

March 7, 1933.

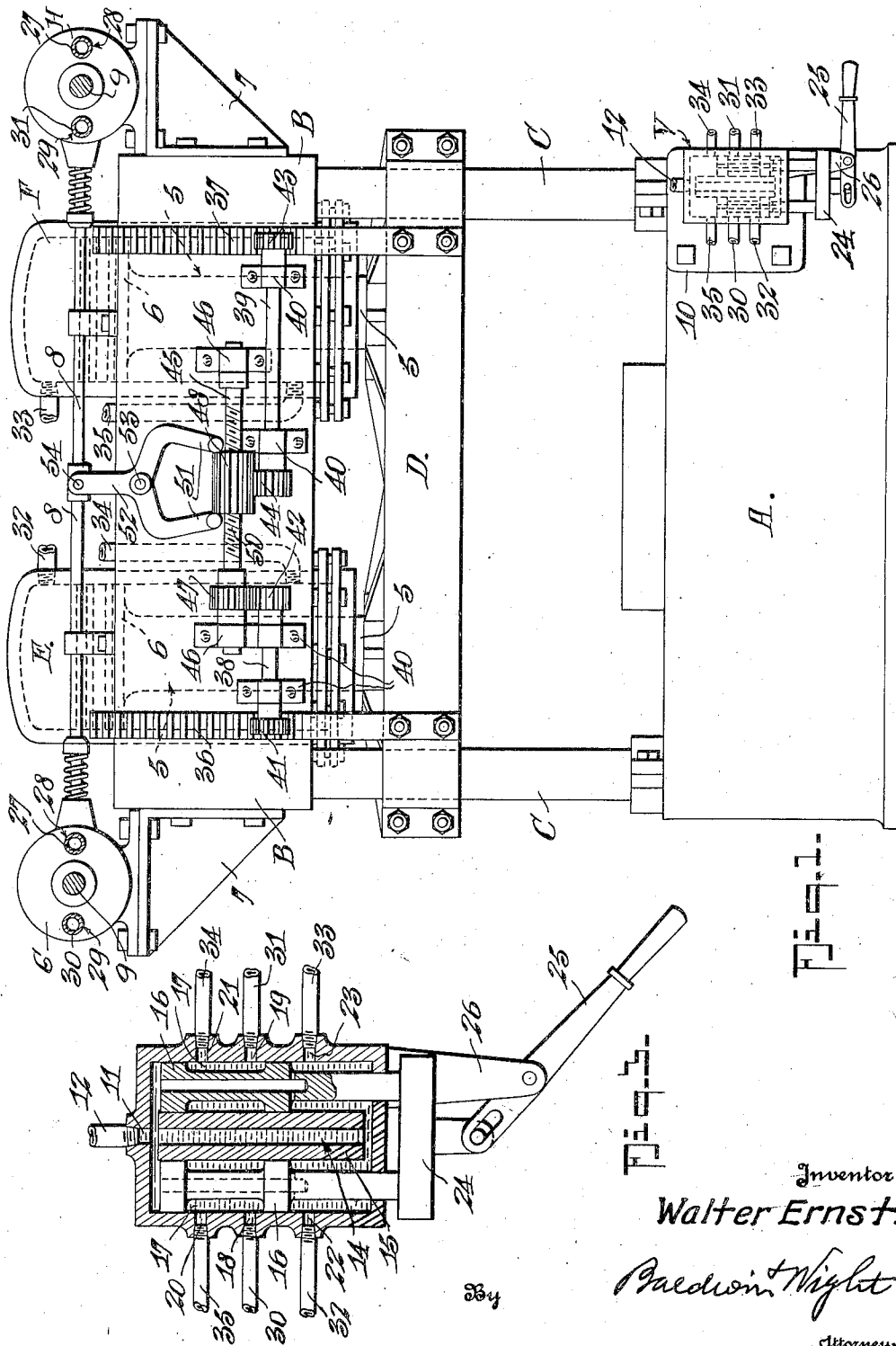
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1,900,050

