

Dec. 19, 1933.

H. H. FITCH ET AL

1,940,410

PUMPING APPARATUS

Filed Oct. 2, 1930

3 Sheets-Sheet 1

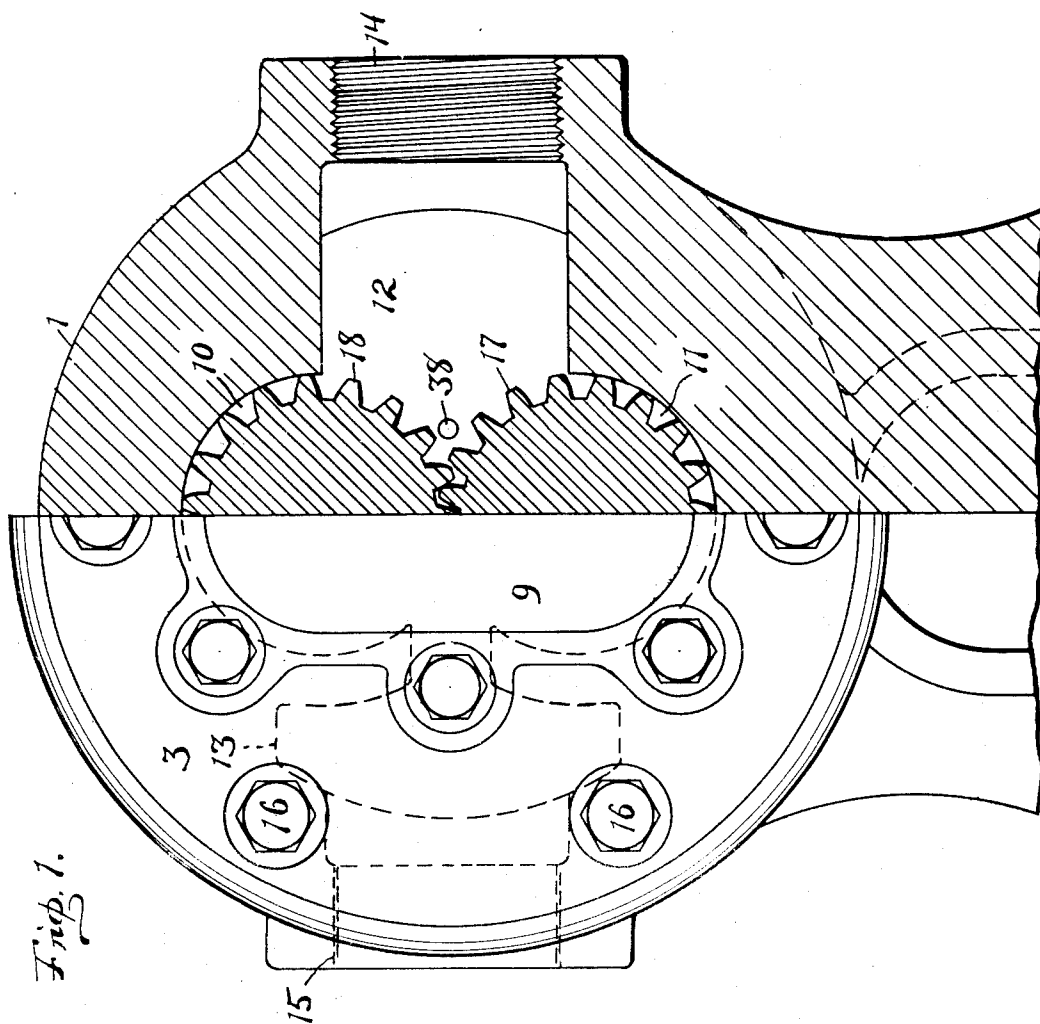


Fig. 1.

