

1,126,812.

Patented Feb. 2, 1915.

4 SHEETS-SHEET 1.

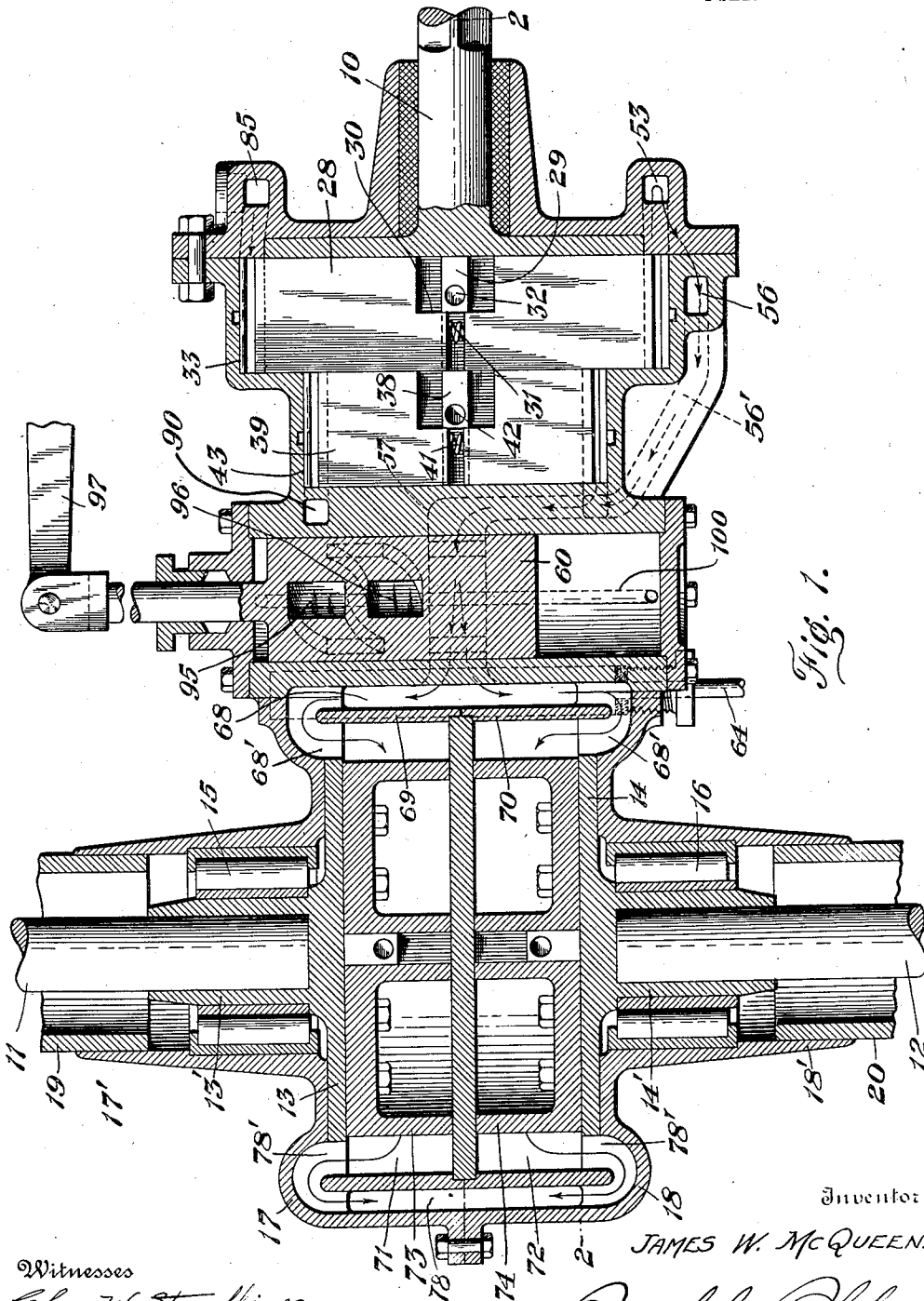


Fig. 1.

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DRIVING MECHANISM.
APPLICATION FILED DEC. 13, 1910.

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4 SHEETS—SHEET 2.

