Dec. 23, 1958 C. M. TURSKY 2,865,294

HYDRAULIC PRESSURE BOOSTER MOTOR

Filed March 12, 1957 2 Sheets-Sheet 1

Fig. 1.

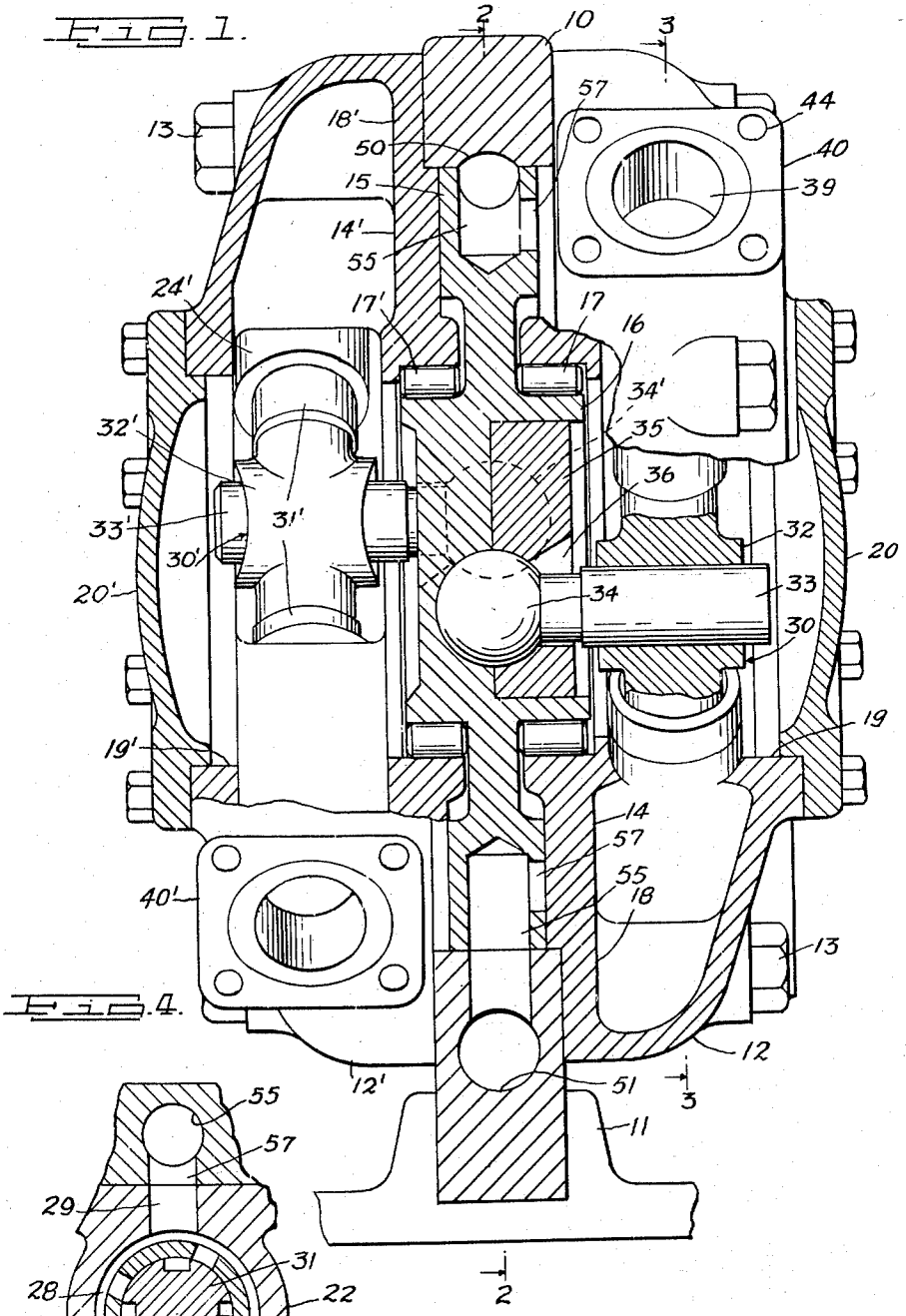


Fig. 4.

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FIG. 2.

