Feb. 6, 1951 W. D. BERKLEY 2,540,235

FLUID OPERABLE APPARATUS

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FIG. 1

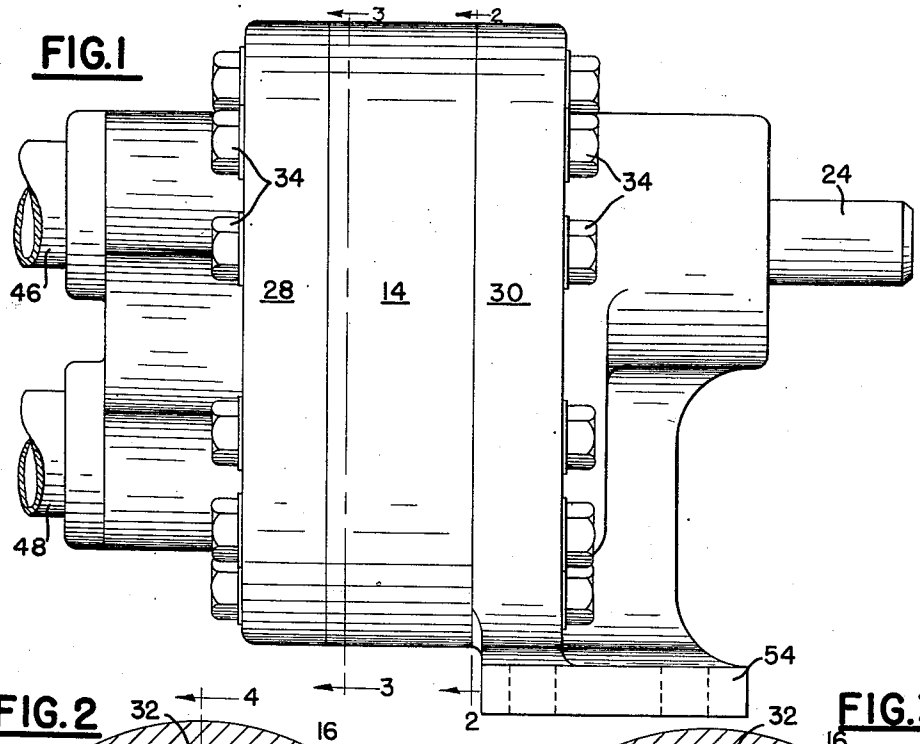


FIG. 2

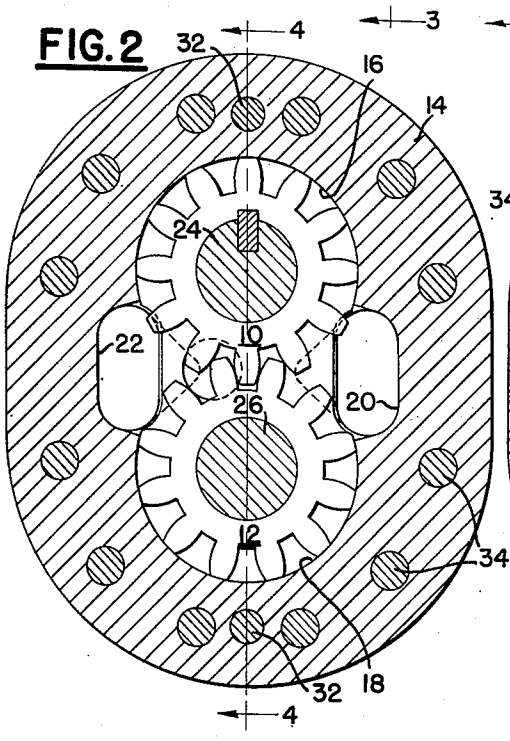
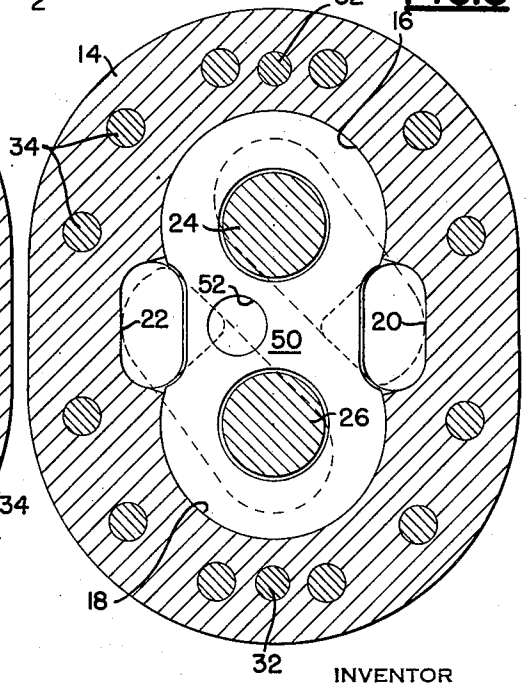


