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PNEUMATICALLY ACTUATED HYDRAULIC CIRCUIT FOR PRESSES

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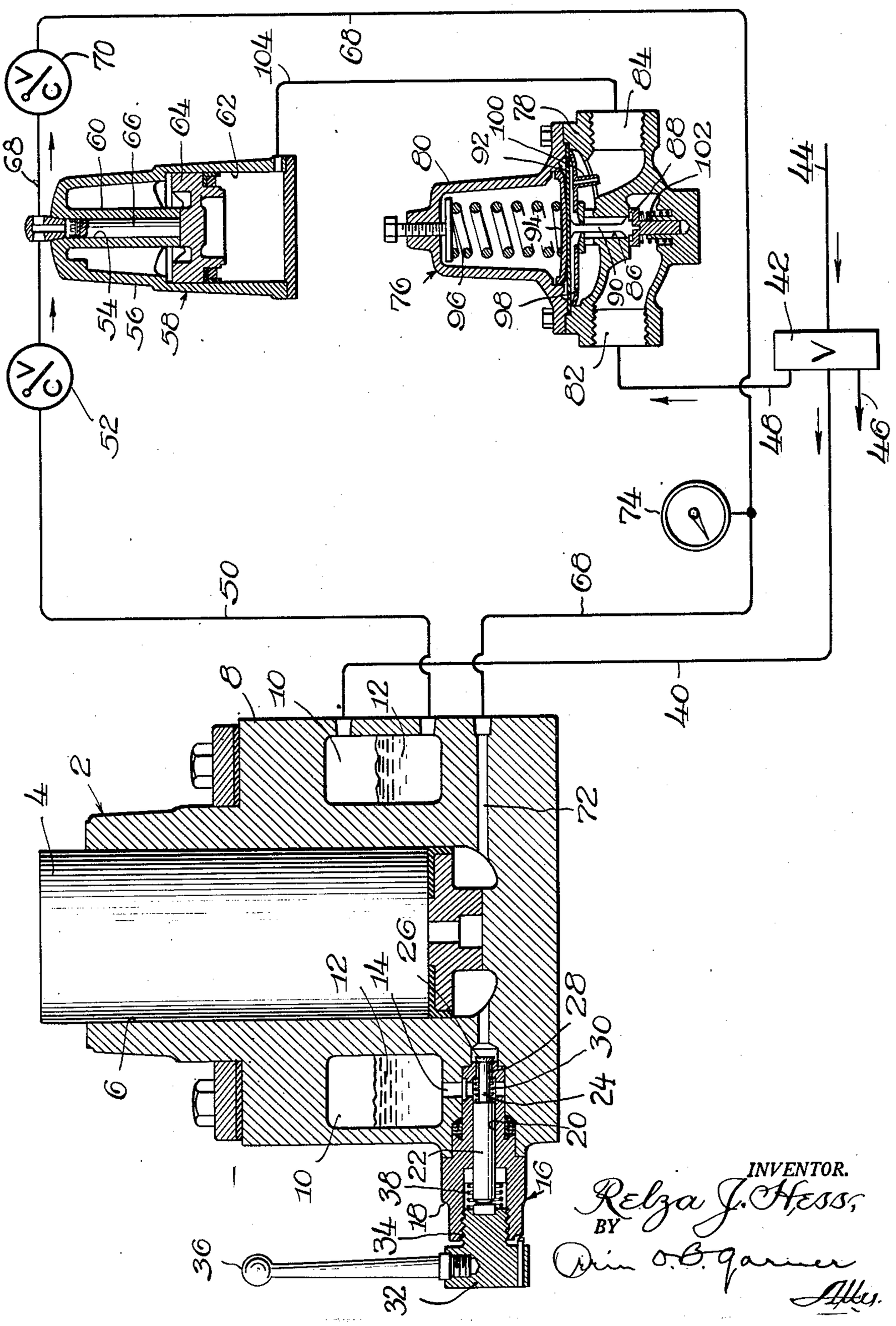

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PNEUMATICALLY ACTUATED HYDRAULIC CIRCUIT FOR PRESSES

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3 Claims. (Cl. 60—51)

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This invention relates to hydraulic presses and more particularly to a novel actuating circuit adapted for operation of small inexpensive hydraulic presses.

Throughout the hydraulic press industry, and particularly in the plastic molding field, there has been a demand for a small, relatively inexpensive hydraulic press for the production of small pieces involving simple pressing techniques and comparatively low tonnage. To meet this demand there have been designed many small presses of the "laboratory type" and a number of small presses constructed according to conventional designs for standard large size presses. Both of these types of presses have proved inadequate inasmuch as the laboratory type press is inconvenient to handle and is generally not powered, and the small presses of conventional design are necessarily expensive per unit of capacity because of the hydraulic pumps and motors required.

