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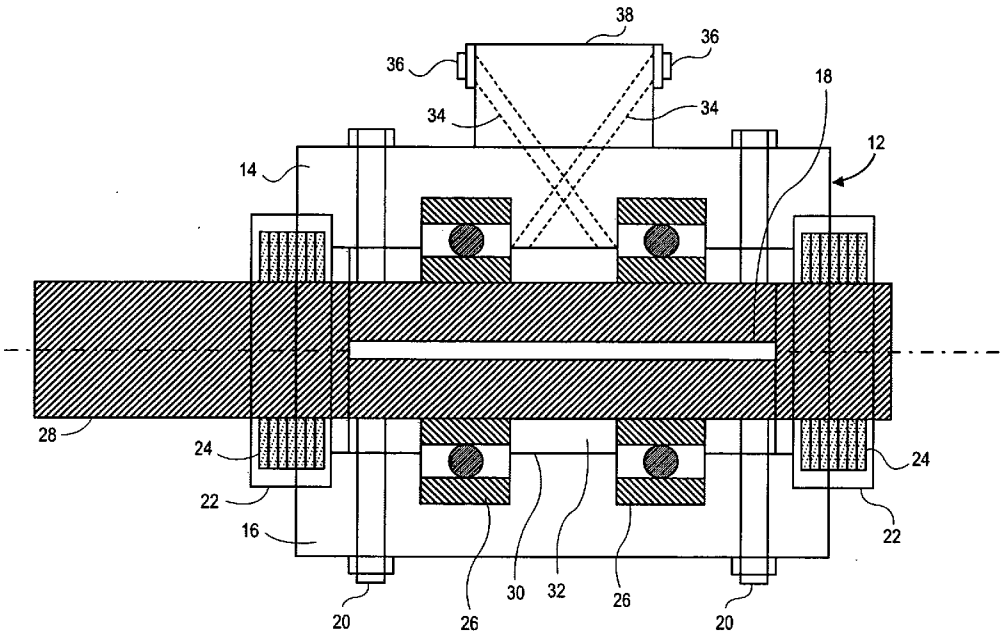
(54) **Title:** PRESSURIZED BEARING ASSEMBLY



(57) **Abstract:** A pressurized bearing assembly includes a pressurized housing having a bearing seal that protects bearings that are provided within the housing. The bearing seal may include a stator, a rotor, and a pressure bleed. The rotor may be provided with one or more fins. The housing may be pressurized with air and/or a lubricant. The housing may also include two o more portions separated by a housing seal. The housing may include a chamber for maintaining the air or lubricant. The lubricant may circulate through the housing via a closed-loop lubrication system. The housing may also be provided with an anti-wetting compound. The housing, stator, and rotor may be made from temperature and corrosion resistant material.

WO 2008/045245 A2

PRESSURIZED BEARING ASSEMBLY

RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Patent Application Serial No. 60/828,290, filed October 5, 2006, titled "Extended Life Bearing Isolation and Housing Device For Use In Molten Metal Baths" and to U.S. Provisional Patent Application Serial No. 60/915,485, filed May 2, 2007, titled "A Pressurized Mechanical Seal For Use In Molten Metal Baths," the disclosures of each are hereby incorporated by reference in their entirety.

FIELD OF THE INVENTION

[0002] The invention relates generally to a seal for a roller or conveyor device used in molten metal baths. More particularly, the invention relates to a seal for a roller or conveyor device used in molten metal baths that is resistant to a high temperature, corrosive, and abrasive environment created by the molten metal bath.

BACKGROUND OF THE INVENTION

[0003] In continuous hot-dip galvanizing of a steel strip, a bath of molten zinc is used. Prior to entering the bath, the strip typically undergoes a heat treatment in a furnace. An end portion of the furnace that extends into the bath, called a snout, seals the furnace from the surrounding air. As the strip passes through the snout, the strip becomes immersed in the bath. Typically, two or more rolls are disposed in the molten bath. A sink roll reverses the travel direction of the strip in the bath, and a pair of stabilizing rolls in the bath stabilize and guide the strip through coating knives.

[0004] In the production of galvanized products, aluminum is typically present in the molten zinc bath for controlling zinc-iron alloy growth. Interfacial zinc-iron alloy on galvanized steel is undesirable because it causes low adherence of the zinc coating to the strip. In conventional hot-dip galvanizing processes, high bath temperatures can decrease roll life by

increasing abrasion and erosion. Also, other components in the bath, such as bearings and sleeves, have decreased lives because of high bath temperatures and dross formation. The decreased lives of such components increases costs directly (*e.g.*, replacement costs) and indirectly (*e.g.*, cessation of production when replacing the components).

[0005] Rollers used on conveyors and inside a zinc-pot of a steel-sheet galvanizing line are usually driven only by friction between the roller and a belt or sheet. Bearing friction torque and associated wear depends mostly on: roller load, roller weight, contacting bearing materials, surface finish and bearing diameter. Bearing wear rate is greatly affected by bearing materials, lubrication, temperature, velocity, average contact pressure and degree of clearance and roundness of a bearing sleeve inside each bearing housing. Bearing wear rate increases dramatically with miss-alignment of the bearing housings and with shaft deflection. Rollers operating in high temperature furnaces or in a hot zinc-pot of a steel galvanizing line often have negligible lubrication. In such cases, bearing life may be limited to only one week of operation before needing replacement.

