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PRESSURE YOKE FOR PUMPS

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Fig. 1

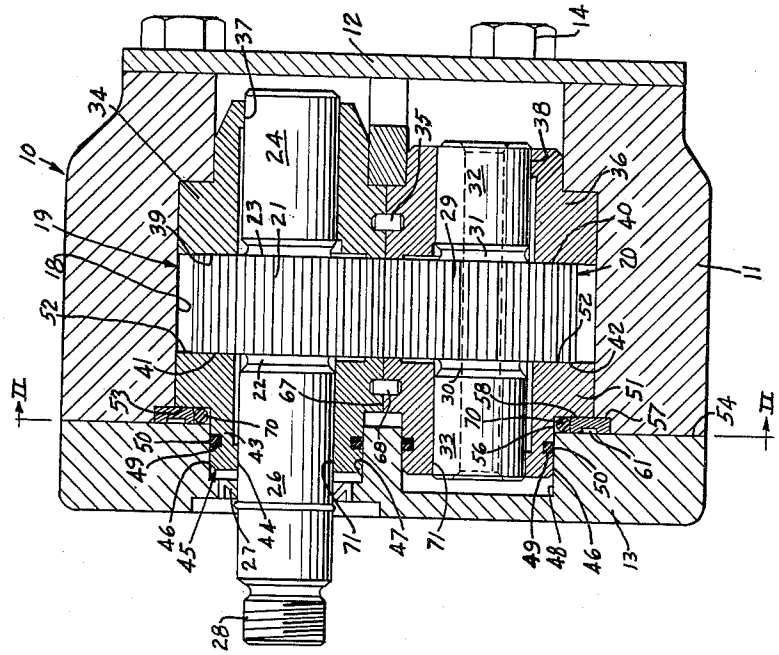
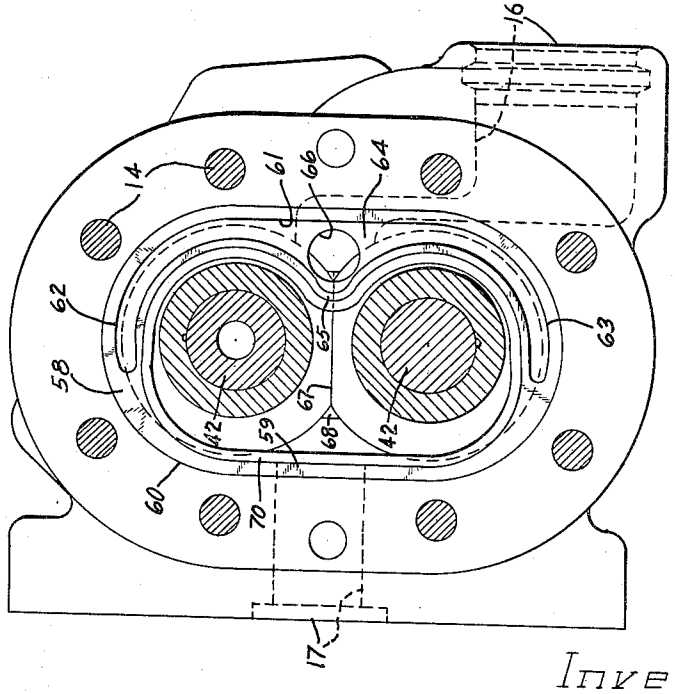


Fig. 2



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PRESSURE YOKE FOR PUMPS

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This invention relates generally to pumps and more particularly to a positive displacement pump such as a gear pump wherein an improved pressure yoke is provided for confining pump-generated pressure to an offset pressure area behind the motive surface of a movable end plate means for balancing the unequal pressure forces developed in the pumping chamber of the pump.

It is an object of the present invention to provide an improved pressure-loaded gear pump using a reduced number of simplified elements.

Another object of the present invention is to provide a pump wherein a better distribution of relative inlet and outlet pressures is obtained.

Yet another object of the present invention is to provide a pressure-loaded gear pump having balanced pressure loading and wherein no accurate shaping of eccentric grooves or eccentric shoulders is required.

A further object of the present invention is to provide a pressure-loaded pump wherein an O ring sealing member engages an end plate and shaped backing means confine the O ring sealing member in an irregular pattern to form within the O ring a pressure chamber increasing proportionally in size towards the discharge side of the pump to balance unequal pressure forces in the pump chamber.

