

[54] **HYDRAULIC COMPRESSION CIRCUITS**

[75] Inventor: **Herbert G. Tull, III**, Charlottesville, Va.

[73] Assignee: **Hoerner Waldorf Corporation**, Ramsey, Minn.

[22] Filed: **Nov. 24, 1971**

[21] Appl. No.: **201,915**

[52] U.S. Cl. **91/404, 91/411 B, 91/420, 91/436, 91/452**

[51] Int. Cl. **F15b 11/16, F15b 13/06**

[58] Field of Search **91/436, 411 B, 411 R, 404, 91/437**

[56] **References Cited**
UNITED STATES PATENTS

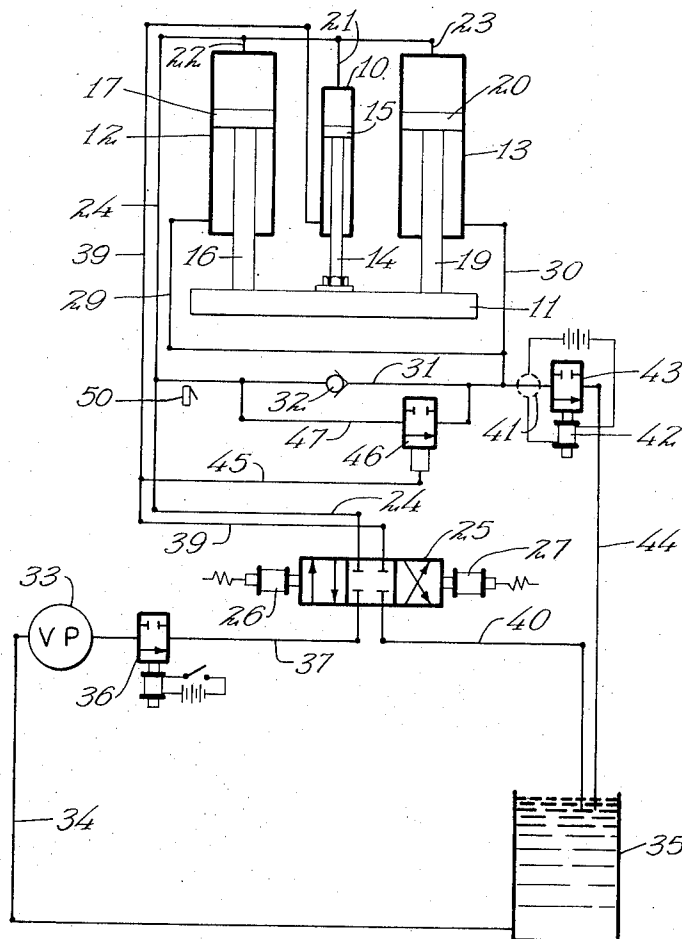
2,192,778	3/1940	Stacy.....	91/411 B
2,218,818	10/1940	Harrington.....	91/436
3,071,926	1/1963	Olson et al.....	91/436

Primary Examiner—Paul E. Maslousky
Attorney, Agent, or Firm—Robert M. Dunning; Jerry F. Best

