

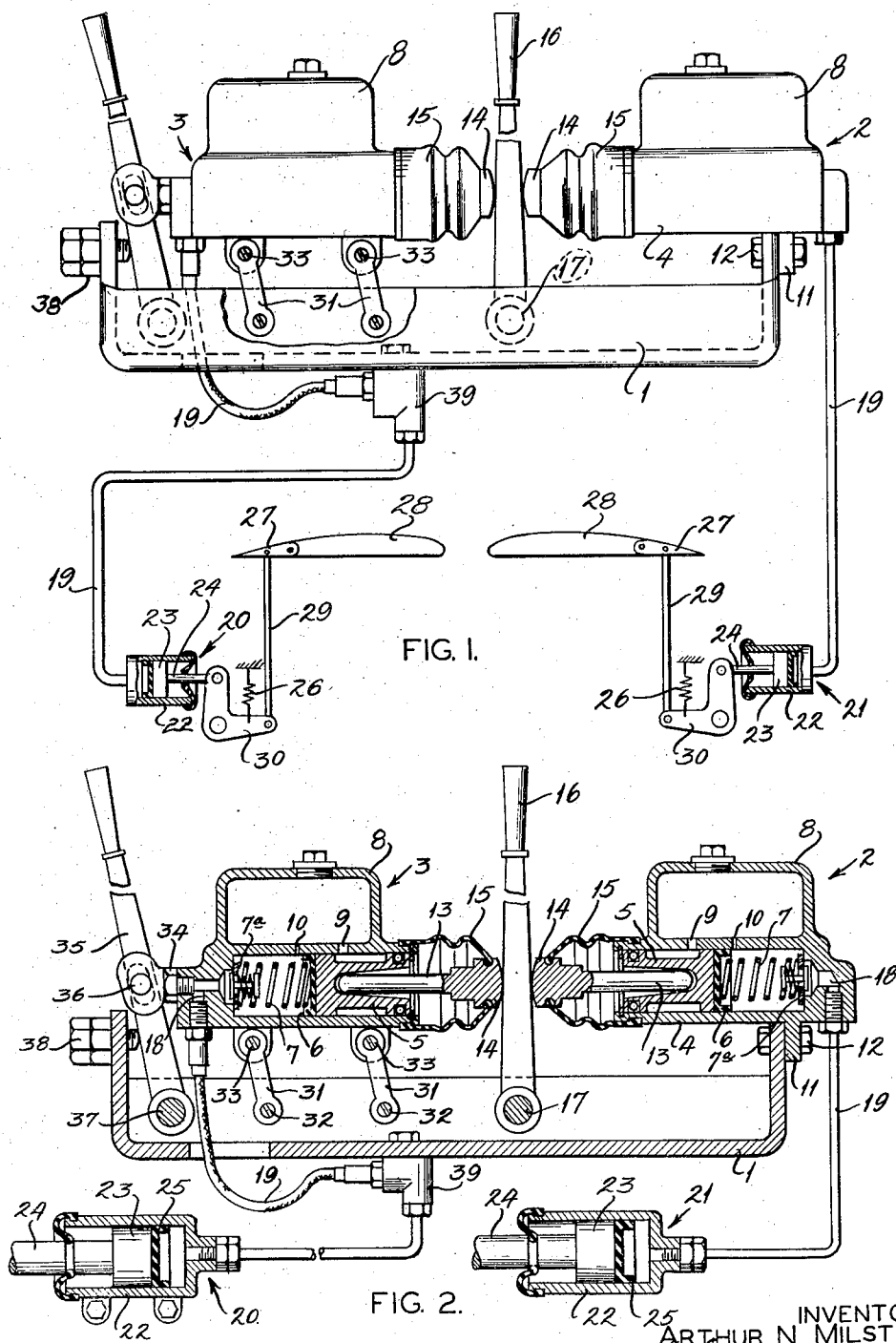
June 12, 1951

A. N. MILSTER
APPARATUS FOR JOINTLY OR SEVERALLY
OPERATING MASTER CYLINDERS

2,556,288

Filed Jan. 24, 1947