HYDRAULIC PRESS PLATEN TRAVEL EQUALIZER

Filed Feb. 24, 1931

2 Sheets-Sheet 1



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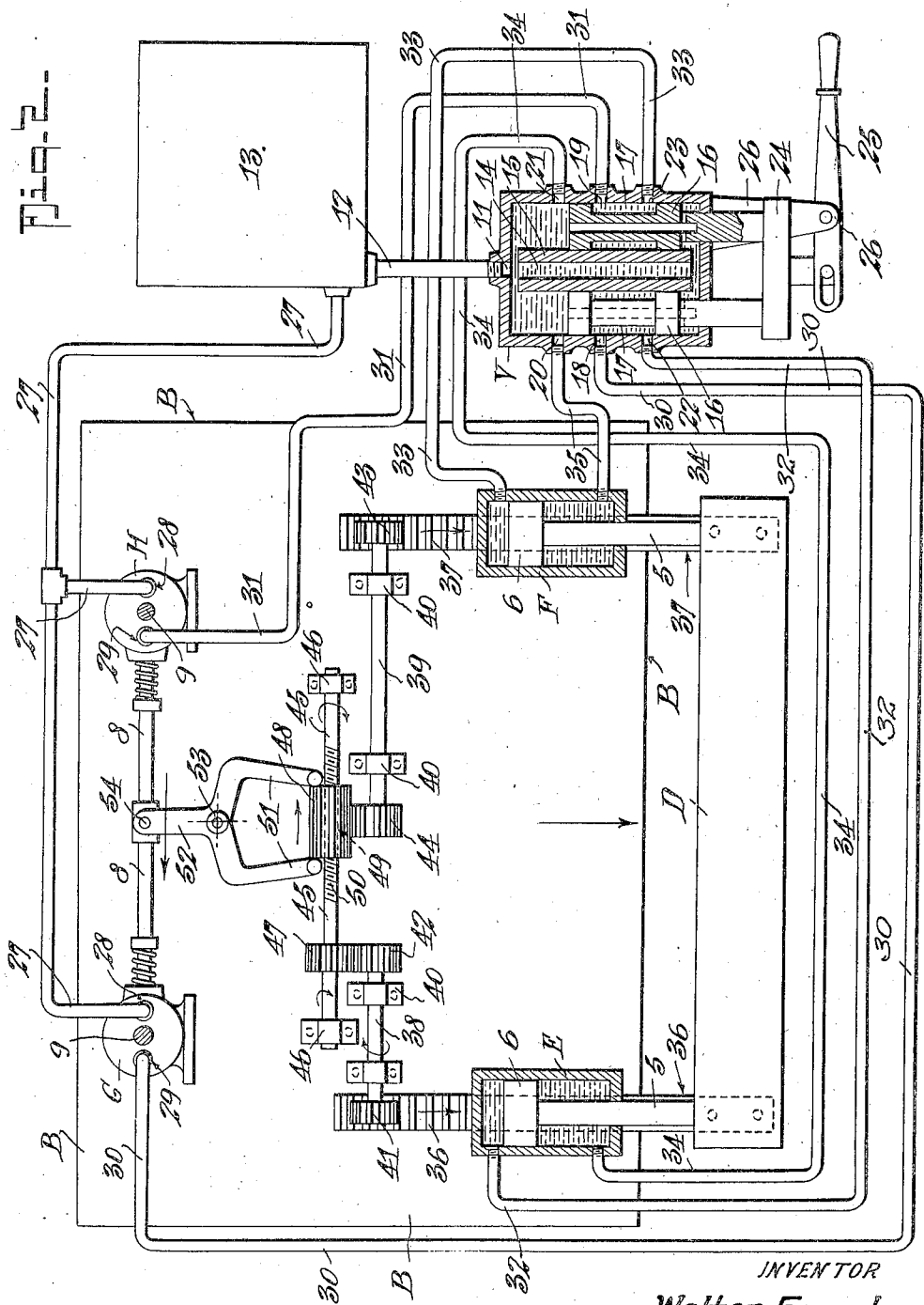
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HYDRAULIC PRESS PLATEN TRAVEL EQUALIZER

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2 Sheets-Sheet 2



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HYDRAULIC PRESS PLATEN TRAVEL EQUALIZER

Application filed February 24, 1931. Serial No. 517,989.

