Feb. 13, 1940. C. B. DALZELL ET AL 2,190,443

SEALING MEANS FOR ROTARY SHAFT OPENINGS

Filed Jan. 20, 1938 2 Sheets-Sheet 1

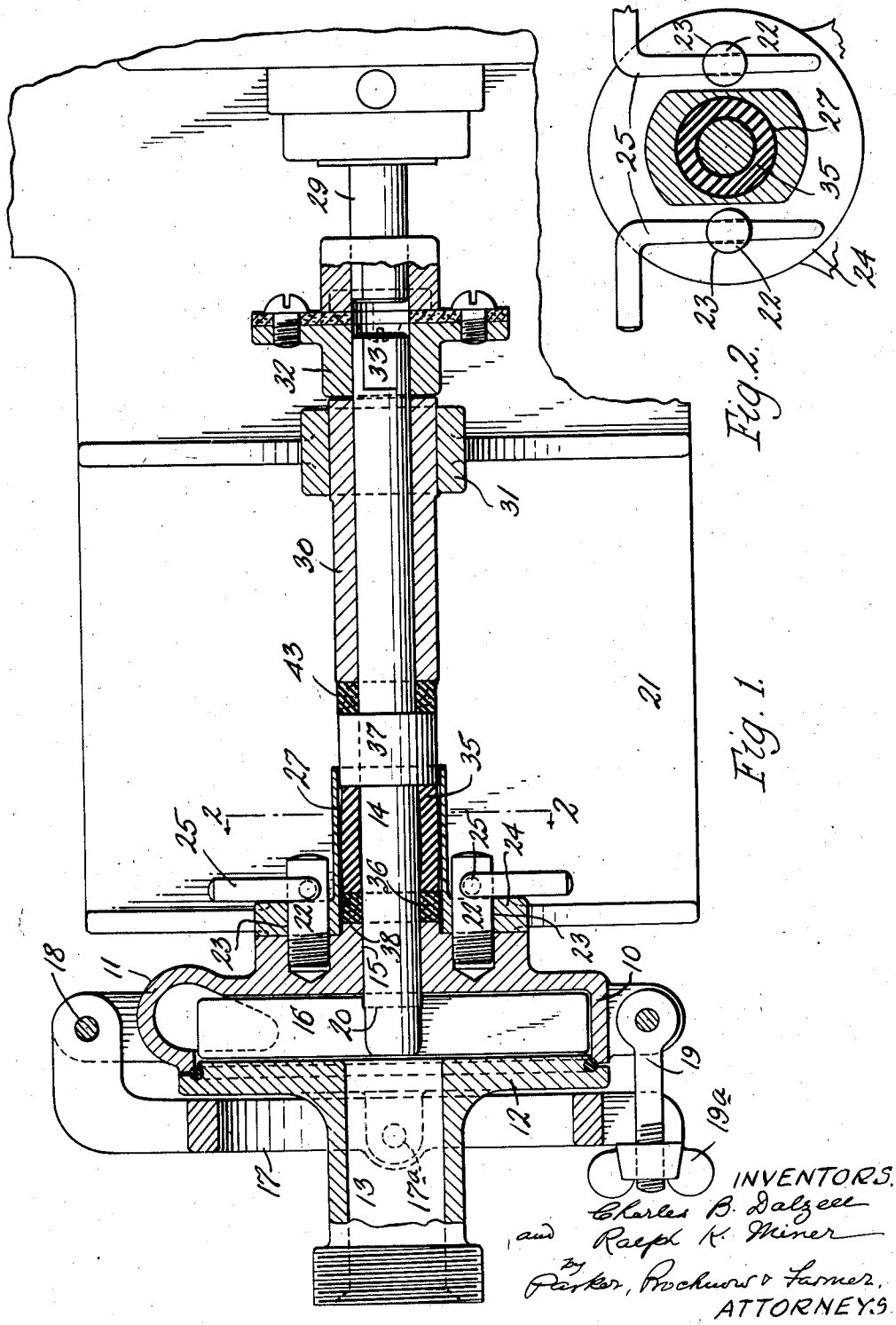


Fig. 1.

Fig. 2.

