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HYDRAULIC CONTROL SYSTEM

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FIG. 1

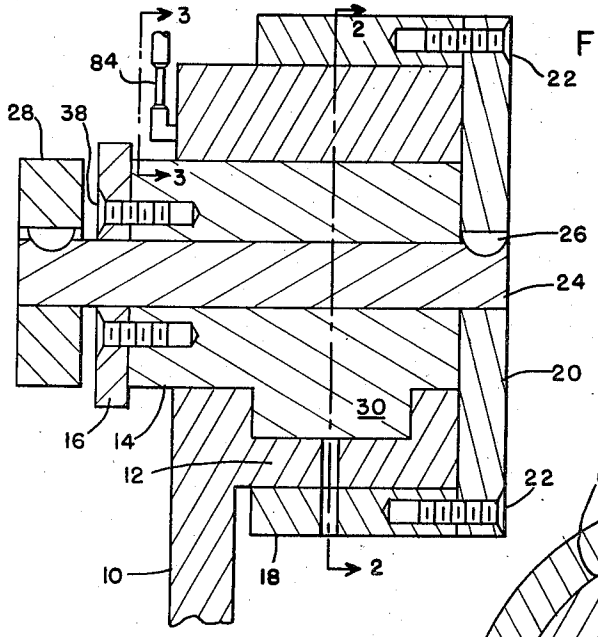


FIG. 2

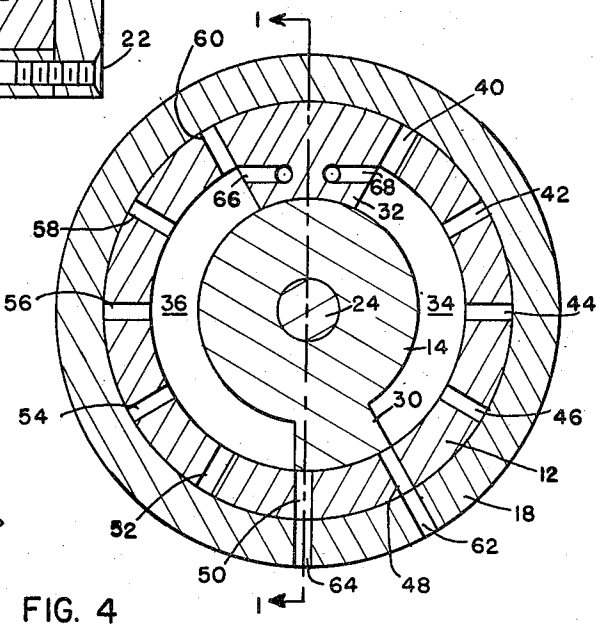


FIG. 3

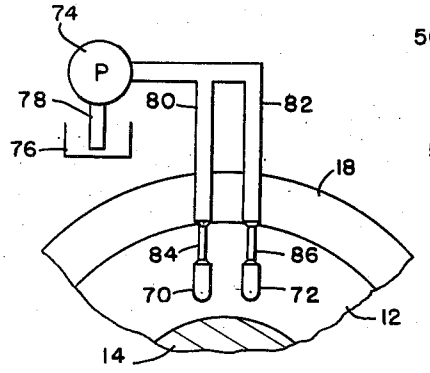
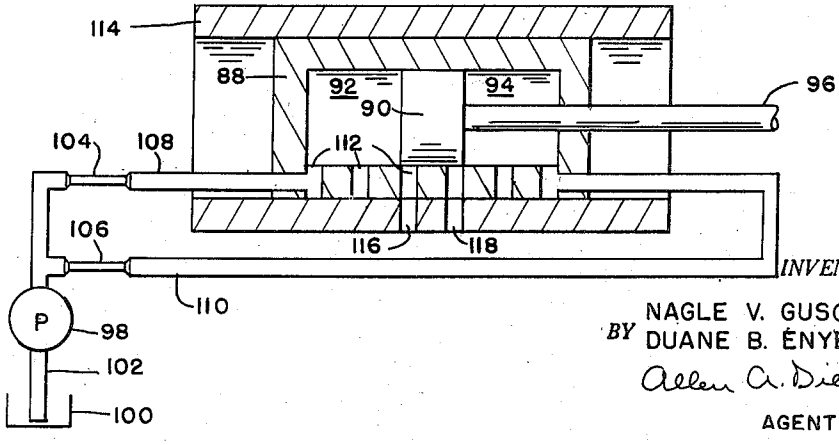


FIG. 4



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HYDRAULIC CONTROL SYSTEM

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2 Claims. (Cl. 121—41)

This invention relates to means for controlling hydraulic motors which, due to the particular construction, have a definite limit of motion. In this class of motors principally fall piston and cylinder motors, and paddle motors wherein one or more paddles move between one or more abutment vanes. In accordance with this invention this class of motors is improved by providing means by which they may move to definite positions intermediate the end positions created by their inherent structure.

Therefore it is an object of this invention to provide means whereby motors which have discontinuous motion may be stopped intermediate their end positions.

