

Nov. 29, 1966

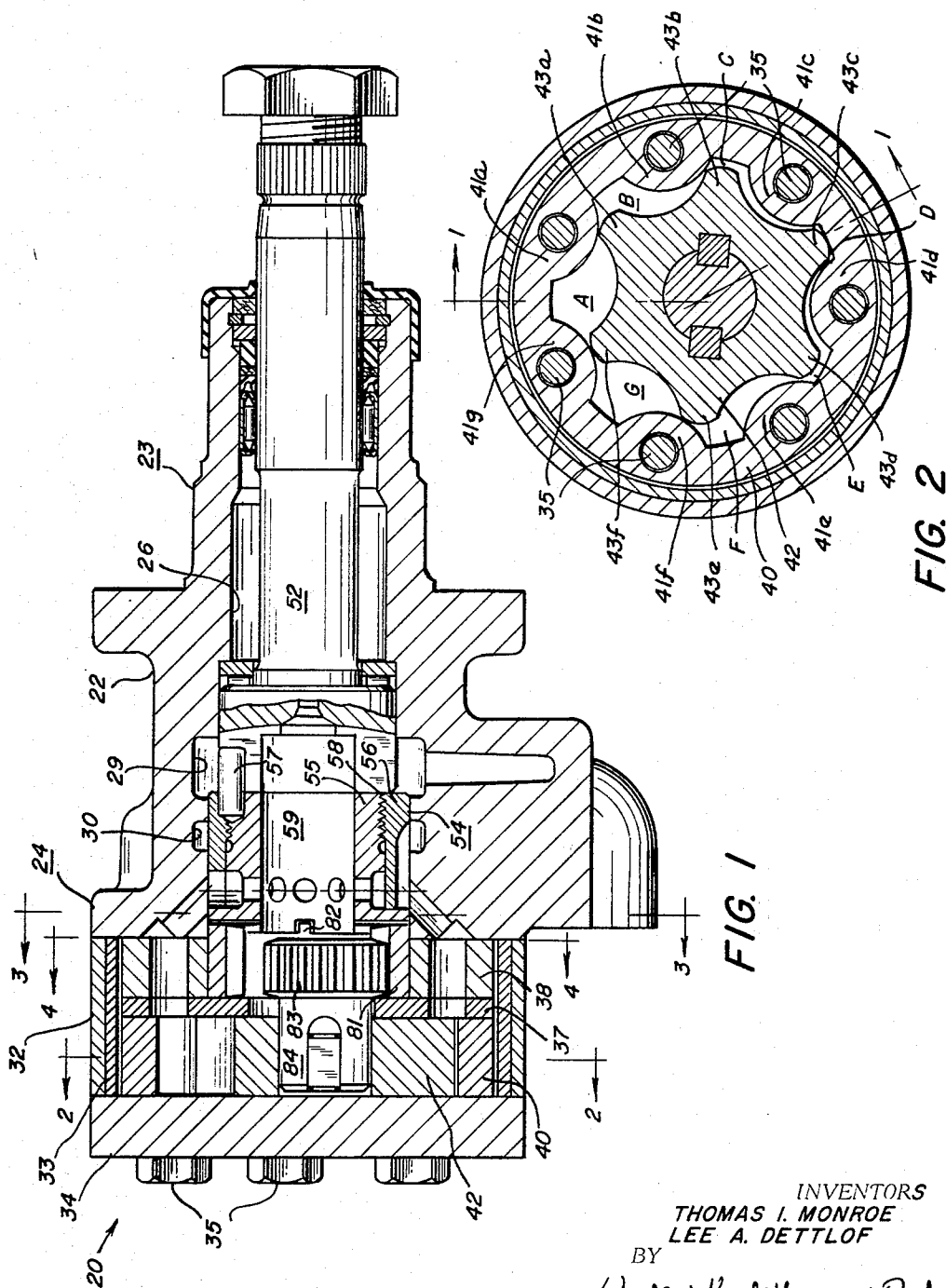
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3,288,078

HYDRAULIC DEVICE

Filed Aug. 25, 1964

4 Sheets-Sheet 1



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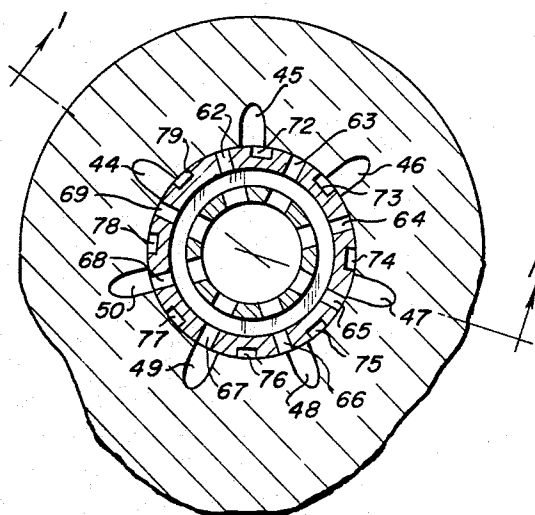