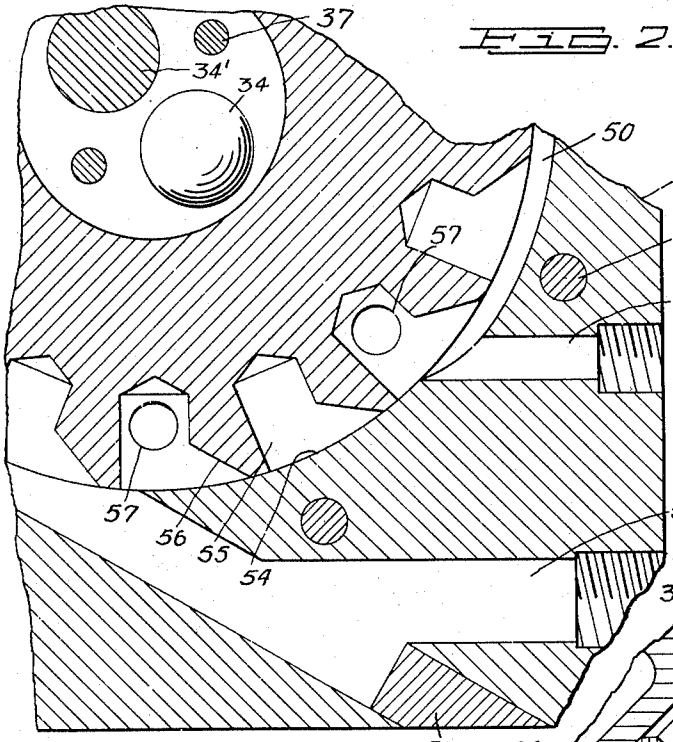
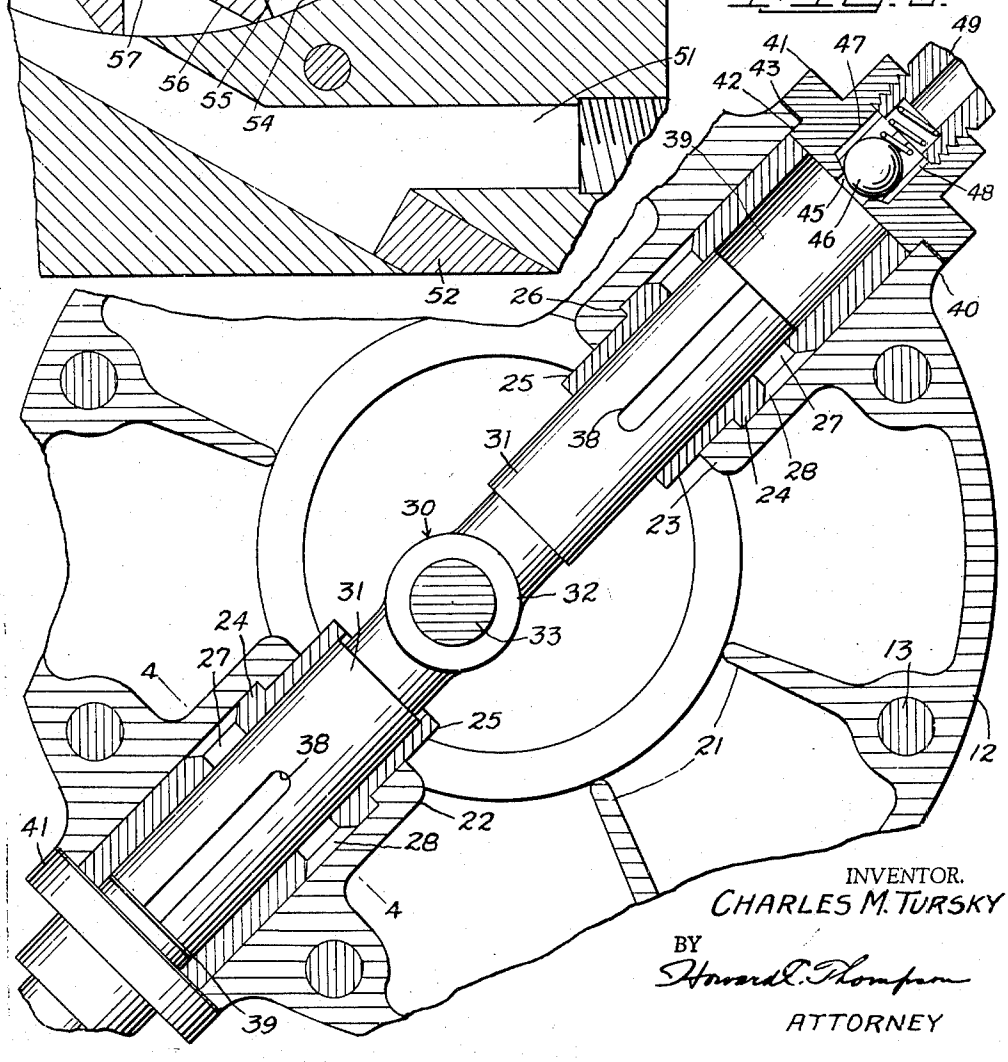


FIG. 3.



