Aug. 27, 1963 H. M. CLARK ETAL 3,101,673

IMPLEMENT AND POWER STEERING PUMP

Filed June 16, 1961 4 Sheets-Sheet 1

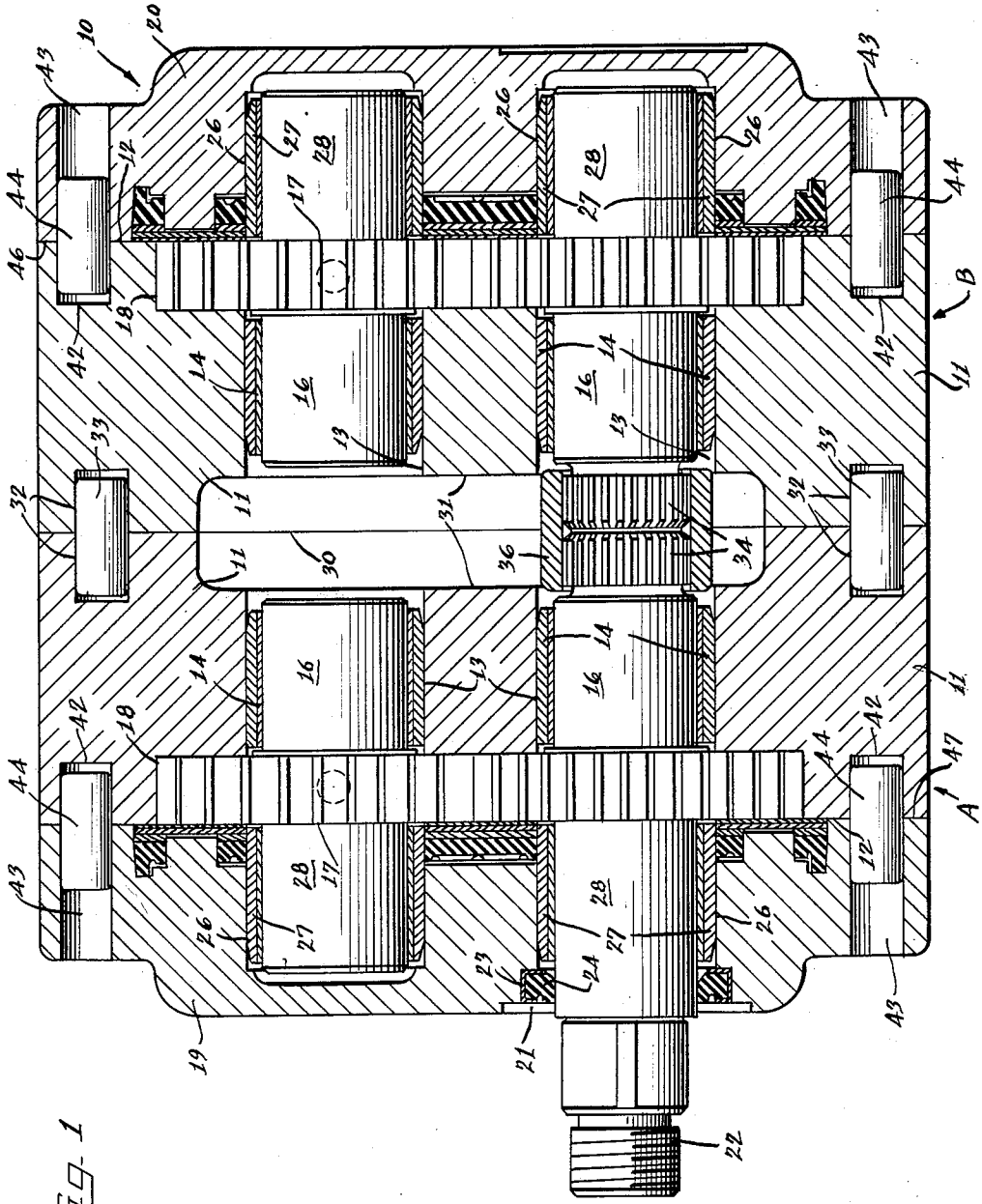

Fig. 1

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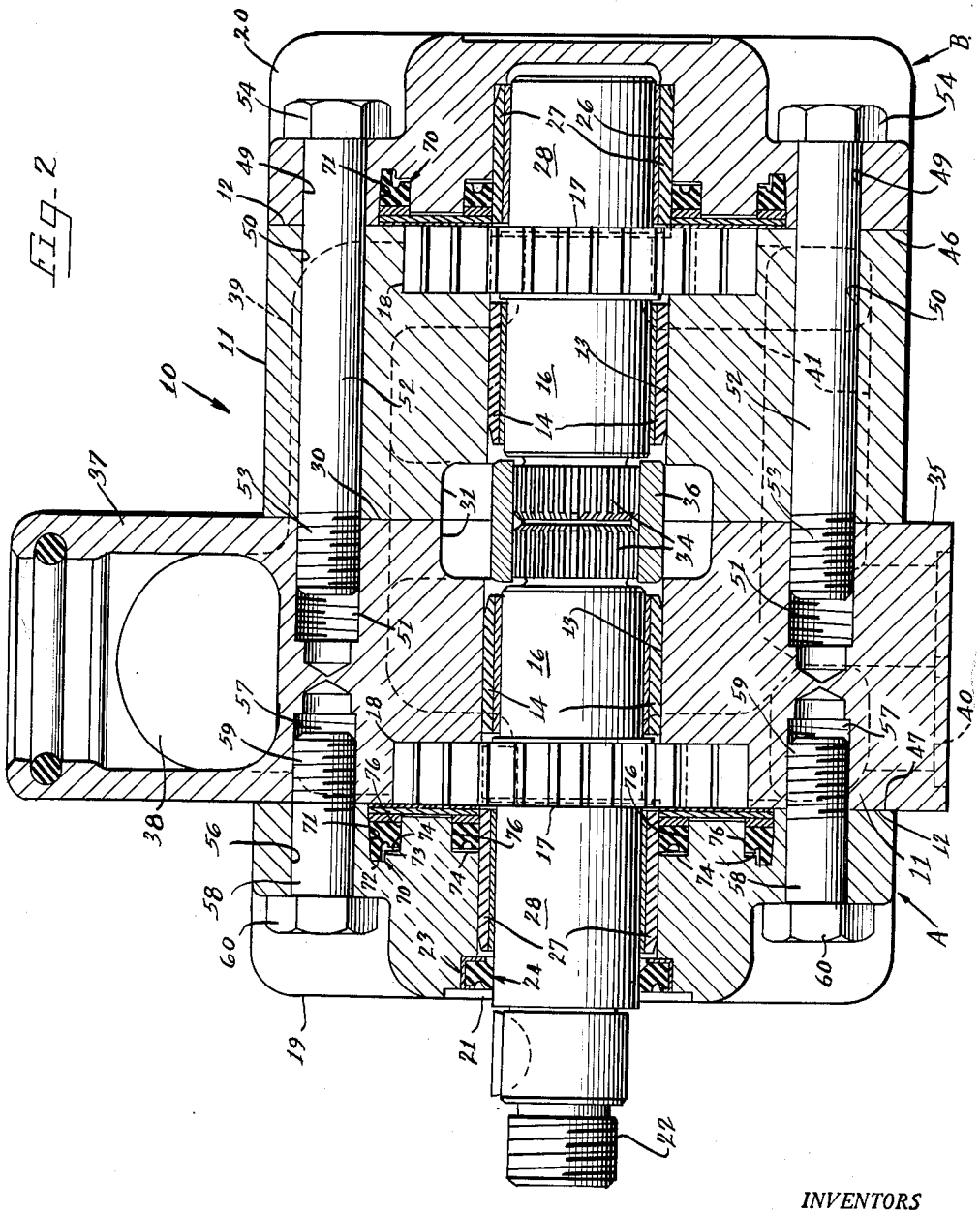
FIG. 2



