

Nov. 12, 1940.

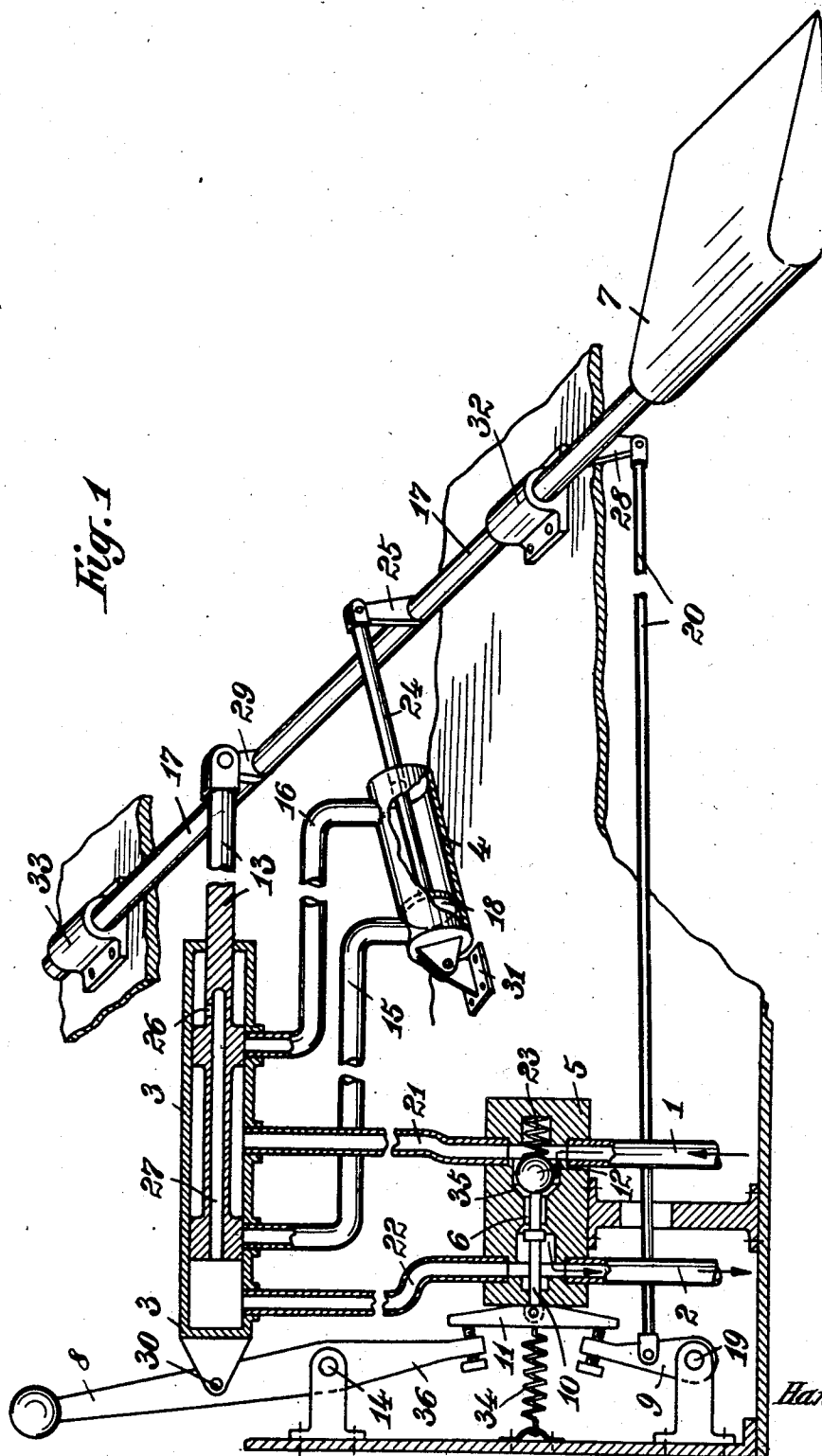
H. REBESKI

2,221,150

CONTROLLING HYDRAULICALLY ACTUATED DEVICES

Filed Nov. 26, 1937

3 Sheets-Sheet 1



Inventor:
Hans Rebesch,

Bailey & Carson
Attorneys

Nov. 12, 1940.