2 Sheets-Sheet 1



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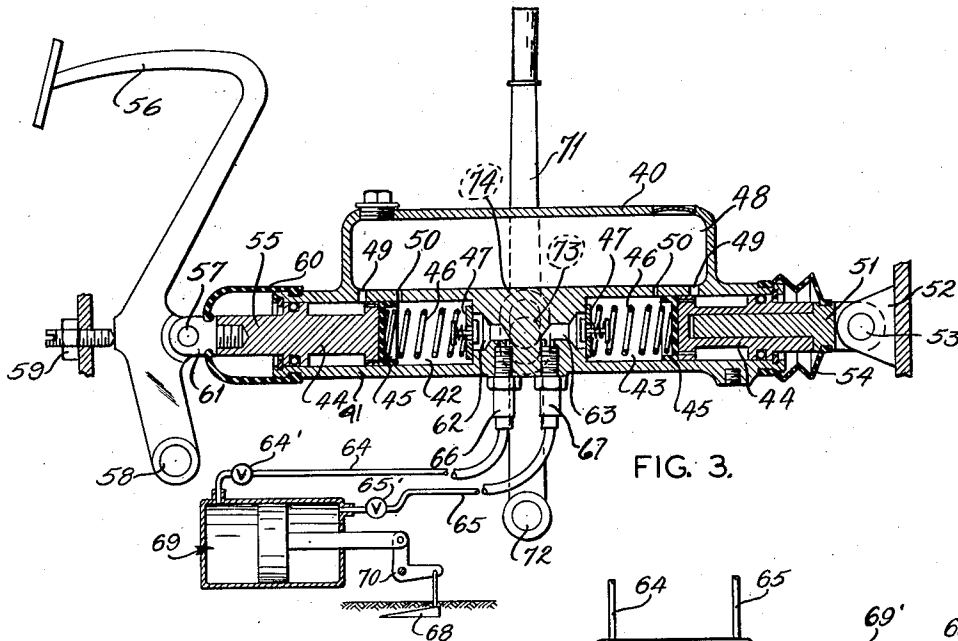


FIG. 3.

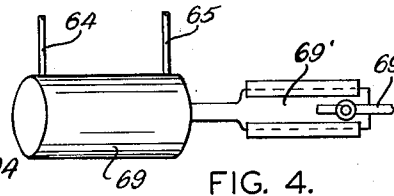


FIG. 4.