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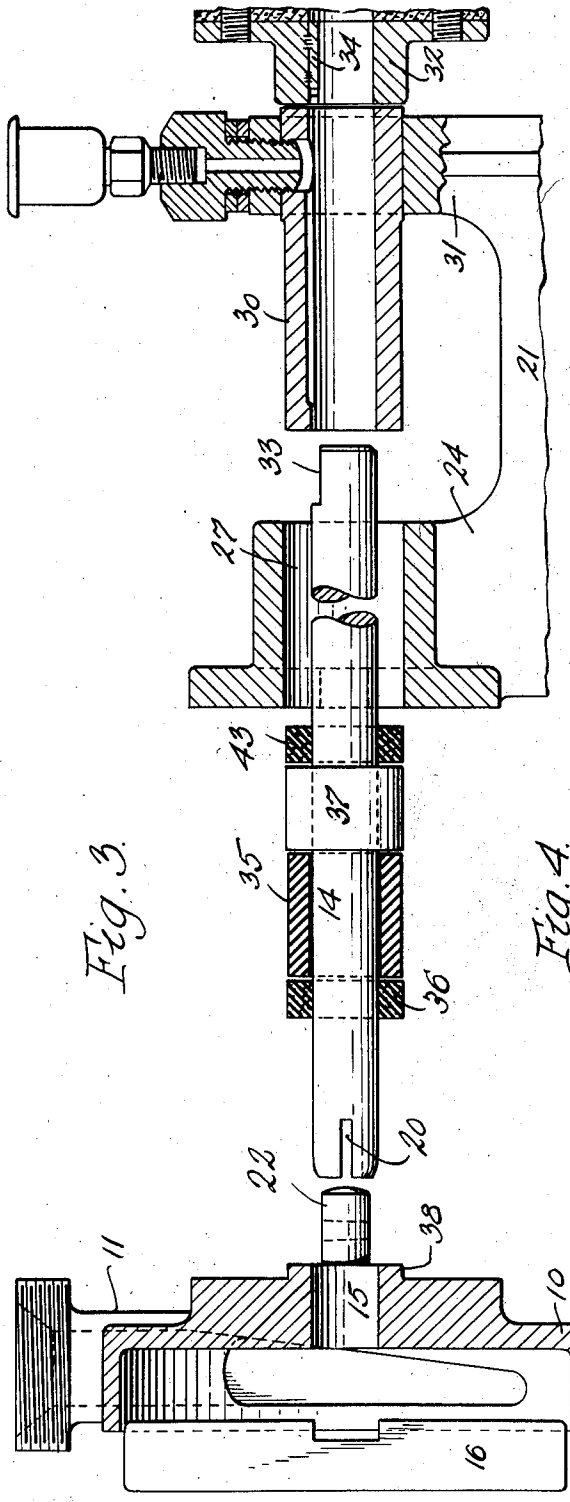


Fig. 3.

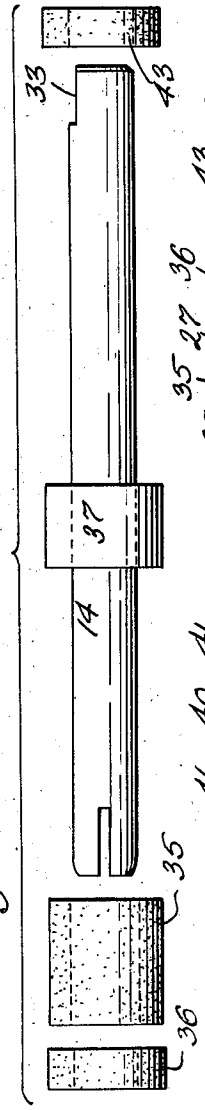


Fig. 4.

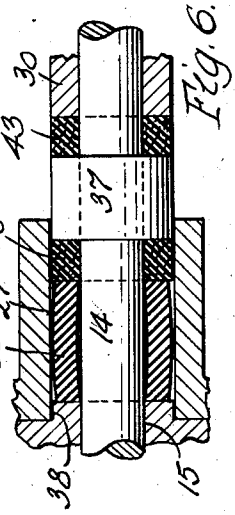


Fig. 6.

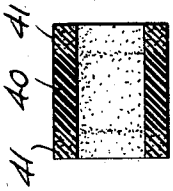


Fig. 7.

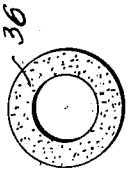


Fig. 5.

