

Nov. 12, 1929.

E. J. MOORE ET AL

1,735,176

FLUID PRESSURE MOTOR

Original Filed July 31, 1919 2 Sheets-Sheet 1

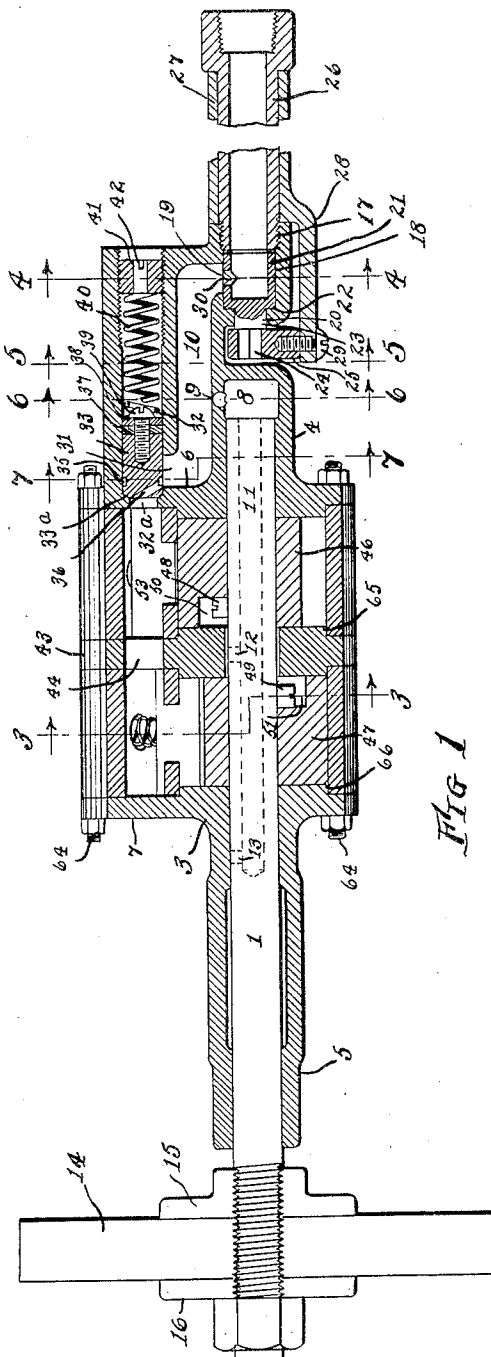


FIG 1

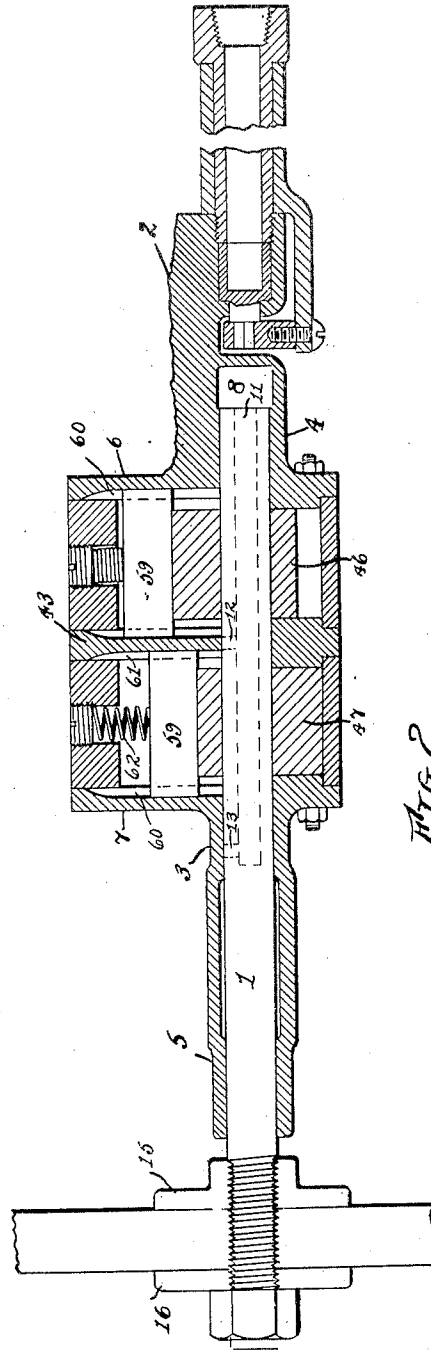


FIG 2

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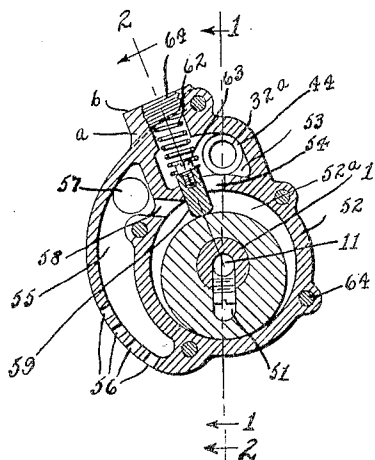


