

March 22, 1966

T. S. REED
REVERSIBLE MOTOR

3,241,457

Filed May 6, 1964

3 Sheets-Sheet 1

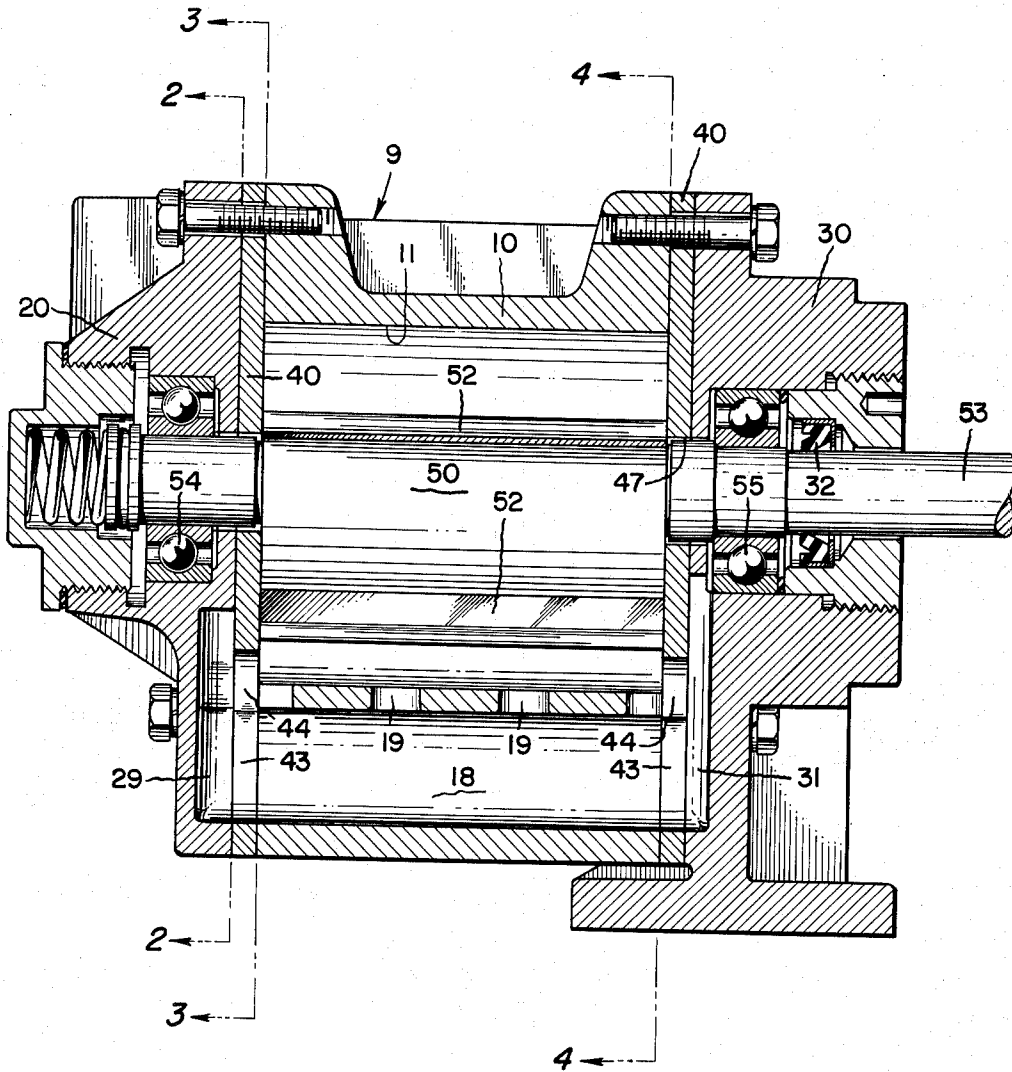


FIG. 1

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3 Sheets-Sheet 2