SUMMARY OF THE INVENTION

[0006] The foregoing disadvantages are met, to a great extent, by the invention, wherein in one aspect a pressurized bearing assembly for use with a zinc pot of a steel sheet galvanizing line is provided that in some embodiments includes a pressurized housing. The pressurized housing is preferably formed of a temperature and corrosion resistant material. The housing may include first and second portions having a housing seal therebetween. The first and second portions may be secured together using any suitable fastening mechanism. The first and second portions may include receiving portions for receiving a shaft of a conveyor used in the galvanizing line as well as roller (or other types of) bearings. The housing may also include an attachment mechanism for attaching the bearing assembly to, for example, a swing arm of the conveyor.

[0007] The housing may include a chamber for storing pressurized air and/or a lubricant. A bearing seal may be provided to substantially isolate the roller bearings provided in the housing from a corrosive and abrasive environment created by, for example, a steel sheet galvanizing line. The pressurized chamber assists in preventing corrosive and abrasive materials from causing wear to the bearings. The bearing seal may include, for example, metal bellows, labyrinth or other type of seal with or without thrust bearings.

[0008] The chamber may also be in fluid communication with, for example, a closed-loop lubrication system. The closed-loop lubrication system may be used to circulate a lubricant such as, for example, oil, throughout the chamber and provide better lubrication for the bearings and to remove potential contaminants from the bearings.

[0009] According to another embodiment of the invention, the bearing seal may be formed using, for example, a stator and a rotor. The bearing seal may be provided on one side of the housing and receives, for example, a shaft of a zinc pot roller. The rotor may be provided with, for example, one or more fins that act as an expeller device that may be used to prevent molten metal from a zinc pot steel sheet galvanizing line from causing wear to the roller (or other types) of bearings. The rotor may be used in combination with the pressurized housing to prevent molten metal or other corrosive and abrasive materials from reaching the roller bearings. The rotor and stator together may also be pressurized and connected to the closed-loop lubrication system.

[0010] There has thus been outlined, rather broadly, certain embodiments of the invention in order that the detailed description thereof herein may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional embodiments of the invention that will be described below and which will form the subject matter of the claims appended hereto.

[0011] In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or

illustrated in the drawings. The invention is capable of embodiments in addition to those described and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein, as well as the abstract, are for the purpose of description and should not be regarded as limiting.

[0012] As such, those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a cross-sectional view of a bearing assembly according to one embodiment of the invention.

[0014] FIG. 2 is an end view of the bearing assembly shown in FIG. 1.

[0015] FIG. 3 is a top perspective view of a bearing assembly according to one embodiment of the invention.

[0016] FIG. 4 is a top perspective view of a top portion of a housing that may be used with a bearing assembly according to one embodiment of the invention.

[0017] FIG. 5 is a top perspective view of a bottom portion of a housing that may be used with a bearing assembly according to one embodiment of the invention.

[0018] FIG. 6 is a top perspective view of a stator that may be used with a bearing assembly according to one embodiment of the invention.

[0019] FIG. 7 is a top perspective view of a rotor that may be used with a bearing assembly according to one embodiment of the invention.

[0020] FIG. 8 is a partial cross-sectional view of a bearing assembly according to one embodiment of the invention.

[0021] FIG. 9 is a cross-sectional view of a bearing assembly according to one

embodiment of the invention.

[0022] FIG. 10 illustrates a steel sheet galvanizing line using the bearing assemblies according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] Figs. 1 and 2 illustrate a bearing assembly 10 for use in molten metal baths according to one embodiment of the invention. The bearing assembly 10 includes a housing 12 having a top portion 14 and a bottom portion 16. The top portion 14 and the bottom portion 16 are preferably separated by a housing seal 18. The housing seal 18 may be used to prevent corrosive, abrasive, and other materials from entering the housing 12. The top portion 14 and the bottom portion 16 may include receiving portions (shown in Figs. 5 and 6) that receive components of the bearing assembly 10. The top portion 14 and the bottom portion 16 may be attached using, for example, fasteners 20 or other suitable fastening mechanisms. The fasteners 20 may include, for example, a bolt and nut assembly.

[0024] The bearing assembly 10 may also include bearing seals 22 that may be provided on each end of the housing 12. The bearing seals 22 may include thrust bearings 24. The bearing seals 22 serve to substantially prevent corrosive and abrasive materials from entering the housing and causing wear to bearings 26. According to one embodiment of the invention, bearings 26 are roller bearings, although other types of bearings may also be used. The bearing seals 22 and the bearings 26 may be provided about a shaft 28 of a roller conveyor or other device.