This invention relates to hydraulic presses of the multi-ram type and primarily has for its object to provide means for so applying and controlling the rate of fluid applied to the rams during a given interval of time so as to cause the platen ends to travel synchronously.

In presses of the type referred to considerable difficulty is experienced in causing the platen to be moved with both ends thereof travelling at uniform speed, lack of uniformity in the resistances opposing travel of the respective ends of the platen serving to cause one ram to move faster than the other. This condition causes the platen to be canted, resulting in inefficient operation or even binding and breakage. The use of two pressure supplying pumps, one delivering to each ram, will remedy this condition so long as it is possible to keep the output of the pumps absolutely uniform. However, if the output of one pump exceeds only slightly the output of the other pump the evil complained of above is again present.

Therefore, it is an object of my present invention to provide means responsive to uneven movement of the platen to regulate the application of fluid to the platen for advancing or retracting the same in a manner causing the ends of the platen to travel synchronously.

In its more detailed nature the invention resides in the provision of means for individually subjecting the rams to advancing and retracting applications of fluid pressure, a novel fluid application controlling means common to both rams, and individual fluid application varying means actuating devices associated with the respective ends of the platen ineffective when the platen ends are travelling synchronously but which become effective when the platen ends start to travel out of synchronism to actuate the fluid application regulating means for varying the amount of fluid being applied to one or the other or both of the rams during a given interval of time and restoring synchronous travel of the platen ends.

Other objects will in part be obvious and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends, the invention further resides in the novel details of construction, combination and arrangement of parts, all of which will be first fully described in the following detailed description, then be particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which:—

Figure 1 is a side elevation of one type of press having embodied therein the present invention;

Figure 2 is a diagrammatic view illustrating the correlation of the platen, the platen movement effecting pumps and rams, the control valve, and the novel means for controlling the travel of the platen whereby its ends are caused to travel synchronously, the valve being shown as set to bring about a downward movement of the platen, and

Figure 3 is a somewhat diagrammatic sectional view showing the control valve set to bring about an upward movement of the platen.

The invention may be embodied in various types of presses employed for various purposes, but is illustrated in connection with a press of the four column downward pressure type. There is shown a base A, a press head B and four strain rods or columns C supporting the head above the base.

The invention is particularly adaptable to use upon presses of the multiple ram type and in this disclosure I have illustrated two double acting platen-driving rams 5, one disposed at each side of the center and adjacent the respective ends of the platen D, the pistons or heads 6 of the rams being slidable in cylinders E and F which are supported in the usual manner upon the head B.

Mounted on suitable brackets 7 carried by the head B is a pair of variable output pumps designated G and H which supply the pressure fluid for advancing and retracting the rams and the platen to which they are secured. The pumps G and H may be of any type capable of performing the functions herein described. In this particular disclosure the pumps are of the Hele-Shaw type and as the particular details of construction

of these pumps from no part of my present invention and may be fully understood by reference to Patent No. 1,250,170, further description of the pumps is thought to be unnecessary in this disclosure. The pumps may be driven by use of electric motors (not shown) imparting rotation to the drive shafts 9 thereof or in any other approved manner.

It is sufficient to state that the output of each pump is increased as the thrust rod 8 associated therewith is moved outwardly with respect to the pump and the output of the pumps will be correspondingly decreased as the thrust rod is moved inwardly. The thrust rod 8 being connected to both pumps, as illustrated in Figures 1 and 2 of the drawings, it will be obvious that as the thrust rod is moved in one direction to increase the output of one pump it will simultaneously bring about a decrease of the output of the remaining pump. Thus the thrust rod serves as means for controlling the rate of discharge by each pump, and, as will appear more fully hereinafter, for controlling the respective rates of application of pressure to the rams 6.