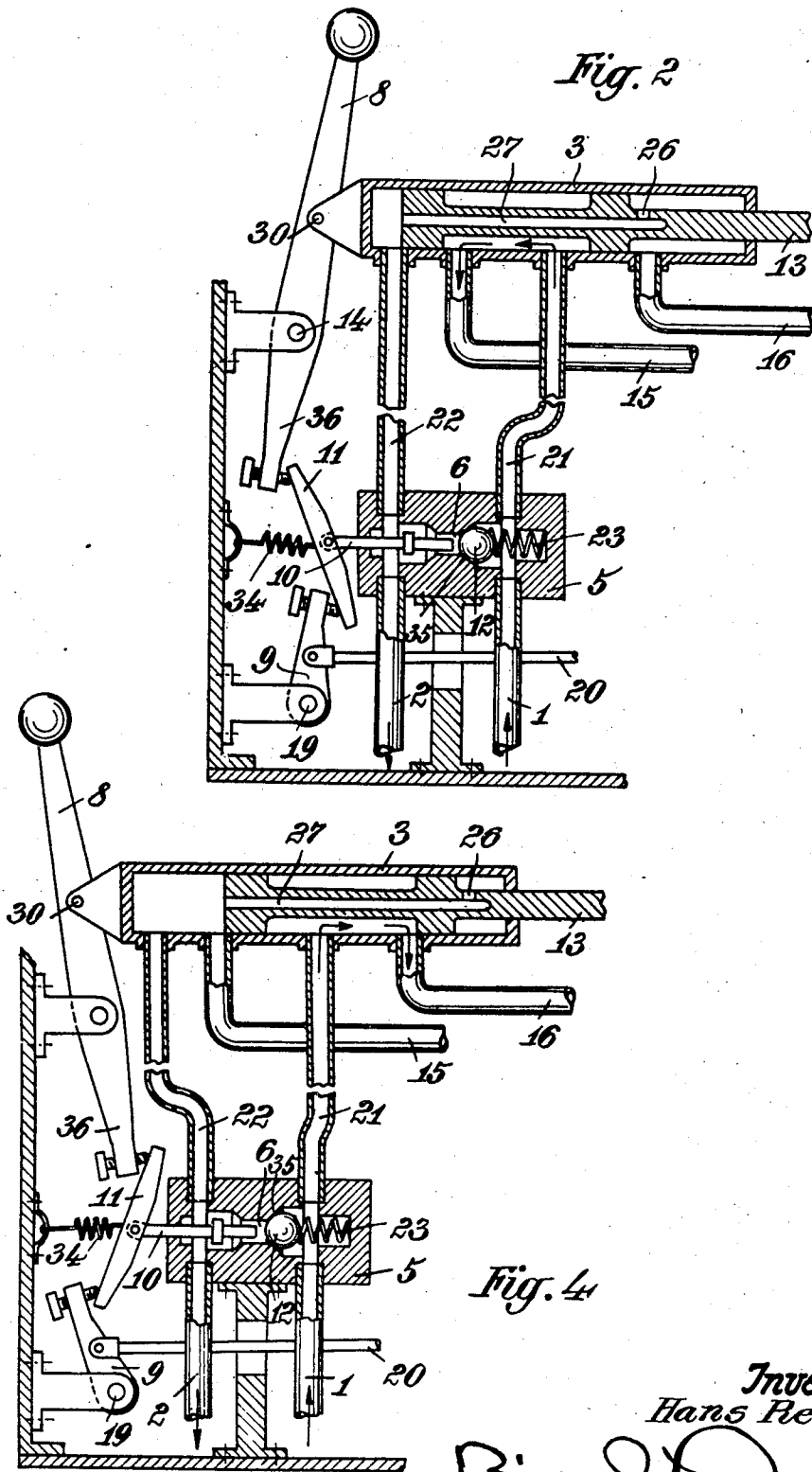
H. REBESKI

2,221,150

CONTROLLING HYDRAULICALLY ACTUATED DEVICES

Filed Nov. 26, 1937

3 Sheets-Sheet 2



Inventor
Hans Rebeski,

Barley & Carson
Attorneys

Nov. 12, 1940.