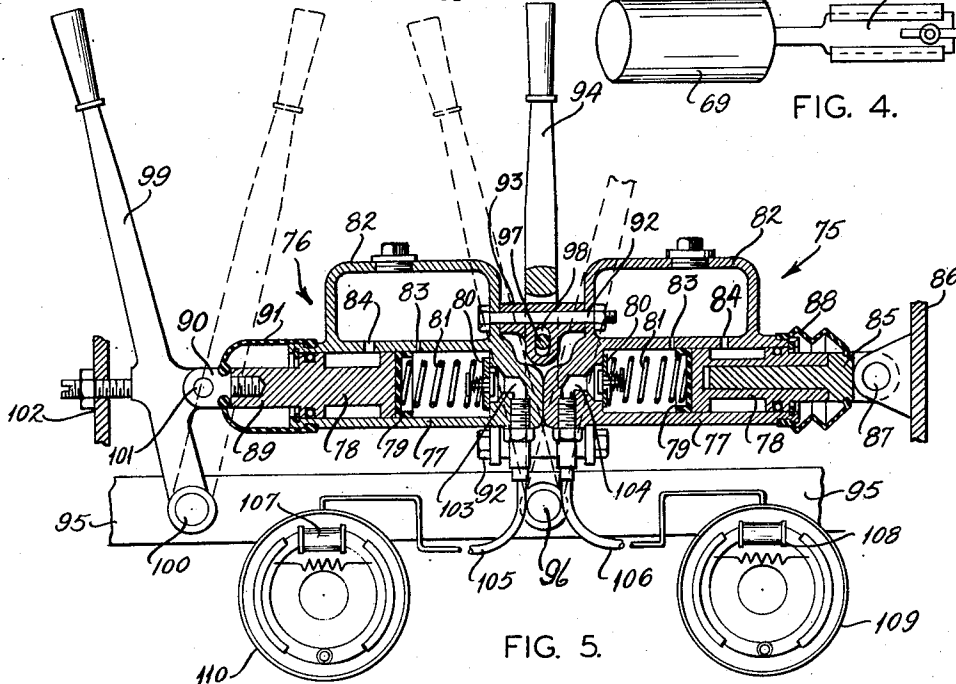


FIG. 5.

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APPARATUS FOR JOINTLY OR SEVERALLY
OPERATING MASTER CYLINDERSArthur N. Milster, St. Louis, Mo., assignor to
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This invention relates to an improvement for actuating a plurality of pressure fluid devices and in its more specific aspects is directed to means for selectively, severally or jointly, operating aircraft wing flaps or other devices.

The object of this invention is to produce a mechanism wherein two or more master cylinders are suitably arranged to enable an operator to selectively, severally or jointly, operate the pressure fluid motors connected to the master cylinders.

In the drawings Figure 1 is an elevational view of two master cylinders connected for joint or several operation;

Figure 2 is a vertical sectional view of the construction illustrated in Figure 1;

Figure 3 is a vertical sectional view of a modified master cylinder arrangement;

Figure 4 is a perspective view of the power cylinder of Figure 3 applied to a machine tool part; and

Figure 5 is a vertical sectional view of another modification form of the invention.

Referring now to the drawings, numeral 1 designates a suitable supporting means for two master cylinder assemblies 2 and 3 associated with a conveyance, as for example, an airplane. The assembly 2 comprises a conventional cylinder 4 having a piston 5 therein provided with a packing cup 6 and in which piston 5 is moved toward the inoperative position illustrated in Figure 2 by means of a spring 7 disposed between the piston packing cup 6 and the closed end of cylinder 4.

A check valve mechanism 7a is held in position at the closed end of cylinder 4 which may be similar in construction and operation to that shown and described in United States Patent No. 2,349,416, issued May 23, 1944. The master cylinder assembly is provided with the usual reservoir 8 and ports 9 and 10 provide communication between the interior of cylinder 4 and reservoir 8. The assembly 2 has a boss 11 secured thereto and a bolt 12 extending through the boss fastens the assembly 2 to support 1. A piston rod 13 arranged in one end of piston 5 extends outwardly and has a head 14 formed thereon. A suitable flexible protecting boot 15 is provided to prevent the ingress of foreign matter into cylinder 4. Each of the master cylinder assemblies is of identical construction.

An actuating handle 16 is pivoted to support 1 by means of a pin 17 for the purpose of selectively actuating either of pistons 5 depending upon the direction of rotation of handle 16.

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The closed end of each of the cylinders is provided with a port 18 to which a conduit 19 is connected. Each of these conduits is connected to motors 20 and 21, respectively, each of which comprises a cylinder 22 provided with a piston 23 having a rod 24 and a packing cup 25. The piston rods 24 are connected to the flap 27 (shown schematically) of an airplane part, such as a wing 28, by means of a suitable connection which comprises a rod 29 and a pivoted bell-crank 30. A spring 26 is connected to the bell-crank 30 to return piston 23 to the original position after pressure is relieved therein.

The master cylinder assembly 3 is pivotally mounted on support 1 by means of a parallel link construction comprising link members 31, 31 which are pivoted at one end to support 1 by pins 32. The other ends of link members 31, 31 are pivoted by means of pins 33 to suitable brackets integral with the master cylinder assembly 3.

The left hand end of master cylinder assembly 3 has a suitable member 34 threaded into it. A lever 35 pivoted to frame 1 by means of pivot pin 37 has a projection 36 thereon which is received in a slot formed in member 34 to thereby permit a lost motion action between the master cylinder assembly 3 and lever 35 when required. The necessary relative motion between the two master cylinder assemblies 2, 3 is provided by piston rods 13, 13 when severally actuated by lever 16 or when jointly actuated by lever 35.