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2,190,443

SEALING MEANS FOR ROTARY SHAFT OPENINGS

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Application January 20, 1938, Serial No. 185,916

10 Claims. (Cl. 286—11)

This invention relates to pumps and the like having means for sealing the openings through which the rotary pump shafts pass out of the pump casings, and particularly to improvements in pumps which are used for handling liquids, such for example, as milk, and have to be frequently taken apart or disassembled for sterilizing or cleaning all parts thereof, including the sealing means, with which the liquid contacts to keep the pumps in proper sanitary condition.

The objects of the invention are to provide a novel and improved pump or the like construction having efficient sealing means for the rotary shaft opening thereof, which will enable quick and easy disassembling and asembling of the parts; also to provide efficient pump sealing means of simple and inexpensive but durable construction which are adapted to operate dry or without liquid lubrication; which will efficiently seal the shaft opening and reduce the wear due to end thrust on relatively movable parts; and which have the other features of improvement and advantage hereinafter described and set forth in the claims.

In the accompanying drawings:

Fig. 1 is a longitudinal, sectional plan view of a centrifugal pump provided with sealing means embodying the invention.

Fig. 2 is a transverse, sectional elevation thereof on line 2—2. Fig. 1.

Fig. 3 is a fragmentary, longitudinal, sectional elevation thereof showing the parts disconnected and partially disassembled.

Fig. 4 is an elevation of the shaft and sealing means removed and separated.

Fig. 5 is an end elevation of the sealing ring or body.

Fig. 6 is a longitudinal, sectional elevation showing a slightly modified arrangement of the parts of the sealing means.

Fig. 7 is a sectional elevation of a seal means of slightly modified construction.

The sealing means are herein disclosed as applied to a centrifugal milk pump which, as illustrated in the drawings, see particularly Fig. 1, comprises a pump casing or cylinder 10 provided with a peripheral liquid discharge connection 11, a removable outer head or cover 12 provided with a central liquid inlet connection 13, a rotary pump shaft 14 extending out of the casing through a shaft opening 15 in the inner end wall of the casing, and a rotor or impeller 16 in the pump casing on the inner end of the pump shaft. The cover 12 is removably secured in place to close the outer end of the casing, as by a yoke 17 on which the cover is pivotally mounted at 17a, and which is suitably hinged at one end at 18 on one side of the pump casing, and is adapted to be forced inwardly to secure the cover tightly in closed position against a sealing gasket at the outer end of the casing, as by a screw 19 hinged on the opposite side of the casing and provided with a wing nut 19a adapted to engage the free end of the yoke, which is slotted to releasably receive the screw. By unscrewing or loosening the nut, the yoke and cover carried thereby can be swung outwardly to open up the pump casing. The impeller 16 shown consists of a flat blade or plate removably seated in a diametrical slot 20 in the inner end of the pump shaft so that when the cover is opened, the impeller can be removed simply by pulling it out of the shaft slot. A notch is shown in the inner edge of the impeller blade to receive the portion of the shaft at the inner end of the shaft slot to prevent radial displacement of the impeller.

Preferably the pump casing is detachably mounted on a base 21 so as to permit its ready dismounting and the removal of the pump shaft, for which purpose, in the canstruction shown, the casing is provided at its inner end with outwardly projecting fixed studs 22 removably secured in holes 23 in an upright fixed support or part 24 of the pump base. The studs may be removably secured in the holes 23 by any suitable means, such as taper pins 25 passing through diametrical holes in the studs 22 at and engaging the outer end of the support 24. The taper pins shown are provided with laterally projecting upper ends to facilitate their insertion and removal. By driving or forcing the pins tightly into the holes of the studs, the latter are drawn inwardly and draw the pump casing tightly up against the adjacent face of the support.

The pump shaft passes through a preferably cylindrical opening 27 extending through the su pport 24 and is detachably or removably connected at its outer end to a motor shaft or other drive element 29. As shown, the pump shaft 14 extends through a bearing sleeve or bushing 30 fixed in a second standard 31 on the pump base, and its outer end has a driving connection with one member 32 of an ordinary flexible coupling, the other member of which is fixed on the drive shaft 29. The driving connection between the pump shaft and the coupling may be formed by providing the end portion of the pump shaft with a flat side face 33 arranged to engage a complementary flat face or key 34 in the hub of the coupling member 32. When the pump casing is

unfastened and removed from the support 24, this connection between the pump shaft and the drive shaft permits the pump shaft to be pulled endwise out through its bearing 30 and the opening 27 of support 24 on the pump base.

