Oct. 19, 1937. T. HANSEN 2,096,490

ROTARY PUMP

Filed Dec. 16, 1935 2 Sheets-Sheet 1

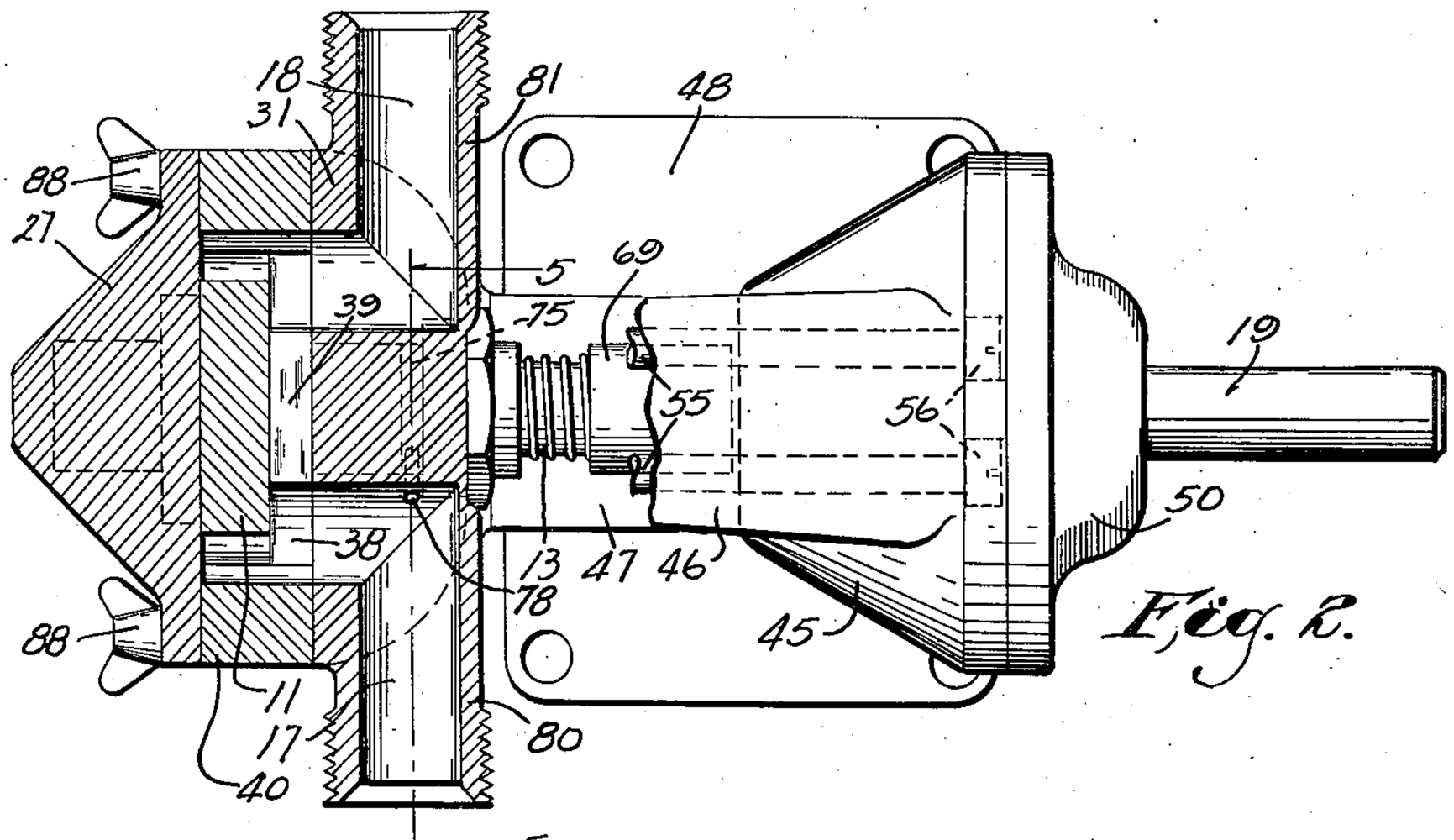

Fig. 2.