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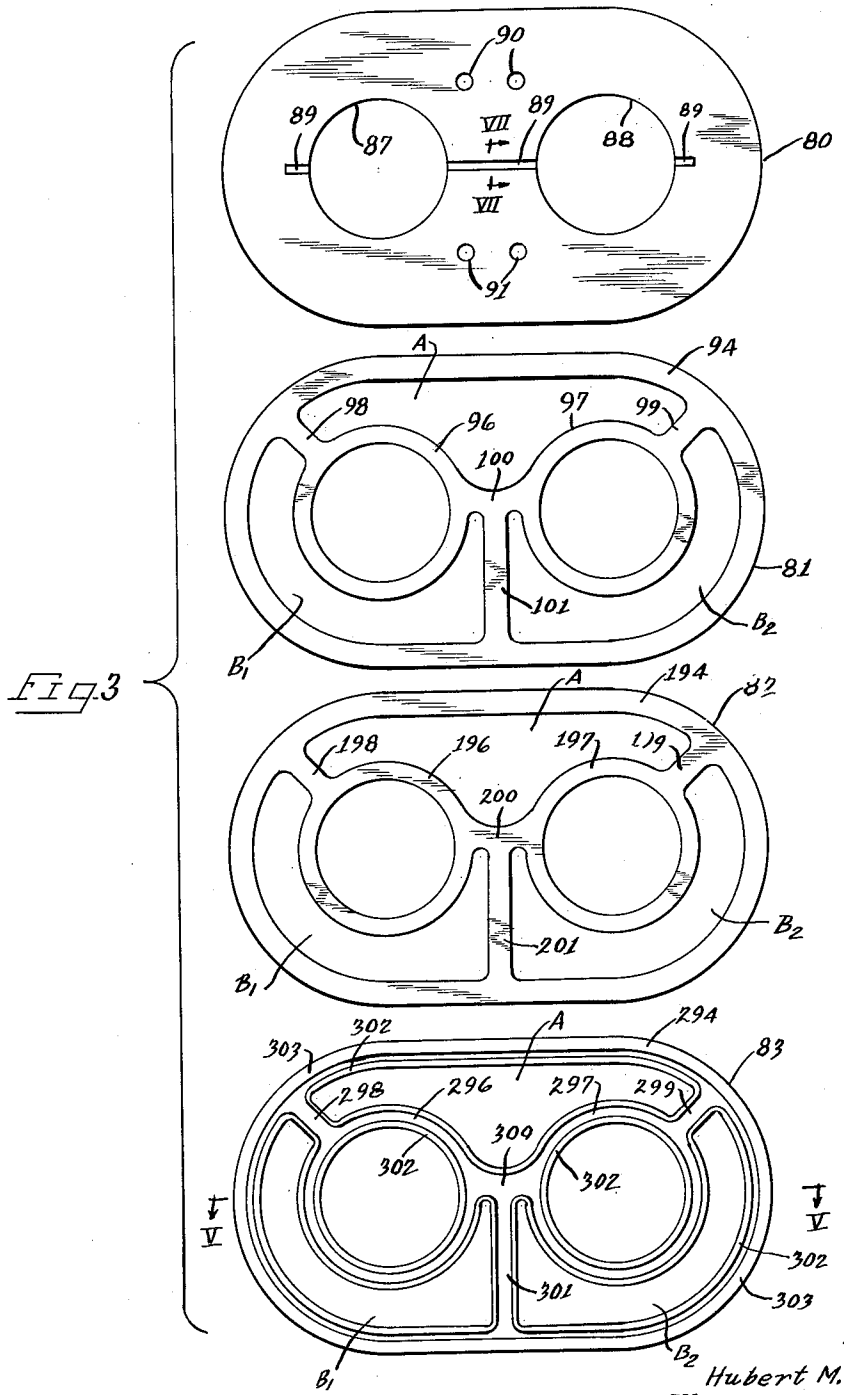