The provision and particular arrangement of the pumps herein disclosed is illustrative only and is not to be construed as a limitation of the scope of use of the invention. The invention comprehends the use of a single variable output pump actuated by the control mechanism to be described hereinafter in combination with a second pump having a constant output, and also the use of said control devices in connection with any form of control valve or like equipment capable of supplying the fluid under pressure in a manner for correcting uneven travel of the platen as outlined hereinafter.

A control valve V is supported as at 10 upon the press base and serves to control the application of fluid pressure for advancing and retracting the rams and the platen carried thereby.

The valve unit comprises a casing having a port 11 communicating through a pipe 12 with a fluid supply tank 13 for admitting fluid to the interior of the casing which is divided into upper and lower chambers communicating through the duct 14 formed in the body wall 15. The body wall is bored to provide guides for two slide valves 16 which are centrally reduced to form annular control passages 17.

The valve unit casing also includes centrally disposed pressure ports 18 and 19 and alternate tank pressure and work pressure ports arranged in upper and lower pairs 20—21 and 22—23 respectively.

The valves 16 are connected to move in unison by a cross head 24 which is engaged by a lever 25 pivoted to a bracket 26 carried by the casing. By employment of the lever 25, the valves may be shifted from a platen

advancing position illustrated in Figure 1 of the drawings to a platen retracting position illustrated in Figure 3 of the drawings.

In order to complete the fluid circuit the tank 13 is connected by pipe lines 27 with the pump inlets 28, and the outlets 29 of the pumps G and H are connected by pipes 30 and 31 respectively with the ports 18 and 19 respectively. The lower set of valve ports 22 and 23 are connected by pipe lines 32 and 33 respectively with the upper ends of ram cylinders E and F respectively, and the upper set of valve ports 20 and 21 are connected by pipe lines 34 and 35 with the lower ends of the ram cylinders E and F. See Figure 2.

From the foregoing description, it will be apparent that with the valves set as illustrated in Figure 2 of the drawings, fluid pressure will be applied on top of the ram pistons 6. The pressure applied in the cylinder E is effected through pump G, pipe line 30, port 8, valve passage 17, port 22, and pipe line 32, the space below the piston being supplied with a column of fluid at tank pressure through the pump line 34, port 21, upper valve casing chamber and pipe line 12. Pressure applied in the cylinder F is effected through pump H, pipe line 31, port 19, valve passage 17, port 23, and pipe line 33, a column of fluid at tank pressure being provided beneath the piston by pipe line 35, valve chamber and pipe line 12.

When the valves are shifted to the position illustrated in Figure 3 of the drawings, working pressure is applied beneath the ram plunger 6 for retracting the platen. It should be explained that the circuit arrangement is such that each pump applied fluid pressure to both rams, serving in one adjustment of the valves to force one ram in the platen advancing direction and in the other adjustment of the valves to force the opposite or remaining ram in a direction for retracting the platen. Thus, with the valves set as illustrated in Figure 3, the pump G applies pressure beneath the ram piston 6 in cylinder F through the pipe line 30, port 18, valve passage 17, port 20 and pipe line 35, and the pump H applies pressure beneath the ram piston in cylinder E through pipe line 31, port 19, valve passage 17, port 21 and pipe line 34. In this instance, a column of fluid at tank pressure is supplied to each of the cylinders E and F above the ram pistons thereof through pipe lines 32, port 22, valve chamber port 23, pipe line 33 and pipe line 12.

Having thus described the pressure circuits I will now proceed with a description of the particular mechanism which I have designed for automatically controlling the amount of fluid applied during a given interval of time to the respective rams responsive to unevenness in travel of the respective ends of the platen.

Racks 36 and 37 are secured one at each end

of the platen D so as to move the platen. Individual counter shafts 38 and 39 are provided and are rotatably mounted in axial alignment in bearings 40 secured to the press head B. The shaft 38 is provided with pinions 41 and 42 and the shaft 39 is provided with pinions 43 and 44, all such pinions being of like diameter, and the pinions 41 and 43 are held in constant mesh with the racks 36 and 37 respectively. The counter shafts 38 and 39 are thus rotated in one direction or another as the platen is advanced or retracted.