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3 Sheets-Sheet 2

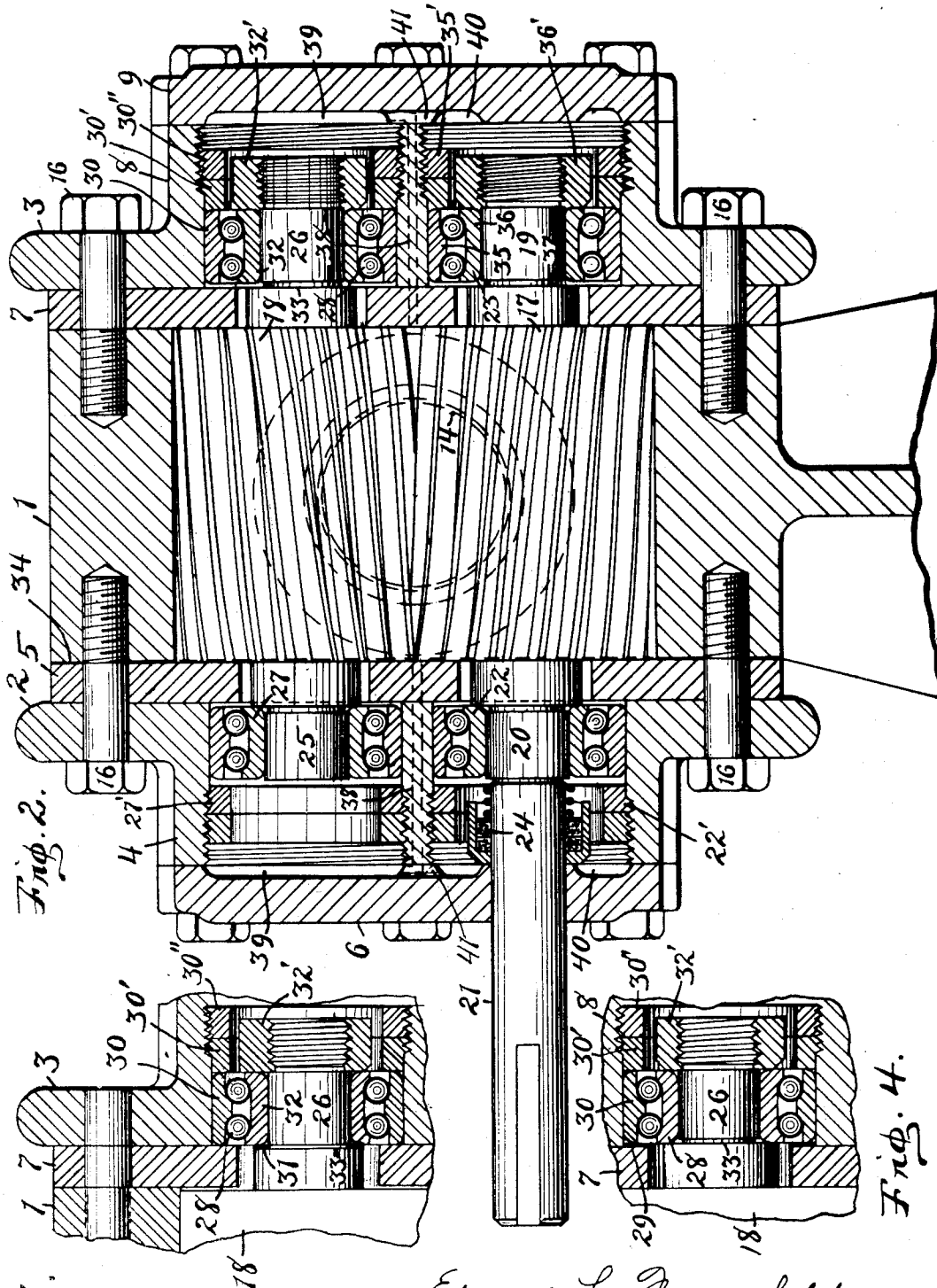


Fig. 2.

Fig. 3.

Fig. 4.