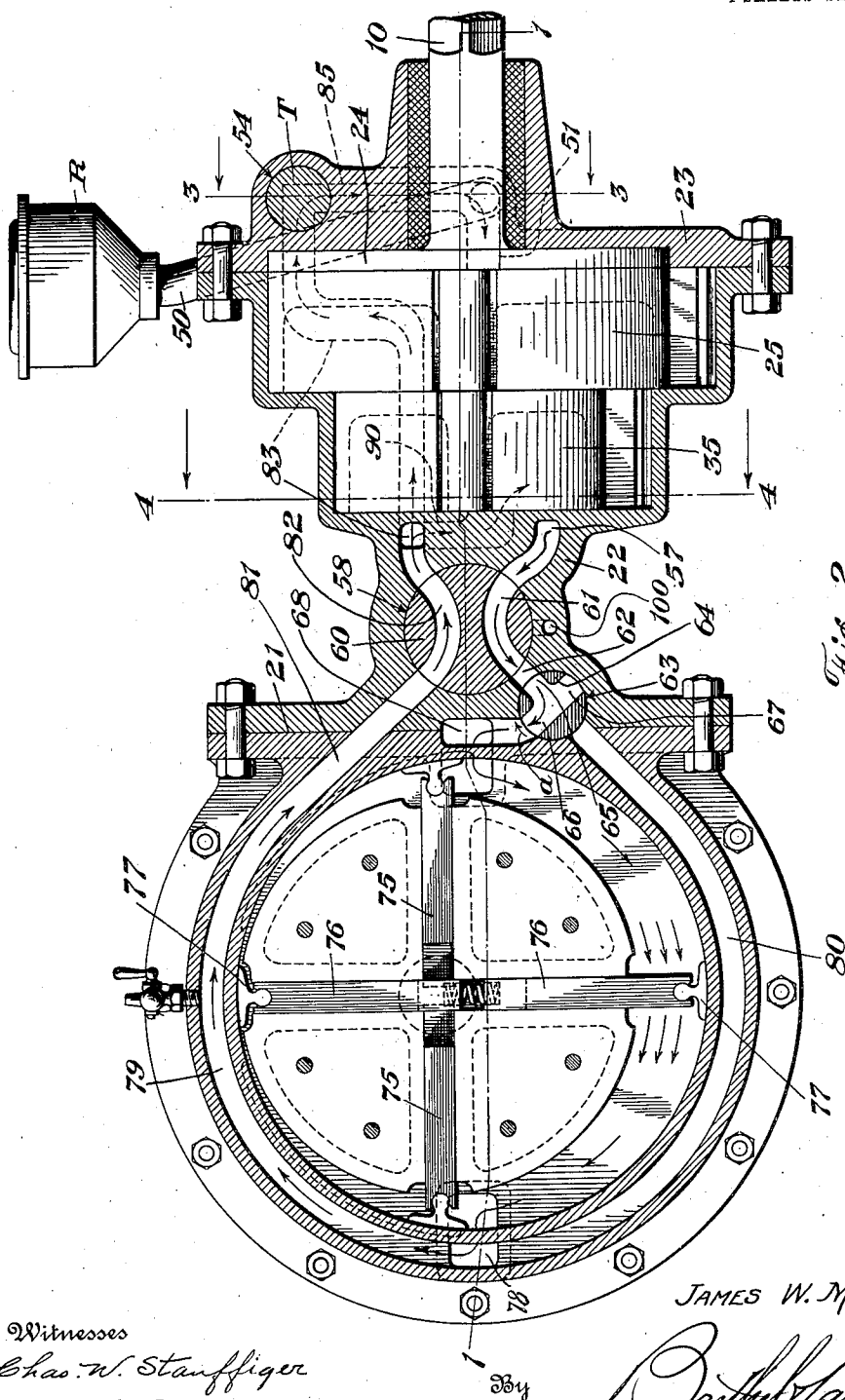


Fig. 2.

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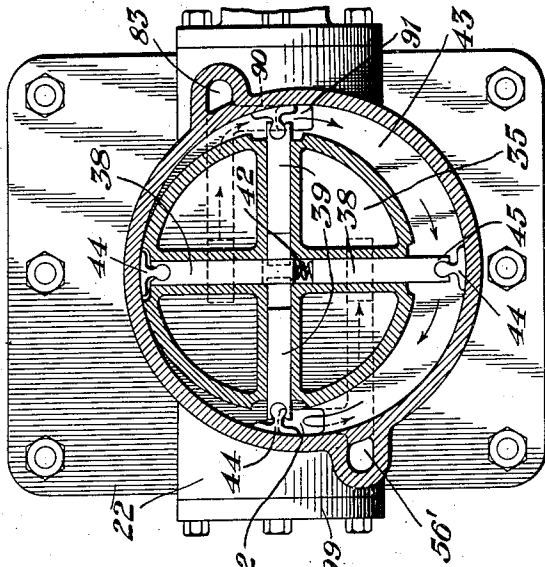


Fig. 4.