The described construction of the pump, that permits ready disconnection and removal or disassembly of its parts, including the pump shaft, to facilitate cleaning them, is shown and described herein to give a clear understanding of the construction and arrangement of the sealing means, which also are constructed and arranged to enable ready removal or disassembly of the parts of the seal in order that these also may be quickly and thoroughly cleaned. However, the sealing means are applicable to pumps and the like of other constructions.

The sealing means comprise a flexible elastic sleeve or ring 35 which surrounds the pump shaft, and a sealing body 36 also surrounding the shaft and held by the elastic sleeve in sealing contact with a complementary sealing part or face. In the embodiment shown in Figs. 1 to 4, the elastic sleeve surrounds the pump shaft within the opening 27 in the support 24 between a fixed collar 37 on the pump shaft and the outer end face of a central integral boss 38 on the end wall of the pump casing which projects into the inner end of the opening 27. In this embodiment the sealing body 36 is in the form of a separate ring or washer arranged between the end of the boss 38 and the inner end of the elastic sleeve. When the pump casing is drawn up tight against the inner end of the support 24 by its taper pins or other securing means, the elastic sleeve is compressed somewhat against the shaft collar 37 and thus presses the sealing body 36 against the end wall of the pump casing around the shaft opening therein. The collar 37 is of such dimension that it forms a substantial closure for the outer end of the opening 27, thereby preventing foreign matter from easily entering into the opening 27 wherein it may contact the sealing element when the pump is assembled. The elastic sleeve and sealing body are loose on the shaft and in the opening 27, which forms a sealing or protecting chamber. In this arrangement, the elastic sleeve and sealing body tend to rotate with the shaft, the sealing body running in sealing contact with the end face of the casing and being compressively sealed against the adjacent face of the elastic sleeve which in turn is compressively sealed at its opposite end against the collar 37 on the shaft 14.

Instead of this arrangement of the sealing ring 36 between the elastic sleeve and the end of the casing, the parts can be reversed as shown in Fig. 6, with the sealing ring 36 arranged between the outer end of the elastic sleeve and the collar 37 on the shaft, in which case the elastic sleeve tends to remain stationary and hold the sealing ring stationary against the end face of the shaft collar 37, which rotates. In some respects this arrangement with the sealing body or ring 36 contacting with the shaft collar 37 may be preferable, since any wear which may occur will be on the shaft collar, and this can be replaced at less expense than the pump casing, on which the wear, if any, would occur in the first described arrangement of the parts.

The sealing ring or body 36 may be made of any suitable material which will run satisfactorily against the complementary sealing face without causing undue wear, a material having antifriction characteristics being preferred. A solid body or ring of carbon or graphite has been found satisfactory and efficient for the purpose. The carbon is hard enough to prevent objectionable wear or rubbing off of the carbon, and at the same time it automatically furnishes the necessary lubrication to take care of slight thrust due to the compression produced by the elastic sleeve, and thus obviates the necessity for oil or other lubricant on the relatively movable sealing faces.

If desired, two sealing rings or bodies 36 could be provided at opposite ends of the elastic sleeve, one between the sleeve and the shaft collar 37 and the other between the opposite end of the sleeve and the end face of the pump casing, but the duplication of the sealing bodies has not been found necessary.

In the embodiments of the invention above described, the sealing body 36 is formed by a ring, washer or gasket separate from the elastic sleeve or ring, but if desired, the seal could be formed by a flexible elastic sleeve or ring made with an integral or permanently attached sealing body or hardened end portion adapted to be held by the flexible elastic portion of the sleeve or ring against the complementary sealing face on the pump casing or shaft. Such a construction is illustrated in Fig. 7, in which 40 represents the flexible elastic portion of the ring or sleeve and 41 integral sealing bodies or hardened portions at the opposite ends of the flexible portion, one adapted to contact the sealing face on the casing and the other contact the sealing face of the shaft collar 37. The hardened sealing bodies 41 of the ring or sleeve can be suitably hardened integral end portions of the elastic sleeve, or bodies of suitable anti-friction material vulcanized to the ends of the flexible elastic body of the ring or sleeve.

In Figs. 1, 3, 4 and 6, an additional sealing washer or ring 43, similar to the ring 36 is arranged between the shaft collar 37 and the adjacent end of the bearing 30, with the opposite ends of this ring pressed against the collar and the end of the bearing by the compression of the elastic sleeve 35, by virtue of which the shaft 14 is mounted in proper operative position. This ring 43 provides a seal at the end of the bearing 30 and may be of carbon or other suitable antifriction material having lubricating qualities which will take care of the wear due to end thrust between the shaft collar and the bearing. This supplemental ring or washer 43 can be used or not, as may be found necessary or desirable.

