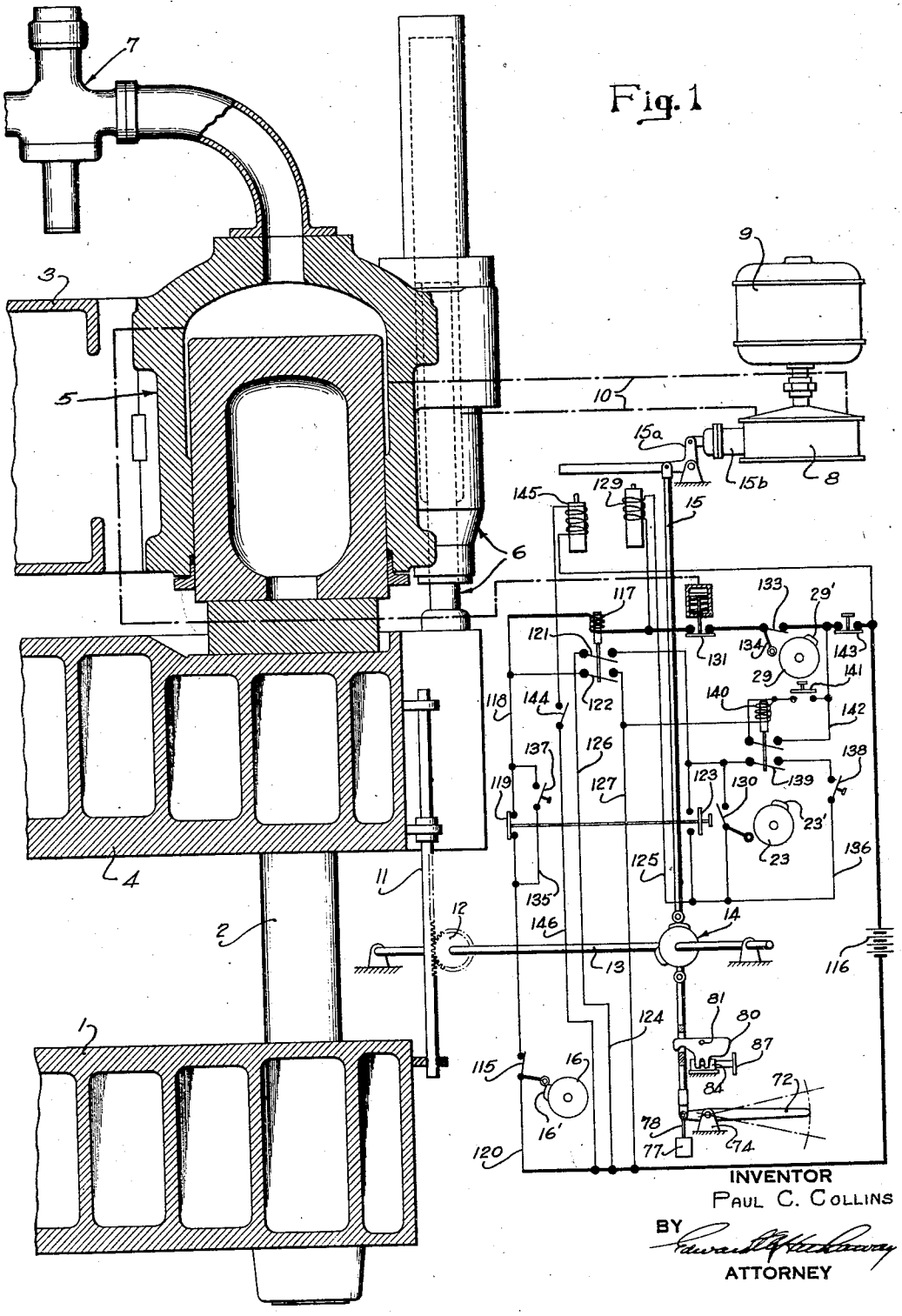
May 30, 1944. P. C. COLLINS 2,350,217

HYDRAULIC PRESS CONTROL

Filed June 17, 1940 5 Sheets-Sheet 1

Fig. 1



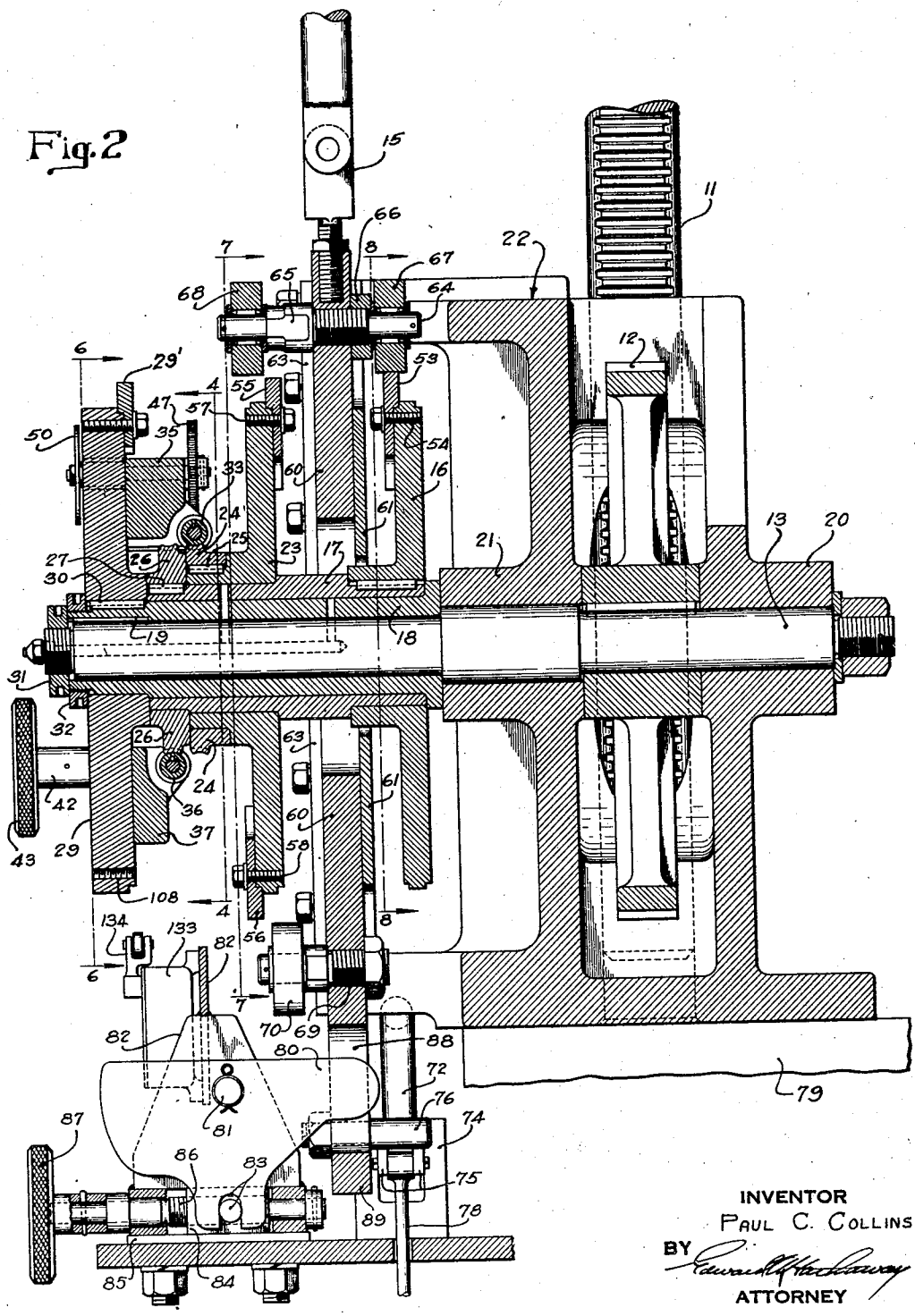
