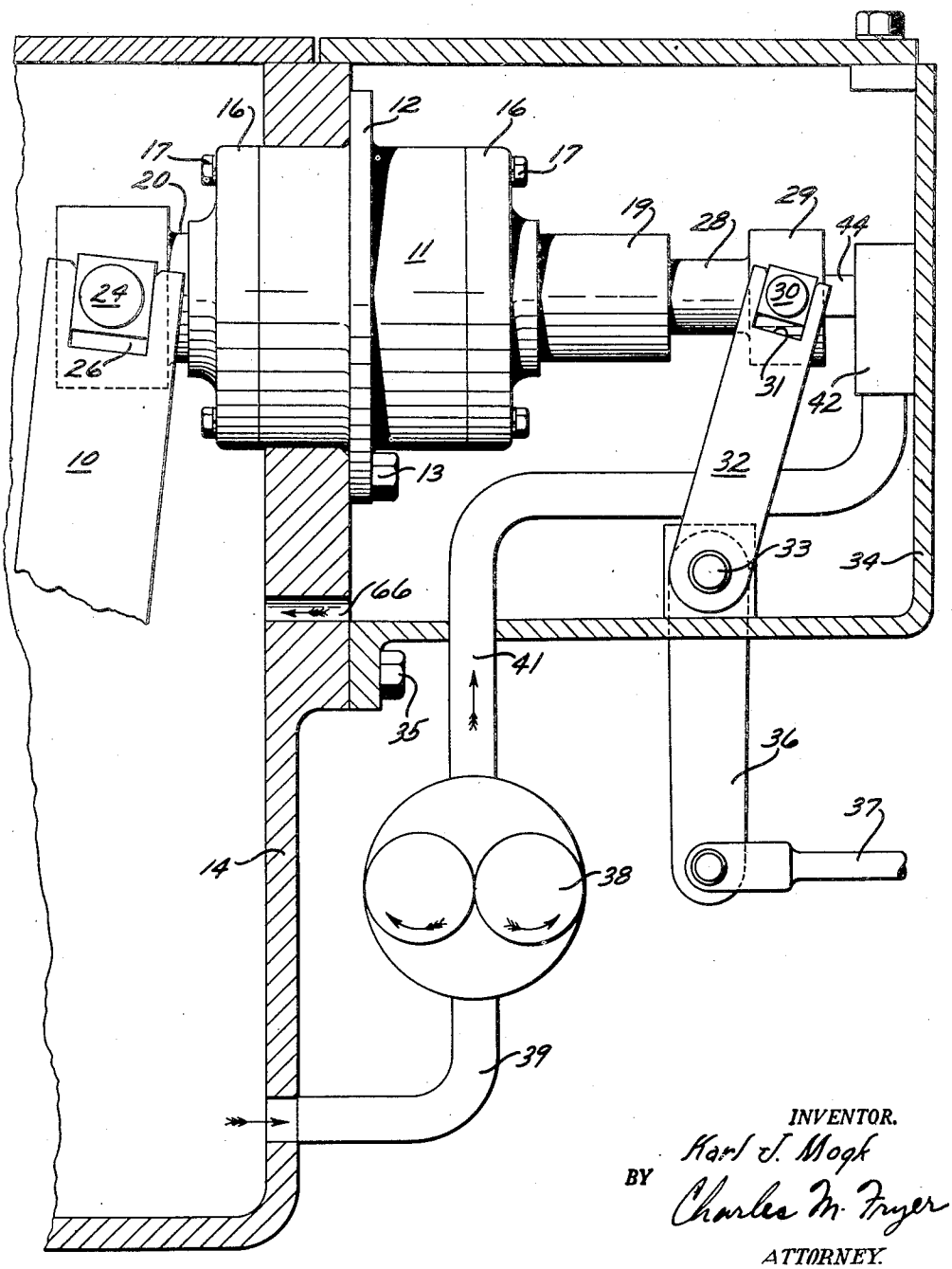
May 16, 1950 K. J. MOGK 2,507,674

DOUBLE ACTING HYDRAULIC JACK

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FIG. 1



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DOUBLE ACTING HYDRAULIC JACK

