July 9, 1963 J. C. McALVAY 3,096,719

ROTARY PUMP OR MOTOR

Filed April 29, 1960 2 Sheets-Sheet 1

Fig. 1

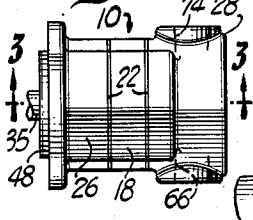


Fig. 2

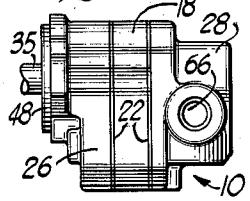


Fig. 3

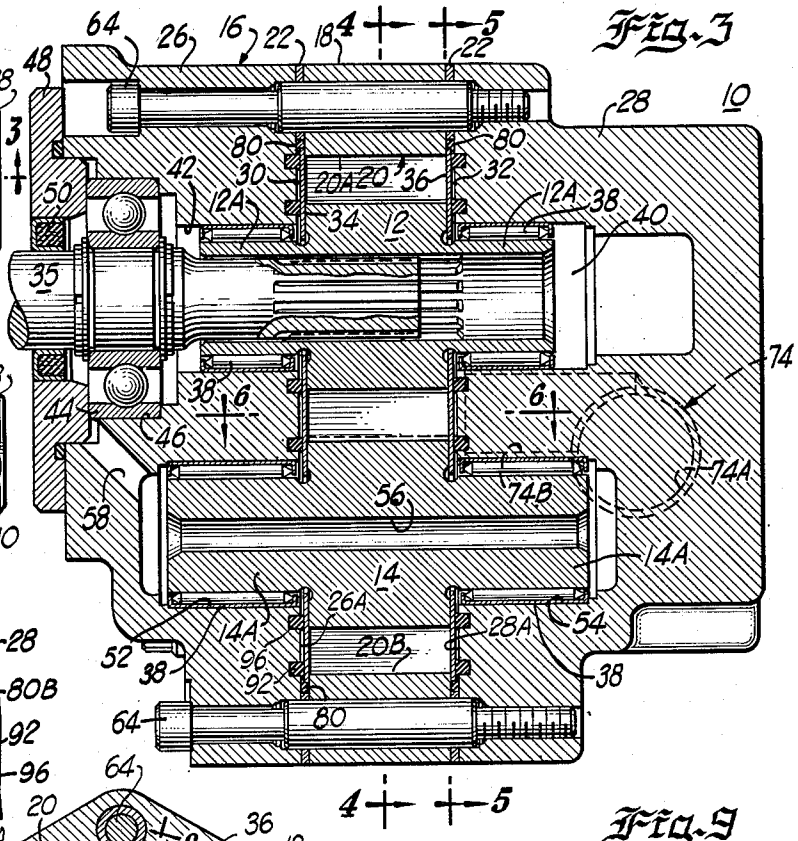
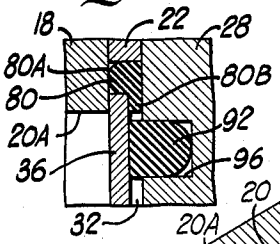


Fig. 5



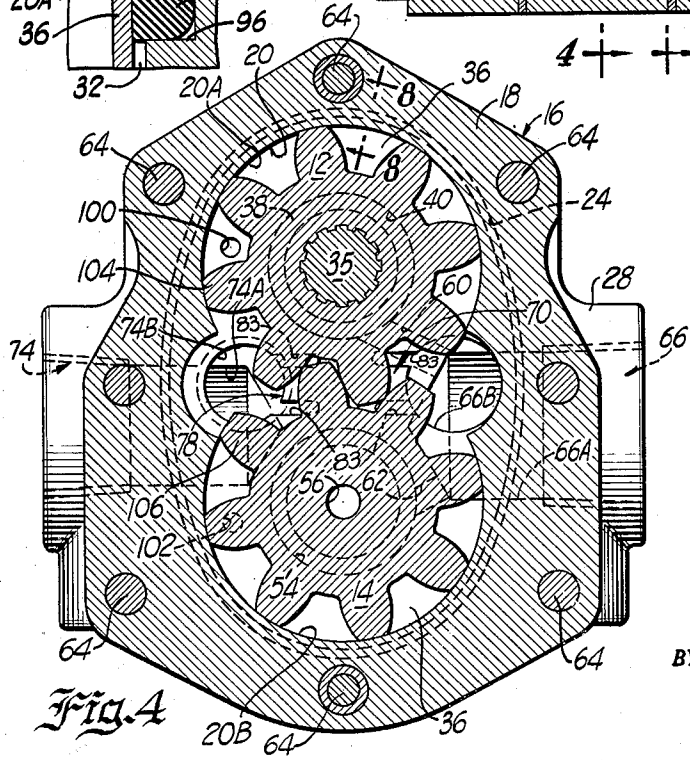


Fig. 4

Fig. 9

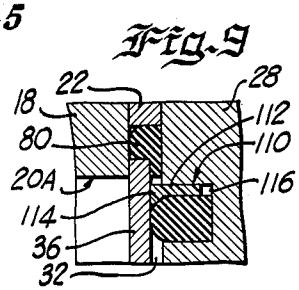
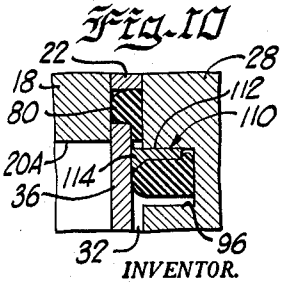