FIG. 3



INVENTOR
WARREN D. BERKLEY
BY
Toulmin & Toulmin
ATTORNEYS

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FIG. 4

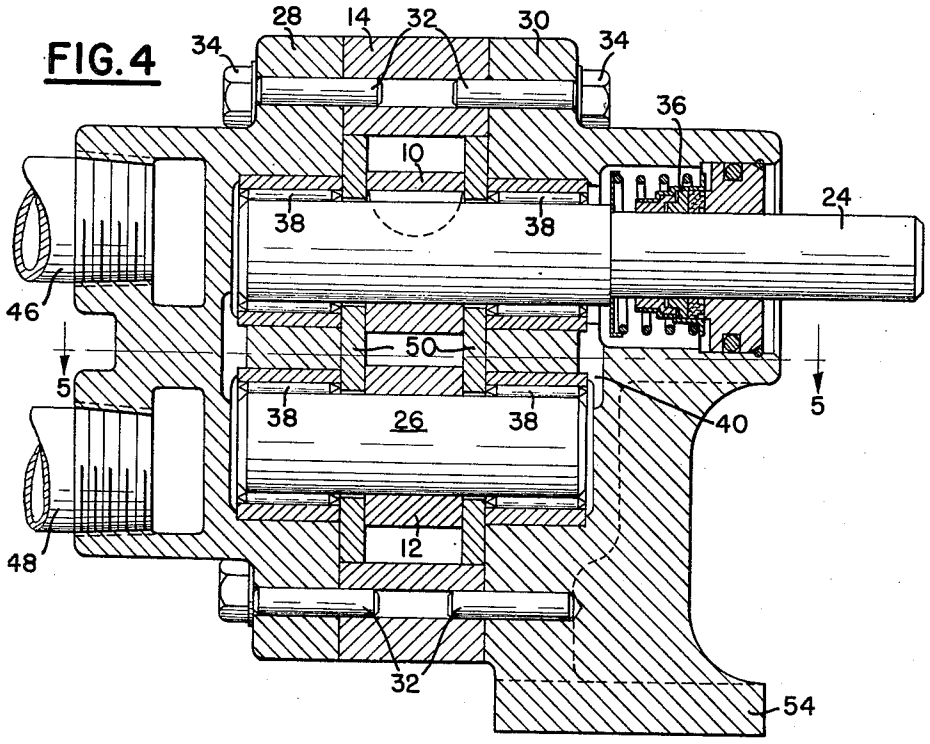
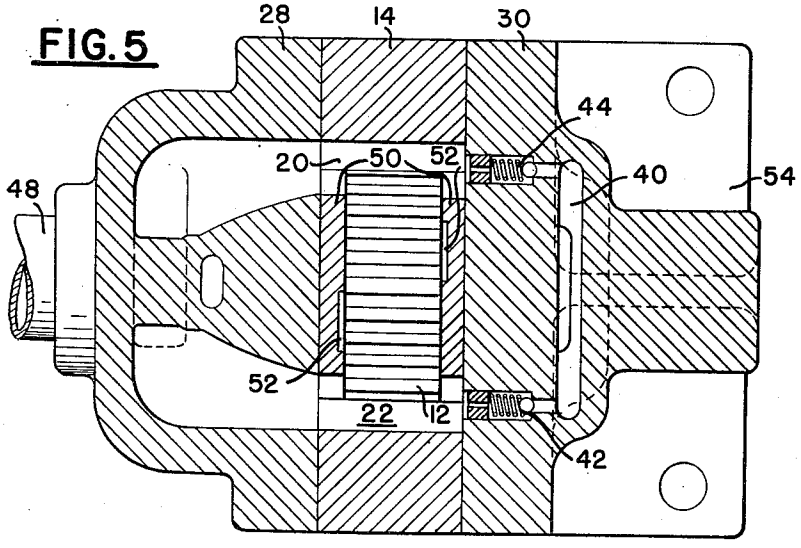