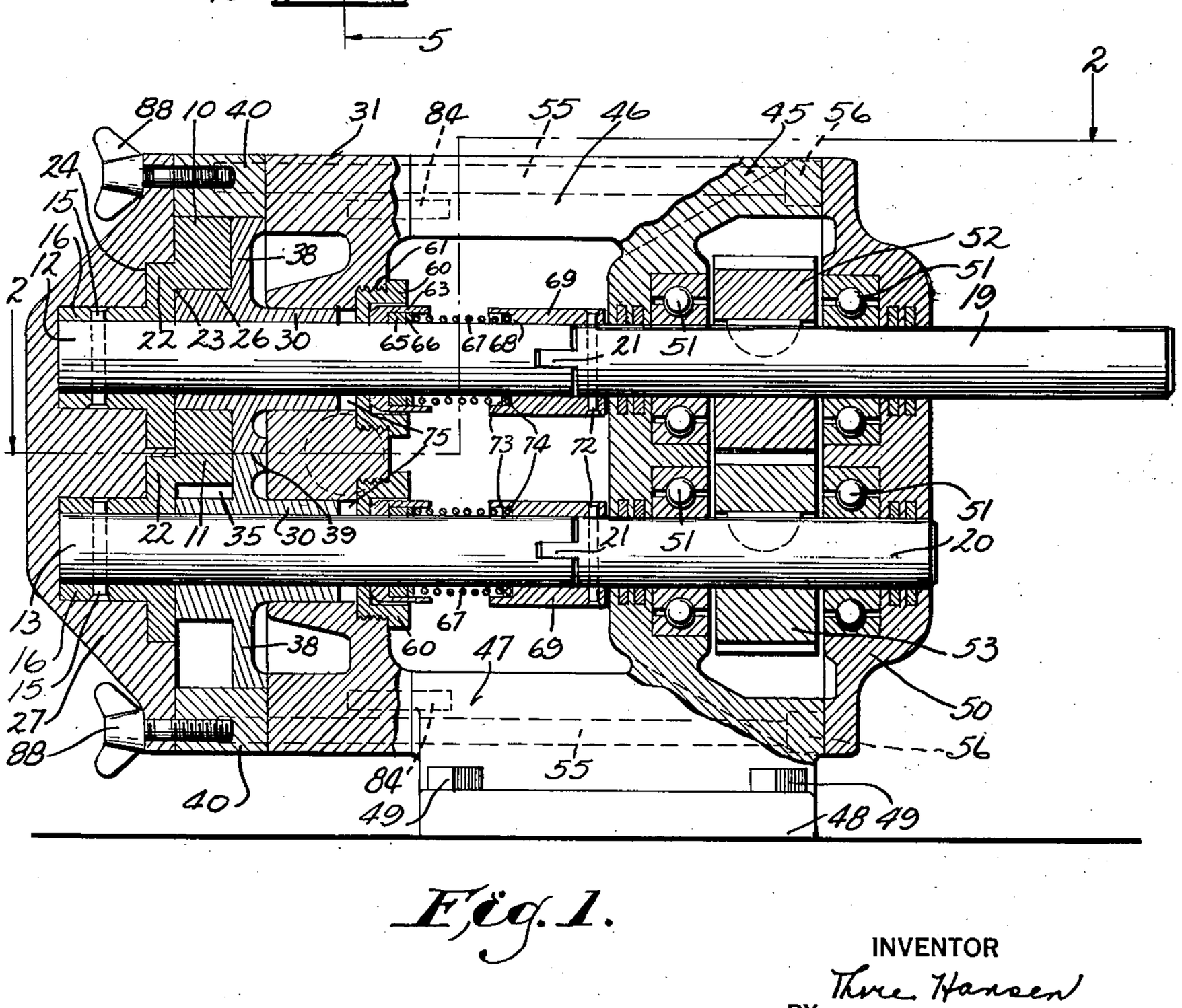

Fig. 1.

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Fig. 3.

