

April 23, 1946.

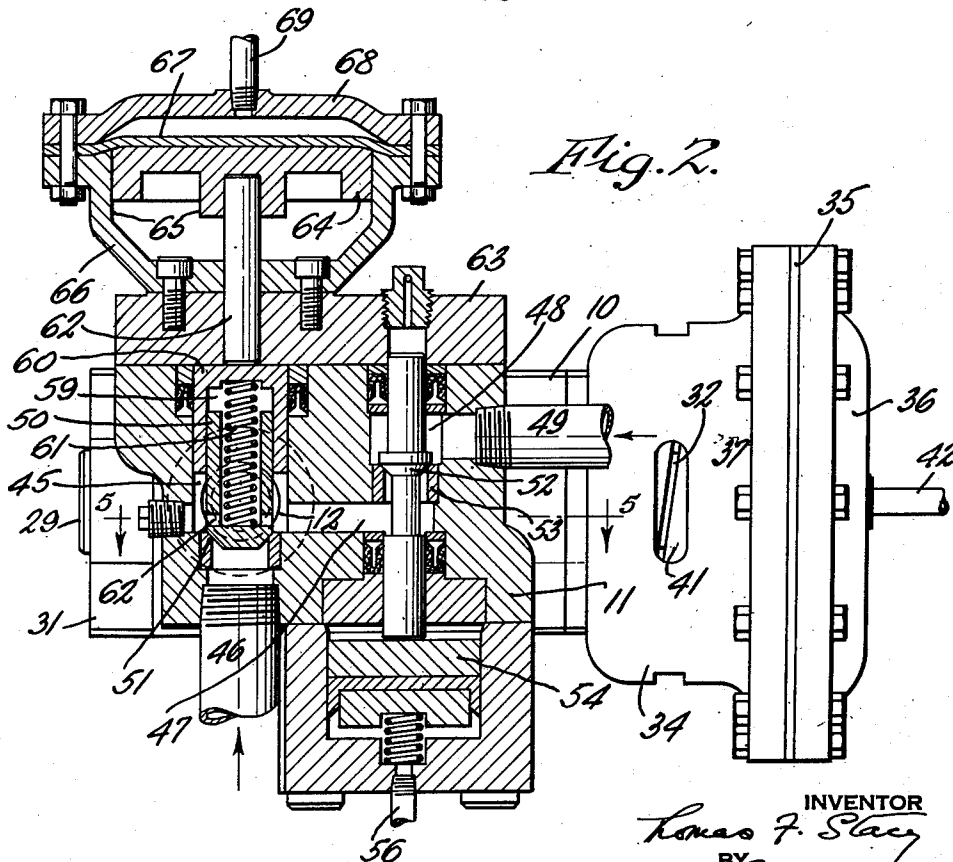
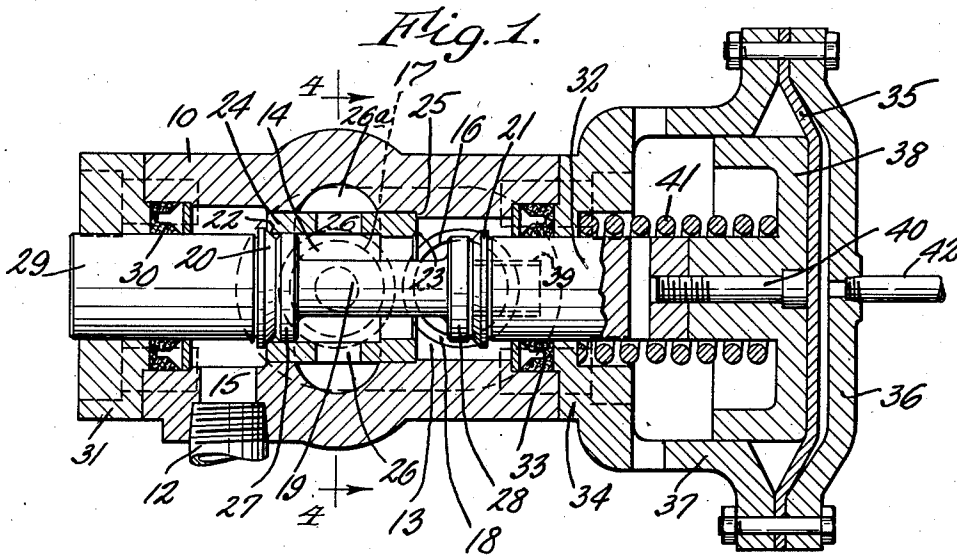
T. F. STACY