FIG. 5



INVENTOR
WARREN D. BERKLEY
BY
Toulmin & Toulmin
ATTORNEYS

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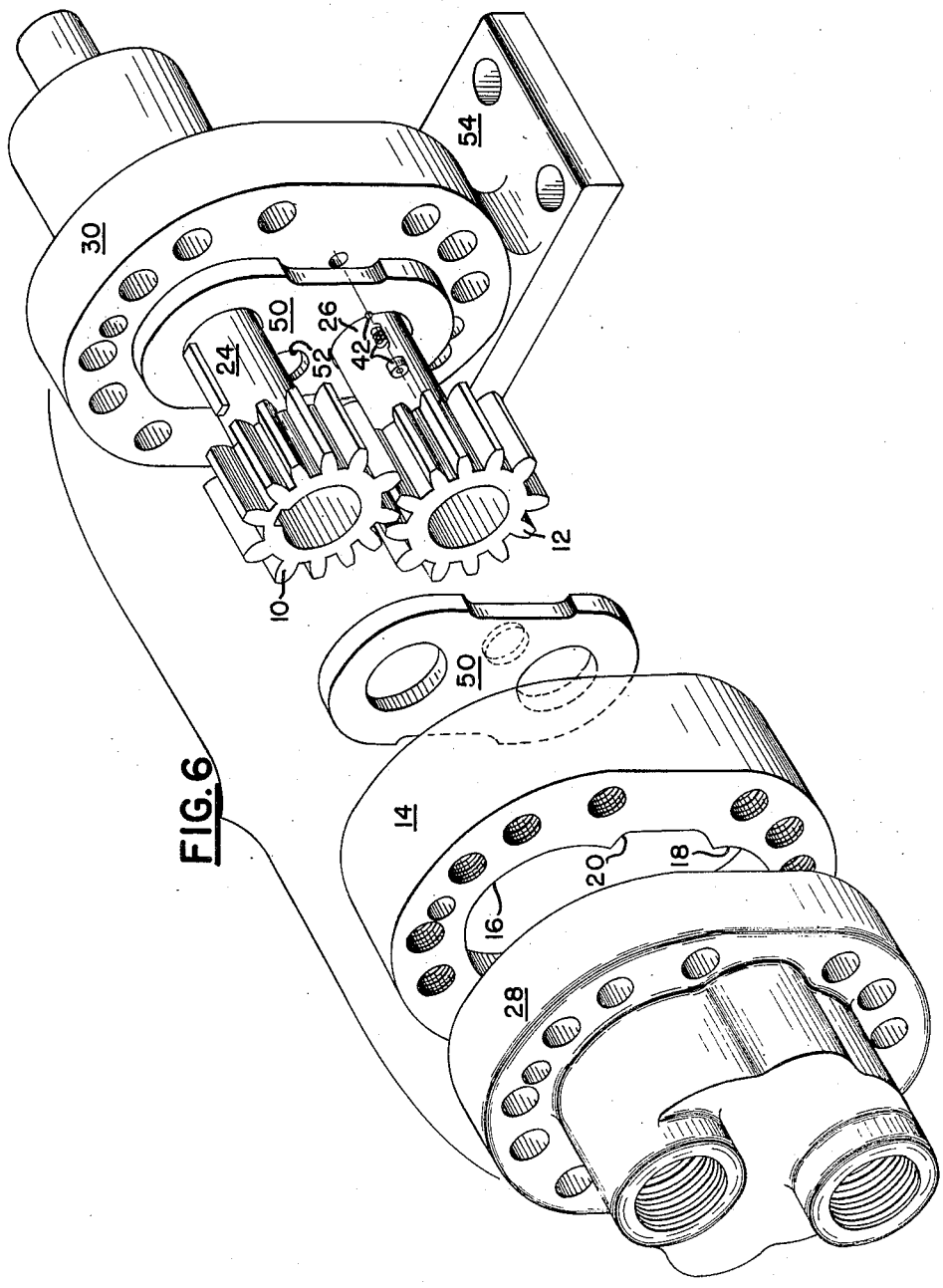