[57] **ABSTRACT**

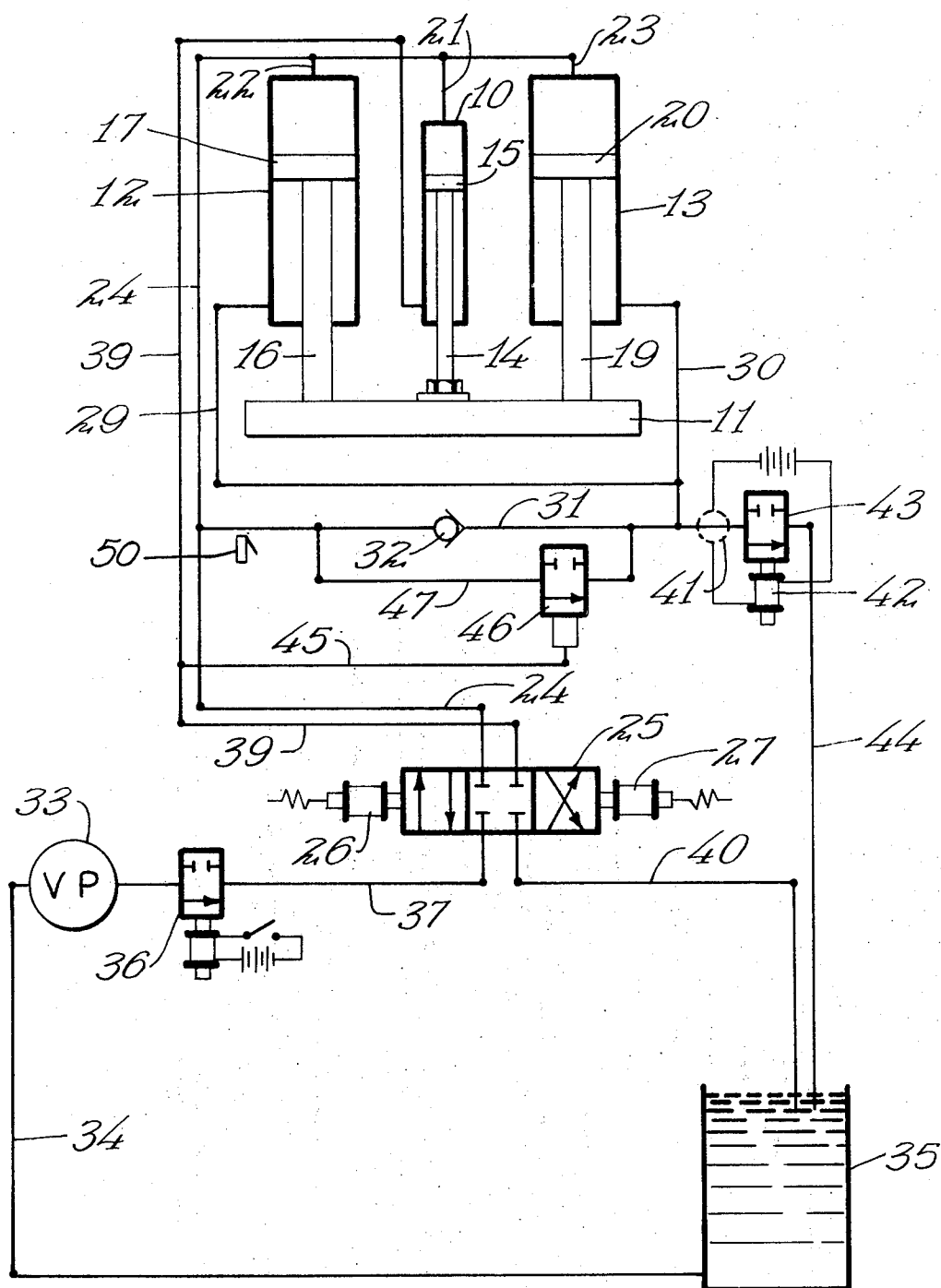
The cycle of operation of a compression platen or the like reciprocated by a main cylinder by adding one or more additional cylinders having piston rods engaging the platen. Fluid pressure is directed against the pistons in the main cylinder and additional cylinders in a direction to move the platen in a compression direction. The other ends of the additional cylinders are connected to the fluid pressure supply line through a check valve to circulate the fluid being forced from the additional cylinders back to the cylinders without flowing through the reservoir pump, moving the platen at relatively high speed and relatively low force. When resistance to movement of the platen exceeds a predetermined amount, the circulating line is closed and fluid from the additional cylinders is bypassed to the reservoir.

1 Claim, 1 Drawing Figure



PATENTED JUL 23 1974

3,824,896



INVENTOR

HERBERT G. TULL III

BY

Robert M. Denning

ATTORNEY

HYDRAULIC COMPRESSION CIRCUITS

This invention relates to an improvement in Hydraulic Compression Circuits, and deals particularly with an arrangement which will permit a rapid compression for balers and similar compression devices.

BACKGROUND OF THE INVENTION

The hydraulic compression of bales and the like is normally a single speed operation. In other words, the platen which compresses the bales usually travels at a single speed due to the fact that the supply of fluid acting upon the compression cylinder is normally uniform. However, where the speed of compression is somewhat critical, it is often desirable to move the compression platen at a speed which is sufficiently high to complete the cycle of operation in a relatively short period of time, making a variable speed of movement desirable.

SUMMARY OF THE INVENTION

The present invention resides in the provision of a Hydraulic System for moving a compression platen or the like in which a plurality of hydraulic cylinders are employed to apply the necessary force to compress a bale or the like. During the first portion of the stroke, the hydraulic force which is applied is capable of moving a platen at a relatively high speed. As the resistance to movement of the platen is increased, hydraulic fluid is directed to and from the cylinders in a manner to slow down the speed of the movable platen and to apply the necessary force platen to complete the compression.

