Aug. 25, 1936. C. A. MOORE ET AL 2,052,419

VARIABLE DELIVERY GEAR PUMP

Filed Sept. 14, 1934 3 Sheets-Sheet 1

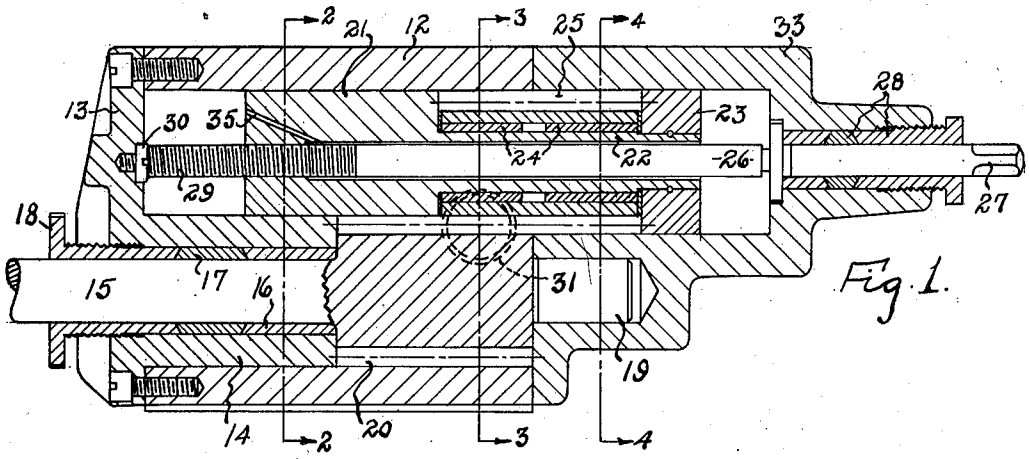


Fig. 1.

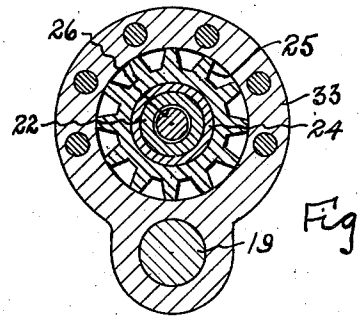


Fig. 4.

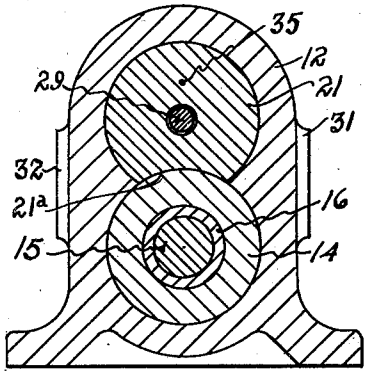


Fig. 2.

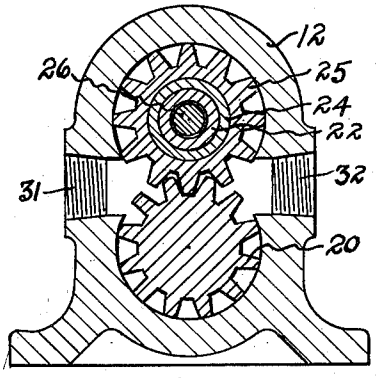


Fig. 3.

INVENTOR.
Charles A. Moore
Preston Whitcomb

BY Darby & Darby.

ATTORNEYS.

