

No. 759,828.

PATENTED MAY 10, 1904.

A. E. OLNEY.
ENGINE.

APPLICATION FILED JUNE 20, 1903.

NO MODEL.

3 SHEETS—SHEET 1.

Fig. 1.

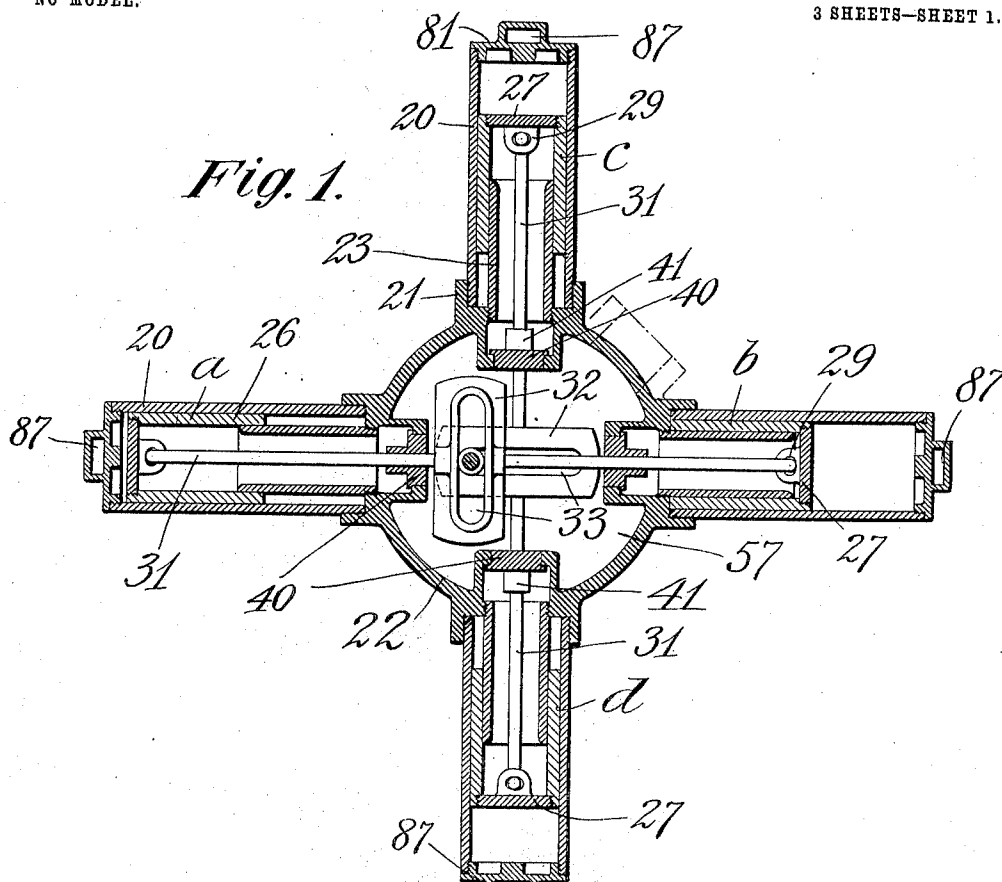
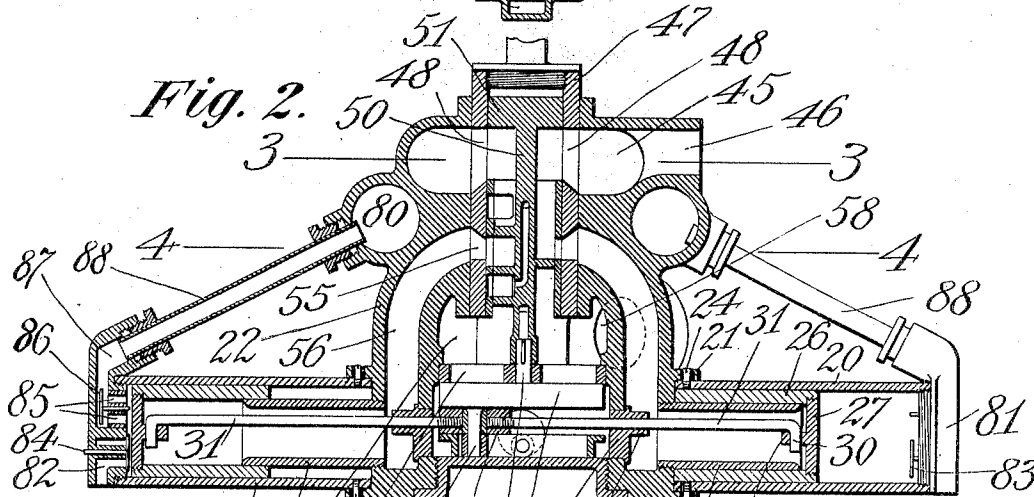