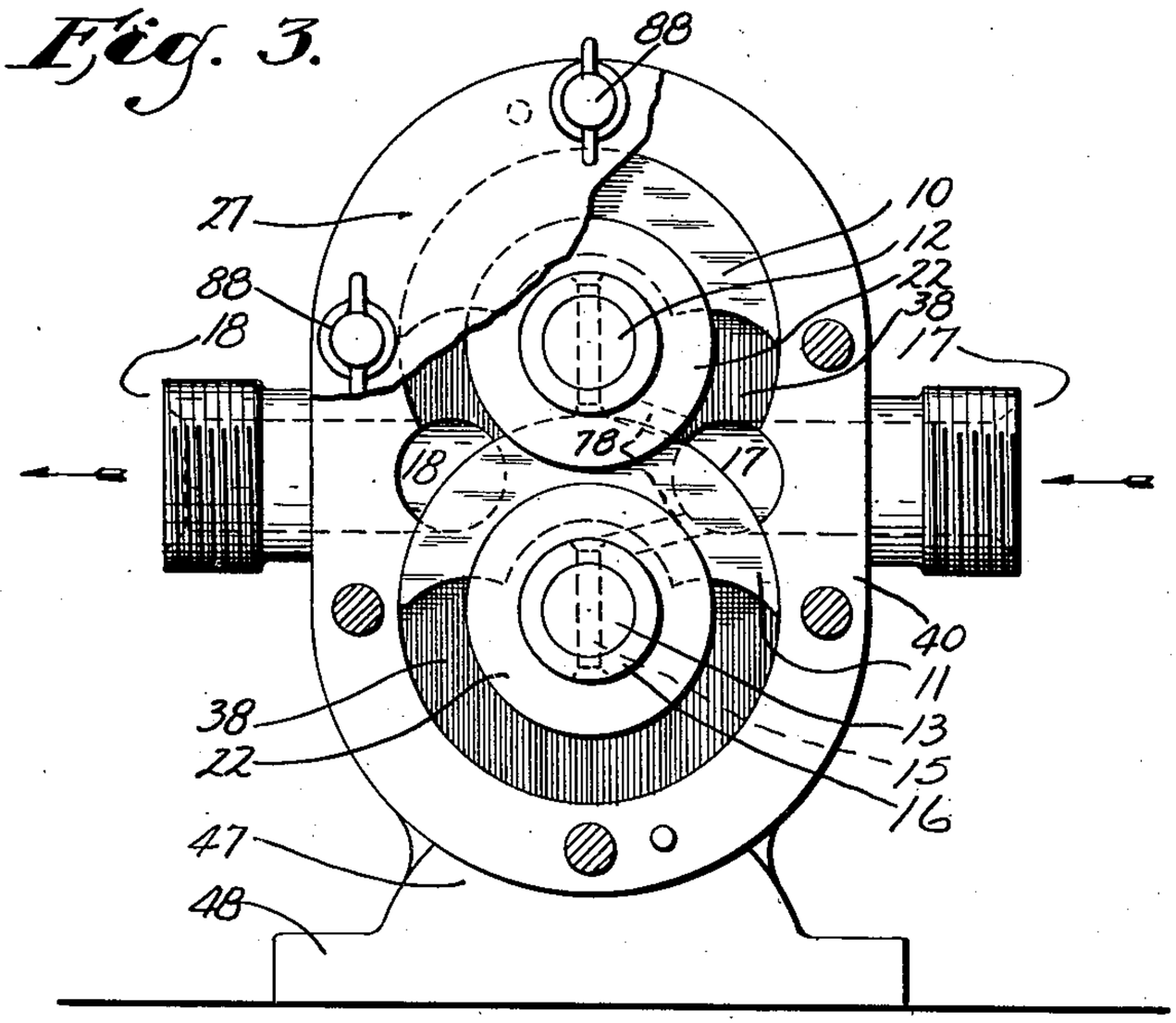
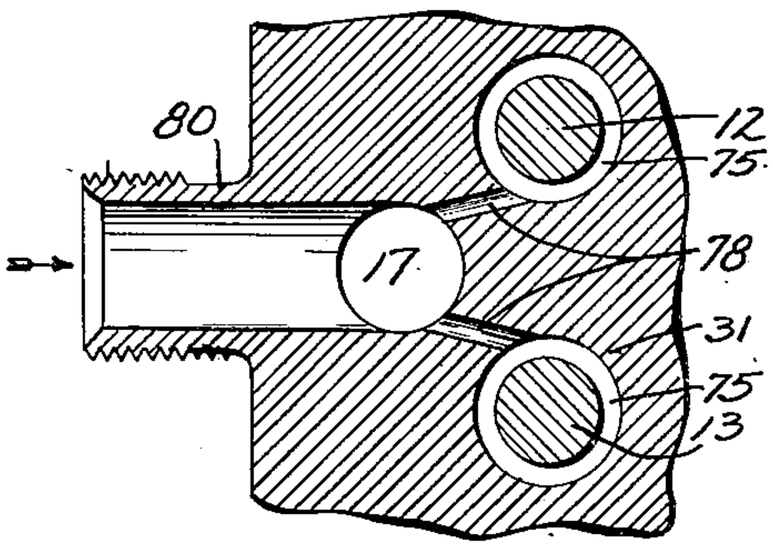