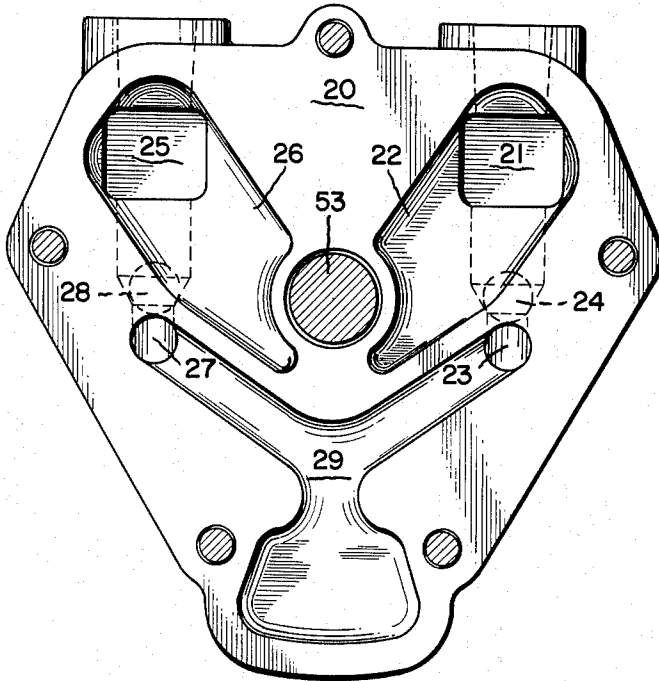


FIG. 2

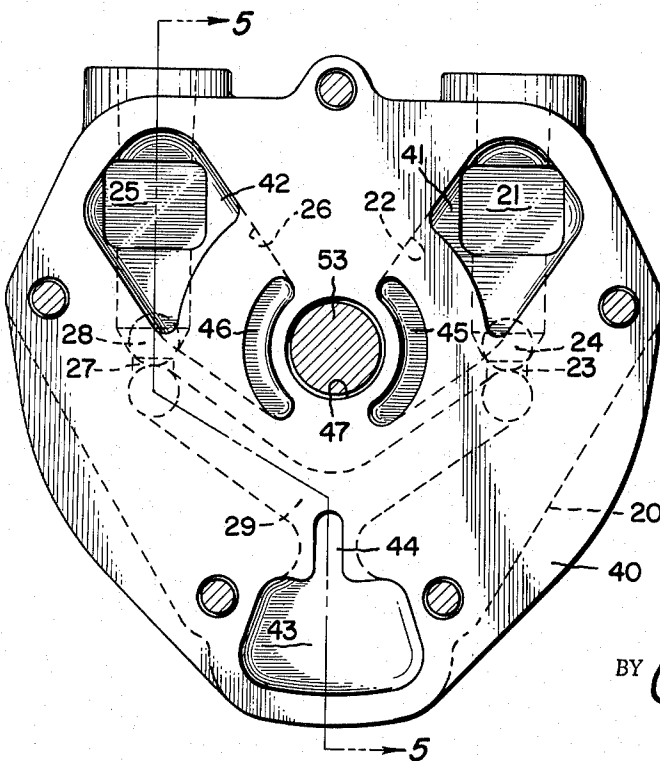


FIG. 3

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3 Sheets-Sheet 3

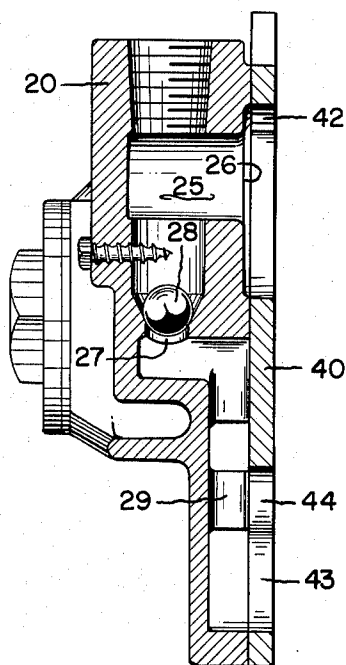
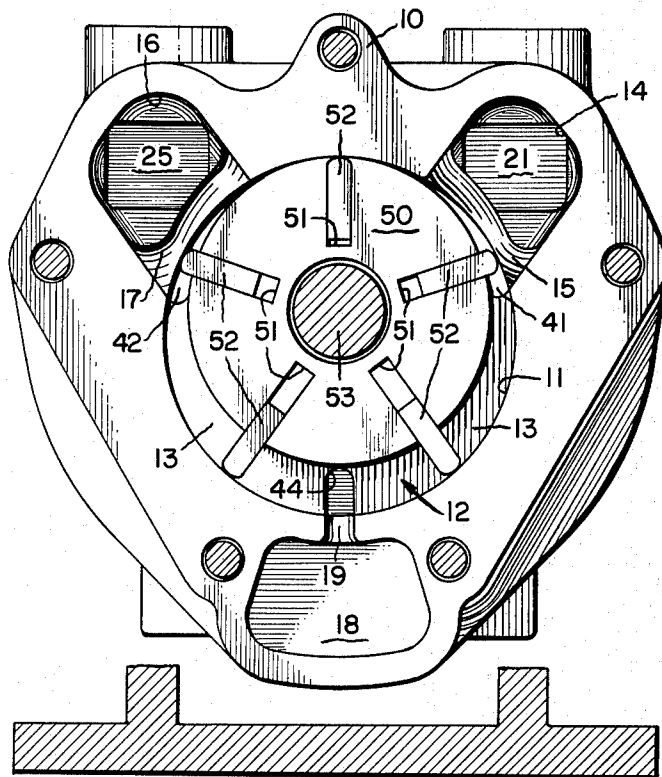