2,398,811

CONTROLLING VALVE FOR HYDRAULIC MOTORS

Filed Sept. 20, 1941

2 Sheets-Sheet 1



INVENTOR
Thomas F. Stacy
BY
Parker, Hochstadt & Lerner.
ATTORNEYS

April 23, 1946.

T. F. STACY

2,398,811

CONTROLLING VALVE FOR HYDRAULIC MOTORS

Filed Sept. 20, 1941

2 Sheets-Sheet 2

Fig. 3.

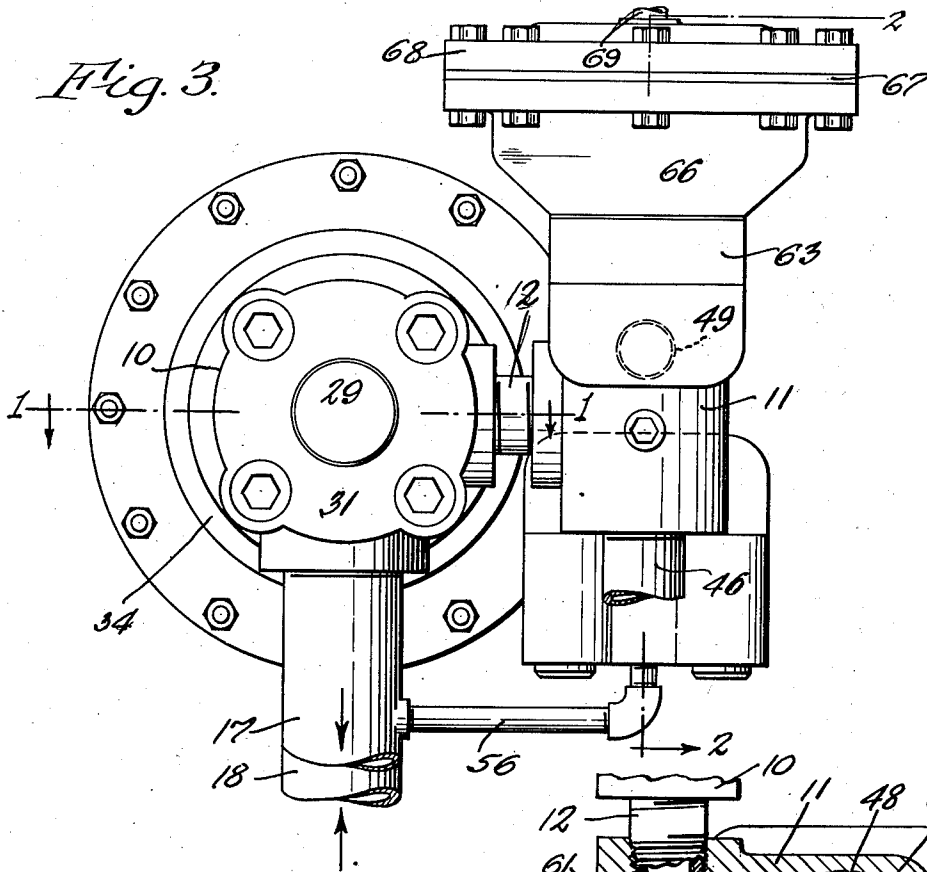


Fig. 4.