[0025] The bearings 26 may be at least partially provided in a chamber 30 created by the top portion 14 and the bottom portion 16 of the housing 12. The chamber 30 may be used to store pressurized air and/or a lubricant 32. The lubricant 32 may be provided to the chamber 30 using passageways 34. The passageways may be in fluid communication with fittings 36 that are in fluid communication with a lubricant source (not shown) and provided on, for example, a swing arm 38 of a roller conveyor or other device.

[0026] The housing 12 is preferably formed of a temperature and corrosion resistant material and may be provided with an anti-wetting compound. The chamber 30 of the housing 12 is preferably pressurized to substantially isolate the bearings 26 and substantially prevent abrasive and corrosive materials from entering the chamber 30 and causing wear to the bearings 26.

[0027] Figs. 3 and 4 illustrate a bearing assembly 40 that may be used in a molten metal bath according to one embodiment of the invention. The bearing assembly 40 may include a housing 42 that may be formed from a top portion 44 (shown in further detail in Fig. 5) and a bottom portion 46 (shown in further detail in Fig. 6).

[0028] The top portion 44 and the bottom portion 46 may include a housing seal 48 positioned therebetween. The housing seal 48 may be used to reduce or prevent corrosive, abrasive or other materials from entering the housing 42. According to one embodiment of the invention, the housing seal 48 includes a gasket that may be, for example, a carbon fiber cloth having a shape corresponding to an outer edge of the top portion 44 and the bottom portion 46.

[0029] The top portion 44 and the bottom portion 46 preferably include receiving portions 50 (shown in Figs. 5 and 6) The receiving portions 50 may be used to receive components such as, for example, bearings 52 (which may be roller bearings), of the bearing assembly 40. The receiving portions 50 may also be used to create a chamber 54 within the housing 42. The chamber 54 may be used to store pressurized air and/or a lubricant 56. The air and/or lubricant 56 may enter and exit the chamber 54 through passageways 58.

[0030] The top portion 44 and the bottom portion 46 may be attached using fasteners 60 or other suitable fastening mechanism. The top portion 44 may also include an attachment mechanism 62 that enables the bearing assembly 40 to be attached to, for example, a swing arm of a roller conveyor or other device.

[0031] The bearing assembly 40 may also include a bearing seal 64 provided on, for example, one side of the housing 42. The bearing seal 64 may include a stator 66 and a rotor 68. The stator 66 and rotor 68 may receive a shaft 70 of a roller conveyor or other device. The stator 66 and rotor 68 may be internally pressurized and/or lubricated through ports 72a (shown in Figs.

7 and 9). This arrangement allows for the flow of air or lubricant through the labyrinth of the seal, exiting below an interior portion of fins (shown in Figs. 8 and 9) of the rotor 68 and forming a bubble of air or lubricant that isolates physical contact between intermeshing surfaces of the bearing seal 64 and, for example, molten zinc. This reduces or eliminates abrasion of and wear to the bearing seal 64.

[0032 Fig. 7 illustrates the stator 66 according to one embodiment of the invention. The stator 66 may include an extended portion 72. The extended portion 72 of the stator 66 may be received by the top portion 44 and the bottom portion 46 of the housing 42 using receiving portions 50. The extended portion 72 helps to substantially prevent corrosive, abrasive or other materials from entering the housing 42.

[0033] Fig. 8 illustrates the rotor 68 according to one embodiment of the invention. The rotor 68 may include one or more fins 74. According to one embodiment of the invention, the housing 42 is pressurized with air and/or lubricant 56 to substantially prevent corrosive, abrasive or other material from entering the housing 42. The fins 74 may be used in conjunction with the pressurized housing 42 to substantially isolate components provided within the housing 42 by forcing material away from the bearing seal 64.

[0034] Fig. 9 is a partial cross-sectional view of the bearing seal 64 according to one embodiment of the invention. The bearing seal 64 may include the stator 66 and the rotor 68. The stator 66 and the rotor 68 may be provided about the shaft 70. The extended portion 72 of the stator 66 may be received by one or more of the receiving portions 50 of the housing 42 of the bearing assembly 40. The extended portion 76 of the rotor 68 may be at least partially received by the stator 66. The rotor 68 may also include a drive ring 78 that may assist in rotating the rotor 68. The stator 66 may include an o-ring 80 that may be used to maintain the stator 66 in a desired location. The bearing seal 64 may also include an air pressure bleed that operates to reduce or prevent physical contact between mating surfaces of the bearing seal 64 and a corrosive and/or abrasive environment such as, for example, a molten metal bath.

[0035] Fig. 10 illustrates a steel sheet galvanizing system 100 that may use bearing assemblies 102 according to the invention. The bearing assemblies 102 may be operatively coupled to a zinc pot roller 104 and swing arms 106 of, for example, a roller conveyor or other device. The galvanizing system 100 may also include a reservoir 108 that is in fluid communication with a pump 110 and a heat exchanger 112. The galvanizing system 100 may also include tubing 114 that provides a closed-loop lubricating system for providing a lubricant to the bearing assemblies 102. According to one embodiment of the invention, the reservoir 108 stores a lubricant such as, for example, oil. The oil is forced from the reservoir 108 by the pump 110 and enters the bearing assemblies 102 through tubing 114. The oil exits the bearing assemblies 102 through tubing 114 and enters the heat exchanger 112. The oil exits the heat exchanger 112 and returns to the reservoir 108. A pressure regulator 116 may also be provided to regulate the pressure within the reservoir 108 and/or the bearing assemblies 102.

