

June 12, 1928.

1,673,514

J. O. JERNBERG

PNEUMATIC MOTOR

Filed Jan. 5, 1923

3 Sheets-Sheet 1

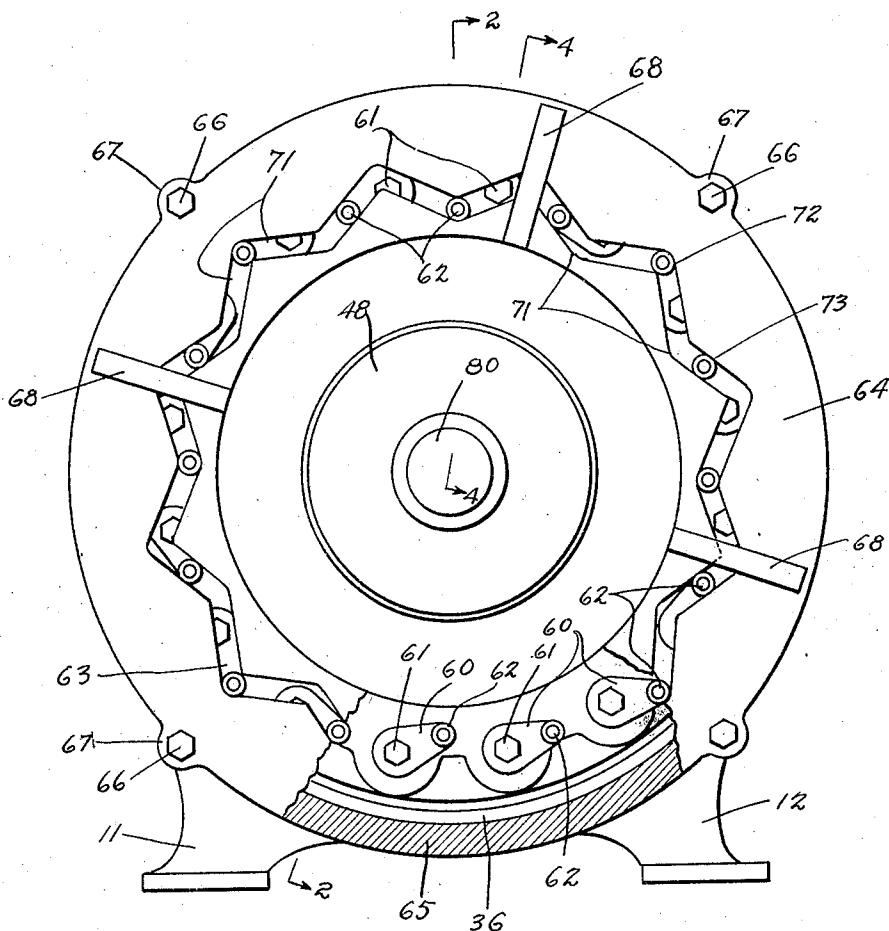


Fig. 1.

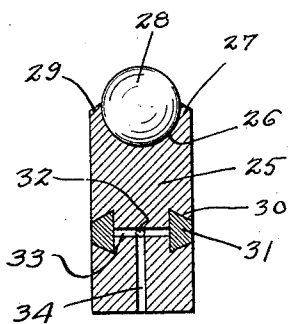


Fig. 6

Inventor

John O. Jernberg

By *Fischer & Gaard*

Attorneys

June 12, 1928.