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HYDRAULIC PRESS CONTROL

Filed June 17, 1940 5 Sheets-Sheet 2

Fig. 2



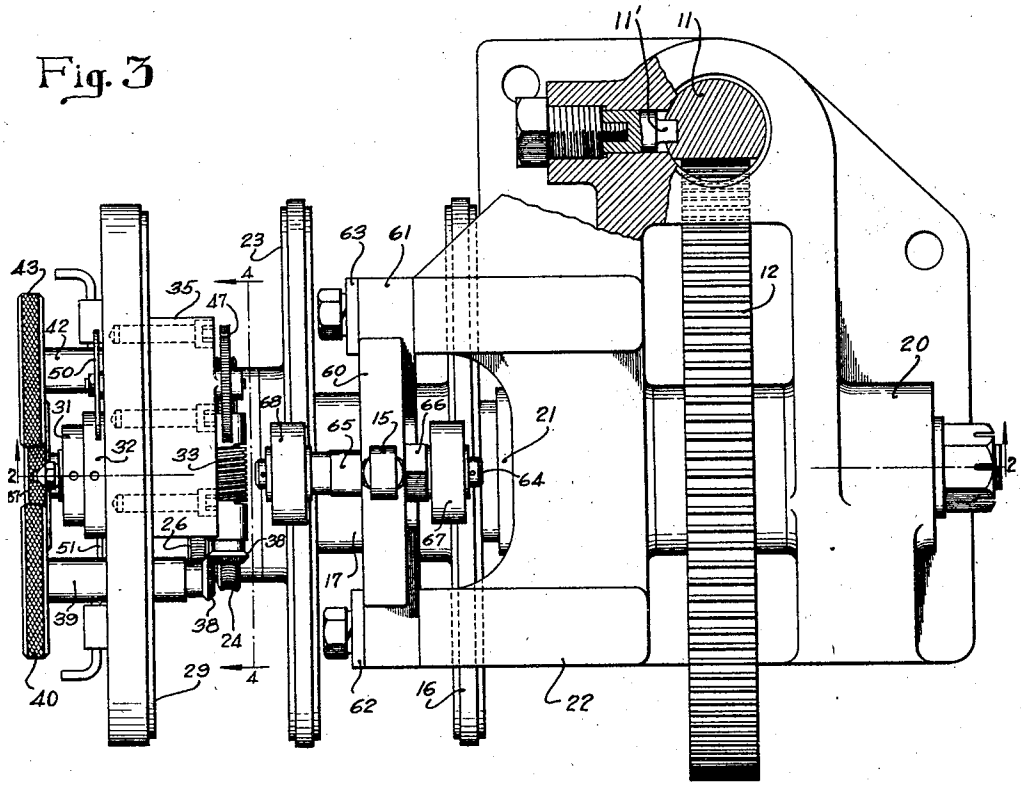
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HYDRAULIC PRESS CONTROL

