No. 785,343. PATENTED MAR. 21, 1905.

H. E. WERNER.

FLUID MOTOR.

APPLICATION FILED SEPT. 12, 1904.

2 SHEETS—SHEET 1.

1084

Fig. 1

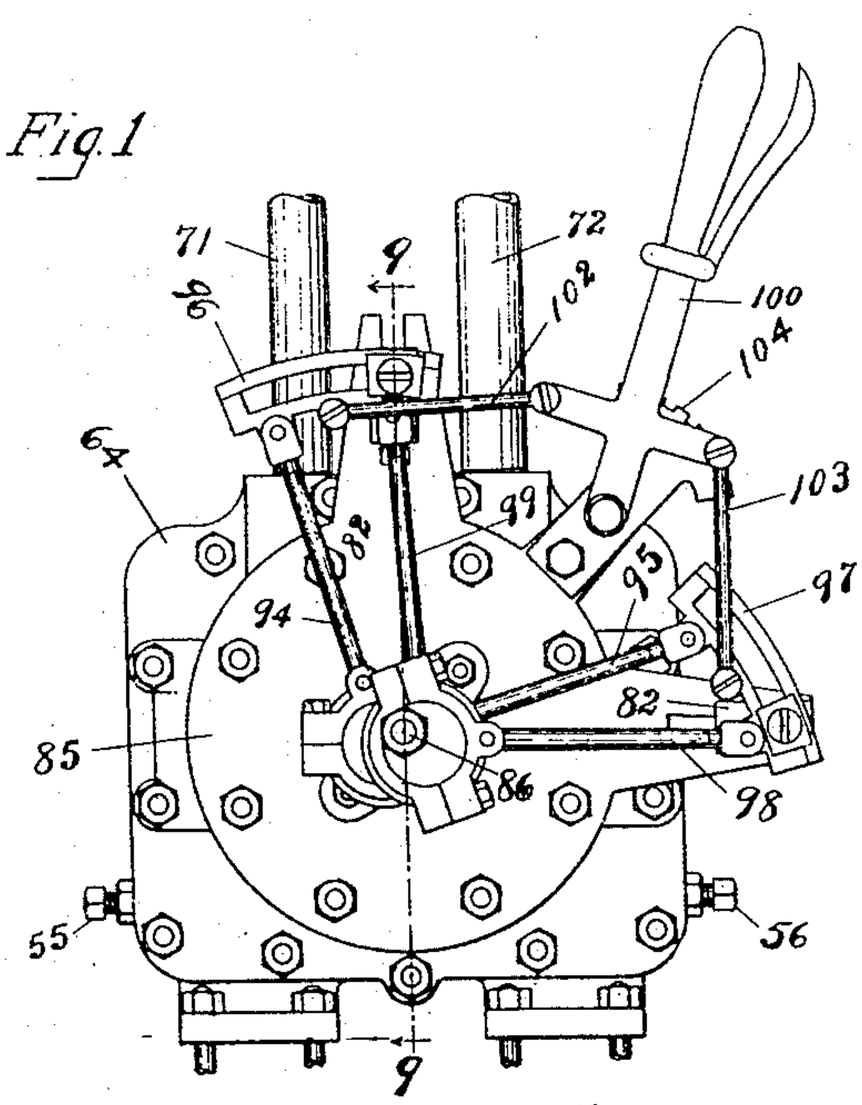