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HYDRAULIC PRESSURE BOOSTER MOTOR

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18 Claims. (Cl. 103—57)

This invention relates to a hydraulic pressure booster motor, wherein the casing structure of the motor comprises a center rotor casing and a pair of similar side cylinder casings having angularly disposed pairs of cylinders arranged therein with crank means coupled with the rotor in said rotor casing for transmitting reciprocating, as well as rotary, oscillating movement to pairs of pistons operating in the cylinder pairs in controlling intake and discharge of the hydraulic pressure medium with respect to said cylinders.

Still more particularly, the invention deals with a motor of the character described, wherein the pairs of pistons have circumferentially spaced ports extending longitudinally of the outer end portions of the pistons and intermittently registering with circumferentially spaced ports of cylinder liners in control of transmission of the hydraulic medium to the cylinders and high pressure discharge of the medium through the head ends of said cylinders.

The novel features of the invention will be best understood from the following description, when taken together with the accompanying drawing, in which certain embodiments of the invention are disclosed and, in which, the separate parts are designated by suitable reference characters in each of the views and, in which:

Fig. 1 is an irregular broken vertical section through a motor made according to my invention, showing parts of the construction in elevation and omitting parts for simplification in the showing.

Fig. 2 is a partial section on the line 2—2 of Fig. 1.

Fig. 3 is a partial section on the line 3—3 of Fig. 1, with parts of the construction broken away and parts shown in elevation; and

Fig. 4 is a partial section on the line 4—4 of Fig. 3.

Considering Fig. 1 of the drawing, it will appear that my improved motor comprises a central rotor casing 10 arranged upon suitable feet or supporting bases, one of which is indicated, in part, at 11. Secured to opposed sides of the rotor casing 10 are a pair of similar cylinder casings 12, 12', these casings being secured by a plurality of circumferentially spaced bolts, indicated, in part, at 13.

The cylinder casing 12 alone will be described in detail and is shown, in part, in Fig. 3 and, as and where portions of the companion cylinder casing 12' are shown in Fig. 1, primed references will be applied.

The casings 12, 12' include inner adjacent wall portions 14, 14', which fit snugly upon opposed sides of a rotor 15 mounted in the rotor casing 10. The rotor 15 has an extended hub portion 16 with roller bearing mountings, as at 17, 17', in the walls 14, 14', as diagrammatically illustrated in Fig. 1 of the drawing. It will also appear that the walls 14, 14' have portions 18, 18' which fit snugly upon opposed sides of the rotor casing 10, thus completely housing the rotor 12 between the casings 10, 12, 12', particularly at the outer peripheral portion thereof.

The outer walls of the casings 12, 12' flare outwardly

to central openings 19, 19', in which are fitted closure plates 20, 20', the latter giving access to the interior of the motor as and when desired. The casings 12, 12' are reinforced by circumferentially spaced ribs 21, as indicated, in part, in Fig. 3.

Considering now Fig. 3, it will appear that the casing 12 has opposed cylinders 22, 23 arranged at substantially 45° to the horizontal and it will be understood that the companion cylinder 12' has a similar arrangement of cylinders which are arranged at 90° to the cylinders 22, 23. Arranged in the cylinders 22, 23 are similar liners 24, the liners 24' being indicated, in part, diagrammatically in Fig. 1. These liners have reduced inner ends 25 forming shoulders, as at 26, seating in the cylinders 22, 23 and suitable means, not shown, is provided for definitely keying the liners against rotation in the respective cylinders. The liners 24 have circumferentially spaced intake ports 27, which open into annular grooves 28 in the periphery of the liners, the grooves 28 registering with ports 29 in the cylinders 22, 23, one of these ports being shown, for example, in Fig. 4 in the cylinder 22, it being understood, in this connection, that the cylinder 23 has a port similar to the port 29.