FIG. 5

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1

3,241,457

REVERSIBLE MOTOR

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6 Claims. (Cl. 91—135)

This invention relates generally to reversible vane type fluid motors and more particularly to means for porting pressure fluid to the motor chambers and the exhaust fluid therefrom.

The present invention is particularly adapted to such motors having a single crescent shaped working chamber having flow connections at both ends each providing inlet flow for rotation of the rotor in one direction and outlet flow for rotation in the reverse direction. A single intermediate flow path is provided for primary exhaust during rotation in both directions porting the primary exhaust to the final exhaust from the end of the working chamber. Although two exhaust paths and a single inlet path are provided, only two motor connections are required.

Accordingly, an object of the present invention is to provide a single primary exhaust path, in a reversible vane type motor with two flow connections, which automatically ports primary exhaust to one or the other of the flow connections discharging final exhaust according to the direction of operation of the motor.

Another object of the present invention is to provide the foregoing motor wherein the automatic porting is accomplished in response to inlet pressure fluid in accordance with the flow connection receiving such inlet pressure fluid.

And another object of the present invention is to provide the foregoing motor wherein the two flow connections and the automatic porting means is disposed in an end cap thereof.

This invention contemplates a reversible fluid actuated motor comprising; a stator having an axial bore closed at its ends; a rotor eccentrically disposed in the axial bore defining with the axial bore a crescent shaped motor chamber; a plurality of angularly spaced vanes movable radially in the rotor engaging the bore and dividing the motor chamber into a plurality of pockets which vary in area as the rotor turns; the stator having a pair of flow paths communicating with the ends of the motor chamber each adapted to receive pressure fluid and to exhaust fluid from the motor chamber when the other path receives pressure fluid; and an exhaust passage communicating with the pair of flow paths and the motor chamber intermediate its ends; and valve means disposed in the stator responsive to pressure fluid blocking communication between the exhaust passage and the flow path receiving pressure fluid.

The foregoing and other objects and advantages will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings wherein one embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawings are for illustration purposes only and are not to be construed as defining the limits of the invention.

FIG. 1 is a sectional view of a vane type fluid motor made in accordance with the present invention,

FIGS. 2, 3 and 4 are sectional views of the novel motor taken on lines 2—2, 3—3 and 4—4, respectively, of FIG. 1, and

2

FIG. 5 is a sectional view of an end cap and the adjacent wear plate of the novel motor taken on line 5—5 of FIG. 3.

A motor, made in accordance with the present invention, has a housing or stator 9 formed by a rotor casing 10 with a through bore 11 that is closed at its ends by cover members or end caps 20 and 30 connected to the casing by fasteners in any manner well known in the art. A port or wear plate 40 is connected between the casing 10 and each of the cover members 20 and 30.

A rotor 50 is disposed eccentrically in bore 11 forming therebetween a crescent shaped working or motor chamber 12, and is rotatable with its shaft or shaft studs 53 rotatably supported by bearings 54 and 55 mounted in covers 20 and 30, respectively. Rotor 50 has a plurality of angularly spaced, radially disposed axial slots 51, and a plurality of vanes 52 are provided each being slidably disposed in one of the slots. Vanes 52 extend the full axial length of rotor 50 forming running seals at their ends with plates 40, and are urged outwardly forming running seals with bore 11 and dividing the crescent shaped working chamber 12 into a plurality of motor pockets 13 that vary in area or progressively increase to a maximum then decrease during motor operation.