Filed June 17, 1940 5 Sheets-Sheet 3

Fig. 3



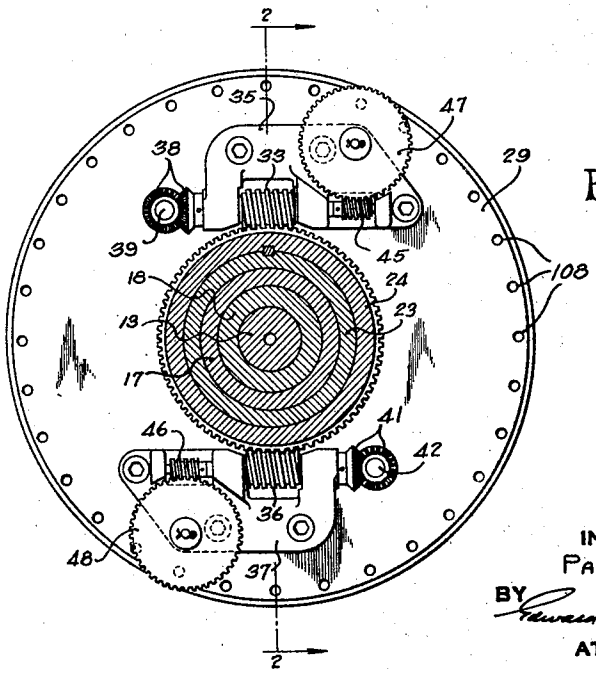


Fig. 4

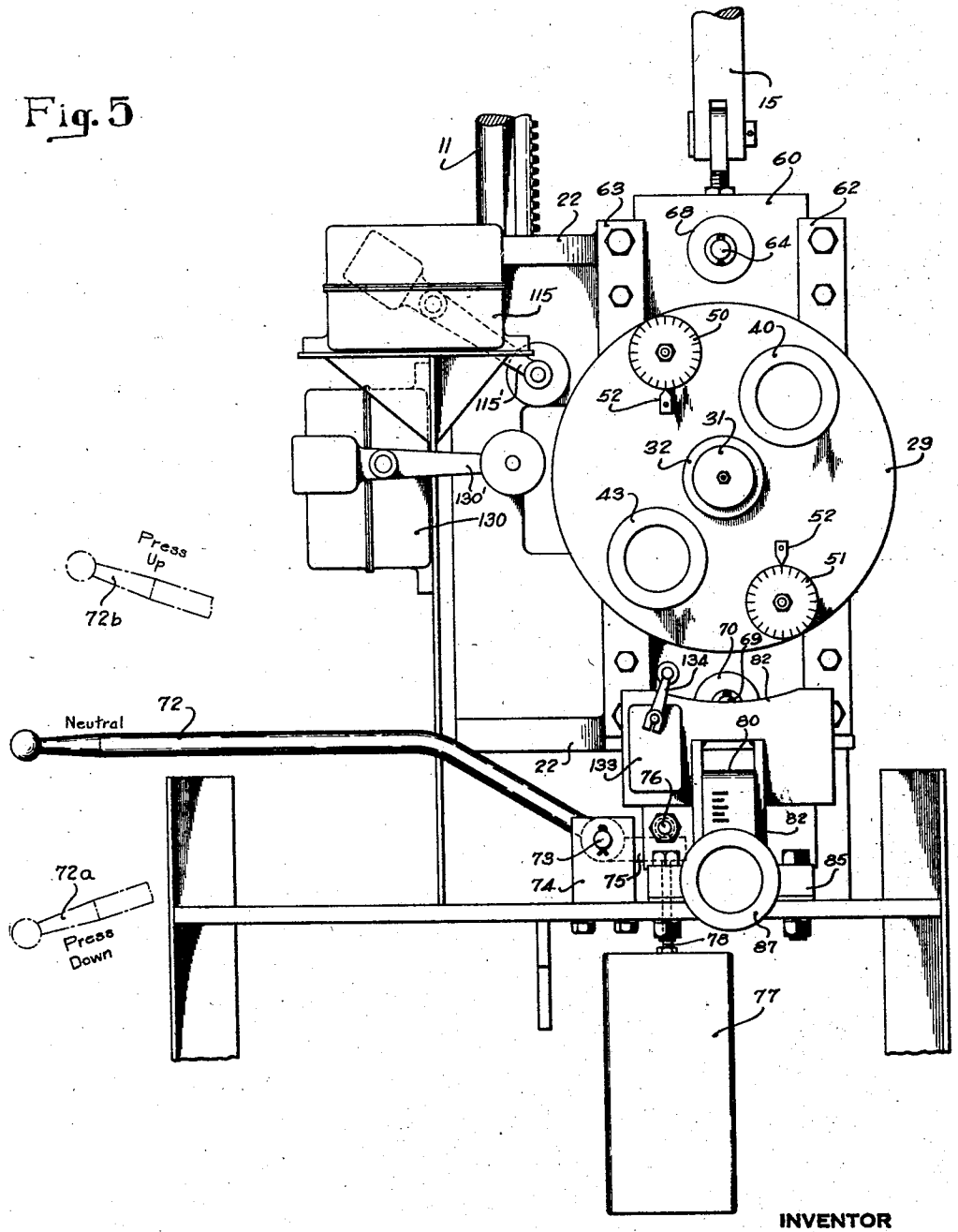
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HYDRAULIC PRESS CONTROL

Filed June 17, 1940 5 Sheets-Sheet 4

Fig. 5



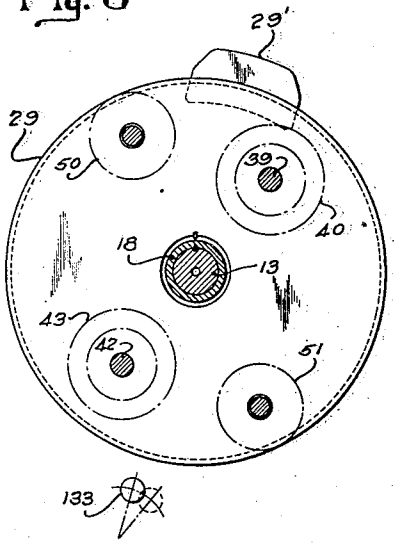
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May 30, 1944. P. C. COLLINS 2,350,217