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

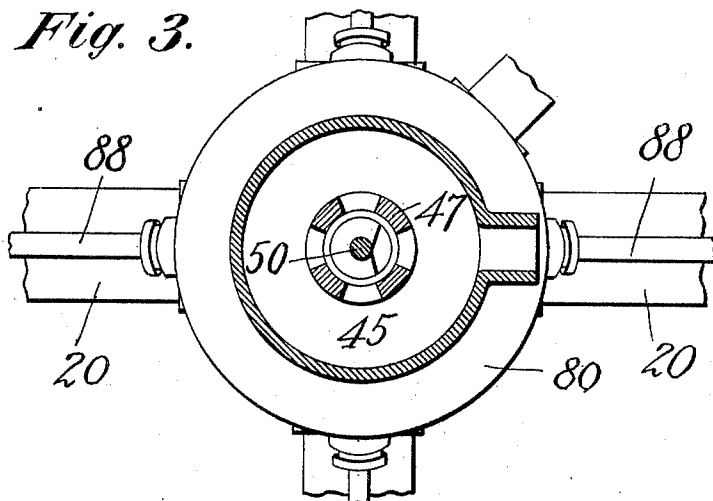
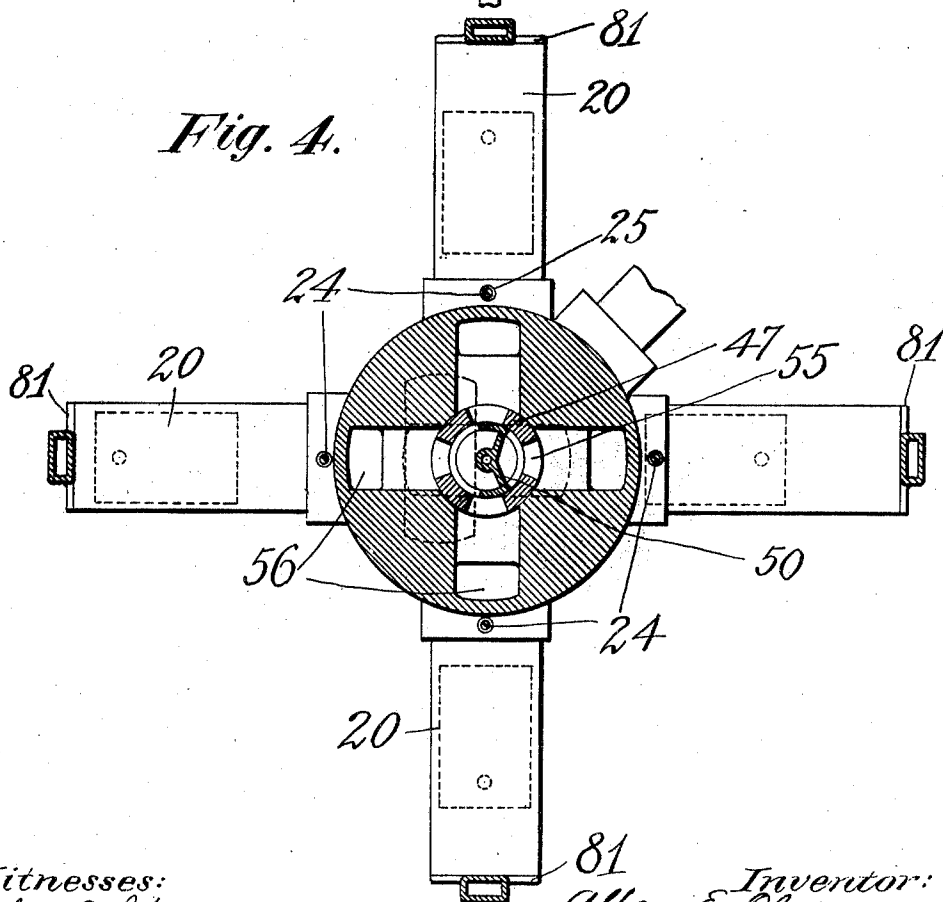