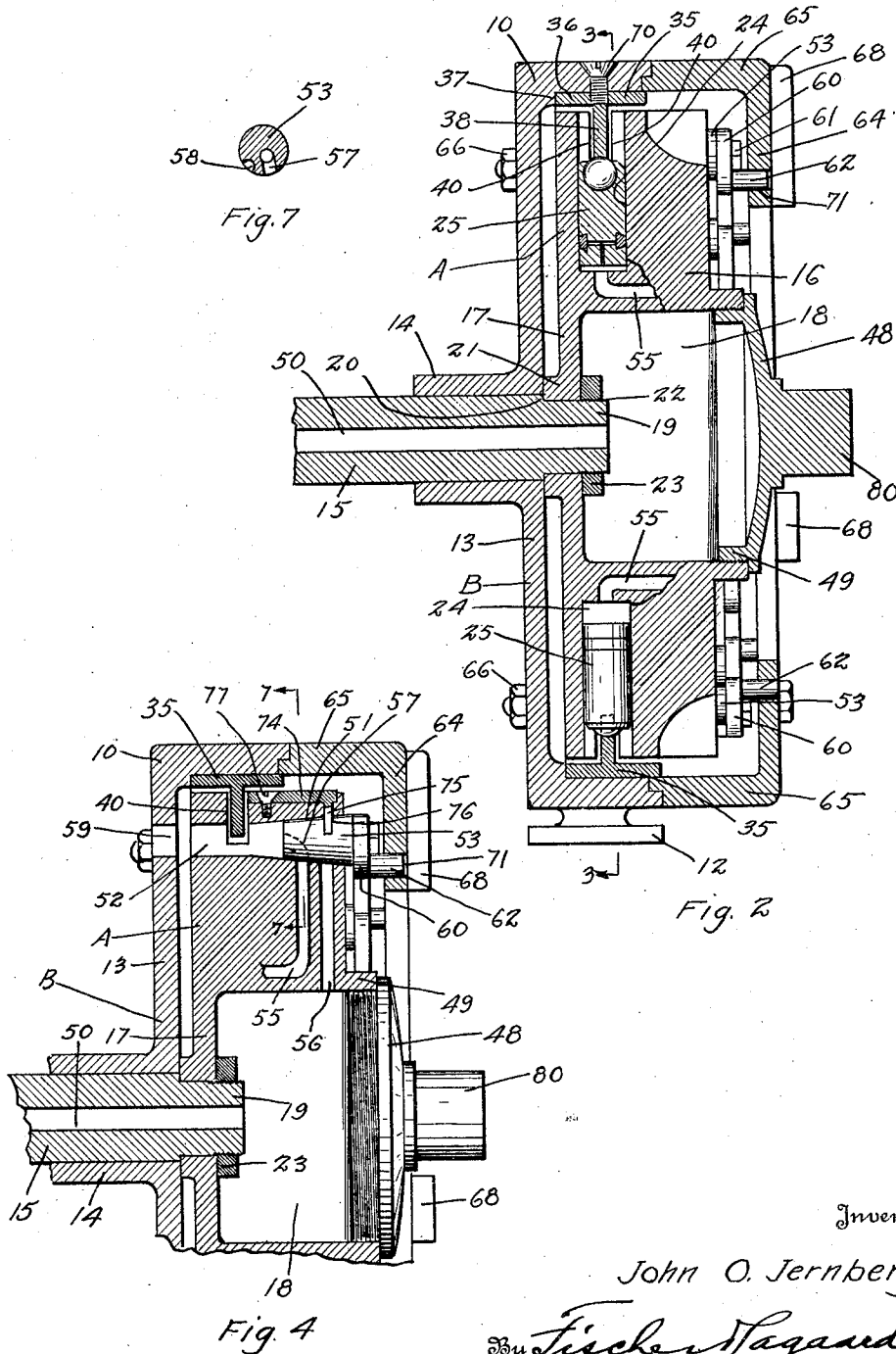
1,673,514

J. O. JERNBERG

PNEUMATIC MOTOR

Filed Jan. 5, 1923

3 Sheets-Sheet 2



Inventor

John O. Jernberg

Fischer Hagard

Attorneys

June 12, 1928.