HYDRAULIC PRESS CONTROL

Filed June 17, 1940 5 Sheets-Sheet 5

Fig. 6



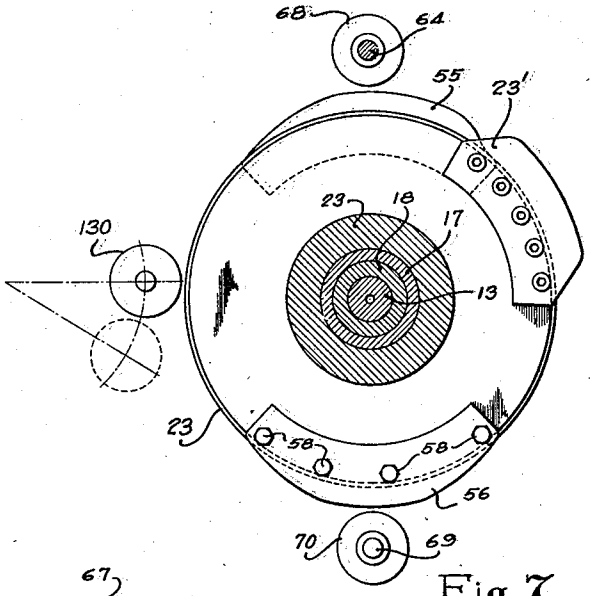


Fig. 7

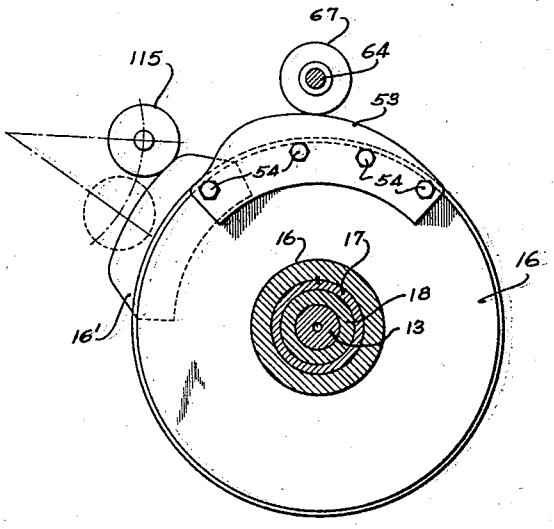


Fig. 8

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Patented May 30, 1944 2,350,217

UNITED STATES PATENT OFFICE

2,350,217

HYDRAULIC PRESS CONTROL

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Application June 17, 1940, Serial No. 341,046

8 Claims. (Cl. 74—568)

This invention relates generally to hydraulic presses and more particularly to improved control means therefor.

The hydraulic press shown herein is of the customary type having a movable platen operated by a main cylinder and ram and by pullback rams and cylinders, the fluid pressure being supplied alternatively to said cylinders from any suitable source such as a reversible hydraulic pump which is shifted selectively to its forward pressure position, to its reversing pullback position or to its neutral position to hold the movable platen in its uppermost position, or, if desired, fluid pressure may be supplied from a continuous source such as a uni-directional discharge pump or from an accumulator system in which cases fluid pressure is alternatively supplied to the main and pullback cylinders through a well-known reversing valve. This reversing valve and its source of pressure are equivalent to the fluid distributing function of the reversible pump mechanism although a reversible pump is shown herein for the purpose of illustration.

One object of the present invention is to provide an improved cam mechanism for controlling and shifting the fluid distributing means, this cam mechanism being operated in synchronism with the platen movements. A further object is to provide an improved cam mechanism whereby the timing of the movements of the press platen, such as the upper and/or lower limits of travel of the platen, may be individually or relatively varied with accuracy, dispatch and convenience, preferably while the press is in continuous operation.

Another object is to provide an improved volumetric control for the pumping mechanism, this control being applicable during either the pressing or return stroke although duplication of the control adapts it to both strokes.

A further object is to provide an improved cam control mechanism in which the timing of the press controlled events are indicated on a suitable indicating mechanism that is instantly and continuously visible to the operator. Another object is to provide an improved variable cam control mechanism that is relatively simple in construction, operation and maintenance and is compact and durable and has a high degree of sensitivity, accuracy and ease of operation, as well as being conveniently accessible to an operator at all times.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawings in which:

Fig. 1 is a diagrammatic illustration of my invention applied to a press which is only partially shown;

Fig. 2 is a vertical section of my improved cam control mechanism taken substantially on the lines 2—2 of Figs. 3 and 4;

Fig. 3 is a plan view of Fig. 2 but omitting the cam lobes for purposes of clarity;

Fig. 4 is a transverse section taken substantially on the lines 4—4 of Figs. 2 and 3;

Fig. 5 is a front elevation of Figs. 2 and 3 viewed from the left side thereof; and

Figs. 6, 7 and 8 are transverse section taken respectively on the lines 6—6, 7—7 and 8—8 of Fig. 2.

In the particular embodiment of the invention such as is disclosed herein merely for the purpose of illustrating one specific form among possible others that the invention might take in practice, I have diagrammatically illustrated in Fig. 1 one side of a hydraulic press having a base or stationary platen 1 joined by columns 2 to an upper stationary crosshead 3. The press is, of course, preferably symmetrically arranged but its details of construction do not enter into the present invention. A movable platen 4 is moved downwardly during a pressing stroke by any suitable number of main rams and cylinders one set of which is generally indicated at 5 and is returned to its upper position by usual pullback rams and cylinders generally indicated at 6. As is customary with hydraulic presses of this type during the initial portion of the pressing stroke pressure fluid is supplied to the main cylinders 5 from a usual filling tank (not shown) communicating through any suitable filling valve diagrammatically indicated at 7. After filling of the main cylinders with low pressure fluid during the initial portion of the pressing stroke the filling valve then closes and fluid under high pressure is supplied to the main cylinders from a pump diagrammatically indicated at 8, Fig. 1. This pump is to be considered for purposes of illustration as of the well-known variable positive displacement Hele-Shaw reversible type having uni-directional rotation driven by a suitable motor 9. Fluid pressure from this pump is alternatively supplied to the main and the pullback cylinders 5 and 6. For purposes of diagrammatic illustration, the pump is shown as connected to the main and the drawback cylinders by pipes 10, although it will, of course, be understood that usual relief valves, by-pass

valves and filling control connections are employed. Such connections and valves do not constitute a part of my present invention and hence further description is not deemed necessary as they are well understood in the art.