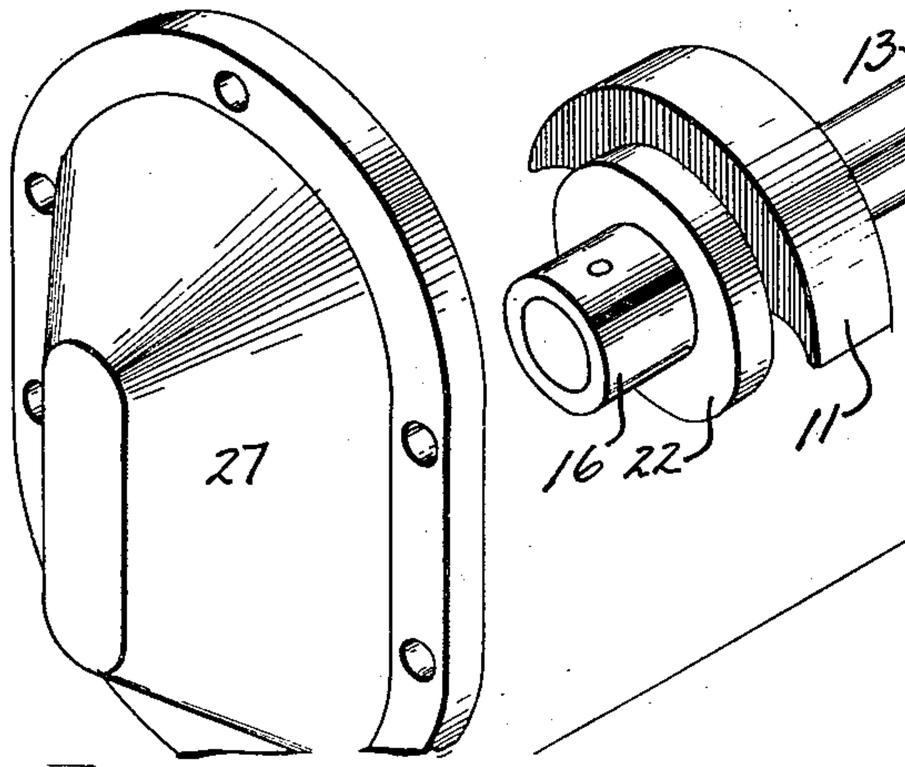


