

Feb. 2, 1960

R. F. HODGSON

2,923,248

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3 Sheets-Sheet 1

Fig.1

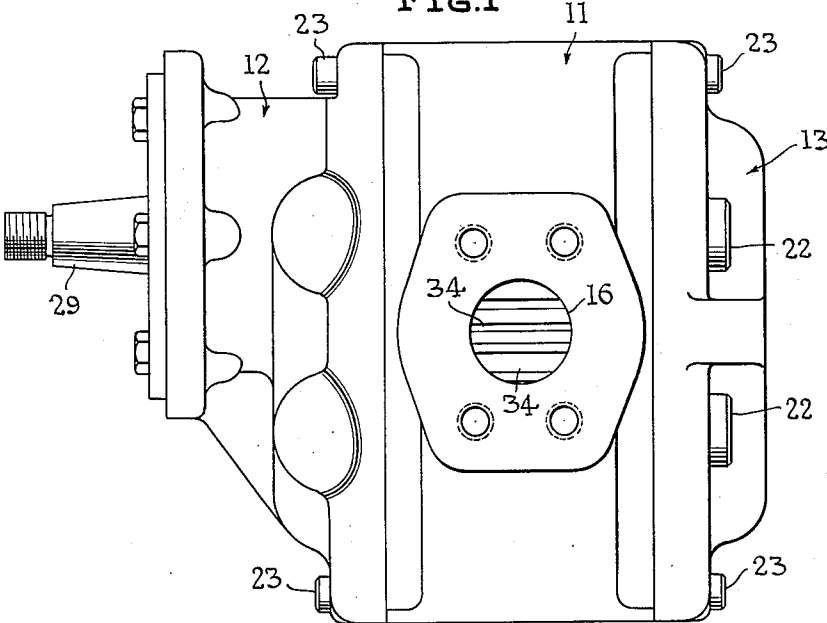
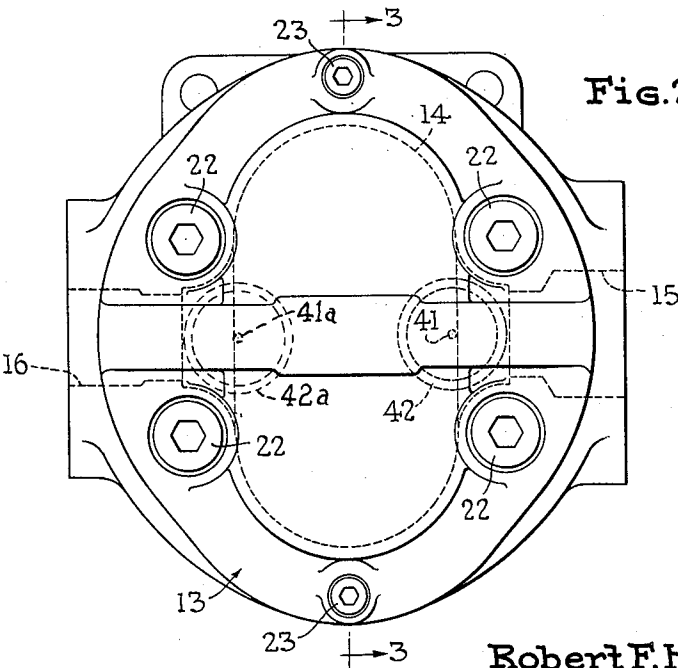