Thus this particular size range of hydraulic presses has been reluctantly neglected by press manufacturers in favor of designs and sizes which have warranted a considerable investment on the part of the purchaser. The present invention relates to a small size inexpensive hydraulic press which is power actuated and is suitable to meet the requirements of the industry.

A general object of the invention is to provide a practical and inexpensive powered hydraulic press for the above-mentioned purposes.

Another object of the invention is to design a hydraulic press comprising a novel actuating system including a pneumatic intensifier or power device for developing hydraulic pressure on the pressure or working stroke of the press.

Still another object of the invention is to design a novel actuating circuit such as above described whereby the rapid advance stroke of the press ram to the work is effected by pneumatic displacement of the hydraulic fluid in the associated reservoir and the pressure or working stroke of the ram against the work is effected by a pneumatic intensifier or pressure device.

A further object of the invention is to charge or set the pneumatic intensifier in a circuit such as above described by hydraulic fluid pneumatically forced from the press reservoir into the intensifier which is preferably discharged or actuated by pneumatic fluid directed thereto from an associated shop line.

The foregoing and other objects and advantages of the invention will become apparent from a consideration of the following specification and

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the accompanying drawing, wherein the single figure is a flow diagram of a novel pneumatically operated hydraulic circuit embodying the invention, the hydraulic press and the pneumatic intensifier being diagrammatically shown in central vertical section.

Describing the invention in detail and referring to the drawing, it may be noted that the hydraulic motor generally designated **2** is illustrated in greatly reduced size for the purpose of convenience, said motor comprising a press ram **4** which is reciprocal within a complementary cylinder **6** in the press frame **8**. The frame **8** is provided with an annular internal reservoir **10** containing a body of hydraulic fluid **12** which is admitted to the lower end of the cylinder **6** through a port **14** and a valve generally designated **16**.

The valve **16** comprises a body or casing **18** with a bore **20** containing a complementary stem or spindle **22** which is connected by a pin **24** to a seat **26** adapted to open and close a port **28** through the inner end of the body **18**. The seat **26** is spring-pressed to its closed position by a spring **30** acting against the stem **22** which is actuated to open and close the seat **26** by a cap or plug **32** threaded into the body **18** as at **34** and operated by a handle **36** against the resistance of a spring **38**. Thus it will be understood that by rotating the handle **36** the plug **32** is operable to urge the stem **22** and the seat **26** inwardly to the open position thereof against the resistance of the spring **30**. Upon rotating the handle **36** in the opposite direction the spring **30** is released to urge the stem **22** and the seat **26** to their closed position preventing flow of fluid from the port **14**. The spring **38** is operable to develop friction on the threads at **34** to create frictional resistance to actuation of the plug **32**.

The reservoir **10** is connected to a pneumatic line **40** which is connected to a three-way selector valve **42** having a connection to a pneumatic supply line **44**, such as a shop air line, supplied with pneumatic pressure fluid from an associated source (not shown). The valve **42** is also connected to a discharge or relief line **46** and to an intensifier or high pressure line **48** for a purpose hereinafter described.

The reservoir **10** is connected to a hydraulic pipe or line **50** which communicates through a one-way check valve **52** with the top of a cylinder **54** in a casing **56** of a pneumatic intensifier or pressure device generally designated **58**. The casing **56** is provided with a depending wall or projection **60** containing the before-mentioned

cylinder 54, and the casing 56 is formed at its lower extremity with a relatively large pneumatic cylinder 62 receiving a piston 64 which is connected to a small piston 66 reciprocal within the cylinder 54. Thus the pistons 64 and 66 move as a unit within their respective cylinders to develop pressure against the ram 4 on the pressure or working stroke thereof after said ram has completed its rapid advance stroke, as hereinafter described.

The cylinder 54 is also connected to an hydraulic line or pipe 68 which communicates through a one-way check valve 70 with a port 72 in the frame 8 communicating with the lower end of the cylinder 6. The line 68 carries hydraulic fluid under high pressure from the cylinder 54 and is thus designated the high pressure line of the system and comprises a gauge 74 to indicate the hydraulic pressure therein.