Fig. 2

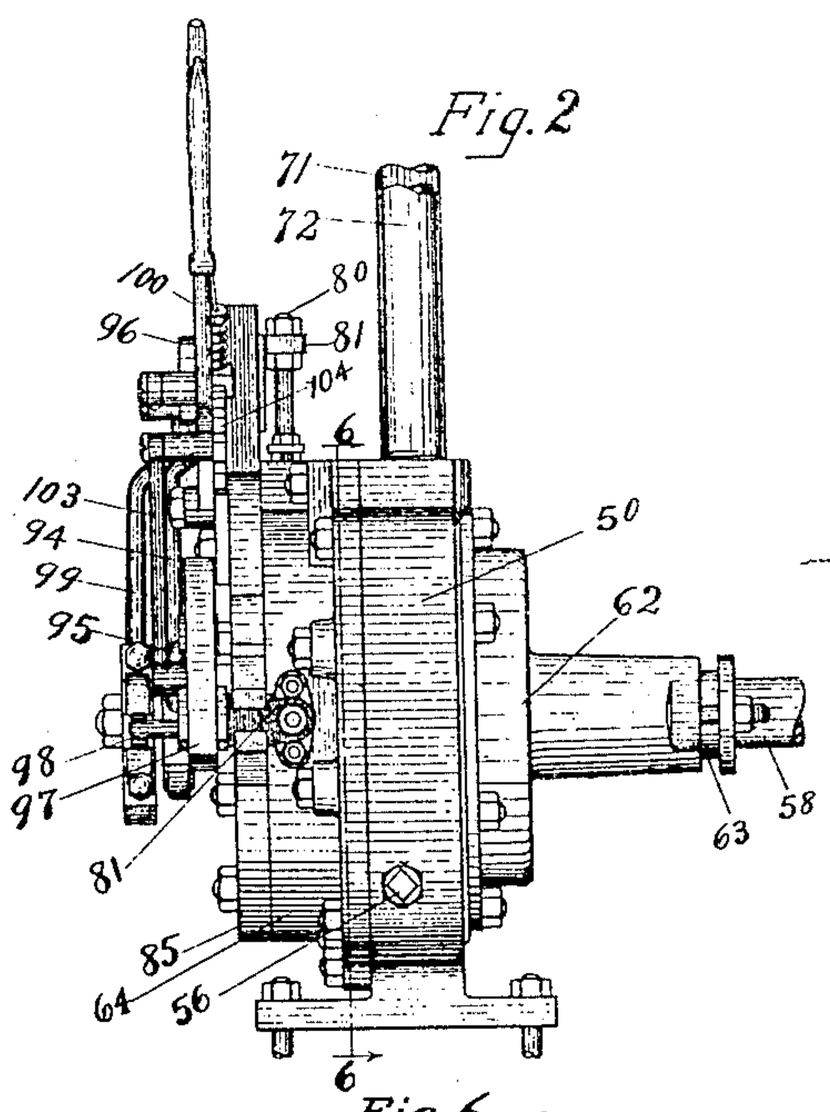


Fig. 4

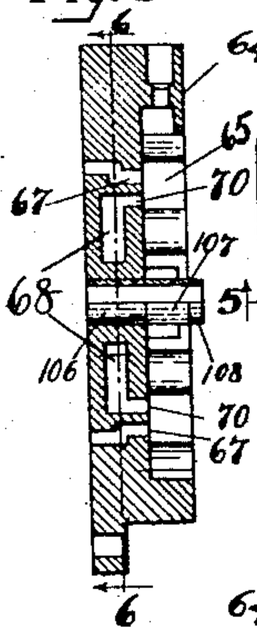


Fig. 3

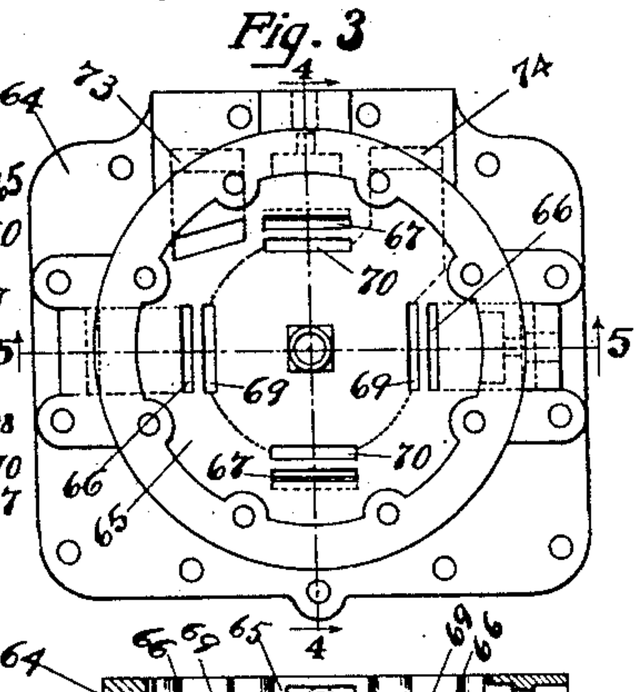


Fig. 6

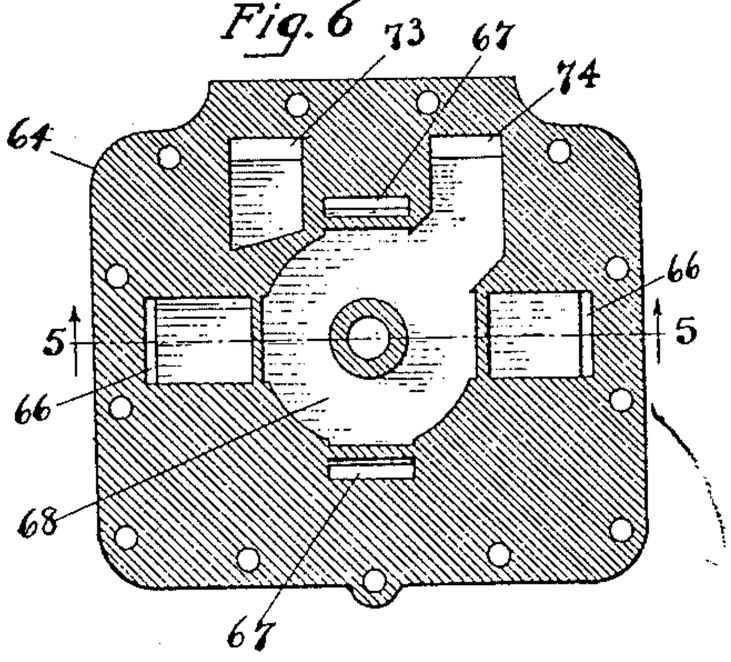


Fig. 5

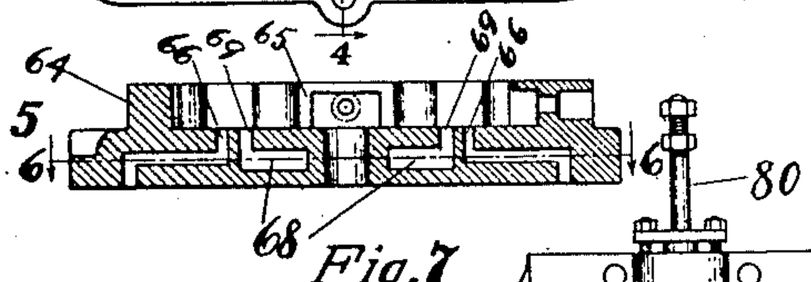


Fig. 8

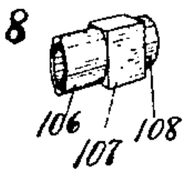
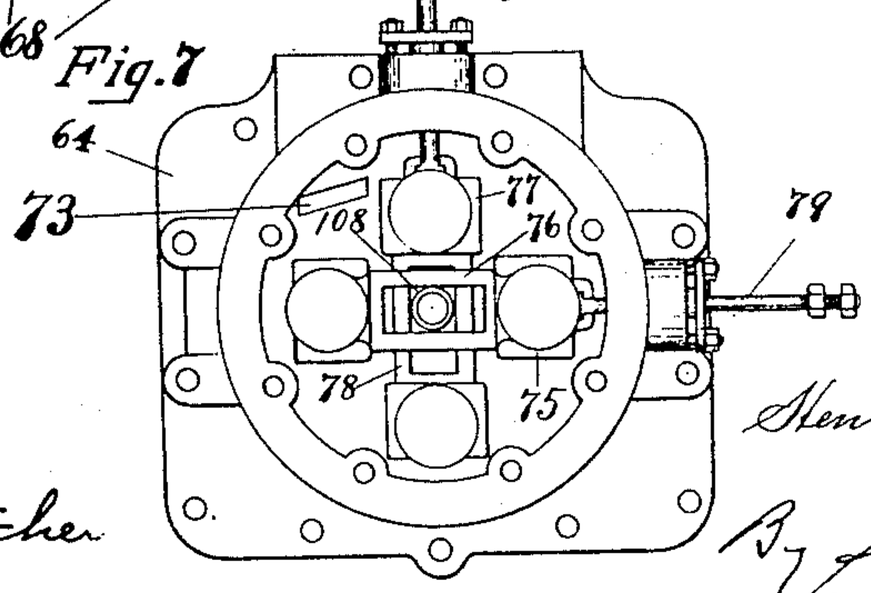


Fig. 7



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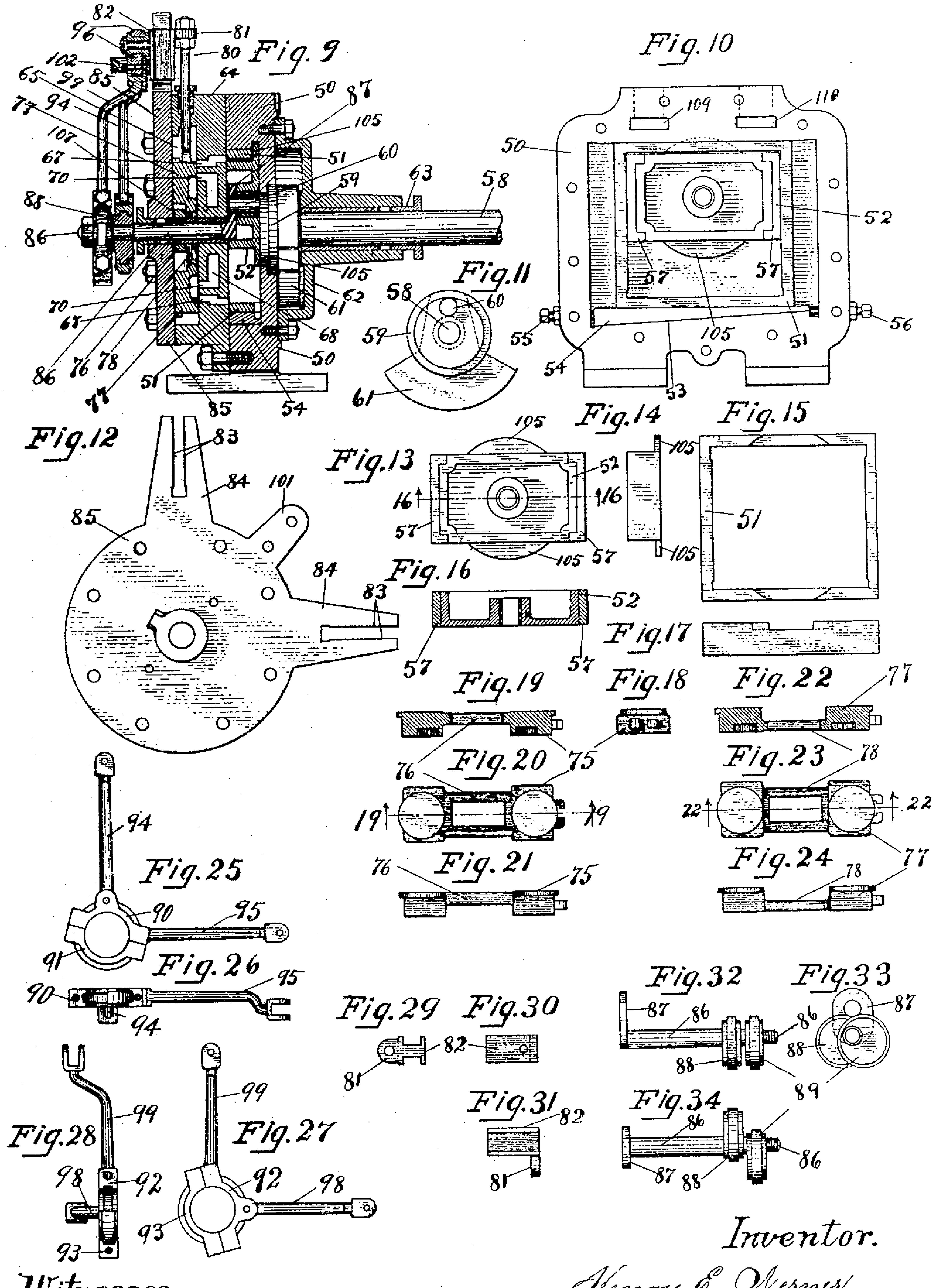
2 SHEETS—SHEET 2.



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No. 785,343. Patented March 21, 1905.

UNITED STATES PATENT OFFICE.

HENRY E. WERNER, OF GRAND HAVEN, MICHIGAN.

FLUID-MOTOR.

SPECIFICATION forming part of Letters Patent No. 785,343, dated March 21, 1905.

Application filed September 12, 1904. Serial No. 224,219.

To all whom it may concern:

Be it known that I, HENRY E. WERNER, a citizen of the United States, and a resident of Grand Haven, county of Ottawa, and State of Michigan, have invented certain new and useful Improvements in Fluid-Motors, of which the following is a specification and which are illustrated in the accompanying drawings, forming a part thereof.

This invention relates to what is known as the "square-piston" type of fluid-motors, there being two pistons, one within the other, the inner one being driven on lines perpendicular to the line of movement of the outer one, the crank being located within the power-chamber and its wrist-pin being journaled in the inner piston.

The object of the invention is to provide an improved valve-gear for motors of this type whereby they may be more economically operated, easily and completely controlled, and reversed. This object is attained by means of a pair of valves actuated by eccentrics and controlled by shiftable links, all as hereinafter described and as illustrated in the accompanying drawings, which show a motor or engine especially adapted for the use of steam, and in which—

Figure 1 shows a front elevation. Fig. 2 is a side elevation. Fig. 3 is an elevation of the steam-chest with its cover and the valve mechanism removed. Fig. 4 is a section on the line 4 4 of Fig. 3. Fig. 5 is a section on the line 5 5 of Figs. 3 and 6. Fig. 6 is a section taken on the line 6 6 of Figs. 4 and 5. Fig. 7 is a similar view to Fig. 3 with the valves in place. Fig. 8 is a perspective of one of the bearings. Fig. 9 is a central longitudinal section of the engine on the line 9 9 of Fig. 1. Fig. 10 is an elevation of the cylinder and pistons, the steam-chest cover being removed. Fig. 11 is a detail of the engine-crank and counterbalance. Fig. 12 is a detail elevation of the cover of the steam-chest. Figs. 13 and 14 are details of the inner piston. Fig. 15 is an elevation of the outer piston. Fig. 16 is a section on the line 16 16 of Fig. 13. Fig. 17 is a detail of the outer piston. Figs. 18, 19, 20, and 21 are details of one of the valves. Figs. 22, 23, and 24 are details of the other valve. Figs. 25 and 26 are details of one set of eccentric-straps. Figs. 27 and 28 are details of the other set of eccentric-straps. Figs. 29, 30, and 31 are details of the valve-rod cross-heads. Figs. 32, 33, and 34 are details of the eccentrics.

