Feb. 28, 1950 M. C. CAUGHREAN 2,498,790

GEAR PUMP

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FIG-1

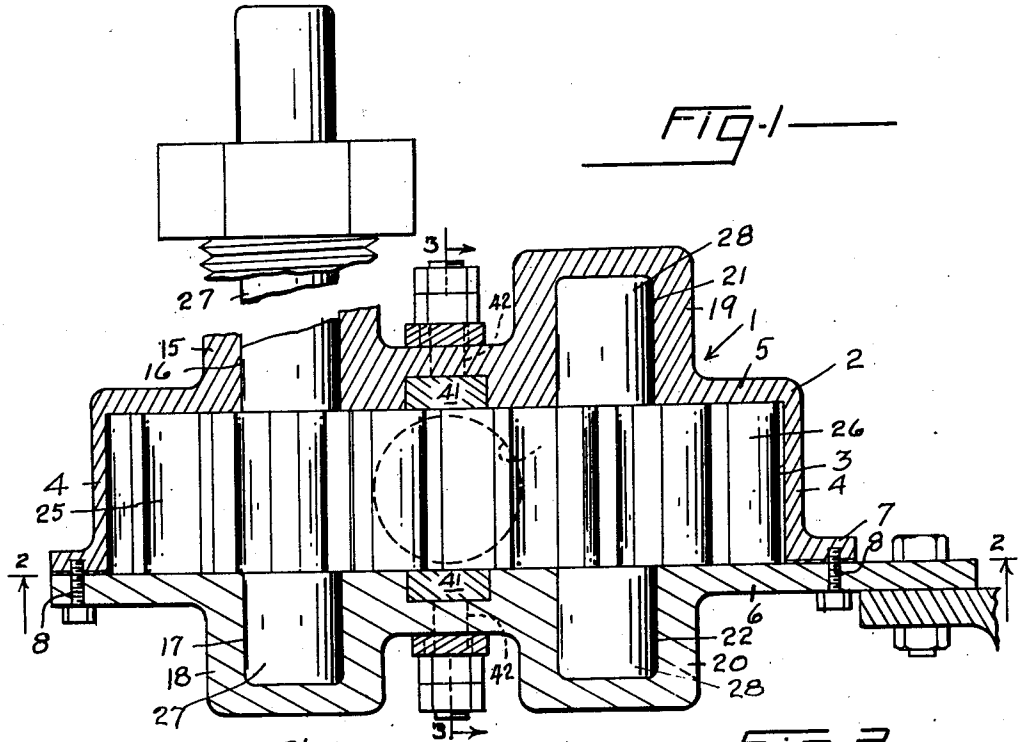

FIG-2

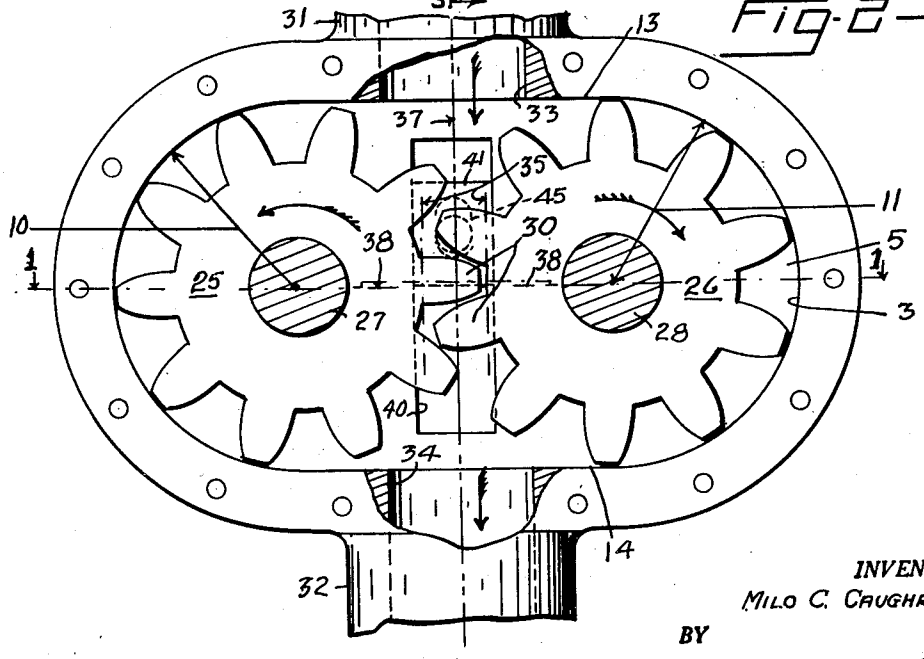

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Fig-3

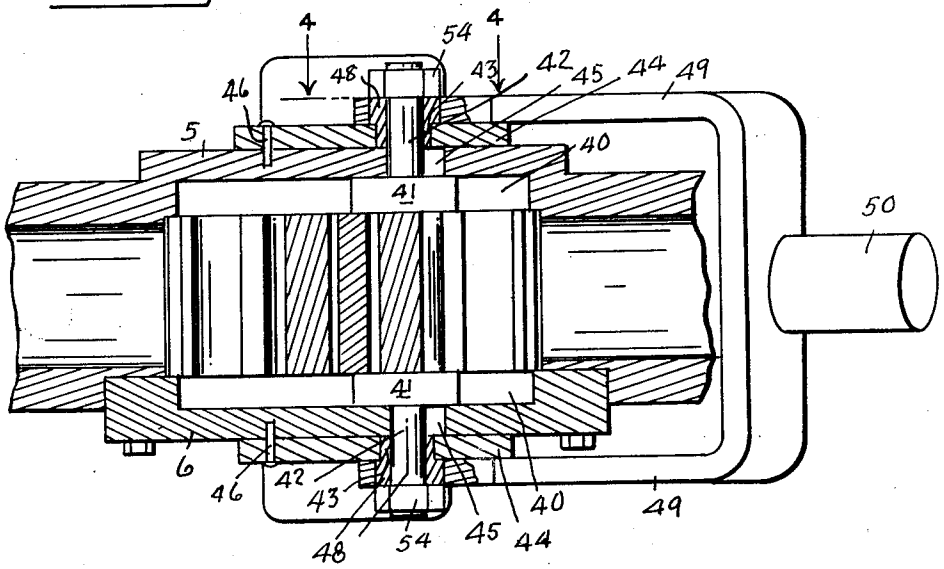
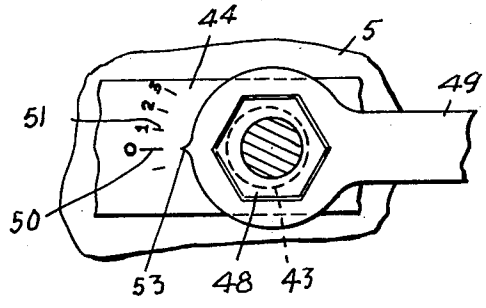


Fig-4



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GEAR PUMP

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10 Claims. (Cl. 103—126)

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This invention relates to a gear pump, and has for one of its objects the provision of a gear pump having improved means for reducing the vibration or knock, prevalent in such pumps.

Another object of the invention is the provision of a gear pump that has greater efficiency than heretofore, and which pump does not require other openings in the gear housing than the conventional inlet and outlet, nor does it require alteration of the gears in any manner.

An additional object of the invention is the provision of a gear pump in which the teeth at the zone of mesh may be more closely fitted together than heretofore, thereby increasing the efficiency, and which pump has less vibration or knock than in pumps where considerably greater clearance is provided between gears at said zone.

A still further object of the invention is the provision of means in a gear pump for decreasing the wear on the gear shafts and bearings.

Another object of the invention is the provision of means in a gear pump for quickly and accurately adapting the pump to fluids of different viscosities and at different rates of speed for obtaining the minimum vibration and wear on the bearings according to the viscosity and compressibility of the fluid, and according to the speed of the pump.

The use of the term "gear pump" is broadly used herein to cover pumps of the co-called "Roots-Type" in which a pair of intermeshing impellers are used on each of the two shafts as well as the type in which many gear teeth are on the gears. The principle is the same in these types of pumps, and the heretofore excessive vibration cause thereof is the same.

The severe and objectionable vibration in gear pumps is principally due to the entrapping of fluid between the gears adjacent the point of closest meshing of the gears. The point where compressibility of the fluid is greatest, whether the fluid is a gas or liquid, is the point where the maximum knock occurs. In liquids there is little compressibility but there is a point where there is a maximum resistance created by the fluid, which point varies with the speed of the pump and with the viscosity and compressibility of the fluid.