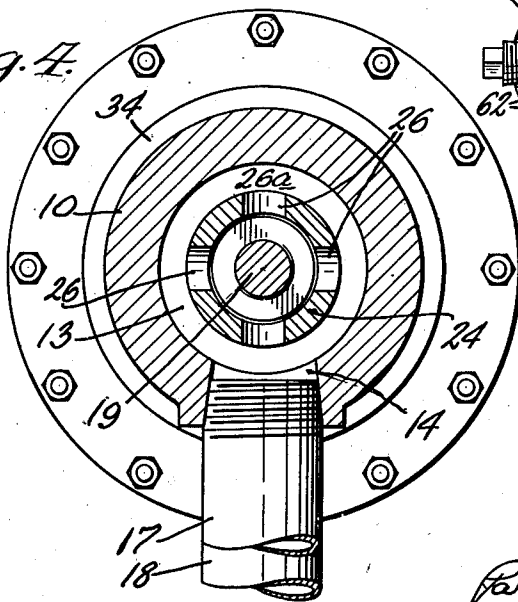
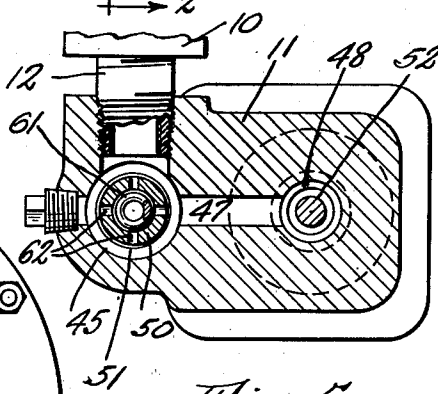


Fig. 5.



INVENTOR
Thomas F. Stacy
BY
Parker, Prosser & Farmer.
ATTORNEYS

UNITED STATES PATENT OFFICE

2,398,811

CONTROLLING VALVE FOR HYDRAULIC MOTORS

Thomas F. Stacy, Piqua, Ohio, assignor to The French Oil Mill Machinery Company, Piqua, Ohio

Application September 20, 1941, Serial No. 411,709

2 Claims. (Cl. 121-46.5)

This invention relates to valve devices for operating or controlling fluid operated presses, motors and the like, and more particularly to a valve device for such purpose, which includes a valve element that operates automatically to deliver operating fluid from a source of high pressure to the press when the ram or movable press element meets a predetermined resistance after initial movement thereof by fluid from a low pressure source.

One object of the invention is to provide a practical and desirable valve device for such purposes, which is of novel and simple construction, and will be efficient and reliable in use.

Other objects are to provide a valve device which comprises, in a unitary structure, a main valve controlling admission of the pressure fluid to and the exhaust of the same from the press, an auxiliary or combined check and stop valve which operates automatically to prevent back flow in the low pressure supply line when the admission valve for the high pressure fluid is opened, and means, preferably a fluid pressure actuated motor, for closing said auxiliary valve to stop the advance movement of the press ram or movable press element in any desired position or at any time prior to the application of the high pressure fluid to the press; to provide a valve device which is provided with a main valve for controlling the admission and discharge of the pressure fluid to and from the press, and a valve which acts automatically as a check valve to prevent back flow in the low pressure supply line when the high pressure is applied to the press, and which is also adapted to be operated at will as a stop valve, to arrest the operation of the press or stop the movable press element in any desired position prior to the application of the high pressure to the press; also to furnish the valve device with a single seat sleeve for a movable valve element, which sleeve forms oppositely-disposed seats, or seats at opposite ends of the sleeve for cooperation with the opposed closure sections on the valve element and construct the device so that the press operating fluid acts on the sleeve in opposition to the pressure of an operating motor for the valve element in such a way as to prevent displacement of the seat sleeve by the pressure exerted thereon by the valve operating motor.