A gear rack rod 11 is suitably connected to the platen 4 so as to be positively moved in unison therewith at all times. This rack drives a pinion 12 and shaft 13 upon which is mounted my improved cam mechanism generally indicated at 14. The pinion is proportioned so that for full platen movement the cam mechanism rotates about three-fourths of a turn. The cam mechanism controls the up and down movements of a rod 15 which is connected through a suitable bell crank 15a to a usual pump servo-motor diagrammatically indicated at 15b. The cam mechanism, linkages and pump are shown in Fig. 1 in their neutral position. When the rod 15 moves upwardly the pump 8 is shifted so as to supply operating fluid to the main cylinders 5 for a pressing operation whereas when the rod 15 is moved downwardly the pump 8 is shifted to the other side of its center so as to supply operating fluid to the pullback cylinders 6 and draw fluid from the main cylinders. Excess or make-up fluid during either of these operations is taken care of by usual communication with the filling tank. The gear rack 11, Fig. 3, is prevented from rotating by a removable pin 11'.

The cam mechanism for controlling the distribution of operating fluid comprises, Fig. 2, a cam supporting disc 16 keyed to a sleeve 17 which is journalled upon an inner sleeve 18, this latter sleeve being keyed as at 19 to shaft 13. Shaft 13 is journalled in bearings 20 and 21 of a suitable stationary frame 22 mounted preferably at a convenient front portion of the frame. A second cam supporting disc 23 is journalled upon the disc sleeve 17. A worm gear 24 is keyed at 25 to a hub of disc 23 while a similar worm gear 26 is keyed at 27 to sleeve 17 of the other cam disc 16. An outermost disc 29 is keyed as at 30 to sleeve 18 and is secured to shaft 13 through key 19. The sleeve and disc arrangement so far described is held in axial position by a nut 31 threaded on shaft 13 and engaging sleeve 18, while an inner nut 32 threaded on sleeve 18 engages disc 29. To either adjust or hold the cam discs 16 and 23 in a predetermined angular relation to each other and to the shaft 13, I provided a worm 33 meshing with worm gear 24 and transversely journalled in a suitable bracket 35 which is secured to the rear side of front disc 29 for bodily rotation therewith. A similar worm 36 meshes with worm gear 26 and is transversely journalled in a bracket 37 which also is secured to disc 29 for bodily rotation therewith. To rotate the worm 33 there is provided, as shown in Fig. 4, a pair of bevelled gears 38 secured respectively to worm 33 and to a shaft 39 which is journalled in disc 29, the front end of shaft 39 being provided with a hand grip 40. Similarly, the other worm 36 is provided with a pair of bevelled gears 41 whose axial shaft 42 is also journalled in disc 29 and provided with a hand grip 43. By manually rotating either or both of the knurled grips 40 and 43, the cam discs 16 and 23 may be relatively angularly adjusted thereby adjusting the extent of movements of the press platen as hereinafter described. To indicate the positions of the cam discs there is provided, as shown in Fig. 4, small worm gears 45 and 46 secured respectively to the worms 33 and 36 so as to rotate therewith. Small worm gears 47 and 48 mesh with the worms 45 and 46 and are suitably journalled in the brackets 35 and 37 which are secured to the back side of disc 29. The worm gears 47 and 48 are mounted upon shafts which extend through disc 29 and carry on their outer face index dials 50 and 51, Fig. 5, suitably graduated so that the angular position of the cam discs 16 and 23 may be indicated by suitable pointers 52 secured to the front face of disc 29.

The cam disc 16 is provided with a pump neutralizing cam lobe 53 secured in any desired fixed angular position with respect to disc 16 by bolts 54. A pair of cam lobes 55 and 56 is similarly secured to the second disc 23 as by bolts 57 and 58. To have the cam lobes operate control rod 15, this rod is secured to a vertically movable crosshead 60 which is slidably guided in a crosshead guide 61 formed in the forward portion of frame 22 and provided, as shown in Figs. 3 and 5, with guide gibs 62 and 63. As shown in Fig. 2, crosshead 60 has a shaft 64 extending therethrough and firmly held by an enlarged collar portion 65 and a nut 66. A pair of cam follower rollers 67 and 68 are journalled upon the outer ends of shaft 64. Rigidly secured to the lower end of crosshead 60 is a similar roller shaft 69 provided with a third cam follower roller 70.

To manually shift the pump to any one of its three positions, namely, forward, neutral or reverse, there is shown in Fig. 5, a hand lever 72 pivoted at 73 in a suitable stationary bracket 74 and having an arm 75 extending, as shown in Fig. 2, beneath a pin 76 which is secured to one side of crosshead 60. The hand lever 72, Fig. 5, is in its neutral position, while the forward or pressing position is shown in dotted lines at 72a and the reverse or return position is shown in dotted lines at 72b. The crosshead 60 is shifted upwardly by engagement of the hand lever arm 75 bearing against the under side of pin 76, Fig. 2, it being understood that the weight of rod 15 and crosshead 60 biases the crosshead and its pin 76 downwardly. To keep the hand lever 72 in a normally inactive relation to pin 76, a weight 77, Fig. 5, is pivotally connected by a rod 78, Fig. 2, to the bifurcated end of arm 75. The hand lever is thus normally maintained in its upper position 72b, Fig. 5. The frame 22 is supported on any suitable stationary part of the press frame or other stationary structure diagrammatically indicated in Fig. 2 at 79.