The present invention enables the operator to substantially eliminate this objectionable resistance by a simple, inexpensive means.

In the drawings Fig. 1 is a sectional view taken through a pump showing the gears edgewise in elevation, and taken along line 1—1 of Fig. 2.

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Fig. 2 is a sectional view taken substantially along line 2—2 of Fig. 1 with a portion broken away at the inlet and outlet to show the latter.

Fig. 3 is a sectional view taken along line 3—3 of Fig. 1.

Fig. 4 is an enlarged fragmentary sectional view taken along line 4—4 of Fig. 3.

In detail, the gear pump herein illustrated comprises a gear housing generally designated 1, which housing is divided into two parts, one part 2 being formed with a generally elliptical recess 3 (Fig. 2) with walls 4 defining the outline of said recess, and a wall 5 forming the bottom.

The bottom 5 forms one of the side walls of the housing when it is assembled, while the walls 4 form the sides of recess 3.

The open side of recess 3 is closed by a wall 6 that comprises the second portion of the housing 1 and which wall is opposed to wall 5. Flange 7 around the free edges of the walls 4 are formed with threaded openings for receiving the threaded ends of stud bolts 8 that are adapted to extend through openings in the marginal portion of wall 6 for securing the wall 6 to the part 1.

The ends of recess 3, as best seen in Fig. 2, and as conventional in gear pumps, are respectively curved about spaced radii 10, 11 to form semicylindrical opposed ends connected by parallel walls 13, 14.

Coaxial with the inner end of radius 10 the wall 5 is formed with an outwardly projecting boss 15 formed with a through cylindrical bore 16, while wall 6 is formed with a cylindrical recess 17 in a boss 18.

Coaxial with the inner end of radius 11 the walls 5, 6 are formed with oppositely outwardly projecting bosses 19, 20 that are formed with opposedly opening cylindrical recesses 21, 22, respectively.

Gears 25, 26 are fitted within the recess 3 in part 1, and the peripheries of said gears slidably contact the semicylindrical ends of the recess 3, which gears are coaxial with the radii 10, 11 respectively. Shafts 27, 28 to which gears 25, 26 are respectively secured are rotatably supported in coaxial bore 16 and recess 17, and in recesses 21, 22 respectively.

The distances between the inner ends of radii 10, 11 or the axes of gears 25, 26 is such that the teeth 30 of the gears 25, 26 closely intermesh at their adjacent sides in the usual manner for gear pumps, except that a much closer fit is possible with the present invention than is found in conventional gear pumps.

Centrally between the ends of the straight sides 13, 14 of the part 2 of said housing in which recess 3 is formed, are coaxial oppositely outwardly projecting bosses 31, 32 (Fig. 2) that are formed with through bores 33, 34 respectively providing an inlet and an outlet.

A plane disposed on the axis of the inlet and outlet and at right angles to sides 15, 6 and on a line 27 normal to a line 28 extending through the axes of shafts 27, 28 will bisect the housing at a point central between the gears 25, 26. The zone of intermesh of gears 25, 26 may be defined as being substantially zone parallel with said plane and extending between walls 5, 6, and parallel lines 35 that are equally spaced from said plane and which lines are spaced apart a distance about equal to the distance between the root circles of gears 25, 26 at their adjacent sides. Lines 35, 37, 38 are indicated as dot-dash lines.

Within this zone of intermesh the gear teeth 30 move into and out of intermeshing relationship, the point of maximum intermeshing of the teeth being along line 38.

The foregoing description substantially corresponds with the structure in a conventional gear pump. The shaft 27 extends through the boss 15 and through an ordinary packing gland to the outside and is power driven for rotating the gears in the directions of the arrows shown therein on Fig. 2. When so actuated the fluid enters the housing through the bore 33, which is at the suction side of the gears, and it is then carried around the gears to the discharge side. The teeth 30 and walls 3 of the housing cooperate to form pockets in which the fluid is carried from the inlet side to the outlet side. The movement of the gear teeth into intermeshing relationship on the discharge side of point or line 38 displaces the fluid between the intermeshing teeth and the fluid is forced out of the housing through the outlet 34.