Additionally, a filter 118 may be provided to filter the lubricant and remove contaminants or other material from the lubricant. According to one embodiment, the filter 118 may be provided between the bearing assemblies 102 and the heat exchanger 112.

[0036] The many features and advantages of the invention are apparent from the detailed specification, and thus, it is intended by the appended claims to cover all such features and advantages of the invention which fall within the true spirit and scope of the invention. Further, since numerous modifications and variations will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation illustrated and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

CLAIMS

What is claimed is:

1. A bearing assembly comprising:

at least one bearing;

a pressurized housing surrounding the at least one bearing;

a pressurized closed-loop lubrication system in fluid with the pressurized housing; and

at least one seal secured to the housing.

2. The bearing assembly of claim 1, further comprising a chamber provided in the pressurized housing.

3. The bearing assembly of claim 2, wherein the chamber comprises at least any one of air and a lubricant.

4. The bearing assembly of claim 2, wherein the at least one bearing is a least partially within the chamber.

5. The bearing assembly of claim 1, further comprising an expeller.

6. The bearing assembly of claim 5, wherein the expeller comprises at least any one of a temperature resistant material and a corrosion resistant material.

7. The bearing assembly of claim 5, wherein the expeller comprises at least one fin.

8. The bearing assembly of claim 1, wherein the pressurized housing comprises at least any one of a temperature resistant material and a corrosion resistant material.

9. The bearing assembly of claim 1, wherein the pressurized housing further comprises an anti-wetting compound.

10. The bearing assembly of claim 1, wherein the pressurized housing is pressurized with at least any one of air and a lubricant.

11. The bearing assembly of claim 1, wherein the seal comprises a pressure bleed.

12. The bearing assembly of claim 1, further comprising a stator.

13. The bearing assembly of claim 12, wherein the stator comprises at least any one of a corrosion resistant material and a temperature resistant material.

14. The bearing assembly of claim 1, further comprising at least one drive ring.

15. The bearing assembly of claim 1, wherein the pressurized housing comprises a first portion and a second portion.

16. The bearing assembly of claim 15, wherein the first portion and the second portion of the pressurized housing comprise at least one slot.

17. The bearing assembly of claim 1, wherein the at least one bearing comprises a roller bearing.

18. The bearing assembly of claim 1, wherein the pressurized housing comprises a first portion and a second portion.

19. The bearing assembly of claim 18, further comprising a housing seal positioned between the first portion and the second portion.