1,673,514

J. O. JERNBERG

PNEUMATIC MOTOR

Filed Jan. 5, 1923

3 Sheets-Sheet 3

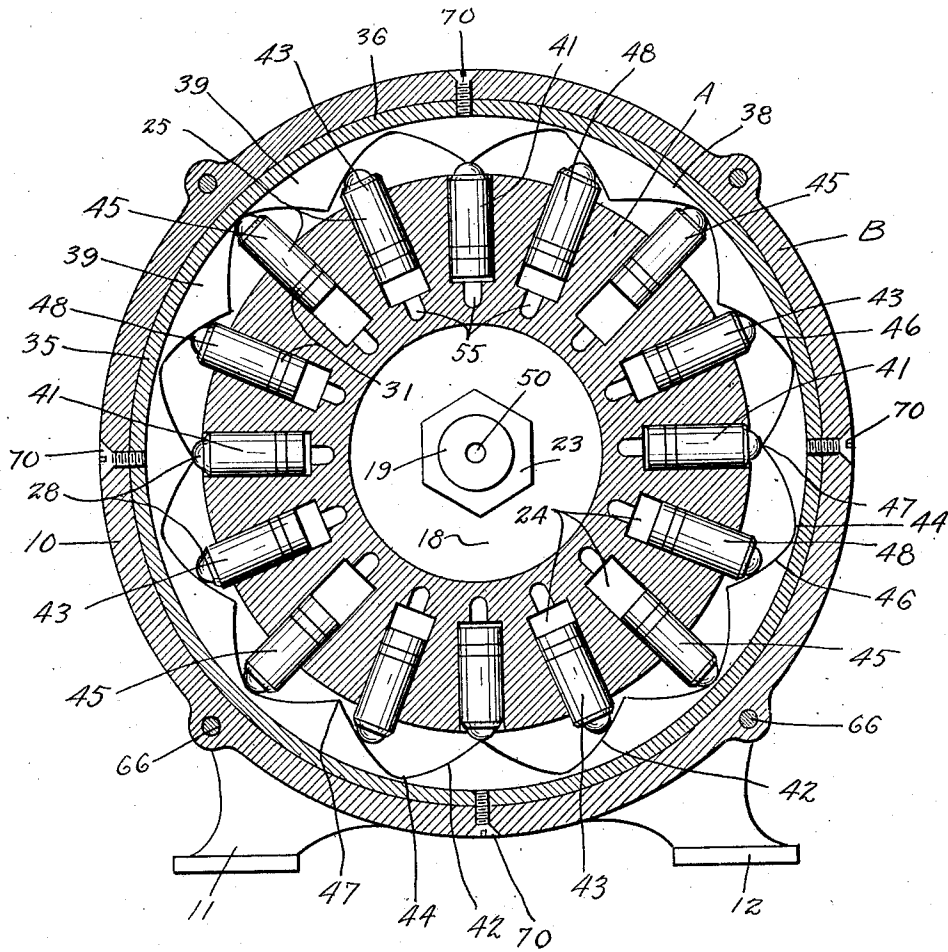


Fig. 3

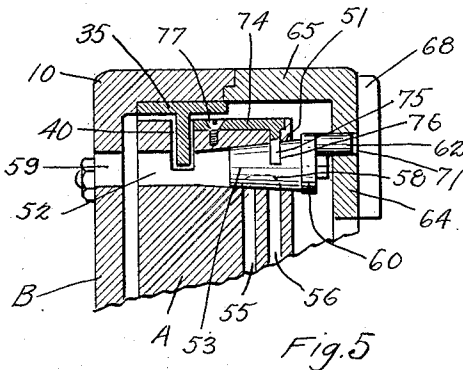


Fig. 5

Inventor

John O. Jernberg.

By Fischer & Lysand

Attorneys

Patented June 12, 1928.

1,673,514

UNITED STATES PATENT OFFICE.

JOHN O. JERNBERG, OF ST. PAUL, MINNESOTA.

PNEUMATIC MOTOR.

Application filed January 5, 1923. Serial No. 610,786.