Casing 10 has three axial passages 14, 16 and 18, passage 14 communicating with one end of chamber 12 through a plurality of axially spaced bores 15; passage 16 communicating with the other end of chamber 12 through a plurality of axially spaced ports 17; and passage 18 communicating with the chamber 12, midway between ports 15 and 17, through ports 19. Thus, passage 18 and ports 19 are disposed on an axial plane that passes through the axis of bore 11 and the axis of rotation of rotor 50.

Each of the wear or port plates 40 has three ports 41, 42 and 43 that are axially aligned and conform in shape with axial passages 14, 16 and 18 respectively; port 43 having a recess or groove 44 that extends the size of the port and overlaps the end of bore 11. Each of the wear or port plates 40 also have a circular opening 47 for the shaft 53 and a pair of arcuate ports 45 and 46 spaced outwardly from and concentric with opening 47; ports 45 and 46 being spaced substantially radially inwardly from ports 41 and 42, respectively, toward opening 47 in axial alignment with bottoms of rotor slots 51.

End cap 20 has a pair of ported chambers 21 and 25 each being adapted to receive pressure fluid as the motor inlet and to exhaust such fluid as the motor outlet when the other chamber is receiving motive pressure fluid. Chamber 21 includes a recess or groove 22 in the cap 20 adjacent plate 40 which conforms in shape to ports 41 and 45, and the plate portion therebetween. Recess 22 thus provides communication from the chamber 21 to passage 14 through port 41, and to bore 11 at the base of slots 51. Chamber 25 includes a groove or recess 26 which corresponds in form and function, to groove 22, for ports 42 and 46.

End cap 20 also has a Y-shaped passage 29, in the form of a recess adjacent plate 40, that is axially aligned, with port 43 and has a pair of diverging paths that communicate with chambers 21 and 25 through ports 23 and 27, respectively. The bottoms of chambers 21 and 25 around the respective ports 23 and 27 form seats for balls or ball check valves 24 and 28, respectively, to control flow between passage 29 and chambers 21 and 25. Gravity urges

balls 24 and 28 to seat when the motor is inoperative; however, light springs (not shown) may be provided.

The drive connection end of shaft 53 that is mounted in bearing 55, as shown extends through end cap 30 that has a seal outward of the bearing to prevent leakage. Cap 30 has a pair of recesses or grooves (not shown) which correspond to grooves 22 and 26 to provide similar flow paths at the other end of the motor, and a recess or groove 31 corresponding to the lower portion of passage 29 and having only a single path which extends upwardly and forms a vent for bearing 55.

Pressure fluid received by chamber 21 flows through groove 22, port 41, passage 14 and ports 15 to the motor chambers 13 in the end of the crescent shaped chamber 12 to cause the rotor 50 to turn clockwise when viewed in FIG. 4 as the pressure fluid expands. Simultaneously, some of the pressure fluid in groove 22 flows through port 45 into the bottoms of slots 51 housing the vanes 52 defining the motor pockets 13 receiving pressure fluid, and is assisted by some pressure fluid from passage 14 which flows through the recess (not shown) in cap 30 and the port 45 in plate 40 adjacent cap 30. Pressure fluid in chamber 21 positively holds ball member 24 seated.

Motor pockets 13 increase or expand as they move away from the end of chamber 12 that is in communication with chamber 21 until they reach maximum size. At this time, a pocket 13 is substantially bisected by the plane that extends through the axes of bore 11 and rotor 50. As such pockets 13 further approach the other end of chamber 12, they decrease or reduce in area and compress the fluid entrapped therein causing a power waste.

To insure full expansion of the pressure fluid in pockets 13 prior to their reduction in area, primary exhaust is accomplished through ports 19 and passage 18, port 43, and thence through passage 29 and port 27 past valve member 28 to chamber 25. Final exhaust of chambers 13 as they reduce in area is accomplished through ports 17 and passage 16, and port 42 to chamber 25. Thus two stage exhaust is accomplished, with all the exhausting fluid being discharged from chamber 25.