An adjustable stop and thrust member 38 is arranged in the left hand end of support 1 for engagement with lever 35 to limit the return movement of the lever and consequently the master cylinder assembly 3.

A suitable fixture 39 is secured to support 1 which is interposed in conduit 19 and thereby enables that portion of the conduit between cylinder 4 and the fixture to be flexible in order to allow flexing movement therein upon the actuation of master cylinder assembly 3.

Referring now to the operation of the device just described, it is assumed that the system is filled with a suitable fluid and that the master cylinders are in inoperative position and that it is desired to actuate motor 21. To do this, lever 16 is grasped by the operator and moved clockwise, thereby moving piston 5 of master cylinder assembly 2 past the compensating port 10 and compressing the fluid in the cylinder ahead of packing cup 6. This fluid now under compression is forced past the valve assembly 7a into conduit 19 and into motor 21 to actuate same. There will be no actuation whatever of piston 5

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in master cylinder assembly 3. Upon release of lever 16, springs 7 and 26 will return piston 5 to the position illustrated in Figure 2.

Assuming that it is desired to actuate motor 20, the operator will grasp lever 16 and move it counter-clockwise thereby moving piston 5 in the master cylinder assembly 3 past compensating port 10 and compressing the fluid in the portion of the cylinder ahead of the packing cup 6 forcing it past valve 7a into conduit 19 and into motor 20 to actuate same. Stop 38 functions as a thrust member when assembly 3 is operated. Parallel linkages 31, 31 permit the relative movement of cylinder 3 with respect to frame 1. When lever 16 is released, springs 7 and 26 associated with piston 5 and motor 20, respectively, will return the master cylinder to the position shown in Figure 2.

Assuming that it is desired to actuate both master cylinder assemblies 2 and 3, the operator will grasp lever 35, rotating it clockwise, as viewed in Fig. 2, causing pistons 5, 5 to move relative to cylinders 4, 4 by reason of the piston rods 13 which are operatively associated through lever 16. It is apparent that both pistons 5, 5, will move packing cups 6, 6 past the compensating ports 10, 10 compressing the fluid in the system and simultaneously actuating both motors 20 and 21.

From the foregoing it is evident that flaps 27, 27 on each of the wings 28, 28 may be selectively, severally or jointly, actuated to assist in the take-off or stopping of an airplane.

The modified construction illustrated in Figure 3 shows a dual master cylinder construction which comprises a casing 40 having a cylinder 41 formed on one side thereof provided with two co-axial bores 42 and 43, each of which is of the same size and each of which is equipped with a piston 44 provided with a packing cup 45 and a spring 46. A suitable valve 47, which may be similar in construction to that in the above identified patent, is arranged at the closed end of each of the cylinder bores 42 and 43. A reservoir 48 common to both cylinders is provided and communication is established between the reservoir and cylinder bores by means of the compensating ports 49 and 50.

Piston rod 51 for piston 44 in cylinder bore 43 is pivoted to a suitable anchor 52 by means of a pin 53 and a protective boot 54 is provided between rod 51 and the casing 40 to prevent the ingress of foreign matter into the cylinder bore 43. The piston 44 in cylinder bore 42 is provided with an extension constituting the piston rod 55 which is suitably pivoted to an actuating pedal 56 preferably by means of a pin 57 which extends through a member 61 secured to rod 55. The actuating pedal is pivoted to a pin 58 and an adjustable stop and thrust receiving member 59 is adapted to engage the brake pedal 56 in the manner indicated. A flexible boot 60 is connected between casing 40 and member 61 to prevent the ingress of foreign matter into cylinder bore 42.