My invention relates to pneumatic motors and has for its object to provide a motor having a plurality of cylinders arranged to give the rotor of the said motor a continuous impetus so that a uniform torque is at all times provided.

Another object of the invention is to position the cylinders within the rotor of the motor and to form the pistons with roatable members attached to the heads thereof which members are adapted to engage cam surfaces secured to the stator of the motor which cause the said rotor to be rotated and also force the pistons back into the cylinders to exhaust the fluid from the same.

A specific object of the invention is to form the heads of the pistons with rotatably mounted ball bearings which are adapted to engage wedge shaped cam members secured to the stator proper.

Another object of the invention resides in forming the rotor with radially positioned cylinders which are open at their outer periphery and in which the pistons are adapted to move, the outer ends of the said rotor and cylinders being provided with annular grooves interconnecting the said cylinders in which the previously mentioned wedge shaped cam members are adapted to ride.

A still further object is to provide valve means for controlling the flow of fluid into the cylinders so as to utilize the energy of the fluid for producing power.

A specific object of the invention is to construct the cam member against which the pistons of the rotor operate in the shape of a ring having a T-shaped cross section, which ring is adapted to ride in the groove formed in the periphery of the rotor.

Another object of the invention is to provide a number of pistons operating the rotor and a less number of actuating members co-operating therewith for causing the rotor to rotate.

The full objects of my invention will be found in the detailed description thereof, and are particularly pointed out in the claims.

Figure 1 is a front elevational view of my invention with a portion of the same broken away to show the interior construction thereof.

Figure 2 is a sectional view of the invention taken on lines 2—2 of Figure 1.

Figure 3 is a sectional view taken on line 3—3 of Figure 2.

Figure 4 is a view similar to Figure 2 of a portion of the device shown therein taken on line 4—4 of Figure 1.

Figure 5 is a view similar to Figure 4 showing the parts illustrated therein in different positions.

Figure 6 is a cross sectional view of one of the pistons of my invention.

Figure 7 is a cross sectional view of one of the valve members of my invention.

The construction of my invention can best be comprehended from an inspection of Figures 1 and 2. The device consists principally of a stator B and a rotor A arranged one within the other and adapted to operate as will be presently described.

The stator B consists of a cylindrical casing 10 to which are attached two legs 11 and 12 by means of which the entire motor may be rigidly bolted to any suitable support therefor. Integrally connected to the casing 10 is provided a back 13 which is formed with a bearing 14 secured thereto. Journalled within the bearing 14, I provide a shaft 15 which extends into the interior of the casing 10.

The rotor proper A of my invention consists of a solid casting 16 which is formed with a rear wall 17 providing an interior chamber 18 with the same. This rotor is attached to the shaft 15 as follows: At the extreme end 19 of said shaft 15, the same is turned down to form a shoulder 20. The wall 17 of rotor A is provided with a boss 21 which is bored out to slide upon the end 19 of shaft 15 and to seat against the shoulder 20. The rotor may be keyed to the end 19, if desired, or secured thereto in any other suitable manner. For holding said rotor in place, the end 19 of shaft 15, as indicated at 22, has a nut 23 screwed thereon.

The construction of rotor A is as follows: Along the outer periphery of the said rotor, the same is bored with a number of vertical bores 24 radially positioned relative to the rotor A and equally spaced. These bores extend to within a short distance of the chamber 18 within the said rotor, said bores being open at their outer ends and forming the cylinders of the motor. Within cylinders 24 are positioned and a number of pistons 41, 43, 45, and 48, the exact construction of which may be seen in Figure 6. These pistons are formed from a bar 25 having at one end a hollow socket 26 formed with an upwardly turned flange 27. A single steel