20. The bearing assembly of claim 19, wherein the housing seal comprises a carbon fiber cloth.

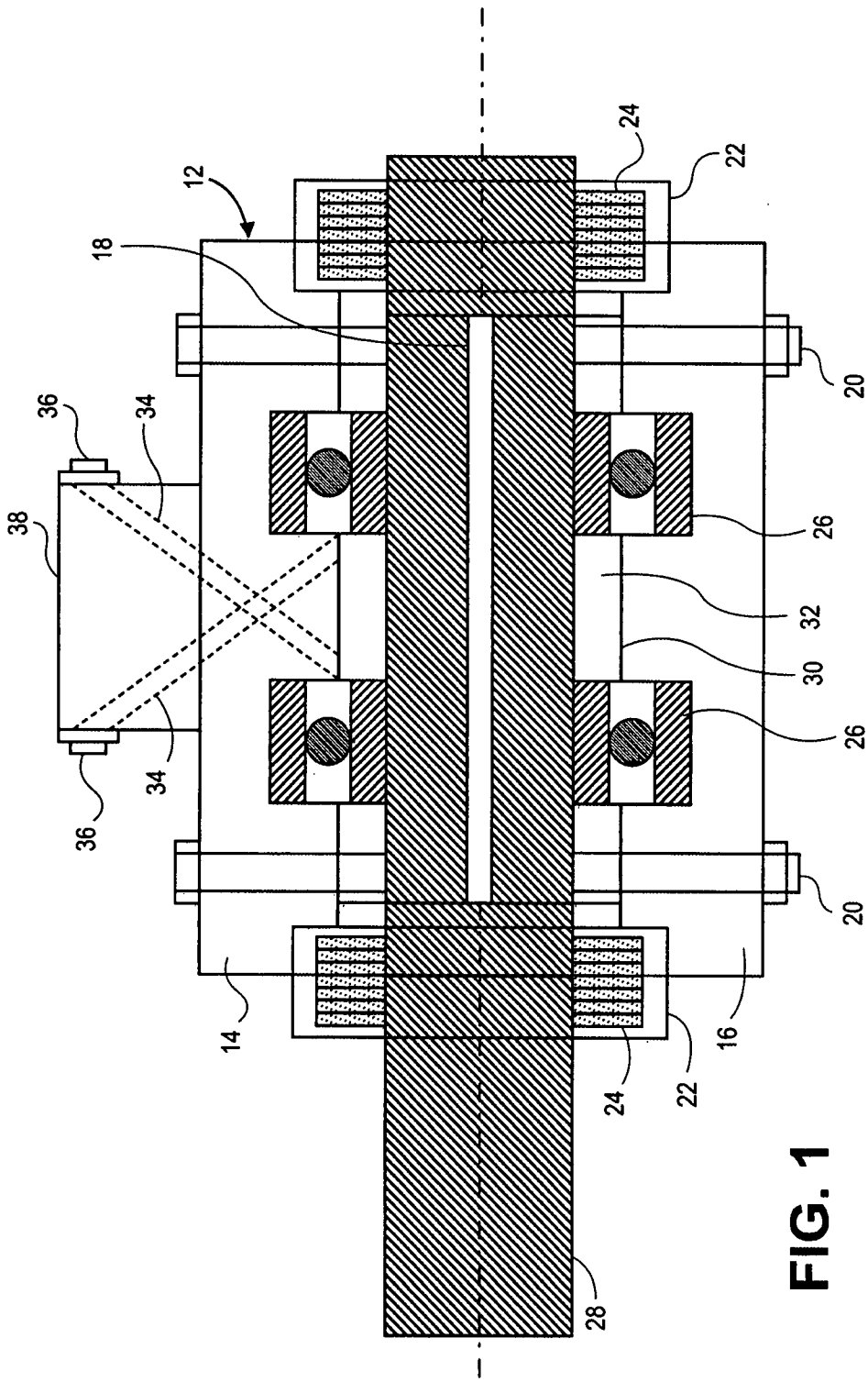


FIG. 1

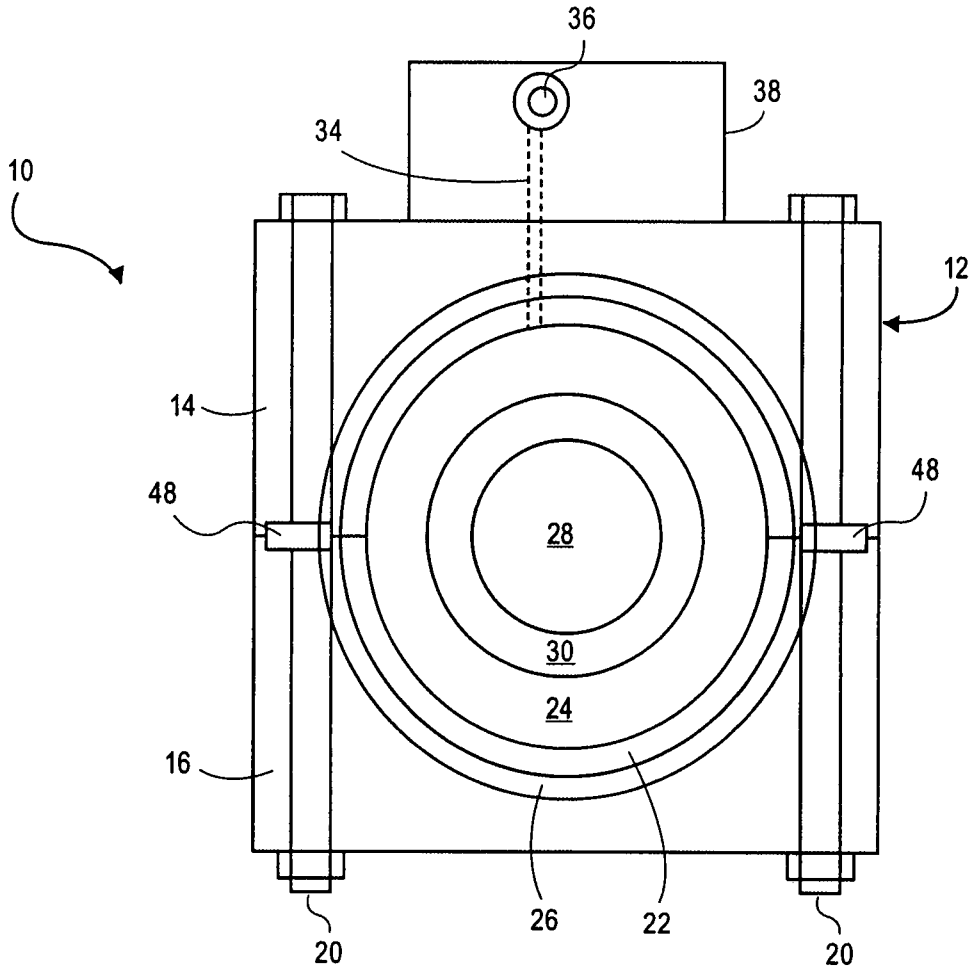


FIG. 2