Further objects and advantages of the invention will appear from the following specification of the preferred embodiment of the invention, shown in the accompanying drawings, and the novel features of the invention are set forth in the appended claims.

In said drawings:

Fig. 1 is a view of the valve device, partly in plan and partly in section, on line 1-1, Fig. 3.

Fig. 2 is an elevation thereof, partly in section, on line 2-2, Fig. 3.

Fig. 3 is an end elevation thereof as seen from the left hand end of Fig. 2.

Fig. 4 is a sectional elevation on line 4-4, Fig. 1.

Fig. 5 is a sectional plan on line 5-5, Fig. 2.

The valve has a casing, which for the sake of convenience of construction, may comprise, as shown in the drawings, two parts or sections 10 and 11, which are rigidly connected together by a short pipe or tube 12 which forms a connecting passage between valve chambers in the two casing parts.

In part 10 of the casing is a main valve chamber 13. Preferably, this chamber is of generally cylindrical form, and the casing is provided with three ports or passages 14, 15 and 16, communicating with the chamber 13, respectively at its intermediate or middle and opposite end portions. The port 15 communicates through the tube 12 with a chamber or passage in part 11 of the casing for admission of the press operating fluid to the main valve chamber 13, and the intermediate port 14 connects, as by a pipe 17, with the cylinder of the press or motor to be operated, while the port 16 is an exhaust port for the discharge of operating fluid from the press cylinder through pipe 18.

Movable axially in the chamber 13 is a main valve element 19 having closure sections 20, 21, which may be formed by annular frusto conical shoulders or enlargements of the element 19, at opposite ends of a reduced middle or waist portion thereof, for cooperation with annular seats 22 and 23 in the valve chamber. The valve seat 22 is located between the admission port 15 and the press port 14, while the seat 23 is located between the press port 14 and the exhaust port 16, so that the closure section 20, by cooperation with the seat 22, controls the admission of the pressure fluid to the press and the other closure section 21 cooperating with the seat 23 controls the discharge of the pressure fluid from the press through the exhaust port 16.

Preferably, the two spaced valve seats 22, 23 are formed by conical faces on the opposite ends of a single sleeve 24 which has a tight or driven fit in the chamber 13, with that end of the sleeve at which the seat 23 is located abutting against an annular shoulder 25 in the chamber, and may also be secured in position by welding. The press port may communicate with the space enclosed

by the sleeve through one or more holes 26 in the sleeve and a surrounding channel 26a in the walls of the chamber 13. The valve element also preferably has cylindrical piston sections 27 and 28 at the inner sides of the enlargements 20, 21, each adapted to move into and out of and slidably fit in the adjacent end portion of the sleeve 24. As shown, the piston section 28 and the end of the sleeve 24 which it enters are of somewhat smaller diameter than the other piston section 27. At one end the valve element 19 has a stem 29 which passes through a suitable packing 30 with a guide hole in a cap or end piece 31 that closes the adjacent end of the valve chamber 13. At its opposite end the valve element has a stem 32 passing through a suitable packing 33 and extending out of the casing through a guide hole in the cap or end piece 34 closing this end of the casing, for connection with an actuating motor or device for the valve element.