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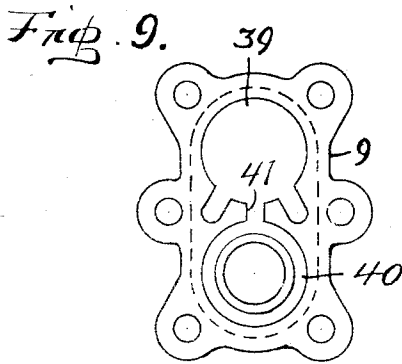
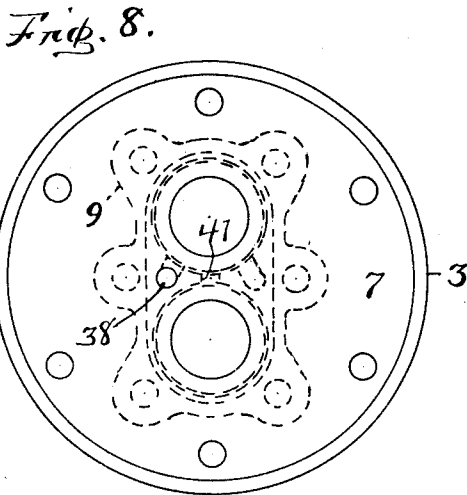
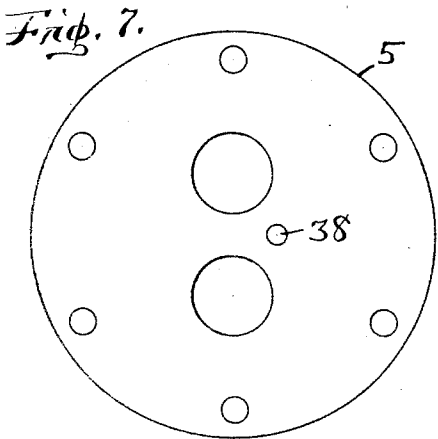
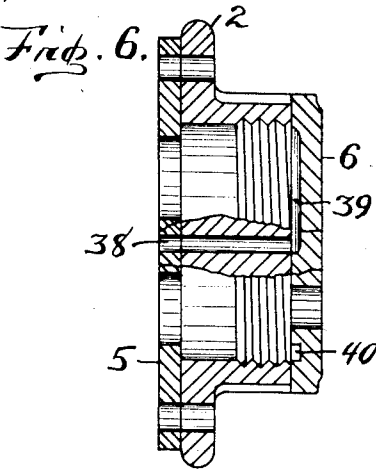
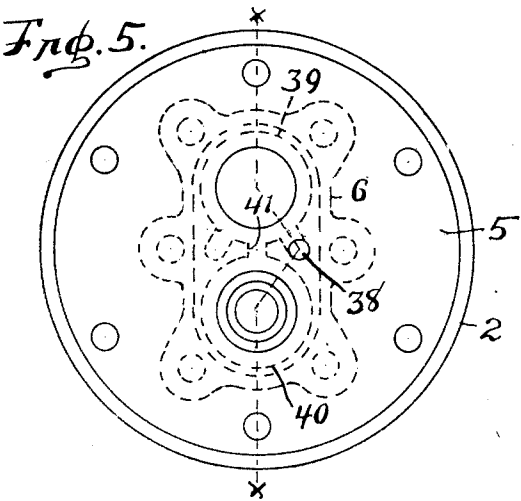
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UNITED STATES PATENT OFFICE

1,940,410

PUMPING APPARATUS

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Application October 2, 1930. Serial No. 485,962

14 Claims. (Cl. 103—126)

This invention relates to improvements in pumping apparatus adapted to develop liquid under high pressure. One of the objects of the invention is to provide in a pump construction means whereby liquid propelling members are closely confined within a housing provided therefor in such manner as to reduce leakage between the housing and said members. Another object is to afford means whereby liquid such as may leak from between the propelling members and the housing into the bearings for said members is drawn into the suction chamber of the pump.

One object of the invention is not only to obtain the leak-proof advantages but to obtain the maximum non-leakage arrangement with the highest pumping efficiency and couple the same with the construction of parts such that they are substantially identical, whereby in production the parts that are associated together may be matched for micrometer likenesses to secure that maximum non-leaking arrangement and thereby obtain the maximum efficiency and this object is obtained by the peculiarities of construction hereinafter set forth.

Other objects and advantages of the invention will appear hereinafter.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which:—

Fig. 1 is an end elevation of a pump in which the invention is embodied, a portion thereof being in section;

Fig. 2 is a longitudinal central section of the pump shown in Fig. 1;

Fig. 3 is a detail view in section including a shim as applied for adjusting one of the propelling members inwardly from the adjacent head-plate;

Fig. 4 is another similar detail view including a shim applied for adjusting one of the propelling members outwardly against the adjacent head-plate;

Fig. 5 is an elevation of one of the cylinder heads for the pump housing viewing the inner face thereof;

Fig. 6 is a section of a cylinder head on the line $x-x$ of Fig. 5;

Fig. 7 is an elevation of one of the head-plates forming part of one of the cylinder heads;

Fig. 8 is an elevation of the rear cylinder head viewed from the inner face thereof;

Fig. 9 is an end elevation of the cap forming part of the cylinder head shown in Fig. 6.