The sealing chamber or opening 27 in the support 24, which is substantially closed or sealed at its outer end when the pump is assembled by the collar 37, is large enough in diameter to allow the shaft collar to slip freely therethrough, and, as will be clear from Figs. 3 and 4 of the drawings, when the pump casing has been detached from the support, it can be removed and the shaft with the sealing sleeve 35, and ring 36 can be pulled out of the sealing chamber and the sealing elements slipped off of the shaft so that all of these parts are accessible for thorough cleaning. The shaft can be removed together with the casing when removing the latter or separately therefrom after the casing has been removed.

We claim as our invention:

1. The combination of a casing, a rotary shaft passing through a shaft opening in a wall of the casing, said wall and shaft having opposed faces

transverse to the axis of the shaft, means forming a fixed sealing chamber around the shaft outwardly from said wall, said casing wall being removably mounted at the inner end of said sealing chamber and movable off of said shaft, sealing means for said shaft opening comprising an elastic imperforate walled sleeve surrounding the shaft in said sealing chamber between said opposed faces, and a sealing body which surrounds the shaft in said sealing chamber and is pressed axially by said sleeve against one of said faces by reaction of said sleeve against said other face, said sleeve and sealing body being loose in and removable with the shaft from said sealing chamber through said inner end thereof when the casing has been removed from the inner end of the sealing chamber and said sleeve and sealing body being removable from said shaft when the shaft is withdrawn from the casing.

2. The combination of a pump casing, a rotary shaft passing through a shaft opening in a wall of the casing, a fixed support external to the casing having a sealing chamber through which the shaft passes from the casing and at the inner end of which said casing wall is removably secured on said support, said shaft having a fixed collar thereon within said sealing chamber providing a face outwardly beyond and opposed to the outer face of said casing wall, sealing means for said shaft opening comprising an elastic imperforate walled sleeve surrounding the shaft between said opposed faces, and an annular sealing body which surrounds the shaft and is pressed by said elastic sleeve against one of said faces by reaction of the sleeve against said other face, said sleeve and sealing body being loosely confined in said sealing chamber and removable with the shaft through said inner end of the sealing chamber when said casing wall is removed from said support and said sealing body and sleeve being loose on and removable from said shaft.

3. The combination of a casing, a rotary shaft passing through a shaft opening in a wall of the casing, a fixed support external to the casing having an axial opening through which said shaft passes from the casing and at the inner end of which said casing wall is removably secured, said shaft having a transverse annular face outwardly beyond and opposed to the outer face of said casing wall, sealing means for said shaft opening comprising an elastic imperforate walled sleeve surrounding the shaft between said opposed faces, and an annular sealing body which surrounds the shaft and is pressed by said elastic sleeve against one of said opposed faces by reaction of the sleeve against said other face, said sleeve and sealing body being of smaller diameter than and removable with the shaft through said inner end of said support opening when said casing wall is removed from said support and said sealing body and sleeve being loose on and removable from said shaft.

4. The combination of a casing, a rotary shaft passing through a shaft opening in a wall of said casing, a fixed support for said casing having an aperture in alignment with said shaft opening in said casing when said casing is mounted upon said support, said shaft having a transverse annular face outwardly beyond and opposed to the outer face of said casing wall, sealing means for said shaft opening comprising a resilient imperforate walled sleeve telescoped over the rotary shaft and occupying a position intermediate the opposed faces when said shaft, said walled sleeve and said casing are mounted in operative position relative to said fixed support, and an annular sealing body which surrounds the shaft and is pressed by said resilient sleeve against said wall face by the reaction of said sleeve against said shaft face, said sleeve and sealing body being of smaller diameter than the aperture in said support and being loosely mounted on and removable from said shaft through said aperture in said support when said casing wall is removed from said support.