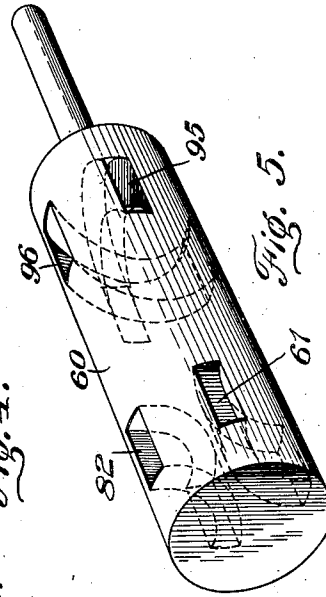


Fig. 5.

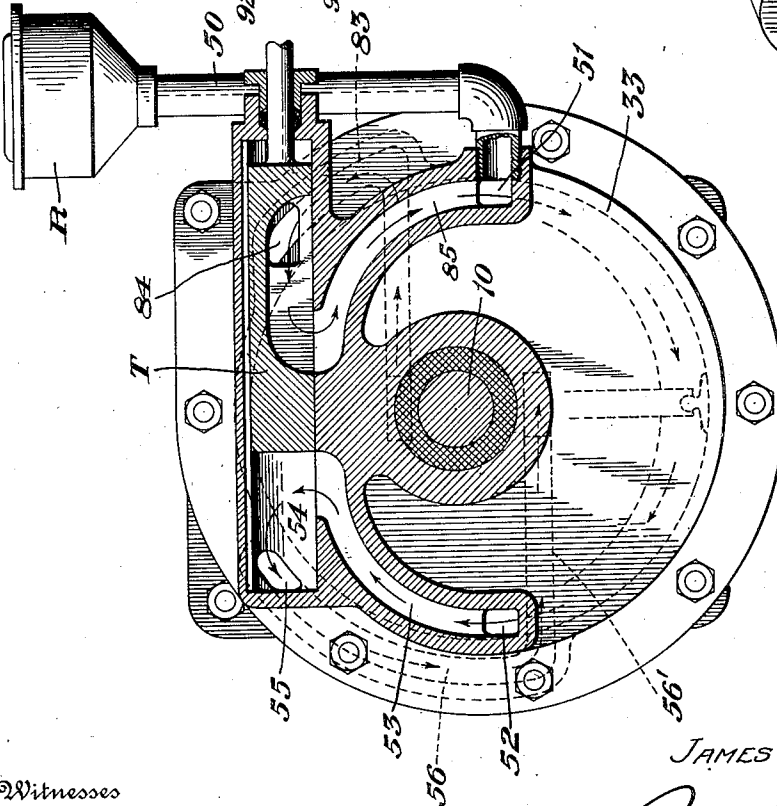


Fig. 3.

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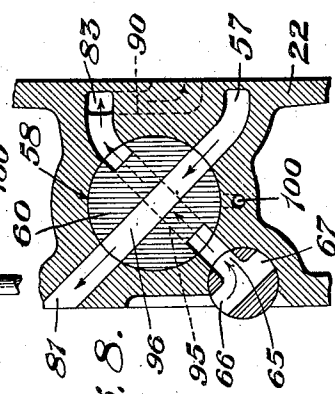
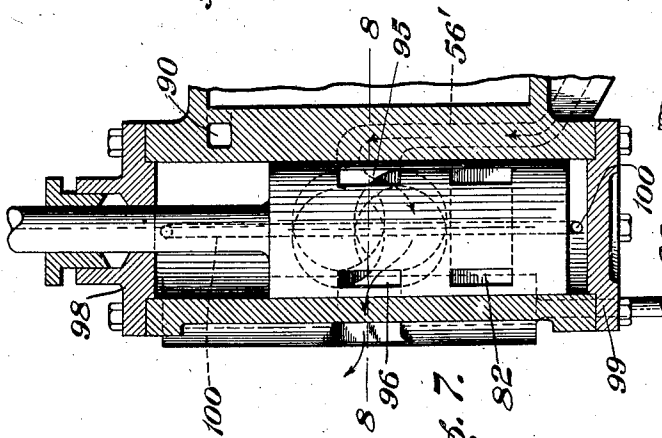
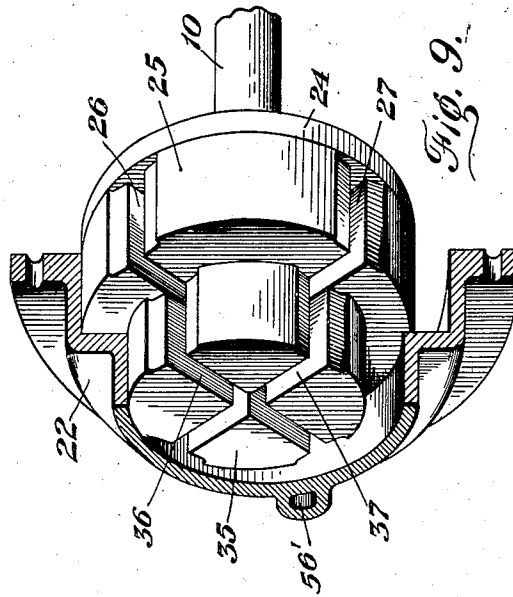
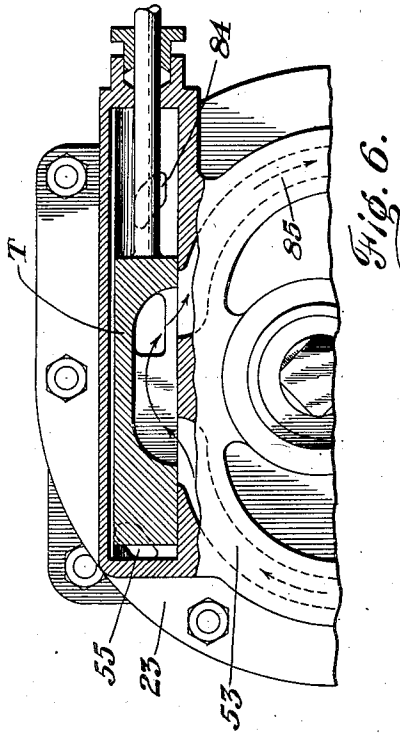
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4 SHEETS-SHEET 4.



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DRIVING MECHANISM.

1,126,812.

Specification of Letters Patent.

Patented Feb. 2, 1915.

Application filed December 13, 1910. Serial No. 597,082.

To all whom it may concern:

Be it known that I, JAMES W. McQUEEN, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Driving Mechanism, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to driving mechanism, and especially to that class thereof which is especially adapted for use in connection with motor vehicles, and it has for one of its objects the provision of a mechanism in which the power transmission is effected by the movement of a fluid supplied under pressure.

The invention has furthermore for its object the provision of means whereby such mechanism may be variable in its efficiency, so that, therefore, the mechanism is adapted to replace the "variable-speed gears" of automobiles; while at the same time the usual differential-gear may be entirely dispensed with.

A further object of the invention resides in the provision of means whereby the fluid-propelling mechanism may be allowed to run free and without producing any propelling effect on the fluid, these means being also adapted to bring one or more fluid-propellers into action.

Further objects of the invention will be found in the organization and construction of the correlated parts as will be hereinafter described and defined in the claims.

The invention has been clearly illustrated in the accompanying drawings, in which similar characters denote similar parts, and in which—

Figure 1 is a central longitudinal section of a driving mechanism constituting an element of a motor vehicle, and embodying my invention; Fig. 2 represents a central vertical section on line 2—2 of Fig. 1; Fig. 3 shows a vertical cross section on line 3—3 of Fig. 2; Fig. 4 is a similar section on line 4—4 of Fig. 2; Fig. 5 is a perspective view of the "reverse-valve" *per se*. Fig. 6 represents a section corresponding to Fig. 3, the control-valves being shown in another position; Fig. 7 represents, in horizontal section similar to that shown in Fig. 1, the "reverse-valve" in its reverse position; Fig. 8 is a vertical section thereof on line 8—8 of Fig. 7; and Fig. 9 is a perspective view of the

multiple-piston head and its relation to the chamber in which it is mounted for movement.

Briefly stated, the present invention is especially applicable to motor-vehicles, and is directly connected with the pair of shafts ordinarily coupled by the differential or compensating gear, and replaces the latter together with its connection with the engine or other power driven shaft of the vehicle, as well as the usual speed gear. In the present instance, the power-shaft actuates two fluid-propelling devices similar to rotary pumps, having different capacities and forcing fluid under pressure into a casing within which a pair of rotatable pistons are mounted and connected with the pair of shaft-sections operating the driving wheels, respectively, both pistons receiving the same pressure from the pumps. A valve is provided for bringing either the small-capacity pump into cooperation with the pistons, or the larger capacity pump may be added thereto, so that consequently either a small quantity of fluid will be acted upon, or a large quantity will be sent against the pistons while the speed of the power shaft may remain constant. Hence the wheel shafts may be actuated under an increased or decreased power-leverage, as will be readily understood. Means are also provided for diverting the flow of the fluid to reverse the movement of the pistons and consequently of the wheels. Furthermore the inlet to the piston-casing may be shut off, in which case continued movement of the wheels will cause the back pressure of the contained liquid to act, in a measure, as a brake. Means are also provided whereby the fluid in one of the pump casings is caused to circulate in without passing into the conduits leading therefrom, in which instance the pump-pistons travel with the engine shaft, without however doing any work as far as driving is concerned. In fact, my improved device, in the form herein shown, constitutes a combination differential reversible two-speed power transmission for connecting the power shaft with the vehicle wheels or their driving shafts.

Referring now to Fig. 1 of the drawings, the numeral 10 denotes the engine or other power shaft, and 11, 12 are the "differential" shafts connected with the driving wheels, respectively, of the vehicle. These shafts are secured with their adjacent ends in hubs 13', 14' of plates 13, 14, said hubs

being journaled in roller-bearings 15, 16, supported in the outwardly extending portions 17', 18' of a casing composed of a pair of sections 17, 18, having abutting flanges secured together in any desired manner. This casing serves also to connect the adjacent ends of the stationary tubular axle-sections 19, 20, of the vehicle, and it has a ported face 21 in contact with the end of a housing 22 containing the reverse-valve and also the fluid-propellers, and closed by a front-cover 23 in which the motor-shaft 10 is journaled.

The shaft 10 has as its end a flange 24 which carries a double piston-supporting member composed of a series of heads of different diameters, the larger head consisting of four sections 25 (see Fig. 9) which are firmly secured to said flange, and are spaced to form a pair of diametrical grooves 26, 27 disposed at right angles to each other. Mounted for sliding movement in these grooves are pairs of blade-pistons 28, 29, respectively, which are notched out near their crossing point as at 30, to clear each other, springs 31, 32, being interposed between inner ends of each pair of pistons to hold the outer ends in contact with the inner annular face of a cylinder or chamber 33 formed in that end of the housing 22. By referring to Fig. 2, it will be observed that the axis of the shaft 10 and head 25 is disposed eccentrically relatively to the axial center of the chamber 33. The other or smaller head of the piston-carrier consists of four sections 35 which are preferably integral with the sections 25, and are spaced to form ways or grooves 36, 37 which are continuations of the grooves 26, 27 previously referred to, and which support pairs of blade-pistons 38, 39 respectively, springs 41, 42 serving to hold the pistons in engagement with the inner face of a cylinder or chamber 43.

In order to provide a substantial surface engagement between the outer ends of the pistons and the chamber-walls, each piston carries at that point a shoe 44 pivotally held in a socket 45 to allow the shoes to accommodate themselves to the change in position as they travel around in the chambers.

In the present invention, the fluid to be pumped or propelled by the pistons, is preferably oil, it being understood that the entire driving mechanism is flooded, and every chamber and crevice filled thereby, a reservoir R being connected by a pipe 50 with an inlet opening 51 (see Fig. 3) which opens directly into the chamber 33 and into the space which gradually increases downwardly between the piston carrier and the chamber. As the carrier is rotated by the engine, the oil is carried by the pistons and forced out of the casing through an outlet-opening 52 also in the front cover, and thence up-

wardly through a channel 53, into a chamber 54 extending laterally across the front face of the cover for purposes to be hereinafter described. The oil then passes out the chamber 54 through an aperture 55 into a channel 56 (see also Fig. 1), which follows downwardly the outline of casing 22 and then rearwardly and horizontally, as at 56', and finally terminating in a port 57 (see Fig. 2) of a chamber 58 in which the reverse-valve is mounted for reciprocation. This valve consists of a plug 60, and is shown in Figs. 1 and 2 in its normal or "regular run" position, in which the conduit 61 registers with the port 57 to conduct the oil through a passage 62 in the housing 22, into a chamber 63 which contains a regulator valve 64 pierced to form three connected conduits 65, 66, 67.

As illustrated, the oil passes through the conduits 65, 66 into a channel 68 which extends horizontally across the annular sides or walls 69, 70 (see Fig. 1) of circular chambers 71, 72 formed in the casing sections 17, 18 above described, this channel 68 constituting the "inlet" for both chambers, and disposed so as to open thereinto through end-openings 68' into the clear spaces between the inner faces of the chambers and the outer faces of piston-carrying heads 73, 74 secured to the plates 13, 14, respectively, above referred to.

The construction of the heads is substantially alike in both instances, and their organization in the casing is substantially as shown in Fig. 2, in which it will be noticed that the rotation-axis of these heads is eccentrically disposed relative to the center of the chamber-axis. Each head supports blade-pistons in pairs 75, 76 which are movable at right angles to each other and carry at their outer ends shoes 77 similar to those above mentioned. Oil passing into the chambers 71, 72 under pressure will therefore rotate the heads 73, 74 under the same force, the incoming oil being distributed into both chambers in exactly the same principle which underlies the "differential gear" ordinarily employed in motor-vehicles in general.

Disposed at points diametrically-opposite to the inlets 68' and below the piston-pair 75 of Fig. 2, are the outlet-openings 78' of a channel 78 extending not only across both of the outer-walls of the casing-section 69, 70, but following the same circumferentially (see Fig. 2) and forming upper and lower branches 79, 80, respectively. At present the oil returns, after it has done its work in actuating the "driven" members 73, 74, to the place whence it came, through the branch 79, thence a passage 81 in the housing, another conduit 82 in the reverse-valve 60, into a channel 83 which extends horizontally and then upwardly to communicate

with a port 84 (see Fig. 3) in the valve chamber 54 previously referred to.

Mounted for longitudinal reciprocation in the chamber 54, is what may be termed the "by-pass-valve" of the device. As shown in Fig. 3, it is of the D type, and in its present position establishes communication between the port 84 and a channel 85, at the lower end of which the "original inlet" 51 above described, enters thereinto. It will therefore be seen that the flow-circuit of the oil is complete, and that the rotary movement of the engine-shaft 10 will be transferred by the oil to both wheel-shafts 11, 12. This transmission is, however, effected not only through the operation of the larger piston-carrier 25, but also simultaneously through the actuation of the smaller carrier 35, so that at present the oil is pumped into the axle-chambers by both of the carriers, as follows:—The return-channel 83 has a drop-branch 90 which opens at 91 into the lower portion of the smaller chamber 43. The power actuated rotation of the head 35 will move the oil in the chamber toward the discharge port 92 which communicates with the pressure-channel 56' above described, so that consequently the piston head 35 contributes its quota of oil under pressure, the quantity thereof, of course, being smaller than that of the larger head 25, while the total quantity pumped by both of the piston-heads will naturally result in actuating the driven members at high speed. Now, in order to adapt the present mechanism to purposes similar to those of a change-speed gear of a motor-vehicle, means are provided whereby the larger piston-head may be thrown out of active function, so that then the entire power of the engine may be utilized to run the smaller head 35 only. These means are herein incorporated in the "by-pass-valve" T, which may be shifted, from the position shown in Fig. 3, to that shown in Fig. 6 so as to shut-off the port 84, and connect the channel 53 directly with the intake-channel 85, and thus the oil in the chamber 33 will be moved without performing any work. At the same time the port 55 is also shut off.

Means are provided, whereby the flow of pressure-oil may not only be diverted from entering the chamber of the driven members, to interrupt the power applied thereto, but whereby the rotative movement of the driven members will be more or less impeded or checked by the back pressure due to the rotation of the driven members in the liquid under momentum. The regulator valve 64 answers for this purpose, because, if the valve as shown in Fig. 2 should be turned for about 90 degrees in the direction of arrow *a*, the oil passing through the passage 62 would have a straight road

through the valve ports 66, 67 in the order named, and directly into the idle branch 80 of the "return circuit." Furthermore the channel 68 would be closed, so that the pistons in the chambers 71, 72 would merely move the liquid already contained therein.

The valve 60, above referred to, has been designated as a "reverse" valve, and it is intended for the purpose of reversing the movement of the "driven" members by sending the flow of oil from the pressure-channel 56' into the upper "return" branch 79 while at the same time the lower return-branch is thrown into communication with the regulator return conduit 83. To this end, the valve plug 60 is provided with a pair of non-intersecting cross-passages 95, 96 (see Figs. 1 and 5) so that a longitudinal sliding movement of the plug will suffice to change the flow of oil as indicated in Figs. 7 and 8, as for instance by means of a hand-lever 97. Both ends of the reverse valve chamber being closed by covers 98, 99, a by-pass channel 100 is provided whereby both ends exteriorly of the valve-ends are connected to ease the shifting movement of the plug.

The construction and organization of the mechanism illustrated in the drawings can naturally be varied in many different ways to produce the same results, and for that reason I do not wish to limit myself to the particular form shown and described, especially as to the number of pistons, and to the several valves, which have been shown in a "spread-out" condition for the purpose of facilitating the understanding of their functions, but which may be more or less consolidated as occasion may render desirable.

I claim:

1. In a driving mechanism, the combination of a casing having a pair of axially aligned pump chambers of different capacities, and a pair of circular axially aligned motor chambers with passages leading from the outlet of the pump chambers to the inlets of the motor chambers and from the outlets of the motor chambers to the inlets of the pump chambers, a reversing valve controlling said passages adapted to reverse the flow therethrough by connecting the outlet of the pump chambers with the outlet of the motor chambers, a by-pass valve for connecting the outlet of one of the pump chambers with its inlet, a drive shaft, pumps attached to the driving shaft within the pump chambers, axially aligned driven shafts arranged transversely to the longitudinal axis of the drive shaft, motor pistons in the motor chambers secured to the inner ends of the driven shafts, a passage extending around the motor chamber, and means for diverting flow of fluid from the motor chamber into said passage.

2. In a driving mechanism, the combina-

tion of a casing formed with circular motor chambers having inlet and outlet ports and a passage formed in the casing around said chambers, said casing being also formed with a pump chamber having an inlet and an outlet port and passages leading from said ports and forming a continuation of the passage around the motor chambers, a pump member in the pump chamber, motors in the motor chambers, a driving shaft to which the pump is attached, driven shafts to which the motors are attached, and a valve controlling one of the passages in the casing and adapted to direct the fluid passing there- through either into the inlet port of the motor chambers or into the passage around said motor chambers, to permit the circulation of fluid around the motor chambers without driving the motors:

3. In a driving mechanism, the combination of a cylindrical casing formed with laterally extending tubular extensions and with a chamber and a passage around the chamber, a transverse wall dividing the chamber of the casing, driven shafts mounted within the tubular extensions of the casing in axial alinement with each other, motor members secured to the inner ends of said shafts within the chamber of the casing at opposite sides of the transverse wall, said casing being also formed with inlet ports opening into the motor chambers at each side of the wall and with outlet ports opening from said chambers into the passage around the chambers, a forward extension of the casing formed with a bearing at its forward end, pump chambers of different capacities, provided with inlet and exhaust ports, said extension being also formed with passages leading

from the ports of said pump chambers and forming a continuation of the passage around motor chambers, a reversing valve controlling both of said passages and formed with passages adapted to cross-connect the said passages, and a valve adapted to connect one of the passages with the inlet port of the motor chambers and adapted to be turned to connect said passage with the passage surrounding said chambers and cut off communication with said port.

4. Driving mechanism comprising a driving shaft, a pair of axially alined driven shafts transversely disposed to the driving shaft, a casing in which the end portions of the shafts are journaled, sets of rotary pump blades mounted on the driving shaft each playing in a pump chamber in the casing eccentric to the driving shaft, sets of motor blades mounted on the driven shafts, each playing in a motor chamber in the casing eccentric to the companion shaft, a reversing valve in the casing adapted to connect outlets from the pump chambers with either one of a pair of openings into each motor chamber and simultaneously place the pump inlets in communication with another pair of motor chamber outlets, a slide valve adapted to connect with the outlet and inlet of one pump chamber to cut out the pump, and a valve for diverting the flow from the motor chamber into the passage around said chamber.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES W. McQUEEN.

Witnesses:

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G. E. McGRANN.