Fig. 5.





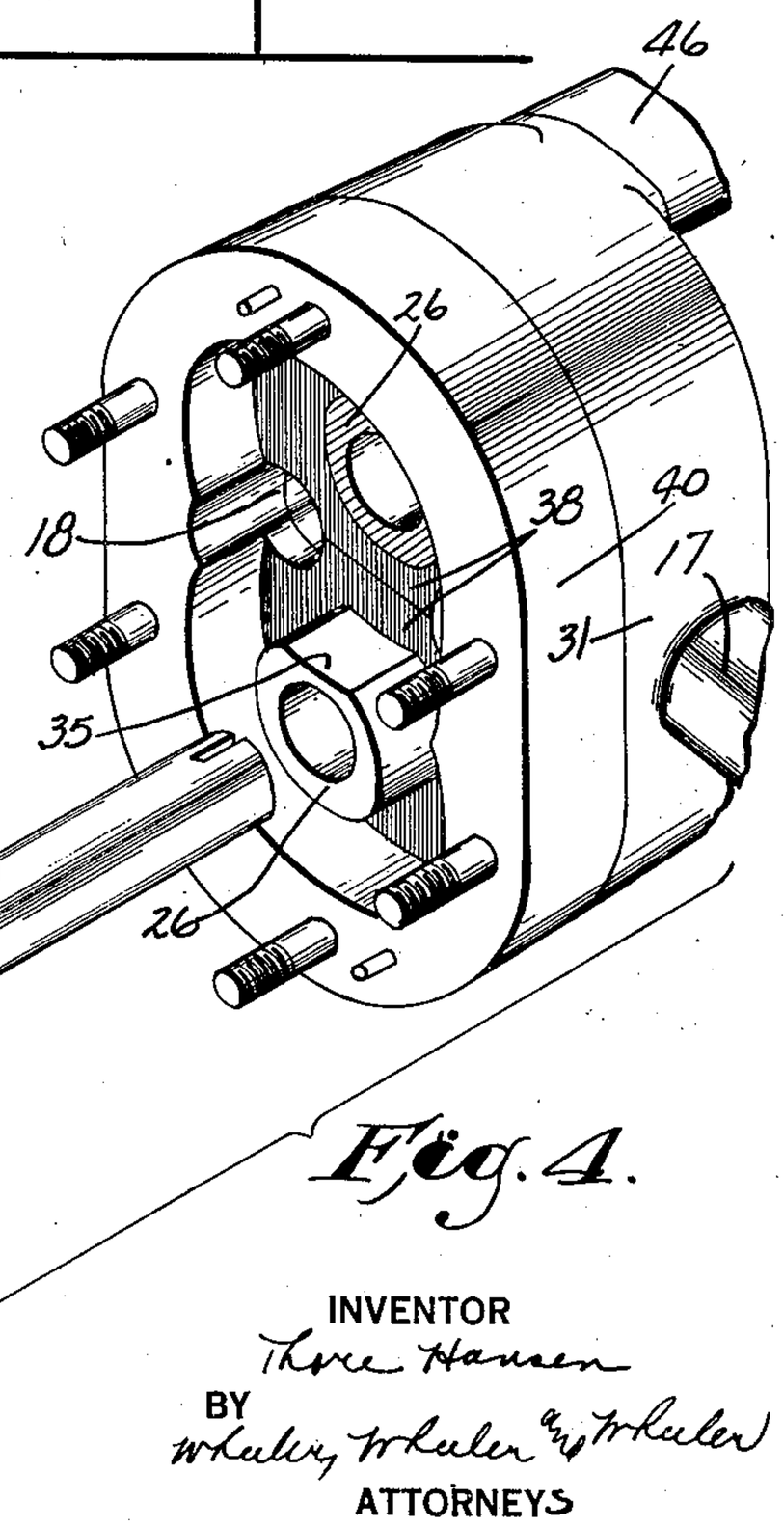


Fig. 4.

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ROTARY PUMP

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Application December 16, 1935, Serial No. 54,626

10 Claims. (Cl. 103—126)

My invention relates to improvements in rotary pumps.

Objects of my invention are to provide means to facilitate increased accuracy in machining, whereby such pumps can be made to serve as high pressure pumps or pumps operable to deliver fluids at greater pressure than has heretofore been possible to attain.

A further object of my invention is to provide a pump of the described class, in which the expense of renewing parts subject to wear will be reduced to a minimum.

A further object is to provide means whereby the working parts of such a pump may be kept in a perfectly sanitary condition during operation, and thoroughly cleansed with minimum expense and loss of time after such operation.

A further object is to provide means whereby the parts of my improved pump which require to be removed for cleansing purposes may be removed and replaced with such facility that a failure to thoroughly cleanse the pump after each operation may be said to be inexcusable.

Further objects are to provide means for ensuring accuracy in positioning of parts removed for cleansing or replacement,—for affording ready access to auxiliary parts requiring removal or adjustment from time to time,—and to provide means whereby such a pump may be constructed in units, including a gear box unit, an outboard body unit, and a replaceable shaft and piston unit associated with a removable cap.

The drawings illustrate an embodiment of my invention in a rotary pump having interacting crescent-shaped pistons mounted upon parallel shafts.

Figure 1 is a sectional view of this embodiment of my improved pump, drawn to a plane intersecting the axes of the shafts.

Figure 2 is a sectional view drawn generally to line 2—2 of Figure 1.

Figure 3 is a front elevation, with all but a fragment of the end cap removed.

Figure 4 is a dispersed view, showing, in perspective, the front end cap and one of the shaft units as they appear when withdrawn from the body unit.

Figure 5 is a fragmentary sectional view drawn generally to line 5—5 of Figure 2.

Like parts are identified by the same reference characters throughout the several views.

Rotary pumps employing a pair of crescent-shaped pistons mounted upon intergeared shafts and arranged with their peripheries each fitted to a concave recess in the hub of the opposing piston are old and well-known in the art. I prefer to embody my invention in this type of rotary pump as illustrated in the drawings. In Figure 3 the pistons 10 and 11 are shown connected with their respective shafts 12 and 13, to which they may be secured in any suitable manner. In the drawings they are shown connected with the shafts by cross pins 15 extending through hubs 16 connected with the respective pistons. Inlet and outlet ports 17 and 18 may be provided, but my improved pump is made reversible whereby either of these ports may serve as the inlet, the other one becoming the outlet, although as hereinafter explained, but one part requires reversal.

To facilitate removal of the pistons for cleansing or repair purposes the shafts are longitudinally divided into sections, as best shown in Figure 1, shaft 12 being in slip-clutch connection with a driving shaft 19, and shaft 13 being similarly connected with a driving shaft 20. As shown in the drawings, the driving shafts are flattened at their inner ends to provide clutch jaws 21, and the piston supporting shafts 12 and 13 are correspondingly socketed. Sufficient clearance is allowed between the shaft ends and in the sockets to allow independent axial expansion and contraction, whereby the pistons are floatingly mounted in their respective cylinders and will not be pressed into binding relation to either the front or rear cylinder wall under temperature variation.