The pneumatic intensifier 58 is actuated or discharged by pneumatic pressure fluid flowing from the line 48 through a conventional regulator generally designated 76, said regulator comprising a body or casing 78 with a spring bonnet or casing 80 secured thereto in any convenient manner. The body 78 comprises a pneumatic inlet passage 82 and a pneumatic outlet passage 84 communicating through a port 86 which is adapted to be opened and closed by a seat 88. This seat is connected by a stem 90 to a flexible diaphragm 92 which abuts the convex bottom surface of a spring plate 94 actuated by a spring 96 which is adjustable to regulate the pressure of the pneumatic fluid flowing from the outlet passage 84. A baffle plate 98 carrying a tube 100 is provided to dampen pulsations of the compressed fluid within the passage 84 which would otherwise tend to cause a hunting or oscillating action of the diaphragm 92 as will be readily understood by those skilled in the art. Also, flow of air through the valve past the tube 100 reduces pressure between the plate 98 and the diaphragm 92, thus causing further opening of the valve augmenting the flow of air therethrough. Thus it will be understood that pneumatic pressure fluid flowing through the inlet port 82 passes through the port 86 when the seat 88 is in its open position and flows into the outlet passage 84. When pressure built up within the outlet passage 84 reacts through the tube 100 against the diaphragm 92 to build up a pressure value of predetermined magnitude thereagainst, the spring 96 is compressed by the diaphragm 92 which is connected to the stem 90 and is thus operable to close the seat 88, thereby preventing the further flow of fluid from the inlet passage 82 to the outlet passage 84 until the pressure value in the latter passage drops below the predetermined value at which the spring 96 is operable to thrust the diaphragm 92 and the stem 90 downwardly, thereby opening the seat 88 against the resistance of a small spring 102 which is operable to urge the seat 88 to its closed position upon the release or upward movement of the stem 90.

In operation of the novel circuit above described, the valve 16 is actuated to its advance position by rotating the valve lever 36 clockwise, thereby opening the seat 26 to accommodate flow of fluid from the reservoir 10 through the port 14 into the bottom of the cylinder 6. At this time the valve 42 is actuated to its rapid advance position wherein pneumatic fluid is directed from the supply line 44 to the pneumatic line 40 which is connected to the reservoir 10, thereby exerting pressure against the body 12 of hydraulic fluid therein. Thus the hydraulic fluid is urged into the bottom of the cylinder 6 and the ram 4 is urged on its rapid advance stroke to the work. When the ram engages the work the valve 16 may be closed, whereupon the hydraulic fluid is forced through the line 50 and the one-way check valve 52 into the cylinder 54 urging the pistons 66 and 64 downwardly to their set or charged position. It may be noted that if desired the valve 16 may be retained in its open position until the pressure is built up sufficiently within the line 50 to set or charge the intensifier 58 as above described, whereupon the valve 16 may be closed.

After the intensifier 58 has been set and the valve 16 has been closed, as above described, the selector valve 42 is actuated to direct pneumatic pressure fluid from the supply line 44 to the pneumatic line 48 and through the regulator 76 into a line 104, the pneumatic pressure within which is adjusted by regulation of the device 76. The pneumatic pressure from the line 104 passes into the cylinder 62 to exert a predetermined pressure against the large piston 64, thereby urging this piston and the associated piston 66 upwardly to force the hydraulic fluid within the cylinder 54 outwardly through the line 68 and the one-way check valve 70 into the port 72 and thence into the bottom of the cylinder 6 to urge the ram 4 on its pressure or working stroke.

Preferably, the above-described circuit is so designed that each stroke or discharge of the intensifier 58 is operable to move the press ram 4 approximately a quarter of an inch on its pressure or working stroke. If a longer stroke is desired the intensifier may be recharged by actuating the selector valve 42 first to its advance position whereat pneumatic pressure fluid is directed through the line 40 to urge hydraulic fluid from the reservoir 10 through the line 50 into the cylinder 54 to reset the intensifier 58, and then the selector valve 42 is actuated to its high pressure position directing pneumatic pressure fluid through the line 48, the intensifier 76 and the line 104 into the cylinder 62, thereby actuating or discharging the intensifier 58. This procedure may be repeated until the ram 4 has reached and maintains the desired pressure or travel. To release the pressure, the selector valve 42 is actuated to its neutral position whereat the pneumatic fluid therein is directed to the discharge line 46, and the valve 16 is then opened, thereby releasing the pressure in the bottom of the cylinder 6 and permitting the ram 4 to drop on its return stroke. The valve 16 is then left in its open position until the ram 4 has again completed its rapid advance stroke on the next cycle of the press.