FIG. 3

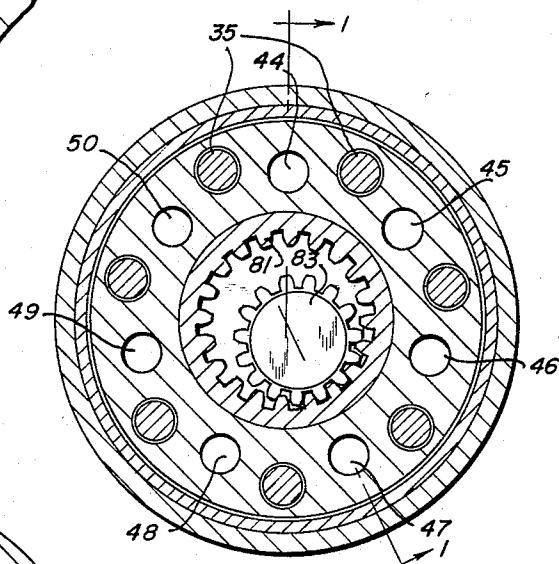


FIG. 4

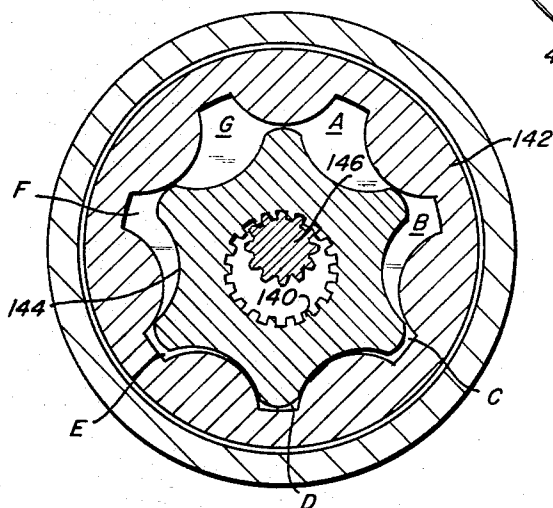


FIG. 8

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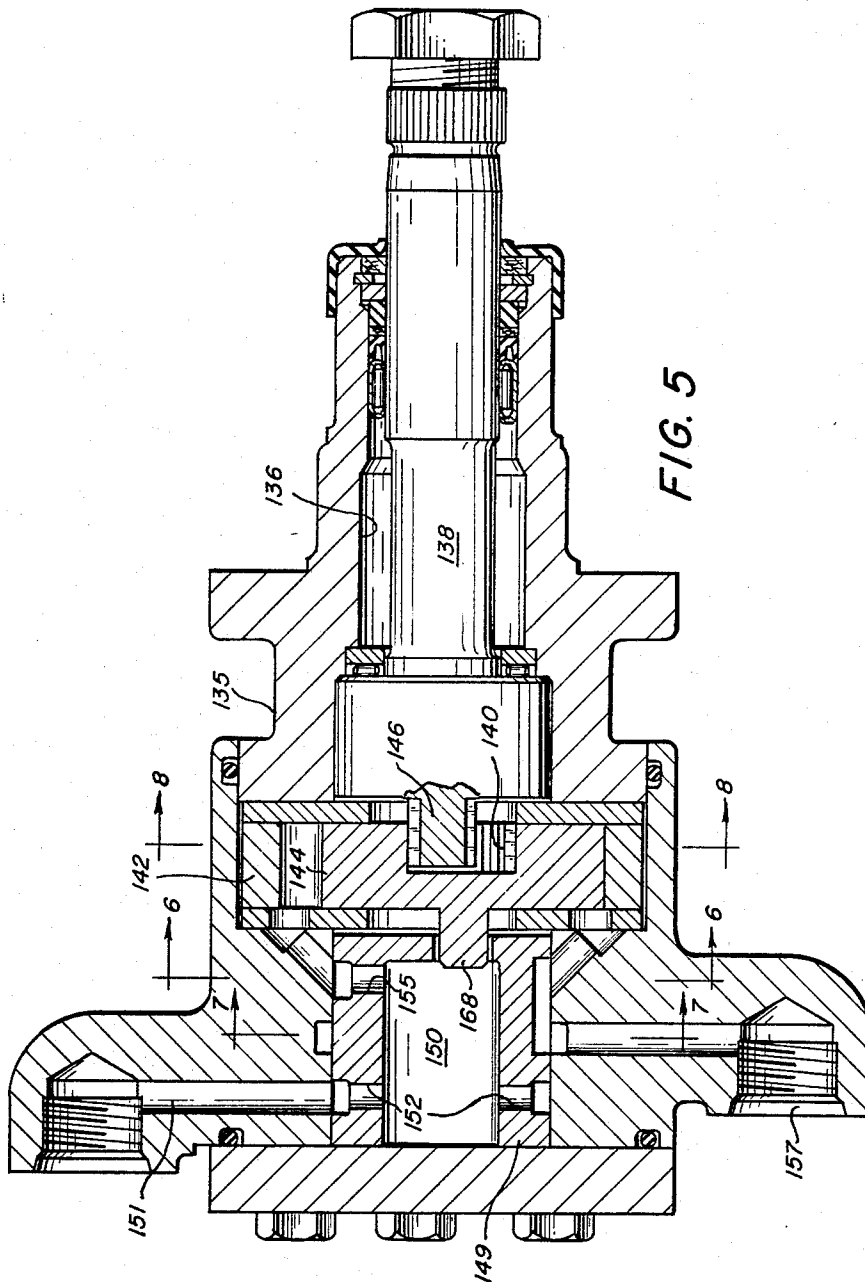