Fig. 10



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ROTARY PUMP OR MOTOR

Filed April 29, 1960 2 Sheets-Sheet 2

Fig. 5

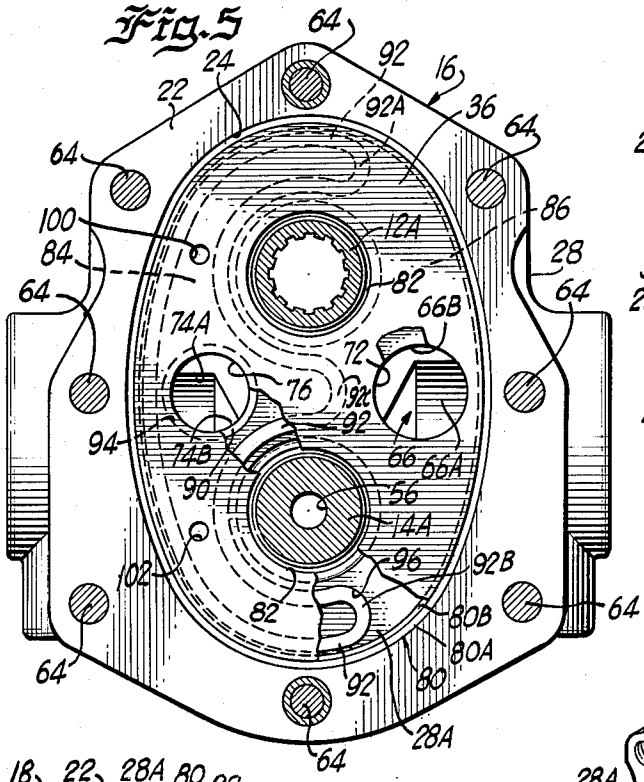


Fig. 5

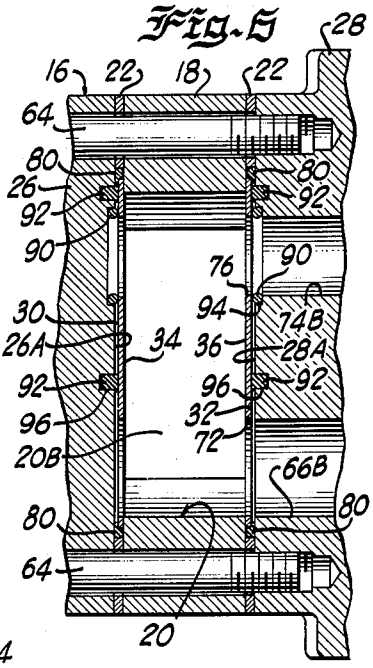
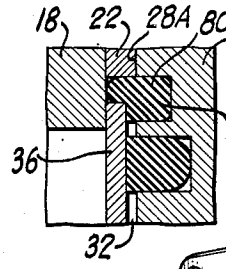


Fig. 11



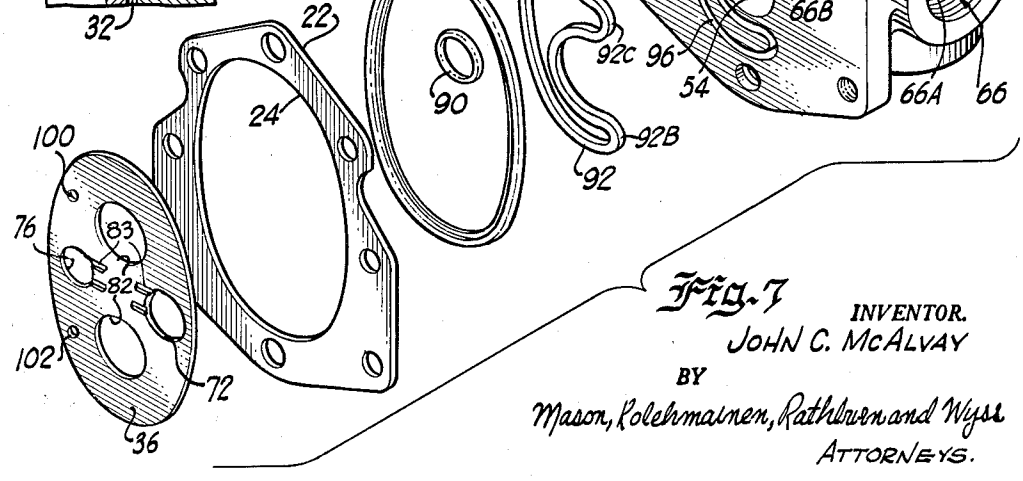


Fig. 7

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3,096,719

ROTARY PUMP OR MOTOR

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Filed Apr. 29, 1960, Ser. No. 25,571
18 Claims. (Cl. 103—126)

The present invention relates to rotary pumps or motors and has for its primary object the provision of a new and improved end loaded gear pump or motor.