A feature of the present invention resides in the provision of a hydraulic circuit in which the fluid being forced from the cylinders is recycled to the opposite ends of the cylinder so as to eliminate the necessity of supplying all of the fluid from the fluid reservoir. In other words, the fluid being forced from the cylinders is combined with the fluid entering the pressure ends of the cylinders so as to speed up the movement of the platen until the force resisting the movement of the platen increases to a predetermined point. From this time on, the compression continues with the full use of all cylinders.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following Specification and Claims.

DESCRIPTION OF THE DRAWINGS

The FIGURE illustrates diagrammatically the hydraulic system which is involved.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drawings illustrate a power cylinder 10 which is designed to move a platen 11 or other similar means. An additional pair of cylinders 12 and 13 are shown which also are capable of moving the platen 10. In actual practice, the piston rod 14 connected to the piston 15 in the power cylinder acts to move the platen 11, and is the only piston rod definitely connected to the platen 11. However, the piston rod 16 connected to the piston 17 in the cylinder 12 bears against the platen 11, as does also the piston rod 19 connected to the piston 20 in the cylinder 13.

The drawings illustrate diagrammatically the various connections which form the circuit. The upper ends or head ends of the cylinders 10, 12 and 13 are connected by connections 21, 22 and 23 to a high pressure line 24 connected to a four-way valve 25. The valve 25 is moved toward one extreme position by a solenoid 26, and is moved toward its other extreme position by a solenoid 27. In one extreme position of the valve 25, the hydraulic fluid is directed toward the upper ends of the cylinders 10, 12 and 13 while in the other extreme position, the fluid is directed to the lower end of cylinder 10 only.

A hydraulic fluid line 29, and 30 connects the lower ends or piston rod ends of the cylinders 12 and 13. The connection 30 is also connected to a conduit 31 through a check valve 32 to the line 24 extending to the upper ends of the cylinders. Thus when fluid is forced from the cylinders 12 and 13, it is free to flow past the check valve 32 to the line 24. A hydraulic pump 33 has a fluid supply line 34 leading from the reservoir 35. A manually operable control valve 36 normally biased by conventional means toward closed position must be open in order for the system to function.

When the four-way valve 25 is moved to the right from the position illustrated, and the control valve 36 is open, fluid is directed from the pump 33 through the valve 36 to the conduit 37, and through the valve 25 to the conduit 24 which leads to the upper ends or head ends of all of the cylinders 10, 12 and 13. As the pistons 17 and 20 move downwardly in the cylinders 12 and 13, the fluid may flow from the piston rod ends thereof through the conduit 29 and the conduit 30 past the check valve 32 and into the conduit 24 to replenish the fluid at the upper ends of the cylinder 12 and 13. The lower end of the cylinder 10 is connected by a conduit 39 which leads through the valve 25 to a conduit 40 leading to the reservoir 35.

In view of the fact that the lower ends of the cylinders 12 and 13 include the piston rods 16 and 19, there is less fluid flowing from the lower ends of the cylinders 12 and 13 to the upper ends of these cylinders and the additional fluids required is made up by the supply of fluid from the pump 33. However, as the major portion of the fluid is directly circulated, the speed of movement of the platen 11 is greatly increased.

As the platen 11 moves, as would happen in the compression of a bale or the like, the resistance to movement of the platen increases. This causes an increase in fluid pressure in the fluid circulating line. Some sort of fluid pressure sensing device 41 is provided for controlling the solenoid 42 of a relief or bypass valve 43 which is normally biased by conventional means toward closed position. Thus when the pressure in the fluid lines 29 and 30 becomes sufficiently high means is provided to open the valve 43 and the fluid from the lower ends of the cylinders 12 and 13 is bypassed through a return line 44 to the reservoir 35. The pressure in the fluid line 24 closes the check valve 32 and the fluid from the pump 33 forces the pistons in the cylinders downwardly with increased force but with less speed. This action takes place at the point near the end of the stroke of the movable platen (as for example about one inch from the end of the stroke).