FIG. 6

INVENTOR
WARREN D. BERKLEY
BY
Toulmin & Toulmin
ATTORNEYS

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FIG.7

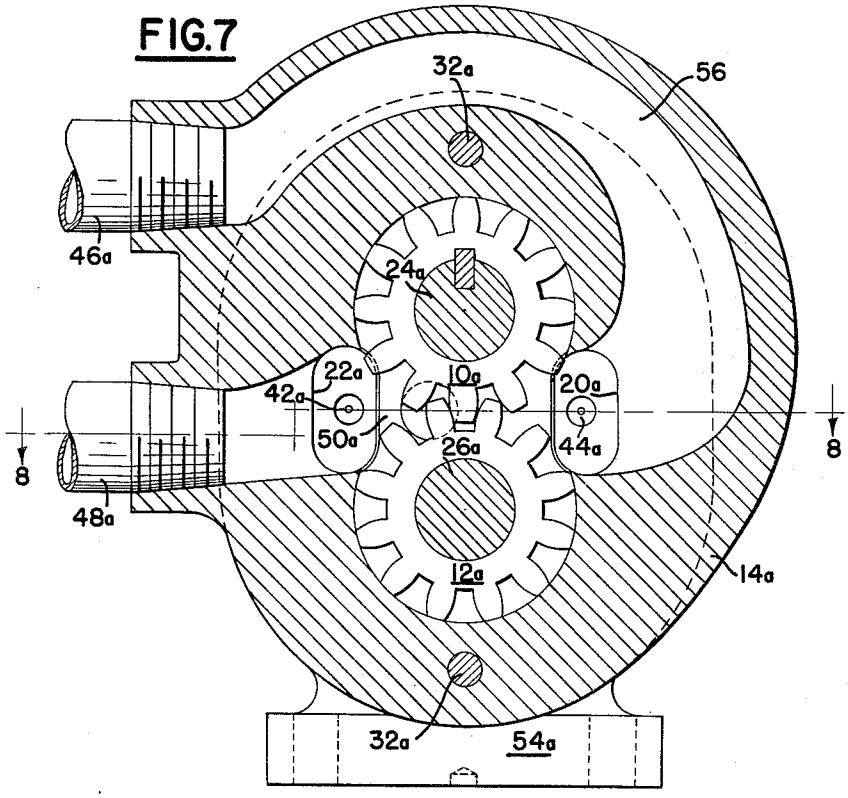
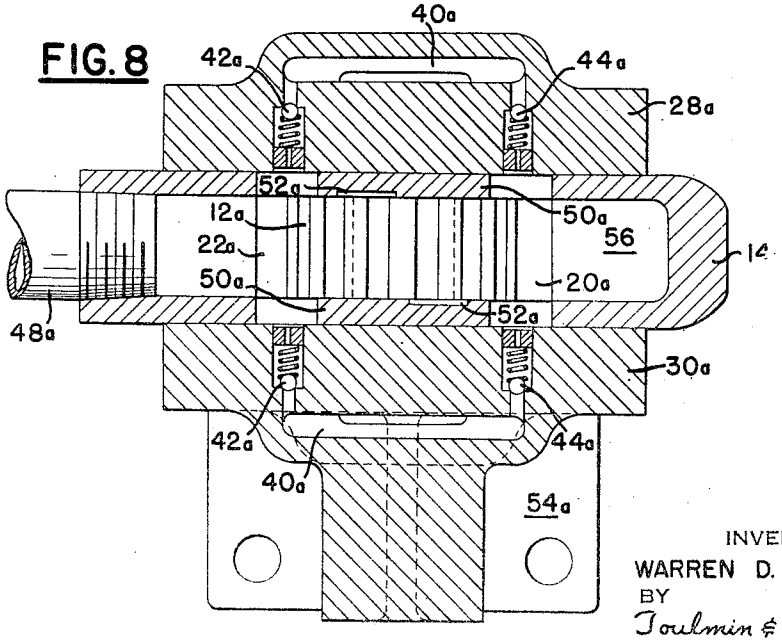