For reverse rotation, pressure fluid is provided to chamber 25 and groove 26 which flows through port 42, and passage 16 and ports 17 to chamber 12. Pressure fluid in chamber 25 positively seats ball check 28, and simultaneously flows from recess 26 through port 46 to the bottoms of adjacent slots 51 of rotor 50.

Primary exhaust again is accomplished through ports 19 and passage 18, port 43, and passage 29. In this instance, however, exhausting fluid from passage 29 passes through port 23 past ball check 24 to chamber 21 which is discharged with the final exhaust from chamber 12 which now flows through ports 15 and passage 14, and port 41.

It should now be readily seen that ported chambers 21 and 25 each provide the inlet for driving the motor in one direction and the outlet when the other of the ported chambers provides the inlet. The simple ball check valve members 24 and 28 are singularly seated by inlet pressure fluid in chamber 21 or 25 to block the flow of pressure fluid from the Y-shaped or bifurcated passage 29 while simultaneously permitting primary exhaust flow from passage 29 to the ported chamber 21 or 25 then receiving final exhaust.

Although but a single embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes may be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

I claim:

1. A reversible fluid actuated motor comprising:

a stator having an axial bore closed at its opposing ends;

a rotor eccentrically disposed within the axial bore to define a crescent-shaped motor chamber with the walls of the axial bore;

a plurality of slidably mounted vanes radially carried by said rotor in engaging relationship with the walls of the axial bore dividing the motor chamber into a plurality of pockets which vary in area during the rotation of said rotor;

said stator including a first fluid passage communicating with the motor chamber adjacent one of the arcuately extending ends thereof for conveying pressurized fluid to the motor chamber during unidirectional rotation of said rotor and conveying exhaust fluid from the motor chamber during reverse directional rotation of said rotor;

said stator including a second fluid passage communicating with the motor chamber adjacent the other arcuately extending end thereof for conveying pressurized fluid to the motor chamber during said reverse directional rotation of said rotor and conveying exhaust fluid from the motor chamber during said unidirectional rotation of said rotor;

said stator including an exhaust fluid passage communicating with the motor chamber intermediate its arcuately extending ends for conveying exhaust fluid from the motor chamber, said exhaust fluid passage communicating with said first and second fluid passages for conveying exhaust fluid thereto; and

valve means interposed intermediate said exhaust fluid passage and said first and second fluid passages responsive to the flow of pressurized fluid through said first and second fluid passages for preventing passage of exhaust fluid from said exhaust fluid passage to said first and second fluid passages when the latter are conveying pressurized fluid to the motor chamber.

2. A reversible fluid actuated motor according to claim 1, wherein said valve means comprises a first valve member disposed intermediate said exhaust fluid passage and said first fluid passage and responsive to pressurized fluid flowing through the latter to prevent exhaust fluid from passing from said exhaust passage to said first fluid passage when the latter is conveying pressurized fluid to the motor chamber, and a second valve member disposed intermediate said exhaust fluid passage and said second fluid passage and responsive to pressurized fluid flowing through the latter to prevent exhaust fluid from passing from said exhaust fluid passage to said second fluid passage when the latter is conveying pressurized fluid to the motor chamber.

3. A reversible fluid actuated motor according to claim 2, wherein each of said first and second fluid passages communicate with said exhaust fluid passage through a seat port, and said first and second valve members are disposed to be retained against the seat ports by pressurized fluid passing through said first and second fluid passages to the motor chamber to prevent exhaust fluid from passing from said exhaust fluid passage to said first and second fluid passages when the latter are conveying pressurized fluid to the motor chamber.

4. A reversible fluid actuated motor according to claim 2, wherein said exhaust fluid passage communicates with the motor chamber in a plane that extends through the axes of the axial bore and said rotor, and said first and second fluid passages communicate with the motor chamber on opposing sides of such plane.

5. A reversible fluid actuated motor according to claim 2, wherein said first and second fluid passages and said exhaust fluid passage extend axially in the stator and each communicate with the axial bore through a plurality of axially spaced ports.

6. A reversible fluid actuated motor according to claim 2, wherein said rotor includes a plurality of radially extending slots, each of said slots communicating with said first and second fluid passages to receive pressurized

fluid therefrom, and said vanes are disposed in said slots to be biased into engaging relationship with the walls of the axial bore by pressurized fluid in said slots.

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