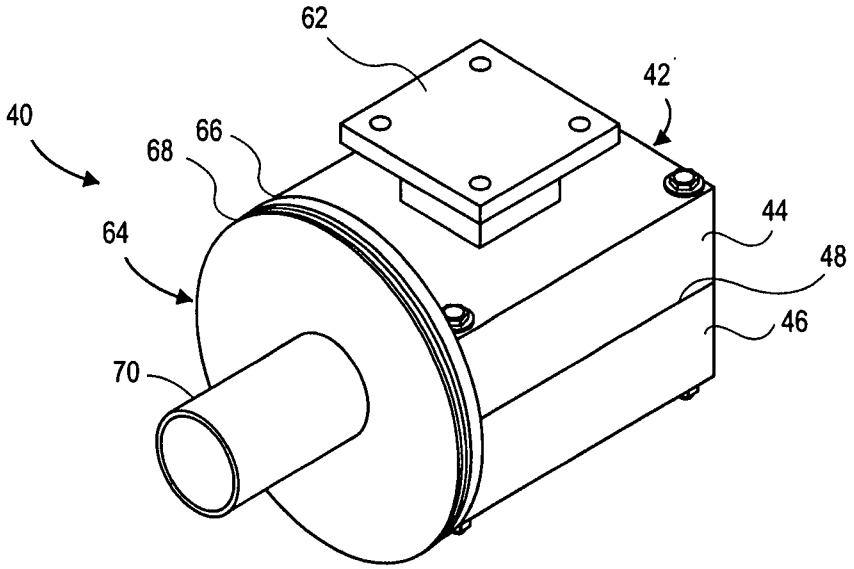

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FIG. 3

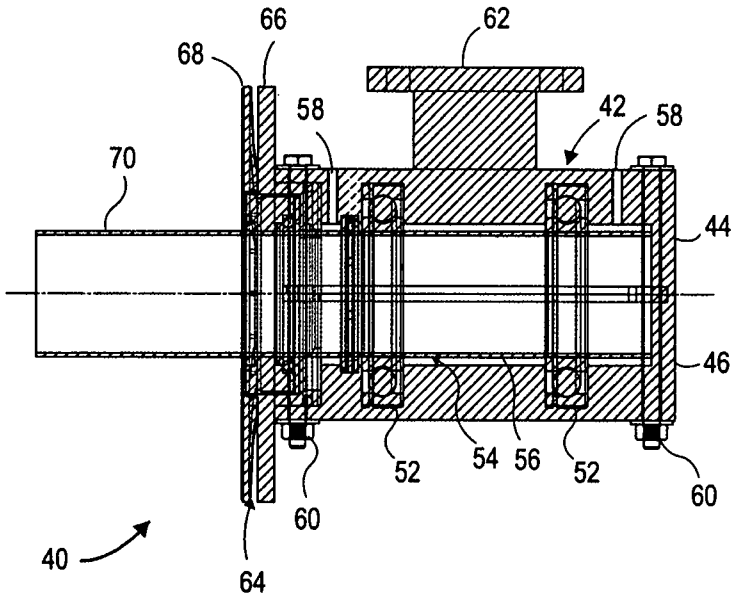
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FIG. 4