FIG. 5

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4 Sheets-Sheet 4

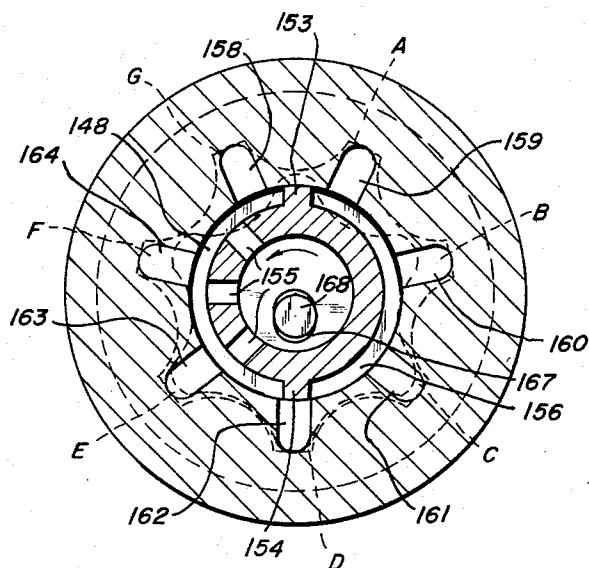


FIG. 6

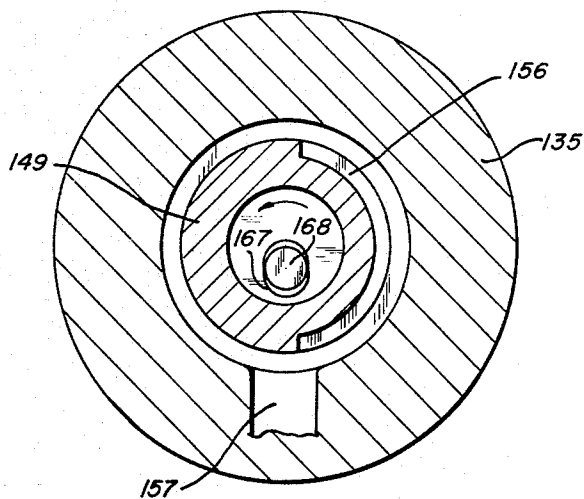


FIG. 7

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3,288,078

HYDRAULIC DEVICE

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Filed Aug. 25, 1964, Ser. No. 391,939

14 Claims. (Cl. 103—130)

The present invention relates in general to hydraulic devices of the internal gear type wherein an externally toothed rotor resides within an internally toothed stator and is adapted to both rotate and orbit relative to the stator and relates more particularly to an improved means of imparting movement to or from the rotor relative to an operating or drive member.

An object of the present invention is to provide a new and improved means of transmitting movement to or from the rotor of a hydraulic device of the internal gear type.

Another object of the present invention is to provide a new and improved means of driving the rotor of an internal gear pump design wherein an increased volumetric displacement is provided with the same rotational movement of the operating member or drive shaft of conventional designs.

Another object of the present invention is the elimination of the cumulative back lash problems inherent in present designs of the double universal joint drive type which have been used to drive the rotor of an internal gear type hydraulic device in its rotative and orbital movement relative to a stator.

Another object of the present invention is to provide a more compact design of the hydraulic device which is disclosed herein and which may be either a pump or a motor.

Another object of the present invention is to provide a new and improved means for driving the rotor of an internal gear type hydraulic device wherein the rotor is driven at a rotative speed which is less than the rotative speed of the drive member.

Another object of the present invention is to provide a means of transmitting movement to or from the rotor relative to the stator in an internal gear type device wherein the problem of force balances is important and the drive gears are so positioned that there is no cocking of the rotor member relative to the stator member.

Another object of the present invention is to provide a new and improved means of transmitting movement between a rotor and an operating member of a hydraulic device of the internal gear type wherein the rotor may rotate faster or slower than the operating member.

Another object of the present invention is to provide a new and improved means of transmitting movement between a rotor and an operating member of a hydraulic device of the internal gear type in combination with commutation means for entering and exiting fluid from spaces between the rotor and a stator with in which it moves.

Other objects and a fuller understanding of this invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is an axial section of a hydraulic device incorporating the teachings of the present invention and taken generally along the line 1—1 of FIGURE 2;

FIGURE 2 is a view taken generally along the line 2—2 of FIGURE 1;

FIGURE 3 is a view taken generally along the line 3—3 of FIGURE 1;

FIGURE 4 is a view taken generally along the line 4—4 of FIGURE 1;

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The position of FIGURES 2, 3, and 4 relative to each other and to FIGURE 1 is indicated by the line 1—1 applied thereto.

FIGURE 5 is an axial section of a modification of the device which is shown in FIGURES 1 through 4;

FIGURE 6 is a view taken generally along the line 6—6 of FIGURE 5;

FIGURE 7 is a view taken generally along the line 7—7 of FIGURE 5; and,

FIGURE 8 is a view taken generally along the line 8—8 of FIG. 5.

FIGURE 1 of the drawings illustrates a preferred embodiment of the present invention and the hydraulic device which is illustrated is specifically that of a hydraulic hand pump. This hydraulic device is illustrated generally by the reference numeral 20, and includes in combination a housing 22 which has first and second end portions 23 and 24, respectively, and wall means 26 define a bore which extends axially through the housing and which has different diameter portions. An annular fluid inlet passage 29 and an annular fluid outlet passage 30 surround the bore, and as will be noted in FIGURE 1, are axially spaced from each other. An annular seal retainer 32 abuts the second end of the housing at one end and is closed at its other end by means of end plate 34 securely held in position by screws 35. Positioned within the annular seal retainer 32 is a seal member 33. Spacer means are provided at the second end portion of the housing, within the seal member 33, and include first and second spacer plates 37 and 38, respectively.