It has long been desirable to produce gear pumps having a high volumetric efficiency and constructed to avoid seizure of the gears against adjacent end faces of the gear chamber. Despite efforts in this direction, difficulties have been encountered, particularly as a result of demands for higher pressures. The use of quick starting motors has also added to the difficulties.

It is an object of the present invention to provide a new and improved gear pump capable of generating high pressures, which can be quickly started and which can be made simply and will operate with satisfactory volumetric efficiency.

A further object of the present invention is to provide a new and improved gear pump having end loading means engaging one or both sides of the gears, which may be called a wear plate, capable of substantial axial movement and which is forced against the gears by pressure generated by the pump, which pressure is chosen to be less than the pump discharge pressure and is effectively isolated from the discharge pressure by at least one gear tooth so as to prevent pressure surges from acting on the wear plate or plates.

A further object of the present invention is the provision of a new and improved pump of the character set forth in the preceding paragraph in which the pressure applied to the wear plate is substantially a single pressure and less than the discharge pressure, whereby construction of the pump is simplified.

In brief, the pump, or it may be a motor, of the present invention includes impeller means comprising a pair of intermeshing gears mounted in a housing comprising a gear plate with an opening configured closely to receive the gears and of a thickness corresponding to that of said gears, spacer plates at each side of the gear plate and each having a generally elliptical opening somewhat larger than that in said gear plate, and opposed end plates abutted against the spacer plates. The housing has inlet and discharge passages leading to gears at inlet and discharge areas. The gears have oppositely extending shafts and the end plates having openings for receiving the ends of the shafts. Relatively thin wear plates are disposed at opposite sides of and abut against the side faces of the gears. The wear plates have shapes corresponding to the openings in the spacer plates and have openings for the shafts and openings of the same size as and aligned with the inlet and discharge passages. The wear plates are of a size such that their peripheral side portions abut against the gear plates and their peripheral edges are spaced from the opening defining edges of the spacer plates to define a seal receiving space. The wear plate thicknesses are substantially less than the thicknesses of the spacer plates whereby the wear plates have substantial freedom for movement toward the end plates and pressure chambers are provided at the sides of the wear plates adjacent the end plates. Resilient sealing gaskets surround the peripheral edges of each of the wear plates. The gaskets have short axially disposed flanges interposed between the peripheral side portions of the wear plates and adjacent portions of the end plates, whereby axial movement of the wear plates is permitted. The end plates have annular resilient sealing means located therein abutted against both the end plates and wear plates around the discharge passage openings in the latter, thereby to seal off discharge pressures from the said pressure chambers. The end plates also have resilient sealing means located therein and abutting against the end plates and wear plates and defining a pressure area surrounding the said discharge passage and extending toward the inlet passageway to slightly beyond a plane normal to a line passing through the inlet and outlet passageways and passing through the axes of rotation of the gears. A pair of openings are provided in each of said wear plates, these openings being similarly located relative to the gears and leading to like pressure regions disposed between the inlet and discharge pressures and isolated at all times from the discharge area by at least one gear tooth. If desired, a back up ring may surround the sealing means abutting against the wear plate and defining the pressure area, thereby to render it more effective and durable.

Other objects and advantages of the present invention will become apparent from the ensuing description of a pump constructed in accordance therewith as illustrated in the accompanying drawings, in which:

FIG. 1 is a top plan view of the pump;

FIG. 2 is a side elevational view of the pump;

FIG. 3 is an enlarged axial cross sectional view taken along the line 3—3 of FIG. 1;

FIG. 4 is a transverse cross sectional view of the pump along the line 4—4 of FIG. 3;

FIG. 5 is a transverse cross sectional view of the pump along the line 5—5 of FIG. 3;

FIG. 6 is a fragmentary enlarged cross sectional view taken along the line 6—6 of FIG. 3 but with the gear pumping elements omitted and illustrating details of the wear plate sealing means;

FIG. 7 is a perspective exploded view of the pump cover plate, spacer and wear plates and associated sealing means;

FIG. 8 is a fragmentary enlarged cross sectional view along the line 8—8 of FIG. 4;

FIG. 9 is a view similar to FIG. 8 illustrating a modified form of construction in which the sealing ring has a back up ring associated with, it, the view illustrating the parts when not under pressure;

FIG. 10 is a view similar to FIG. 9 illustrating the parts under pressure; and

FIG. 11 is a view similar to FIG. 8 of a modified construction.

Referring now to the drawings, the present invention is illustrated in connection with a gear pump indicated as a whole by reference character 10. It should be understood that the invention may be utilized in connection with a gear motor and features may be utilized in pumps and motors of types other than the gear type.

The pump includes a pair of intermeshing gears 12 and 14 mounted within a housing 16. The housing comprises a gear plate 18 having an opening 20 comprising intersecting circular cavities 20A and 20B and configured closely to receive the gears. The gear plate 18 is of a thickness corresponding to that of the gears and, if anything, slightly thicker. Relatively thin spacer plates 22 are disposed at opposite sides of the gear plate and they are each provided with a generally elliptical opening 24 (see especially FIG. 7) somewhat larger than the opening 20 in the gear plate. The housing is completed by the opposed end plates 26 and 28 abutted against the spacer plates and having generally planar faces 26A and 28A facing toward the gears. The location of the spacer plates between the end plates and gear plate provides pressure chambers 30 and 32 at opposite sides of the gears in which are mounted relatively thin wear plates 34 and 36 abutting against the opposite sides of the gears and to which further

reference will shortly be had. The spacer plates are thicker than the wear plates by about five percent of the gear plate thickness.