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5

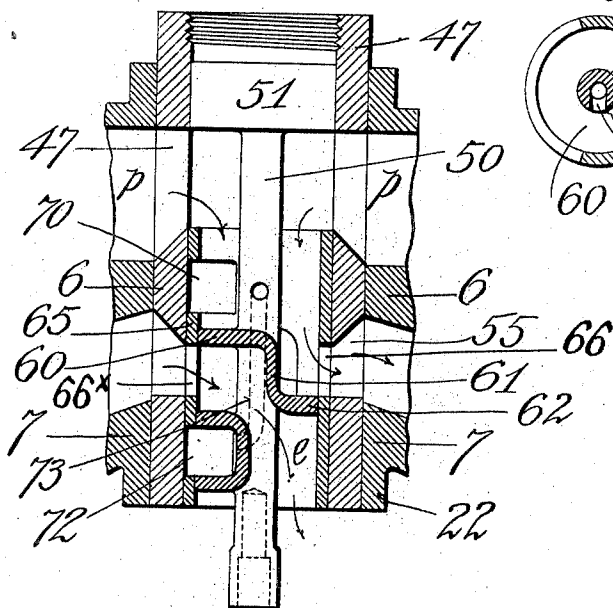


Fig. 6.

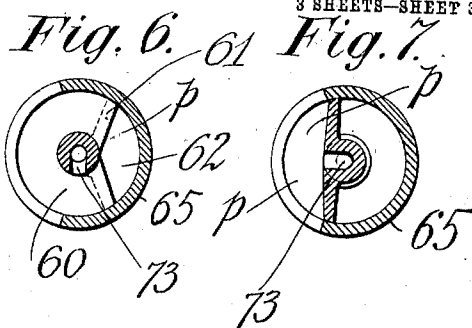


Fig. 7.

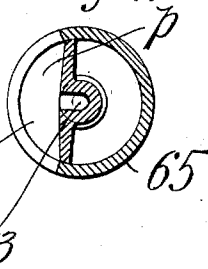


Fig. 8.

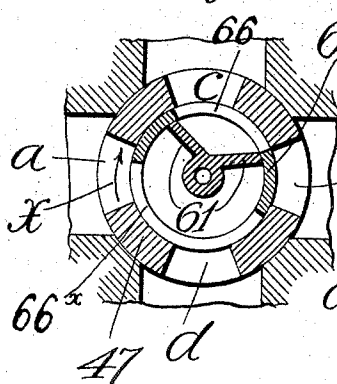


Fig. 9.

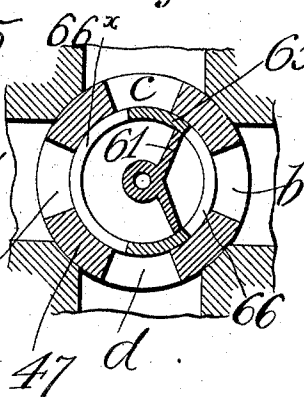
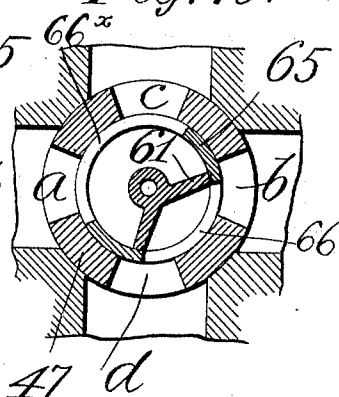


Fig. 10.



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UNITED STATES PATENT OFFICE.

ALLAN E. OLNEY, OF BOSTON, MASSACHUSETTS.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 759,828, dated May 10, 1904.

Application filed June 20, 1903. Serial No. 162,335. (No model.)

To all whom it may concern:

Be it known that I, ALLAN E. OLNEY, a citizen of the United States of America, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Engines, of which the following is a full, clear, and exact description.

This invention relates to motors, and more especially to that class thereof in which fluid under pressure is employed to impart a reciprocatory movement to pistons for the purpose of compressing air; and it has for one of its objects the provision of a device of this character in which a plurality of working cylinders are radially disposed around a common center and organized for consecutive operation, so that a steady impulse will be given to the shaft or other power-transmitting medium the movement of which controls the position of the opposite piston during its return stroke.