Fig.2



INVENTOR

Robert F. Hodgson

BY

Dodge and Sons

ATTORNEYS

Feb. 2, 1960

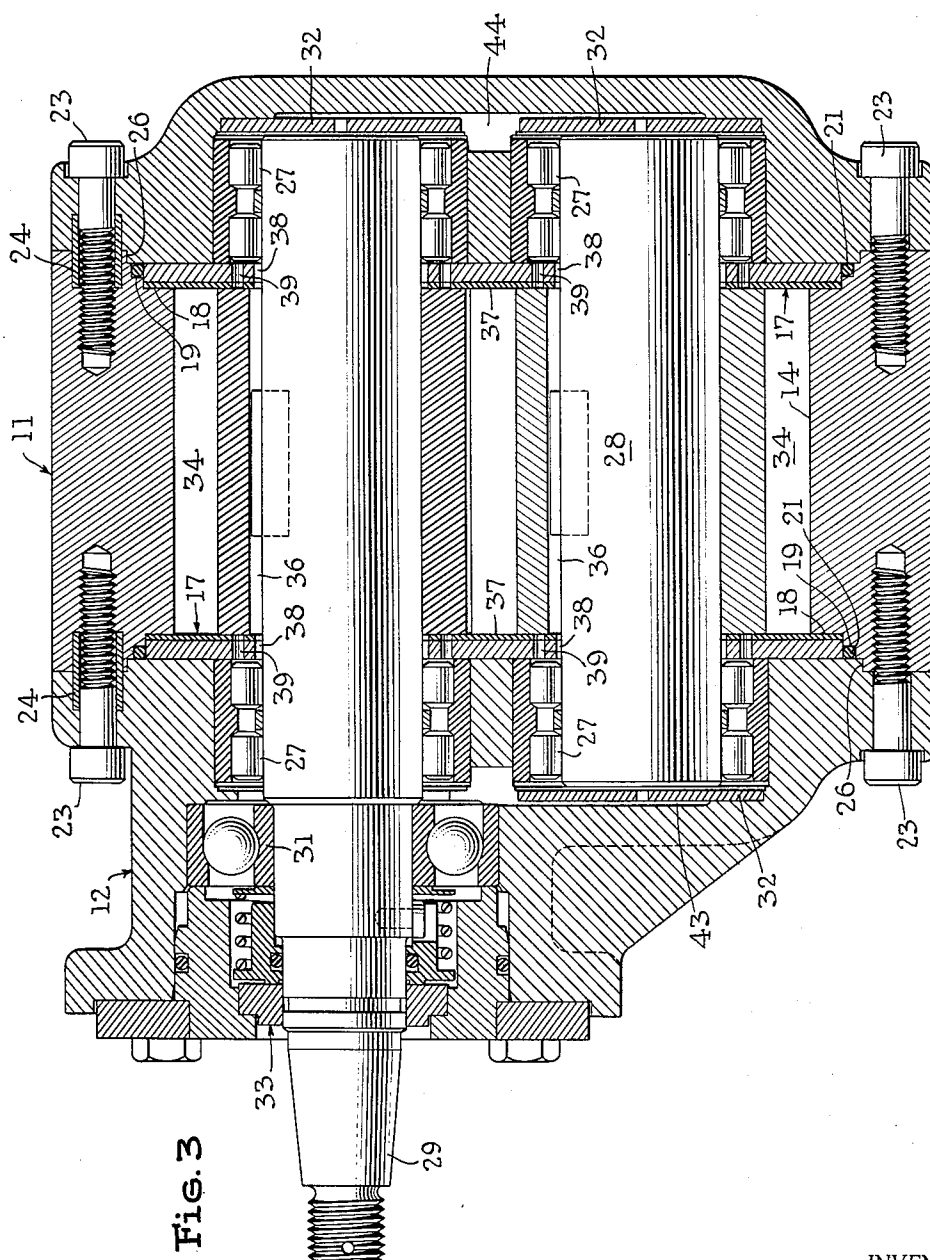
R. F. HODGSON

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INVENTOR

INVENTOR
Robert F. Hodgson

BY

Dodge and Sons

ATTORNEYS

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R. F. HODGSON

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Fig. 5

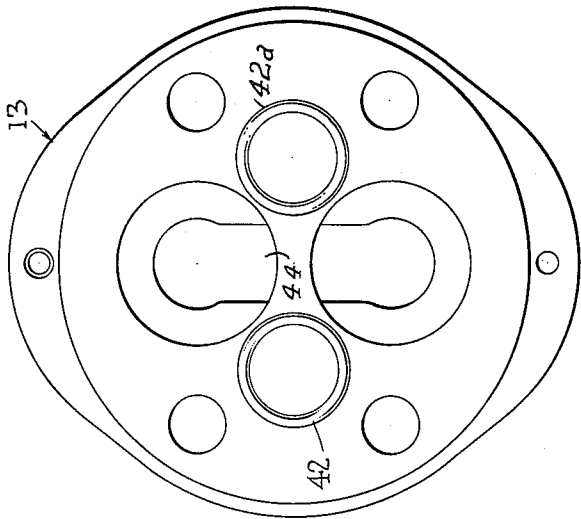


Fig. 4

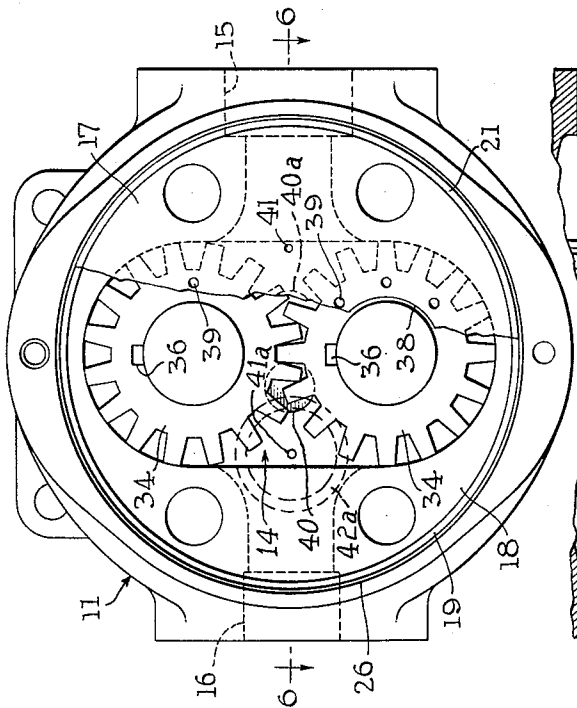
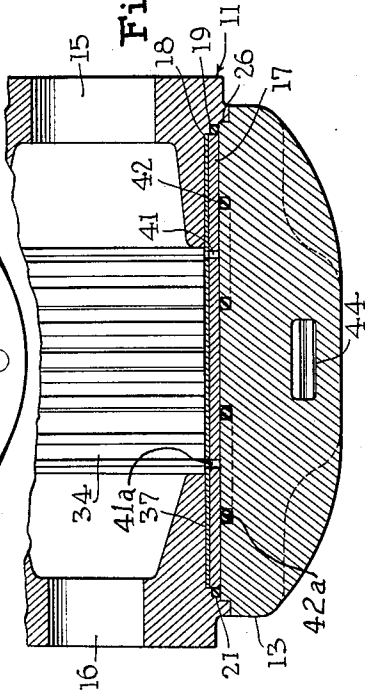


Fig. 6



INVENTOR

Robert F. Hodgson

BY *Dodge and Son*

ATTORNEYS

1

2,923,248

PUMP

Robert F. Hodgson, Chagrin Falls, Ohio, assignor to The New York Air Brake Company, a corporation of New Jersey

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3 Claims. (Cl. 103—126)

This invention relates to gear pumps. Specifically it relates to means whereby the useful life of the pump may be lengthened.

It is common practice in gear pumps to provide wear plates confined between the pump body and the cover plates. These plates are intended to absorb the wear which would otherwise occur between the gears and the cover plates. It will be apparent that if pressure fluid flows to the outer face of the wear plate and is not permitted to escape, fluid at discharge pressure will act over the entire outer face of the wear plate. The present invention is directed to means to maintain nearly balanced the forces reacting on opposite faces of the wear plate. In the region of pump outlet, the inner face of the wear plate is subject to discharge pressure. At the inlet on the other hand the inner face of the wear plate is subject to inlet pressure. This results in an unbalanced condition.

According to the present invention in the region of the inlet a portion of the outer face of each wear plate is isolated from the balance of the outer face by a member, which is confined between the wear plate and the pump cover. A through port is formed in the wear plate which permits free communication between this isolated portion of the outer face and pump inlet. In this way the forces on the inner and outer faces of the wear plate are more nearly balanced in the region of the inlet than is characteristic of conventional gear pumps. Additional through ports are provided in the wear plate in the region of the side faces of the gears. These ports act both to balance the forces reacting on the plate and to provide better lubrication between the wear plates and the side faces of the gears.