FIG.8



INVENTOR
WARREN D. BERKLEY
BY
Toulmin & Toulmin
ATTORNEYS

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FLUID OPERABLE APPARATUS

Warren D. Berkley, Dayton, Ohio, assignor to H-P-M Development Corporation, Wilmington, Del., a corporation of Delaware

Application December 13, 1946, Serial No. 715,925

3 Claims. (Cl. 103—126)

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This invention relates to fluid operable apparatus and particularly to gear pumps and motors.

The particular object of the present invention is to provide a gear pump or motor having superior operating characteristics and a long operating life.

Still another object of this invention is to provide a gear pump or motor which is easily maintained in efficient operating condition.

A still further object is to provide an improved design for a gear pump or motor in which the several parts of the unit may be easily manufactured to within the close tolerances permitted for this type of equipment.

A further object is the provision of a gear pump adapted for being operated in either direction and having means for continuously drawing the leakage fluid from the pump casing into the main flow channel therethrough.

These and other objects and advantages will become more apparent upon reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a side elevation of a pump constructed according to this invention;

Figure 2 is a transverse section therethrough indicated by the line 2—2 on Figure 1;

Figure 3 is another transverse section and is indicated by the line 3—3 on Figure 1;

Figure 4 is a longitudinal section and is indicated by the line 4—4 on Figure 2;

Figure 5 is a plan section indicated by the line 5—5 on Figure 4;

Figure 6 is an exploded perspective view showing the several parts of the unit in partially assembled condition;

Figure 7 is a transverse section through a modified construction; and

Figure 8 is a plan section indicated by the line 8—8 on Figure 7.

Referring to the drawings, a pumping unit according to this invention comprises a pair of pumping gears 10 and 12 which are rotatable within a cylinder block 14. The block 14 comprises the cylindrical recesses 16 and 18 which closely receive the gears 10 and 12, respectively, and also has the cut-out spaces 20 and 22 therein in the plane at which the gears mesh for the purpose of permitting fluid flow to and from the said gears.

One of the gears, as for example the gear 10, is keyed to a drive shaft 24 while the other of the said gears is mounted on a shaft 26 and need not be keyed thereto. Preferably, the said gear

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is pressed on the shaft in order to facilitate the journaling thereof within the pump.

As best seen in Figures 4, 5 and 6, the cylinder block 14 is abutted on either side by the end plates 28 and 30 of the pump. These plates are doweled to the cylinder block as by the dowel pins 32 and are retained in position by a plurality of cap screws 34. It will be understood that the cap screws 34 could be replaced by through bolts if desired in order to eliminate the tapping of the cylinder block for the cap screws.