The closed ends of cylinder bores 42 and 43 are provided with ports 62 and 63 to which one end of conduits 64 and 65, each provided with valves 64' and 65', respectively, are connected by means of suitable fixtures 66 and 67. The other ends of conduits 64 and 65 are connected to the opposite sides of a dual acting motor 69 so that pressure may be applied to both sides of the piston therein of the type commonly employed for hydraulic actuation of farm equipment. The mo-

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tor is connected to an implement 68 through a pivoted bell-crank 70. The action of the fluid on the piston is used to regulate the vertical location of the implement and subsequently with equal fluid pressure applied on each side of the piston maintains a definitely preselected location. Valves 64' and 65' may be closed to lock the implement 68 in adjusted position.

A lever 71 pivoted on pin 72 has a pin 73 thereon operating in a slot 74 formed in casing 40 to permit a lost motion action between lever 71 and the master cylinder casing 40. The adjustable stop 59, anchorage 52, and pins 58 and 72 are suitably secured to portions of the frame of the vehicle with which the device is associated.

Referring now to the operation of the disclosure in Figure 3, assume that the system is filled with a suitable fluid and that it is desired to move the implement 68 upward with respect to the ground level. The operator will move lever 71 to the right and thus force pressure fluid from co-axial cylinder bore 43 past valve assembly 47 into conduit 65 and thus force the piston in motor 69 to the left. As the piston moves to the left it raises the implement 68 by means of a suitable bell-crank mechanism 70. When the proper relationship between implement 68 and the ground level has been attained the operator then closes valve 65' to entrap fluid in the motor and exerts a force on pedal 56 which acts on both co-axial bores 42 and 43 and pistons 44 but causes pressure fluid to exert a force on the other side of the piston in motor 69, thus firmly and definitely locating the implement with respect to the ground level. Lever 71 when moved to the left applies pressure to the left side of the piston in motor 69 when reverse movement of implement 68 is required. Valve 64' is now closed to lock the implement in adjusted position.

In the event that it is desired to move the implement downward or increase the distance between it and the ground level, then the operator moves lever 71 to the left, causing pressure fluid to act upon the left side of the piston in motor 69 and forcing implement 68 downward by means of bell-crank assembly 70, thereafter closing valve 64' to entrap fluid in the motor and then actuating lever 71 to the right or pedal 56 to apply pressure to the other side of the piston in motor 69. Implement 68 is locked in the lowered position by closing valve 65'. Springs 46 return pistons 44 to their initial position.

Figure 4 shows the dual motor 69 of Figure 3 applied to a member 69' of a machine tool, e. g., the cross-slide of a lathe. The usual tool 69'' is mounted on the slide. Motor 69 (Fig. 4) is connected to the master cylinder assembly of Figure 3 in the same manner as motor 69 in said figure. The depth of cut to be taken by tool 69' or its "in" and "out" movement is regulated in the same manner as the movement of implement 68 is controlled.

The disclosure in Figure 5 comprises two master cylinder assemblies 75 and 76, each of which includes a cylinder 77 and a piston 78. Each of the pistons is provided with a packing cup 79 and each cylinder has a valve assembly 80 therein which may be similar in construction to that disclosed in the above identified patent. Each of the cylinders has a return spring 81 arranged therein. Each of the cylinders is provided with a reservoir 82 and communication between the

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reservoir and each of the cylinders is established by means of compensating ports 83 and 84.

Piston 78 associated with assembly 75 is provided with a piston rod 85 which is pivotally supported on an anchorage 86 by means of a pin 87. A suitable flexible boot 88 is placed about the open end of cylinder 77 and rod 85 to prevent the ingress of foreign matter into the cylinder. Piston 78 of master cylinder assembly 76 is provided with an extension 89 which constitutes a piston rod and to which a member 90 is secured. A suitable flexible boot 91 is arranged about the open end of cylinder 77 and is associated with member 90 to prevent the ingress of foreign matter into piston 78 of master cylinder assembly 76.

The master cylinder assemblies 75 and 76 are, in effect, separate and distinct constructions and are joined together by a plurality of bolts or other securing means 92 which extend through a fixture 93 for the purpose of locking the two assemblies together.