Yet another object of the present invention is to provide a pump having a fixed plate member within the housing cut or stamped with an interior configuration to receive sealing means such as an O ring sealing member, thereby to form a barrier prescribing a desired pressure-loaded area on the motive surface of a sealing end plate.

Many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheet of drawings in which a preferred structural embodiment of a pump incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

FIGURE 1 is a cross-sectional view of a pressure-loaded gear pump incorporating the principles of the present invention; and

FIGURE 2 is a cross-sectional view with parts shown in elevation taken generally on line II—II of FIGURE 1.

As shown on the drawings:

The pump of the present invention is shown generally at 10 and comprises a housing or casing made up of a body member 11, a closure 12 and a cover member 13 fastened together by a plurality of fasteners indicated generally at 14. The housing is formed with an inlet 16 and an outlet 17 communicating with a pumping chamber 18 in which rotary fluid displacement means move the fluid from the inlet to the outlet under increased pressure. In this form of the invention, the rotary fluid displacement means comprise meshed together gears including a driver gear shown generally at 19 and a driven gear shown generally at 20. The gears 19 and 20 may conveniently comprise two part elements including a driver gear hub 21 press-fit on a shaft relieved as at 22 and at 23 on opposite sides of the gear hub 21, and including gear shaft extensions shown at 24 and 26, the extension 26 protruding outwardly through a shaft seal 27 carried in the cover member 13 and providing on the free end

thereof outwardly of the casing a coupling portion 28 for connecting the pump to a suitable prime mover.

The driven gear 20 likewise comprises a gear hub 29 press-fit on a shaft which is relieved as at 30 and at 31 and which includes gear shaft extensions shown at 32 and 33, respectively.

Fixedly mounted within the body portion 11 of the casing or housing are a pair of bushings 34 and 36 pinned together as at 35 and providing for the gear shaft extensions 24 and 32 bearing surfaces 37 and 38, respectively. The bushings 34 and 36 also provide a thrust face shown at 39 for engaging against the adjoining side face 40 of the driver and driven gears 19 and 20.

On the opposite side of the gears 19 and 20, the gear hubs 21 and 29 have side faces shown at 41 and 42, respectively. An end plate means is provided for the pump to seal and engage against the adjoining side faces 41 and 42 of the gears and such end plate means are preferably pressure-loaded, thereby to function as wear plates and to provide an efficient form of sealing to increase the pumping efficiency of the pumping apparatus.

In this particular embodiment, the end plate means takes the form of combination bearings and end plates. Thus, there is provided for each of the driver and driven gears 19 and 20 a movable bushing indicated generally at 45 and comprising a generally tubular body portion 43 forming a bearing surface 44 in which a corresponding shaft extension 26 or 33 is journaled. The outer peripheral surface of the tubular portion is shown at 46 and slidingly engages a counterbored wall 47 provided for the shaft of the driver gear 19 or a counterbored recess 48 provided for the shaft extension of the driven gear 20. The peripheral wall 46 of the tubular body portion 43 is grooved as at 49 to receive an O ring sealing member 50, thereby establishing a seal along the line of junction between the tubular body portion 43 and the cover member 13.

At the end of each bushing 46, there is provided a radially outwardly extending flange 51 having a front sealing face 52 for engaging against the adjoining side face 42 of the driven gear 20 and 41 of the driver gear 19. Each bushing 45 is further provided with a rear motive surface 53 on the back of the flange 51 which rear motive surface 53 is spaced from the adjoining wall 54 provided by the cover member 13, thereby to provide a pressure control chamber 56 of which the rear motive surface 53 forms one wall.

It will be noted that the body member 11 is provided with a counterbored recess 57, thereby to provide a radial shoulder which cooperates with the wall 54 of the cover member 13 to clamp a rigid plate member 58 therebetween. The rigid plate member 58 is thus fixed in the housing of the pump 10 and includes inner peripheral wall portions 59 which extend into the pressure control chamber 56, thereby to prescribe an open area of irregular configuration which is offset towards the discharge side of the pump.