As seen in Figure 4, the shaft 24 to which the gear 10 is keyed, extends through the end plate 30 into position to be engaged by a drive motor when the unit is used as a pump, or to be connected with a driven member if the unit is to be used as a motor. There is preferably an oil seal as indicated at 36 in the end plate 30 through which the shaft extends so that there is no leakage of oil to the outside of the unit during operation.

While the shafts 24 and 26 may be journaled in any of several well-known manners, it is preferred to use the needle type roller bearings which are indicated at 38 and which are placed in suitably machined recesses in the end plates 28 and 30. The recesses which receive the bearings in the end plate 30 are connected by a cored passage means 40 which is best seen in Figures 4 and 5, and which communicates with the spaces 20 and 22 in the cylinder block through the check valves 42 and 44, respectively, these check valves opening from the recess 40 so that whichever side of the pumping unit is the suction side will continuously withdraw the leakage fluid which accumulates in the said recess.

The end plate 28 is adapted for receiving the conduits 46 and 48 by means of which fluid is conducted to and from the pumping unit. The conduit 46, as seen by the dotted line construction in Figure 3, communicates with the space 20 in the cylinder block 14 by means of a cored passage in the end plate 28. Similarly, the conduit 48 communicates by the cored passage shown in Figure 3 with the space 22 in the cylinder block.

As will be noted in Figures 4, 5 and 6, the axial length of the gears 10 and 12 is less than that of the cylinder block 14 in order to provide space between the said gears and the end plates 28 and 30 for the wear plates indicated by the numeral 50. These wear plates are flat, smoothly machined and fit closely between the gears and the end plates and within the cylinder block. By means of these wear plates, the cylinder block and end plates may be machined with flat sur-

faces thereon so that exceedingly close tolerance limits may be observed in the manufacture of the unit.

Furthermore, any side thrust on the pumping gears is carried entirely by the wear plates so that there is no wear on the cylinder block or end plates, and, after a predetermined period, the wear plates can be replaced to bring the pumping unit into its original operation condition. It will be observed that the wear plates could be constructed of a suitably wear resistant material different from that of the cylinder block and end plates if so desired.

As the gears 10 and 12 rotate in order to transfer fluid between the spaces 20 and 22 in the cylinder block 14, the tooth spaces in the pumping zone have fluid entrapped therein by the tooth of the gear in engagement therewith. If this pressure is not relieved, it will lead to high separating thrusts on the pumping gears which will induce wear on the cylinder block. For relieving this pressure, the wear plates 50 are provided with the channels 52 therein which may, as shown, comprise cylindrical recesses which extend over the zone within which it is desired to relieve the entrapped fluid. One of these is provided in each wear plate so that regardless of the direction of rotation of the pump, the aforementioned entrapped fluid is relieved.

While any suitable mounting means may be provided for the pump, the arrangement illustrated in the drawings includes the foot member 54 which is preferably cast integrally with the end plate 30 and by means of which the unit may be mounted on a mounting pad provided on a machine part or a suitable base member.

Modification of Figures 7 and 8

Figures 7 and 8 illustrate a slightly modified construction and similar parts in these figures are correspondingly numbered with the addition of a subscript *a*.

In these views, the porting for the fluid flowing to and from the pumping unit is entirely in the cylinder block 14*a* and both of the conduits extend into the cylinder block from one side thereof. The lower of the conduits communicates in substantially a straight line with the pumping zone of the gears 10*a* and 12*a* and the upper of the conduits communicates with the pumping zone on the opposite side of the gears through a passage 56 cored in the cylinder block and extending around the upper gear 10*a*.