ball bearing 28 is positioned within the said socket 26 and the edge of the flange 27, which is shown at 29, is turned over the said ball 28 within the socket 26. The construction is such that the ball 28 may freely rotate within the socket 26 but is held from removal therefrom. Around the periphery of bar 25, I cut a dove-tailed groove 30 in which is positioned a suitable packing ring 31. This ring may be constructed of leather or other suitable packing material which may be readily expanded to close against the sides of the cylinder wall to form a fluid tight connection therewith. In combination with the said packing ring, I drill two holes 32 and 33 which cross each other and enter into the slot 30. These grooves are further connected by a hole 34 leading to the rear face of the piston. The purpose of these holes is for causing the packing ring 31 to press against the walls of the cylinders to prevent leakage of fluid past the piston. When pressure is applied within the cylinders, the fluid is forced through the holes 32, 33 and 34 and the said packing ring 31 forced outwardly as required.

Secured within the inner surface of the casing of stator B, I provide a T-shaped ring member 35 having an annular flange 36 which is positioned within the casing 10 and seated against the shoulders 37 formed in the said casing. A flange 36 is attached to the casing 10 by means of a number of screws 70 passing through the said casing and screwed into the said flange. Member 35 is further formed with an inwardly extending rib 38 which forms the stem of the T. This rib, as best shown in Figure 3, is cut to provide a series of successive wedge shaped cam members 39 arranged around the entire member. An annular groove 40 formed along the outer periphery of rotor A connects all of the cylinders 24 through the centers thereof. Within this groove, the various cam members 39 are adapted to be positioned so that the balls 28 in the pistons may engage the said cams as the rotor A is rotated.

The operation of the device is as follows: When the parts are positioned, as shown in Figure 3, every fourth cylinder 41 is at the extreme end of its stroke ready to receive pressure from the fluid operating the motor. As soon as the cylinders receive pressure, it causes the said piston balls 28 to roll on the outwardly sloping surfaces 42 of the various cams 39 which causes the motor to be rotated in the direction of the arrow. In the said figure, pistons 43 are shown as being moved partly outwardly within their cylinders and therefore are positioned a short distance from the apexes 47 of the outwardly sloping cam surfaces 46 of the cam 39. These pistons in the position of the parts, as shown in Figure 3, are the particular pistons which are causing the rotation of the rotor. The pres-

sure within the cylinders continues until the pistons reach the valleys 44 in the most outward portion of the cam members 39, at which time the cylinders are permitted to exhaust as will presently be explained. Pistons 45 are shown in this position. As the rotor A continues to rotate, all of these pistons are caused to travel inwardly along the inwardly inclined cam surfaces 46 of cams 39 until the same again reach the apexes 47 of the said cams as is the case of pistons 41. Pistons 48 are shown in their inward movement along the cam surfaces 46 as specified. It will be noted in regard to the cam members 39 that there are 12 such cam members in the rotor illustrated, while sixteen pistons and cylinders are employed. This will give the necessary phase relation between the various cylinders, so that some of the cylinders will be at the apexes of the cams, others at the valleys and still others at the sloping surfaces thereof. In this manner, it can clearly be seen that by the automatic manipulation of suitable valves for controlling the flow of the fluid into the various cylinders 24 that the rotor A may be caused to rotate relative to the stator B by means of the pistons within the said cylinders engaging the various cams 39.

The method of conducting the fluid pressure into the various cylinders 24 of the rotor A is as follows: Chamber 18 is closed by means of a cap 48 which is screwed into a flange 49 formed on the casting 16. A bore 50 passing through the central portion of the shaft 15 is connected with a suitable source of pressure supply not shown in the drawings which leads directly into the chamber 18. Between each of the cylinders 24, there is positioned a conical valve chamber 51 which communicates through a port 52 with the space in back of the rotor A and the back 13 of stator B. Within each of the valve chambers 51 is positioned a conical valve member 53 best shown in Figure 4. The various valve members B are held from removal within the valve chambers 51 by couplings 74, each of which has a downwardly extending arm 75 adapted to seat into a groove formed along the said valve member. Couplings 74 are held in place by means of screws 77 screwed into the casting 16. A port 55 is directly connected with the lower end of each of the cylinders 24 and the adjacent valve chamber 51 with the interior of the chamber 18. Operating in conjunction with the ports 55 and 56 are two ports 57 and 58 formed in the periphery of each of the valve members 53 and 54. The port 57 is adapted to register with the port 55 and to bring the same in communication with the port 52. This port is shown in dotted lines in Figure 4 and also in Figure 7. The port 58 which is shown in Figures 5 and 7 is positioned adjacent port 57 in valve member 53,