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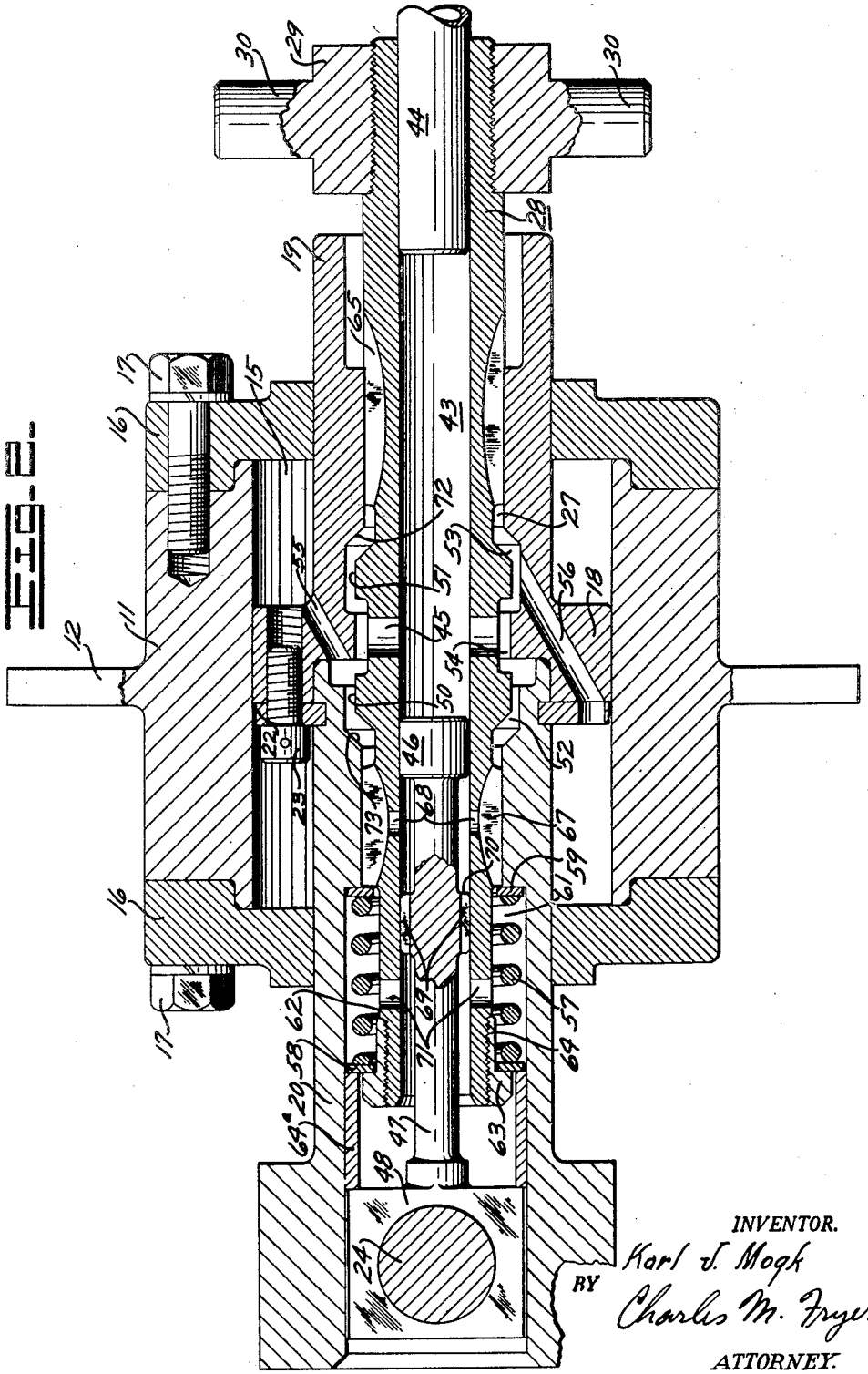