To adjust the volumetric displacement of the pump, I provide an arm 80, Fig. 2, pivoted at 81 to a stationary bracket 82. This arm has a pin and slot connection 83 with a nut 84 which is non-rotatably but slidably supported on the base 85 of bracket 82. An axially fixed screw 86 is threaded in nut 84 and has a hand grip 87 whereby rotation of the screw in either direction causes the nut 84 to move arm 80 upwardly or downwardly within a slot 88 of crosshead 60. To obtain any desired volumetric displacement of the pump for use on the pressing stroke and thereby determine the rate of pressing speed, the arm 80 is adjusted downwardly to a predetermined point at which it serves as a limit stop for the lower end 89 of crosshead 60. This limits the upward movement of the crosshead 60 beyond its neutral position and accordingdy limits the volumetric displacement of the pump, it

being understood that the slot 88 is of sufficient height that the arm 80 may be adjusted upwardly to a point giving maximum volumetric displacement without having the upper end of the slot strike the arm. It will be understood that arm 80 is spaced from the lower end of slot 88 when pump neutralizing cam 53 is in engagement with roller 67 and hence this space allows crosshead 60 and pump rod 15 to be moved upwardly away from cam 53 to shift the pump off of neutral to its forward or pressing position until lower end 89 strikes arm 80. Hence the extent to which the pump may be shifted in its forward position to determine its volumetric displacement is controlled by the adjustment of arm 80.

As shown in Fig. 5, three limit switches diagrammatically indicated at 115, 130 and 133, provided respectively with pivotal actuating arms 115', 130' and 134 are suitably mounted upon a portion of the stationary frame 22 or 80. These switch arms are actuated by various cams mounted upon certain of the cam discs, shown in Fig. 2, to be described in connection with the operation of the equipment.

Operation

The mode of operation of my improved cam mechanism will be more readily understood when described in connection with the control circuit of Fig. 1 which, for purposes of illustration, is of the electrical type.

The cam control of Fig. 2 and the circuit in Fig. 1 are shown in neutral with the press platen stopped in its upper position wherein a switch 115 is closed by cam 16' thereby establishing a circuit from a current source 116 through a solenoid 117 and a line 118, across a closed switch 119 and a line 120 to the other side of the current supply 116. Energization of solenoid 117 closes two switches 121 and 122. The operator can now initiate down movement of platen 4 by closing a palm switch 123 whereby current is supplied from source 116, thence through wire 124, across switches 121, 123 and wire 125 to a thrustor solenoid 129 and thence back to the other side of the current supply 116. Upon closure of palm switch 123, the switch 119 is simultaneously opened to insure a single cycle control to be described later. However, opening of switch 119 does not interrupt the current for relay solenoid 117 because the circuit therefor connects from wire 118 across switch 122 and wire 127 to the other side of the current supply. Energization of solenoid 129 shifts the pump 8 to its full forward pressing position, fluid being discharged from the pump to the main cylinders 5. It is desirable to have the operator keep his hands on the palm switch 123 so as to avoid injury during down movement of the press but when the press has moved down sufficiently so as to close the dies it is permissible for the operator to take his hands off of the palm switch 123. To do this it is necessary to maintain the solenoid 129 energized which is done by a cam 23' closing a switch 130 placed in parallel with palm switch 123. The cam is so angularly positioned that it closes the switch 130 when the dies are closed. When the press approaches its draw position, it is desirable to slow down the pressing speed, this being done by a cam 55, Fig. 2, engaging roller 70 to move it and rod 15 downwardly so as to partially reduce the pump stroke and thereby slow down the press speed. This partial down movement is against the upwardly biasing but yieldable force of thrust or solenoid 129.

For reversing the press in accordance with pressure, a pressure responsive switch 131 opens automatically in response to a predetermined main cylinder pressure. Opening of this switch automatically de-energizes thrustor solenoid 129 thereby allowing the weight of rod 15 and associated parts to shift the pump to its reverse position and thus supply fluid to the pullback cylinders 6. Rod 15 and crosshead 60 move downwardly until roller 68, Fig. 2, engages the cam 56, this cam limiting the extent of downward movement of roller 68 so that the pump effects only a very restricted rate of reverse press movement if at all. If a rubber pad or other resilient means is interposed between the press platens as is required in some operations, then the foregoing restricted pump reversal avoids a sudden rebound of the movable press platen upon release of pressure in the main cylinder. For instance if the cam 56 is adjusted to give a very restricted press reversal, the resilient force will be controlled to allow only a gradual upward movement of the press and even though this is for a short distance it will be sufficient to rotate disc 23 and hence move cam 56 out of the path of roller 68. This roller will thereupon drop until the roller engages the periphery of disc 23 and thus allow the pump to move past its neutral position and into reverse so as to supply operating fluid to the pullback cylinders and move the press upwardly. When the main cylinder pressure initially drops, the pressure responsive switch 131 immediately recloses but this will not allow re-energization of relay solenoid 117 because top position switch 115 has been previously opened on the initial down stroke. The press will therefore continue upwardly until neutralizing cam 53, Fig. 2, engages roller 67 and shifts rod 15 and the pump back to their neutral position thereby bringing the press to a stop. Substantially simultaneously with shifting of the pump to neutral, cam 16' closes switch 115 but reclosure of this switch does not cause the press to restart on its down stroke even though closure of switch 115 re-energizes relay solenoid 117 and closes switches 121 and 122. The reason why closure of switch 121 does not re-energize thrustor solenoid 129 is because palm switch 123 is presumed to be open and also switch 130 is also opened during the initial reverse movement of the press. Hence, to restart the press the operator must first close palm switch 123 whereupon the above described cycle is started. Hence, energization of thrustor 129 requires closure of both switches 115 and 123.