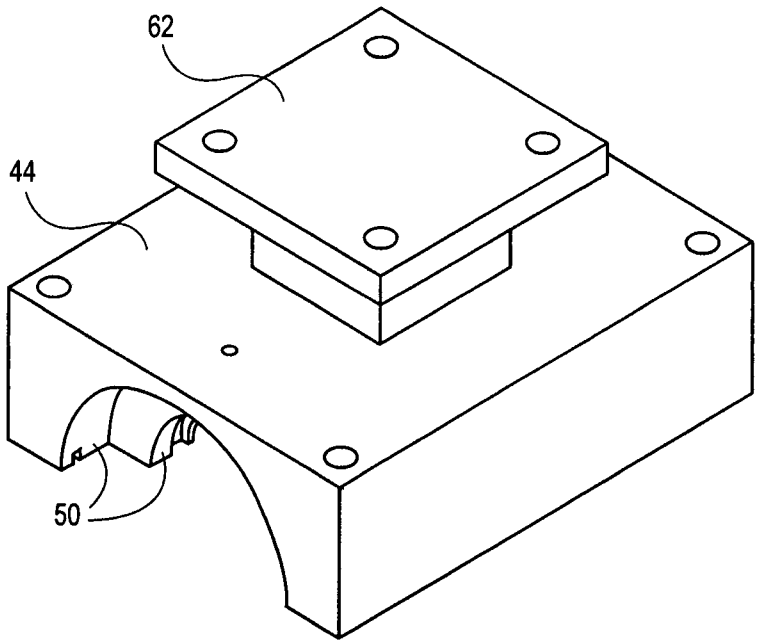


FIG. 5

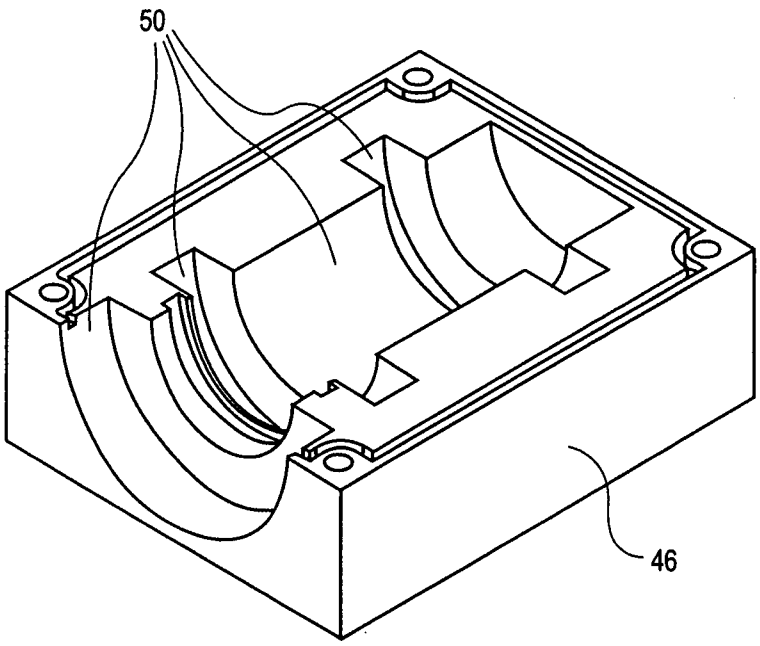


FIG. 6

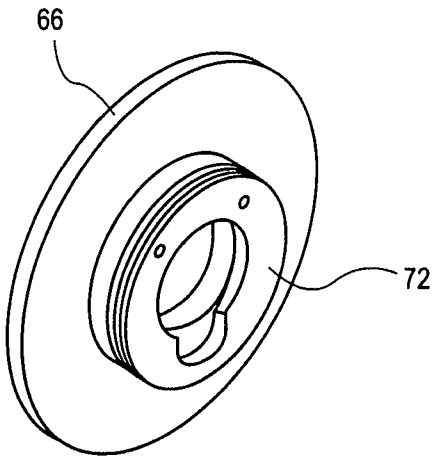


FIG. 7

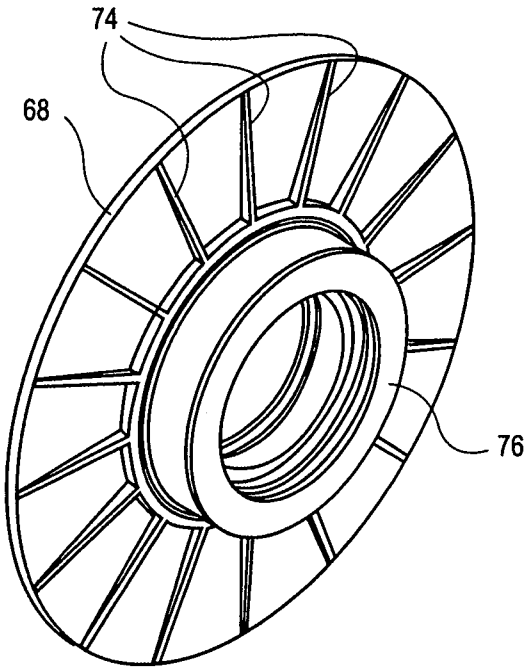


FIG. 8

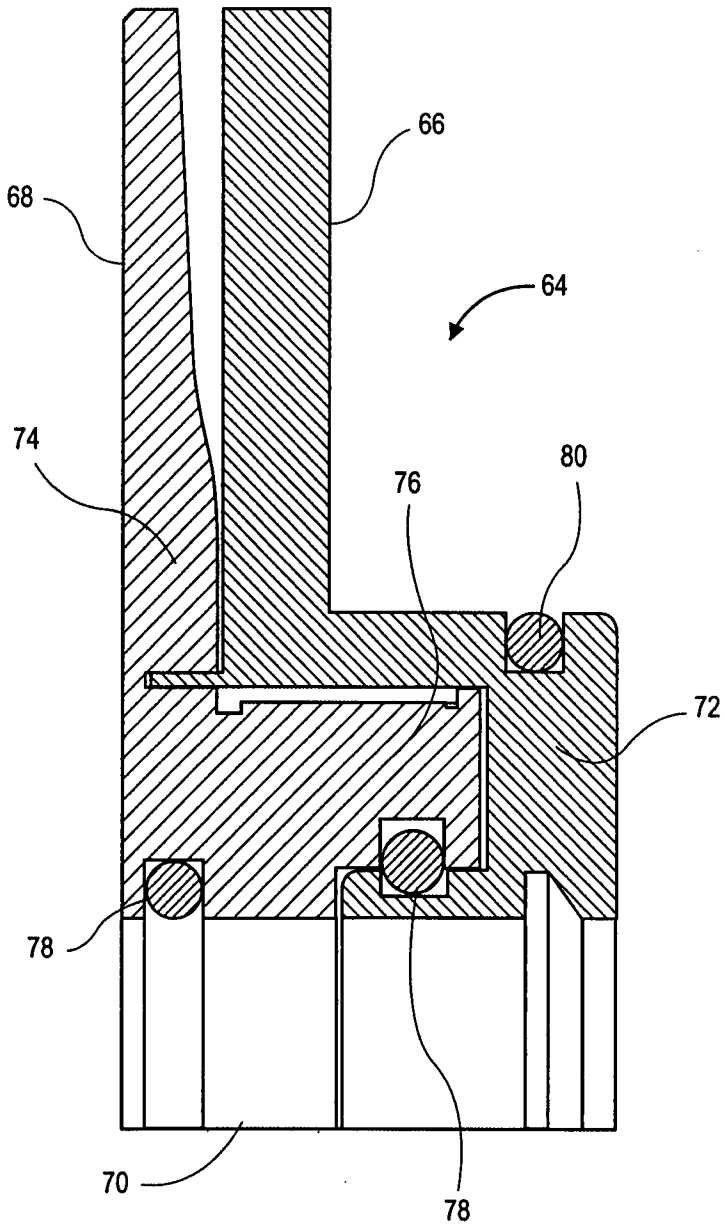