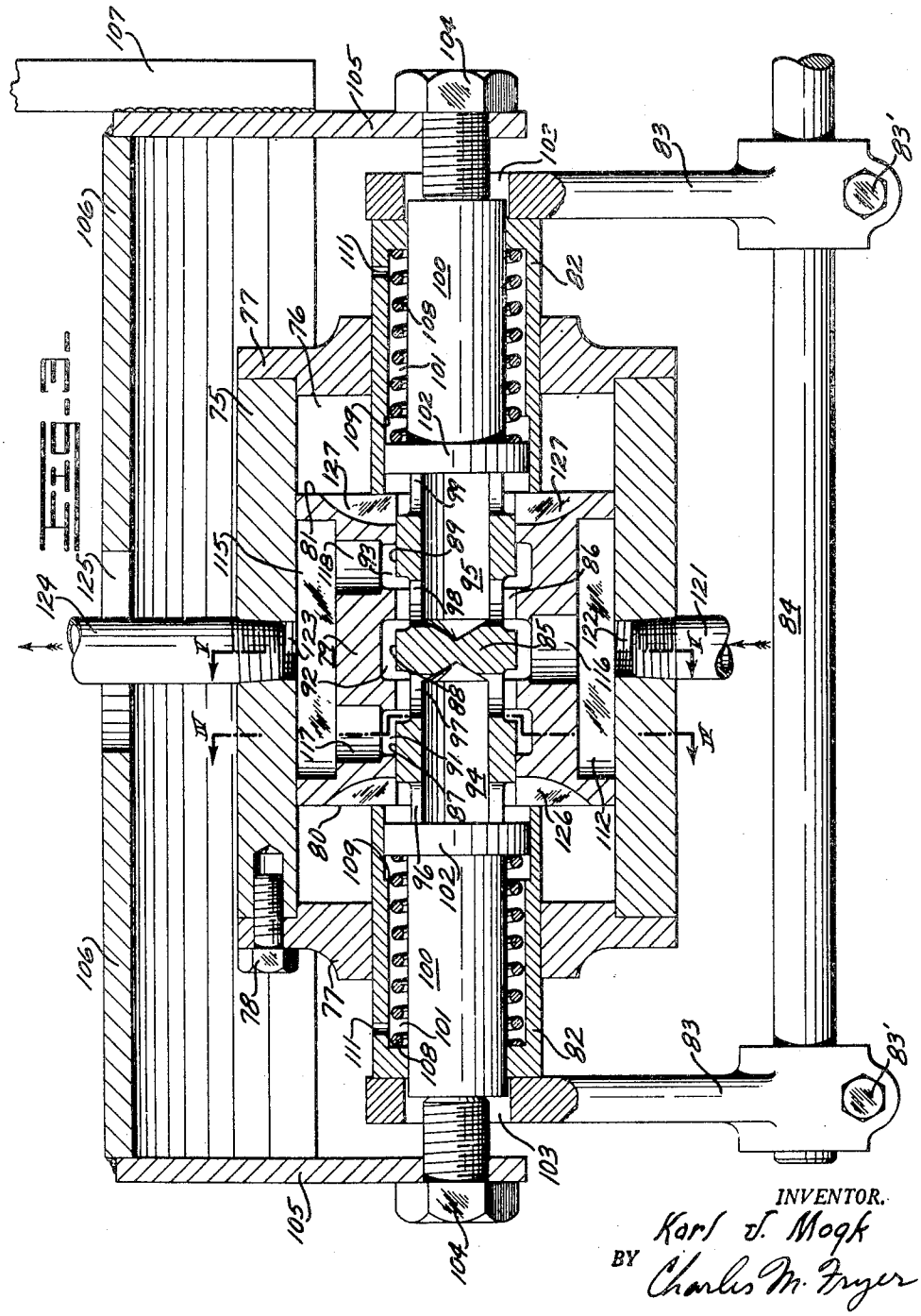
FIG. 2.