My invention has, furthermore, for its object the combination, with a plurality of consecutively-operated cylinders and fluid-conduits therefor, of a valve for controlling the admission and exhaust for said cylinders, respectively.

My invention has, furthermore, for its object the improved construction of the fluid-distributing valve, as will be hereinafter described, and particularly pointed out in the claims.

In the drawings, Figure 1 is a horizontal section of my improved motor, taken in alinement with the axes of the cylinders. Fig. 2 is a central vertical cross-section thereof. Fig. 3 is a horizontal section on line 3 3, Fig. 2. Fig. 4 is a similar section on line 4 4, Fig. 2. Fig. 5 is a vertical central section of the valve and the passages controlled thereby. Fig. 6 is a section of the valve on line 6 6, Fig. 5. Fig. 7 is a section on line 7 7, Fig. 5; and Figs. 8, 9, and 10 are horizontal sections of the valve and the conduits leading to the several cylinders, the valve being shown in different positions to illustrate the manner in which the fluid is controlled thereby.

Similar characters of reference indicate corresponding parts in all of the views.

In the preferred form shown in the draw-

ings my invention comprises a series of working cylinders 20, radially disposed around a common center and provided with pistons operatively connected with a crank secured upon a centrally-disposed shaft and to which pressure may be applied in any convenient manner.

The motor as herein shown is especially adapted to be used in connection with water under pressure, and its particular purpose is to pump air into a reservoir, from which it may be drawn as required.

The cylinders 20 are preferably four in number and disposed substantially at right angles with each other, as clearly shown in Fig. 1, each cylinder consisting of a tube seated with one end in a hub 21, formed on a casing 22, in which the several conduits for the pressure fluid are contained.

In order to facilitate the assemblage of the several cylinders 20 with the casing 22, means are provided whereby such cylinders may not only be securely held on said casing, but whereby, furthermore, each cylinder may be enabled to conform in alinement with an inner tube 23, the inner end of which is in screw-threaded engagement with the casing 22, these means comprising in the present instance screws 24, passing through oppositely-disposed apertures in the hub 21 and screw-threaded into said cylinder, while packings, such as 25, may be employed to form a tight connection between said cylinders and the casing and yet not interfere with the adjustment of the cylinders into alinement with the tubes 23, respectively. Inasmuch as the construction of all the cylinders and pistons is substantially the same, the following description of one may be deemed sufficient to answer for all.

Interposed between the inner tube 23 and the cylindrical shell 20 is a tubular piston 26, having at its outer end an end plate 27, rigidly secured thereto, said end plate being provided with an ear 28, having an elongated aperture 29 (see Fig. 1) to receive the bent portion 30 of a pitman 31, the other end of which may be rigidly secured to a cross-head 32.

In the present construction each pair of oppositely-disposed cylinders is in alinement,

and in order to avoid interference between the oppositely-disposed pitman-rods one pair is superposed to the other, each set being connected to a cross-head mounted for straight-line movement with the piston, and it will for that reason be understood that the movement of said cross-heads will be substantially at right angles to each other. Each cross-head is slotted at 33 to permit for the arcuate travel of a crank-pin 34, secured to a crank-disk 35, mounted upon a shaft or stud 36, which is journaled in a spider 37, secured to and within the casing 22 in any convenient manner.

From the foregoing description it will be understood that when the piston *a* (see Fig. 1) is in its extreme outward position the piston *b* will be in its extreme inward position, and likewise pistons *c* and *d* will be in their half-stroke positions.

The pitman-rods 31 are in the present instance guided in bushings 40, the body portion of which is cylindrical, and the rod-supporting hubs 41 are disposed eccentrically relatively thereto, so that similar bushings 40 may be employed to guide all the respective pitman-rods 31, it being understood, of course, that while one pair of bushings 40 is so disposed within the casing 22 that the hubs 41 will be above the axis of the pistons, such as *a* and *b*, the other set of bushings will have its supporting-hubs disposed below said axis and in alinement with the pitman-rods 31 of the pistons *c* and *d*.