The spacer rings 22 may be omitted if desired and be replaced by integral portions of the gear or end plates.

The gear 12 has oppositely extending integral tubular shaft portions 12A drivingly connected to a drive shaft 35 by a splined connection. The shaft is journalled in needle bearing structures 38 mounted in a recess 40 in end plate 28 and in a bore 42 in end plate 26. The shaft 35 is journalled in ball bearings 44 mounted in a bore 46 communicating with bore 42. The bearings 44 are held in place by an annular cap 48 surrounding the shaft and having a shaft seal 50.

The gear 14 has oppositely extending shaft portions 14A mounted in needle bearings 38 in bores 52 and 54 in end plates 26 and 28, respectively. The shaft has a passageway 56 through its interconnecting bores 52 and 54. They are connected by passageway 58 in end plate 26, to bore 46 whereby shaft leakage is conducted to bore 52 and it and gear leakage are conducted to bore 54 through passage 56. From bore 54, the leakage fluid is conducted by passageway 60 (see FIG. 4) to the inlet of the pump. Recess 40 is similarly connected to the pump inlet by a passageway 62 (see FIG. 4).

The various parts of the pump housing are held in assembled relation by suitable means such as the bolts 64.

The pump is provided with an inlet passageway 66 in end plate 28 having a horizontal laterally extending part 66A and an axially extending part 66B extending to face 28A and communicating with the low pressure inlet region 70 of the gear chamber 20 through an opening 72 in wear plate 34.

The pump has a high pressure outlet or discharge passageway 74 with a lateral portion 74A and an axial portion 74B aligned with an opening 76 in the wear plate 34 and leading to the high pressure region 78 of the pump chamber.

The wear plates 34 and 36 constitute end loading means for the sides of the gears and they are constructed and arranged and supplied with loading pressures so as to provide a pump having good volumetric efficiency and operating characteristics even when operated at high pressures and using motors with quick starting characteristics. The wear plates are generally elliptical in shape, see FIGS. 5 and 7, corresponding in shape to the openings 24 in the spacer plates. They are of a size such that their peripheral portions extend into overlapping abutting relation to the inner edges of the gear plate 18, see particularly FIGS. 3 and 8, the amount of the overlapping being about ⅛ inch. The wear plates are sealed at their outer peripheries by an elliptical continuous resilient sealing ring or gasket 80 having a thickened portion 80A effectively between the wear plate and spacer plate and a thinner radially inwardly extending flange 80B clamped between the rear face (the one facing the end plate) of the wear plate and the end plate. The arrangement is such that leakage of fluid from the pump housing is prevented while the wear plate has some freedom of movement at its periphery and substantial freedom for axial movement. The wear plates have openings 82 through which the gear shafts extend.

The wear plates have a thickness such that they have some transverse flexibility or give. For a plate having a major axis of about 4.09 inches and a minor axis of about 2.67 inches, a discharge opening of ¾ inch diameter, an inlet opening of ⅝ inch, shaft openings of 2.280 inches, the plate should have a thickness of about .062 inch. Also, the sides of the wear plates facing the gears should have a fairly heavy bronze bearing facing and relief passages 83 for relieving gear intertooth pressures may be provided, as indicated in FIGS. 4 and 7. The wear plates, instead of being elliptical may have a configuration substantially like that of the gear chamber 20. In this event, the gaskets 92 would have like configurations, as would the openings 24 in the spacer plates 22.

The wear plates are each supplied with loading pressure from a source at a pressure less than discharge pressure and isolated from pressure pulsations at the discharge or outlet, which loading pressure is applied to an area approximating one half the area of the gear chamber and disposed at the outlet, half of the pump.

The wear plates have the previously described pressure chambers 30 and 32 at their back sides. These are divided simply into a high pressure or loading area 84 and a low pressure area 86 (see FIG. 5). The loading area is defined by a pair of endless gaskets 90 and 92. Gasket 90 is a relatively small circular one surrounding the openings 76 in the wear plate and outlet passageway portion 74B in end plate 28. It thus isolates the high pressure discharge area and passageway of the pump from the wear plate pressure chambers. Gasket 92 is of a modified E shape in general configuration and surrounds the outlet side of the pump with a portion 92A above, a portion 92B below and a portion 92C between the gear shafts to slightly beyond a plane normal to a line passing through the inlet and outlet passageways and also passing through the axes of rotation of the gears 12 and 14. The gaskets are preferably mounted in grooves 94 and 96 in the planar faces 26A and 28A of the respective end plates (see FIG. 7), whereby they are effectively held in place against even high pressures.

The areas inside of gasket 92 and outside of gasket 90 are supplied with a pressure less than discharge pressure through small openings 100 and 102 in the wear plates. For a wear plate of dimensions such as those given above, the openings may be of a diameter of ⅛ inch. The latter are symmetrically located at the outlet side of the pump and, as may be noted from FIG. 4, they are located so as to be isolated from the discharge passage area by at least one gear tooth, these being the teeth 104 and 106 in FIG. 4. As a result, excessively high pressures and pressure pulsations are prevented from acting on the wear plates so that they do not become excessively forced against the gears.