The pump shown in Figs. 1 to 9 inclusive is comprised of a housing, one part of which constitutes

a cylinder or casing 1 which is closed at its ends respectively by the cylinder heads 2 and 3 which are substantially identical in structure. The cylinder head 2 consists of a bearing box 4, a head-plate 5, and a cap 6, the box 4 being disposed between the head-plate and cap. The cylinder head 3 also is composed of a head-plate 7, a bearing box 8 and a cap 9, similarly arranged. Cap 6, herein, is apertured for reception of drive shaft 21 and in that respect only differs from cap 9.

The cylinder or casing 1 has two circular bores 10 and 11 longitudinally disposed, the adjacent radii of which intersect each other, and is provided with a suction chamber 12 and a discharge chamber 13 located upon the opposite sides of said longitudinal bores, both of which communicate therewith. The suction chamber has an inlet opening 14 and the discharge chamber has an outlet opening 15. The heads 2 and 3 are secured respectively to the corresponding ends of the cylinder or casing 1 by means of bolts 16 with said head-plates 5 and 7 positioned against the cylinder and interposed between boxes and casing.

Within the bores 10 and 11 in the cylinder 1 are disposed a pair of propelling members, each consisting of a gear, 17 and 18 respectively, arranged so as to mesh with each other. Each gear is of the same length as the width of the casing. In mass production each unit, that is the casing and gears, are matched to the same micrometer lengths. The gear 17 has axial projections 19 and 20 that project from its ends, and a drive-shaft 21 contiguous with the projection 20 extends through the cap 6 of the cylinder head 2, there being provided in the boxes 4 and 8 bearings 22 and 23 respectively for the projections 20 and 19. Also, in the bearing box 4 are provided spring pressed packing rings 24 that encompass the drive shaft 21 suitably arranged to prevent leakage about the shaft from within the box through the cap 6.

The gear 18 has axial projections 25 and 26 that extend respectively into the boxes 4 and 8, there being provided in said boxes corresponding bearings 27 and 28 for said projections. When the drive shaft is rotated the gears 17 and 18 are revolved so that fluid entering the suction chamber 12 is thereby impelled into the discharge chamber 13 as is customary in the operation of gear pumps.

In order to prevent leakage between the ends of the gears and the head-plates 5 and 7 it is essential that the head-plates are held in close

contact with the ends of the gears, and it is also essential that the pressure of the head-plate against the ends of the gears is not so great as to bind the gears tightly between the head-plates and thus prevent rotation thereof. For the purpose of adjusting the gears, the bearings therefor and the head-plates, with respect to each other, (Figs. 2, 3 and 4) there is provided a shim 29 (Fig. 4) that may be placed between the external raceway 30 of the bearing 28 and the adjacent face of the head-plate 7 whereby the end of the gear 18 is drawn against the head-plate 7 with more or less displacement dependent upon the thickness of the shim 29 when the raceway 30 is tightened against the shim by tightening the lock rings 30' and 30''.

Should the pressure of the gear 18 against the head-plate 7 be so great as to hamper rotation of the gear, the shim 29 may be eliminated and in lieu thereof a shim 31 (Fig. 3) may be inserted between the internal raceway 32 of the bearing 28 and a shoulder 33 on the axial projection 26 whereby pressure of the gear 18 against the head-plate 7 is relieved more or less dependent upon the thickness of said shim. In this manner the extent of the displacement of the end of the gear 18 against the head-plate 7 is adjustably varied and consequently the effectiveness of the seal and the efficiency of the pump is controlled.

The pressure of the gear 18 against the head-plate 5 may be adjustably varied when so required by inserting a shim 34 (Fig. 2) of suitable thickness between the head-plate 5 and the corresponding end of the cylinder 1. Thus, by applying shims 29, 28 and 34 as may be required the gear 18 may be secured snugly between the head-plates 5 and 7. The gear 18 clears both plates 5 and 7. The gear 18 is held for thrust in either direction from one end only and the other end floats. Also, by applying shims in similar manner (not shown) between the external raceway 35 of the bearing 23 and the head-plate 7, or between the internal raceway 36 of the bearing 23 and the shoulder 37 on the axial projection 19, the displacement of the gear 17 against the head-plate 7 may be adjustably varied. The shim 34 serves also to adjust the pressure when required between the end of the gear 17 and the head-plate 5.