Mounted in and operating in the liners 24, 24' are piston units 30, 30', each having a pair of opposed pistons 31, 31' operating in the liners 24, 24'. The piston units 30, 30' have, centrally thereof, hub portions 32, 32', in which are mounted crank pins 33, 33', the pins having inner ball ends 34, 34' having bearing supports in the hub portion 16 of the rotor 15, the ball ends being retained in position in the hub portion by a removable bearing plate 35. This plate, as well as the opposed side of the bearing 16, is apertured, as seen at 36 in Figure 1, to provide clearance for the swinging movement of the crank pins 33, 33', as will be apparent. The plate 35 is held in position by screws, as indicated at 37 in Fig. 2.

The pistons 31 have circumferentially spaced grooves 38 extending longitudinally of the outer end portions thereof and opening through the head ends of the pistons to register with the cylinder ends 39 of the liners 24.

It will appear from a consideration of Fig. 2 that the crank pins 33, 33' are offset in opposite directions with respect to the axis of rotation of the rotor 15, so that, when the upper piston 31 is in its lower position, the corresponding upper piston 31' of the opposed cylinder will be in its raised position, it being apparent, in this connection, that the opposed pistons are in the opposed positions.

Mounted on the outer flanged ends 40, 40' of the respective cylinders are detachable heads 41, the heads being omitted in Fig. 1 for simplification in the illustration. However, here again, the brief description of the heads 41 will be applicable to the heads applied to the companion cylinders illustrated at the left of Fig. 1 of the drawing.

The heads 41 include reduced portions 42 fitting snugly in the cylinders 39 and sealing said ends of the cylinders, gaskets 43 being preferably employed to seal the heads on the flanges 40. The fastening bolts for the heads are not shown in Fig. 3, but the apertures for reception of said bolts are diagrammatically illustrated at 44 in Fig. 1. The heads 41 have discharge ports 45 normally closed by spring-pressed ball valves 46 mounted in a large diameter bore 47, having circumferentially spaced ribs 48 to centralize the ball valves 46 therein. Coupled with the outer ends of the head is an exhaust or discharge pipe 49, which communicates with the bore 47, as will be apparent. It will be understood, in this connection, that, in the pressure discharge of the hydraulic medium from the cylinders 39, the ball valves 46 are readily unseated and these check valves are used simply to insure seating

in the opposed stroke of the pistons in the respective cylinders.

Turning now to the rotor casing **10**, it will appear that this casing has, centrally thereof, a circumferentially extending groove or passage **50**, which starts from a position adjacent the inner end of an intake port **51**, note Fig. 2, plugged, as seen at **52**, to a discharge port **53** arranged directly above the port **51** and, between these two positions, the rotor **15** fits snugly on the surface **54** so that the pressure medium is sealed from passage from the port **53** to communication of the port **51** with the annular passage **50**.

The rotor **15** is shown partially in sectional detail in Fig. 2 of the drawing. The rotor has a multiplicity of circumferentially spaced pockets **55** in the periphery thereof, the pockets having, at one side thereof, flared portions **56** for extending admission of the charge of the pressure medium into the pockets from the port **51**, as will be apparent in rotation of the rotor **15** in a clockwise direction, as noted in Fig. 2. It will appear from this figure of the drawing that alternate pockets **55** have discharge ports **57** opening through one side surface of the rotor; whereas, the intermediate pockets will have similar ports opening through the opposed side surface of the rotor. Thus, as the rotor is driven by the predetermined pressure of a hydraulic medium introduced into the port **51**, this medium, under such pressure, passes into the passage **50** and the respective pockets **55** and is discharged into the annular grooves **28** of the respective liners **24** through the ports **29**, note Fig. 4, as and when the ports **57** register with said ports **29**.

Considering Fig. 4 of the drawing, it will be apparent that, when the pistons **31** are in the pressure discharge position for high pressure discharge of the pressure medium from the cylinders **39**, in other words, the position of the lower piston **31** in Fig. 1, the ports or passages **38** will be in non-registering position with the ports or passages **27**. However, in the cycle of operation of the motor, as this piston is moved inwardly by rotation of the crank **33**, the piston **31** is rotated, bringing the ports **38** in registering position with the ports **27**, thus timely admitting the pressure medium into the cylinder **39** and the completion of this intake stroke is noted by the upper piston **31** in Fig. 3, it being understood that, at the completion of this inward stroke of the upper piston **31**, the ports **27**, **38** will come to a closed position, similar to that illustrated in Fig. 4 and, during the upward or compression stroke of the upper piston **31** and until such piston reaches the limit of its upward stroke, these ports will remain closed with respect to each other; whereupon, at the beginning of the downward stroke of said upper piston, the ports will again open, thus timely admitting the pressure medium into the upper cylinder **39** until such time as such upper piston **31** reaches the bottom of its intake stroke, at which time the ports **27**, **38** will again close and this cycle of operation continues in both cylinder units in the operation of the rotor.