FIG 3

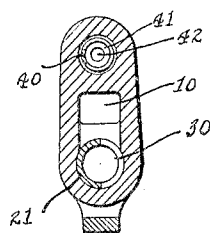


FIG 4

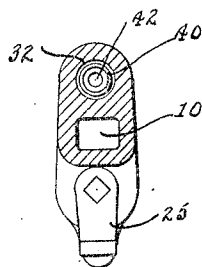


FIG 5

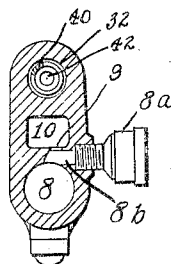


FIG 6

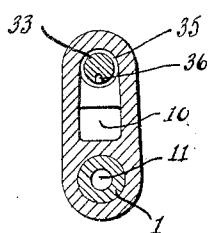


FIG 7

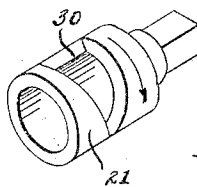


FIG 8

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UNITED STATES PATENT OFFICE

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FLUID-PRESSURE MOTOR

Application filed July 31, 1919, Serial No. 314,511. Renewed December 17, 1925.

This invention relates to fluid pressure motors, and has for its general object to improve the construction and operation of such motors. Further and more limited objects of the invention are to provide a novel means for controlling the supply of pressure fluid to the cylinders and pistons of such motors; to provide such motors with an efficient construction and arrangement of throttle or controlling valve; to provide for the pistons of motors of the rotary type an improved means for lubrication; and to provide for the last mentioned types of motors a novel arrangement for the distribution of the exhaust fluid. A still further object of the invention is to provide a rotary motor which may be conveniently operated and applied to the work by hand. We realize the foregoing objects in and through the construction and arrangement of parts shown in the drawings forming part hereof, wherein Fig. 1 represents a longitudinal sectional view through a motor constructed in accordance with our invention, the said view corresponding to the line 1—1 of Fig. 3, the shaft being shown in elevation and certain parts being broken away; Fig. 2 a view similar to Fig. 1 and corresponding to the line 2—2 of Fig. 3; Figs. 3, 4, 5, 6 and 7 sectional details corresponding respectively to the lines 3—3, 4—4, 5—5, 6—6 and 7—7 of Fig. 1; and Fig. 8 a detail in perspective of the manually operated throttle or controlling valve.

Describing the parts by references characters, 1 denotes the motor shaft, said shaft being mounted in a pair of heads indicated at 2 and 3, the head 2 being what is known to the trade as the "dead" head and the head 3 the "live" head. Each head comprises a sleeve portion indicated at 4 and 5 respectively, the said sleeve portions being connected with flat heads 6 and 7 respectively, which heads form the ends of the cylinder assembly. Each of these heads is of the general contour shown in Fig. 3. The sleeve 4 is provided with a chamber 8 to which lubricant may be supplied from a suitable receptacle, as a grease cup 8^a, through a port 8^b. This chamber is adapted to communicate by a smaller port 9 with a section 10 in the head assembly 2 of

the conduit through which the pressure fluid is supplied to the cylinders. The shaft 1 is provided with a central bore 11 communicating at one end with said chamber and having ports 12 and 13 adapted to conduct lubricant from the chamber 8 to the working parts of the motor, to be referred to hereinafter. The operating end of the shaft 1 may be provided with any suitable tool, a grinding wheel 14 being shown as secured to such shaft end by means of nuts 15 and 16.