Aug. 25, 1936. C. A. MOORE ET AL 2,052,419

VARIABLE DELIVERY GEAR PUMP

Filed Sept. 14, 1934 3 Sheets-Sheet 2

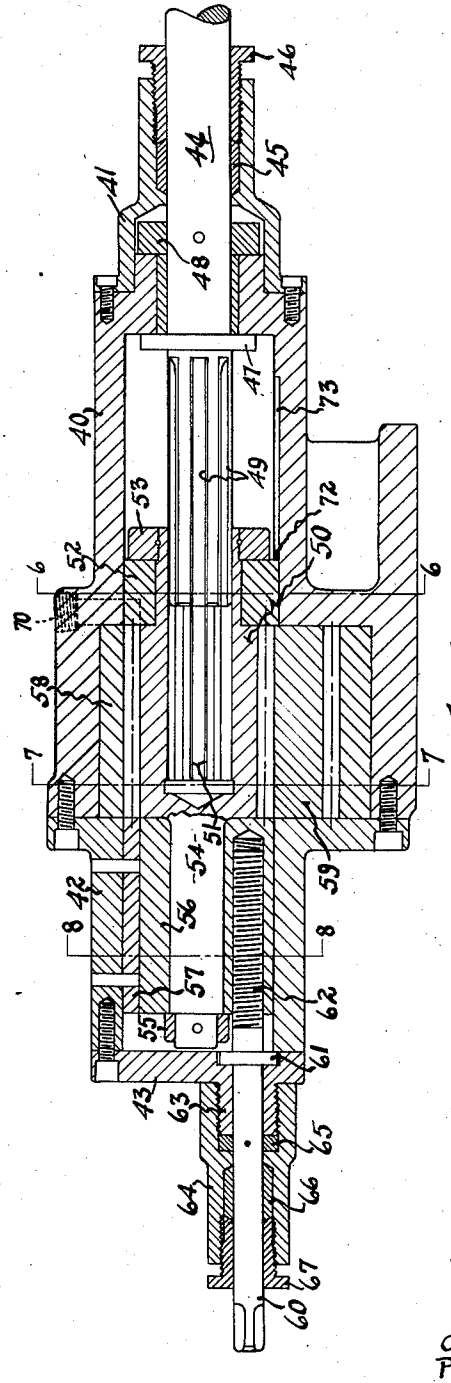


Fig. 5.

INVENTOR.
Charles A. Moore
Preston Whitcomb

BY Darby & Darby

ATTORNEYS.

Aug. 25, 1936. C. A. MOORE ET AL 2,052,419

VARIABLE DELIVERY GEAR PUMP

Filed Sept. 14, 1934 3 Sheets-Sheet 3

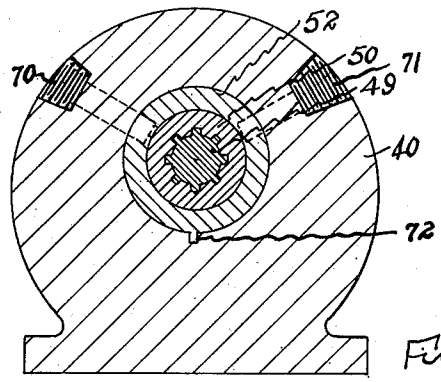


Fig. 6.

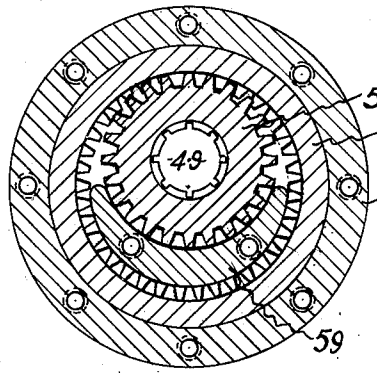


Fig. 7.

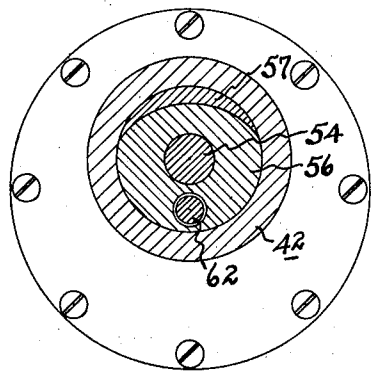


Fig. 8.