Fig 3

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Fig. 5

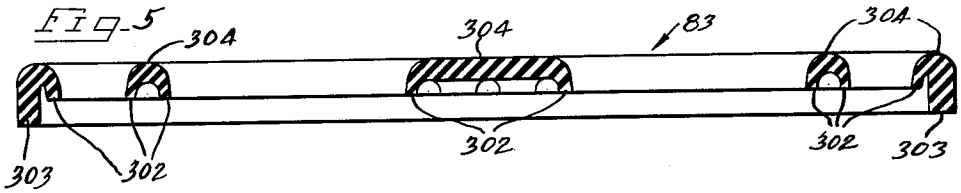


Fig. 4

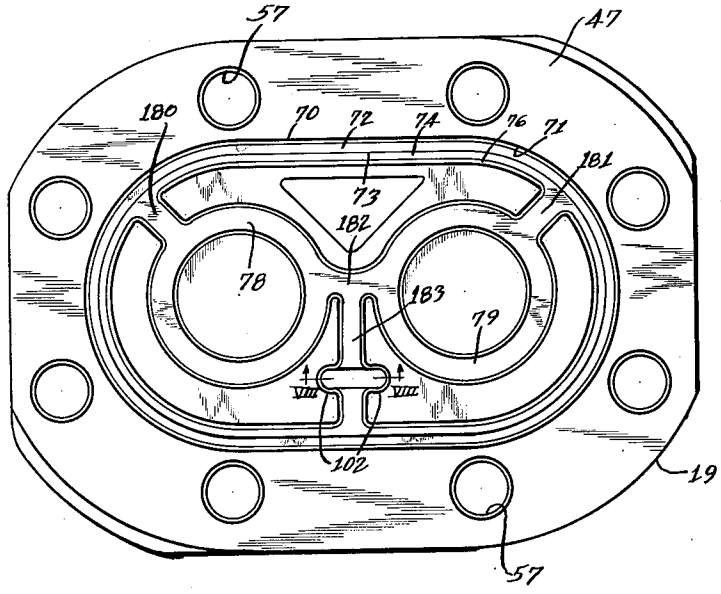


Fig. 6

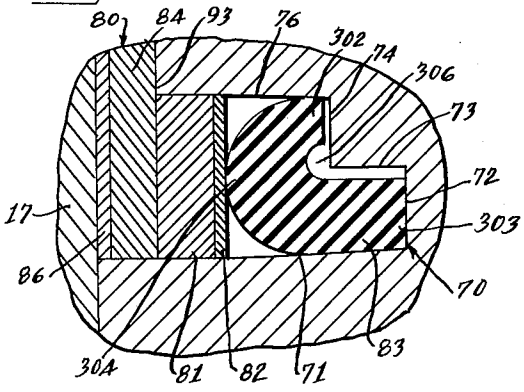


Fig. 7

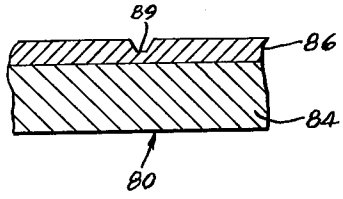
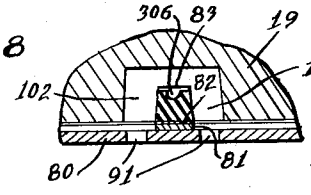


Fig. 8



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3,101,673

IMPLEMENT AND POWER STEERING PUMP

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4 Claims. (Cl. 103—126)

This invention relates generally to a pressure-loaded pump and more particularly to an improved pressure-loaded pump wherein a pressure plate is hydraulically sealed without requiring the application of a mechanical seal pressure to a sealing pack associated with the pressure plate and controlling the application of inlet and outlet pressures to minor and major areas of the pressure plate, respectively.

It is an object of the present invention to provide an improved pump construction.

Yet another object of the present invention is to provide a sealing arrangement for a pressure-loaded pump wherein a pressure plate may be hydraulically sealed without requiring the application of mechanical seal pressure to the sealing pack.

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 detained description which follows and the accompanying sheets 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 taken in a first plane through a pump incorporating the principles of the present invention;

FIGURE 2 is a cross-sectional view taken on a transverse plane and showing additional details of construction of the pump of FIGURE 1;

FIGURE 3 is an exploded view of the seal pack provided for the pump of FIGURES 1 and 2;

FIGURE 4 is an elevational view of the cover member provided in the pump of the present invention;

FIGURE 5 is a cross-sectional view of the sealing web taken substantially on line V—V of FIGURE 3;

FIGURE 6 is an enlarged fragmentary cross-section view showing additional details of the seal pack;

FIGURE 7 is an enlarged fragmentary view taken generally on line VII—VII of FIGURE 3; and

FIGURE 8 is an enlarged fragmentary cross-sectional view taken substantially on line VIII—VIII of FIGURE 4 but showing additional components of the seal pack assembled in place.

As shown on the drawings:

The pump of the present invention is shown generally at 10 and comprises a double unit construction, each unit of which being substantially identical insofar as structural and functional features are concerned and, accordingly, like reference numerals will be applied to like parts wherever possible.

First of all, as shown in FIGURE 1, each pump unit is identified for convenience by A or B and each unit includes a casing member 11 having a radially extending wall 12 intersected by a pair of bores 13 adapted to retain bearing means 14 for journaling shaft extensions 16 of the driver and driven gears of a rotary fluid displacement means 17. The rotary fluid displacement means 17 operate within a common counterbored enlargement of the respective bores 13 forming a pumping chamber 18 formed as a recess in each respective radial wall 12.