From the foregoing, it will be apparent that the motor has what might be termed a three-motion operation, namely the continuous rotary motion in the drive of the rotor, the reciprocating motion contributed to the piston units and the rotary reciprocating motion contributed to the piston units by virtue of the crank arrangement employed. The crank pins **33**, **33'** assume the different angular positions in their movement from the positions shown in Figs. 1 and 3 to the positions where the pin **33** is uppermost and the pin **33'** is lowermost and, again, in movement of the pin **33** from its uppermost to its lowermost position, these positions being described with respect to the longitudinal axis of the cylinder liners. It is by virtue of this rocking or angular movement of the pins **33**, **33'** that the clearance openings **36** are provided.

It will be understood that a hydraulic medium introduced into the motor for operation of the rotor at one pressure can be discharged from the motor at a higher

pressure through the heads **41** for service use of any type or kind and a booster motor of the type and kind under consideration can be utilized in many fields, particularly where increase of pressure of the hydraulic medium is desired.

It will be understood that the rotor diameter is large as compared with the stroke of the pistons of the piston units and, in the same sense, it will appear that the volume of the pressure medium in the rotor and rotor casing is greater than the capacity of the cylinders. These factors insure efficient operation of the motor at all times.

In the use of booster motors of the type and kind under consideration, the booster pressure discharge from the respective cylinders will be directed to a storage tank and, as and when the pressure in the storage tank reaches a predetermined pressure, the booster motor will automatically stop and will remain idle until such time as the pressure in the storage tank drops to a point requiring re-charge by the booster motor.

By utilizing the liners in the cylinders, these liners can be initially adjusted for positioning of the liner ports with respect to the piston ports in attaining the most efficient operation of the motor. When this has been attained, the liners are then definitely retained or keyed in the adjusted position. It is also desirable to point out, at this time, that the bores of the liners, as well as the surfaces of the pistons, are highly finished so that the pistons will operate in the liners with close tolerances, thus dispensing with the use of conventional piston rings.

It will be apparent that the piston units, operating in the opposed cylinders and in combination with the ports of said cylinders in their rotary reciprocating motion, act as a valve stage in the control of the transmission of the pressure medium from the rotary stage to the cylinder stage, which charge is intermittent through the ports **57** as they register with the ports **29**. In this operation, it will be understood that the cylinders are charged with the pressure of the medium as discharged from the rotor through said ports into the respective cylinders. In the aforesaid operation, it will be apparent that the introduction of the pressure medium into the cylinder results in the action of this pressure upon the piston in assisting in the drive of the piston unit during the booster pressure discharge of the opposed piston of said unit. Considering, in this connection, Fig. 3 of the drawing, it will be apparent that the pressure medium introduced into the upper cylinder **39** assists in driving the upper piston **31** downwardly to assist the rotor in the drive of the lower piston **31** in the lower cylinder for the booster pressure discharge through the head of said lower cylinder.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A booster motor of the character described, comprising a rotor casing, a pair of similar cylinder casings fixed to and bearing upon opposed sides of the rotor casing, a multiple pocket rotor rotatably mounted in the rotor casing and having bearing engagement with adjacent surfaces of the cylinder casings, the rotor having a hub portion, a pair of oppositely directed crank pins having ball mountings in the hub of said rotor at equally spaced opposed positions with respect to the axis of said rotor, each cylinder casing having spaced cylinders with cylinder liners therein, the cylinders of one casing being disposed at 90° to the cylinders of the opposed casing, piston units operating in the liners of spaced cylinders, each unit having a hub portion mounted on its associated crank pin and a pair of pistons at end portions of the unit, the rotor casing having intake and discharge ports for a pressure medium, said rotor casing, intermediate said ports, having a circumferentially extending passage, the pockets of said rotor registering with said passage and said intake and discharge ports, adjacent walls of the cylinder casings having circumferentially spaced ports