The external raceway 30 of the bearing 28 is held against the head-plate 7, or against the shim 29 when the shim is inserted therebetween, by means of a threaded ring 30' in the bearing box 8, there being provided a lock-ring 30'' to prevent the former ring from loosening. Also, the internal raceway 32 is held against the shoulder 33, or against the shim 31 when inserted therebetween, by a threaded collar 32' on the outer end of the axial projection 26. The outer raceway 35 of the bearing 23 is likewise held against the head-plate 7 by corresponding threaded rings 35', and the internal raceway 36 is held against the shoulder 37 by a threaded ring 36' on the axial projection 19. The bearings 23 and 28 are of that type so constituted when confined as to resist end thrust of the members supported thereby, and thus when their external raceways are clamped in place between the head-plates 7 and their retaining rings, and their internal raceways are clamped between the shoulders on the axial projections for the gears and the retaining rings therefor, longitudinal play of said gears is resisted. The bearings 22 and 27 for the axial projections 20 and 25 respectively are loosely confined on said projections respectively between the

head-plate 5 and threaded rings 22' and 27' in the bearing box 4 so that endwise adjustments of the gears 17 and 18 is permitted as when the shims 29, 31 and 34 are applied.

A feature of the invention is the provision of a duct 38 in each cylinder head 2 and 3 that affords communication for liquid between the uppermost chamber 39 in the corresponding cylinder head and the suction chamber 12 whereby such liquid that may leak past the ends of the gears 17 and 18 and the head-plates 5 and 7 and accumulates in the bearing boxes 4 and 8 is admitted to the suction chamber 12. The lowermost chamber 40 in each cylinder head has communication with the uppermost chamber 39 thereof through a recess 41 made in the corresponding caps 6 and 9 so that leakage of liquid into said lowermost chamber 40 overflows through the recess 41 into the upper chamber 39 from which it passes with the accumulation of liquid in the upper chamber 39 through the duct 38 into the suction chamber. In this manner when the pump is in operation circulation of liquid through the bearing boxes is established. This is of advantage especially when the liquid passing through the pump is possessed of lubricating qualities, inasmuch as the bearings for the gears are lubricated thereby and accumulations of sludge in the bearing boxes is obviated.

We claim:

1. In a pump adapted for high pressure operation and commercial production and accompanied by high efficiency in operation, the combination with a pair of meshing gears of substantially equal length, a shaft for each gear and projecting oppositely beyond the same, an intermediate housing of substantially the said width as the gear length, and a plate for closing each open end of the housing and apertured to permit the projecting portions of the shaft to extend there-through, of a head structure operatively abutting each plate for closing the end of said housing, each head structure including a bearing box in the form of a chamber into which the projecting portion of the shaft extends, each shaft having at least one threaded end, an anti-friction bearing construction seated in each bearing box chamber and rotatably supporting the projecting portion of the associated shaft, a nut retainer threaded into each chamber and operatively bearing on the bearing construction, a lock nut threaded into each chamber for retaining the retainer nut in adjusted position, a nut threaded upon the threaded portion of the shaft and operatively bearing upon the bearing construction, and washer shim means associated with at least one projecting end of each shaft and positioned between the bearing construction and the plane of the plate opposite the face of the plate adjacent the gear, said head structure including detachable means for closing the chambers thereof.

2. A device as defined by claim 1, characterized by one of the washer shim means being interposed between the stationary portion of an anti-friction bearing and the plate.

3. A device as defined by claim 1, characterized by one of the projecting ends of the shafts including a shoulder and one of the washer shim means being interposed between the rotatable portion of one of the anti-friction bearing constructions and said shoulder.

4. A device as defined by claim 1, characterized by one of the washer shim means being interposed between the stationary portion of an anti-friction bearing and the plate, and one of the projecting ends of the shafts including a shoulder

and another of the washer shim means being interposed between the rotatable portion of another of the anti-friction bearing constructions and said shoulder.