5. The combination of a casing, a rotary shaft passing through a shaft opening in a wall of said casing, a fixed support for said casing having an aperture in axial alignment with said shaft opening in said casing when said casing is mounted upon said support, said shaft having a transverse annular face outwardly beyond and opposed to the outer face of said casing wall, sealing means for said shaft opening comprising a resilient imperforate walled sleeve telescoped over the rotary shaft and occupying a position intermediate the opposed faces when said shaft, said walled sleeve and said casing are mounted in operative position relative to said fixed support, and an annular sealing body which surrounds the shaft and is pressed by said resilient sleeve against said shaft face by reaction of the sleeve against said wall face, said sleeve and sealing body being of smaller diameter than the aperture in said support and being loosely mounted on and removable from said shaft through said aperture in said support when said casing wall is removed from said support.

6. The combination of a casing, a rotary shaft passing through a shaft opening in a wall of the casing, a fixed support external to the casing having an axial opening through which said shaft passes from the casing and at the inner end of which said casing wall is removably secured, said shaft having a transverse annular face outwardly beyond and opposed to the outer face of said casing wall, and sealing means for said shaft opening comprising an elastic imperforate wall having a structurally integral end formed of anti-friction material and surrounding the shaft between said opposed faces, said anti-friction end of said sleeve being pressed by said elastic sleeve against one of said opposed faces by reaction of the sleeve against said other face, said sleeve with its structurally integral anti-friction end being of smaller diameter than and removable with the shaft through said inner end of said shaft opening when said casing wall is removed from said support and said sleeve together with its structurally integral anti-friction end being loose on and removable from said shaft.

7. The combination of a casing, a rotary shaft passing through a shaft opening in a wall of the casing, a fixed apertured support external to the casing in which said aperture is in axial alignment with said shaft opening when said casing is mounted upon said support, means for removably mounting said casing upon said support, a collar fixed on said shaft and having a transverse annular face outwardly beyond and opposed to the outer face of said casing wall, sealing means for said shaft opening comprising an elastic imperforate walled sleeve surrounding a portion of the shaft between said opposed faces, and an annular sealing body at each end of said sleeve surrounding the shaft and adapted to be pressed by said elastic sleeve against said opposed faces when the casing is mounted upon said support.

8. The combination of a casing, a rotary shaft passing through a shaft opening in a wall of the casing, a fixed apertured support external to the casing upon which said casing may be removably mounted by drawing said casing toward said support in alignment with said shaft, a support for said rotary shaft, a fixed collar on said shaft adjacent said support providing a face opposed to the adjacent face of said casing wall, sealing means for said shaft opening comprising an elastic imperforate walled sleeve surrounding a portion of the shaft between said opposed faces, and an annular sealing body which surrounds the shaft and is pressed by said elastic sleeve against one of said opposed faces by reaction of the sleeve against the other face, said sleeve and sealing body being compressible against said opposed faces and said collar on said shaft being biased toward said shaft support upon the tightening of said casing upon said casing support for the operative assembly of said casing, rotary shaft, shaft opening and sealing means upon the said supports.

9. The combination of a pump casing, a rotary shaft passing though a shaft opening in a wall of the casing, a fixed apertured support external to the casing upon which said casing is removably secured, a support for said rotary shaft, a fixed collar on said rotary shaft adjacent said support when assembled with said casing for operation and having a face outwardly beyond and opposed to the outer adjacent face of said casing wall, sealing means for said shaft opening also comprising shaft positioning means comprised of an elastic imperforate walled sleeve surrounding a portion of the shaft between said opposed faces, and an annular sealing body which surrounds the shaft and is pressed by said elastic sleeve against one of said opposed faces by the reaction of the sleeve against said other face, said sleeve and sealing body being loosely carried on said shaft, whereby upon the assembly of said shaft in said support and said casing upon said casing support said elastic sleeve will be compressed, thereby exerting pressure against said collar on said shaft to bias the same toward said shaft support and thereby maintaining the same in operative position.

10. A sealing means for a rotary shaft passing through a shaft opening in a wall of a casing comprising, in combination, an elastic imperforate walled sleeve telescoped onto said shaft, which shaft has an outer transverse face opposed to an adjacent face on said wall, a fixed support for removably supporting said casing and having a shaft aperture axially aligned with the shaft opening in the casing wall when the casing is operatively supported on said support, and at least one sealing body telescoped onto said shaft and pressed by said sleeve against one of the opposed faces by the reaction of the sleeve against the other of the opposed faces, said sleeve and said sealing body being loose on and removable from said shaft and being of such proportion and construction and also being so arranged upon said shaft that, upon removal of said casing from said support, said sleeve and said sealing body may be removed from said shaft through the aperture in said support.

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