

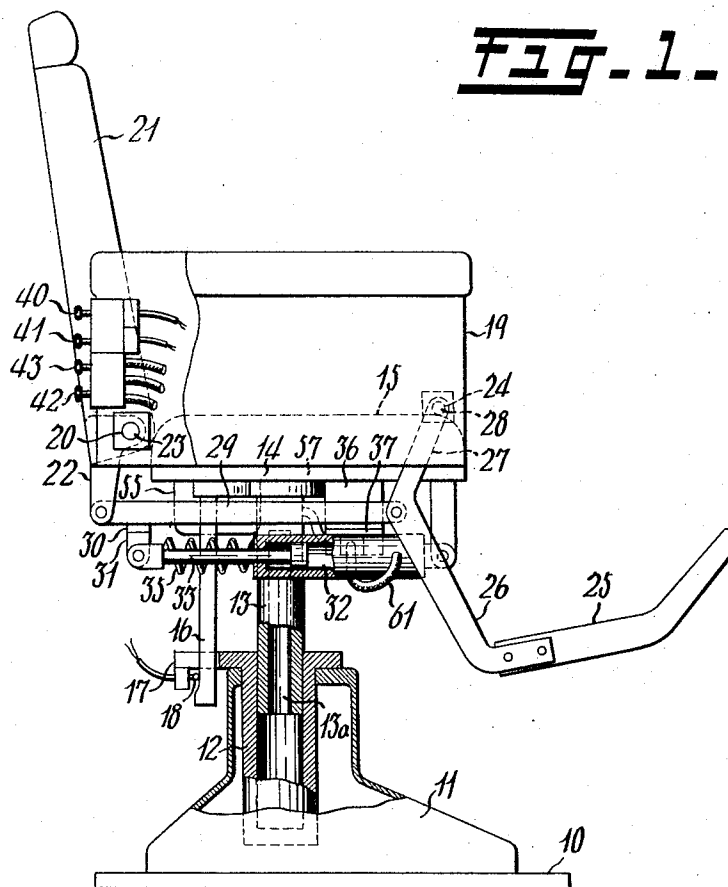
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TERUO WATANABE
HYDRAULIC ADJUSTMENT BARBER CHAIR

3,368,845

Filed March 15, 1966

3 Sheets-Sheet 1



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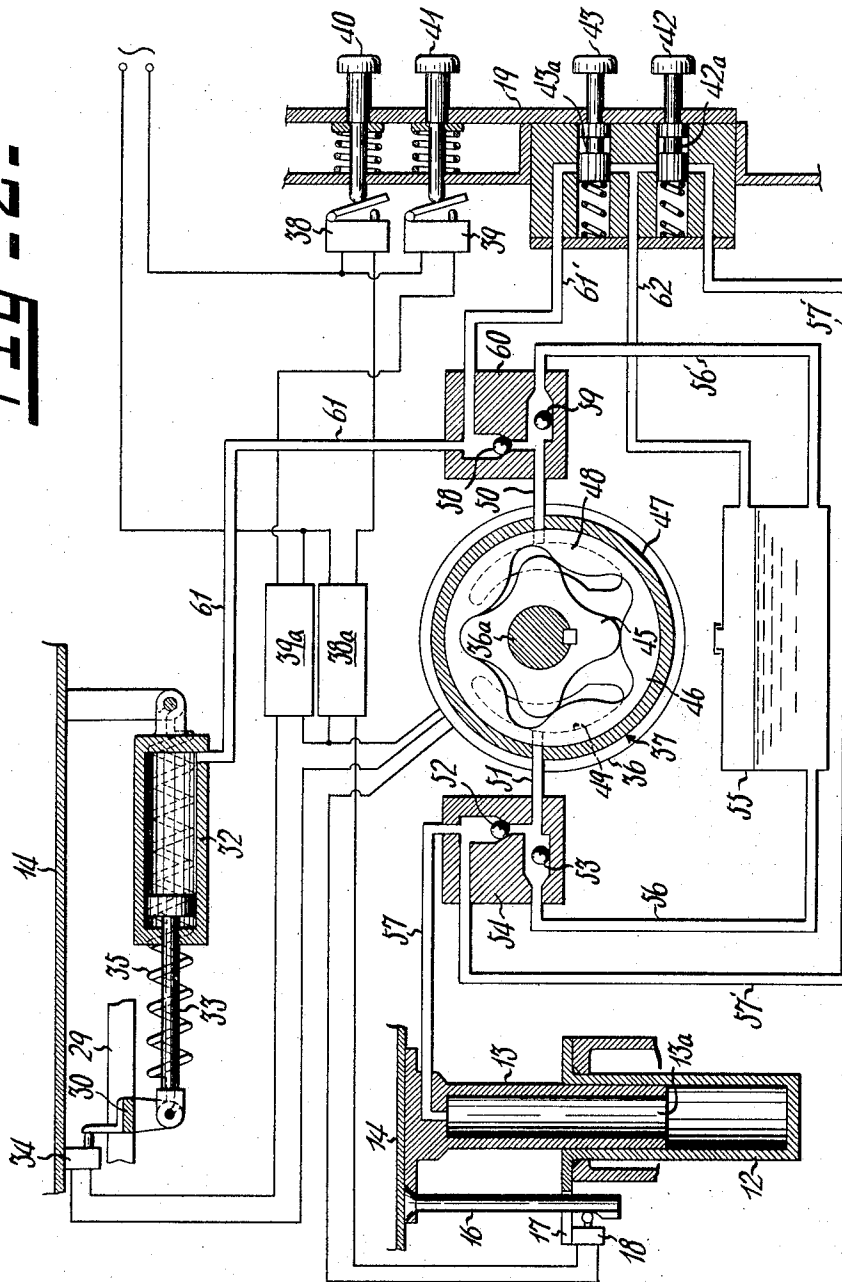
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FIG. 2.