INVENTOR.
Charles A. Moore
Preston Whitcomb

BY Darby & Darby

ATTORNEYS

Patented Aug. 25, 1936 2,052,419

UNITED STATES PATENT OFFICE

2,052,419

VARIABLE DELIVERY GEAR PUMP

Charles A. Moore, Greenwich, Conn., and Preston Whitcomb, Kenmore, N. Y., assignors to Manning, Maxwell & Moore, Inc., New York, N. Y., a corporation of New Jersey

Application September 14, 1934, Serial No. 743,932

6 Claims. (Cl. 103—120)

This invention relates to improvements in gear pumps by means of which the delivery thei of may be varied.

An important object of this invention is the provision of an improved form of gear pump by means of which the amount of fluid displaced for any given speed of operation may be varied.

The common practice with gear pumps at present in order to accomplish variable flow involve the use of a by-pass by means of which some of the fluid is shunted off from the main stream. When the pumps of this type are employed with rotary engines and similar equipment, by-passing a portion of the constant volume output of the pump results in the exertion of a constant torque by the power device. A constant horse-power output is by much the more desirable characteristic of such equipment but has been incapable of attainment because of the lack of a correct way to vary the output of the pump. With the present invention involving a variable delivery of the volume of fluid from the discharge output of the pump the engine connected thereto may have a constant horse-power output.

Many other objects are successfully secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement and relative location of parts in accordance with the following description.

In the drawings,

Fig. 1 is a central, longitudinal, cross sectional view through a form of pump in accordance with this invention employing spur gears which may have either straight or spiral teeth;

Fig. 2 is a cross sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a cross sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a cross sectional view on the line 4—4 of Fig. 1;

Fig. 5 is a central, longitudinal, cross sectional view through a modified form of pump structure employing internal gears which may have teeth of either the straight or spiral form;

Fig. 6 is a cross sectional view on the line 6—6 of Fig. 5;

Fig. 7 is a cross sectional view on the line 7—7 of Fig. 5; and

Fig. 8 is a cross sectional view on the line 8—8 of Fig. 5.

The present practice with geared pumps in order to secure a variable output therefrom where the pump speed is constant is to by-pass or shunt away a portion of the liquid output of the pump. Of course, the pump may be operated at variable speeds but this involves expensive control equipment and a variable power source for operating the pump, which requires complicated and expensive operating and control mechanism. Thus, with present practice, gear pumps have a constant displacement and the quantity of fluid flowing therefrom is varied by by-passing the necessary portion thereof.

With the present invention geared pumps are constructed so as to have a variable displacement. The structure is so arranged that the meshing gears may be moved axially with respect to each other to vary the area of the meshing portions of the gears. The result is that at a constant speed of operation the displacement of the pump may be varied at will. The advantages of such an arrangement are manifold. In the case, however, where such pump is used in combination with a rotary engine a constant horsepower output may be secured, imparting to the combination practical capabilities not heretofore attained.

The form of pump in accordance with this invention, illustrated in Figures 1–4, inclusive, employs externally meshing gears which may have either straight or curved teeth. The structure comprises a casing composed of the tubular portion 12, the cap portion 33, and the end plate 13, all secured together to form a closed chamber. The end plate 13 is provided with an internally projecting hub portion 14 which has a longitudinal bore therethrough. The operating shaft 15 is journalled in this bore in the bearing member 16 and passes through a packing gland nut 18 and packing 17. Intermediate the ends of the shaft 15 it is enlarged and provided with gear teeth 20 on the periphery thereof. The extension 19 of this shaft is journalled in the cap piece 33. A longitudinally slidable member 21 is formed with a reduced extension 22 which has secured on the end thereof a collar 23 forming a unit having an annular extended peripheral groove. Surrounding the core of this groove are a pair of bearing members 24 upon which is rotatably supported a sleeve having gear teeth 25 on the periphery thereof meshing with the gear teeth 20. The member 21 has a longitudinal bore extending therethrough through which a shaft or rod 26 passes. The end 27 of this shaft protrudes exteriorly of the cap 33 and passes through a bearing member and packing gland nut 28. This shaft is provided with a collar which rides in a recess on the inner wall of the cap. The end 29 of the shaft 26 threadedly engages member 21

and rests against, at its free end, a thrust bearing member 30 secured to the end plate 13. The member 21 has a longitudinal surface recess 21a of circular cross section snugly fitting the surface of the hub 14 and the gear 20 (Fig. 2). The casing is provided with a pair of diametrically opposed threaded passages 31 and 32 which extend to and from the meshing gears 20 and 25. The member 21 is provided with a passage 35 so that any trapped fluid between this member and the end plate may escape to the other side of the member as it moves back and forth.