Located between the plate 37 and the end plate 34 in a fixed position is an internally toothed member 40, commonly referred to as a stator, and the stator in this instance is provided with seven teeth or lobes numbered 41a, 41b, 41c, 41d, 41e, 41f, and 41g. An externally toothed member, commonly referred to as a rotor 42, is mounted within the internally toothed member and is adapted for rotational movement about its own axis and for orbital movement with respect to the axis of the stator. The rotor is provided with teeth 3, there being specifically six in number in this embodiment, and these teeth have been numbered 43a, 43b, 43c, 43d, 43e, and 43f. The action of the rotor in its rotational and orbital movement with respect to the stator is to produce a series of alternately expanding and contracting chambers as the rotor partakes of such movement. These chambers are located in the spaces formed between the teeth 41 of the stator and these spaces have been identified with the letters A, B, C, D, E, F, and G.

Wall means serve to define a plurality of equally spaced ports which extend from the chambers formed between the stator teeth through the spacer plates 37 and 38, and through the second end portion of the housing and terminate at circumferentially spaced positions at the bore 26 which is provided in the housing. These ports have been numbered 44 through 50 (FIGURES 3 and 4). A drive shaft or operating member 52 is positioned in the bore of the housing at the second end portion thereof and a hydraulic commutator 54 is located in the bore of the housing between the left end of the drive shaft and the rotor 42 as seen in FIGURE 1. The commutator is conveniently constructed of an inner annular member 55 and an outer annular member 56 threadably connected together at 58. The left end of the drive shaft 52 and the commutator 54 are conveniently connected together for common rotation by means of a drive pin 57 which extends between the two members.

The commutator 54 is hollow as best seen in FIGURE 1, and this provides an axial opening 59 which is constantly in communication with the annular fluid inlet pas-

sage 29. A plurality of circumferentially spaced openings lead from the axial opening 59 in the commutator through the wall of the commutator and terminate at the bore 26 of the housing and are located in axial alignment with the ports 44 through 50 and are adapted to alternately communicate with these ports upon rotation of the commutator. These radial commutator openings have been numbered 62 through 69.

A plurality of circumferentially spaced slots are located on the outer surface of the commutator and are alternately positioned between the circumferentially spaced openings 62 through 69 in the commutator and the right end of each of these slots as seen in FIGURE 1 is in constant communication with the annular fluid outlet passage 30. These slots have been numbered 72 through 79 respectively. The other end of each of the slots (the left end as seen in FIGURE 1) is in axial alignment with the ports 44 through 50 and are adapted to alternately communicate therewith upon rotation of the commutator 54.

An internal drive gear 81 in the nature of a ring gear having inwardly extending teeth is rotatively connected to the commutator by means of tangs 82 so as to provide common rotation between these two elements. An external drive gear 83 in the nature of a pinion gear is fixedly connected to the rotor 42 for common rotation and orbital movement therewith. The pinion gear is connected to the rotor by means of a stub shaft 84 which is fixedly connected or secured in a corresponding opening in the rotor 42 by keys. In the embodiment which has been illustrated herein, the ring gear 81 has been provided with 20 teeth and the pinion gear 83 has been provided with 15 teeth. The construction of the internal-external drive gear arrangement to drive the rotor lends itself to a discovery with regard to the porting of the commutator. The ratio of the teeth on the ring gear 81 to the teeth on the pinion gear 83 of 20 to 15 provides a gear ratio of $1\frac{1}{3}$ to 1. It has been found that the gear ratio of $1\frac{1}{3}$ times the number of teeth on the rotor 42, namely six in this particular embodiment, gives a product of eight, which is equal to the number of slots 72 through 79 in the commutator and also the number of radial commutator openings numbered 62 through 69 in this embodiment. To produce proper commutation it is necessary also that the number of slots and also the number of commutator openings be equal to the number of stator lobes plus one or minus one. Since the rotor undergoes six orbits relative to the stator for each complete rotation of the rotor, and seven pulses are produced for each orbit, there are normally 42 pulses produced for each rotation of the rotor and as a result of the gear ratio of $1\frac{1}{3}$ to 1 it follows that for each rotation of the drive shaft 52 there are 56 pulses produced.

The operation of the hydraulic pump disclosed in FIGURE 1 is basically as follows. Assuming the drive shaft 52 is rotated in a counter-clockwise direction as viewed in the direction of FIGURES 2, 3 and 4, the commutator 54 and as a result the ring gear 81 are caused to rotate in a counter-clockwise direction. The pinion gear 83 is caused to rotate in a clockwise direction and since the pinion gear is fixedly attached to the rotor 42, the rotor also rotates in a clockwise direction. The rotor 42 orbits, or one might say the axis of the rotor orbits, relative to the axis of the stator 40 in a direction which is counter-clockwise. As a result of this rotation, the chambers E, F and G are undergoing an intake stroke and are connected to the inlet passage 29 by way of radial commutator openings 66, 67 and 68 which respectively are in communication with ports 48, 49 and 50 and chambers A, B, and C are undergoing an exhaust or pressure stroke and are connected to the outlet passage 30 by way of slots 79, 72 and 73 and ports 44, 45 and 46. Chamber D as shown is in a state of transition and at the position shown is neither on a pressure or an intake stroke.