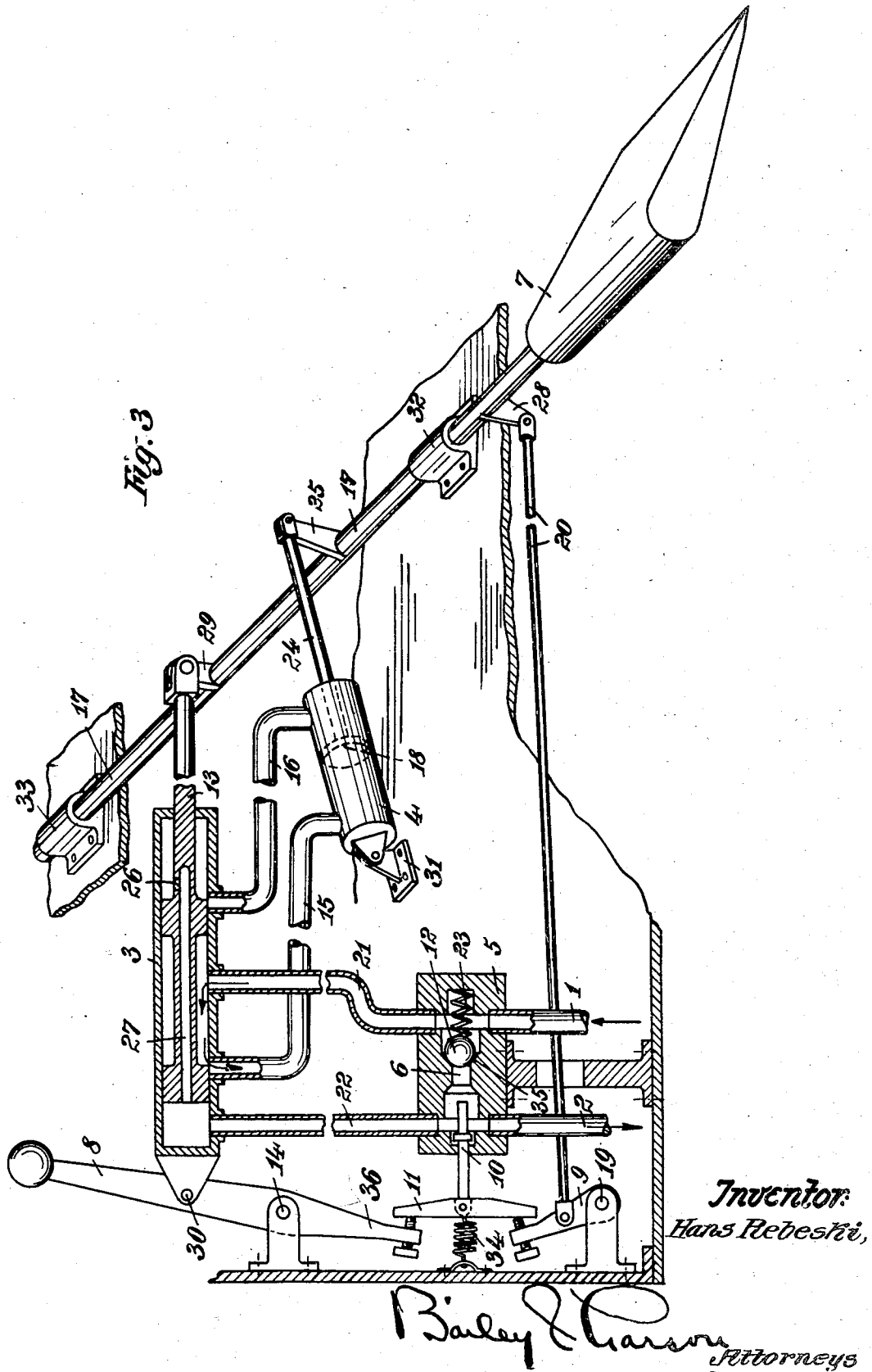
H. REBESKI

2,221,150

CONTROLLING HYDRAULICALLY ACTUATED DEVICES

Filed Nov. 26, 1937

3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,221,150

CONTROLLING HYDRAULICALLY ACTUATED DEVICES

Hans Rebeski, Brandenburg, Germany, assignor
to Arado Flugzeugwerke Gesellschaft mit be-
schränkter Haftung, Brandenburg, Germany,
a German company

Application November 26, 1937, Serial No. 176,767
In Germany December 5, 1936

3 Claims. (Cl. 121-41)

The invention relates to an arrangement for controlling the flow of the working medium for hydraulically actuated devices serving for displacing structural members in particular structural members of aircraft, the supply of working medium to which is regulated by a common valve interposed in the medium supply and discharge conduit of the displacing device.