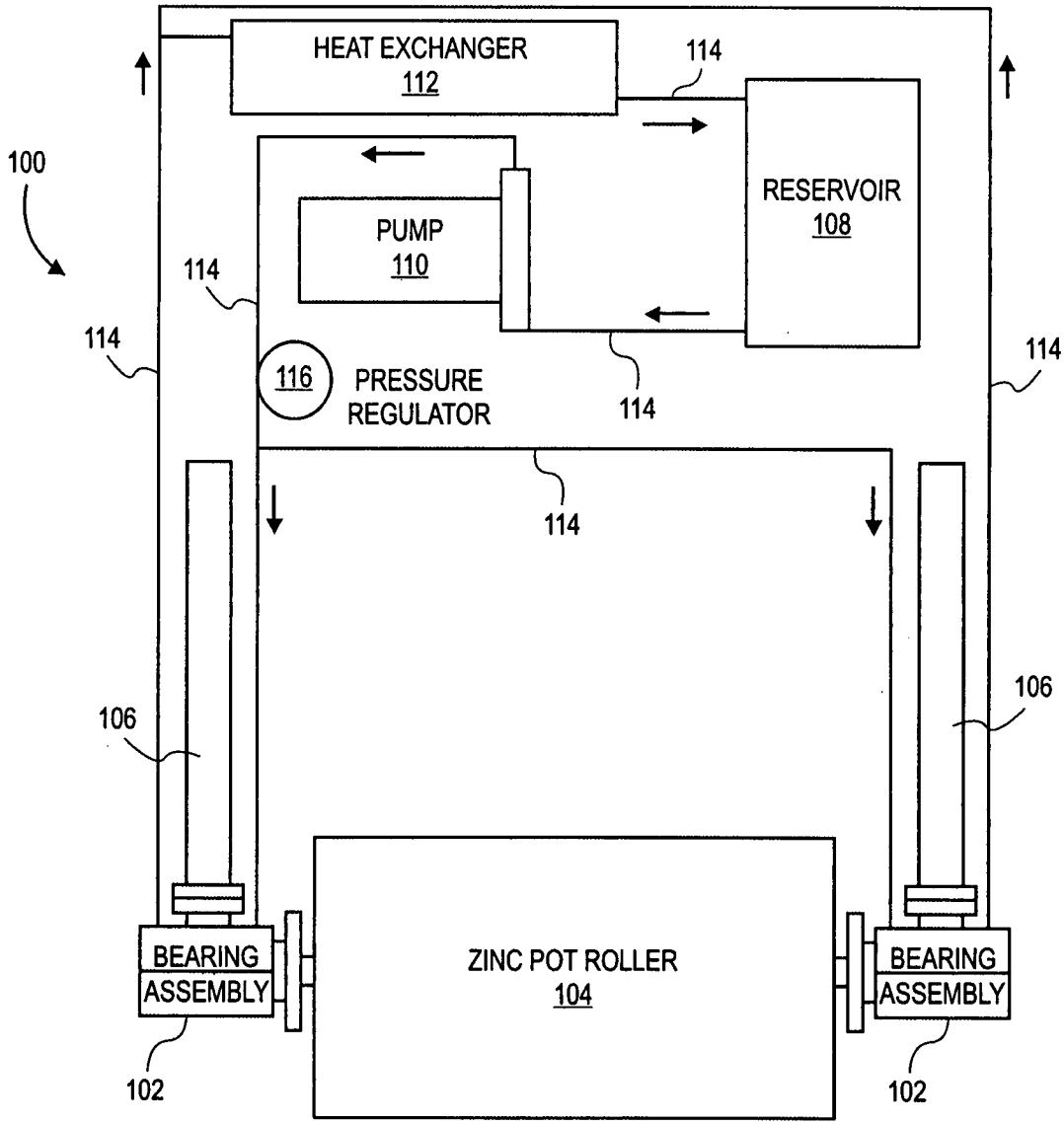


FIG. 9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PRESSURE
REGULATOR
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114
106
106
BEARING
ASSEMBLY
ZINC POT ROLLER
104
BEARING
ASSEMBLY
102
102

FIG. 10