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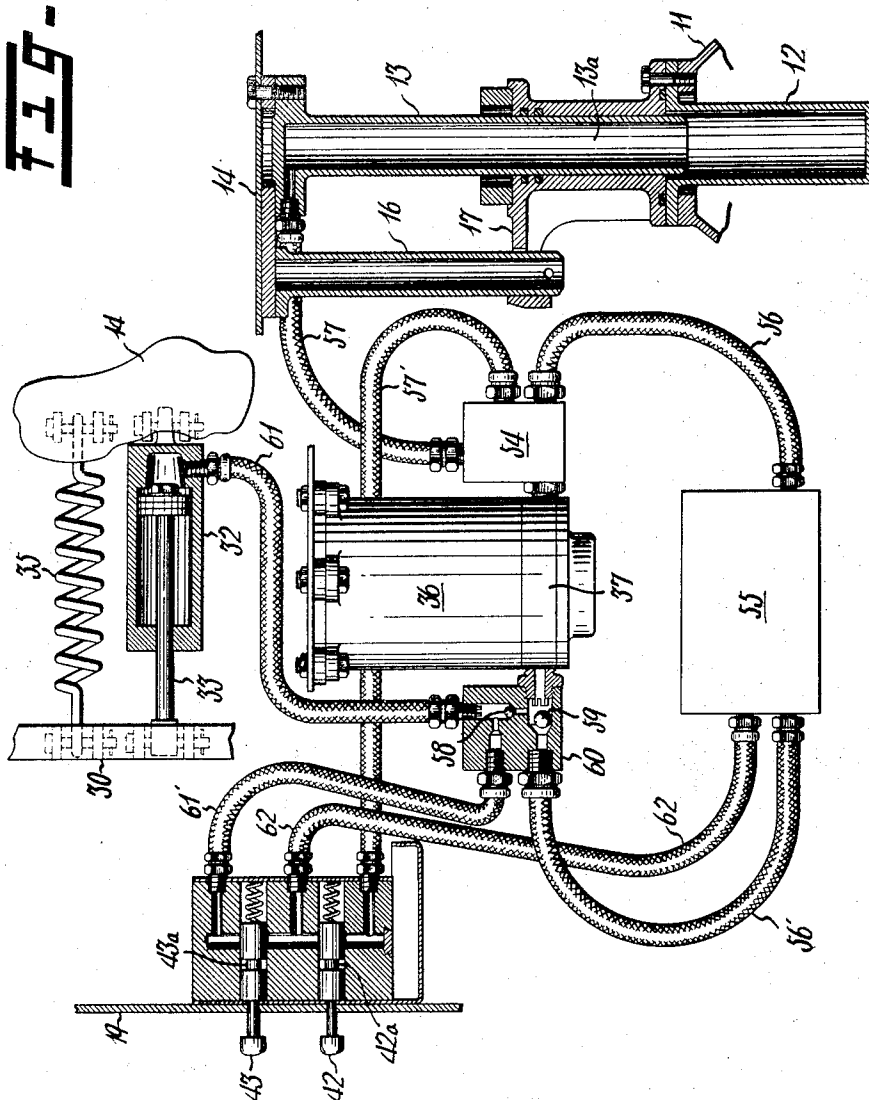
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FIG. 3.