It is to be understood that I do not wish to be limited by the exact embodiment of the device shown which is merely by way of illustration and not limitation as various and other forms of the device will, of course, be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In an actuating circuit for an hydraulic motor comprising cylinder means and ram means reciprocal therein; the combination of a closed reservoir of hydraulic fluid, operating valve means adapted in the rapid advance position thereof to accommodate flow of fluid from

said reservoir to said cylinder means and adapted in the closed position of said valve means to positively cut off said flow, an intensifier device comprising spaced cylinders and engaged pistons reciprocal therein, one of said cylinders and associated piston having a greater cross sectional area than the other, an hydraulic connection between said reservoir and said other cylinder entirely independent of said valve means and comprising one-way check valve means accommodating flow of hydraulic fluid to said other cylinder, a connection between said other cylinder and said cylinder means entirely independent of said operating valve means and comprising one-way check valve means accommodating flow of hydraulic fluid to said cylinder means, pneumatic valve means operable in the advance position thereof to exhaust said one cylinder and to deliver pneumatic fluid from an associated source to said reservoir for urging the fluid therefrom to said cylinder means in the rapid advance position of said operating valve means thereby urging said ram means on rapid advance stroke thereof and forcing fluid from the reservoir to said other cylinder, and for urging hydraulic fluid from the reservoir to the other cylinder in the closed position of said operating valve means, said pneumatic valve means being adapted in the high pressure position thereof to deliver pneumatic fluid from said source to said one cylinder, and an adjustable valve connected between the pneumatic valve means and said one cylinder for regulating the pressure of pneumatic fluid delivered to said one cylinder.

2. In an actuating circuit for an hydraulic motor comprising cylinder means and ram means reciprocal therein; the combination of a closed reservoir of hydraulic fluid, operating valve means adapted in the rapid advance position thereof to accommodate flow of fluid from said reservoir to said cylinder means and adapted in the high pressure position to cut off said flow, a pneumatic intensifier unit comprising an hydraulic pressure device having a constant connection entirely independent of said operating valve means to said reservoir and having another constant connection to said cylinder means independent of said operating valve means and the first-mentioned connection, said intensifier device comprising a pneumatic pressure device operatively connected to said hydraulic device for actuation thereof, and pneumatic valve means adapted in one position thereof to exhaust said pneumatic pressure device and to deliver pneumatic pressure fluid to said reservoir for urging the hydraulic fluid therefrom to said hydraulic pressure device and to said cylinder means in the rapid advance position of said operating valve means, and in the high pressure position of said operating valve means for urging hydraulic fluid from said reservoir to said hydraulic pressure device, said pneumatic valve means being adapted in another position to deliver pneumatic pressure fluid to said pneumatic pressure device, and adjusting valve means connected between the pneumatic valve means and the pneumatic device for regulating pressure of pneumatic fluid delivered to said pneumatic pressure device.

3. In an actuating circuit for an hydraulic motor comprising cylinder means and ram means reciprocal therein; the combination of a closed reservoir of hydraulic fluid, operating valve means connected to said reservoir and to said cylinder means for accommodating flow of fluid from said reservoir to said cylinder means in the rapid advance position of said valve means and adapted in the high pressure position thereof to cut off said flow, a pneumatic intensifier unit comprising an hydraulic pressure device having a connection to said reservoir entirely independent of said operating valve means, and having another connection to said cylinder means entirely independent of said operating valve means and the second-mentioned connection, said intensifier unit comprising a pneumatic pressure device operatively connected to said hydraulic device for actuation thereof, pneumatic valve means adapted in one position thereof to exhaust the pneumatic pressure device and to deliver pneumatic pressure fluid to said reservoir for urging the hydraulic fluid therein to said hydraulic pressure device and also to said cylinder means in the rapid advance position of said operating valve means and for urging hydraulic fluid from said reservoir to said hydraulic pressure device in the high pressure position of said operating valve means, said pneumatic valve means being adapted in another position to deliver pneumatic pressure fluid to said pneumatic pressure device, valve means for cutting off communication between said hydraulic device and said reservoir when pneumatic pressure fluid is delivered to said pneumatic pressure device, one-way check valve means in the connection between said hydraulic pressure device and said cylinder means for accommodating flow of hydraulic fluid to the latter, and means for adjusting pressure of pneumatic fluid delivered from said pneumatic valve means to said pneumatic pressure device.

RELZA J. HESS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
552,274	Cole	Dec. 31, 1895
706,688	Reynders et al.	Aug. 12, 1902
1,249,736	Frink	Dec. 11, 1917
1,903,887	Widener	Apr. 18, 1933
2,165,095	Frechette	July 4, 1939
2,198,049	Dinzl	Apr. 23, 1940
2,208,451	Eaton	July 16, 1940
2,403,912	Doll	July 16, 1946