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Fig. 4.

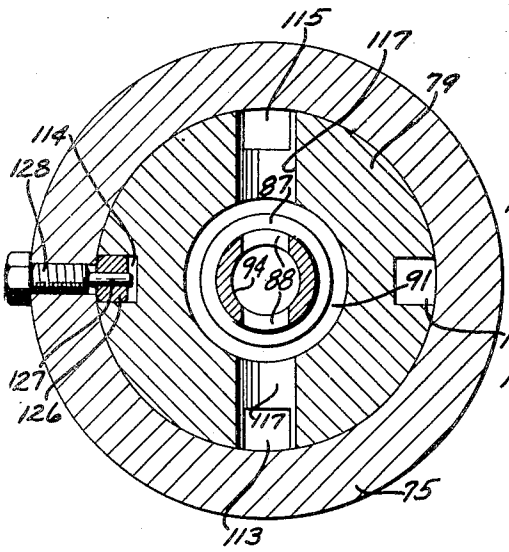


Fig. 5.

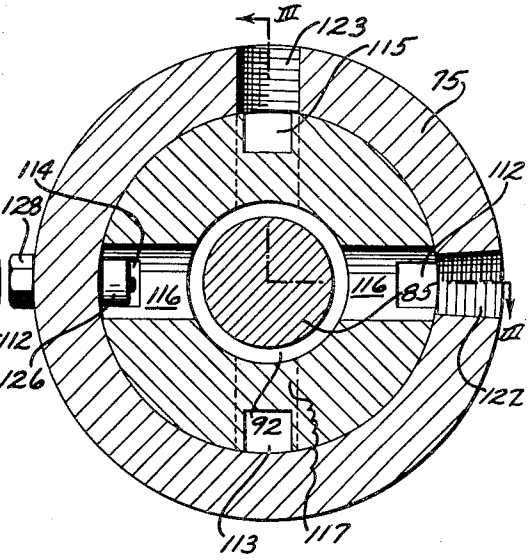


Fig. 6.

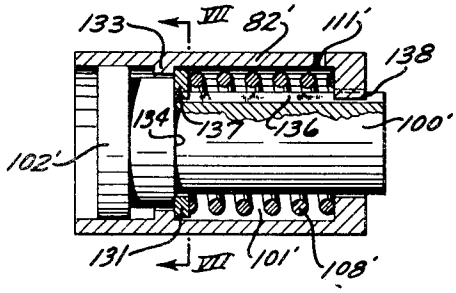
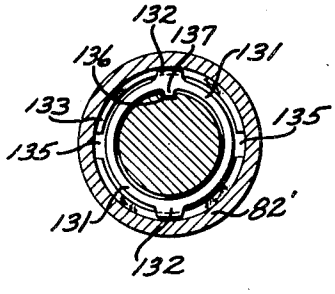


Fig. 7.



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DOUBLE-ACTING HYDRAULIC JACK

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Application September 30, 1948, Serial No. 51,967

2 Claims. (Cl. 121—41)

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This invention relates to hydraulic jacks of the kind generally referred to as boosters and more particularly to a double acting hydraulic jack or booster particularly adapted for use in an automotive-type transmission or the like.

It is conventional practice in heavy automotive-type vehicles to employ hydraulic boosters for actuating various control elements associated with the steering mechanism, the transmission gear shifting mechanism, the master clutch and the like. Such boosters usually comprise a piston actuated by fluid under pressure from a suitable pump and a control means for directing the flow of fluid to the piston. In the past, boosters of this type have been entirely dependent on a supply of fluid under pressure for their operation with the result that failure of the fluid supply resulted in the operator being unable to actuate the controls.