The "dead" head of the motor is provided with a bore comprising an internally threaded portion 17, a cylindrical portion 18 adapted to communicate with the conduit section 10 through a port 19, and a reduced cylindrical portion 20. Rotatably mounted within the cylindrical chamber formed at 18 is a valve comprising a cylindrical cup 21 which is open toward the threaded section 17 of the bore, the opposite end of the cup being closed and adapted to abut against an annular shoulder provided between the bore sections 18 and 20. From the closed end of the cup 21 there projects a cylindrical stem 23 which fits within the bore section 20, and from said stem there projects an annular extension 24 to which there is secured an operating arm 25. A pipe connection 26 comprising a part or section of the conduit for the supply of pressure fluid to the cylinders is threaded into the bore section 17. Mounted on this pipe connection is a sleeve 27 having an arm 28 projecting therefrom and connected to the arm 25 by means of screws 29. The cup constitutes a throttle or controlling valve for regulating the volume of pressure fluid which may pass from the conduit 26 to the conduit section 10, the said valve being provided with a tapered port 30 of about 180° in extent, whereby, by rotation of the valve in the direction indicated by the arrow on Fig. 8, the supply of pressure fluid to the conduit section 10 may be gradually increased, and by rotation in the opposite direction may be gradually decreased. It will be observed that a slight clearance is provided between the open end of the cup valve 21 and the adjacent end of the pipe section 26. By the construction and arrangement of parts, the unbalanced pres-

sure of the pressure fluid entering the pipe section 26 will hold the valve firmly to its seat, and leakage of such fluid will be prevented.

5 The delivery end of the conduit section 10 is provided with a port 31 which is adapted to communicate with a bore 32, and through the delivery end 32^a of said bore in the head 6, with the cylinders. Mounted in said bore 10 32 is a plunger valve 33 the front end of said valve being tapered as shown at 33^a to cooperate with the similarly tapered valve seat 32 at the rear of the port 32^a. The valve 33 is provided with an annular channel 35 15 adapted to register with the port 31 and communicating with a diagonal port 36 extending through the front of said valve. It will be apparent that pressure fluid from the conduit section 10 may pass through the groove 20 35 into the port 36 irrespective of the position of the valve, provided only that the groove 35 registers with the port 31. The rear end of the valve 33 is provided with a packing ring 37 secured thereto by means of a washer 25 38 and a screw 39. Mounted within the bore 32 is a helical spring 40 bearing at one end against the washer 38 and at its opposite end against a plug 41 which is threaded into said bore, the said plug being provided with a 30 venting port 42 whereby, should any pressure fluid leak into the bore 32 past the valve 33, it will be vented to the atmosphere and not interfere with the proper functioning of said valve.

35 As hereinbefore stated, the heads 6 and 7 constitute the end walls of the motor cylinders. Two such cylinders and two rotary pistons are shown herein, and the construction and manner of assembling these parts 40 of the motor will now be described.

43 denotes a head, similar in contour to the heads 6 and 7 and equidistant therefrom. This intermediate head is sleeved upon the shaft 1 and is provided with a port 44, preferably in alignment with the port 32^a, and 45 with a port 45 the purpose of which will be explained hereinafter. On each side of the head or partition 43, the shaft 1 has mounted thereupon a rotary piston, indicated at 46 50 and 47, respectively, and arranged 180° apart on said shaft. Each of these rotary pistons is shown as secured to the shaft by means of a headed screw 48, 49 threaded into said shaft and entering a recess 50, 51, provided 55 respectively therefor in each piston, each recess extending into its piston from the end which faces the intermediate wall or partition 43.

Each of these rotary pistons is mounted 60 within a combined cylinder and muffler-chamber casting shown in section in Fig. 3, each of these castings being interposed between the intermediate head or partition 43 and the heads 6 and 7, respectively. One of 65 the cylinders is indicated at 52 and the axis

of said cylinder coincides with the axis of the shaft 1. Cast with each cylinder is a fluid distributing chamber 53, the chamber at the right hand end of Fig. 1 communicating with the port 32^a and with the distributing chamber of the other cylinder through the 70 port 44. The chamber 53 of each cylinder communicates with the cylinder proper through a port 54. In addition to the chamber 53, each cylinder casting is provided with 75 a muffler chamber 55 extending downwardly from the chamber 53 and provided with a plurality of exhaust outlets 56 near the bottom thereof. In order to facilitate the discharge of the exhaust gases, each cylinder is 80 enabled to discharge such gases not only through the muffler chamber associated therewith but through the muffler chamber of the other cylinder. For this purpose, the intermediate wall or partition 43 is provided with 85 a port 57 registering with and establishing communication between both muffler chambers.