It is another object to provide means whereby such motors may be stopped accurately and positively intermediate their end positions.

It is another object to provide means whereby such motors may be stopped at any one selected position of a plurality of different positions.

It is another object to provide means to provide such stopping control in an economical manner.

Other objects and advantages will become apparent on consideration of the following specification and the attached drawings in which Figure 1 is a partial sectional elevation of a rotary motor taken generally along the line 1—1 of Figure 2,

Figure 2 is a sectional view of across the axis of the motor of Figure 1 taken along the line 2—2 of Figure 1,

Figure 3 is a partial elevation of the embodiment of Figure 1 taken along the line 3—3 of Figure 1, and

Figure 4 is a partial cross sectional view of a different embodiment wherein the motor with which the invention is employed is of the linear motion type.

Referring now to Figure 1, a rotary motor is shown therein. This motor has a frame mounting member 10 carrying a generally circular motor frame 12 and within the motor frame 12 is a rotary member 14 which carries an output gear 16. Embracing the motor frame 12 is a cylindrical valving member 18 which may be manually moved by means of a plate 20 which is secured to the member 18 by means of screws 22 and is keyed to a shaft 24 by means of a key 26. On the other end of the shaft 24 is a knob 28 which is keyed thereto for manually rotating the shaft 24 and the cylindrical member 18 which rotates therewith.

As is best seen in Figure 2 the output member 14 carries a vane 30 which rotates within the confines of the stationary member 12 in an almost annular space therein. Member 12 carries thereon an abutment member 32 which provides walls to limit the motion of the vane 30 and through the means of the vane 30 and abutment 32 two spaces 34 and 36 are defiend. It can be readily seen that if fluid under pressure is permitted to flow into one of the spaces, for example 34, and space 36 is permitted to be connected to a drain, the vane 30 will have a pressure differential thereacross and the output member 14 will move in a clockwise

direction as viewed in Figure 2. Motion of the output member 14 will turn gear 16 which is secured thereto by appropriate means such as screws 38. Clearance between the motor frame 12 and the vane 30 as well as between the output member or rotor 14 and the abutment 32 is kept at a minimum to minimize leakage.

According to applicant's invention, motor frame 12 has a plurality of holes or ports 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, and 60 communicating between its interior and its exterior. These holes are spaced apart and are related to the width of the vane 30 so that the vane 30 substantially closes at least two of the holes. The cylindrical member 18 acts as a valving member and contains two holes 62 and 64 which are adapted to line up with two of the holes in the member 12, which holes are spaced apart approximately the width of the vane 30 as is mentioned above. The holes 62 and 64 are permitted to drain fluid to the sump. It can be seen that manual motion of knob 28 causes cylindrical valving member 18 to rotate and valve different pairs of holes 40 to 60 to drain.

The abutment 32 contains interdrilling which provides fluid inlets 66 and 68. Inlet 66 is connected to line 70 (see Figure 3) and inlet 68 is connected to line 72. A pump 74 draws fluid from a sump 76 through line 78 and discharges it under pressure to lines 80 and 82. Lines 80 and 82 are respectively connected to lines 70 and 72 through fluid resistances 84 and 86. Hydraulic oil is preferably used as an operating fluid for it acts as a lubricant as well as a power medium. However, gas, water, or other liquid could be used by providing suitable clearances so no rubbing occurs or by the provision of carbon or special metal in the wearing areas to prevent galling.

In the illustration of Figures 1 through 3 the motor is shown as having one vane and one abutment. As is well known in the art, two diametrically opposed vanes and two diametrically opposed abutments may be used to double the torque with the same fluid pressure at the expense of total motion. In this case the cylindrical valving member 18 would be provided with two diametrically opposed pairs of holes to provide openings to drain adjacent both sides of both vanes when the rotor is in its desired position. Fluid would be supplied through resistances to both sides of both abutments.

The pump 74 supplies the operating fluid under pressure to lines 80 and 82, and the pressure may be limited to a safe value by means of a relief valve or by using a pressure compensated variable delivery pump. The resistances 84 and 86 are provided to act as flow dividers so that when one or the other of lines 70 or 72 is open to drain the pump pressure does not fall off appreciably but fluid under pressure is supplied to the other side of movable vane member 30 to cause motion. Of course separate pumps could be used to supply lines 70 and 72 or other known flow dividing means could be used.

