sleeve and the housing.

4. A pump for circulating boiler water at a relatively high temperature and pressure comprising a housing and

a casing fastened together by a plurality of bolts, first passageway means formed in and defined by said housing and said casing for said boiler water, a drive shaft mounted on said casing and said housing, a pressure breakdown device that is mounted on said casing and disposed around said shaft, second passageway means formed in and defined by said casing and leading to said pressure breakdown device, said second passageway means extending between certain of said bolts, conduit means disposed in said second passageway means and adapted to be connected to a source of water that is relatively cool as compared to said boiler water, said conduit means comprising a sleeve mounted within the second passageway means having, at least in one portion, an outside dimension smaller than the inside dimension of the second passageway means so as to provide a space therebetween, means providing fluid communication between the space and the interior of the sleeve to permit fluid flowing through the sleeve to enter the space, and means forming a relatively fluid-tight seal between the sleeve and the housing to maintain the fluid in the space in a relatively stationary condition so as to provide a heat insulating layer between the sleeve and the housing.

5. In a device for conveying high temperature fluids including a heat conductive housing and an element within the housing which must be kept at a lower temperature than the housing, and passageway means including a chamber surrounding a portion of the element for circulating a cooling fluid past the element, the combination therewith of an insulating sleeve mounted in the passageway means to carry the cooling fluid therethrough, said sleeve having an outside diameter smaller than the inside diameter of the passageway means so as to provide a space therebetween, means providing fluid communication between the space and the interior of the sleeve to permit fluid flowing through the sleeve to enter the space, and means forming a relatively fluid-tight seal between the sleeve and the housing to maintain the fluid in the space in a relatively stationary condition to serve.

6. A pump for circulating boiler water at a relatively high temperature and pressure comprising a housing having first passageway means formed in and defined by said housing for said boiler water, a drive shaft mounted on said housing, a sleeve mounted on said housing and disposed around said drive shaft, said sleeve having a plurality of extended surfaces formed thereon, a plurality of second passageway means formed in and defined by said housing which lead to a chamber formed in said housing that contains said sleeve, a plurality of conduit means disposed in said second passageway means, said conduit means comprising a sleeve mounted within the second passageway means having, at least in one portion, an outside dimension smaller than the inside dimension of the second passageway means so as to provide a space therebetween, means providing fluid communication between the space and the interior of the sleeve to permit fluid flowing through the sleeve to enter the space, and means forming a relatively fluid-tight seal between the sleeve and the housing to maintain the fluid in the space in a relatively stationary condition so as to provide a heat insulating layer between the sleeve and the housing.

7. A pump for circulating boiler water at a relatively high temperature and pressure comprising a housing and a casing fastened together by a plurality of bolts, first passageway means formed in and defined by said housing and said casing for said boiler water, a drive shaft mounted on said casing and said housing, a sleeve mounted on said casing and disposed around said drive shaft, said sleeve having a plurality of extended surfaces formed thereon, second passageway means formed in and defined by said casing which lead to a chamber formed in said casing that contains said sleeve, said second passageways extending between certain of said bolts, water conduit means disposed in said second passageway means and adapted to be connected to a source of water that is relatively cool as compared to said boiler water, said water conduit means comprising a sleeve mounted within the second passageway means having, at least in one portion, an outside dimension smaller than the inside dimension of the second passageway means so as to provide a space therebetween, means providing fluid communication between the space and the interior of the sleeve to permit fluid flowing through the sleeve to enter the space, and means forming a relatively fluid-tight seal between the sleeve and the housing to maintain the fluid in the space in a relatively stationary condition so as to provide a heat insulating layer between the sleeve and the housing.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,128,103 April 7, 1964

Thomas Ravese

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 28, for "container" read -- contained --; column 5, line 39, after "serve" insert -- as a heat insulating medium between the sleeve and the housing --.

Signed and sealed this 10th day of November 1964.

(SEAL)
Attest:

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Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents