No. 681,422. Patented Aug. 27, 1901.

M. J. MILMOE & W. S. PORTER.

FLUID CLUTCH.

(Application filed Oct. 10, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 2

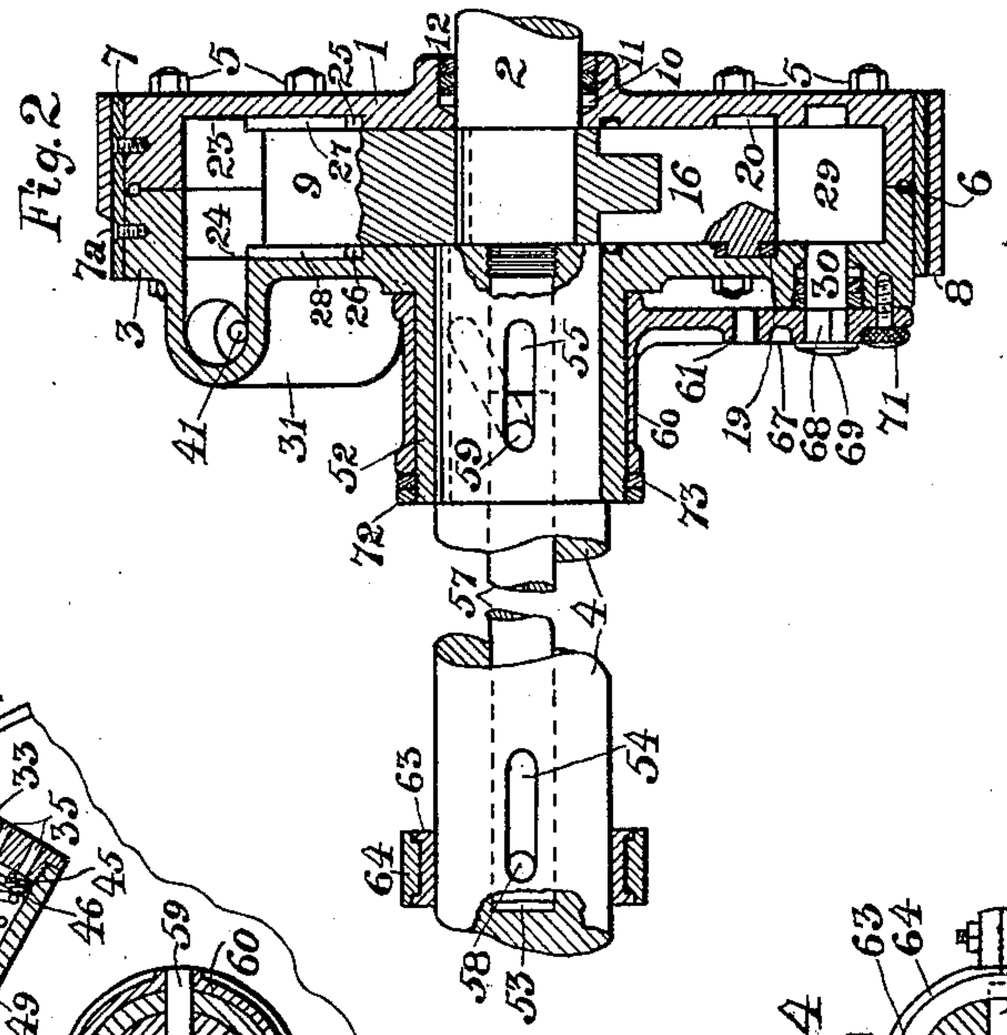

Fig. 3

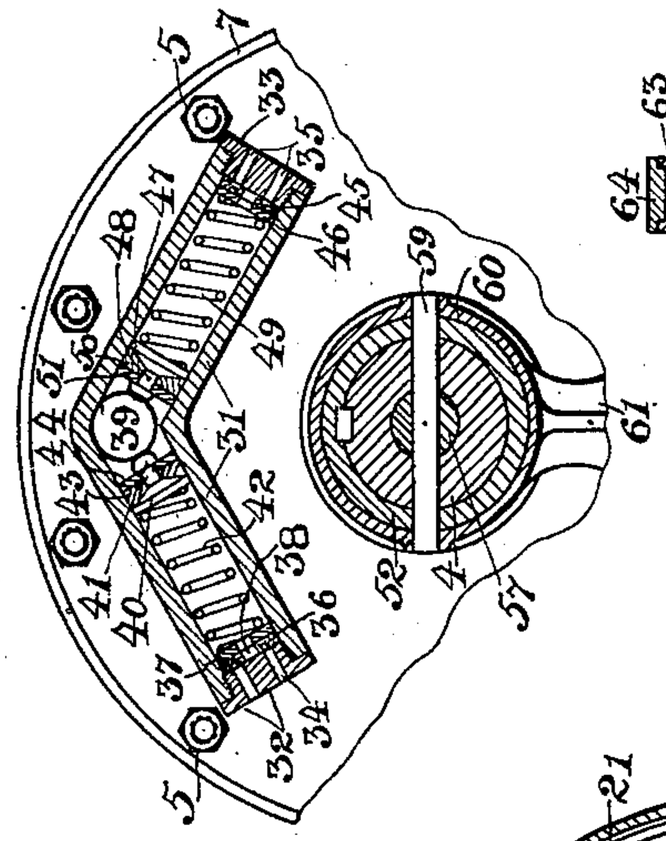

Fig. 4

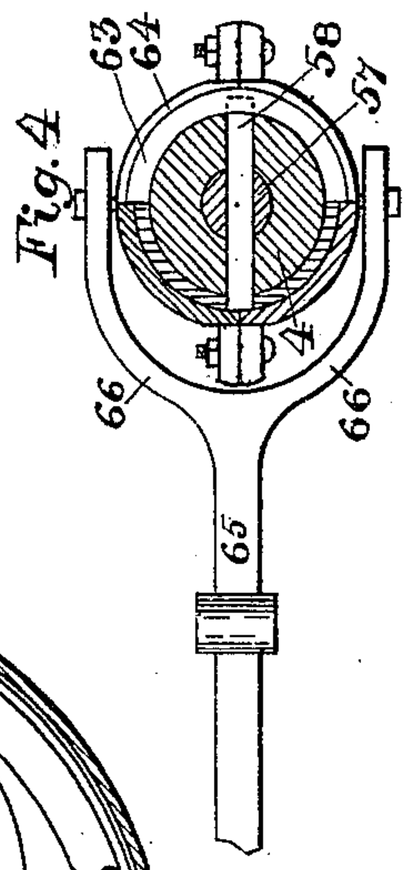

Fig. 1

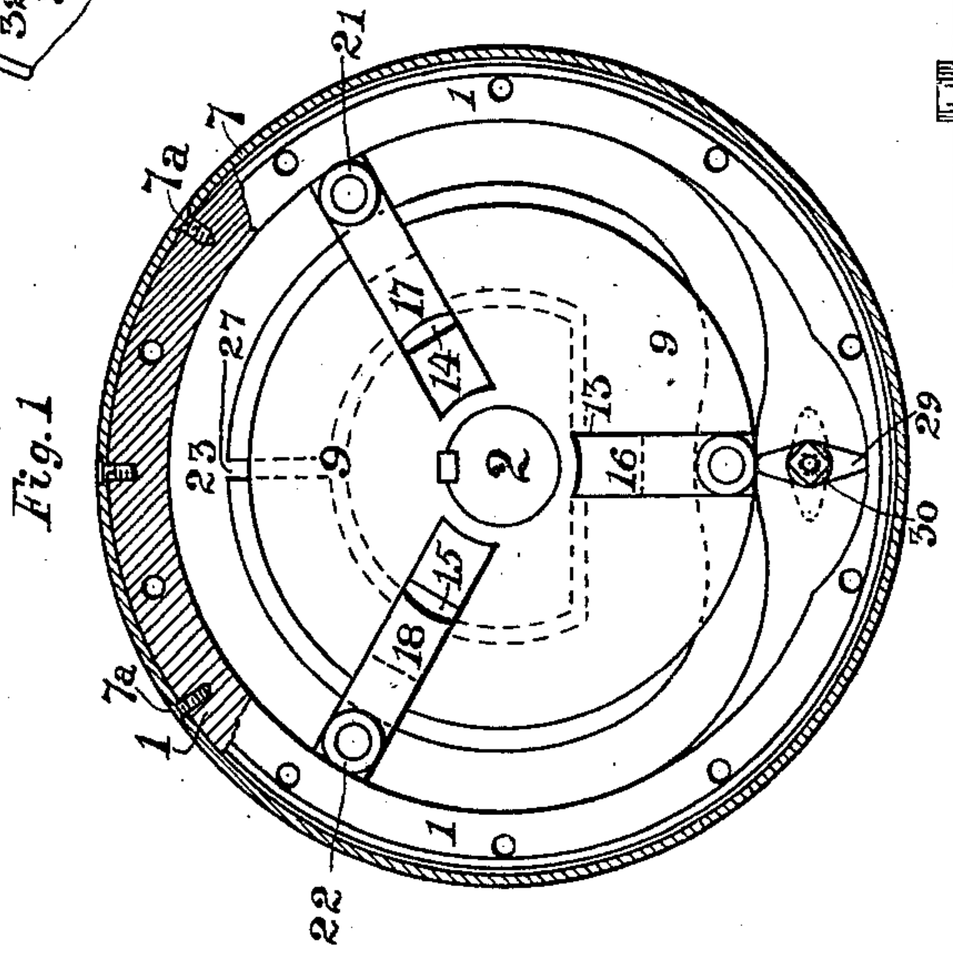

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Fig. 6

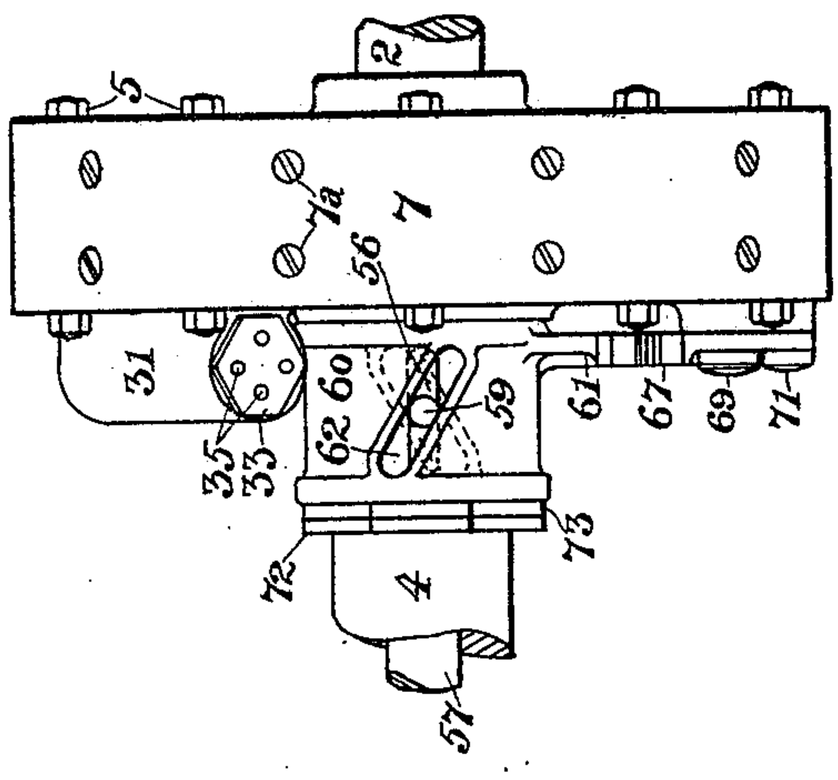
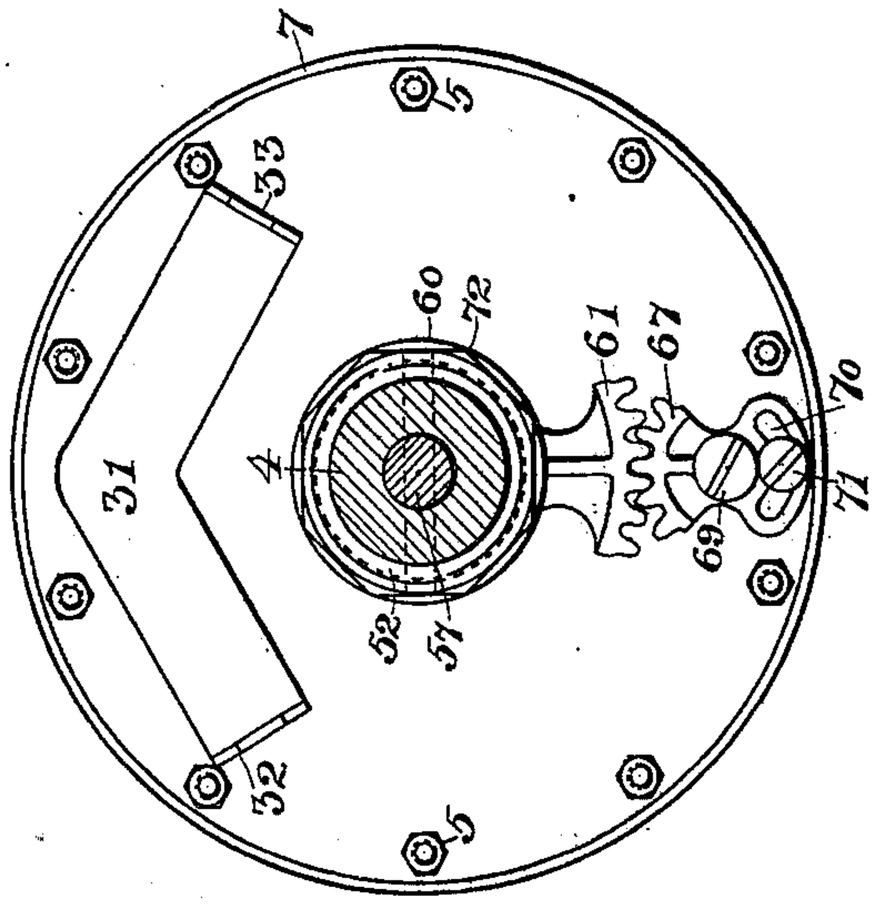


Fig. 5



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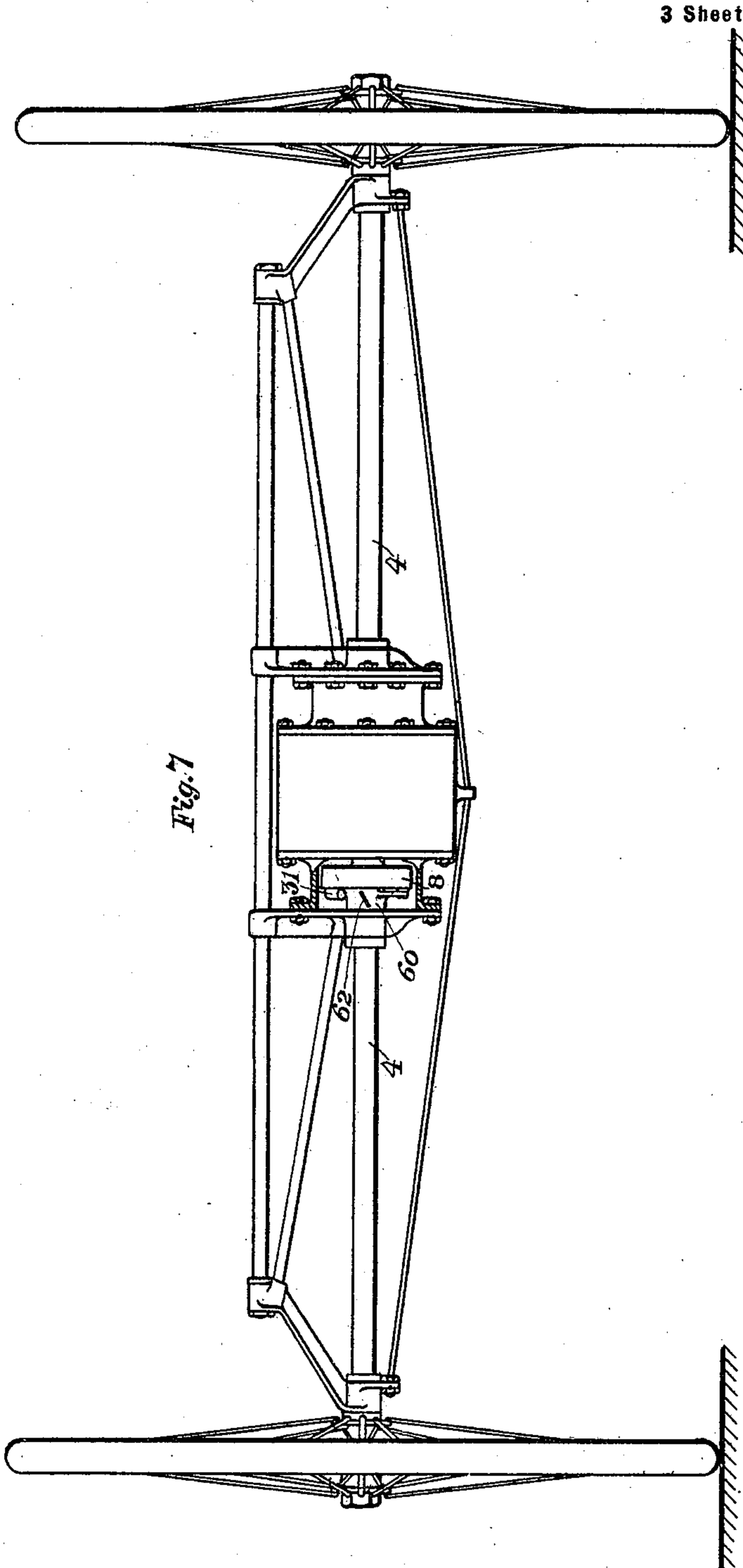

Fig. 7.

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UNITED STATES PATENT OFFICE.

MICHAEL J. MILMOE AND WILLIAM SHERWOOD PORTER, OF CHICAGO, ILLINOIS.

FLUID-CLUTCH.

SPECIFICATION forming part of Letters Patent No. 681,422, dated August 27, 1901.

Application filed October 10, 1900. Serial No. 32,608. (No model.)

To all whom it may concern:

Be it known that we, MICHAEL J. MILMOE and WILLIAM SHERWOOD PORTER, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fluid-Clutches; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

Our invention relates to fluid-clutches, more particularly to that class of devices designed for interposition between a driving and a driven shaft and for transmitting the power of the former variably to the latter by means of alterable fluid-pressure. In these devices there is usually a revoluble body fixed to the power-shaft and having radially-reciprocating vanes which sweep the interior of an outer casing attached to the driven shaft. Between the revoluble body and the casing a practically annular space is formed and contains any chosen fluid. Under normal conditions the fluid is forced to follow the annular space by the revolving vanes and no torque is applied to the casing or driven shaft. By the introduction of a valve in the fluid-space its free path may be either entirely or partly closed. If entirely closed, the whole power of the driving-shaft is delivered to the casing. If the valve is fully open, the path of the fluid is unopposed and no power reaches the casing. Between these two extremes the power or speed may obviously be varied.

The objects of our invention are, first, to improve and simplify the construction and arrangement of the various parts of fluid-clutches of the stated character; secondly, to prevent the pressure upon the liquid within the casing falling below atmospheric pressure, and, thirdly, to relieve any excess pressure due to overheating by the introduction of an adjacent air space or cushion.

Each constituent element of our invention is described in detail and its individual office, together with the mode of operation of the whole, fully explained hereinbelow.

Of the accompanying drawings, throughout which like numbers designate like parts, Figure 1 is a side view looking toward the driving-shaft, the half of the casing toward the driven shaft having been removed to disclose the internal mechanism. In this figure there is shown in section the external friction-band, which is in practice to be encircled by a strap-brake, and a portion of the rim of the casing is broken away to exhibit one method of securing the band upon the periphery of the casing. Fig. 2 is a cross-section. Fig. 3 is an exterior view of part of the casing attached to the driven shaft and shows in vertical section the lobe formed on the casing and the devices by means of which the air-pressure upon the fluid is governed and in cross-section a part of the elements that operate the valve. Fig. 4 is another cross-section illustrating some of the parts introduced for operating the valve. Fig. 5 is an exterior view of the side of the casing toward the driven shaft and shows the segmental gear constituting a portion of the valve-operating mechanism. Fig. 6 is a view from a point at right angles to the shafting and shows the oppositely-inclined slots in the gear-sleeve and longitudinal slot in the driven shaft and casing-hub engaging a pin projecting from the sliding or shifter rod. The final view, Fig. 7, represents the motor-axle of a vehicle and shows one manner of suspending an electric motor in combination with a pair of our fluid-clutches, one being attached to each extremity of the motor-shaft.

Our clutch may be employed to transmit power to machinery of any character, and it is immaterial what sort of motor drives it. Any fluid adapted for the purpose can be used. It is our intention primarily, however, to conform our invention to the requirements of motor-vehicles.

Considering the drawings, numeral 1 marks the side of the casing loose on the driving-shaft 2 (see Fig. 1) of any description of motor.

Numeral 3 designates the side of the casing secured upon the driven shaft 4. (See Fig. 2.) This driven shaft may lead to a machine

of any sort, or it may be the driving-axle of a carriage, as delineated in Fig. 7.

For convenience of construction it is our custom to cast the casing in two sides, as drawn, and to connect them by bolts 5, running a ring of packing 6 in twin grooves in the meeting surfaces of the sides, as shown, to render the joint fluid-tight. In practice we fit a band 7 around the outside of the completed casing and attach the band by screws 7^a, as shown in Figs. 1 and 2. This band forms a brake-wheel face constructed to be grasped by a strap-brake 8, used in certain forms of vehicles.

Further considering Figs. 1 and 2, numeral 9 marks a disk or flat cylinder keyed to driving-shaft 2, which shaft passes out through the center of side 1 of the casing. This central shaft-opening 10 in the side possesses the nature of a stuffing-box, inasmuch as it accommodates a circle of packing 11, pressed inwardly by the threaded ring 12, that engages interior threads of the opening. The stuffing-box construction is a precaution against the escape of the internal fluid. Disk 9 is provided with radial slots 13, 14, and 15, usually cut at one hundred and twenty degrees apart, and these slots are respectively guides for the vanes 16, 17, and 18. At the outer end each vane is furnished with a pair of rollers. Both rollers at the outer end of vane 16 are shown in Fig. 2 and numbered 19 and 20. But one roller each for vanes 17 and 18 are shown (see Fig. 1) and these are numbered, respectively, 21 and 22. As all the rollers are precisely alike, it is not thought to be necessary to multiply the views merely to exhibit all of them. Two cam-shaped grooves of corresponding size and position, in which the rollers travel, are formed in the inner surfaces of the sides of the casing. Cam-groove in side 1 is marked 23, and the like groove in side 2 of the casing is numbered 24. Let it be assumed here that the disk 9 revolves. It will be understood that the rollers follow the grooves 23 and 24, and each vane as the bottom of the casing is reached retreats into its slot, from which it is withdrawn as the rollers encounter the circular portions of the grooves. The side edges of the vanes fit the interval between the sides of the casing very closely in order that no fluid shall pass them. It will be noted that there is a space between the inner ends of the vanes and the bottom of the slots and that this space must alternately fill and discharge. To afford passages for the contents of these spaces out and back, we form circular duct 25 on the inner surface of side 1 of the casing and duct 26 on the corresponding surface of side 2. From duct 25 a trench 27 leads upwardly into the fluid-space between the disk and casing, and from duct 26 a like trench 28 leads to the same fluid-space. Owing to the close fit between the edges and ends of the vanes and the interior of the casing these ducts afford no escape for the fluid from the lower to the upper portion of the fluid-space, whatever pressure may be exerted upon the fluid in the lower divisions of that space. The curve given the ducts 25 and 26 is shown in broken lines in Fig. 1. They will be again referred to.

In Fig. 1 it is represented that the fluid-space between disk 9 and the casing is somewhat enlarged, and at this point is located the valve 29, turned by the stem 30, rotatively supported by the sides of the casing. In the manner common to these clutches if the valve be closed, as shown in Fig. 1, it will divide the fluid-space either by contact with the outer end of the vane, as drawn, or by contact with the periphery of the disk. It is evident that no fluid can pass the valve, and if the disk revolves the casing must be carried with it. If the valve is partly closed, only a portion of the full effect is applied to the casing.

To introduce the fluid into the casing and to regulate its pressure and the external pressure on it, we form upon the outer surface of side 2 of the casing the angularly-extending lobe 31, a longitudinal section of which appears in Fig. 3. Screw-plugs 32 and 33 stop the ends of the tubular interior of lobe 31, and through plug 32 are the apertures 34 34 and the like apertures 35 35 through plug 33. The parts contained in the two legs of the lobe are exactly alike. Resting against the inner surface of screw-plug 32 is a valve composed of a circular leather 36 and a metal washer 37. A hole 38 pierces both centrally. Attention is directed to the fact that the hole 38 does not register with either aperture of of screw-plug 32. In fact, when pressed against the plug the leather closes all those apertures. Farther inward toward the opening 39, leading from the lobe into the casing, is a piston 40, having a conical shape, tipped with a headed screw 41, projecting from its apex. Between piston 40 and washer 37 a light coil-spring 42 is confined, the office of which is to hold the washer and piston in position. A ring of packing 43, that fits over the conical face of the piston, and a metal plate 44 encircle the screw 41 and are retained by its head. The duplicate parts in the remaining leg of the lobe are marked by number 45 for the leather, 46 for the washer, 47 for the piston, and 48 for its projecting screw, 49 for the coil-spring, 50 for the packing-ring, and 51 for the metal plate upon the screw 48. Let the fluid-space in the casing be filled, after removing all the parts just described contained in either leg of the lobe, until the fluid begins to enter the empty tubular interior of the chosen leg and return the parts removed to their proper places, as shown. It is believed to be clear that the inclosed fluid will be under approximately atmospheric pressure and that the two similar portions of the tubular interiors of the legs in which the coil-springs are located will contain confined bodies of air. If under an excess of heat the liquid expands unusually, these air bodies or cushions will yieldingly take up the extra

pressure otherwise thrown harmfully upon the casing. If by reason of an undiscovered leak in some part of the apparatus any quantity of the fluid should be centrifugally thrown out and the internal pressure fall below that of the atmosphere, air would enter through the apertures in the screw-plugs and, forcing the leathers and washers from their seats, exert a restoring pressure upon the pistons, pushing them forward until the internal and external pressures balanced.

We will now explain the mechanism by which the valve-stem 30 is turned with respect to the casing, whether the clutch be revolving as a whole, or only the motor is actuated, or all the parts are at rest.

Side 2 of the casing has a hub marked by number 52, by which the side is secured upon the driven shaft 4. Shaft 4 is centrally bored from the end. (Shown in Fig. 2.) The bore is designated by number 53. Two longitudinal slots (marked 54 and 55) are cut diametrically through the bored portion of driven shaft 4. Bore 53 may be of any desired length and the slots 54 and 55 at any distance apart. Registering with slot 55 is a like slot 56 through hub 52 of the side 2 of the casing, and it will be understood that a similar slot through this hub exists upon the opposite side of it, although not shown. Occupying bore 53 and movable lengthwise within it is a sliding rod 57, and diametric pins 58 and 59 (see Figs. 3, 4, and 5) project from the rod, through which they are secured. These pins extend through and travel the slots 54 and 55 in driven shaft 4, and pin 59 extends through slot 55, the slot 56 in hub 52, and its twin opposite slot through the hub. The pin 59 also engages the inclined slots in the sleeve 60 of the toothed segment 61. But one of the inclined slots in the gear-sleeve is shown. It is marked 62. If the sleeve were turned half-way around, slot 62 would take the position exactly of the second inclined slot through the sleeve. That position is indicated by the broken lines in Fig. 6 crossing the upper slot. Pin 58 after emerging from slot 54 enters a collar 63, encircling the driven shaft 4 and revolving with it. Collar 63 is externally grooved, and an outer collar 64 engages the grooved collar without revolving. Lever 65, having a prong 66, pivoted to collar 64, will move the collar either way along the driven shaft. The sliding rod 57 would be likewise moved, and by the agency of the inclined slots a partial rotation would be impressed upon sleeve 60 of segment 61. As this segment meshes with the smaller geared segment 67, which is attached to the valve-stem 30, the operation of valve 29 is fully controlled. Stem 30 has a squared end 68, which passes through a corresponding orifice in segment 67 and is prevented from working off by the screw 69.