A cover member 19 is provided at one end of the pump

10 and a somewhat similar cover member 20 is provided at the other end of the pump, the cover member 19 differing from the cover member 20 in being provided with an opening 21 accommodating a driving shaft extension 22, which opening 21 is suitably counterbored as at 23 to accommodate a shaft seal assembly 24.

In other respects, the cover members 19 and 20 are similar since each is provided with a bore recess 26 accommodating bearing means 27 for journaling gear shaft extension 28 formed on the rotary fluid displacement means 17.

The two casing parts 11 have a mating wall joint 30 recessed as at 31 at an inner portion and also recessed as at 32 at an outer portion for receiving a locating pin 33.

In order to interconnect the two pump units, suitable splines as at 34 are formed on the shaft extensions 16, 16 and are interconnected by an internally splined sleeve 36.

One of the casing parts 11 is provided with a boss 37 thereby to form a common inlet 38 for the two pump units, the other casing part 11 having a cored passage 39 communicating with the inlet 38 in the boss 37.

The same casing part 11 in which is formed the inlet 38 also has a boss 35 in which is formed a common outlet 40, the other casing part 11 having a cored passage 41 communicating fluid at discharge pressure to the outlet 40. The bosses 37 and 35 are formed to accommodate connections of the pump to a conduit system.

Each casing part 11 is also recessed inwardly of its radially extending wall 12 as at 42 and each corresponding cover part 19 and 20 is similarly recessed as at 43, thereby to receive a locating pin 44 in each respective pair of adjoining recesses.

The cover 20 has a radial wall 46 which engages against the radial wall 12 of the adjoining casing part 11, while the cover 19 has a radial wall 47 which engages against the radial wall 12 of the adjoining casing part 11.

In order to place the casing parts 11, 11 and the cover members 19, 20 in firm assembly with one another, fastening means are provided. For example, the cover member 20 is apertured as at 49, while the adjoining cover part 11 is apertured as at 50 and the other cover part 11 is provided with a corresponding plurality of threaded recesses 51. Thus, a bolt 52 threaded as at 53 is inserted through the apertures 49 and 50 and threaded into a recess 51, whereupon the bolt may be tightly drawn up by turning a head portion 54.

In like manner, the cover member 19 is apertured as at 56 and threaded apertures 57 are provided in the adjoining cover part 11, thereby to facilitate the use of a bolt 58 having a threaded portion 59 so the cover member 19 may be fastened in firm assembly by turning the head portion 60 of each bolt 58.

Referring specifically to FIGURE 4 in connection with FIGURES 1 and 2, the wall 47 of the cover member 19 is shown in detail to illustrate the recessing arrangement provided in the wall 47 for accommodating a novel seal pack in accordance with the principles of the present invention. The wall 46 of the cover member 20 is similarly recessed and, accordingly, like reference numerals may be employed.

First of all, note there is a generally ovaloidal shaped recess 70 which is larger than the adjoining pumping chamber 18. The outer wall of the ovaloidal recess 70 is shown at 71 and extends generally axially to the deepest point of the recess, terminating in a radial wall 72.

Spaced inwardly of the wall 71 is another generally axially extending wall 73. The walls 71, 72 and 73 to-

gether form a channel which is peripherally continuous with respect to the ovaloidal recess 70.

The wall 73 is terminated by a radial wall 74 extending inwardly to another generally axially extending wall 76 which is spaced inwardly of both the walls 71 and 73. The wall 74 and the wall 76 have an irregular shape and it will be noted that there is formed at the depth prescribed by the cooperation of such two walls a channel which includes two circumferentially continuous, generally circular grooves 78 and 79 joined to a peripherally continuous groove by two angular slots 180 and 181 on the inlet side of the pump. A slot 182 interconnects the circular grooves or channels 78 and 79 and a transversely extending slot 183 interconnects the slot 182 with the peripherally continuous slot.

Received within the ovaloidal recess 70 is a seal pack shown in exploded relation in FIGURE 3. The seal pack consists essentially of three major parts including a pressure plate, a backing means and a sealing web, the pressure plate being shown at 80, the backing means being shown as constituting two separate members 81 and 82 and the sealing web being shown at 83.

More specifically, the pressure plate 80 comprises a flat plate-like member 84 having a bronzed face lamination 86 for presenting a sealing face to the adjoining side face of the rotary pumping means 17. The plate member 84 is of generally ovaloidal configuration, thereby to conform in shape to the ovaloidal recess 70. As shown in FIGURES 1 and 2, the outer margins of the pressure plate 80 overlie the wall 12 of the casing part, while the inner portions of the pressure plate 80 span the adjoining pumping chamber in which the rotary fluid displacement means 17 is rotated.