A preferred embodiment of the invention will be described having reference to the accompanying drawings in which:

Figure 1 is a side elevation of the pump.

Figure 2 is an end elevation.

Figure 3 is a section taken on line 3—3 of Figure 2.

Figure 4 is an end elevation of the pump with one cover plate removed and a portion of the wear plate broken away.

Figure 5 is an elevation of the inner face of the cover plate.

Figure 6 is a partial section on line 6—6 of Figure 4.

Referring first to Figures 1, 2 and 3, it will be apparent that the pump comprises a three part housing comprising a body 11, an adapter cover plate 12 and an end cover plate 13. The body 11 has formed therein a pumping cavity 14 (see Figure 4) having an inlet passage 15 and outlet passage 16. A wear plate 17 is clamped at its margin between the body 11 and each of the cover plates 12 and 13. The wear plate 17 is received in an annular recess 18 in the face of the body 11. A somewhat shallower recess 19 is afforded in the face of body 11 and receives an O ring 21 which seals against leakage between the body 11 and the cover plates

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12 and 13. The assembled relation of the housing is maintained by four bolts 22 which extend inward through end cover plate 13, wear plates 17 and body 11 and are received in tapped holes in the adapter cover plate 12.

Additional bolts 23 are provided as shown in Figure 3. These bolts extend through cover plates 12 and 13 and thread into body 11. As also shown in Figure 3, the uppermost bolts 23 are encircled by a sleeve 24 which is received in aligned counterbores provided in each cover plate and the faces of body 11. It will be noted that the inner faces of the cover plates have circumferential shoulders which are received in an annular recess 26 in the body 11. The recesses 26 and 18 assure proper transverse alignment of the parts and the sleeves 24 assure proper initial radial alignment.

The cover plates 12 and 13 each sustain a pair of roller bearings 27. A driven shaft 28 is sustained by two of these bearings 27 and a drive shaft 29 is sustained by the others. Shaft 29 projects outward through the adapter cover 12. A ball thrust bearing 31 mounted in the adapter cover 12 encircles the projecting portion of shaft 29. A thrust plate 32 is provided in each of the blind bearing recesses in the cover plates. Leakage of oil along shaft 29 is prevented by an oil seal generally indicated at 33. Keyed to each of the shafts 28 and 29 is a gear 34. The keyway 36 extends from one face of the gear to the other and the gears may shift longitudinally of shafts 28 and 29, so that they may be properly positioned between the wear plates 17. The face of the wear plates which are exposed to the gears are provided with a bronze facing 37. This facing absorbs the wear.

Referring now to Figures 4, 5 and 6, it will be seen that the wear plates 17 are circular and each has two large apertures 38 which encircle the shafts 28 and 29. A circular series of holes 39 is disposed around each of these apertures. These holes 39 are arranged adjacent the side faces of the gears at a point between the hub and the root of the teeth.

Each plate 17 is provided with a port 41 which extends therethrough adjacent the inlet 15. An O ring 42 disposed in a groove defined between each wear plate 17 and the corresponding cover plate, encircles the port 41 thereby isolating the encircled portion of the wear plate's outer face from the remainder.

The inner face of each wear plate 17 is provided with a relief recess 40 located as shown in Figure 4. This recess 40 serves to relieve fluid which is trapped between the meshing gear teeth. As shown in Figures 3 and 5 cored passages 43 and 44 are provided between the bearing recesses in plate 13 and the seal chamber and the bearing recesses in plate 12 respectively.

As has already been pointed out the purpose of the invention is to avoid excess friction and wear between the plates 17 and the gears. Since the plates 17 are supported only at their peripheries, the central portions are subject to distortion because fluid at discharge pressure acts over the entire outer face of the wear plates and only over a portion of the inner face. Experience indicates that fluid at or near discharge pressure is effective over most of the inner face of the wear plate, but it will be seen that inlet pressure acts on the inner face of the plate over the generally triangular area defined by arcs of the gear teeth extending from the point of their interengagement to the side walls of the impeller cavity 14. The area encircled by the sealing ring 42 is approximately equal to this triangular area. The port 41 admits fluid at inlet pressure to the encircled area. Thus it will be seen that the forces are nearly balanced. If desired the shape of the area encircled by the ring can be made congruent to the triangular area defined above,

but this adds to the cost of machining and the advantage gained thereby is slight.