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ABSTRACT OF THE DISCLOSURE

A fluid control system for operating a pair of fluid cylinder assemblies including separate fluid supply lines, having a pump with a single fluid pump circuit common to each fluid supply line. The pump is operable to pump fluid in opposite directions selectively in the common pump circuit to selectively supply fluid under pressure to either of the fluid cylinder assemblies. In addition, valve means are provided for opening one of the fluid supply lines while simultaneously closing the other fluid supply line in response to a predetermined operating condition of the pump.

The present invention relates to an improvement in the adjustment means of the barber chair to effect hydraulically the adjustment of the height of the chair and the reclining of the back rest and the present invention also applies to multi-purpose chairs, such as dental chairs, in which it is necessary to adjust the height or the reclining of the back rest.

One of the important objects of the present invention is not only to effect collectively by means of a very simple operation the adjustment of the height of the chair and the raising or reclining of the back rest, but also to greatly simplify the hydraulic means which is mainly responsible for the above-mentioned adjustment.

Another object is to minimize pumping which supplies hydraulic pressure by making use of the gravity of the chair, do away with causes of the wear of the revolving parts and minimize oil requirements. A third object is to simplify the hydraulic actuating mechanism and to get rid of causes of mechanical and electrical troubles. A fourth object is to reduce cost by simplifying the hydraulic means as mentioned above and to make the chair available at a low price.

Further and more specific objects of the present invention will be clear by the following description and the accompanying drawings of an embodiment of the invention.

FIGURE 1 is a side elevation, partly sectional, of the present chair.

FIGURE 2 is a schematic diagram showing the pipe lines and electric circuits.

FIGURE 3 is an elevation of the arrangement of pipe lines and cylinders.

Referring to FIGURE 1, the cylinder 12 for raising the chair is mounted in the pedestal 11 on the base 10. The hollow piston 13 is positioned in the cylinder 12 for reciprocation therein. The seat frame 14 is fixed at the top of the piston 13. The seat 15 of the chair is positioned on the seat frame 14. The piston 13 is a cylindrical type with the head closed, and the cylindrical interior 13a of the piston 13 opens to the cylinder 12. The oil pipe 57 is connected to the side of the top of the piston 13, and oil is supplied from the head of the interior 13a to the cylinder 12.

In the piston 13 is provided the guide rod 16 which goes down perpendicularly from the top of the piston 13. The guide rod 16 is inserted to the guide groove 17 provided at the side of the cylinder 12 and moves the piston

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13 only vertically. The end of the rod 16 pushes the limit switch 18 to stop the oil pump, when the seat frame 14 gets to the highest position.

On both sides of the seat frame 14 are fixed the elbow rests 19, at the back ends of which are provided the pivots 20. The upper ends of the arm plates 22 fixed on both sides of the end of the back rest 21 are supported in the pivots 20 by the axes 23, and the back rest 21 is reclined at the back of the seat 15, around the axes 23. At the bottom of the fronts of the elbow rests are provided the pivots 24. The upper ends of the links 27 fixed at the top of the side lever 26 of the foot rest 25 are supported in the pivots 24 by the axes 28, and the bottoms of the links 27 and those of the arm plates 22 of the back rest 21 are connected by means of the connecting bars 29 provided along both sides of the seat frame 14. Thus, the foot rest 25 is raised and lowered as the back rest 20 is reclined and raised. The connecting bars 29 located under both sides of the seat frame 14 are connected by the cross bar 30 from left to right at the back end of the seat frame 14. To the bracket 31 projecting below the cross bar 30 is connected the end of the piston rod 33 of the back rest cylinder 32 whose closed end is fixed at the bottom of the front end of the seat frame 14. To the end of the back rest cylinder 32 is connected the oil pipe 61, and thus oil is supplied to the cylinder 32. When the cylinder 32 is oiled, the piston 33 pushes the connecting bars 29 toward the back of the chair by means of the cross bar 30, and the back rest 21 is raised around the axes 23 fixing the arm plates 22, the foot rest 25 goes down revolving around the axes 28 supporting the side bars 27 by means of the connecting bars 29.

Opposite the cross bar 30 or the connecting bars 29 at the bottom of the seat frame 14 is provided the limit switch 34, as shown in FIGURE 2, so that oiling may stop when the back rest 21 is raised correctly.

Between the cross bar 30 and the front end of the seat frame 14 is stretched the spring 35 to draw the piston rod 33 into the cylinder 32.