An operating handle 94 is pivoted to a frame 95 of the vehicle with which the master cylinder assembly is associated by means of a pin 96. A pin 97 is associated with handle 94 and is received in an aperture 98 formed in fixture 93, the aperture being elongated to provide a lost motion connection between pin 97 and fixture 93. Another handle 99 is pivoted to frame 95 by means of a pin 100 and is also pivoted to member 90 by means of a pin 101. An adjustable stop and thrust receiving member 102 is secured to a suitable portion of the vehicle and is engageable with handle 99 in order to limit the return movement of the handle and to take up the thrust imposed on cylinder 77 of assembly 76 when piston 78 therein is actuated.

Each of the cylinders 77 is ported at 103 and 104 and has suitable fixtures arranged therein to which conduits 105 and 106 are connected. These conduits terminate in brake operating motors 107 and 108 for the purpose of actuating the brake assemblies 109 and 110, e. g., for the right and left hand drive wheels of a tractor, the latter constructions being well known in the art. The two motors can be employed to actuate other devices than those illustrated.

Referring now to the operation of the Figure 5 device, it is assumed that the system is filled with a suitable fluid and that brake motor 108 is to be operated. Handle 94 is rotated in a clockwise direction, causing piston 78 to move relatively to cylinder 77 and pressure will be applied to the fluid in the cylinder after the packing cup 79 passes compensating port 83 to force fluid past valve 80 through conduit 106 to operate the brake motor 108. It is now desired to actuate the brake motor 107 and handle 94 is rotated counter-clockwise which action will move piston 78 in assembly 76 relatively to cylinder 77 causing packing cup 79 to pass the compensating port 83 and force fluid past valve 80 into conduit 105 and thence to brake motor 107 to actuate same. Assuming that it is desired to actuate both motors 107 and 108, handle 99 is rotated in a clockwise direction, thereby relatively moving both pistons 78, 78 in cylinders 77, 77 and ultimately operating motors 107 and 108 simultaneously. The pivoted connection 87 enables the joined master cylinder assemblies 75 and 76 to pivot about pin 87 when the piston-cylinder devices are actuated.

Return movement of pistons 78, after release of handles 94 and 99, to the positions indicated

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in Figure 5 is accomplished by the return springs in brake assemblies 109 and 110 and the springs 81, 81 in each of the cylinders 77, 77.

Having fully described my invention, that which I claim as novel and desire to protect by Letters Patent of the United States is:

1. A mechanism comprising a plurality of pressure producing devices, each of which consists of a cylinder having a piston therein movable relative to said cylinder; means for supporting said devices so that the longitudinal axes of said cylinders are in substantial alignment; operating means for selectively severally actuating said devices; and other operating means mounted on one end of said aligned devices for jointly actuating said devices to thereby produce a substantially equal pressure in each device.

2. A mechanism comprising a pair of cylinders; a piston in each of said cylinders and movable relative thereto to produce a pressure fluid in each; means for supporting said cylinders so that the longitudinal axes thereof are in alignment; an operating member to selectively severally actuate said piston-cylinder mechanisms; and another operating member mounted on one end of said aligned cylinders for jointly actuating said piston-cylinder mechanisms to thereby develop a substantially equal pressure in the pressure fluid produced in each mechanism.

3. A mechanism comprising a pair of pressure fluid producing devices, each consisting of a cylinder having a piston therein; a fluid motor connected to each device; means for rigidly supporting one of said devices; means for pivotally supporting the other of said devices so that the longitudinal axis of each cylinder is in substantial alignment; an operating member for selectively severally relatively moving the piston and cylinder of each device for actuating the motor connected thereto; and another operating member for jointly relatively moving the piston and cylinder of each device to thereby produce a substantially equal pressure in each device for applying a substantially equal pressure to each motor and for jointly actuating the fluid motors.