The holes 39 arranged in circular series around the openings 38 serve to permit oil to flow from the outer face of the wear plate 17 to the side faces of the gears 34. This affords good lubrication between these surfaces and also approximate balance between the forces acting on opposite faces of the wear plates in the region of the side faces of the gears.

Since the forces on the wear plates are nearly balanced distortion which would give rise to friction and rapid wear is minimized.

The preferred embodiment has been described as though it were a unidirectional pump. As illustrated, the invention is embodied in a reversible pump although up to this point only one direction of rotation has been described. If the direction of rotation is reversed, connection 15 becomes the outlet and 16 the inlet. Under these conditions, the rings 42a isolate the pressure balancing areas on the inlet side of the pump and are supplied with pressure fluid through ports 41a. Each wear plate 17 is provided with a single relief recess, one, 40, is effective for one direction of rotation, and the other, 40a, is effective for the other direction of rotation.

The rings 42 or 42a on the discharge side of the pump, which depends on the direction of pump rotation, do not effect the pressure balance since they receive liquid at discharge pressure through ports 41 or 41a. It will be seen that discharge pressure acts over the entire outer face of wear plates except when the rings 42 or 42a are located on the inlet side of the pump. Hence the pressure balance resulting from the use of such rings is the same in either a unidirectional pump or a reversible pump.

I claim:

1. A reversible pump comprising a three-part housing, said housing including end covers and a central part having therein an impeller cavity oval in section; a pair of externally interengaging impellers rotatable in and substantially filling said cavity; flow connection means in said housing and communicating with opposite sides of said cavity substantially on the minor axis thereof, the covers being fastened to said center part and closing said cavity; a wear plate fixedly confined at its periphery between each cover and the central part of the housing and engaging the side faces of the impellers, said wear plates being elastic and capable of being deflected by pressure fluid on their opposite faces; two endless sealing means confined between each wear plate and the corresponding cover plate, and each encircling a portion of the outer face of the corresponding wear plate and thereby isolating that portion from the balance of the outer face of the wear plate, said balance of the outer face being subject to pressure fluid at discharge pressure, the two sealing means being on the minor axis of the impeller cavity, and spaced from one another and on opposite sides of the major axis of the cavity; and means affording flow passages between the impeller cavity and each of the volumes enclosed by said sealing means, said encircled portion of the outer face of the wear plate and the cover plate, said flow passages extending from the cavity on the same side of its major axis as the volume with which it communicates.

2. In a gear pump, the combination of a three-part

housing including a central part having therein a generally elliptical impeller cavity having inlet and outlet connections thereto, and two end parts; externally interengaging impellers rotatable in said cavity; wear plates, one fixedly confined at its periphery between each end part and the central part and having an inner face abutting side faces of said impellers, said wear plates being elastic and capable of being deflected by pressure fluid on their opposite faces; endless sealing means confined between the outer face of each wear plate and the corresponding housing end part and encircling an area thereof substantially equal to the area bounded by arcs of said impellers extending approximately 90° from the point of interengagement of the impellers and the straight line joining the end of said arcs, the center of each encircled area lying on the minor axis of said cavity and each encircled area being on the inlet side of the pump, the unencircled portions of the outer face of the wear plates being subject to fluid at discharge pressure; and port means extending between each volume defined by the sealing means, the housing end part and the encircled area of the wear plate, and the portion of said cavity into which the inlet connection opens.

3. The combination defined in claim 2 in which each end part sustains two bearings, each bearing in one end part being axially aligned with a bearing in the other end part; two shafts, one journaled in each pair of aligned bearings and on each of which an impeller is carried, the wear plates having openings therein through which the shafts extend, and each opening being encircled by a circular series of apertures, said series of apertures being located between the margins of said openings and the trace of the roots of the teeth on said impellers, and communicating with the outer faces of the wear plates in regions not encircled by said sealing means, said apertures admitting fluid at discharge pressure between the side faces of the impellers and the wear plates to provide lubrication and to balance the opposed pressures acting on the wear plates in the region of the apertures.

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