A driven shaft 45 is rotatably mounted in bearings 46 carried by the head B and this shaft is common to both of the shafts 38 and 39, being provided with a fixed pinion 47 which meshes with the pinion 42 of the shaft 38 and with a pinion 48 of like size meshing with the pinion 44 carried by the shaft 39.

It will be observed by reference to Figures 1 and 2 that the pinion 48 has considerable length and is provided with a threaded bore to receive the threaded portion 50 with which the driven shaft 45 is provided. The pinion 48 is thus provided with a quick pitch screw mounting on the driven shaft 45.

It will be readily understood that so long as the respective ends of the platen D are travelling synchronously, the speed of rotation imparted to the pinions 47 and 48 will be the same, the pinion 48 rotating as though fixed upon the shaft 45. Should one end of the platen tend to advance ahead of the other end, the speed of rotation imparted to the pinions 47 and 48 would be different and the screw mounting 50 would become effective to move the pinion 48 longitudinally in one direction or another upon the driven shaft 45. The pinion 48 is engaged at either end by the forked arms 51, of a pump output varying lever 52 which is pivotally mounted at 53 on the press head B and connected as at 54 with the thrust rod 8. Thus the longitudinal movement imparted to the pinion 48 in response to unevenness in travel of the platen will be transmitted through the lever 52 to the thrust rod 8 so as to simultaneously increase the amount of fluid being applied during a given interval of time to the trailing ram and decrease the amount of fluid being applied during a given interval of time to the advancing ram.

By providing a suitable pitch in the screw mounting 50, and a suitable ratio leverage in the lever 52, the device can be made very sensitive so that the slightest difference in movement of the racks 1 and 2 will produce a very large movement of the thrust rod 8 and the pumps will immediately react to any disturbance in the uniformity of speed of the two rams.

In further describing the operation of my improved control device let us assume that the end of the platen carrying the rack 36

is tending to move ahead of the other or remaining end of the platen. This will result in a rotation of the countershaft 38 slightly in excess of the speed of rotation of the countershaft 39, serving, through the positive gear connections 42 and 47, to drive the shaft 45 at a speed slightly in excess of the speed of rotation of the countershaft 39. Thus it will be seen that the speed of rotation of the pinion 48 will be retarded relatively to the speed of the shaft on which it is mounted, and the direction of rotation of the shafts 38 and 45 being as indicated by arrows in Figure 2, and the screw being left-handed, longitudinal movement will be imparted to pinion 48 in the direction indicated by the arrow on Figure 2. This movement of the pinion 48 will impart a movement to the thrust rod 8 in the direction of the arrow on Figure 2, causing the output of pump H to be increased with the result that an increase of pressure fluid will be applied on top of the ram in the cylinder F causing that end of the platen to catch up with other or leading end. Simultaneously with the increasing of the output of the pump H the output of the pump G will be decreased so that the rate of discharge of fluid from the pump G acting against and causing the ram in the cylinder E to lead will be decreased.

It will be readily understood that when the opposite end of the platen is leading, the action just described would be reversed with reverse effect. It will also be obvious that this automatic pump output control is equally effective when the rams are being forced upwardly to retract the platen.

While it is possible to use only one variable output pump in combination with another pump the output of which is constant and yet obtain the full advantages of the control system as above outlined, I prefer to use two variable output pumps associated as shown and described so that when the output of one is increased the output of the other will be simultaneously diminished, thus speeding up the correction of uneven travel of the platen.

From the foregoing description, taken in connection with the accompanying drawings it is thought that the novel details of construction, the manner of use and the advantages of my invention will be readily apparent to those skilled in the art to which it relates.

I claim:

1. In a hydraulic press, a platen, a ram disposed at each side of the center of the platen, a pump for supplying hydraulic pressure to each ram, one said pump being a variable output pump, a rack travelling with each end of the platen, a countershaft associated with each rack and having a driven pinion meshing with the rack and a driving pinion, a driven shaft having a driving pinion fixed thereon and meshing with one driven pinion,

a second like diameter pinion having a screw mounting on said driven shaft whereby it will rotate with the driven shaft when the platen ends are travelling synchronously but will move longitudinally on said driven shaft in response to uneven platen end travel, and means actuated by the longitudinal movement of the screw mounted pinion to vary the output of the variable output pump to correct the uneven travel of the platen.