Safety single cycle control.—If the operator fails to take his hands off of palm switch 123 during return movement of the platen, still the press will not restart on its down stroke after returning to its upper position for the reason that switch 119 is connected to switch 123 and is open when switch 123 is closed. Hence, so long as switch 119 is open relay solenoid 117 cannot be reenergized even though switch 115 is reclosed when the press returns to its upper position. Therefore, with solenoid 117 de-energized, the switch 121 cannot reclose and the circuit through the now assumed closed palm switch 123 is fully broken. Hence, energization of solenoid 117 requires closure of both switches 115 and 119. However, if the operator removes his hand from palm switch 123, then switch 119 will close thereupon re-energizing relay 117 to close switches 121 and 122. Thereupon the operator can reclose palm

switch 123 to energize thrustor solenoid 129 to start the next down cycle.

Position reversal.—A normally closed switch 133 is provided with a switch arm 134 adapted to be engaged by a cam 29' when the press platen reaches a predetermined lower position. Opening of switch 133 breaks the control circuit in the same manner as opening of the pressure responsive switch 131. It will be understood that when pressure reversal is employed the positioning switch is maintained closed preferably by removing the position reversal cam. Conversely, when position reversal is employed the pressure reversal switch 131 is maintained closed preferably by closing the fluid pressure pipe thereto.

To obtain full automatic operation wherein the press moves up and down without stopping, it is only necessary to maintain a continuously closed circuit across switches 119 and 123, this being accomplished by the provision of by-pass circuits 135 and 136 both of which would be closed by manual switches 137 and 138. Circuit 136 is also provided with a switch 139 which is closed by a solenoid 140, this solenoid being energized upon momentary closure of a manual switch 141. Energization of this solenoid then closes a holding circuit 142. Switch 139 remains closed so long as there is no emergency stop of the press. Hence, when the press moves to its upper position to close top limit switch 115, a circuit is immediately established for energizing relay solenoid 117 thereby to close switch 121 which establishes a circuit for thrustor solenoid 129 to shift the pump to its forward pressing position. At the lower position of the press it is reversed in accordance with a predetermined condition of operation brought about either by position reversal or pressure reversal through switches 131 or 133. Hence, the press will move continuously up and down.

Emergency stopping and return of the press at any point during its pressing stroke during semi-automatic operation (one complete pressing and return cycle only) is accomplished merely by momentarily opening a switch 143 which thereupon breaks the circuit for relay solenoid 117 so that switches 121 and 122 open. The pump then is automatically shifted to its reverse position to move the press upwardly, the press coming to a stop at its uppermost position by action of cam 53 moving the pump to neutral. The press can then be restarted merely by closing palm button 123. During full automatic operation the same emergency switch can be employed. However, to restart the press operation it is necessary to momentarily close switch 141 to re-energize solenoid 140 thereby to close switch 139 and re-establish the by-pass circuit 136.

To stop the press in any desired position during the down stroke without having the press then move upwardly, it is only necessary to shift the pump to its neutral position, this being accomplished by closure of a switch 144 which closes a circuit 146 for energizing a neutralizing thrustor specifically shown herein for the purpose of illustration in the form of a solenoid 145. The solenoid 145 engages the lever of bell crank 15*a* and is able to move the same upwardly only to its neutral position. To restart the cycle the switch 144 is opened thereby causing the weight of rod 15 and associated parts to shift the pump to its forward pressing position.

Operation—cam adjustments

The present invention has particular reference to the improved mechanism for relatively adjusting the cams of Figs. 2, 6, 7 and 8 whereby the timing of various press operations may be easily, quickly and positively adjusted with a high degree of accuracy together with providing an arrangement that is sturdy and compact so that it may be installed in a remote control stand separate from the press structure per se if so desired. This adjustment can be effected either during operation of the press or while the same is at rest. To make such adjustments, for example to vary the position neutralizing cam 53, Fig. 2, and thereby determine the top position of the press platen, it is only necessary for the operator to manually rotate knob 43 which rotates shaft 42, bevel gears 41, worm 36 and worm gear 26 thereby causing a key 27, Fig. 2, to rotate sleeve 17 which in turn rotates cam disc 16 and accordingly angularly adjusts the position of neutralizing cam 53. Similarly, to adjust the position of slow draw stroke cam 55, as well as cam 56 which allows initial resilient reversal of the press platen by virtue of a rubber pad or other means, the operator manually adjusts knob 40, Fig. 3, which, as shown in Figs. 2 to 4, rotates shaft 39, bevel gears 38, worm 33 and worm gear 24 thence through key 25 causing rotation of cam disc 23 and cams 55 and 56. The foregoing cam adjustments are indicated on the face of front disc 29 by indexed dial discs 50 and 51, Figs. 2 and 5, connected to the adjusting mechanisms for discs 16 and 23 through a small worm and worm gear shown in Fig. 4 at 45, 47 and at 46, 48. Suitable pointers 52, Fig. 5, have a normally fixed position with respect to disc 29 thereby to indicate the angular position on the dials 50 and 51. A position reversal cam 29', Fig. 2, may be removably bolted to disc 29 at any desired angular position thereon thereby determining the position at which the press platen is reversed. To allow for such adjustment a series of angularly spaced bolt holes 108, Fig. 4, may be placed around the disc circumference.

During operation of the press it will be understood that the cam discs 16, 23 and 29 have a continuous back and forth movement, specifically an oscillating movement, in synchronism with movement of the press platen. During such oscillating movement it is possible for the operator to grasp handle 40 or 43, rotate the same for adjusting the discs 16 and 23 thereby permitting the operator to observe the extent of platen movement and its immediate effects in response to the cam adjustments. In this way no time is lost and all mechanical elements are in continuous operative relation without any need of making disconnections or other time consuming or expensive adjustments.