Hydraulic presses operating with an accumulator and combined high and low pressure pumps are already known the supply of working medium to which is regulated by a common valve interposed in the medium supply and return pipes. In hydraulic presses a displaceable bolt for actuating an excess pressure valve is displaced during the pressure balancing periods by the water in the pressure chamber to such an extent that a connection between the pressure chamber and the pressure balancing conduit is established. In the pumps referred to a valve disposed in parallel between the high and low pressure conduit is indirectly actuated by a definite pressure in the high pressure conduit in such manner that it opens a direct connection between the conduit connecting the low pressure and the high pressure pumps and the oil container.

In these known arrangements the valve controlling the supply of working medium is actuated by a definite pressure of the working medium produced in the supply conduit.

Moreover displacing devices have also been suggested in which a valve controlling the supply of working medium is actuated in dependence on the movement or displacement of the corresponding structural member by this member itself.

In these displacing devices a piston of a control cylinder follows the movement of the structural member displaceable with the aid of a working cylinder until the desired position of the parts is attained and finally then at this moment closes the conduit through which the working medium, for example oil or compressed air, is supplied to the control cylinder. As however the pump for the working medium operates continuously there is a possibility that the working medium which after the said closing of the supply pipe is compressed still further in the conduit can escape by an excess pressure valve. The pump during the whole time for which no pressure is required has to overcome the comparatively high pressure to which the valve is adjusted. It should also be noted that the interval of time during which no pressure is required may be comparatively long particularly

when the structural member is in its initial position. As a result in such cases the pump is excessively heavily stressed.

The invention avoids the disadvantages mentioned by this that the valve through the common action of a member provided for switching on the displacing device and an auxiliary member moving together with the structural member, in the initial position of the structural member, holds open a direct connection between the supply and return conduits, but holds it closed in all other positions of the structural member.

In these other positions of the structural member, the valve or regulating member for the supply of fluid to the device mentioned for moving the structural member automatically into its closing position, and the means for adjusting the regulating member by the hand actuated switch means for the moving or displacing device and the auxiliary member moving with the structural member are actuated.

Further features of the invention are hereinafter described in detail in connection with the accompanying drawings.

In the drawings is shown diagrammatically one example of an arrangement in accordance with the invention showing the application of a hydraulic device for displacing or turning aircraft landing flaps.

Fig. 1 shows the device in accordance with the invention in side elevation partly in section and also in perspective the part to be moved in its initial position.

Fig. 2 shows the device in accordance with the invention in side elevation partly in section at the commencement of displacement of the part to be moved from its initial position.

Fig. 3 shows the device in side elevation and partly in section and also in perspective the structural part to be moved being in its operating position.

Fig. 4 shows the device in accordance with the invention also in side elevation and partly in section at the commencement of the return movement of the structural member to be moved from the working position into the initial position.

Referring to the drawings, the supply conduit, designated 1 supplies pressure medium, such as oil under pressure, for actuating the motor means and the pressure medium is supplied thereto preferably by a continuously operating pump, not shown. The corresponding return conduit, through which the pressure medium is

returned to the pump, is designated 2. The control valve device 3 consists of cylinder and piston members which are movable relative to one another for controlling supply and return of pressure medium from the cylinder 4 of the motor means or prime mover. In addition to the cylinder 4, which is pivotally mounted on a fixed mounting at 31, this motor means includes also a piston 18 reciprocable therein and provided with a piston rod 24. A regulator valve having a casing 5 is interposed between the conduits 1 and 2 and provided with a transverse channel or by-pass passage 6 which, at its right hand end, communicates with a supply passage having an enlarged chamber containing a valve ball 12 forming the valve member, which valve member is normally resiliently seated by the spring 23 and which is adapted to be positively unseated by means hereinafter described. The valve seat is designated 35 and delimits the right hand end of the by-pass passage 6.

In the open position of the valve member 12, when it is displaced from its seat 35, as shown in Fig. 1, the pressure medium flows in the direction of the arrows through passages 1, 6 and 2. In the example illustrated, 7 designates the structural member desired to be controllably moved which is illustrated as the landing flap of an airplane.

The means for controlling the control valve 3 and the adjustable valve member 12 of the regulator valve 5 consists of the double armed lever 8 rotatable about a pivot 14 which lever is pivotally connected with the casing of the control valve 3 at 30 and at its upper end preferably carries a knob or grip for operation by hand. The lever 8 can act with its lower end 36 in its swinging movement about the pivot 14 on the one arm of a double armed lever 11. The end of an auxiliary lever 9 rotatable about a fixed pivot 19 can act on the other arm of this lever 11.