adapted to register with ports of alternate pockets of said rotor, cylinder heads at outer ends of said cylinders, said cylinder heads having check valve controlled discharge ports, the liners of said cylinders having annular grooves in registering alinement with the circumferentially spaced ports on adjacent walls of said cylinder casings, said pistons having circumferentially spaced longitudinally extending grooves at outer end portions thereof opening into the ends of the cylinders, and said liners having circumferentially spaced ports registering with the annular grooves of said liners and with the grooves of said pistons at predetermined intervals in the cycle of operation of the rotor for admitting the pressure medium into the cylinder ends, preparatory to pressure discharge of the medium from said cylinders through the exhaust ports of said heads.

2. A structure as defined in claim 1, wherein the hub portion of the rotor includes a removable bearing plate, and said bearing plate and hub portion being apertured to compensate for rotary and angular movement of the crank pins.

3. A structure as defined in claim 2, wherein anti-friction bearings are disposed between the hub portion of the rotor and the walls of the cylinder casings.

4. A structure as defined in claim 3, wherein the cylinder casings have large openings centrally of outer sides thereof and closure plates for said openings.

5. A structure as defined in Claim 1, wherein the pockets of the rotor include flared outer portions directed toward the intake port of the rotor casing.

6. A structure as defined in claim 5, wherein the outer ends of the cylinders of each cylinder casing are flanged for mounting of the heads thereon, and said heads include portions extending into the cylinders and abutting the cylinder liners.

7. A structure as defined in claim 6, wherein the cylinder casings include circumferentially spaced reinforcing ribs intermediate the cylinders of said casings.

8. In a booster motor of the character described, employing a central rotor having circumferentially spaced pockets, with means for injecting a pressure medium into the pockets in rotation of said rotor, a pair of piston units at opposed sides of the rotor, each unit comprising a pair of pistons operating in opposed cylinders, means in operative engagement with the rotor for reciprocating and rotary oscillating the piston units in control of admission of the pressure medium from the rotor pockets to the head end portions of the cylinders, in which said units operate and in pressure discharge of said pressure medium through head ends of said cylinders, and one group of pockets directing the pressure medium to one piston unit and the other group directing the pressure medium to the other piston unit.

9. A structure as defined in claim 8, wherein one piston unit and its opposed cylinders are at right angles to the other piston unit and its cylinders.

10. A structure as defined in claim 9, wherein the rotor operates in a rotor casing, the rotor casing having an intake port for introduction of the pressure medium, an exhaust port for the pressure medium, and the rotor casing, intermediate said intake and exhaust ports, having a circumferentially extending groove communicating with the pockets of the rotor.

11. A structure as defined in claim 10, wherein the pistons of each unit operate in liners fixed in the opposed cylinders for each unit.

12. A structure as defined in claim 11, wherein the pistons of each unit and the liners, in which the pistons operate, having intermittently registering ports timely controlling admission of the pressure medium to head end portions of the cylinders.

13. A structure as defined in claim 8, wherein said second named means comprises crank pins having universal mountings in the hub portion of said rotor and a slidable and rotatable mounting in each of the piston units.

14. A booster motor of the character described, comprising a fluid pressure driven rotor, two pairs of piston units, means movably supported in the rotor and operatively engaging said unit for imparting reciprocating and rotary oscillating motions to said piston units in the drive of said rotor, opposed cylinders in which the pistons of said units operate, the cylinders of one unit being positioned at right angles to the cylinders of the opposed unit, and means for timely introducing the pressure fluid driving said rotor into the head ends of pistons of said units for booster pressure discharge of the medium from head end portions of the cylinders of said units in the cycles of operation of the motor.

15. A structure as defined in claim 14, wherein the rotor includes a hub portion the cylinders of said piston units constitute part of cylinder casings sealed upon opposed sides of said rotor, and anti-friction bearings between the hub portion of the rotor and said cylinder casings.

16. A structure as defined in claim 14, wherein said first named means comprises crank pins having universal bearings in the hub portion of said rotor.

17. A structure as defined in claim 14, wherein the piston units are disposed at opposite sides of the rotor, and said rotor having independent discharges of the fluid pressure at said sides for directing the same to the respective piston units and to said second named means.

18. A structure as defined in claim 17, wherein the cylinders include heads, and said heads having check valves controlling discharge of the boostered pressure medium through said heads.

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