The casing 22 comprises in the present instance a pressure-chamber 45, having an inlet 46 and having permanent communication with the interior of a bushing 47, centrally disposed in said casing, and having ports 48, through which water is admitted to the interior. Mounted for rotation within said bushing is a valve the stem 50 of which is provided at its upper end with a head 51 in running fit with the interior of the bushing 47, while its lower end is slightly enlarged to fit over the stud 36 or crank-shaft 36, with which it may have a spline connection, as indicated in Fig. 2. The bushing 47 has also a series of ports 55 to permit the passage of fluid from the interior of the bushing 47 to conduits 56, leading to the several cylinders 20, respectively, and in order to control the supply of pressure fluid to these several working cylinders in proper succession the valve is so constructed that not more than one pair of cylinders at a time may be supplied, while the other pair of the adjacent cylinders will at that time be in direct communication with the interior chamber 57 of the casing 22, this chamber constituting an exhaust-chamber from which the discharge fluid may be conducted through an opening 58, as clearly shown in Fig. 2.

From the foregoing it will be understood that the exhaust-chamber 57 contains water, which may serve in the present instance as a

lubricant for the several elements of the motor contained therein—as, for instance, the crank-disk 35 and both of the cross-heads 32.

In order to facilitate the construction of the valve in actual practice, the valve which I employ is preferably made in two parts, consisting first of the stem 50, with which wings or partitions of proper form and shape are integral, and the other part of which consists of a tubular shell cut away at certain places to permit the passage of water from the interior of the valve-shell through the valve-shell port 66 and adjacent ports 55 in the concentric stationary bushing, and said valve-shell has the exhaust-port 66 sidewise there-through, opposite the pressure-port 66^x and at the same level therewith.

Referring to Fig. 5, it will be seen that the stem 50 is provided with a horizontally-disposed partition 60, surrounding said stem to the extent shown in Fig. 6, and then dropping, as indicated by 61, sufficiently to fall below the ports 55 of the valve-bushing 47, whereupon said partition extends again horizontally, as shown at 62. This partition, in connection with the valve-shell 65, constitutes a chamber whereby the liquid under pressure is confined above said partition and permitted to communicate with such port 55 as may be opposite the shell-port 66 at any given instant. Below the partition comprising the sections 60, 61, and 62 the interior of the valve-shell 65 may be in communication with those ports 55 which are opposite to those in connection with the pressure-chamber, so that when fluid under pressure serves to move one piston outward the inward movement of its opposite piston will discharge the water through the port below the partition 60 and into the exhaust-chamber 57. For instance, referring to Figs. 8, 9, and 10, it will be seen that in Fig. 8 the pressure-chamber *p* of the valve is in communication with the port leading to the cylinder *c*, therefore driving the piston thereof outward and at the same time moving the piston in the cylinder *d* inward. Hence the exhaust-chamber *e* of the valve is in communication with the cylinder *d*, and the water may be readily discharged therefrom, and in this figure it will be also seen that the valve is in such a position that water is just about to be admitted into the port leading to the cylinder *b* as the valve is rotated in the direction of the arrow *x*, while the cylinder *a* is already in communication with the exhaust-chamber *e* of the valve. In Fig. 9 cylinder *b* receives its full power-supply while the cylinders *a*, *c*, and *d* are in full and part communication with the exhaust-chamber *e* of the valve, respectively, while in Fig. 10 the cylinders *b* and *d* receive fluid under pressure and the cylinders *a* and *c* are exhausting.

Means are provided whereby any cramping action or unbalancing of the valve will be prevented, these means consisting, substantially,

of cut-out sections in the valve-shell. (See Fig. 5.) Here the valve-shell is shown as cut out at 70 to permit water to come into contact with the interior of the valve-bushing 47, and therefore relieve all tendency of the valve being forced toward the left side of its axis in the pressure-chamber, and have also shown a balancing-chamber 72 disposed below the partition 60 and receiving water under pressure through a conduit 73, the upper end of which is in communication with the pressure-chamber *p* above mentioned.

As above stated, my improved motor is especially adapted for the purpose of compressing air, and in the present instance I have shown an annular air-chamber 80 disposed below the pressure-chamber 45 and connected with the several cylinders 20, the outer ends of which constitute air-compressing chambers and are provided with heads 81, each of which has an air-inlet 82, normally closed by a valve 83, which may be guided on a valve-rod 84, mounted for sliding movement in the head 81, so that when the piston 26 travels inward air will be admitted through the inlet 82, filling the space vacated in the cylinder by the movement of the piston, which air will be subsequently compressed and discharged through ducts 85, normally closed by a valve 86, which may be of any suitable construction. The ducts 85 are in constant communication with conduits 87, from which the air may be conducted into the air-chamber 80 through tubes or similar connections 88, as will be readily understood.