It will thus be seen that by way of the mechanism utilized to transmit the movement from the drive shaft 52 to the rotor 42, in addition to providing an extremely compact design, produces the additional advantage that a multiplication effect is achieved. It will be readily appreciated by those skilled in the art that the device shown herein is capable of functioning as a motor as distinguished from the pump which has been specifically described. It will also be appreciated by those skilled in the art that the device illustrated herein is symmetrical and if the drive shaft 52 is rotated in a clockwise direction as distinguished from the counter-clockwise direction described hereinabove, the functions of the various commutator passages as well as the inlet and outlet passages are reversed. In other words, the inlet passage 29 becomes an outlet passage and the outlet passage 30 becomes an inlet passage. The openings 62 through 69 instead of being inlet openings become outlet openings and the slots 72 through 79 instead of porting the high pressure side of the device serve to port the low pressure or input side of the device.

FIGURES 5 through 8 illustrate another means of driving the rotor of the internal gear set or in the case of a motor of transmitting motion from the rotor of the internal gear set to the operating member or shaft. In addition, this modification serves to illustrate how a simple form of commutator mechanism may be utilized as distinguished from the more complicated form shown in FIGURES 1 through 4. The device illustrated in FIGURES 5, 6, 7, and 8 will be described as a pump which will be understood to be symmetrical and reversible with respect to the direction of rotation of the drive shaft and it will also be appreciated by those skilled in the art that the device is capable of functioning as a motor. As described, the device includes a housing 135 provided with an axial bore 136 and positioned within the housing is an operating member or drive shaft 138 which has integrally formed on the left end thereof as seen in FIGURE 5 an external drive gear 146 in the nature of a pinion. This gear 146 is coaxial and rotates in common with the drive shaft. An internally toothed stator 142 is fixedly held in position in the housing at the left end of the drive shaft as seen in FIGURE 5 as in the device of FIGURE 1 and as in this device an externally toothed rotor 144 is adapted to rotate and orbit within the fixed stator. The rotor 144 is adapted to be driven by means of a connection between the same and the drive shaft which includes the external drive gear 146 and an internal drive gear in the nature of a ring gear 140 formed on the rotor 144 proper and as a result rotates and orbits in common with the rotor. In the particular embodiment described, the number of teeth on the gear 140 is 18 and the number of teeth on the gear 146 is 12 thereby providing a step down gear arrangement from the drive shaft to the rotor and as a result one rotation of the drive shaft results in the rotor making $\frac{2}{3}$ of a turn.

The commutating of the pump, in other words, the providing of entrance of unpressurized fluid to the expanding chambers formed between the rotor and stator teeth and the exiting of pressurized fluid from the contracting chambers formed between the rotor and stator teeth is accomplished by means of a simple commutator 149. The chambers here are also identified by the reference letters A through G (FIGURE 6).

The commutator 149 has a hollow central bore 150 which is constantly in fluid communication with an inlet passage 151 by way of radial openings 152. The bore 150 of the commutator is in constant communication with a semicircular inlet portion 148 of the commutator, which is defined by lands 153 and 154, by way of openings 155. The lands 153 and 154 on their opposite sides define a generally semi-circular shaped outlet portion 156 of the commutator. These two portions (148 and 156) are adapted to pass adjacent the ports 158 through 164 upon rotation of the commutator which provides fluid

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communication to and from the spaces (A through G) between the stator teeth.

As will be apparent from an understanding of the previous description of the operation of the rotor-stator mechanism, the rotor both rotates and orbits relative to the stator. For each complete rotation of the rotor about its own axis, its own axis orbits about the axis of the stator six times. In order to properly provide entrance of fluid to and from the spaces (A through G) between the stator teeth with the type of commutator 149 which is illustrated in this embodiment, it is necessary for each orbit the rotor makes relative to the stator, that the commutator 149 make one complete revolution about its own axis. In order to accomplish this end result, the commutator 149 is provided with a slotted opening 167 within which a pin 168 resides, the right end of which as seen in FIGURE 5 is formed as an integral part of the rotor 144. As a result, when the rotor 144 moves through one orbit, the pin 168 rotates the commutator through one complete revolution. This provides the proper relative sequence to the commutator so that the fluid from the contracting chambers formed between the stator and rotor teeth is being received in the outlet portion of the commutator whereas the inlet portion of the commutator is supplying fluid to the expanding chambers formed between the rotor and stator teeth.

Obviously if the drive shaft 138 is rotated in the opposite direction, the function of the inlet passage 151 and outlet passage 157 are reversed as are the inlet and outlet portions of the commutator indicated by the reference numerals 148 and 156. The specific operation of the device illustrated in FIGURES 5 through 8 and assuming a clockwise direction of rotation of the rotor 144 as viewed in the direction of FIGURES 6 and 7 would put chambers A, B and C on a pressure stroke or in other words in a contracting condition and would put chambers E, F, and G in an inlet condition or in other words an expanding condition. The chamber D is in a neutral or transition position. Under these conditions fluid exits the chambers A, B and C by way of ports 159, 160 and 161 to the outlet portion 156 of the commutator which in turn is in communication with outlet passage 157. The chambers E, F, and G are in communication with the inlet passage 151 by way of the bore 150, openings 155, and inlet portion 148. Upon rotation of the rotor in a clockwise direction as viewed in FIGURE 6, the rotor orbits in a counter-clockwise direction thereby progressively passing the chambers G, F, E and D through pressure pulses and the pin 168 and slotted opening 167 insures that the orbiting of the rotor drives the commutator in the proper direction so that the inlet portion 148 of the commutator and the outlet portion 156 of the commutator are always in communication with the proper chambers A through G. As mentioned hereinabove, it will be obvious to those skilled in the art that reversing the direction of rotation of the rotor causes the inlet and outlet functions to be reversed. The rotation of the drive shaft by means of the convenient construction of the gears 140 and 146 provides a convenient step-down arrangement between the rotation of the drive shaft and the rotation of the rotor. The location of the gear 146 within the gear 140 provides a driving arrangement between the rotor and drive shaft where there is very little force effect tending to cock or tilt the rotor relative to the stator. This particular feature is usually more important when the device functions as a motor and those skilled in the art will readily appreciate the reversibility of the device to function as a motor as well as a pump. This construction also illustrates how the communication of the internal-external gear drive means of driving the internal pump or motor set may be varied while still maintaining the teachings of the present invention.

It will also be appreciated by those skilled in the art that in the construction of the internal gear set which has been disclosed herein, either the rotor or the stator may

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be fixed while the other rotates. With this variation in construction it will be appreciated that either the internal or external gear may be attached to the movable element of the internal gear set depending upon the operating characteristics desired.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous change in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A pump including in combination a housing having a bore therein, wall means defining inlet and outlet passageways in said housing communicating with said bore, an internally toothed stator fixedly connected to said housing, an externally toothed rotor mounted for rotary and orbital movement with respect to said stator, said rotor having one less tooth than said stator, a commutator in said bore, a drive shaft coaxial with and connected to said commutator for rotating the same, a plurality of ports communicating at one end with spaces between the teeth on said stator and at the other end with said bore, said commutator having a first plurality of circumferentially spaced passages constantly connected at one end to said inlet passageway and at their other end adapted to be alternately connected to said plurality of ports, said commutator also having a second plurality of circumferentially spaced passages constantly connected at one end to said outlet passageway and at the other end adapted to be alternately connected to said plurality of ports, said first plurality of circumferentially spaced passages being located alternately with said second plurality of circumferentially spaced passages, an internal drive gear connected to said drive shaft for common rotation therewith and with said commutator, an external drive gear within said internal drive gear and meshing therewith and being connected to and coaxial with said rotor for common rotational and orbital movement therewith, the number of internal drive gear teeth over the number of external drive gear teeth comprising a gear ratio and the number of said first plurality of circumferentially spaced passages as well as the number of said second plurality of circumferentially spaced passages being equal to said gear ratio multiplied by the number of teeth on said externally toothed rotor.

2. A pump including in combination a housing having a bore therein, wall means defining inlet and outlet passageways in said housing communicating with said bore, an internally toothed stator fixedly connected to said housing, an externally toothed rotor mounted for rotary and orbital movement with respect to said stator, said rotor having one less tooth than said stator, a commutator in said bore, a drive shaft coaxial with and connected to said commutator for rotating the same, a plurality of ports communicating at one end with spaces between the teeth on said stator and at the other end with said bore, said commutator having a first plurality of circumferentially spaced passages being constantly connected at one end to said inlet passageway and at their other end being adapted to be alternately connected to said plurality of ports, said commutator also having a second plurality of circumferentially spaced passages being constantly connected at one end to said outlet passageway and at the other end being adapted to be alternately connected to said plurality of ports, said first plurality of circumferentially spaced passages being located alternately with said second plurality of circumferentially spaced passages, an internal drive gear connected to one of said drive shafts and said rotor for common rotation therewith, an external drive gear within said external drive gear and meshing therewith and being connected to and

coaxial with the other of said drive shafts and said rotor for common rotational movement therewith, the number of teeth on the drive gear connected to said drive shaft over the number of teeth on the drive gear connected to said rotor comprising a gear ratio and the number of said first plurality of circumferentially spaced passages as well as the number of said second plurality of circumferentially spaced passages being equal to said gear ratio multiplied by the number of teeth on said externally toothed rotor.

3. A hydraulic device including in combination a housing having a bore therein, wall means defining inlet and outlet passageways in said housing communicating with said bore, an internally toothed stator fixedly connected to said housing, an externally toothed rotor mounted for rotary and orbital movement with respect to said stator, said rotor having one less tooth than said stator, a commutator in said bore, a shaft coaxial with and connected to said commutator, a plurality of ports communicating at one end with spaces between the teeth on said stator and at the other end with said bore, said commutator having a first plurality of circumferentially spaced passages being constantly connected at one end to said inlet passageway and at their other end being adapted to be alternately connected to said plurality of ports, said commutator also having a second plurality of circumferentially spaced passages being constantly connected at one end to said outlet passageway and at the other end being adapted to be alternately connected to said plurality of ports, said first plurality of circumferentially spaced passages being located, alternately with said second plurality of circumferentially spaced passages, an internal drive gear connected to one of said shafts and said rotor for common rotation therewith, an external drive gear within said internal drive gear and meshing therewith and being connected to and coaxial with the other of said shafts and said rotor for common rotational movement therewith.