The oil supply to the cylinders 12 and 32 is effected by the two-rotation pump 37 connected to the motor 36 which rotates in two opposite directions. As shown in FIGURE 2, the rotating direction of the motor 36 is controlled by the circuit opened and closed by the normal rotation switch 38 and the circuit opened and closed by the reverse rotation switch 39. When the raising button 40 is pushed, the switch 38 closes the normal rotation circuit of the motor 36, and rotates the motor 36 by means of the relay 38a. When the button 40 is released, the switch 38 opens the normal rotation circuit or the guide rod 16 in the piston 13 works the limit switch 18, and stops the motor 36. By pushing the button 41 for raising, the switch 39 closes the reverse rotation circuit of the motor 36 and rotates the motor 36 reversely by means of the reverse rotation relay 39a. When the button 41 is released, the switch 39 opens the reverse rotation circuit or the cross bar 30 or connecting bars 29 acting relative to the raising piston 33 pushes the limit switch 34, and stops the motor 36.

The pump 37 for both rotations consists of the star-shaped rotor 45 having four angles fixed to the axes 36a of the motor 36, the rotating ring 46 having the star-shaped concave inner circumference with five angles and the casing 47 enclosing the rotating ring 46. The pump 37 is of the type which sets the rotor 45 in the rotating ring 46 eccentrically. The rotor 45 rotates while an angle of the rotor 45 engages a concave of the rotating ring 46, and the rotating ring 46 follows the movement of the rotor 45, so that the expansion and contraction of the gap between the rotor 45 and the rotating ring 46 caused by the rotation may do pumping. To the oil windows 48 and 49 provided by symmetrically on the casing wall of the rotor

45 and rotating ring 46 are connected the main pipes 50 and 51.

To the main pipe 51 is connected the valve block 54 having the two ball valve 52 and 53, and to the ball valve 52 is connected the pipe 57 leading to the piston 13 for raising the chair. The ball valve 52 and 53 moves together with the fluid and are opened or closed without any spring. The ball valve 53 is located between the pipe 56 from the oil tank 55 and the main pipe 51. There is provided the discharge pipe 57' which leads to the lowering push valve 42a from the side of the valve block 54 leading directly to the pipe 57 of the ball valve 52.

The main pipe 50 likewise is connected to the pipe 61 leading to the back rest cylinder 32 through the valve block 60 having two ball valves 58 and 59. The ball valve 58 is located between the main pipe 50 and the pipe 61. There is provided the discharge pipe 61' leading to the reclining push valve 43a from the pipe 61 connected directly to the valve block 60. The ball valve 59 is located between the pipe 56' from the oil tank 55 and the main pipe 50.

The lowering push valve 42a and the reclining push valve 43a are disposed in parallel as shown in FIGURE 2, and the return pipe 62 is connected to the oil tank 55 from the center of the oil line between the valves 42a and 43a. The valves 42a and 43a stop the oil flow between the discharge pipe 57' and the pipe 62, and between the discharge pipe 61' and the pipe 62.

The push button 40 for raising the chair, the push button 41 for raising the back rest, the push button 42 of the valve 42a for lowering, the push button 43 of the valve 43a for reclining are provided in positions which permit easy operation, such as at the back of one side of the elbow rests 19.

In FIGURE 2, when the push button 40 for raising is pushed, the normal rotation switch 38 closes the normal rotation circuit, and the motor 36 rotates in a normal direction, the oil in the oil tank 55 is sucked up from the pipe 56' so that the pump 37 may work, and the ball valve 59 is opened by the flow of the oil and the oil is sent to the main pipe 51 through the pipe 50 and the pump 37. The pressure of the oil in the main pipe 51 closes the ball valve 53 and opens the ball valve 52. The oil fills the cylinder 12 through the pipe 57, and the piston 13 thus goes up, namely, the chair goes up. At this moment, the oil is also in the discharge pipe 57', but since the lowering push valve 42 is closed, the oil does not get into the return pipe 62.

When the chair reaches a certain height and the raising push button 40 is released, the motor 36 stops, and so does the pump 37. Thereupon, the oil in the cylinder 12 tends to flow back from the pipe 57, but the ball valve 52 of the valve block 54 is pushed against the valve seat by the oil pressure flowing back and prevents the oil from getting out of the cylinder 12. Thus, the chair stops at the desired height.

To lower the chair, the lowering push button 42 is pushed, and then the lowering push valve 42a connects the discharge pipe 57' and the return pipe 62. Hence, the oil in the cylinder 12 returns to the oil tank 55 through the pipe 57, the discharge pipe 57', the push valve 42a and the return pipe 62. So the piston 13 goes down by the gravity of the chair.