It is an object of the present invention to provide a double acting hydraulically actuated booster capable of being readily and easily manufactured and which will automatically be actuated mechanically in the event that the supply of fluid under pressure is not available. Other objects and advantages of this invention will be made apparent in the following specification wherein reference is made to the accompanying drawings.

In the drawings:

Fig. 1 is a longitudinal sectional view through a vehicle clutch housing illustrating a typical application of a hydraulic booster;

Fig. 2 is a longitudinal sectional view through a booster incorporating the present invention;

Fig. 3 is a development of a section taken along the line III—III of Fig. 5;

Fig. 4 is a sectional view taken along the line line IV—IV of Fig. 3;

Fig. 5 is a sectional view taken along the line V—V of Fig. 3;

Fig. 6 is a modified form of the neutralizing mechanism illustrated in Fig. 3; and

Fig. 7 is a sectional view taken along the line VII—VII of Fig. 6.

Figs. 1 and 2 of the accompanying drawings illustrate a double acting hydraulic booster embodying the present invention in its association with a control lever 10 for effecting engagement or disengagement of a vehicle clutch or the like (not shown). The booster comprises a housing 11 having a radially extending flange 12 secured by means of cap screws 13 to a wall of a housing 14 enclosing the clutch mechanism. The booster housing 11 is provided with a cylindrical

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bore 15, the ends of which are closed by cover plates 16 secured to the housing by means of cap screws 17. A piston 18 is disposed for reciprocation within the bore 15 and is provided with a pair of opposed extending stem portions 19 and 20, each extending through a suitable aperture provided in the adjacent end cover 16. The stem 19 is formed integrally with the piston 18 while the stem 20 is formed from a separate piece rigidly secured to the piston by means of a split ring 22 and cap screws 23. At its extending end, the stem 20 carries a pin 24, the ends of which are received within recesses 26 provided in the bifurcated end of the clutch control lever 10 in such a manner that movement of the piston 18 causes the control lever to rock about its supporting axis to effect engagement or disengagement of the clutch mechanism (not shown).

The piston contains an elongated bore 27 for the sliding reception of a valve spool 28, the manipulation of which effects distribution of fluid under pressure to either side of the piston for actuating the control lever 10. The extending end of the valve spool carries a collar 29 having a threaded connection therewith which is provided with a pair of extending arms 30, received within slots 31 formed in the end of a bifurcated lever 32 nonrotatably supported on a shaft 33. The shaft 33 extends through and is supported for rotation in a housing 34 enclosing the mechanism and secured to the housing 11 by means of cap screws 35. A lever 36 is non-rotatably secured to the extending end of the shaft 33 and is pivotally connected to a manually controlled link 37 which may extend to the operator's station.

The piston 18 is normally actuated by fluid under pressure from a suitable pump illustrated at 38. Fluid such as oil contained within the housing 14 is admitted to the pump through an inlet line 39 and is directed through a pressure line 41 to a fitting 42 rigidly secured to the housing 34 by any suitable means (not shown). From the fitting 42, the fluid is admitted to an axial bore 43 provided in the valve spool by means of a tube 44, one end of which is received within the bore 43 forming a sliding connection therewith. From the bore 43, the oil is admitted to the bore 27 provided in the piston 18 by means of a pair of apertures 45. The fluid is prevented from continuing along the bore 43 by a piston-like closure or plug 46, disposed for sliding movement therein. The plug 46 is provided with a stem portion 47 terminating in an enlarged end 48 secured to the pin 24 carried in the end of the stem 20 of the piston 18 and is thus in effect

connected to the piston itself. The purpose of the plug 46 is to react the fluid pressure within the bore 43 under certain conditions of operation that will be more fully described later in the specification.