It will be noted in Fig. 5 that the outermost portion of smaller segment 67 has an enlarged and flattened terminal, through which is formed a circumferential slot 70, and that a set-screw 71 passes through this slot into the casing. The movement of the segment is thus limited by the slot, and, in fact, it may be prevented if the screw is set up hard enough, or the valve may be locked by the screw in a predetermined position, and the vehicle can then be propelled at the set speed only.

In Figs. 2 and 6 appear the threaded rings or annular nuts 72 73, which serve to retain the gear-sleeve revolubly upon the hub of side 2 of the casing.

We are aware that fluid-clutches for power-transmission purposes having reciprocating vanes and by-pass valves have been constructed, and we do not claim those features solely or broadly.

What we claim as our invention, and desire to secure by Letters Patent of the United States, is—

1. In a fluid-clutch, the combination of revoluble driving and driven parts, a valve arranged to control the movement of the said fluid, mechanism for operating the valve, devices adapted to admit air to supply diminished internal pressure and to prevent the escape of the air so admitted, substantially as described.

2. In a fluid-clutch, the combination of revoluble driving and driven parts, a valve arranged to control the movement of the said fluid, mechanism for operating the valve, devices adapted to admit air to supply diminished internal pressure and to prevent the escape of the air so admitted, the said devices being constructed and arranged to keep the admitted air from actual contact with the working fluid, substantially as described.

3. In a fluid-clutch, the combination of revoluble driving and driven parts, a valve arranged to control the movement of the said fluid, mechanism for operating the valve, devices holding a body of air in confinement and adapted to admit additional air to supply diminished internal pressure and to prevent the escape of the air so confined and admitted, substantially as described.

4. In a fluid-clutch, the combination of a casing having one side provided with a fluid-entrance, a lobe possessing a hollow interior, the fluid-entrance opening into the lobe, said lobe interior having air-inlets, valves governing the said air-inlets, pistons fitting the said lobe interior, and springs arranged between the said valves and pistons, substantially as described.

5. In a fluid-clutch, the combination of a casing having one side provided with a fluid-entrance, a lobe possessing legs having hollow tubular open-ended interiors, the fluid-entrance opening into the lobe, screw-plugs closing the open ends of the lobe, apertures formed through the said plugs and eccentrically located, valves governing said apertures and having central holes, pistons fitting the

interiors of the said legs, and springs arranged between said pistons and valves within the said legs, substantially as described.

6. In a fluid-clutch, the combination of a casing having one side provided with a hub, a driven shaft secured within the said hub, the said shaft being bored longitudinally and slotted diametrically through the bored portion, the said hub having oppositely-located slots corresponding to one of the slots in the shaft, a geared segment having a sleeve riding said hub and oppositely-inclined slots through the sleeve, a sliding rod occupying the bore of the shaft, pins secured in the said rod and projecting through the slots in the said shaft, hub and sleeve, a second geared segment meshing with the first-mentioned segment, and a valve having its stem secured to the said second segment, substantially as described.

7. In a fluid-clutch, the combination of the casing, a valve within the casing, a valve-stem, a toothed segment 61, a second toothed segment meshing with segment 61 and attached to the said valve-stem, devices adapted to fix the second toothed segment stationary upon the casing thereby securing the said valve in any given position, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

MICHAEL J. MILMOE.
WILLIAM SHERWOOD PORTER.

Witnesses:
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FRED A. THAYER.