The hubs 16 are connected with their respective pistons by elbowed annular flanges 22 extending radially from the hubs and axially between shoulders 23 and 24, on the inner wall 26 of the piston cavity or cylinder and cap 27 respectively. A cap member 27 forms the end wall of the pump casing, and the portions which bear on the pistons 10 form the front sides of the piston cavities.

The inner wall 26 of each piston cavity serves also as a sleeve bearing for the associated shaft, and it preferably has a rearward extension 30 of reduced thickness which is fitted to a bore in a supporting body or back wall member 31.

The portion 26 of this sleeve has a concave recess 35 to receive the opposing piston when in registry therewith. At the junction of the portion 26 with the reduced portion 30 an outwardly extending flange 38 provides a rear or lining wall for the piston cavity, and the two liner walls or flanges 38 are faced off in a transverse plane midway of the two shafts and fitted together as indicated at 39 in Figure 1, to form a steam-tight ground joint. The peripheries of the flanges 38

are also faced off, ground, and fitted to a peripheral wall **40**, the form of which is best shown in Figure 4 as of a generally figure 8 contour, with the two lobes intersecting midway between the shafts in the plane **39**.

The pump casing formed by the back wall **31**, the wall **40** of the intercommunicating cylinders, and the front cap **27**, will preferably be wholly supported from a gear housing member **45** which has a pump supporting overarm **46** and an under arm **47**. The latter has a base flange **48**, whereby the entire structure may be secured to a suitable support by bolts **49**. The gear housing, with its rear cap **50**, contains suitable bearings **51** for the driving shafts, and between these bearings the shafts **19** and **20** are intergeared, the shaft **19** having a fixed spur gear **52** and the shaft **20** having an intermeshing spur gear **53**. Power may be applied to the shaft **19** to rotate the pistons in opposite directions.

The structure of the driving mechanism is not material to the invention herein claimed, and further description of the gear housing and its contents is therefore deemed unnecessary except to point out that the arms **46** and **47** serve as spacers and supporting arms for the pump proper. Bolts **55** extend through suitable apertures in these arms and in the back wall member **31**, and have threaded engagement in the peripheral wall **40** of the piston cavities. The heads **56** of these bolts are countersunk and normally covered by the rear cap **50**. The joint between the driving and driven shafts, and the only packing devices required by the pump, are exposed in the space between the gear housing and the pump back wall **31**, whereby any leakage from the pump cavity along the shafts **12** and **13** will immediately become visible, and whereby the packing may be readjusted or replaced as required.

The particular form of packing to the employed between the driven shafts and the back wall **31** is not material to the invention herein claimed. In the construction illustrated, cup-shaped packing nuts **60** are fitted to their associated shaft members and screwed into the enlarged and threaded bores **61** formed in the back wall **31**.

Cooperative cup-shaped packing members **63** are also fitted to the driven shafts, and their inner faces, together with the opposing faces of the nuts **60**, are accurately machined to produce a ground joint. Within the cup-shaped member **63** a compressible packing member **65** may be inserted and compressed by means of a seating ring **66** and a compression spring **67** associated with each shaft. The rear ends of these springs are preferably socketed at **68** in joint spanning sleeves **69**.

It is not material to the invention herein claimed whether the sleeves **69** are secured to the respective driving shafts to rotate therewith or whether they comprise loose sleeves fitted to the shaft ends and held by pressure of the springs **67** against the adjacent wall of the gear housing **45**. In the drawings these sleeves are illustrated as connected with their associated driving shafts by cross pins **72**. If so connected they will rotate with the shafts and seating rings **73** may be employed for the springs **67**, with interposed antifriction or ball bearings **74**, whereby the rotary movements of the sleeves **69** will not be transmitted to the springs.

It will be observed that I have provided gaps **75** between the rear ends of the bearing members **30** and the packing nuts **60**. The annular cavities thus provided are in communication with the inlet port **17** through the return ducts or ports **78**.

The clamping bolts **55** are symmetrically disposed to permit a rotative adjustment of the back wall **31** which serves as a means for connection of the supply and return pipes with the inlet and outlet ports **17** and **18**. The back wall is provided with tubular oppositely disposed coupling studs **80** and **81**, through which the wall **31** is bored to provide the radial extensions of the ports **17** and **18**. Bores extending axially through the flange **38** and the front face of the wall **31** intersect the inner ends of the radially extending bores, whereby fluid may be delivered to and discharged from the cylinder cavities in a plane substantially including the axes of the radial bores and the line of cylinder intersection, as best shown in Figure 3. When inlet pipes are to be connected at one side of the pump the bolts **55** are removed and the wall **31** adjusted to bring the inlet port to that side. When the inlet pipes are to be connected at the opposite side of the pump the withdrawal of the bolts **55** allows the wall **31** to be rotated a one-half turn, whereupon it may be again clamped in position by means of the same bolts, since their symmetrical arrangement makes this possible. The arms **46** and **47** may be provided with dowel pins **84**, which are fitted to suitable sockets in the wall **31**, whereby accurate positioning is facilitated independently of the bolts. It will, of course, be understood that when the bolts **55** are withdrawn from the back wall **31** the entire pump structure may be bodily reversed instead of relatively reversing the wall **31** with reference to the intermediate member **40** and its associated parts.