The valve spool 28 is provided with a pair of spaced integral collars 50 and 51 which cooperate during its sliding movement with a pair of recesses 52 and 53 formed in the bore 27 of the piston to effect direction of the fluid therethrough. The recesses are connected by a bore 54 having a diameter less than that of the recesses but greater than that of the bore 27. The diameter of each of the collars 50 and 51 is substantially the same as that of the bore 54 and they are adapted to enter therein preventing communication between the recess 52 and 53 upon manipulation of the valve spool within the bore 27. The piston 18 is provided with a pair of passages 55 and 56, the passage 55 providing communication between the recess 52 and the bore 15 on the right hand side of the piston as viewed in Fig. 2, while the passage 56 provides communication between the recess 53 and the bore 15 on the opposite side of the piston.

The valve spool is normally retained in a neutral position such as is illustrated in Fig. 2 by means of a spring 57 interposed between a pair of thrust washers 58 and 59. The washer 59 is adapted to abut a shoulder formed at the end of a counterbore 61 provided in the bore 27 and a shoulder formed at the end of a portion of reduced diameter 62 provided on the valve spool 28. The washer 58 is adapted to abut a flange 63 formed on a nut 64 having a threaded connection with the end of the valve spool and one end of a sleeve 64a disposed within the counterbore 61. The sleeve 64a is free to slide within the counterbore 61 but is normally urged into abutment with the end 48 of plug 46 by the action of the spring 57. Thus, when the valve spool is moved in either direction with respect to the piston, the spring 57 will be deflected urging the spool to return to the neutral position.

With the valve spool in the neutral position, fluid admitted to the bore 43 of the valve spool is directed through apertures 45 to the bore 54 in the piston where it divides and flows into recesses 52 and 53. From the recess 53, fluid is free to flow through a plurality of slots 65 extending longitudinally along the periphery of the valve spool into the housing 34. From the housing 34, the fluid is returned to the housing 14 by way of a passage 66 provided in the wall of the housing 14 adjacent to the housing 34. From the recess 52, the fluid flows through a second set of slots 67 extending longitudinally along the periphery of the valve spool 28, through a pair of apertures 68 into the bore 43. From the bore 43, the fluid is free to flow through a plurality of reliefs 69 formed in a collar 70 on the stem 47 of the piston out into the housing 14. In order to prevent a hydraulic lock forming in the counterbore 61, by the action of the washer 58, it is vented to the bore 43 by a pair of apertures 71.

In operation, movement of the valve spool to the right, as viewed in Fig. 2, until the collar 51 abuts a shoulder 72 formed by the intersection of the recess 53 and the bore 27 directs all of the fluid entering the recess 53 through the passage 56 to the bore 15 thus exerting fluid pressure on the left hand side of the piston urging it to the right. Movement of the valve spool to the left until the collar 50 abuts a shoulder 73 formed by the intersection of the recess 52 with the bore 27

directs the fluid entering recess 52 through passage 55 to bore 15 thus exerting fluid pressure on the right hand side of the piston, urging it to the left as viewed in Fig. 2.

It is during operation toward the left, as just described, that the plug 46 comes into action. Upon release of the valve spool 28, the spring 57 would not be able to overcome the pressure within the bore 43 if such pressure were acting in an axial direction upon the valve spool. However, as this pressure is acting on the plug 46 and through it on the piston 18, the valve spool is free to be returned to its neutral position by action of the spring 57.

In the event of failure of the oil supply, the piston 18 can be mechanically actuated in either direction due to the abutment of the collars 50 and 51 with the shoulders 73 and 72 respectively. At this time, there would be a direct mechanical connection between the valve spool and the piston permitting manual shifting of the control lever 10. It is not intended that this will occur under normal conditions; however, it is desirable to provide a means of mechanically actuating the control lever during times of emergency.

Figs. 3, 4 and 5 illustrate a modification of the booster just described which is adapted to be connected in series in a common hydraulic circuit with other hydraulic mechanisms or the like. The booster comprises a housing 75 having a central bore 76, the ends of which are closed by cover plates 77 secured to the housing by means of cap screws 78. A piston 79 having end faces 80 and 81 is disposed for reciprocation within the bore 76. Each face is in abutment with a sleeve 82 extending through and supported for reciprocation in end covers 77. At their outer ends, each of the sleeves is adapted to abut one of a pair of spaced arms 83 carried on and secured as by cap screws 83' to a link, a part of which is illustrated at 84 which may extend to any suitable mechanism such as the clutch control lever 10 illustrated in Fig. 1.