The valve having the ports and passages in the arrangement substantially as described and for the operative or controlling effects set forth may be constructed in various specific ways, all within the range of invention residing as characterized for this new valve, and in the drawings, Sheet 3, the central stem of the valve having the double step-shaped intermediate partition 60, 61, and 62 of circular form as viewed endwise of the valve, and having the surrounding shell with the opposite ports therein and said stem having the cylindrical head or flange end is as far simplified and satisfactory as I have been able to attain, this construction serving not only to balance the valve by the establishment of pressures at opposite sides of the axis, but assures also a balancing of the valves as regards pressures in the line of the axis—that is to say, that while the water chamber or pocket 72 opposite the pressure-port and below the same conduces materially toward the balancing of the valve against pressures transversely thereof at the pressure-port side the recess 70 at the same side as the chamber or recess 72, but located above the plane of the pressure-port, secures a more perfect equilibrium of the valve as regards the pressures transversely thereagainst—and inasmuch as the greater portion of the water-pressure is in a

downward direction against the double step-shaped partition adjacent the outlying series of ports *p* the provision of the upper end valve member 51, equally receiving the motor-pressure, maintains the valve in equilibrium as regards endwise-crowding pressure in opposite directions.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a hydraulic motor the combination with the casing having a pressure-chamber and an exhaust-chamber, and a plurality of working cylinders, and a series of passages having centrally and circularly arranged ports in a common plane and connected with the cylinders, of a valve having at one side thereof a pressure-chamber, and at the other side thereof an exhaust-chamber having openings in the common plane of said ports for successive registry therewith, the valve pressure-chamber being in constant communication with the pressure-chamber of the engine-casing, and the valve exhaust-chamber being in constant communication with the exhaust-chamber in the engine-casing, and said valve having at the side of its exhaust-chamber, a sidewise-opening balancing-chamber, at a point endwise removed from the plane of the pressure and exhaust ports, in communication with the valve pressure-chamber.

2. In a motor, in combination, an engine-casing having an axially-arranged pressure-chamber, with an inlet-passage at its upper portion, an axially-arranged exhaust-chamber, with an outlet-passage at its lower portion, having a series of inwardly-open, radially-arranged cylinders with pistons therein, in a plane transversely intersecting the exhaust-chamber, and having a series of radially-arranged cylinder-connecting passages formed in the casing, and inwardly terminating in ports connecting with an intermediate portion of the length of the pressure-chamber, and being all intersected by a common plane transversely of the axis of said pressure-chamber, an axially-arranged shaft extending centrally through the aligned pressure and exhaust chambers having a crank at its lower end in the exhaust-chamber, a valve, fixed on an intermediate portion of said shaft, of cylindrical form, having in opposite portions thereof pressure and exhaust chambers, respectively, and in communication constantly with the pressure and exhaust chambers in the engine-casing, and having the opposite outwardly-opening ports arranged to register successively with each of said cylinder passage-ports, rectilinear connecting-rods, engaged with the cylinder-pistons, and extending therefrom into the exhaust-chamber, wall-sections, separating the exhaust-chamber from the inner ends of the cylinders and their connecting-passages, having openings there-through for the endwise play of the connect-

ing-rods, and means of engagement between the ends of the connecting-rods and the crank on said valve-carrying shaft.

3. In an engine, the combination with an engine-casing having a plurality of radially-arranged inwardly-opening cylinders, each comprising an outer tube closed at its outer end, and an inner tube extended less far outwardly than the outer tube, and of less diameter than such tube, and having an annular space between its outer surface and the surrounding outer tube, tubular pistons, fitted and endwise movable between the outer and inner cylinder-tubes, a crank-shaft and pistons, and connections between the crank-shaft and said tubular pistons.

4. The combination with a plurality of working cylinders each comprising an outer and an inner tube, a casing, a crank-shaft, pitmen connecting said crank-shaft and pistons, and eccentric-heads for guiding said pitmen and secured in said casing, of means for adjustably supporting said cylinders on said casing.

5. The combination with a plurality of working cylinders each comprising an outer and an inner tube, tubular pistons operative between said inner and outer tubes, a casing, a crank-shaft, pitmen connecting said crank-shaft and pistons, and means for guiding said pitmen, of means for adjustably supporting said cylinders on said casing.