The front ends of the driven shafts **12** and **13**, together with the hubs **16** of the rotary pistons, are socketed in the front end cap **27**, which not only provides a forward bearing but prevents these driven shafts from withdrawing from their associated power shafts. Since no other means are provided for holding the shafts **12** and **13** against lineal movement they can be immediately withdrawn when the cap is removed, and by providing thumb nuts **88** on the cap retaining bolts, manual removal of the cap is expedited. When the shafts **12** and **13** and their associated pistons are withdrawn they may be separately cleansed, and free access is obtained to the interior of the cylinders, whereby the walls may be quickly and thoroughly cleansed.

The parts of my improved pump may be machined with extreme accuracy, with a tolerance of less than one half of the minimum obtainable in similar pumps as heretofore constructed. This is due in part to the fact that the unit parts are separately constructed and machined, the back wall bored for the shaft apertures, and the radial runs of the inlet and outlet ports, the horizontal runs of the ports bored after partial assembly, and the joints otherwise doweled.

Complete accessibility for sanitary and repair purposes is thus combined with such precision in structure and assembly as to enable fluids to be pumped at high pressures comparable to those attained by piston pumps and with the added advantage of a non-pulsating delivery.

When assembled, an exceedingly high pressure may be maintained within the piston cavities of the alternately working pistons due to the extreme accuracy of machining which is made possible by the unit assembly above described. Leakage is therefore only possible along the shafts, and any material which tends to follow these shafts is relieved of pressure when it reaches one of the annular cavities **75**, inasmuch as these cavities are in communication with the

inlet or suction port through the drain ports 78. When cleaning the pump, steam or other cleansing fluid may be driven into the cavities 75 through the shaft apertures, or may be driven through the ports 78 and allowed to return through the shaft apertures. Therefore, removal of the shafts permits areas reached by the pumped material to be placed in a perfectly sanitary condition after each period of pumping operation.

The only parts subject to wear or deterioration of a character requiring replacement during the life of the driving mechanism are the pistons and the intermediate cylinder wall assembly. These parts can be readily replaced at comparatively small cost. In fact, the construction of the pump in units comprising the driving and supporting unit, the reversible back wall, the intermediate cylinder wall assembly, and the piston and shaft assembly, together with the location of the packing and the slip-joint shaft couplings with reference to accessibility, are all features which not only facilitate complete sanitation, but facilitate repairs with minimum replacement of parts and maximum retention of undamaged parts.

The sleeves 26, with their extension 30 and flanges 38, when assembled in pressed fit relation to the wall 40, form a substantially integral unit which may, if desired, be integrally formed from a single piece of metal. As an intermediate unit of the pump it may be bodily removed and reassembled with the other parts of the pump and replaced by a similar unit. Being independent of the back wall, except as it is supported therefrom by the dowel pins and bolts, its removal and replacement can be made without disturbing the back wall in its relation to the gear housing and associated parts.

I claim:

1. A rotary pump comprising the combination of a driving unit, including a pair of intergeared driving shafts, a gear housing therefor and a duplex cylinder having intersecting piston receiving cavities, pistons in said cavities, driven shafts fixedly connected with the respective pistons, said driven shafts being aligned with their driving shafts in slip-joint connection therewith, and an end cap normally holding the driven shafts in motion receiving relation to the driving shafts, the opposite wall of the piston cavity being provided with integral sleeve bearings for said driven shafts and exterior packings adapted to allow said driven shafts and pistons to be freely removed as units when the cap is removed, without removal of the packings.

2. A rotary pump comprising a driving and supporting unit and an outboard pump unit detachably connected with the supporting and driving unit in an outboard position, said pump unit including a piston and shaft assembly in slip-joint connection with the power elements of the supporting and driving unit, a removable wall normally holding the piston and shaft assembly in operative position, an intermediate wall cooperative with the removable wall to provide a pump cavity free from packing material, and a back wall provided with exterior packing through which the shafts extend for connection with the power assembly.