A valve spool 85 is disposed for reciprocation in an axial bore 86 provided in the piston 79. The valve spool is provided with raised lands 87, 88 and 89 which cooperate with recesses 91, 92 and 93 formed in the bore 86. The ends of the valve spool are provided with recesses 94 and 95, the recess 94 communicating with the bore 86 through spaced apertures 96 and 97 while the recess 95 communicates with the bore 86 by way of spaced apertures 98 and 99. The valve spool 85 is interposed between a pair of plungers 100, each of which is received within a recess 101 provided in each of the sleeves 82. Each plunger is provided with a flanged end 102 which is in abutment with the adjacent end of the valve spool and at its opposite end extends through an opening 103 provided in each of the arms 83 and abuts the threaded end of a cap screw 104 carried in an arm 105 forming a part of a manually controlled shifter yoke 106. The yoke 106 carries an arm 107 rigidly secured thereto which may extend to within easy reach of the operator permitting manipulation of the valve spool 85 within the bore of the piston.

The diameter of the flanged end 102 of the plungers 100 is larger than that of the lands 87, 88 and 89 thus permitting the operator to feel the build up of fluid pressure acting on either face of the piston. This difference in area also serves automatically to return the valve spool to a neutral position wherein the pressure acting on each face of the piston is equal. The tend-

ency of the fluid pressure to neutralize the valve spool with respect to the piston is augmented by springs 108, one of which is interposed between the flange 102 and the end of the recess 101 in each sleeve. The face of the flange 102 opposite from the piston is adapted to engage a shoulder 109 formed by a suitable counter-bore in each sleeve. Engagement of the flange 102 with the shoulder 109 limits axial movement of the valve spool within the bore 86 of the piston under the influence of fluid pressure acting on the ends of the recesses 94 and 95. Each of the sleeves 82 is provided with an aperture 111 which permits any oil which may enter the bore 101 around the flange 102 to escape, thus preventing a formation of a hydraulic lock within the recess during manipulation of the valve spool.

The piston 79 is provided with longitudinally extending slots 112, 113, 114 and 115 (Figs. 4 and 5) equally spaced about its periphery. Slots 112 and 114 are diametrically opposed to each other and are connected by a passage 116 extending transversely through the piston. The slots 113 and 115 are diametrically opposed to each other and are connected by a pair of passages 117 and 118. The passage 116 intersects and communicates with the recess 92 provided in the bore of the piston while the passages 117 and 118 intersect and communicate with the recesses 91 and 93 respectively. Fluid under pressure is admitted to the housing 75 by way of an inlet line 121 having a threaded connection with a port 122 provided therein which registers with the slot 112, and is discharged through a second port 123 which registers with the slot 115. A discharge line 124 has a threaded connection with the port 123 and may extend through an elongated opening 125 provided in the yoke 106 to a similar mechanism or the like (not shown). By providing communication between diametrically opposed slots, fluid pressure acting on the periphery of the piston is balanced preventing binding of the piston in the bore 76 during reciprocation. The piston is prevented from rotating relative to the housing by a roller 126 received within the slot 114 and carried for rotation on the extending end 127 of a cap screw 128 having a threaded connection with the housing 75. The roller permits free reciprocation of the piston in the bore but prevents rotation therein, thus insuring continuous registry of the ports 122 and 123 with the slots 112 and 115 respectively.