and is adapted to register with ports 55 and 56 so as to bring these two ports into communication. When the valve member 53 is oscillated to take the position shown in Figure 5, fluid within chamber 18 passes through port 56, through port 58 and then through port 55 into the respective cylinders 24 forcing the pistons outwardly to cause the same to press against the cam members 39 to rotate rotor A. When the pistons reach the outermost position similar to the pistons 45 in Figure 3, valve members 53 are oscillated by means to be presently described, so as to cause the port 57 to register with port 55 and port 56 to be closed from communication with valve chamber 51. In this position, the fluid within the various cylinders 24 may escape through the port 52 into the space back of rotor A and from there through suitable openings 59 in back 13 into the atmosphere. The valve actuating mechanism is so arranged that the ports remain open until the pistons almost reach the extreme ends of their strokes.

For operating the various valve members 53, a device shown in Figures 1 and 4 is employed. To each of the valve members 53 is attached a crank arm 60 which is rigidly bolted thereto by means of a cap screw 61. These arms have rotatably mounted thereon at the extreme ends thereof rollers 62 which extend outwardly beyond the surfaces of crank arms and cap screws 61. The valve members 53 are oscillated by means of the rollers 62 and the crank arm 60 which rollers are adapted to pass along a zigzag groove 63 formed in a plate like member 64 positioned in front of the rotor A. The plate 64 is formed with a flange 65 which is seated against the casing 10 and the two are securely bolted together by bolts 66 passing through suitable bosses 67 formed on the said casing and flange. In the drawings, I have shown the groove 63 extending completely through the plate-like member 64 in which case, it becomes necessary to provide bars 68 extending across the same to hold the parts of the plate 64 in proper relation to maintain the groove 63. When said groove 63 extends only partly through the said plate, these bars 68 may be eliminated.

From an inspection of Figure 1, it will be seen that the groove 63 is of similar shape to the cam surface of the various cams 39. It will further be noted that the said groove is formed with a number of undulations 71 which are of the same number as the number of cams 39, which, in this case, would be 12 so that the various valve members 53 may be positioned relative to the various pistons 41, 43, 45 and 48 as required, thereby providing the relative valve openings necessary for the operation of the device. When the pistons are at the innermost portion of the cylinder, as shown in

Figure 2, the valve members 53 and the crank arms 60 are so positioned that the rollers 62 thereof are at the innermost valleys of the groove 63, as indicated at 71 in Figure 1. When, on the other hand, the pistons are at the outermost positions, rollers 62 are positioned, as indicated at 72 and when the pistons are in intermediate positions within their cylinders, the rollers are similarly positioned in intermediate positions between the valleys and ridges with the groove 63 as shown at 73. It can therefore be clearly comprehended that the valve members are correspondingly oscillated to cause the fluid to enter or leave the cylinders in proper relation to the movement of said cylinders and the rotation of rotor A.

For deriving power from my motor, I provide a hub 80 which is attached to the disc 48 secured to rotor A. A pulley or other suitable transmission device, not shown in the drawings, may be secured in any suitable manner to the hub and will serve for transmitting power from the rotor.