3. A rotary pump having an intermediate wall and a detachable cap wall formed to provide intersecting piston cavities, the cap wall being provided with shaft receiving sockets and the intermediate wall having integral shaft receiving sleeve bearings, shafts fitted to the sleeve bearings and cap sockets, pistons fixed to the shafts, a back wall having portions concentric with the sleeve bearings and fitted thereto, and exterior packing devices and couplings associated with said shafts exterior to said back wall, together with driving shafts connected by said couplings in slip-joint relation to the piston shafts and provided with sleeve coverings for said joints adapted to hold the shaft ends in alignment.

4. A rotary pump assembly comprising a ported back wall having shaft receiving apertures, an intermediate wall having intersecting piston cavities in one face and provided with bearing hubs in which the shafts are fitted, said hubs extending into the back wall apertures, shaft members mounted in the hubs and provided with fixed arcuate pistons receivable in the respective piston cavities, a cap member having bearing sockets for the front end of each such shaft member and also adapted to serve as front walls of the piston cavities, and driving connections in slip-joint connection with the respective shafts, said back wall being provided with drain apertures leading from space adjacent the rear ends of said hubs to the inlet port.

5. A rotary pump assembly comprising intermediate and cap walls formed to provide duplex piston receiving cavities and integral shaft bearings, in combination with a back wall into which the bearings of the intermediate wall extend, exterior packing devices for the shafts attached to the rear face of the back wall, said back wall being ported between said bearings and packings for drainage to the inlet side of the pump, and driving shafts in slip-joint connection with the pump shafts, whereby removal of the cap, pump pistons and shafts will allow access to said cavities and ports without disturbing the intermediate and back walls, packings, and driving shafts.

6. In a rotary pump, a driving unit having a supporting housing, a pumping unit supported from said housing at top and bottom and spaced therefrom at the sides and central portions, shaft connections between the driving unit and the pumping unit, detachable in the space between said units, and shaft packings engageable exteriorly with one wall of the pumping unit to prevent leakage along the shaft, said pump having a wall provided with drain ports leading from space around the shafts in the vicinity of said packings to the inlet to relieve the packings from pressure of the pumped material, said ports being accessible by removal of the pump shafts without disturbing either the driving unit or the packings.

7. In a rotary pump, the combination with front and back walls, of an intermediate member cooperative with the front wall to form piston receiving cavities, said intermediate member being removable as a unit when the front wall is removed, and having a doweling hub engageable with the back wall and forming a bearing for the shaft, said back wall having exterior shaft packing, an independently supported driving shaft with which the pump shaft is in slip-joint connection, and a sleeve covering said joint.

8. In a rotary pump, the combination with front and back walls, of an intermediate member cooperative with the front wall to form piston receiving cavities, said intermediate member being removable as a unit when the front wall is removed and having a doweling hub engageable with the back wall and forming a bearing for the shaft, said back wall having exterior

shaft packing, an independently supported driving shaft with which the pump shaft is in slip-joint connection, a sleeve covering said joint, and a spring supported by said sleeve in pressure relation to said packing, the pump shaft being removable without disturbing the driving shaft, sleeve or packing.

9. A sanitary rotary pump comprising the combination of a set of walls including a front and rear wall, said walls when assembled being adapted to form cavities for intersecting pistons, a set of intersecting arcuate pistons having hubs socketed in said front wall, shafts socketed in, fitted to, and permanently secured to said hubs with the connected end portions of the shafts and hubs completely enclosed and supported by said front wall, said shafts having their opposite end portions extending through the rear wall, removable bearing members for said shafts associated with the inner side of the rear wall and removable when the front wall and shafts are removed, driving members in slip-joint connection with the exposed ends of the respective shafts, and packing devices applied to the outer face of the rear wall and supported independently of said shafts, the pistons and their associated shafts being removable as units when the front wall is removed.

10. A sanitary rotary pump for liquid foods, comprising the combination with a supporting wall, of a detachable wall and intermediate removable wall members adapted for cooperation with the detachable wall to provide cavities for intersecting pistons, a set of intersecting arcuate pistons having hubs enclosed by and socketed in said detachable wall to accurately position the pistons, and shaft members secured to said hubs with their opposite end portions extending through said supporting wall, whereby the pistons and their associated shafts may be freely removed as units when the detachable wall is removed and whereby the removal of the pistons releases the intermediate wall members for removal, independently mounted driving shaft members in end to end slip coupling relation to the first mentioned shaft members and provided with joint covering sleeves fixed to the respective driving shaft members, packing members for the piston carrying shafts applied to the exposed surfaces of the supporting wall and each including a packing ring, and means connected with the associated coupling sleeve for supporting the ring under resilient pressure when the piston carrying shafts are removed.

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