The pressure plate 80 has a pair of spaced apertures 87 and 88 through which pass the shaft extensions 28 of the gears. The bronzed layer 86 is also grooved as at 89 to provide anti-trapping relief, as well as to permit distribution of a fluid film over the sealing face of the pressure plate during operation.

On both the discharge side and the inlet side of the pressure plate 80, there is provided a pair of apertures shown at 90 on the inlet side of the pump and 91 on the outlet side of the pump for communicating fluid at inlet and outlet pressure, respectively, in an axial direction.

The rear face of the pressure plate 80 forms a motive surface 93 whereby the seal pack may be pressure-loaded and wherein the applied pack pressure is not only balanced but is independent of any mechanical loading effected by the fasteners 52 and 58. To insure the absence of mechanical loading, it will be noted the short legs of the sealing web 83 are spaced out of contact with the cover 20.

Received within the recess 70 is a backing means for engaging the motive surface 93 and partitioning the same into segregated major and minor areas. The backing means comprise a first backing member shown at 81 and which may conveniently comprise a phenolic coated canvas member of generally ovaloidal shape including a circumferentially continuous outer margin 94, a pair of inner peripherally continuous circular portions 96 and 97 joined to the outer margin 94 by two angularly disposed webs 98 and 99 on the inlet side of the pump and interconnected to one another by a web 100. The web 100 and the outer margin 94 are connected by a cross piece 101. There is thus formed a minor area on the inlet side of the pump shown at A and a major area which has two components illustrated at B_1 and B_2.

The backing means further comprises a second backing member 82 made of "fish paper" or any other suitable material. Although thinner than the backing member 81, the backing member 82 is of the same size and configuration as the backing member 81 and, accordingly, like reference numerals increased by 100 have been applied to the corresponding parts.

Next, there is provided the sealing web which may be made of a suitable resilient material and which has been identified at 83. The overall configuration of the sealing web 83 is similar to that of the backing members 81 and 82 and, accordingly, to identify the specific structural parts, similar reference numerals increased by 200, relative to the backing member 81 and increased by 100 relative to the backing member 82, have been applied.

As is clearly shown in the enlargement of FIGURE 6, the sealing web 83 is somewhat J shape in cross-section and includes a short leg 302 and a long leg 303.

There is also provided a bight portion 304 which engages against the backing member 82. When in assembly with a corresponding cover member, the short leg 302 is spaced from the shoulder 74 but engages the side of the groove 76 while the long leg 303 engages against the shoulder 72, thereby forming in cooperation with the corresponding cover member a pressure pocket 306. The pressure in the pocket 306 expands the material of the web 83 both ways against the groove walls of the cover to seal and also applies a loading force to the plate.

The long leg 303 does apply a "mechanical loading" to the pressure plate but such "loading" is applied over the casing part only of the pressure plate.

In referring to the structural detail of each respective cover member, for example, the cover member 19 as shown in FIGURE 4, it will be noted the cross channel 83 has a pair of enlarged lobes shown at 102. The lobes 102 are disposed opposite the apertures 91 formed in the pressure plate 80, thereby communicating fluid at pump-generated pressure from the outlet side of the pump into the pressure pocket 306 behind the sealing web 83. Accordingly, the sealing web 83 will apply pack pressure to the sealing pack in an axial direction, thereby to engage the pressure plate 80 against the adjoining side face of the gears.

The apertures 90, of course, communicate the minor area A on the back side of the pressure plate 80, or the motive surface 93 to inlet, thereby insuring that the entire minor area A will be at reduced pressure.

The two sectors B_1 and B_2 of the major area will also be communicated with pump-generated discharge pressure through the apertures 91, thereby balancing the pump-generated pressures present in the pumping cavity and acting on the pressure face of the pressure plate 80.

By virtue of such provision, it will be noted that a sizable portion of the sealing pack is under the influence of applied pressure that is somewhat balanced. Furthermore, the pressure loading of the sealing web is effected while avoiding the necessity of applying mechanical seal pressure to the pack. Accordingly, possible variations in seal pressure are avoided and the difficulties attendant upon an unloaded seal pressure are also eliminated.

While minor modifications might be proposed by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of our contribution to the art.