The gasket 92 has its region 92C chosen so as to bring the wear plate in contact with or close clearance relative to the mesh point of the gears. This is important because the isolation of the discharge and inlet ports is little more than at a point and any end clearance leads to excessive leakage. The distance between the arcuate end and inner and outer spans of the gasket is made to correspond as nearly as possible to the depth of the gear teeth. The points 92A and 92B are located beyond the plane passing through the axes of the gears in order to have the sealing gasket bring the wear plate into contact with some of the gear teeth on the suction side of the pump. This provides reasonable sealing of the pump for priming under vacuum or low pressure pumping.

The position of the openings 100 and 102 is determined empirically and they are located at an angular position which resulits in high efficiency and at the same time keeps the bearing loads on the gear ends acceptably low.

In view of the high pressures utilized with pumps, the E-shaped gasket 92 is subjected to high pressures. To make it more effective a backing ring 110 of rigid or semi-rigid material may be utilized, as shown in FIGS. 9 and 10. It is of the same configuration as the gasket 92 and disposed outside the gasket in the groove 96. It has a relatively elongated portion 112 parallel to the side walls of the groove and an inwardly flared portion 114 overlying the rounded wear plate facing portion 92A of the gasket. The portion 112 has a depth less than that of the gasket to provide a space 116 "beneath" it.

In the absence of pressure, the gasket is as shown in FIG. 9. Under pressure, the gasket forces the back up ring upwardly and also is forced underneath the ring into space 116, whereby the sealing action is improved and damage to the gasket minimized.

An alternative construction of the sealing gasket **80** is illustrated in FIG. 11. In it the thin flange portion **80B** is eliminated, the base portion of the entire gasket being thickened as indicated by reference character **120**.

In operation as a pump, the shaft **35** is driven as by an electric motor having fast starting characteristics. When placed into operation, liquid is drawn to the suction or low pressure area **70** of the pump from the inlet **66**. Liquid at high pressure is discharged from the high pressure area **78** through the previously described outlet **74**.

During starting, it may be that the gears heat up more rapidly than the pump housing, which is larger. This, however, has no deleterious effect because the wear plates **34** and **36** are moved axially outwardly and have substantial movement to accommodate expansion of the gears. The wear plates are also maintained against the side faces of the gears in the area **84**, at a pressure proportionate to and substantially less than discharge pressure. The pressure area **84** is, as previously described, defined by the sealing gaskets **90** and **92**, which effectively seal the gears and yet provides for ample movement of the wear plate when required. The pressure within the ring **84** is supplied through the openings **100** and **102** which are at a lower pressure than and isolated from discharge pressure. The pump of the present invention operates satisfactorily with abrupt starts and high ecceleration and with repeated cycling from low to high pressure. The volumetric efficiency is high.

The apparatus described above may be used as a motor. When so used the construction is advantageous in that the location of the openings **100** and **102** results in reduction of pressure applied to the end plates. Were the loading area connected to the pressure port, the pressure required to move the motor load would be applied to the loading area, causing the wear plate to load against the gear ends, further increasing the pressure necessary to turn the motor, the degenerative accumulation resulting in the motor failing to start or being very inefficient. This does not occur with the arrangement of the present invention, as the source of loading pressure is the slip past the first gear tooth, which slip is at least in part regulated by the loading. The result is that the slip pressure at the holes **100** and **102** is self limiting and does not cause the braking of the gear.

It should be noted also that, if desired, only one of the wear plates and associated structures could be used.

While the present invention has been described in connection with details of illustrative embodiments, these details are not intended to be limitative of the invention except as set forth in the accompanying claims.

What is claimed as new and desired to be secured by United States Letters Patent is:

1. In a rotary machine of the class described, impeller means comprising a pair of intermeshing gears, a housing for said impeller means comprising a gear plate with an opening configured closely to receive said gears and of a thickness corresponding to that of said gears, spacer plates at each side of the gear plate and each having an opening somewhat larger than that in said gear plate, and opposed end plates abutted against said spacer plates, said housing having inlet and discharge passages leading to gears at inlet and discharge areas, said gears having oppositely extending shafts and the end plates having openings for receiving the ends of the shafts, relatively thin wear plates disposed at opposite sides of and abutting against the side faces of the gears, said wear plates having shapes generally corresponding to the openings in said gear and spacer plates and having openings for said shafts and openings of the same size as and aligned with said inlet and discharge passages, and being of a size so that their peripheral side portions abut against the sides of the gear plates and their peripheral edges are spaced from the opening defining edges of the spacer plates to define a seal receiving space, the wear plate thicknesses being substantially less than the thicknesses of said spacer

plates whereby the wear plates have freedom for movement toward the end plates and there are provided pressure chambers at the sides of the wear plates adjacent the end plates, resilient sealing gaskets surrounding the peripheral edges of each of said wear plates and having short axially disposed flanges interposed between the peripheral side portions of the wear plates and adjacent portions of said end plates, said end plates having resilient sealing means located therein abutted against the end plates and wear plates around the openings in the latter aligned with the discharge passage, thereby to seal off discharge pressures from the said pressure chambers, and said end plates having resilient sealing means located therein and abutting against the end plates and wear plates and defining pressure areas surrounding the said first mentioned resilient means and extending toward the inlet passageways somewhat beyond a plane normal to a line passing through the inlet and outlet passageways and also passing through the axes of rotation of the gears, and a pair of small openings in each of said wear plates leading to said pressure areas, said openings being similarly located relative to the gears and leading to areas of pressure disposed between the inlet and discharge pressures and isolated at all times from the discharge area by at least one gear tooth.