In operation, when the valve spool is in the neutral position such as is illustrated in Fig. 3, fluid under pressure in the slot 112 is admitted to the recess 92 by way of passage 116 where it is divided and may flow through the bore 86 into recesses 91 and 93. From the recesses 91 and 93, fluid is free to flow through passages 117 and 118 into slot 115 and is discharged through pipe 124. When it is desired to actuate the link 84 to the right as viewed in Fig. 3, the valve spool is moved to the right by manipulation of the manual control 107 until the flange 102 of plunger 100 abuts the face 80 of the piston. At the same time, the land 88 enters the bore 86 between recesses 92 and 93. Simultaneously, the land 87 closes off recess 91, thus all of the fluid in the chamber 92 is directed through apertures 97 into recess 94 and thence outwardly through apertures 96 through a plurality of slots 126 provided in the face 80 of the piston. Thus, all of the fluid is directed against the face 80 moving the piston to the right, imparting a like motion to the link 84. During movement of the piston to the right, the fluid in the bore 76 adjacent to

the face 81 will be displaced through slots 127 provided therein and directed through apertures 99 into the bore 95. From the bore 95, the fluid is directed to the recess 93 through aperture 98 and is then free to flow through passage 118 into slot 115 and is discharged through pipe 124. Upon release of the manual control lever 107, the valve spool is returned to a neutral position with respect to the piston by the springs 108.

Movement of the link 84 to the left is accomplished by movement of the valve spool to the left, at which time, the land 88 enters the bore between recesses 91 and 92 and simultaneously the land 89 blocks off the recess 93. At this time, fluid in the recess 92 is directed through apertures 98 into recess 95 and thence through apertures 99 and slots 127 into bore 76 adjacent to face 81, thus moving the piston to the left. During movement of the piston to the left, the fluid in the bore 76 adjacent to the piston face 80 is displaced through slots 126, apertures 96, into recess 94 and thence through apertures 97 into recess 91. From the recess 91, the fluid is directed through passage 117 into the slot 115 from which it is discharged through pipe 124. In the event of failure of the fluid supply, the piston 79 can be mechanically actuated by virtue of the flange 102 of plungers 100 abutting the adjacent piston faces.

Figs. 6 and 7 illustrate a modification of the sleeves 82 and plungers 100, illustrated in Fig. 3, in which like parts are identified by the same reference characters primed. In this modification, the spring 108' is interposed between the end of a recess 101' and a washer 131. The washer is provided with a pair of diametrically opposed ears 132 extending outwardly from its perimeter and adapted to abut a shoulder 133 provided on the sleeve 82' and extending inwardly into the recess 101'. The washer is also adapted to abut a shoulder 134 formed on a plunger 100' thus positively limiting the maximum expansion of the spring. By so limiting the expansion of the spring, the neutral position of the valve spool is positively established.

Slots 135 are provided in the shoulder 133 to permit the washer 131 to be inserted into the recess 101'. The plunger 100' is provided with a slot 136 extending longitudinally along its circumference for the reception of a tang 137 extending inwardly from the washer 131 as well as a similar tang 138 extending inwardly from the end of the sleeve 82'. To assemble this mechanism, the washer 131 is placed on the plunger with the tang 137 in the slot 136 and then inserted into the recess 101' by aligning the ears 132 with the slots 135. The plunger and washer are then rotated ninety degrees until the slot 136 is in alignment with the tang 138, thus locking the assembly in its operating position.

I claim:

1. In a hydraulic boster or the like which includes a cylinder and a piston reciprocal therein and carrying a hollow piston rod, a valve spool in said rod operable to direct fluid under pressure to the cylinder selectively at opposite sides of the piston, said valve spool having an axial bore through which the fluid is introduced, and a sliding closure in said bore supported by the piston rod to prevent fluid pressure within the spool from holding the spool against free axial movement.

2. In a hydraulic booster or the like including a fixed cylinder, a piston reciprocable therein, a

part to be moved, and a hollow piston rod connecting the piston and the part to be moved, a valve spool slidable in the piston rod, said rod having ports controlled by the spool for directing fluid from the interior of the rod to opposite sides of the piston for moving said part in opposite directions, said valve spool having an axial bore through which said fluid is introduced, and a closure for one end of said bore carried by the part to be moved, and slidable axially relative to the valve spool.

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