As is clearly shown in FIGURE 2, viewed in connection with FIGURE 1, the plate member 58 is of a general ovaloid configuration, the outer peripheral surface shown at 60 being symmetrically disposed and the inner peripheral portions being irregularly conformed principally by an inwardly extending portion 65 protruding between the tubular bearing portions 43, 43 of the bushings 45, 45 at the inlet side of the pump. Moreover, because of the offset relation of the opening extending axially through the plate 58, there is also provided considerable room on the inlet side of the pump so that the plate 58 is characterized by a shallow recess shown generally at 61 and including a first lobe portion 62 and a second lobe portion 63, both generally annular in configuration and extending outwardly around the respective bushings 45, 45

and having an enlarged medial section **64** opposite the inlet zone of the pump. The enlarged medial section **64** is apertured as at **66**, thereby to place the shallow recess **61** in full communication with the pump inlet in maintaining within the recess **61** a low pressure.

Because the flanges **51** of the bushings **45**, **45** are both generally circular in configuration, there is an overlapping relationship which is taken care of by providing each flange with a flattened chordal portion shown clearly in FIGURE 2 at **67**, a pin **68** being provided therebetween to keep the bushings **42**, **42** more or less fastened together. At the point of juncture of the flattened chordal portions **67**, there is formed a passage **68** in the housing on the discharge side of the pump, thereby communicating pump-generated pressure to the pressure area inside of the inner peripheral portions **59** of the plate **58**.

In order to form an effective seal barrier, a sealing means which may conveniently take the form of an O ring sealing member made of a rubber-like material and shown at **70** is provided. The O ring sealing member **70** is backed up by the inner peripheral portions **59** of the plate **58**, thereby to confine the O ring sealing member **70** in the same special shape as the opening formed in the plate **58**. The O ring sealing member **70** is preferably of the same general width in cross-section as the width of the fixed plate **58** and thereby seals against the rear motive surface **53** of the end plate means as well as against the wall **54** of the cover member **13** to form a barrier which separates the separate sealing zones. Thus, it will be noted that pump-generated pressure will be confined on the rear motive surface over an area corresponding to the area prescribed interiorly of the O ring sealing member **70** and which area is offset towards the discharge side of the pump so that the effective thrust area will increase proportionately towards the discharge side of the pump and thereby pressure balance the unequally distributed forces existing in the pumping chamber **18**.

Although two separate bushings **45**, **45** are shown for the purpose of providing a bearing surface **71** to journal the shaft extensions **26** and **33** of the driver and driven gears, it will be appreciated that a single end plate member could also be employed, if desired.

There is thus provided a plate seated in a counterbore of the pump body and lined by a single sealing ring to give the desired eccentric pressure-loaded motive surface desired for pressure-balancing the sealing means. The arrangement thus provided gives a better distribution of the relative inlet and outlet pressures and completely eliminates the necessity of accurately shaping eccentric grooves and interfitting shoulders and other structural requisites of the prior art.

Although various minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of this patent all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. In a pump,
   - a housing having a pressure control chamber formed therein communicating with pump generated pressure,
   - end plate means having a motive surface forming one wall of said pressure control chamber,
   - a rigid plate member in said housing having a through opening formed therein including radially inner peripheral side walls disposed in an irregular configuration offset towards the discharge side of the pump and prescribing the outer peripheral boundaries of said pressure control chamber,
   - and sealing means at said radially inner peripheral side walls in said pressure control chamber,
   - said sealing means being made of resilient material sufficiently thicker than said rigid plate member to confine pump generated pressure over said area against said end plate means to balance the unequal pressure forces in the pump.

2. In a pump having rotary intermeshing gears,
   - a housing in which said gears are rotated to pump fluid from an inlet to an outlet in a pumping chamber,
   - an end plate means having a front sealing surface for engaging the adjoining side face of the gears and a rear motive surface spaced from an adjoining housing wall to form a pressure control chamber communicating with pump generated pressure, a rigid plate member in said housing behind said end plate means,
   - said rigid plate member having an open area formed therein and including radially inner peripheral portions extending axially therethrough but being offset towards one side of the pump,
   - and flexible sealing means backed up against the side walls of the open area in said plate member,
   - said sealing means forming the outside walls of said pressure control chamber and being made of resilient material sufficiently thicker than said rigid plate member to confine pressure acting on said motive surface over an area increasing proportionally towards the discharge side of the pump.