When this device is employed as a pump, shaft 15 is connected to a suitable power source, such as a constant speed electric motor, so that the gears are caused to revolve at a desired speed of rotation. The quantity of fluid which will be taken into either passage 31 or 32, depending upon the direction of rotation of the gears, and discharged from the other passage will depend upon the area of the teeth 20 and 25 in contact. By rotating shaft 26, which may be accomplished by means of a crank on its end 27, for example, the member 21 may be moved back and forth, carrying with it the gear 25. When the member moves to the left from the position shown in the figure the meshing area of the teeth increases while movement in the opposite direction decreases the meshing area, with the result that the displacement of the pump is increased or decreased, respectively. It is clear from the description of the structure that rotation of shaft 26 can only effect movement of member 21 and its attached parts since this shaft is locked against endwise movement. It is equally clear to those skilled in the art that this pump may be employed as a motor, in which case fluid under pressure is delivered to the gears to cause them to revolve, with the result that power may be taken from shaft 15.

The principles of this invention are illustrated as applied to an internal gear pump, as has been depicted in Figures 5–8, inclusive. In this form the casing comprises the central portion 40, the end cap 41, the extension portion 42, and the end plate 43, all of which are secured together to form a closed chamber. At 44 is the operating shaft for the pump which extends through a packing 45 and a packing gland nut 46 in the end cap 41. This shaft has a collar 47 intermediate its ends which abuts against one wall of the portion 40 of the casing and is provided with a collar 48 pinned thereto which abuts against the opposite face of this wall. Thus the shaft 44 is held against longitudinal movement. The end 49 of this shaft is splined, as shown, and engages with a splined bore 51 in the spur gear or pinion 50. The right hand end of this gear is provided with a reduced hub which is journalled in a bearing member 52 held in place by means of a collar 53 secured to the hub. The other end of the gear 50 is provided with a shaft extension 54 likewise provided with a collar 55 secured to its free end. This shaft 54 is mounted in a bearing member 56. The gear 50, bearing member 52, collar 53, shaft 54, collar 55 and bearing member 56 are thus all securely locked together for unitary movement. A crescent-shaped fixed filler piece 57 is secured in the portion 42 of the housing by means of pins so as to engage the upper portion of the bearing member 57 which has been shaped to provide a running fit therewith. At 58 is an internal or ring gear journalled in the housing between the portions 40 and 42 of the casing. At 60 is a small shaft or rod which extends through a threaded extension 63 on the end cap 43 and externally of a sleeve 64 mounted on this extension. A packing 66 and a packing gland nut 67 prevent leakage around this shaft.

The shaft is provided with a collar 61 which engages the end plate 43 in a recess and has secured thereto a collar 65 which engages the outer face of the extension 63. This construction prevents longitudinal movement of shaft 60 when it is revolved. The end 62 of this shaft threadedly engages the bearing member 56. Thus when shaft 60 is revolved the assembly including the spur gear 50 may be moved axially. This engagement with the operating shaft 4 is maintained through the splined connection. The bearing member 52 is provided with a lug or key 72 which slides in a groove 73 in the part 40 of the housing. Thus the bearing member 52 may slide back and forth with gear 50 but may not turn. The inlet and outlet passages 70 and 71 extend partway into the bearing member 52 and issue at one side (see Figure 5) so that the fluid is passed from one to the other by the gears. In view of the description previously given, the operation of this pump to effect variable displacement at constant speed will be apparent. Here, as before, the pump may be reversed in its action and employed as a motor.