4. A pump including in combination an internally toothed stator, an externally toothed rotor mounted for rotary and orbital movement with respect to said stator, said rotor having one less tooth than said stator, a commutator, inlet and outlet passageways extending to said commutator, a drive shaft coaxial with and connected to said commutator for rotating the same, a plurality of ports communicating at one end with spaces between the teeth on said stator and at the other end with said commutator, said commutator having a first plurality of spaced passages connected at one end to said inlet passageway and at their other end adapted to be alternately connected to said plurality of ports, said commutator having a second plurality of spaced passages connected at one end to said outlet passageway and at the other end adapted to be alternately connected to said plurality of ports, said first plurality of spaced passages being located alternately with said second plurality of spaced passages, an internal drive gear connected to said drive shaft for common rotation therewith and with said commutator, an external drive gear within said internal drive gear and meshing therewith and being connected to and coaxial with said rotor for common rotational and orbital movement therewith, the number of internal drive gear teeth over the number of external drive gear teeth comprising a gear ratio and the number of said first plurality of spaced passages as well as the number of said second plurality of spaced passages being equal to said gear ratio multiplied by the number of teeth on said externally toothed rotor.

5. A hydraulic device including in combination an internally toothed stator, an externally toothed rotor mounted for rotary and orbital movement with respect to said stator, said rotor having fewer teeth than said stator, a commutator, inlet and outlet passageways extending to said commutator, a shaft connected to said commutator, a plurality of ports communicating at one

end with spaces between the teeth on said stator and at the other end with said commutator, said commutator having a first plurality of spaced passages connected at one end to said inlet passageway and at their other end adapted to be alternately connected to said plurality of ports, said commutator having a second plurality of spaced passages connected at one end to said outlet passageway and at the other end adapted to be alternately connected to said plurality of ports, an internal drive gear connected to one of said shaft and said rotor for common rotation therewith, an external drive gear within said internal drive gear and meshing therewith and being connected to the other of said shaft and said rotor for common rotational movement therewith, said internal and external drive gear connection causing said shaft and said rotor to rotate at different rotational speeds.

6. A hydraulic device including in combination an internally toothed stator, an externally toothed rotor, one of said rotor and stator being mounted for rotary and orbital movement with respect to the other, said rotor having one less tooth than said stator, a commutator, inlet and outlet passageways extending to said commutator, a shaft connected to said commutator, a plurality of ports communicating at one end with spaces between the teeth on one of said stator and rotor and at the other end with said commutator, said commutator having a first plurality of spaced passages connected at one end to said inlet passageway and at their other end adapted to be connected to said plurality of ports, said commutator having a second plurality of spaced passages connected at one end to said outlet passageway and at the other end adapted to be connected to said plurality of ports, an internal drive gear connected to one of said shaft and said movable one of said rotor and stator for common rotation therewith, an external drive gear within said internal drive gear and meshing therewith and being connected to the other of said shaft and said one of said rotor and stator for common rotational movement therewith, said internal and external drive gear connection causing said shaft and said movable one of said rotor and stator to rotate at different rotational speeds.

7. A hydraulic hand pump including in combination a housing having first and second end portions and wall means defining a bore extending axially therethrough, an annular fluid inlet passage and an annular fluid outlet passage in said housing surrounding said bore and being axially spaced from each other, annular seal means abutting said second end portion of said housing at one end portion thereof, an end plate covering the other end portion of said annular seal means, a spacer plate abutting said second end portion of said housing and residing within the confines of said annular seal means, of internally toothed member fixedly secured between said end plate and said spacer plate and within the confines of said annular seal means and having an axis, an externally toothed member mounted within said internally toothed member for rotational and orbital movement with respect thereto, said externally toothed member having an axis and having one less tooth than said internally toothed member, wall means defining a plurality of equally spaced ports extending from the spaces between the teeth on said internally toothed member through said spacer plate and through said housing to said housing bore at said second end portion of said housing, a drive shaft extending axially into said bore from said first end portion of said housing, a commutator located in said bore at said second end portion of said housing coaxial with said drive shaft, means connecting said drive shaft and commutator together for common rotation, said commutator having an axial opening communicating with said annular fluid inlet passage, a plurality of circumferentially spaced openings leading from said axial commutator opening to said housing bore in axial alignment with said ports and adapted to alternately communicate therewith upon rotation of said commutator, a plurality of circum-

ferentially spaced slots on the outer surface of said commutator and alternately located between said circumferentially spaced openings in said commutator, one end of each of said slots being in constant communication with said annular fluid outlet passage, the other end of each of said slots being in axial alignment with said ports and adapted to alternate communicate therewith upon rotation of said commutator, an internal drive gear coaxial with and connected to said commutator for common rotation therewith, a pinion gear fixedly connected to said externally toothed member for common rotation and orbital movement therewith, said pinion and internal drive gear being in meshing engagement whereby said pinion and externally toothed member are rotated at a greater rotational speed than said drive shaft and commutator, the number of teeth on said internal gear over the number of teeth on said pinion gear comprising a gear ratio, the number of said slots as well as the number of said openings in said commutator being equal to said gear ratio multiplied by the number of teeth on said externally toothed member, and the number of discharge strokes of said hand pump per revolution of said drive shaft being equal to said gear ratio multiplied by the number of teeth on said externally toothed member multiplied by the number of teeth on said internally toothed member.