Each rotary piston 46 and 47 is provided with an external cylindrical surface adapted 90 to contact with the inner wall of its cylinder and of such extent as simultaneously to seal the inlet port 54 and the exhaust port 58 thereof. From each side of this surface, the curvature of the outer wall of each piston is 95 uniform and gradually increases with the corresponding decrease in the length of the radii, so that a crescent-shaped chamber 52^a will be provided between the piston and the cylinder as shown in Fig. 3. 100

In order to distribute the pressure fluid in operative relation to each piston, each cylinder is provided with an abutment 59 105 mounted in the cylinder casting and in grooves 60 and 61 provided respectively in each of the heads 6 and 7 and in the opposite sides of the intermediate head or partition 43. Each of these abutments is interposed 110 between the inlet port 54 and the exhaust port 58 of its cylinder, and preferably projects into the cylinder chamber 52^a in a radial direction. For the purpose of holding the inner end of each abutment in engagement 115 with its rotary piston prior to the supply of pressure fluid to the cylinders, a light spring 62 is provided, the inner end of said spring surrounding the head of a bolt or screw 63 projecting from the outer face of the abutment and the outer end of said spring bearing 120 against a plug 64 threaded into a boss 6. As soon as there is any material pressure fluid entering the chambers 53, the unbalanced pressure of such fluid acting on top of the abutments will hold them positively 125 to their seats upon their respective pistons.

The motor may be assembled by first placing the intermediate wall or partition 43 in the proper position upon the shaft. The rotary pistons will then be slipped over their 130 respective ends of the shafts with their re-

cesses 50 and 51 receiving the heads of the key screws 48 and 49, respectively. The cylinder castings and the abutments therein will then be slipped over their respective pistons. The "live" and the "dead" head will then be applied to the shaft and the said heads, cylinders, and the intermediate head will be secured together by means of the through bolts 64, it being noted that the said heads are provided with seats, indicated at 65 and 66, for the ends of the cylinders and for the ends of the muffler chambers. The ends of the cylinders will be closed by the three heads and the ends of the muffler chambers 55 and of the distributing chambers 53 will also be closed by said heads, with the exception of the ports 44 and 57 in the intermediate head, the purpose of which has been hereinbefore explained.

With the parts constructed and arranged as described, when it is desired to operate the motor, the operator will support the tool as a whole by grasping the outer portion or extension of the head or bracket 2 and the sleeve-like extension 5 of the head or bracket 3, these portions constituting the supporting handles of the tool, and he will turn the valve 21 by means of the handle sleeve 27 so as to admit pressure fluid through the conduit section 26 into the conduit section 10. This fluid will be supplied to both cylinders through the ports 31 and 36 and the distributing chambers 53. With no load on the motor and a fixed opening of the valve 21, the speed of the motor will be constant. When the motor is loaded, as by applying the grinding wheel 14 to the work, pressure will accumulate on the delivery side of the valve 33, thereby moving said valve rearwardly and increasingly opening the port 31. Within the limits of its capacity, the motor will therefore operate at constant speed under varying load conditions with a given area of opening of the port 30. The greater the load, the greater will be the back pressure of the fluid and the greater the movement of the valve 33 to admit pressure fluid in accordance with such load. As the load decreases, the back pressure also decreases, and the valve 33 will be moved toward closing position by its spring 40.

Because of the arrangement of the pistons at 180° apart, the exhaust through their respective cylinders will be unequal except at two points only in the revolution of each piston; in all other positions in the revolutions of such pistons, the exhaust will be unequal. By discharging the exhaust from each cylinder into both muffler chambers, the exhaust as a whole will be evenly distributed and the motor will run smoothly. By exposing the lubricant in the chamber 8 to the pressure of the fluid in the conduit section 10, the pressure on the lubricant within the bore 11 and upon the lubricant supplied to the sides of the pistons and to the bearings in the sleeve 5 will be equalized, so that the lubricant may be sup-

plied by centrifugal action from the interior of the shaft through the port 12 to the sides of the pistons as well as through the port 13 to the bearing for the shaft provided in the "live" head sleeve 5.

Each of the rotors is of hard wear-resistant metal while the cooperating abutment is of softer material, such as fiber or soft metal. By making the abutments of such material, the rotors will not be cut down by the abutments, as the latter take the wear. This enables the rotors to operate efficiently for a long period without the development of leakage between the rotors and their cylinder walls.

Having thus described our invention what we claim is:—

1. In a rotary motor, the combination of a cylinder, a rotor therein, a shaft extending through said cylinder and to which said rotor is secured, said shaft having a bore for lubricant and a port extending from said bore to conduct lubricant to said cylinder, a fluid pressure conduit communicating with said cylinder, and a connection between said conduit and the supply portion of said bore thereby to equalize the pressure upon the said port and upon the supply end of said bore.