This actuating motor, as shown, comprises a flexible diaphragm 35 which is clamped at its marginal portion between a cover member 36 and a yoke 37 formed on the end cap 34, and bears on or is attached at its central portion to the outer end of a plunger or piston 38 which is secured to the stem 32, and is movable and guided in a cylindrical cavity in the yoke 37. For convenience of manufacture and assembly, the valve stem 32 may be a separate piece secured by a screw stud and socket 39 to the valve element, and the plunger 38 may be formed by a separate piece secured by a central screw 40 to the outer end of the valve stem 32. A coil spring 41 surrounding the valve stem and bearing at opposite ends against the end cap 34 and the plunger 38 acts to move the plunger and valve element outwardly to the position shown in Fig. 1, in which the closure section 20 engages the valve seat 22 and shuts off admission of pressure fluid to the press, while the press port 14 is in open communication with the exhaust port 16. The valve element is moved in the opposite direction to seat the closure section 21 against the seat 23 and thereby close the exhaust and open the press port 14 for the admission of pressure fluid to the press, by air or fluid pressure on the motor diaphragm 35. Air under pressure may be admitted for this purpose to the diaphragm chamber through a pipe 42 under the control of a suitable pilot valve, not shown. By opening the pilot valve, compressed air or fluid is admitted and the diaphragm actuated to move the plunger 38 and valve element 19 against the action of spring 41 to open the admission passage and close the exhaust passage, and when the pilot valve is closed, the valve element 19 is returned to the position shown, to close the admission passage and open the exhaust passage, by the spring 41.

In the section or part 11 of the valve casing is a valve chamber 45. The low pressure fluid supply pipe or line 46 connects with this chamber, and the chamber 45 communicates with the main valve chamber 13 in part 10 of the casing through the pipe 12 that connects the two casing parts. Chamber 45 also communicates by a passage 47 with a high pressure valve chamber 48 in part 11 of the casing to which high pressure fluid is admitted through a supply pipe 49. In the chamber 45 is an auxiliary, or combined check and stop valve element 50 adapted to close against an annular seat 51 to shut off the admission of the low pressure fluid to the main valve chamber 13, and in the chamber 48 is a high pressure ad-

mission valve element 52 which cooperates with an annular seat 53 in the chamber 48, to control admission of high pressure fluid to the check valve chamber 45. High pressure valve element 52, as usual, may be closed against its seat by the pressure of the high pressure fluid thereon, to prevent admission of the high pressure fluid to the check valve chamber 45, until opened by a suitable actuating piston or member 54 actuated by fluid pressure admitted to the cylinder in which the piston operates through a pipe or passage 56 which may connect with the main press cylinder or the press supply pipe 17. When the ram or movable press element engages the work or meets a predetermined resistance, greater than the pressure of the low pressure fluid on the ram, the pressure in the main press cylinder and in the pipe 56 will increase, and this increased pressure acting on the piston 54, is adapted to open valve 52 against the closing pressure of the high pressure fluid on the valve.

The auxiliary valve element 50, as shown, is of hollow, cylindrical form open at its upper end and having a closed lower end adapted to engage the valve seat 51, and it is slidable axially in the cylindrical cavity 59 of an actuating piston or plunger 60 which, in turn, is slidable axially in the cylindrical valve chamber 45. A coil spring 61 in the hollow valve element and bearing at opposite ends against the same and the piston 60 tends to yieldingly hold the valve element closed against its seat 51, but permits the valve to be opened by the low pressure fluid from the supply passage 46 against the lower end of the element, when the main valve 19 is opened to admit the pressure fluid to the press. One or more holes 62 through the lower portion of the cylindrical wall of element 50 admits high pressure fluid from the passage 47 into the cavity of the piston 60, and the pressure thereof against the upper end of the valve element acts to seat said valve element and prevent back flow of high pressure fluid into the low pressure supply line 46 when valve 52 is opened to admit high pressure fluid to the press.

Piston 60 is adapted to be moved inwardly, and, by compressing spring 61, to close auxiliary valve element 50 to shut off the admission of low pressure fluid to the press, and thereby arrest the operation of the press, or stop the press ram or movable press element in any position or at any time prior to the admission of the high pressure fluid to the press. Preferably the piston is moved for this purpose by a motor-actuated plunger 62 passing through a hole in a cap or end piece 63 that closes the upper end of valve chamber 45. The actuating motor for plunger 62, as shown, comprises a head or piston 64 on the outer end of the plunger 62 and is arranged to move in a cylindrical cavity or chamber 65 in a yoke 66 fixed on the casing 11. The head 64 bears against a flexible diaphragm 67 which is clamped at its marginal portion between the end of the yoke 66 and a cover piece 68. Compressed air or fluid under pressure admitted to the chamber between the diaphragm and cover 68, as by a pipe 69 connected to the cover, under the control of a suitable pilot valve (not shown) will move the diaphragm, plunger 62, and piston 60 inwardly, and thereby compress the spring 61 and close the auxiliary valve element 50 against its seat and shut off admission of operating fluid to the press.