The double armed lever 11 is pivotally connected at its central portion with a plunger 10, the one end of which projects from the valve housing 5 and which plunger is movable longitudinally in the passage 6 in such manner that the free end thereof is engageable with the ball 12 for moving it from its seat 35 against the pressure of the spring 23 as shown in Fig. 1. To limit its outward movement the plunger 10 is provided with a stop collar which bears, in the position shown in Fig. 3, against the regulator valve housing 5. A spring 34 or other resilient member fixed at one end and at the other end connected with the plunger 10 tends to move the plunger 10 into the position shown in Fig. 3. The spring 34 could naturally also act in another manner, in the direction mentioned, on the plunger 10.

The relatively shiftable members of the control valve device 3 consists for example of a cylinder in which a control piston 13 provided with suitable control passages is movable longitudinally. The piston 13 is pivotally connected at its right hand end with an arm 29 which is mounted on a shaft 17 supported in bearings at 32 and 33. This shaft 17 carries the structural member to be moved in the form of the landing flap 7 and is displaced or turned by the piston 13 movable in the cylinder 4 of the motor means. To this end the piston rod 24 of the piston 13 is rotatably mounted on an arm 25 carried by the shaft 17. The arms 25 and 29 mounted on the shaft 17 are approximately similarly directed. The shaft 17 carries at its opposite end a further

arm 28 which acts by means of the pivoted rod 20 or the like in its turning movement on the said lever 9.

The supply conduit between the regulator valve housing 5 and the casing of the control valve 3 is designated 21. The corresponding return conduit for returning the pressure medium from the control valve 3 to the regulator valve is designated 22. The supply conduit extending between the control valve casing and the cylinder 4 of the motor means is designated 15 while the corresponding return conduit is designated 16. The conduits 15, 16, 21 and 22 are necessarily flexible because of the relative movement occurring between the motor means, the control valve 3 and the regulator valve. The path of the pressure medium in the various operative positions of the parts of the device is indicated by arrows in the respective figures of the drawings.

The modus operandi of the motor means, control and regulator valves in accordance with the invention is as follows:

As is clear from Figure 1 in the starting position of the arrangement, if the regulator valve 5 were not present the oil or pressure medium supplied through the conduit 1 under pressure would pass through the conduit 21 into the casing of the control valve 3 and collect there as the conduits 15 and 16 are closed by the control piston. It must therefore flow through an excess pressure valve provided in the oil supply conduit into the return conduit 2. In order to avoid this, for the reasons mentioned above, the regulator valve 5 is interposed between the conduits 1 and 2. The valve 5, in the initial position of the landing flap 7, provides a direct communication through the passage parts of the transverse passage 6 between the conduits 1 and 2 since the ball 12, in consequence of the positions of the initiating member 8 and of the auxiliary member 9, is lifted by the plunger 10 from the valve seat 35.

If the landing flap 7 is to be shifted from its initial position (Fig. 1) into the operative position (Fig. 3) the movement initiating member comprising the manually operable lever 8 is brought to the position shown in Fig. 2 and with it casing of the control valve 3 is shifted to the right. The lower end 36 of the lever 8 thus swings to the left and the lever 11 moves into the position shown in Fig. 2, since the auxiliary member 9 is in its initial position, the plunger 10 with the ball 12 is pressed to the left by the spring 23. By the consequent seating of the ball 12 on its seat 35 the communicating passage 6 is closed and the oil or pressure medium from the conduit 1, since the control piston at present also is in its initial position, passes through the conduits 21 and 15 into the cylinder 4 of the motor means and there acts on the piston 13.

The piston 13 is moved to the right and moves the landing flap 7 through the medium of the piston rod 24 and of the lever arm 25 by rotation of the shaft 17 into its working position shown in Fig. 3. The oil or pressure medium at the right hand of piston 13 is thus forced through conduit 16 into the casing of the control valve 3 and further through the bores 26, 27 of the control piston 13 into the return conduits 22 and 2. In consequence of the rotary movement of the shaft 17 the auxiliary lever member 9 is now turned about its axis 19, on the one hand, by the lever arm 28 through the connecting rod 20 and the lever 11 and the plunger 10 finally assumes

the position shown in Fig. 3 when the flap 7 is in its operative position. On the other hand on the rotary movement of the shaft 17 through the medium of the lever arm 29 the control piston 13 is moved so far to the right that, in the working position of the flap 7, there remains between the control cylinder chamber and the conduit 15 a small passage so that the pressure acting on the landing flap 7 is always balanced by the oil pressure acting on the working piston 18.