The gears in moving into intermeshing relationship entrap fluid, between the intermeshed teeth, which fluid cannot escape readily enough to prevent a severe knock or pound each time the teeth cross the point 38 where they are in fullest intermeshing relationship. The greater the clearance provided to minimize this pound or knock, the less the efficiency of the pump.

According to the preferred form of the present invention the opposed sides of the walls 5, 6 are formed with opposedly opening recesses 40 that are elongated along the line 37 and the width of said recesses, respectively, is slightly greater than the distance between lines 35 or the distance between the root circles of gears 25, 26 at their closest sides. These recesses have parallel sides equally spaced from the center line 37 and a block 41 is fitted in each recess for sliding longitudinally thereof. The opposed faces of blocks 41 are flush with the opposed surfaces of walls 5, 6, so as to form a sliding seal fit with the sides of gears 25, 26.

The blocks 41 are each formed with stub shafts 42 that extend oppositely outwardly (and coaxially) through slots 45 formed in the bottoms of recesses 40, which slots are elongated longitudinally of the recesses 40. The blocks 41 thus cover the slots.

The outer ends of shafts 42 extend through eccentric bushings 43 (Fig. 3) rotatable in coaxial openings formed in plates 44, said plates being pivoted at 46 at one of their ends to the walls 5, 6, respectively so the plates can swing slightly when the eccentric bushings are rotated.

The bushings 43 are formed with heads 48 to which the outer ends of the arms 49 of a yoke having an operating handle 50 are attached. Thus upon swinging handle 50 in one direction the blocks 41 will simultaneously move in one direction and upon swinging handle 50 in the opposite direction the blocks 41 will be moved in the opposite direction. Marks 51 on the outer sides of plates 44 (Fig. 4) may indicate the different distances that blocks 41 will be moved from a main mark 52 in direction toward the suction side of the gears. A pointer 53 on each of the ends of the yoke arms will scan or move past said marks 51 as the handle is swung.

Nuts 54 on the outer ends of shafts 42 may be tightened to substantially lock the blocks 41 in any desired position.

Assuming, for example, that when mark 50 and pointer 53 are together, the square end edge of block 41 is coincident with line 38 (Fig. 2) with the main body of the block at the suction side of said line. Then movement of the handle 50 in one direction will move the block further toward the suction side, although the blocks 41 can be moved so that their leading edges cross the line 38, in actual practice the movement is toward the suction side.

The adjustability of the blocks 41 enables the operator to move the blocks, during operation of the pump, to the point where the greatest efficiency with the minimum degree of vibration or knock is obtained. The inertia and the kinetic energy of the fluid being pumped require adjustability of the block. If only one fluid of a predetermined uniform viscosity and specific gravity were being pumped at a uniform rate of speed the block could be fixed.

From the foregoing description it will be seen that the liquid trapped between the teeth of the gear adjacent and at the point of maximum intermesh of said gears is free to flow into recesses 40 and out of the discharge outlet 32. However, none of the fluid will pass to the suction side because the blocks 41 will prevent such passage.

It is obvious that modifications may be made in the device that has been specifically described and illustrated. The invention as specifically described and illustrated is merely a preferred form of the invention. For example, the elimination of one of the two blocks would produce highly beneficial results over conventional structure and other modifications could be made without involving the expense of invention.

I claim:

1. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said teeth to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from the said one side of said point, an inlet and an outlet formed in said housing communicating with the said zone of intermesh at said one side and said opposite side of said point respectively, and an inwardly opening recess formed in one of said opposed sides of said hous-

ing opening into said zone of intermesh up to said point at the said opposite side of said point and communicating with said outlet for receiving fluid trapped between intermeshing gears up to said point, said recess extending past said point to the said one side thereof adjacent said inlet, and means adjustably positioned within said recess at said one side of said point supported for movement toward and away from said point preventing passage of fluid in said zone of intermesh at said other side from moving across said point to said one side.

2. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said teeth to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with said zone of intermesh at said one side and said opposite side of said point respectively, a recess formed in one of said opposed sides opening into said zone of intermesh at said point and at said one side and opposite side thereof, the portion of said recess opening into said opposite side being in communication with said outlet and means positioned within said recess for defining one end of said portion, said means being movable in said recess in direction away from said opposite side of said point for enlarging said portion to different distances past said point.

3. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said teeth to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with said zone of intermesh at said one side and said opposite side of said point respectively, a recess formed in one of said opposed sides opening into said zone of intermesh at said point and at said one side and opposite side thereof, the portion of said recess opening into said opposite side being in communication with said outlet and means positioned within said recess for defining one end of said portion, said means being movable in said recess in a direction away from said opposite side of said point for enlarging said portion to different distances past said point, and means outside said housing for so moving said means in said recess.

4. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the

zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said teeth to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with said zone of intermesh at said one side and said opposite side of said point respectively, a recess formed in one of said opposed sides opening into said zone of intermesh at said point and at said one side and opposite side thereof, the portion of said recess opening into said opposite side being in communication with said outlet and means positioned within said recess for defining one end of said portion, said means being movable in said recess in a direction away from said opposite side of said point for enlarging said portion to different distances past said point, said means within said recess comprising a block, and means accessible from outside said housing for moving said block in said recess.

5. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said gears to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with the said zone of intermesh at said one side and said opposite side of said point respectively, a pair of opposedly opening recesses formed in said opposed sides opening into said zone of intermesh at said point and at the said opposite side thereof, movable means defining the ends of said recesses at said point movable in a direction toward said inlet side of said point for enlarging said recesses upon movement.

6. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said gears to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with the said zone of intermesh at said one side and said opposite side of said point respectively, a pair of opposedly opening recesses formed in said opposed sides opening into said zone of intermesh at said point and at the said opposite side thereof, movable means in each of said recesses defining the ends of said recesses at said point and movable in a direction toward said inlet side of said point for enlarging said recesses upon said movement, means for so moving said movable means simultaneously the same distances from said point.

7. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said gears to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with the said zone of intermesh at said one side and said opposite side of said point respectively, a pair of opposedly opening recesses formed in said opposed sides opening into said zone of intermesh at said point and at the said opposite side thereof, movable means in each of said recesses defining the ends of said recesses at said point and movable in a direction toward said inlet side of said point for enlarging said recesses upon said movement, means for so moving said movable means simultaneously the same distances from said point, and means for locking said movable means in adjusted position.

8. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said gears to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with the said zone of intermesh at said one side and said opposite side of said point respectively, a pair of opposedly opening recesses formed in said opposed sides opening into said zone of intermesh at said point and at the said opposite side thereof, said recesses continuing past said point toward the inlet side, a pair of blocks supported in said recesses at said one side of said point, one edge of each block terminating adjacent said point, said blocks having their opposed sides flush with said opposed sides of said housing and in sliding engagement with said gears.

9. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said gears to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with the said zone of intermesh at said one side and said opposite side of said point respectively, a pair of opposedly opening recesses formed in said opposed sides opening into said zone of intermesh at said point and at the said opposite side thereof, said recesses continuing past said point toward the inlet side, a pair of blocks supported in said recesses at said one side of said point, one edge of each block terminating adjacent said point, said blocks having their opposed sides flush with said opposed sides of said housing and in sliding engagement with said gears, means connecting said blocks for identical simultaneous movement in said recesses at said one side of said point and away from said point.

10. In a gear pump including a pair of gears with their teeth in intermeshing relationship and supported for rotation within a housing with their opposite sides in contact with two opposed sides of said housing and with the outer ends of their teeth around their peripheries outwardly of the zone of intermesh in contact with the inner sides of said housing whereby said teeth will cooperate with said inner sides to form pockets for conducting fluid from one side of the point of maximum intermeshing of said gears to the opposite side of said point upon rotation of said gears for movement of their teeth oppositely outwardly from said one side of said point, an inlet and an outlet formed in said housing respectively communicating with the said zone of intermesh at said one side and said opposite side of said point respectively, a pair of opposedly opening recesses formed in said opposed sides opening into said zone of intermesh at said point and at the said opposite side thereof, said recesses continuing past said point toward the inlet side, a pair of blocks supported in said recesses at said one side of said point, one edge of each block terminating adjacent said point, said blocks having their opposed sides flush with said opposed sides of said housing and in sliding engagement with said gears, means connecting said blocks for identical simultaneous movement in said recesses at said one side of said point and away from said point, and means for so moving said blocks.

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