2. In a hydraulic press, a platen, a ram disposed at each side of the center of the platen, individual pumps for supplying hydraulic pressure to the rams to advance and retract the same, one said pump being a variable output pump, a rack travelling with each end of the platen, a countershaft associated with each rack and having a driven pinion meshing with the rack and a driving pinion, a driven shaft having a driven pinion fixed thereon and meshing with one driving pinion, a second like diameter pinion having a screw mounting on said driven shaft whereby it will rotate with the driven shaft when the platen ends are travelling synchronously but will move longitudinally on said driven shaft in response to uneven platen end travel, means actuated by the longitudinal movement of the screw mounted pinion to vary the output of the variable output pump to correct the uneven travel of the platen, and means for causing each pump to apply pressure to both rams whereby to be effective in advancing one and retracting the other.

3. In a hydraulic press wherein is provided a travelling platen and means to apply pressure fluid at each side of the center of the platen to cause it to travel, a rack travelling with each end of the platen, a countershaft associated with each rack and having a driven pinion meshing with the rack and a driving pinion, a driven shaft having a driven pinion fixed thereon and meshing with one driving pinion, a second like diameter pinion having a screw mounting on said driven shaft whereby it will rotate with the driven shaft when the platen ends are travelling synchronously but will move longitudinally on said driven shaft in response to uneven platen end travel, and means actuated by the longitudinal movement of the screw mounted pinion to vary the amount of pressure fluid applied during a given interval of time at respective sides of the center of the platen as may be necessary to correct the uneven travel of the platen.

4. In a hydraulic press wherein is provided a travelling platen and means to apply pressure fluid at each side of the center of the platen to advance and retract said platen, a rack travelling with each end of the platen, a countershaft associated with each rack and having a driven pinion meshing with the rack and a driving pinion, a driven shaft having a driven pinion fixed thereon and meshing with one driving pinion, a second like diam-

eter pinion having a screw mounting on said driven shaft whereby it will rotate with the driven shaft when the platen ends are travelling synchronously but will move longitudinally on said driven shaft in response to uneven platen end travel, means actuated by the longitudinal movement of the screw mounted pinion to vary the amount of pressure fluid applied during a given interval of time at respective sides of the center of the platen as may be necessary to correct the uneven travel of the platen, and means for causing the pressure fluid applying means active at a given side of the center of the platen during advance travel to be active at the opposite side of the center of the platen during the retractive travel thereof.

5. In a power press, a platen, a hydraulic ram disposed at each side of the center of the platen, an individual variable output pump for supplying hydraulic pressure to each ram, a rack travelling with each end of the platen, a countershaft associated with each rack and having a driven pinion meshing with the rack and a driving pinion, a driven shaft having a driven pinion fixed thereon and meshing with one driving pinion, a second like diameter pinion having a screw mounting on said driven shaft whereby it will rotate with the driven shaft when the platen ends are travelling synchronously but will move longitudinally on said driven shaft in response to uneven platen end travel, and means actuated by the longitudinal movement of the screw mounted pinion to increase the output of one pump and simultaneously decrease the output of the other pump to correct the uneven travel of the platen.

6. In a power press, a platen, a hydraulic ram disposed at each side of the center of the platen, an individual variable output pump for supplying hydraulic pressure to each ram, a rack travelling with each end of the platen, a countershaft associated with each rack and having a driven pinion meshing with the rack and a driving pinion, a driven shaft having a driven pinion fixed thereon and meshing with one driving pinion, a second like diameter pinion having a screw mounting on said driven shaft whereby it will rotate with the driven shaft when the platen ends are travelling synchronously but will move longitudinally on said driven shaft in response to uneven platen end travel, means actuated by the longitudinal movement of the screw mounted pinion to increase the output of one pump and simultaneously decrease the output of the other pump to correct the uneven travel of the platen, and means for causing each pump to apply pressure to both rams whereby to be effective in advancing one and retracting the other.