2. In a rotary machine as claimed in claim 1 wherein the inlet and discharge passages communicate with the gears through the openings in one of said wear plates.

3. In a rotary machine of the class described, impeller means comprising a pair of intermeshing gears, a housing for said impeller means comprising a gear plate with an opening configured closely to receive said gears and of a thickness corresponding to that of said gears, a spacer plate at least at one side of the gear plate and having an opening somewhat larger than that in said gear plate, an end plate abutted against said spacer plate, said housing having inlet and discharge passages leading to gears at inlet and discharge areas, shaft means for supporting said gears and having oppositely extending shaft portions and the end plate having an opening for receiving said shaft porions, a relatively thin wear plate disposed at the side of and abutting against the side faces of the gears, said wear plate having a shape corresponding to the opening in said gear and spacer plates and having openings for said shaft portions and openings of the same size as and aligned with said inlet and discharge passages, and being of a size such that its peripheral side portion abuts against the side of the gear plate and its peripheral edge is spaced from the opening defining edge of the spacer plate to define a seal receiving space, the wear plate thickness being substantially less than the thickness of said spacer plate whereby the wear plate has freedom for movement toward the end plate and there is provided a pressure chamber at the side of the wear plate adjacent the end plate, a resilient sealing gasket surrounding the peripheral edge of said wear plate and having a short axially disposed flange interposed between the peripheral side portion of the wear plate and adjacent portion of said end plate, said end plate having resilient sealing means located therein abutted against the end plate and wear plate around the opening in the latter aligned with the discharge passage, thereby to seal off discharge pressure from the said pressure chamber, and said end plate having resilient sealing means located therein and abutting against the end plate and wear plate and defining a pressure area surrounding the said first mentioned resilient means and extending toward the inlet passageway somewhat beyond a plane normal to a line passing through the inlet and outlet passageway and also passing through the axes of rotation of the gears, and a pair of small openings in said wear plate leading to said pressure area, said openings being similarly located relative to the gears and leading to areas of pressure disposed between the inlet and discharge pressures and isolated at all times from the discharge area by at least one gear tooth.

4. In a rotary machine of the class described, impeller means comprising a pair of intermeshing gears, a housing

for said impeller means comprising a gear plate with an opening configured closely to receive said gears and of a thickness corresponding to that of said gears, a spacer plate at one side of the gear plate and having an opening somewhat larger than that in said gear plate, an end plate abutted against said spacer plate, said housing having inlet and discharge passages leading to gears at inlet and discharge areas, shaft means supporting said gears and having oppositely extending shaft portions and the end plate having an opening for receiving the shaft portions, a relatively thin wear plate disposed at the side of and abutting against the side faces of the gears, said wear plate having a shape corresponding to the opening in said gear and spacer plates and having openings for said shafts and openings of the same size as and aligned with said inlet and discharge passages, and being of a size such that its peripheral side portion abuts against the side of the gear plate and its peripheral edge is spaced from the opening defining edge of the spacer plate to define a seal receiving space, the wear plate thickness being substantially less than the thickness of said spacer plate whereby the wear plate has freedom for movement toward the end plate and there is provided a pressure chamber at the side of the wear plate adjacent the end plate, a resilient sealing gasket surrounding the peripheral edge of said wear plate and having a short axially disposed flange interposed between the peripheral side portion of the wear plate and adjacent portion of said end plate, said end plate having resilient sealing means located therein abutted against the end plate and wear plate around the opening in the latter aligned with the discharge passage, thereby to seal off discharge pressure from the said pressure chamber, and said end plate having resilient sealing means located therein and abutting against the end plate and wear plate and defining a pressure area surrounding the said first mentioned resilient means and extending toward the inlet passageway somewhat beyond a plane normal to a line passing through the inlet and outlet passageway and also passing through the axes of rotation of the gears, and a pair of small openings in said wear plate leading to said pressure area, said openings being similarly located relative to the gears and leading to areas of pressure disposed between the inlet and discharge pressures and isolated at all times from the discharge area by at least one gear tooth.