4. A mechanism comprising a pair of pressure fluid producing devices, each consisting of a cylinder having a piston therein; a fluid motor connected to each device; means for rigidly connecting the cylinders of each device so that their longitudinal axes are in substantial alignment; means for pivotally supporting said connected cylinders; an operating member for selectively severally relatively moving the piston and cylinder of each device for actuating the fluid motor connected thereto; and another operating member for jointly relatively moving the piston and cylinder of each device to thereby produce a substantially equal pressure in each device for applying a substantially equal pressure to each motor and for jointly actuating the fluid motors.

5. A mechanism comprising a pair of pressure fluid producing devices, each consisting of a cylinder having a piston therein; a fluid motor connected to each device; a head common to each cylinder for rigidly connecting the cylinders of each device so that their longitudinal axes are in substantial alignment; means for pivotally supporting said connected cylinders; a fluid reservoir common to each piston and cylinder device; an operating member for selectively severally relatively moving the piston and cylinder of each device for actuating the motor connected thereto; and another operating member

for jointly relatively moving the piston and cylinder of each device to thereby produce a substantially equal pressure in each device for applying a substantially equal pressure to each motor and for jointly actuating the fluid motors.

6. A mechanism comprising a pair of pressure fluid producing devices; a dual motor having a piston therein and adapted to have pressure fluid applied to both sides thereof; means for connecting one end of said motor with each of said devices; an operating means for selectively severally actuating each of said devices for actuating said motor in one direction; and another operating means for jointly actuating both devices to thereby produce a substantially equal pressure in each device for applying a substantially equal pressure to both sides of said piston for locking said piston against motion.

7. A mechanism comprising a pair of pressure fluid producing devices; a dual motor having a piston therein and adapted to have pressure fluid applied to both sides thereof; means for connecting one end of said motor with each of said devices; an operating means for selectively severally actuating each of said devices for actuating said piston in one direction; another operating means for jointly actuating both devices to thereby produce a substantially equal pressure in each device for applying a substantially equal pressure to both sides of said piston for locking said piston against motion; and valve means for maintaining said piston in locked position.

8. A mechanism comprising a pair of pressure fluid devices, each consisting of a cylinder having a piston therein; a dual motor which comprises a piston and a cylinder, said piston forming two fluid chambers in the cylinder; means for establishing communication between one of said motor chambers and one of said devices; means for establishing communication between the other of said devices and the other motor chamber; means for selectively severally relatively moving the piston and cylinder in each pressure producing device for actuating said motor piston in one direction; and another means for jointly relatively moving the piston and cylinder of said pressure producing devices to thereby produce a substantially equal pressure in said pair of devices for applying a substantially equal pressure on both sides of said motor piston for locking it in position.

9. A mechanism comprising a pair of pressure fluid producing devices, each consisting of a cylinder having a piston therein and in which the cylinders are rigidly connected; means for pivotally supporting said rigidly connected cylin-

ders; a dual motor which comprises a cylinder having a piston therein for forming two fluid chambers therein; means for establishing communication between one of said motor chambers and one of said devices; means for establishing communication between the other of said devices and the other motor chamber; means for selectively severally relatively moving the piston and cylinder in each pressure producing device for actuating said motor piston in one direction; and another means for jointly relatively moving the piston and cylinder in said pair of pressure producing devices to thereby produce a substantially equal pressure in both devices for applying a substantially equal pressure on both sides of said motor piston for locking it in position.

10. A mechanism comprising a pair of pressure fluid producing devices, each consisting of a cylinder having a piston therein; means for rigidly connecting said cylinders so that the longitudinal axis of one cylinder is substantially aligned with the longitudinal axis of the other cylinder; a dual motor which comprises a cylinder having a piston therein for forming two fluid chambers in the motor cylinder; means for establishing communication between one of said motor chambers and one of said devices; means for establishing communication between the other of said devices and the other motor chamber; means for selectively severally relatively moving said piston and cylinder in each pressure producing device for actuating said motor piston in one direction; and another means for jointly relatively moving the piston and cylinder of said pair of pressure producing devices to thereby produce a substantially equal pressure in both devices for applying a substantially equal pressure on both sides of said motor piston for locking it in position.

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