By this means, the movement of the press ram or movable press element can be quickly and

easily arrested prior to the admission of the high pressure fluid to the press whenever this may be desirable, as for instance, for the purpose of enabling a required adjustment of a die, mold or other part to be operated by the press. When the operation of the press is thus arrested, the main valve element 19 will be in its open position, admitting the low pressure fluid to the press cylinder and closing the press cylinder exhaust port. The ram or movable press element therefore will be held stationary or prevented from fluctuations when it is thus stopped by operation of the auxiliary valve 50.

The described construction of the main operating or control valve for the press gives important advantages in the production and performance of the device. Since the annular seats for both the admission and exhaust closure sections of the valve element are formed on the single seat sleeve 24, the seats can be readily made or machined to insure precise relative position or alignment of the parts with resulting precision in the performance of the device. Furthermore, the end face of the seat sleeve at the fluid inlet end thereof is exposed to the pressure of the press operating fluid in the valve chamber 13 when the valve element 19 is in position to admit the pressure fluid to the press. At such time the exhaust closure section 21 of the valve element will be pressed against its seat at the opposite end of the sleeve and close this end of the sleeve. The press operating fluid will therefore press against the exposed inlet end of the sleeve in opposition to the pressure in the opposite direction which the valve actuating motor or diaphragm 35 exerts on the sleeve through the medium of the valve element 19. This exposed inlet end face of the sleeve is made of adequate area for the pressure of the press operating fluid thereon to balance the opposing pressure of the valve actuating motor and thus prevent the possibility of the sleeve 24 being shifted or displaced by such pressure of the motor thereon.

From the foregoing description it will be observed that the motor or press may be started to initiate a movement of the platen or working member in advancing direction and then, without reversing the press or motor the platen or working element may be stopped in any intermediate position before it encounters substantial resistance, and held in such intermediate position for a selected period, after which the advance of the platen or working member may be continued, or returned to initial position as may be desired.

This provides a very simple but convenient and practical way of "inching" the platen or working member of the motor, which is very desirable in setting up work or dies, preparatory to regular operations.

It will be understood that various changes in the details and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

I claim as my invention:

1. In a control valve unit for fluid-pressure-operated presses and the like of the type having fluid supply, exhaust and press passages, a main valve controlling said passages and operable to supply fluid to and exhaust it from the press, and a free check valve which controls said supply passage and is opened by the supply fluid pressure in said passage to admit fluid to said main valve and is closed by fluid pressure between said check valve and said main valve to prevent back flow in said supply passage, the combination therewith of a piston movable relatively to said check valve and between which and the check valve the pressure acts for closing said valve, and means operable at will for moving said piston in a direction to close the check valve while said main valve remains open to admit the fluid to the press.

2. In a control valve unit for fluid-pressure-operated presses and the like of the type having low and high pressure fluid supply passages and exhaust and press passages, a main valve operable to supply fluid to and exhaust it from the press, a pressure responsive valve controlling the high pressure fluid supply, and a free check valve which controls said low pressure fluid supply and is opened by the low pressure supply fluid to admit said fluid to said main valve and is closed by fluid pressure between the check valve and said main valve when said high pressure valve is opened, the combination therewith of a piston movable relatively to said check valve and between which and the check valve said pressure acts for closing said valve, and means operable at will for moving said piston to close said check valve for arresting operation of the press while said main valve remains open to admit the fluid to the press and prior to the opening of said high pressure valve.

THOMAS F. STACY.