5. In a rotary machine of the class described, impeller means comprising a pair of intermeshing gears, a housing for said impeller means comprising a gear plate with an opening configured closely to receive said gears and of a thickness corresponding to that of said gears, spacer plates at each side of the gear plate and each having an opening somewhat larger than that in said gear plate, and opposed end plates abutted against said spacer plates, said housing having inlet and discharge passages leading to gears at inlet and discharge areas, shaft means with oppositely extending portions supporting said gears and the end plates having openings for receiving said shaft portions, relatively thin wear plates disposed at opposite sides of and abutting against the side faces of the gears, said wear plates having shapes generally corresponding to the openings in said gear and spacer plates and having openings for said shaft means and openings of the same size as and aligned with said inlet and discharge passages, and being of a size so that their peripheral side portions abut against the sides of the gear plates and their peripheral edges are spaced from the opening defining edges of the spacer plates to define a seal receiving space, the wear plate thicknesses being less than the thicknesses of said spacer plates whereby the wear plates have freedom for movement toward the end plates and there are provided pressure chambers at the sides of the wear plates adjacent the end plates, resilient sealing gaskets having portions surrounding the peripheral edges of each of said wear plates and having radially short portions interposed between the peripheral side portions of the wear plates and said end plates, said end plates having resilient sealing means located therein abutted against the end plates and wear plates around the openings in the latter aligned with the discharge passage, thereby to seal off discharge pressures from the said pressure chambers, and said end plates having resilient sealing means located therein and abutting against the end plates and wear plates and defining pressure areas surrounding the said first mentioned resilient means and extending toward the inlet passageways somewhat beyond a plane normal to a line passing through the inlet and outlet passageways and also passing through the axes of rotation of the gears, and a pair of small openings in each of said wear plates leading to said pressure areas, said openings being similarly located relative to the gears and leading to areas of pressure disposed between the inlet and discharge pressures and isolated at all times from the discharge area by at least one gear tooth.

6. In a rotary machine of the class described, impeller means comprising a pair of intermeshing gears, a housing for said impeller means comprising a gear plate with an opening configured closely to receive said gears and of a thickness corresponding to that of said gears, spacer plates at each side of the gear plate and each having an opening somewhat larger than that in said gear plate, and opposed end plates abutted against said spacer plates, said housing having inlet and discharge passages leading to gears at inlet and discharge areas, shaft means with oppositely extending shaft portions supporting said gears and the end plates having openings for receiving the ends of the shafts, relatively thin wear plates disposed at opposite sides of and abutting against the side faces of the gears, said wear plates having shapes generally corresponding to the openings in said gear and spacer plates and having openings for said shaft means and openings of the same size as and aligned with said inlet and discharge passages, and being of a size so that their peripheral side portions abut against the sides of the gear plates and their peripheral edges are spaced from the opening defining edges of the spacer plates to define a seal receiving space, the wear plate thicknesses being less than the thicknesses of said spacer plates whereby the wear plates have freedom for movement toward the end plates and there are provided pressure chambers at the sides of the wear plates adjacent the end plates, resilient sealing gaskets having portions surrounding the peripheral edges of each of said wear plates and having radially short portions interposed between the peripheral side portions of the wear plates and said end plates, grooves in said end plates respectively receiving the major portions of said gaskets, said end plates having resilient sealing means located therein abutted against the end plates and wear plates around the openings in the latter aligned with the discharge passage, thereby to seal off discharge pressures from the said pressure chambers, and said end plates having resilient sealing means located therein and abutting against the end plates and wear plates and defining pressure areas surrounding the said first mentioned resilient means and extending toward the inlet passageways somewhat beyond a plane normal to a line passing through the inlet and outlet passageways and also passing through the axes of rotation of the gears, and a pair of small openings in each of said wear plates leading to said pressure areas, said openings being similarly located relative to the gears and leading to areas of pressure disposed between the inlet and discharge pressures and isolated at all times from the discharge area by at least one gear tooth.

7. In a rotary machine of the class described, impeller means, a housing for said impeller means, a wear plate in said housing having a first side abutting against a side of said impeller means and a second side facing the housing, means including a pressure chamber providing for lateral movement of said wear plate relative to the impeller means, high and low pressure passages passing through said plate to said impeller means, first sealing means in said pressure chamber between the second side of said plate and said housing surrounding the high pressure passage,

second sealing means in said pressure chamber between the housing and second side of said plate surrounding said first sealing means and bounding an area at the high pressure passage side approximately one half of the size of said impeller means less the area sealed off by the first sealing means, and passage means in said plate inside the area bounded by said second sealing means connecting said area to an impeller region where the pressure is more than the inlet pressure and less than the pressure in the high pressure passageway.

8. In a rotary machine of the class described, impeller means, a housing for said impeller means, a pair of wear plates in said housing each having a first side abutting against a side of said impeller means and a second side facing the housing, means including pressure chambers associated with the wear plates providing for lateral movement of said wear plates relative to the impeller means, high and low pressure passages passing through said plates to said impeller means, first sealing means in said pressure chambers between the second sides of said plates and said housing surrounding the high pressure passage, second sealing means in said pressure chambers between the housing and second sides of said plates surrounding the high pressure sealing means and bounding areas at the high pressure passage side approximately one half of the size of said impeller means less the area sealed off by the first sealing means, and passage means in said plates inside the areas bounded by said second sealing means connecting said areas to an impeller region where the pressure is more than the inlet pressure and less than the pressure in the high pressure passageway.