6. The combination with a plurality of working cylinders each comprising an outer and an inner tube, tubular pistons operative between said tubes, and having solid outer heads, transversely-slotted ears on said heads, pitmen connecting said pistons, and means for guiding said pitmen, of means for adjustably supporting said cylinders in said casing.

7. In a hydraulic motor the combination with the casing having a pressure-chamber and an exhaust-chamber, and a plurality of working cylinders, and a series of passages having centrally and circularly arranged ports in a common plane and connected with the cylinders, of a valve having at one side thereof a pressure-chamber, and at the other side thereof an exhaust-chamber having openings in the common plane of said ports for successive registry therewith, the valve pressure-chamber being in constant communication with the pressure-chamber of the engine-casing, and the valve exhaust-chamber being in constant communication with the exhaust-chamber in the engine-casing, and said valve having at the side of its exhaust-chamber, a sidewise-opening balancing-chamber, at a point endwise removed from the plane of the pressure and exhaust ports, in communication with the valve pressure-chamber, and said valve having walls endwise beyond the plane of the valve-ports endwise resisting the water-pressure against the valve for the purposes set forth.

8. For a hydraulic motor of the character

described, a valve comprising a central stem having intermediately thereof a double step-shaped portion comprising the wall portions 60, 61 and 62, of edgewise-circular conformation, and the cylindrical shell 65 having the opposite pressure and exhaust port recesses respectively above and below said angular wall, open at top and bottom, said shell having recess 70, and sidewise-opening chamber 72 at the exhaust-port side of the valve, but located above and below said exhaust-port, and the stem having the cylindrical end enlargement 51, above the open end of the shell, and also having the duct 73 sidewise opening through the stem above the angular wall, and connecting with the chamber 72, for the purposes set forth.

9. In an engine, a casing, constructed with an axial chamber, and having a series of radially-arranged cylinders, having an annular pressure-chamber in a plane remote from that of the cylinders, having a concentrically-arranged exhaust-chamber, and having a series of passages, inwardly terminating in ports in a common plane open to the axial chamber, and outwardly terminating in the ends of the cylinder, a rotary valve in the said axial chamber, having oppositely-located ports, both in the plane of the inner ports of said passages, and one thereof being in constant communication with the pressure-chamber, and the other in constant communication with the exhaust-chamber, pistons in said cylinders, a valve-shaft extending into the exhaust-chamber and having a crank member and piston-rods extending through the wall separating the cylinder and exhaust chambers, and operative in the latter chamber on the crank.

10. In a motor, in combination, an engine-casing having an axially-arranged pressure-chamber, with an inlet-passage at its upper portion, an axially-arranged exhaust-chamber, with an outlet-passage at its lower portion, having a series of inwardly-open, radially-arranged cylinders with pistons therein, in a plane transversely intersecting the exhaust-chamber, a series of radially-arranged cylinder-connecting passages formed in the casing, and inwardly terminating in ports connecting with an intermediate portion of the length of the pressure-chamber, and being all intersected by a common plane transversely of the axis of said pressure-chamber, and pistons in said cylinders, an annular reservoir for compressed air, an axially-arranged shaft extending centrally through the aligned pressure and exhaust chambers having a crank at its lower end in the exhaust-chamber, a valve, fixed on an intermediate portion of said shaft, of cylindrical form, having in opposite portions thereof pressure and exhaust chambers, respectively, and communicating constantly with the pressure and exhaust chambers in the engine-casing, and having the opposite outwardly-opening ports arranged to register

successively with each of said cylinder passage-ports, rectilinear connecting-rods, engaged with the cylinder-pistons, and extending therefrom into the exhaust-chamber, wall-
5 sections, separating the exhaust-chamber from the inner ends of the cylinders and their connecting-passages, having openings there-through for the endwise play of the connecting-rods, means of engagement between the
10 ends of the connecting-rods and the crank on said valve-carrying shaft, an inlet and an automatic valve therefor, at the extremity of each

of the cylinders outwardly beyond the pistons, and conduits 88 respectively connecting the outer ends of the cylinders and said reservoir 15 having automatically-acting valves therein, arranged for operation reversely of the operations of said air-inlet valves.

Signed by me at Springfield, Massachusetts,
in presence of two subscribing witnesses.

ALLAN E. OLNEY.

Witnesses:

WM. S. BELLOWS,
A. V. LEAHY.