8. A hydraulic device including in combination a housing having a bore therein, wall means defining inlet and outlet passageways in said housing communicating with said bore, an internally toothed stator fixedly connected to said housing, an externally toothed rotor mounted for rotary and orbital movement with respect to said stator, said rotor having one less tooth than said stator, a commutator in said bore, a plurality of ports communicating at one end with spaces formed by the teeth of said stator and at the other end with said bore, said commutator having inlet opening means constantly connected at one end to said inlet passageway and at the other end adapted to be connected to said plurality of ports, said commutator also having outlet opening means constantly connected at one end to said outlet passageway and at the other end adapted to be connected to said plurality of ports, a drive shaft in said bore, an external drive gear connected to said drive shaft for common rotation therewith, an internal drive gear surrounding said external drive gear and meshing therewith and being connected to and coaxial with said rotor for common rotational and orbital movement therewith, wall means defining a slot in said commutator, a drive pin member connected to and coaxial with said rotor and adapted for rotary and orbital movement therewith, said drive pin member residing in said slot and causing said commutator to rotate in accordance with the orbital movement of said rotor to appropriately connect said spaces formed by said stator teeth and with said inlet and outlet passageways.

9. A hydraulic device including in combination a housing having a bore therein, wall means defining inlet and outlet passageways in said housing communicating with said bore, an internally toothed stator fixedly connected to said housing, an externally toothed rotor mounted for rotary and orbital movement with respect to said stator, said rotor having fewer teeth than said stator, a commutator in said bore, a plurality of ports communicating at one end with spaces formed by the teeth of said stator and at the other end with said bore, said commutator having inlet opening means constantly connected at one end to said inlet passageway and at the other end adapted to be connected to said plurality of ports, said commutator also having outlet opening means constantly connected at one end to said outlet passageway and at the other end adapted to be connected to said plurality of ports, a drive shaft in said bore, an external drive gear connected to said drive shaft for common rotation therewith, an internal drive gear surrounding said external drive gear and meshing therewith and

being connected to and coaxial with said rotor for common rotational and orbital movement therewith, connection means between said rotor and commutator causing said commutator to rotate in accordance with the orbital movement of said rotor to appropriately connect said spaces formed by said stator teeth with said inlet and outlet passageways.

10. A hydraulic device including in combination a housing having a bore therein, wall means defining inlet and outlet passageways in said housing communicating with said bore, an internally toothed stator, an externally toothed rotor, one of said rotor and stator being mounted for rotary and orbital movement with respect to the other, said rotor having fewer teeth than said stator, a commutator in said bore, a plurality of ports communicating at one end with spaces formed by the teeth of said stator and at the other end with said bore, said commutator having inlet opening means constantly connected at one end to said inlet passageway and at the other end adapted to be connected to said plurality of ports, said commutator also having outlet opening means constantly connected at one end to said outlet passageway and at the other end adapted to be connected to said plurality of ports, a drive shaft in said bore, an external drive gear connected to said drive shaft for common rotation therewith, an internal drive gear surrounding said external drive gear and meshing therewith and being connected to said movable one of said rotor and stator for common rotational and orbital movement therewith, connection means between said movable one of said rotor and stator and said commutator to appropriately connect said spaces formed by said stator teeth with said inlet and outlet passageways.

11. A hydraulic device including in combination a housing having a bore therein, wall means defining inlet and outlet passageways in said housing communicating with said bore, an internally toothed stator, an externally toothed rotor, one of said rotor and stator being mounted for rotary and orbital movement with respect to the other, said rotor having fewer teeth than said stator, a commutator in said bore, a plurality of ports communicating at one end with spaces formed by the teeth of said stator and at the other end with said bore, said commutator having inlet openings means constantly connected at one end to said inlet passageway and at the other end adapted to be connected to said plurality of ports, said commutator also having outlet opening means constantly connected at one end to said outlet passageway and at the other end adapted to be connected to said plurality of ports, a drive shaft in said bore, an external drive gear connected to said movable one of said rotor and stator and said drive shaft for common rotation therewith, an internal drive gear surrounding said external drive gear and meshing therewith and being connected to the other of said movable one of said rotor and stator and said drive shaft, and connection means between said movable one of said rotor and stator and said commutator to appropriately connect said spaces formed by said stator teeth with said inlet and outlet passageways.

12. A fluid device including in combination a housing, an outer internally toothed member and an inner externally toothed member located in said housing, one of said inner and outer members being mounted for rotary movement with respect to the other, one of said inner and outer members being mounted for orbital movement with respect to the other, said inner member having fewer teeth than the outer member, the mounting of said inner and outer members and rotation of one relative to the other producing a plurality of alternately expanding and contracting chambers, an operating shaft, an internal drive gear connected to one of said operating shaft, and said rotatable one of said inner and outer members for common rotation therewith, an external drive gear meshing with said internal drive gear and being connected to the other of said operating shaft,

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and said rotatable one of said inner and outer members for common rotational movement therewith, a bore in said housing, a commutator separate from said inner and outer members and rotatably mounted in said bore, a plurality of ports in said housing corresponding in number to said chambers and communicating at one of their ends with a respective chamber and communicating at the other of their ends at circumferentially spaced positions at said bore and adjacent said commutator, said commutator having wall means thereon defining fluid inlet means and fluid outlet means adapted to be connected to the bore end of said ports upon rotation of said commutator.

13. A fluid device as claimed in claim 12 wherein means are provided for connecting the commutator to said operating shaft whereby the commutator is rotated at the speed of the operating shaft.

14. A fluid device as claimed in claim 12 wherein means are provided for connecting the commutator to the orbiting one of said inner and outer members whereby the commutator is rotated at orbit speed.

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