The advantages of my invention are manifest. An extremely simple motor is provided in which the use of cranks and crank shafts for transmitting the energy from the pistons to the flywheel is eliminated. At the same time, a device is provided in which a very uniform torque may be secured, even at low speed, if desired. The employment of balls in conjunction with the pistons decidedly reduces friction making the device highly efficient and practical. By employing a different number of cam members in comparison with the number of cylinders, the parts may be all constructed the same, so that the cost of building the motor is greatly reduced.

In accordance with the patent statutes, I have described the principles of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the construction shown is only illustrative and that the invention can be carried out by other means and applied to uses other than those above set forth within the scope of the following claims.

I claim:

1. A motor comprising a rotor, a plurality of radially disposed cylinders in said rotor having their outer ends open at the periphery of said rotor, pistons movable within said cylinders, said rotor having an annular slot interconnecting all of said cylinders, a stator encircling said rotor, having a back and an integral circular flange projecting from said back, a T-shaped cam member located in said slot and secured to the inner surface of said flange against which said pistons operate, a shaft having a fluid passageway therein connected to said rotor, a bearing for said shaft in the back of said

stator, a central pressure chamber in said rotor to which said passageway leads, a valve chamber for each cylinder, ports leading from said pressure chamber to said valve chambers, ports leading from said cylinders to said valve chambers, exhaust ports leading to said valve chambers, a three way valve in each valve chamber adapted to connect said cylinder ports to either the exhaust ports or said pressure chamber ports and a cam track of similar configuration to said T-shaped cam member for operating said valves.

2. A motor comprising a rotor, a plurality of radially disposed cylinders in said rotor having their outer ends open at the periphery of said rotor, pistons movable within said cylinders, said rotor having an annular slot interconnecting all of said cylinders, a stator encircling said rotor, having a back and an integral circular flange projecting from said back, a T-shaped cam member located in said slot and secured to the inner surface of said flange against which said pistons operate, a shaft having a fluid passageway therein connected to said rotor, a bearing for said shaft in the back of said stator, a central pressure chamber in said rotor to which said passageway leads, a valve chamber for each cylinder, ports leading from said pressure chamber to said valve chambers, ports leading from said cylinders to said valve chambers, exhaust ports leading to said valve chambers, a three way valve in each valve chamber adapted to connect said cylinder ports to either the exhaust ports or said pressure chamber ports, a cam track of similar configuration to said T-shaped cam member for operating said valves and said rotor being spaced from the back of said stator to form an exhaust chamber to which all of said exhaust ports lead.

3. A motor comprising a rotor, a plurality of radially disposed cylinders in said rotor having their outer ends open at the

periphery of said rotor, pistons movable within said cylinders, a stator encircling said rotor, having a back and an integral circular flange projecting from said back, a T-shaped cam member secured to the inner surface of said flange against which said pistons operate, a shaft having a fluid passageway therein connected to said rotor, a bearing for said shaft in the back of said stator, a central pressure chamber in said rotor to which said passageway leads, a valve chamber for each cylinder, ports leading from said pressure chamber to said valve chambers, ports leading from said cylinders to said valve chambers, exhaust ports leading to said valve chambers, a three way valve in each valve chamber adapted to connect said cylinder ports to either the exhaust ports or said pressure chamber ports and a cam track of similar configuration to said T-shaped cam member for operating said valves.

4. A motor comprising a rotor, a plurality of radially disposed cylinders in said rotor having their outer ends open at the periphery of said rotor, pistons movable within said cylinders, a stator encircling said rotor, having a back and an integral circular flange projecting from said back, a T-shaped cam member secured to the inner surface of said flange against which said pistons operate, a central pressure chamber connected to a fluid pressure supply in said rotor, a valve chamber for each cylinder, ports leading from said pressure chamber to said valve chambers, ports leading from said cylinders to said valve chambers, exhaust ports leading to said valve chambers, a three way valve in each valve chamber adapted to connect said cylinder ports to either the exhaust ports or said pressure chamber ports and a cam track of similar configuration to said T-shaped cam member for operating said valves.

JOHN O. JERNBERG.