9. In a rotary machine of the class described, impeller means, a housing for said impeller means having inlet and outlet passageways leading to said impeller means, a wear plate in said housing having a first side abutting against a side of said impeller means and a second side facing the housing, means including a pressure chamber at the second side of said plate providing for lateral movement of said wear plate relative to the impeller means, said plate having passageway defining means communicating with a high pressure impeller region, first sealing means in said pressure chamber between the second side of said plate and said housing surrounding the passageway defining means communicating with said high pressure impeller region, second sealing means in said pressure chamber between the housing and second side of said plate surrounding the said first sealing means and bounding an area at the high pressure impeller side approximately one half of the size of said impeller means less the area sealed off by the first sealing means, and passage means connecting the area bounded by said second sealing means to an impeller region where the pressure is more than the inlet pressure and less than the pressure in the high pressure passageway.

10. In a rotary machine of the class described, impeller means, a housing for said impeller means having high and low pressure regions, a wear plate in said housing having a first side abutting against a side of said impeller means and a second side facing the housing, means including a pressure chamber at the second side of said plate providing for lateral movement of said wear plate relative to the impeller means, sealing means in said pressure chamber between the housing and second side of said plate bounding a single area at the high pressure side approximately one half of the size of said impeller means and passage means connecting the area bounded by said sealing means to an impeller region where the pressure is more than the inlet pressure and less than the highest pressure in said machine.

11. In a rotary machine of the class described, a housing, impeller means of the gear type in said housing, end loading means for the impeller means comprising a wear plate and resilient gasket means abutting against and bounding a pressure area on said wear plate, a groove in said housing in which a portion of said gasket is located, and a relatively rigid ring encircling the gasket means adjacent the wear plate and disposed partially in said groove at the side of the gasket remote from said pressure area said ring engaging both said gasket means and a side of the groove to prevent extrusion of said gasket means by pressure in said pressure area.

12. In a machine as claimed in claim 11 in which said ring has a height such that there is provided a space between it and the bottom of the groove.

13. In a machine as claimed in claim 11 in which said ring has an inwardly and outwardly flared portion abutting the gasket means and wear plate.

14. In a machine as claimed in claim 11 in which said ring has a height such that there is provided a space between it and the bottom of the groove, said ring also having an inwardly and outwardly flared portion abutting the gasket means and wear plate.

15. In a rotary machine of the class described, impeller means comprising a pair of intermeshing gears, a housing for said impeller means comprising a gear plate with an opening configured closely to receive said gears and of a thickness corresponding to that of said gears, means including an end plate abutted against said gear plate, providing an opening somewhat larger than that in the gear plate, said housing having inlet and discharge passages leading to the gears at inlet and discharge areas, shaft means for supporting said gears and having oppositely extending shaft portions and the end plate having an opening for receiving said shaft portions, a relatively thin wear plate disposed at the side of and abutting against the side faces of the gears, said wear plate having a shape corresponding to the opening in said gear plates and having openings for said shaft portions and openings of the same size as and aligned with said inlet and discharge passages, and being of a size such that its peripheral side portion abuts against the side of the gear plate and its peripheral edge is spaced from the opening defined by the means including said end plate to define a seal receiving space, the wear plate thickness being such that it has freedom for movement toward the end plate and there is provided a pressure chamber at the side of the wear plate adjacent the end plate, means sealing the peripheral edge region of said wear plate, said end plate having resilient sealing means located therein abutted against the end plate and wear plate around the opening in the latter aligned with the discharge passage, thereby to seal off discharge pressure from the said pressure chamber, and said end plate having resilient sealing means located therein and abutting against the end plate and wear plate and defining a pressure area surrounding the said first mentioned resilient means and extending toward the inlet passageway somewhat beyond a plane normal to a line passing through the inlet and outlet passageway and also passing through the axes of rotation of the gears, and a pair of small openings in said wear plate leading to said pressure area, said openings being similarly located relative to the gears and leading to areas of pressure disposed between the inlet and discharge pressures and isolated at all times from the discharge area by at least one gear tooth.

16. In a rotary machine as claimed in claim 15 wherein the inlet and discharge passages communicate with the gears through the openings in said wear plate.

17. In a rotary machine of the class described, gear type impeller means, a housing for said impeller means having high and low pressure passageways leading to said impeller means, a wear plate in said housing having a first side abutting against a side of said impeller means and a second side facing the housing, means including a pressure chamber at the second side of said plate providing for lateral movement of said wear plate relative to the impeller means, sealing means in said pressure chamber between the housing and second side of said plate bounding a single area at the high pressure side of the chamber approximately one half of the size of said impeller means, and passage means connecting the area

bounded by said sealing means to an impeller region where the pressure is more than inlet pressure and less than the highest pressure in said machine and isolated at all times from the high pressure passageway by at least one gear tooth.

18. In a rotary machine of the class described, gear type impeller means, a housing for said impeller means having high and low pressure passageways leading to said impeller means, a pair of wear plates in said housing each having a first side abutting against a side of said impeller means and a second side facing the housing, means including a pressure chamber at the second side of each of said plates providing for lateral movement of said wear plate relative to the impeller means, sealing means in each said pressure chamber between the housing and second side of said plate bounding a single area at the high pressure side of the chamber approximately one half of the size of said impeller means, and passage means connecting the area bounded by said sealing means to an impeller region where the pressure is more than

inlet pressure and less than the highest pressure in said machine and isolated at all times from the high pressure passageway by at least one gear tooth.

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