2. In a rotary motor, the combination of a cylinder, a rotor therein, a shaft extending through said cylinder to which said rotor is attached, the said shaft having a bore extending from one end thereof and a port communicating with said bore and adapted to supply lubricant to said rotor within said cylinder, a chamber from which lubricant is supplied to said bore, a fluid pressure conduit communicating with said cylinder, and a port establishing communication between the said chamber and the said conduit.

3. In a rotary motor, the combination of a plurality of cylinders, a rotor in each cylinder, a "live" head at one end of the cylinders and a "dead" head having a sleeve bearing at the opposite end of said cylinders, a shaft mounted in said heads and said sleeve, the "live" head being provided with a chamber for lubricant, a shaft extending from said chamber through said cylinders and mounted in said sleeve and being secured to said rotors, the said shaft having a bore extending from said chamber into said sleeve and being provided with ports establishing communication between said bore and the cylinders and between said bore and the sleeve, and a fluid pressure supply conduit communicating with said cylinders and having a port establishing communication between said chamber and said conduit.

4. In a rotary motor, the combination of a cylinder, a rotor in said cylinder, a "live" head at one end of the cylinder and a "dead" head having a sleeve bearing at the opposite end of said cylinder, a shaft mounted in said heads and said sleeve, the "live" head being

provided with a chamber for lubricant, a shaft extending from said chamber through said cylinder and mounted in said sleeve and being secured to said rotor, the said shaft having a bore extending from said chamber into said sleeve and being provided with ports establishing communication between said bore and said cylinder and between said bore and said sleeve, and a fluid pressure supply conduit communicating with said cylinder and having a port establishing communication between said chamber and said conduit.

5. In a rotary motor, a casing portion having two adjoining cylinders, an intermediate wall between the cylinders and two end walls closing the ends of the cylinders, one end wall having a bracket with a handle portion and the other end wall having a sleeve-like extension forming a handle portion, a shaft extending through said sleeve-like extension, through the cylinders and intermediate wall, two rotors eccentrically mounted on the shaft and disposed 180° apart and located in said cylinders, the casing portion having a lateral extension with radially disposed guideways communicating with the cylinders and with inlet and exhaust chambers on opposite sides of the guideways, and a sliding abutment in each guideway having its inner edge in engagement with the annular wall of the associated rotor, the inlet chamber extending through the intermediate wall and communicating with both guideways so that the pressure of the air will be exerted on the abutments to hold them in engagement with the rotors.

6. In a rotary motor, the combination with a casing portion having two coaxial cylinders, an intermediate wall and two end walls, each of the latter having a projecting handle portion, one being in the form of a sleeve-like extension, a shaft mounted therein and extending through the cylinders and intermediate wall, two annular rotors in the cylinders eccentrically mounted on the shaft, the casing portion having a segmental lateral extension containing two radial abutment guideways, and inlet and outlet chambers located on opposite sides of the guideways, the latter communicating with the inlet chamber and the outlet chamber having a plurality of exhaust openings, and abutments in said guideways having their inner edges pressed into engagement with the rotors.

7. In a rotary motor, the combination with a casing portion having two coaxial cylinders, an intermediate wall and two end walls, each of the latter having a projecting handle portion, one being in the form of a sleeve-like extension, a shaft mounted therein and extending through the cylinders and intermediate wall, two annular rotors in the cylinders eccentrically mounted on the shaft, the casing portion having a segmental lat-

eral extension containing two abutment guideways and inlet and outlet chambers located on opposite sides of the guideways, the latter communicating with the inlet chamber and the outlet chamber having a plurality of exhaust openings, and abutments in said guideways having their inner edges pressed into engagement with the rotors, the outer wall of said segmental lateral extension having removable means in line with the abutments and serving to close the outer ends of the guideways.

8. In a rotary motor, the combination with a casing portion having two coaxial cylinders, an intermediate wall and two end walls, each of the latter having a projecting handle portion, one being in the form of a sleeve-like extension, a shaft mounted therein, and extending through the cylinders and intermediate wall, two annular rotors in the cylinders eccentrically mounted on the shaft, the casing portion having a segmental lateral extension containing two abutment guideways, and inlet and outlet chambers located on opposite sides of the guideways, the latter communicating with the inlet chamber and the outlet chamber having a plurality of exhaust openings, and abutments in said guideways having their inner edges pressed into engagement with the rotors, the outer wall of said segmental lateral extension having adjustable means in line with the abutments, and springs interposed between said means and the abutments.

In testimony whereof, I hereunto affix my signature.

EDWARD J. MOORE.

In testimony whereof, I hereunto affix my signature.

RAYMOND H. MOORE.