3. A pressure-loaded gear pump comprising a casing having a pumping chamber including an inlet and an outlet,
   - rotary intermeshing driver and driven gears in said pumping chamber to move fluid from the inlet to the outlet,
   - shaft extensions on said gears journaled in said casing,
   - movable end plate means in said casing having a front sealing surface engaging an adjoining side face of the gears and having a rear motive surface spaced from an adjoining housing wall to form a pressure control chamber communicating with pump-generated pressure,
   - and a fixed plate in said housing having radially inner peripheral wall portions extending into and forming the outer peripheral limits of said pressure control chamber,
   - said wall portions being shaped to form said pressure control chamber as an irregularly shaped open area in register with said motive surface and offset towards one side of the pump,
   - and an O ring sealing member backed up against said radially inner peripheral wall portions,
   - said O ring being made of resilient material and being sufficiently thicker than said fixed plate to seal and confine pressurized fluid against said motive surface over an area corresponding to said open area and balancing unequal pressure forces in the pumping chamber.

4. In a pressure-loaded gear pump comprising a casing having a pumping chamber including an inlet and an outlet,
   - rotary intermeshing driver and driven gears in said pumping chamber to move fluid from the inlet to the outlet,
   - shaft extensions on said gears journaled in said casing,
   - a movable bushing on one side of the pump opposite each corresponding gear including a tubular body portion and having a flange formed on one end,
   - said flange having a first sealing face for engaging against the corresponding side face of the adjoining gear and a motive surface spaced from an adjoining wall of the casing to form a pressure control chamber,
   - a fixed plate in said housing having a radially inner peripheral wall portion extending into said pressure control chamber to form the outer wall thereof but being spaced radially outwardly of said tubular portions of said bushings and offset towards one side of the pump,

and sealing means backed up against said radially inner peripheral wall portion,
said sealing means being made of resilient material and being sufficiently thicker than said fixed plate to seal and confine fluid at pump-generated pressure in said pressure control chamber over an area of said motive surface which increases proportionally towards the discharge side of the pump for balancing unequal pressure forces in the pump.

5. In a pump,
a pump body having a pumping chamber formed by a bore thereof,
said pump body having a counterbore,
a plate member seated in said counterbore,
said plate having an opening therethrough,
the radially inner peripheral edges of said plate member at said opening prescribing an open area offset towards one side of the pump,
and a single continuous resilient O ring conforming in peripheral dimension and shape with said opening lining the edge of said opening,
and end plate means continuously engaged by said O ring and being subjected to the pressures in said opening,
thereby affording eccentric balanced pressure loading.

6. In a pump,
a generally ovaloid plate fixed in the pump body,
said plate having a through opening formed therein offset towards one side of the plate,
the radially innermost edges of said opening forming the outer walls of a pressure control chamber for a pressure loaded end plate means,
said plate having a shallow recess formed in one face thereof, said recess having spaced lobes merging in a center area on the inlet side of the pump,
said center area having an opening extending therethrough and a pump in which said plate is mounted having an inlet zone opposite said opening in said center area to communicate inlet pressure to said shallow recess,
and means communicating pump-generated discharge pressure to said opening to pressurize the pressure control chamber,
and flexible sealing means overlying the edges of said opening to confine pump-generated pressure in said pressure control chamber to an area behind the end

plate means which increases proportionately towards the discharge side of the pump for balancing the unequal pressure forces in the pump.

7. In a pump,
a housing having a pressure control chamber formed therein communicating with pump-generated pressure,
end plate means having a motive surface forming one wall of said pressure control chamber,
a rigid plate member having an outside peripheral surface shaped in an ovaloid configuration in said pressure control chamber and having a through opening formed therein including radially inner peripheral side walls disposed in an irregular configuration offset towards the discharge side of the pump and forming the outer walls of said pressure control chamber,
flexible sealing means overlying said radially inner peripheral side walls to confine pump-generated pressure behind the end plate means over an area corresponding to the area inside of said radially inner peripheral side walls to balance the unequal pressure forces in the pump,
and means forming a shallow recess in one face of said rigid plate member outwardly of said radially inner peripheral side walls on the inlet side of the pump, said shallow recess having first and second lobe portions and a center portion formed with a through opening communicating pump inlet pressure to said shallow recess.

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