The "cylinder" or power-chest is shown at 50 and comprises a flat and substantially rectangular casting chambered in one of its flat faces to receive the pistons 51 52. The piston 51 is in the form of an oblong rectangular frame and has a sliding bearing within the power-chamber at its top and bottom and reciprocates longitudinally within this chamber.

In order to secure a proper fit for the bearing-surfaces of the piston, one wall of the power-chamber is oblique to the direction of movement of this piston, as shown at 53, and a wear-plate 54, having one similarly oblique face, is interposed between such oblique wall and the piston. This wear-plate is of less length than the power-chamber, so that it may be adjusted longitudinally in order to bring it in contact with the piston-face, and this adjustment is accomplished by means of a pair of set-screws 55 56, setting in through the walls of the power-chest and engaging the ends of the wear-plate.

The piston 52 is oblong rectangular in form and is located within the piston 51, and has a bearing at its ends against the inner walls thereof. The length of the inner piston—that is to say, its dimension in the line of its movement—is less than the width of the outer piston, so as to provide space for the piston-stroke. Wear-plates 57 are applied one to each side of the piston 52 and may be secured thereto by means of instanding lugs engaging suitable recesses within the side walls of the piston, as shown.

The drive-shaft of the engine is shown at 58 and enters the power-chest through its rear wall, which is apertured to receive a crank-disk 59, Figs. 9 and 11, fixed upon the shaft. The wrist-pin 60, projecting from this crank-disk, is journaled centrally in the piston 52, so that the combined action of the two pistons causes the rotation of the shaft. A counterweight 61 is preferably applied to the shaft 58 immediately back of and, as

shown, integral with the crank-disk 59, its function being to balance the wrist-pin and the vertically-movable piston 52. This counterweight is inclosed by means of a cap 62, bolted to the chest 50, and provided with a stuffing-box 63 for packing the shaft 58.

As thus far described the engine presents no novel features.

The steam-chest comprises a suitably-chambered plate 64, bolted to the front of the power-chest 50 and forming the outer wall of the power-chamber. This plate is recessed, as shown at 65, from its outer face to provide a steam-chest and to accommodate the valves, Figs. 3, 4, and 5.

Two pairs of ports 66 66 and 67 67 lead from the chamber 65 to the power-chamber, the former pair leading to opposite sides of the piston 51 and the latter to opposite sides of the piston 52. The plate 64 is provided with an exhaust-cavity 68 and with two sets of ports 69 69 and 70 70, located, respectively, in line with the ports 66 and 67 and connecting the chambers 65 and 68.

The steam-pipe is shown at 71 and the exhaust-pipe at 72. Both of these pipes enter the engine through the walls of the power-chest 50 through the ports 109 110, communicating, respectively, with the ports 73 74 in the walls of the steam-chest, the one leading to the chamber 65 and the other from the chamber 68. This disposition of the parts permits the removal of the plate 64 without detaching the steam and exhaust pipes.

The ports 67 and 70 are controlled by a double **D**-valve 75, its two ends being united by a longitudinally-slotted shank 76, and the ports 66 and 69 are controlled by a similar valve 77, having a longitudinally-slotted connecting-shank 78. The shanks 76 and 78 are suitably offset from the body portions of the valves of which they form a part, so that they may cross within the steam-chest and allow for the independent reciprocation of each of the valves.

The valves 75 and 77 are provided with stems 79 80, each being shown, Figs. 7 and 18 to 24, as attached to its valve by means of a **T**-head engaging a suitable lug and as passing through the walls of the plate 64, suitable stuffing-boxes being provided for properly packing them to prevent the escape of steam. At its outer end each of these valve-stems is attached to an apertured lug 81 of a cross-head 82, running in guideways 83, formed in bracket-arms 84, projecting radially from the cap 85 of the steam-chest.