The passage 21 which is subject to fluid pressure only during actuation of the regulated structural element is preferably provided with suitable known excessive pressure valve means (not shown).

If the landing flap 7 is to be returned from its operating position shown in Fig. 3 into its initial position the lever 8 is turned into the position shown in Fig. 4 and the cylinder of the control valve 3 is thus moved to the left. The lower part of the lever 8 thus swings to the right and the lever 11 moves into the position shown in Fig. 4. The plunger 10 is not moved as the auxiliary member 9 at the beginning of the return movement of the flap is still in its position shown in Fig. 4.

If the casing or cylinder of the control valve 3 is shifted to the left the control cylinder and piston at this moment are in the position relative to one another shown in Fig. 4. The oil or pressure medium coming from the supply conduit 1 passes therefore into the cylinder 4 of the motor means and displaces the piston 18 to the left therein. The shaft 17 is thus rotated in counter-clockwise direction through the medium of the rod 24 and of the lever 25 and the landing flap 7 returns gradually to its initial position. The pressure medium at the left of the piston is thus forced through the conduit 15 and the casing or cylinder of the control valve 3 into the return conduits 22 and 2.

With the movement or rotation of the landing flap the piston 13 of the control valve 3 is also moved to the left until the landing flap 7 has reached its initial position. At this moment the control piston 13 then closes the connections between the casing or cylinder of the control valve 3 and the conduits 15 and 16. Moreover, on the return movement of the landing flap 7, the auxiliary member 9 is turned about its pivot 19 to the right by the lever arm 28 through the connecting rod 20 and the lever 11, and the plunger 10 is thereby brought to the initial position shown in Fig. 1. The plunger 10 thus unseats the ball valve member 12 from the valve seat 35 during the last part of its rightward movement so that the direct connection between the conduits 1 and 2 is provided by the passage 6 as soon as the landing flap has reached its initial position. All the parts of the device are then again in the position shown in Fig. 1.

I claim:

1. In fluid pressure means for controlling a movable element including fluid motor means

operatively connected to said movable element, control valve means for controlling the supply of fluid to said motor means including a movable cylinder and a piston reciprocable in said cylinder and connected with said movable element for movement therewith, supply and return connections extending to said control valve means from a pressure fluid source, a regulator valve having therein supply and return passages forming portions of said supply and return connections, a by-pass passage in said regulator valve adapted when open to connect said supply and return passages in said regulator valve, normally closed valve means in said by-pass passage, and valve operating means responsive to predetermined positioning of said control valve cylinder and said movable element for opening said by-pass passage.

2. Apparatus according to claim 1, said valve means including a ball normally spring pressed to seating position, and said valve operating means including a plunger normally resiliently withdrawn from said ball, a double armed lever pivoted on said plunger, a manually operable lever for moving said control valve cylinder and having an end portion engageable with one arm of said double armed lever, and an auxiliary lever member engageable with the other arm of said double armed lever and connected with said movable element for movement therewith.

3. In an apparatus for controlling the flow of pressure fluid in a device containing control valve members relatively movable by manual actuation of a lever having a fixed pivot, said control valve members controlling the supply and return of fluid from the cylinder of a fluid motor having a piston reciprocating therein, said piston having a connecting rod operatively connected with a structural member for imparting movement thereto, the combination of a valve member connected by passages with the supply and return conduits from a control valve device and movable automatically into its closing position for the supply of fluid through said control valve to said fluid motor, and operating means for opening said valve member, said operating means including a double armed lever connected with a power transmission member engageable with said valve member, said double armed lever being engageable at one end with said manually actuated lever for movement thereby and engageable at the opposite end by an auxiliary member movable with the shiftable structural member and including a lever rotatably mounted on a fixed pivot, said double armed lever of the operating means being released by said manually actuatable lever at the beginning of the displacement of the structural member from initial to adjusted position in such manner that in turning about said auxiliary member, it controls the said power transmission member to such extent that the valve member moves into its closing position.

HANS REBESKI.