The effectiveness with which my improved cam mechanism is adapted to be brought into compact relationship to position reversal switch 133, top position switch 115 and switch 130 while allowing the operator to remove his hands from palm switch 133 is seen in Fig. 5 wherein these switches are conveniently spaced around the disc 29.

Also brought into compact cooperative relationship to the cam operated crosshead 60, Fig. 2, is my improved pump volume control 80—87 whereby the operator without changing his position with respect to the cam control mechanism may manually rotate handle 87, Fig. 2, thereby swinging arm 80 upwardly or downwardly to provide a limit stop for upward movement of crosshead 60 through engagement of lower portion 89

thereof with arm 80. The extent of upward movement of crosshead 60 determines the extent of eccentricity of the Hele-Shaw type of pump thereby controlling the rate of discharge or volume from the pump. Such volume control in turn determines the rate of movement of the press platen. In addition to this convenient volumetric control, I have also brought into cooperative control with the crosshead 60 but without interfering with the cam or volume controls a manual operating lever 72, Figs. 2 and 5, whereby by swinging lever 72 downwardly to position 72a the short arm 75 of the lever engages pin 76, Fig. 2, to raise crosshead 60 and thereby effect a pressing operation, whereas by moving lever 72 to position 72b, Fig. 5, the lever arm 75 permits the weight of crosshead 60 and rod 15 to move said elements downwardly thereby reversing the pump and sending the press platen to its upper position.

From the foregoing disclosure it is seen that I have provided an extremely simple, effective and sturdy control mechanism having a high degree of flexibility of operation with maximum compactness and convenience, together with accuracy and sensitivity.

It will of course be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A control apparatus for a hydraulic press comprising, in combination, an oscillatable shaft, a plurality of cam discs journalled coaxially of said shaft to have oscillating movement therewith and each being independently adjustable relative thereto and to each other, a plurality of members arranged concentrically with respect to each other and to said shaft for adjusting said cam discs, and means whereby said plurality of concentric members oscillate at all times as a normal continuous part of the oscillation of said shaft.

2. The combination set forth in claim 1 further characterized in that said means includes a member rigidly connected to said shaft, operating members carried by said latter member in positions offset from the shaft axis, and gearing connecting said operating members with said concentric adjusting members.

3. The combination set forth in claim 1 further characterized in that said means includes a member fixed to said shaft, a plurality of operating elements journalled in said latter member and offset from the axis of said shaft, worms carried by said member and adapted to be rotated respectively by said operating elements, and worm gears secured respectively to said concentric adjusting members whereby rotation of said worms effects adjustment of their respective cam discs.

4. A control apparatus for a hydraulic press comprising, in combination, a shaft, a plurality of cam discs journalled coaxially of said shaft to have movement therewith and each being adjustable relative thereto and to each other, means for effecting said adjustment of the cam discs including actuating members disposed coaxially of said shaft, a member fixed to said shaft to move therewith at all times as a continuously normal part of the movement thereof, a plurality of operating elements journalled in said latter member and offset from the axis of said shaft, worms carried by said member and adapted to be rotated respectively by said operating elements, worm gears secured respectively to said coaxial adjusting members whereby rotation of said worms effects adjustment of their respective cam discs, and gearing connected to said worms and having indicating shafts extending substantially at right angles to said worms thereby to indicate the angular position of said cam discs.

5. The combination set forth in claim 1 further characterized in that said means includes a member fixed to said shaft, a plurality of operating elements journalled in said latter member in positions offset from the axis of said shaft, worms carried by said member and adapted to be rotated respectively by said operating elements, worm gears secured respectively to said concentric adjusting members whereby rotation of said worms effects adjustment of their respective cam discs, and means for oscillating said shaft whereby said cam discs and operating elements oscillate therewith.

6. A control mechanism for a hydraulic press having a movable member whose movement is under the control of hydraulically operated means for which fluid is supplied from a pressure fluid source comprising, in combination, means for variably controlling the pressure fluid for the hydraulically operated means, a shaft, a pair of axially spaced cam discs arranged coaxially of said shaft to be driven thereby, a crosshead for effecting actuation of said variable controlling means and being disposed between said discs and having ends extending in opposite directions from said shaft, means for reciprocably guiding said crosshead, and a pair of cam followers mounted on the opposite sides of said crosshead at one end thereof and a third cam follower mounted on one of said sides of the other end of said crosshead whereby the cam followers at opposite ends of said crosshead but on the same side thereof are both engageable by one of said cam discs to control successive portions of movement of said crosshead in one direction of movement thereof and the other cam is engageable with said third cam follower to control movement of said crosshead in opposite direction of movement thereof thereby to effect a predetermined movement of said movable press member.

7. A control mechanism for a hydraulic press comprising, in combination, a press control member having a reciprocable crosshead, an oscillating shaft traversing the plane of reciprocation of said crosshead, a cam disc disposed coaxially of said shaft and driven thereby to move said crosshead in one direction, and means for controlling the extent of movement of said crosshead in a part of its movement including a pivoted arm engageable with said crosshead and a screw and nut operatively connected to said arm to adjust the same.

8. A control mechanism for a hydraulic press comprising, in combination, a press control member having a reciprocable crosshead, an oscillating shaft traversing the plane of reciprocation of said crosshead, a cam disc disposed coaxially of said shaft and driven thereby to move said crosshead in one direction, said crosshead having a slot elongated in the direction of reciprocation, a pivotal arm extending into said slot to control the extent of movement of said crosshead in a part of its movement, and a screw and nut operatively connected to said arm for adjusting the same.

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