In place of the pressure sensing device 41, an electric switch may sense the position of the movable platen 11 when the platen reaches a predetermined point of travel (as for example about an inch from the end of

3

the compression stroke) and actuates the solenoid 42 to open this valve. This functions very satisfactory, for as soon as the valve 43 is opened, the pressure in line 24 drops due to the greatly increased effective area of the cylinders versus a gradual increase in the compression load. In other words at the point the position sensing switch opens the valve 43, the lower ends of the cylinders 12 and 13 are open to the reservoir and speed of travel of the platen is reduced, and the full pressure of the pump is exerted upon the upper ends of the cylinders.

In view of the fact that a position switch for closing a circuit is well known in the art, it is not shown in detail. However, it may comprise merely a micro switch 50 in the path of the movable platen and operable to close the circuit to the solenoid 42.

When the compression operation is completed, the four-way valve 25 is reversed in its position, directing fluid from the pump 33 through the valve 36 and the fluid line 37 to the fluid line 39 connected to the lower end of the cylinder 10. The platen 11 is then raised by the piston rod 14 and the piston 15 which are connected to the platen 11, the upward movement of the platen forcing the piston rods 16 and 19 with their respective pistons 17 and 20 upwardly in the cylinders 12 and 13. Pressure in the line 39 acts through a branch line 45 to the under surface of a pilot valve 46 which is normally urged by conventional means toward closed position and which is located in a conduit 47 arranged in parallel with the check valve 32. When the valve 46 is open, fluid from the line 24 may bypass the check valve 32 and flow through the conduits 29 and 30 to the lower ends of the cylinders 12 and 13 replacing the fluid in the lower ends of these cylinders. The conduit 24, which is connected to the upper ends of all of the cylinders 10, 12 and 13 is also connected through the four-way valve 25 to the return line 40 leading to the reservoir 35. Thus the return stroke is controlled completely by the movement of the piston 15 in the cylinder 10.

In the drawing, the conduits connecting the cylinders must of necessity be quite long for the purpose of illustration. In actual practice a valve block is provided in which the various valves and passages are mounted in close proximity so that the length of the flow path is maintained at a minimum. The circulation of fluid directly from one end of each of the cylinders 12 and 13 to the other ends thereof results in a considerable decrease in the time required for each cycle of operation, and also greatly reduces the friction or the resistance to flow of the fluid.

For the purpose of simplifying the description, and because of the fact that the valves and cylinders are closely coupled certain of the Claims described the fluid lines between the reversing valve 25 to the cylinder as "passages," and to define the fluid lines from the piston rod end of the additional cylinder or cylinders as "connections." While the use of a plurality of additional cylinders is preferred, in some instance a single

4

additional cylinder may be feasible.

In accordance with the Patent Statutes, I have described the principles of construction and operation of my improvement in *HYDRAULIC COMPRESSION CIRCUITS* and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that obvious change may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. A hydraulic circuit for use in combination with a movable platen which is subject to increasing resistance to movement during its movement in one direction, a main cylinder, piston rod and piston connected to said platen for reciprocating the same, the end of the cylinder through which the piston rod extends comprising the rod end and the other end comprising the head end, a fluid pump and a fluid reservoir, including:

at least one additional cylinder, piston rod and piston engaging said platen for urging said platen in said one direction, the end of the cylinder through which the piston rod extends comprising the rod end and the other end comprising the head end.

a reversing valve,

a conduit from said pump to said reversing valve,

a conduit from said reversing valve to said reservoir,

a first passage from said reversing valve to the head ends of both said cylinders,

a second passage from said reversing valve to the piston rod end of said main cylinder, whereby said reversing valve may direct fluid from said pump to either of said passages while connecting the other passage to said reservoir,

a first connection from the piston rod end of said additional cylinder to said first passage, said connection including a check valve through which fluid may flow from said additional cylinder to said first passage to combine with fluid therein, but said check valve preventing a reverse flow,

a second connection from said first connection to said reservoir and including a normally closed bypass valve, and

means operable by movement of said movable platen to a point near the end of its compression stroke to open said bypass valve to direct fluid from said piston rod end of said additional cylinder to said reservoir, closing said check valve,

a pilot valve connected in parallel relation with said check valve and operable, when open, to permit a reverse flow from said first passage to the piston rod end said additional cylinder, said pilot valve being opened by fluid pressure from said pump in said second passage, whereby when said reversing valve directs fluid under pressure to said second passage, fluid may flow from said first passage to the piston rod end of said additional cylinder.

* * * * *

60

65