When the lowering push button 42 is released at a certain height of the chair, the push valve 42a stops the flow of oil from the pipe 57' to the pipe 62, and the chair stops.

To recline the back rest, the reclining push button 43 is pushed, and the discharge pipe 61' connected with the pipe 61 and the return pipe 62 are connected, so the oil in the back rest cylinder 32 is returned to the oil tank 55 through the pipe 61, the discharge pipe 61', the reclining push valve 43a and the return pipe 62. By the spring 35 acting on the cross bar 30, the piston 33 is

drawn into the back rest cylinder 32, and the back rest 21 is reclined.

When the raising push button 41 is pushed, the reverse rotation switch 39 is turned on, the motor 36 rotates in a reverse direction, the pump 37 is worked, and oil is supplied to the main pipe 50 from the oil tank 55 through the pipe 56 and the main pipe 51. So the oil fills the back rest cylinder 32 through the ball valve 58 of the valve block 60 and the pipe 61. The piston 33 is pushed out, the connecting bars 29 move backwards by means of the cross bar 30, the back rest 21 is raised, and the foot rest 25 is lowered. When the raising push button 41 is released, the back rest 21 stops and remains where it is raised.

As will be understood from the foregoing explanation, in the lowering of the chair and the reclining of the back rest the motor 36 is at a stop. Only when the chair or the back rest is raised, the motor 36 and the pump 37 rotate. The ball valves 52 and 53, 58 and 59 work automatically in the direction of the flow of the fluid and dispense with a hand cock or complicated electro-magnetic valve. The present invention also makes it possible to use flexible pipes, such as synthetic resin pipes, as oil pipes and shorten pipe lengths so as not to expose pipes outside the chair, as shown in FIGURE 3. The present invention, as mentioned above, greatly simplifies the mechanism of the hydraulic adjustment chair, removes causes of electrical and mechanical troubles and reduces production cost.

In effect, the fluid control system is provided with a first fluid supply circuit including pipes 56', 50, 51 and 57, intercommunicating the sump 55 with the hydraulic cylinder 12, a second fluid supply circuit including pipes 56, 51, 50 and 61, intercommunicating the sump 55 and hydraulic cylinder 32, and a fluid pump circuit consisting of the fluid passageway through the pump 37, which is connected in common with common portions of the first and second fluid supply circuits between pipes 50 and 51. In addition, the valves 54 and 60 are operatively connected to both the first and second fluid supply circuits to selectively close one supply circuit while opening the other supply circuit, depending on the direction of drive of the pump 37, by virtue of the operation of the sets of check ball valves 52, 53, and 58, 59, as previously described.

I claim:

1. A fluid control system adapted for use with a chair structure having a seat adapted to be moved vertically by means of a first fluid cylinder assembly, and a back rest pivotally connected to the seat and adapted to be positioned angularly relative to the seat by means of a second fluid cylinder assembly, comprising a first fluid supply circuit operatively connected to said first fluid cylinder assembly, a second fluid supply circuit operatively connected to said second fluid cylinder assembly, a fluid pump having a fluid pump circuit disposed in a common portion of said fluid supply circuits, said pump being operable to selectively pump fluid in forward and reverse directions in said fluid pump circuit, first and second valve means, each of said valve means comprising a set of check valves and being operatively connected to said first and second supply circuits at common points in said circuits whereby upon operation of said pump in pumping fluid in one of said directions, said valve means is operative to open one of said fluid supply circuits and simultaneously close the other of said fluid supply circuits, means for driving said pump and control means for selectively actuating said drive means to drive said pump in opposite directions to produce forward and reverse fluid flow in said fluid pump circuit.

2. A fluid control system according to claim 1, including a fluid return line for each fluid cylinder assembly, having a selectively operable valve.

3. A fluid control system according to claim 1, wherein

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said pump is driven by an electric motor having an electrical control circuit, for selectively driving said pump in forward and reverse directions to produce forward and reverse fluid flow.

4. A fluid control system according to claim 3, wherein said electrical control circuit includes means responsive to predetermined conditions of said fluid cylinder assemblies for deenergizing said electric motor. 5

5. A fluid control circuit according to claim 1, including a fluid return line for each fluid cylinder assembly, having a selectively operable valve, and wherein each of said valve means comprises a set of check valves and said pump is driven by an electric motor having an electrical control circuit, for selectively driving said pump in forward and reverse directions to produce forward and reverse fluid flow. 10 15

6. A fluid control system according to claim 5, wherein

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said electrical control circuit includes means responsive to predetermined conditions of said fluid cylinder assemblies for deenergizing said electrical motor.

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