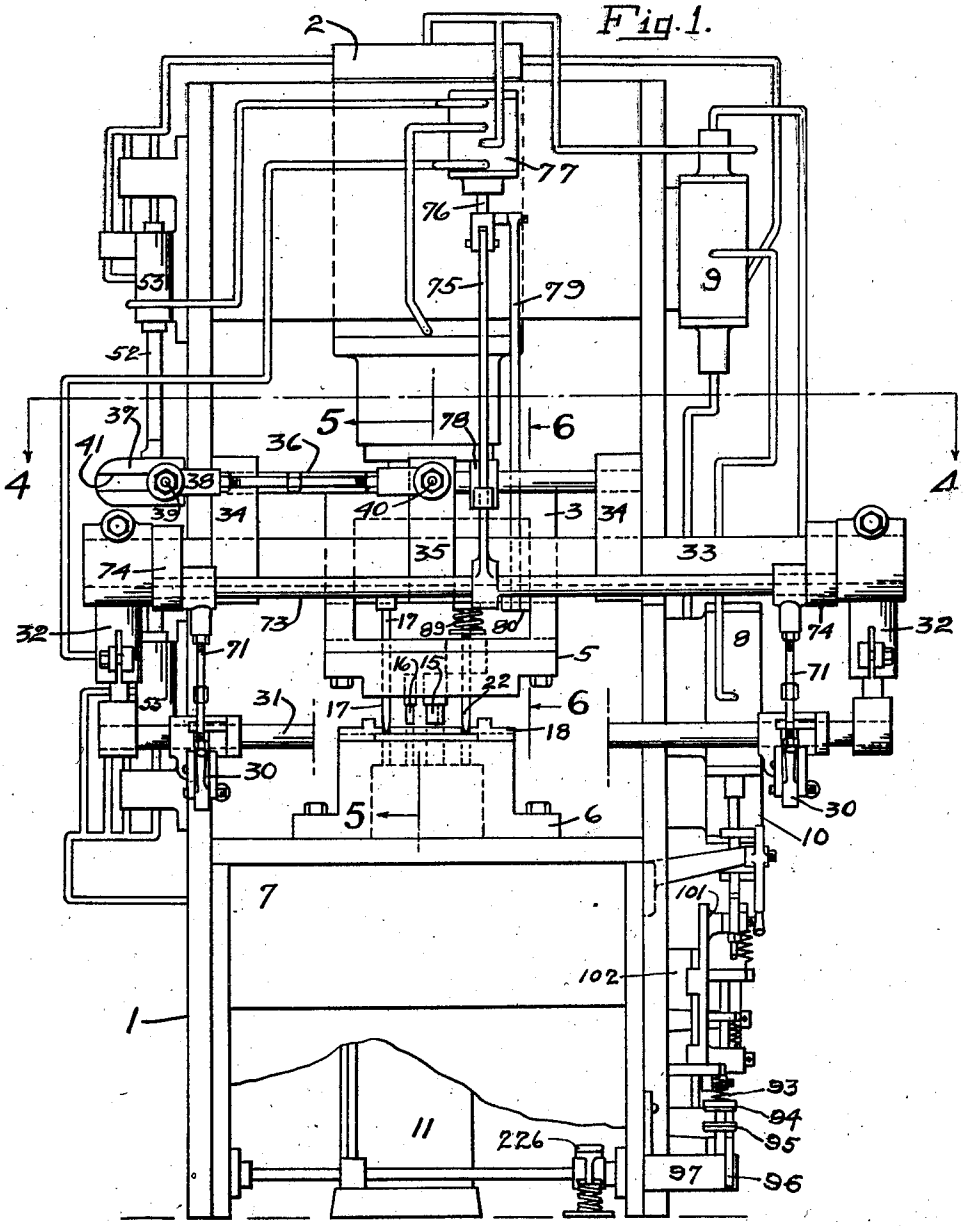
Oct. 8, 1935. W. FERRIS 2,016,710

SELF FEEDING HYDRAULIC PRESS

Filed Aug. 4, 1930 8 Sheets-Sheet 1

Fig. 1.