The valves are actuated by means of a pair of eccentrics fixed upon an extension of the shaft 58, projecting through the steam-chest and its cap 85. This extension is in the form of a short shaft-section 86, having at its inner end, which projects into the power-chamber, a crank 87, apertured to fit upon the end of the wrist-pin 60, which projects beyond the inner face of the piston 52. The shaft-section 86 is preferably journaled in a bushing set in the center opening of the plates 64 and 85, its inner end 106 having a driven fit within the plate 64 and its outer end 108 fitting snugly in the plate 85. The middle section 107 of this bushing is squared and serves as a bearing and guide for the valves 76 77. The eccentrics 88 89, fixed upon the outer end of the shaft 86, are so set as to time the valves with which they coöperate properly with reference to the movements of the pistons.

Each eccentric carries two straps, those mounted upon the eccentric 88 being designated, respectively, 90 and 91, and those mounted upon the eccentric 89 being designated, respectively, 92 and 93, one of each pair of straps being superposed upon the other. An eccentric-rod leads from each strap to a valve-controlling link, to which it is pivotally united.

The eccentric-rods 94 95, leading from the straps 90 and 91, are attached to corresponding ends of the links 96 97, coöperating, respectively, with the valves 75 and 77, and the rods 98 99, leading from the straps 92 93, are attached to said links at their opposite ends relatively to the points of attachment of the rods 94 95. The links 96 97 are segmental in form and are in sliding engagement one with each of the cross-heads 82.

A hand-lever 100, pivoted to a bracket 101, projecting radially from the steam-chest cap 85 intermediate of the bracket-arms 84, is connected, by means of links 102 103, with the links 96 and 97, respectively. The hand-lever 100 swings over a notched quadrant 104, fixed to the bracket 101, and is provided with the usual hand-latch mechanism for securing it in an adjusted position.

The shifting of the links 96 97 by means of the lever 100 changes the positions of the valves 75 77 relatively as to the pistons 51 and 52, thereby providing for stopping and starting the engine for a variable cut-off of the steam and for reversing the engine.

I prefer to provide the faces of the piston 52 with an extension or lap, as shown at 105, so as to entirely cover the crank-disk 59 while full steam-pressure is applied to this piston, thus cutting off the steam from the chamber of the cap 62, and thereby avoiding necessity for packing the stuffing-box 63 to the extent that would otherwise be required.

I claim as my invention—

1. In a fluid-motor of the type described, in combination, a pair of pistons movable in relatively perpendicular paths, a slide-valve coöperating with each piston, a shiftable link for actuating each valve, a pair of eccentrics, and a pair of eccentric-rods connecting each eccentric with both links.

2. In a fluid-motor, in combination, a power-chamber, a reciprocative piston in

the chamber, a second reciprocative piston carried by the first-mentioned piston and the two pistons movable in transverse paths, a crank-shaft having its wrist-pin journaled in the second-named piston, a steam-chest ported to the power-chamber, a pair of valves within the chest one for controlling the ports serving each piston, an oscillatable and longitudinally-shiftable link for actuating each valve, a pair of eccentrics, and rods connecting each eccentric with both of the links.

3. In a fluid-motor of the type described, in combination, a power-chest, a pair of pistons movable in transverse paths within the power-chest; a valve-chest adjacent the power-chest; a pair of valves within the valve-chest one for controlling each piston; a power-shaft actuated by the pistons; a supplemental shaft actuated by the pistons and extending through the valve-chest; eccentrics on the supplemental shaft; and connection between the eccentrics and the valves.

4. In a fluid-motor, in combination, a power-chest; a pair of pistons within the power-chest and movable in transverse paths; a crank-shaft having its wrist-pin in engagement with one of the pistons; a valve-chest adjacent the power-chest; a pair of valves within the valve-chest, one for controlling each piston; a supplemental crank-shaft extending through the valve-chest and being in alinement with the first-named shaft and having its crank connected with the wrist-pin thereof; eccentrics on the supplemental shaft; and connection between the eccentrics and the valves.

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Witnesses:
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