From the above description it will be apparent that this invention resides in certain principles of construction and operation as illustrated in the drawings. It is recognized that those skilled in the art may readily vary the application of these principles and the structure by which they are applied without departure from the scope of this invention. We do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration, but rather to the scope of the appended claims.

What we seek to secure by United States Letters Patent is:

1. A variable delivery gear pump of the type described comprising a casing forming a closed chamber, a ring gear journaled for rotation in the casing, a pair of spaced bearing members slidably mounted in the casing, a pinion closely fitting between and journaled in said members meshing with said ring gear, a driving shaft journaled in said casing and having a splined connection with said pinion for effecting rotation thereof, and means mounted in said casing and engaging one of said bearing members for effecting longitudinal reciprocation of the bearing members and pinion to vary the discharge of the pump, said casing having inlet and exhaust ports.

2. In a variable delivery gear pump of the type described the combination comprising a casing forming a closed chamber and having an inlet and an outlet port, a ring gear mounted in said casing for rotation, a pinion meshing with said ring gear, a pair of bearing members in which said pinion is journaled, said bearing members being slidably mounted in the casing, means for securing said bearing members to said pinion for sliding movement therewith, a driving shaft journaled in said casing and having a splined connection with said pinion, means for preventing rotation of one of said bearing members, and means engaging the other of said bearing members for effecting longitudinal movement of both bearing members and pinion, said last means preventing rotation of the adjacent bearing member.

3. A variable delivery gear pump of the type described comprising a closed casing having an inlet and an outlet port, a ring gear mounted in said casing for rotation on a fixed axis, a pinion

meshing with said ring gear, a pair of bearing members in which the pinion is journaled at opposite ends to rotatably support the pinion on an axis eccentric with the axis of the ring gear, said bearing members being secured to said pinion for longitudinal reciprocation therewith, a driving shaft journaled in said casing and having a sliding connection with the pinion, and means threadedly engaging one of said bearing members for effecting longitudinal reciprocation thereof conjointly with the pinion.

4. A variable delivery gear pump of the type described comprising a closed casing having an inlet and an outlet port, a ring gear mounted in said casing for rotation on a fixed axis, a pinion meshing with said ring gear, a pair of bearing members in which the pinion is journaled at opposite ends to rotatably support the pinion on an axis concentric with the axis of the ring gear, said bearing members being secured to said pinion for longitudinal reciprocation therewith, a driving shaft journaled in said casing and having a sliding connection with the pinion, means threadedly engaging one of said bearing members for effecting longitudinal reciprocation thereof conjointly with the pinion, and a fixed filler plate for filling the space between the ring gear and the pinion, one of said bearing members cooperating with the ring gear and the filler plate as the pinion varies in its area of meshing with the ring gear to block the space between the ring gear and filler plate.

5. A variable delivery gear pump of the type described comprising a closed casing having an inlet and an outlet port, an internal gear journaled for rotation in said casing, a carrier slidably mounted in the casing, a pinion journaled on said carrier and meshing with said gear, a shaft having aligned relatively slidable parts journaled in said casing and connected thereto for driving said gear and pinion, and means threadedly engaging the carrier for effecting longitudinal reciprocation thereof to vary the meshing area of the gear and pinion, one of the shaft parts being held against axial movement and the other connected to said carrier for sliding movement therewith.

6. A variable delivery gear pump comprising a casing having an inlet and an outlet port, an internal gear rotatably mounted in the casing, a pair of spaced bearing members slidably mounted in the casing, a shaft having two relatively slidable parts journalled in the bearing members, a pinion secured to one of the shaft parts and closely fitting between the bearing members, the other shaft part being fixed against longitudinal movement, said bearing members and pinion being slidable as a unit, and means for causing them to slide in the casing.

CHARLES A. MOORE.
PRESTON WHITCOMB.