As will best be seen in Figure 8, this type of porting enables both of the end plates 28*a* and 30*a* to have check valves opening from the cavities thereof so that the leakage fluid can continuously be drawn into the cylinder block. Still another advantage which obtains from the porting shown in Figures 7 and 8 is that the drive shaft 24*a* can be made double ended if desired for the purpose of operating a plurality of elements from a single drive motor.

Operation

In operation, let it be assumed that the gear 10 is driven in the clockwise direction, as viewed in Figure 2. As the gears 10 and 12 rotate, fluid is drawn in through the conduit 48 and recess 22 into the tooth spaces in the gears and carried around thereby until the said spaces communicate with the recess 20 in the cylinder block. Thereafter, as the teeth of each gear mesh with the tooth spaces of the other, fluid is displaced from the spaces and discharged from the pump through the conduit 46. As the teeth move into the spaces, they reach a position wherein they make contact with both sides thereof and thereby entrap fluid beneath the bottom of the tooth space and the top of the tooth therein. This entrapped fluid is relieved through recess 52 which, as seen in Figure 2, communicates with the said tooth space until it reaches a minimum volume.

If, during the operation of the pump there is a leakage of pressure fluid to one side of the gears, they are thrust to the side against one of the wear plates. The wear which then takes place in confined to the side of the gear and the surface of the wear plate and this is maintained at a minimum by constructing a wear plate of a good bearing bronze.

Also during the operation of the pump there will be a leakage of fluid through the bearings thereof into the cavities in the end plates. This fluid is continuously drawn into the suction side of the pump from at least one of the said cavities through one of the check valves 42, 44. In the example taken where the recess 22 is the suction side, the fluid is drawn in through the check valve 44, but it will be understood that if the rotation of the gears were reversed then the check valve 42 would become effective.

Among the other advantages to be gained from constructing a pump according to this invention is that pumping units of different size can readily be made merely by changing the gear size, the shaft length, and the axial length of the cylinder block. This permits the quantity production of the end plates and wear plates with a subsequent reduction in the individual expense of each piece.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In a gear pump or motor; a cylinder block; a pair of pumping gears closely received within said block while in mesh; shafts supporting said gears; end covers for said block rigidly secured thereto and having bearing wells into which said shafts extend; a pair of identical wear plates receivable in said block and closely fitting between said gears and said end covers, said wear plates and said block being adjacently recessed to define high and low pressure chambers on opposite sides of the meshing zone of said gears; channel means formed in at least one of said wear plates adjacent the meshing zone of said gears for maintaining the tooth spaces of said gears in communication with one of said chambers during at least a part of the travel of said spaces through said zone; and a plurality of passageways connecting said bearing wells with said chambers, said passageways including check valves opening toward said chambers.

2. In a gear pump or motor having a pair of meshing pumping gears rotatable within a cylinder block, shafts supporting said gears and end covers secured to opposite faces of said block and having bearing wells into which said shafts extend; a wear plate in each end of said cylinder block fitting between said gears and said end covers, each of said wear plates and said cylinder block being formed with adjacent recesses to define high and low pressure chambers on the opposite sides of the meshing zone of said gears;

channel means in at least one of said wear plates for maintaining the tooth spaces of said gears in communication with one or the other of said chambers during the travel of the tooth spaces of said gears through said meshing zone; and passage means interconnecting said wells and said chambers and including separate check valves opening into said chambers.

3. In a gear pump or motor having a pair of meshing gears and shafts supporting said gears; a cylinder block surrounding the outer peripheral portions of said gears; a pair of flat wear plates disposed on opposite sides of said gears, each of said wear plates being formed on one side thereof with a recess to define with said cylinder block high and low pressure chambers located to either side of the meshing zone of said gears; end covers secured to the opposite faces of said cylinder block, said end covers being formed with bearing wells for the reception of bearings for journalling the shafts on which said gears are supported; passage means formed in at least one of said end covers and connecting the bearing wells thereof with each of said chambers; and check valves in

said passage means opening toward said chambers.

WARREN D. BERKLEY.

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