7. In a hydraulic press wherein is provided a platen and a double acting platen-

driving ram disposed at each side of the center of the platen and connected to the latter and to which pressure fluid is applied for causing the platen to travel in both directions, means to apply pressure fluid to both sides of the platen-driving rams to move the platen toward and from the work, means for controlling the rate of application of pressure to the respective platen-driving rams, and means responsive to uneven travel of the platen in either direction for moving said controlling means to increase the rate of application of pressure fluid to one platen-driving ram and diminish the rate of application of pressure fluid to the other platen-driving ram in order to restore even travel of the platen.

8. In a hydraulic press wherein is provided a platen and a double acting platen-driving ram disposed at each side of the center of the platen and connected to the latter and to which pressure fluid is applied for causing the platen to travel in both directions, means to apply pressure fluid to both sides of the platen-driving rams to move the platen toward and from the work, means for controlling the rate of applying pressure to one of said platen-driving rams, and means responsive to uneven travel of the platen in either direction for moving said controlling means to vary the amount of pressure fluid applied to said one platen-driving ram during a given interval of time relative to that applied to the other platen-driving ram during such period of time in order to restore even travel of the platen.

9. In a hydraulic press wherein is provided a platen and a platen-driving ram disposed at each side of the center of the platen and connected to the latter and to which pressure fluid is applied for causing the platen to travel, an individual pump for applying pressure fluid to each platen-driving ram, means for controlling the rate of application of pressure to the respective platen-driving rams, and means responsive to uneven travel of the platen for moving said controlling means to increase the rate of application of pressure fluid to one platen-driving ram and diminish the rate of application of pressure fluid to the other platen-driving ram in order to restore even travel of the platen.

10. In a hydraulic press wherein is provided a platen and a ram disposed at each side of the center of the platen to which pressure fluid is applied for causing the platen to travel, an individual pump for applying pressure fluid to each ram, and means responsive to uneven travel of the platen to increase the pressure fluid output of one pump relative to that of the other pump in order to restore even travel of the platen.

11. In a hydraulic press wherein is provided a platen and a ram disposed at each

side of the center of the platen to which pressure fluid is applied for causing the platen to travel, individual pumps one associated with each ram in a given direction of travel for applying pressure fluid to the rams to move the platen toward and from the work, and means responsive to uneven travel of the platen in either direction to increase the rate of application of pressure fluid to one ram and diminish the rate of application of pressure fluid to the other ram in order to restore even travel of the platen.

12. In a hydraulic press wherein is provided a platen and a double acting ram disposed at each side of the center of the platen to which pressure fluid is applied for causing the platen to travel, individual pumps one associated with each ram in a given direction of travel for applying pressure fluid to the rams to move the platen toward and from the work, hydraulic connections between the pumps and the rams including means for respectively directing the discharge of each pump to one ram during a working stroke and to the other ram during a return stroke, each pump being thereby active to move one ram on the working stroke and the other ram on the return stroke, and means responsive to uneven travel of the platen in either direction to increase the rate of application of pressure fluid to one ram and diminish the rate of application of pressure fluid to the other ram in order to restore even travel of the platen.

13. In a hydraulic press wherein is provided a platen and a double acting ram disposed at each side of the center of the platen to which pressure fluid is applied for causing the platen to travel, individual pumps one associated with each ram in a given direction of travel for applying pressure fluid to the rams to move the platen toward and from the work, hydraulic connections between the pumps and the rams including means for respectively directing the discharge of each pump to one ram during a working stroke and to the other ram during a return stroke, each pump being thereby active to move one ram on the working stroke and the other ram on the return stroke, and means responsive to uneven travel of the platen in either direction to increase the pressure fluid output of one pump relative to that of the other pump in order to restore even travel of the platen.

In testimony whereof, I have hereunto subscribed my name.

WALTER ERNST.