It can be seen from the description of the device of Figures 1 through 3 that as the pump 74 discharges fluid under pressure into lines 80 and 82 it is conveyed through resistances 84 and 86 into spaces 36 and 34 through ports 66 and 68. If the knob 28 is turned to cause the ports 62 and 64 to lie over the ports 54 and 56 it can be seen that the space 36 will be opened to drain through port 56 and port 64. At the same time the fluid entering through port 68 will be under pressure to cause a force to act on the face of vane 30 and this force will turn the output member 14 in a clockwise direction as seen in Figure 2 until the vane 30 covers both ports 54 and 56. In this position the pressure in space 36 will rise for it is no longer open to drain and the vane 30 will stop. Preferably, the vane 30 does not

overlap the ports so that positioning of the output member **14** is very accurate. If the angular position of vane **30** is incorrect to the slightest extent, one drain will be at least slightly opened and the pressure on that side of the vane **30** will fall due to flow through and consequent pressure drop in resistance **84** or **86**. A correcting force results to restore the vane **30** to the correct position. If the knob **28** is turned the other way so that ports **42** and **44** communicate to drain through ports **62** and **64**, it can be seen that the space **34** is open to drain and fluid under pressure entering through port **66** will move the vane **30** until it covers both ports **42** and **44**. By moving the cylindrical valving member **18** over any pair of ports in the motor frame **12** the vane **30** is moved by power to cover that pair of ports. Of course, if the vane **30** is made the same width as one of the ports in motor frame **12**, only one of the ports need be opened to drain. Thus the vane **30**, output member **14**, and gear **16**, seek their new position. Gear **16** can be used to drive any device such as a selector valve where accurate positioning in a plurality of different positions is desired.

The embodiment of Figure 4 is a reciprocating fluid motor having a cylinder **88** and a piston **90** therein. The piston divides the cylinder into spaces **92** and **94** in cooperation with the end walls of cylinder **88** and connected to the piston **90** is a piston rod **96**. A pump **98** draws fluid from a sump **100** through a suction line **102** and the pump **98** delivers it under pressure through two fluid resistances **104** and **106**. Resistance **104** is connected by means of line **108** to a port in the end of the cylinder to discharge into space **92** and resistance **106** discharges into a line **110** which in turn is connected into space **94** in the other end of the cylinder **88**. The cylinder is securely mounted in a stationary fashion by means of the lines **108** and **110** or by any other suitable structural means. The cylinder **88** has a plurality of holes **112** therein and the holes are spaced apart such a distance that at least two of them are substantially covered by the piston **90** at the same time. The holes **112** serve as ports for porting to drain. Embracing the cylinder **88** is a cylindrical valving member or sleeve **114** which contains ports **116** and **118** for porting pairs of the holes **112** to drain. The ports **116** and **118** are spaced in such a manner that they open selected pairs of ports **112** to drain.

It can be seen that if the sleeve **114** is moved to port the leftmost pair of ports **112** to drain through ports **116** and **118**, that the space **92** will be open to drain but fluid under pressure will flow through resistance **106** and line **110** to the space **94** thereby causing the piston **90** and its rod **96** to move leftward until the piston covers the pair of drained ports. Similarly, the cylindrical valving member **114** can be moved to align with ports **116** and **118** with any pair of ports **112** to open them to drain. Fluid pressure on the other side of piston **90** causes the piston to move to cover both of the drained ports **112**. Thus it can be seen that this motor can move to any one of a plurality of selected positions for accurate positioning of the piston rod **96** and the appropriate mechanism attached thereto. Again, if the piston is of such width as to cover only one port **112**, then only one port need be opened to drain to cause positioning.

While valving has been described as being done by ported valving members **18** and **114**, it is clear that valving could also be done by any appropriately operating valves. For example, if an electrical positioning signal is available, it might be desirable to use solenoid operated valves. These motors have been described in particularity with respect to input and output members, but it can be seen that the members described as output members herein can be secured to the frame and the other member be used as an output member.

This invention is capable of a number of embodiments and thus it is desired that the scope of the invention be defined by the appended claims.

What we claim is:

1. In a unitary fluid pressure actuated motor and motor control valve structure, a frame, walls defining an annular space in said frame, an abutment on said frame extending into said annular space, a driven member arranged to oscillate around a given axis, a vane on said driven member extending into said annular space, fluid pressure supply means for supplying fluid to said space on each side of said abutment, a plurality of ports in said frame, at least one of said ports being away from said abutment, a valving member embracing said frame and covering said ports and having valving ports therein, said valving member being actuatable coaxially with said driven member to open at least one of said ports from said space, whereby upon supplying fluid to said space on each side of said abutment said vane moves to cover said open port.

2. In a unitary fluid pressure actuated motor and control valve structure, a main frame for supporting the motor and control valve, said frame having cylindrical walls arranged around a centerline defining an annular space in said frame, an abutment in said frame extending into said annular space, a driven member arranged to rotate around a given axis which corresponds to the center line of said cylindrical walls, a vane on said driven member extending into said annular space, said vane and said abutment dividing said annular space into first and second spaces, fluid pressure supply means for supplying fluid under pressure into each of said spaces, a plurality of substantially radial ports in said frame extending from said annular space to the outside of said frame, at least one of said ports being away from said abutment, a valving member embracing said frame and arranged to cover said ports and having at least one valving port therein, said valving member being rotatable, in the same plane and on the same axis as said driven member to correspond to the desired position of said driven member to open at least one of said substantially radial ports, whereby upon supplying fluid to said first and second space on the sides of said abutment said driven member is caused to rotate to cover said open port so that it seeks the same angular position as a valving member.

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