We claim as our invention:

1. A pump comprising a casing having a recess in one wall forming a pumping chamber, a cover engaging said one wall and having recess means formed therein for receiving a seal pack axially opposite said pumping chamber, fastening means interconnecting said casing and said cover outwardly of said pumping chamber and said recess means, and a seal pack in said recess means comprising a pressure plate having outer marginal portions overlapping the edges of said pumping chamber and engaging against said one wall of said casing, said pressure plate including inner sealing portions for engaging and sealing against the adjoining side face of rotary fluid displacement means in the pumping chamber, said recess means including an irregularly shaped recess having a generally ovaloidal continuous outer channel, a pair of substantially circular inner channels, a first and a second cross channel extending between each said inner and outer channels and disposed

at an angle with respect to each inner channel on the inlet side of the pump, a third cross channel between said inner channels and a fourth cross channel between said third channel and said outer channel, a similarly irregularly shaped backing means in said channels, and a similarly irregularly shaped sealing web of generally J-shaped cross-section in said channels behind said backing means, said sealing web having an outer long leg and an inner short leg, each of said legs having portions engaging and sealing against the wall portions of said cover member and together therewith forming a pressure pocket, said pressure plate having a back face forming a motion surface, said motive surface being divided by said backing means into a major motive area on the outlet side of the pump and a minor motive area on the inlet side of the pump, said pressure plate having openings extending therethrough communicating inlet pressure into said minor area and discharge pressure into said major area to provide balanced loading of said pressure plate, and means in said cover conducting fluid at pump-generated pressure into the pressure pocket, thereby hydraulically sealing the pressure plate without requiring any mechanical seal pressure on the pack.

2. A pump comprising a casing having a pumping chamber, a cover engaging said casing and having recess means formed therein for receiving a seal pack axially opposite said pumping chamber, and a sealing web of generally J-shaped cross-section in said recess means of said cover, said recess means and said web including a generally ovaloidal continuous outer portion, a pair of substantially circular inner portions, and at least two cross channels joining the inner portions to the outer portions on the inlet side of the pump and a third cross channel interconnecting the inner portions, thereby to form segregated major and minor areas, a pressure plate, said sealing web having a long leg and a short leg each having portions engaging and sealing against the sides of said recess means and forming with said cover a pressure pocket, the bight portion of said web between said legs engaging an adjoining motive surface of the pressure plate, means conducting fluid at pump-generated pressure to said pocket for hydraulically sealing the pressure plate, the radially outermost portion of said web being inwardly of the outer portion of said pressure plate, whereby the pressure plate is hydraulically sealed without requiring any mechanical seal pressure on the pack.

3. A pump comprising a casing having a recess in one wall forming a pumping chamber, a cover engaging said one wall and having recess means for receiving a seal pack, fastening means interconnecting said casing and said

cover outwardly of said pumping chamber and said recess means, and a seal pack in said recess means comprising a pressure plate, backing means and a sealing web, said sealing web having a channel formed in its back surface to form with an adjoining wall of said cover a pressure pocket, said backing means and said sealing web including a radially outermost peripherally continuous margin spaced inwardly of the outer margin of said pressure plate, and a pair of inner peripherally continuous walls joined to said outer margin at plural points including at least two angularly spaced portions on the inlet side of the pump, means joining said inner walls together thereby to segregate the back face of said pressure plate into major and minor areas for loading with correspondingly high and low pump pressures, respectively, said pressure plate having outer marginal portions overlapping the edges of said pumping chamber and engaging and sealing against the adjoining side face of rotary gears in the pumping chamber, said web having a J-shaped cross-section with a long leg and a short leg, said long leg engaging and said short leg being spaced from the bottom of said recess means in said cover and both said legs engaging the side walls of said recess means to form a pocket, and means for conducting pump-generated pressure to said pocket.

4. A pump comprising a casing means including a cover having a cover wall formed with a web retaining groove and provided with a cover wall shoulder at the bottom of said groove, a resilient sealing web for said pump comprising a short leg and a long leg together forming a web somewhat J shaped in cross-section, said web having a bight portion between said legs for engaging a backing member, said short leg being spaced from said adjoining cover wall shoulder but engaging the side of said web-retaining groove formed in said cover, said long leg engaging said cover at the bottom of said groove to form a pressure pocket, wherein pressure in the pocket will expand the material of the web both ways against the groove walls to seal and apply a pressure loading force through the backing member.

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