- 5 5. In a pump adapted for high pressure operation and commercial production and accompanied by high efficiency in operation, the combination with a pair of meshing gears of substantially equal length, a shaft for each gear and projecting oppositely beyond the same, an intermediate housing of substantially the said width as the gear length, and a plate for closing each open end of the housing and apertured to permit the projecting portions of the shaft to extend there-
10 through, of a head structure operatively abutting each plate for closing the end of said housing, each head structure including a bearing box in the form of a chamber into which the projecting portion of the shaft extends, each shaft hav-
15 ing at least one threaded end, an anti-friction bearing construction seated in each bearing box chamber and rotatably supporting the projecting portion of the associated shaft, a nut retainer threaded into each chamber and operatively bearing on the bearing construction, a lock nut
20 threaded into each chamber for retaining the retainer nut in adjusted position, a nut threaded upon the threaded portion of the shaft and operatively bearing upon the bearing construction, and washer shim means associated with at least one projecting end of each shaft and positioned between the bearing construction and the plane of the plate opposite the face of the plate adjacent the gear, said head structure having
25 its chambers extending entirely therethrough, the end adjacent the plate being partially closed thereby, and said head structure including a single detachable cap for closing all of the chambers included in the head.
- 30 6. A device as defined by claim 5, characterized by one of the washer shim means being interposed between the stationary portion of an anti-friction bearing and the plate.
- 35 7. A device as defined by claim 5, characterized by one of the projecting ends of the shafts including a shoulder and one of the washer shim means being interposed between the rotatable portion of one of the anti-friction bearing constructions and said shoulder.
- 40 8. A device as defined by claim 5, characterized by one of the washer shim means being interposed between the stationary portion of an anti-friction bearing and the plate, and one of the projecting ends of the shafts including a
45 shoulder and another of the washer shim means being interposed between the rotatable portion of another of the anti-friction bearing constructions and said shoulder.
- 50 9. In a pump adapted for high pressure operation and commercial production and accompanied by high efficiency in operation, the combination with a pair of meshing gears of substantially equal length, a shaft for each gear and projecting oppositely beyond the same, an intermediate housing of substantially the said width as the gear length, and a plate for closing each open end of the housing and apertured to permit the projecting portions of the shaft to extend there-
55 through, of a head structure operatively abutting each plate for closing the end of said housing, each head structure including a bearing box in the form of a chamber into which the projecting portion of the shaft extends, an anti-friction

bearing construction seated in each bearing box chamber and rotatably supporting the projecting portion of the associated shaft, a nut retainer threaded into each chamber and operatively bearing on the bearing construction, a lock nut threaded into each chamber for retaining the
80 retainer nut in adjusted position, and washer shim means associated with at least one projecting end of each shaft and positioned between the bearing construction and the plane of the plate opposite the face of the plate adjacent the gear, said head structure having its chambers extend-
85 ing entirely therethrough, the end adjacent the plate being partially closed thereby, and said head structure including a single detachable cap for closing all of the chambers included in the head.

10. A device as defined by claim 9, characterized by one of the washer shim means being interposed between the stationary portion of an anti-friction bearing and the plate. 95

11. A device as defined by claim 9, characterized by one of the projecting ends of the shafts including a shoulder and one of the washer shim means being interposed between the rotatable portion of one of the anti-friction bearing constructions and said shoulder. 100

12. A device as defined by claim 9, characterized by one of the washer shim means being interposed between the stationary portion of an anti-friction bearing and the plate, and one of the projecting ends of the shafts including a shoulder and another of the washer shim means being interposed between the rotatable portion of another of the anti-friction bearing constructions and said shoulder. 105

13. In a pump for high pressure operation and commercial production and accompanied by high efficiency in operation, the combination of a pair of meshing gears of substantially equal length, a shaft for each gear and projecting oppositely beyond the same, a housing structure including a gear chamber therein of substantially the same width as the gear length and having closed opposite ends, said closed opposite ends being apertured to permit the projecting portions of the shafts to extend therethrough, of a head structure abutting each end of the housing structure for enclosing the projecting shaft ends, each head structure including a bearing box in the form of a chamber into which the projecting portion of the shaft extends, an anti-friction bearing structure seated in each bearing box chamber and rotatably supporting the projecting portion of the associated shaft, a nut retainer threaded into each chamber and operatively bearing on the bearing construction, a lock nut threaded into each chamber for retaining the retainer nut in adjusted position, and washer shim means associated with at least one projecting end of each shaft and positioned between the bearing construction and within the bearing box chamber, said head structure including detachable means for closing the chambers thereof, said housing structure including at least one parting to permit gear insertion. 115

14. A device as defined by claim 13, characterized by the shaft and the supported gear being integral and the parting in the housing structure being transverse to the axis of the gear when mounted therein. 125

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