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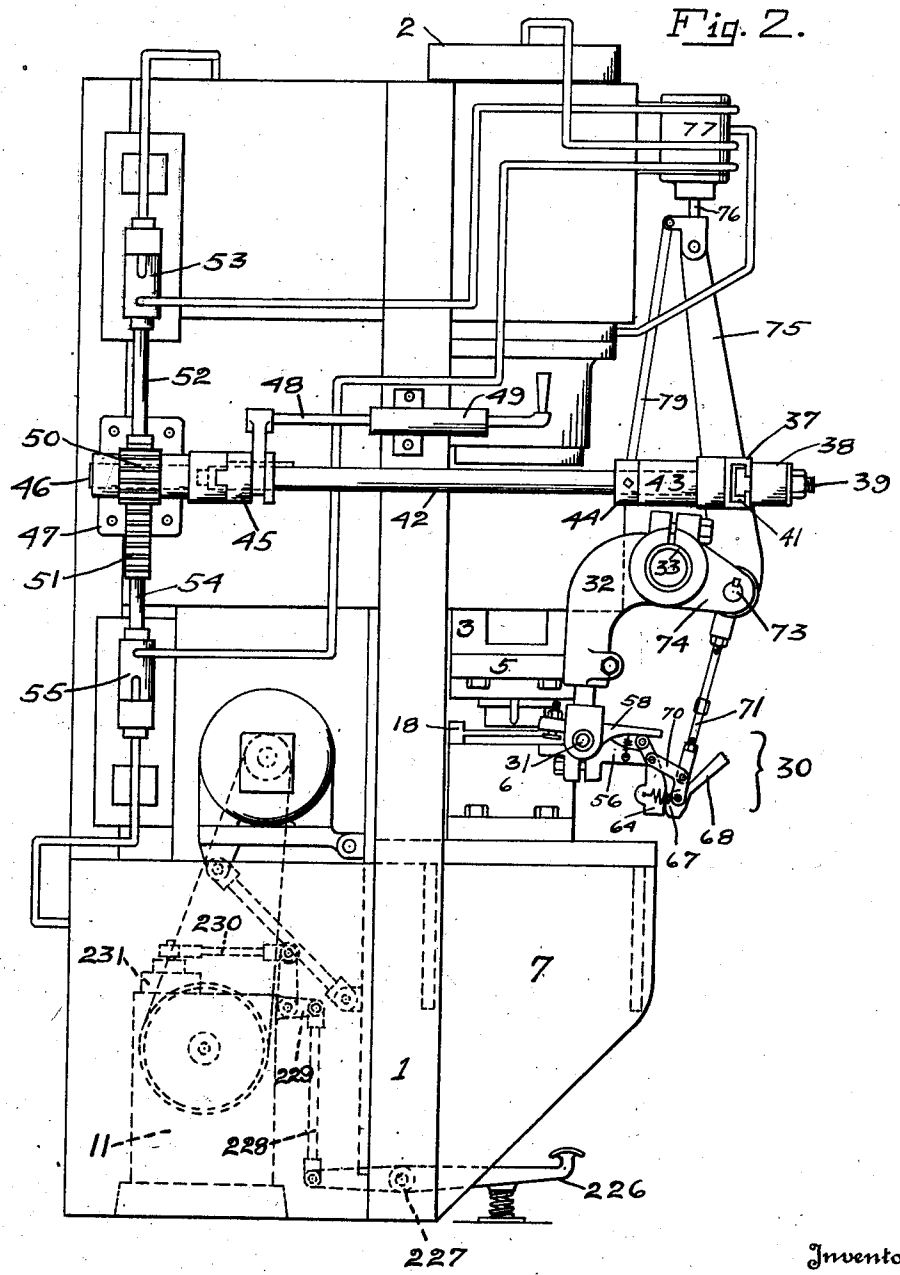
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SELF FEEDING HYDRAULIC PRESS

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Fig. 2.



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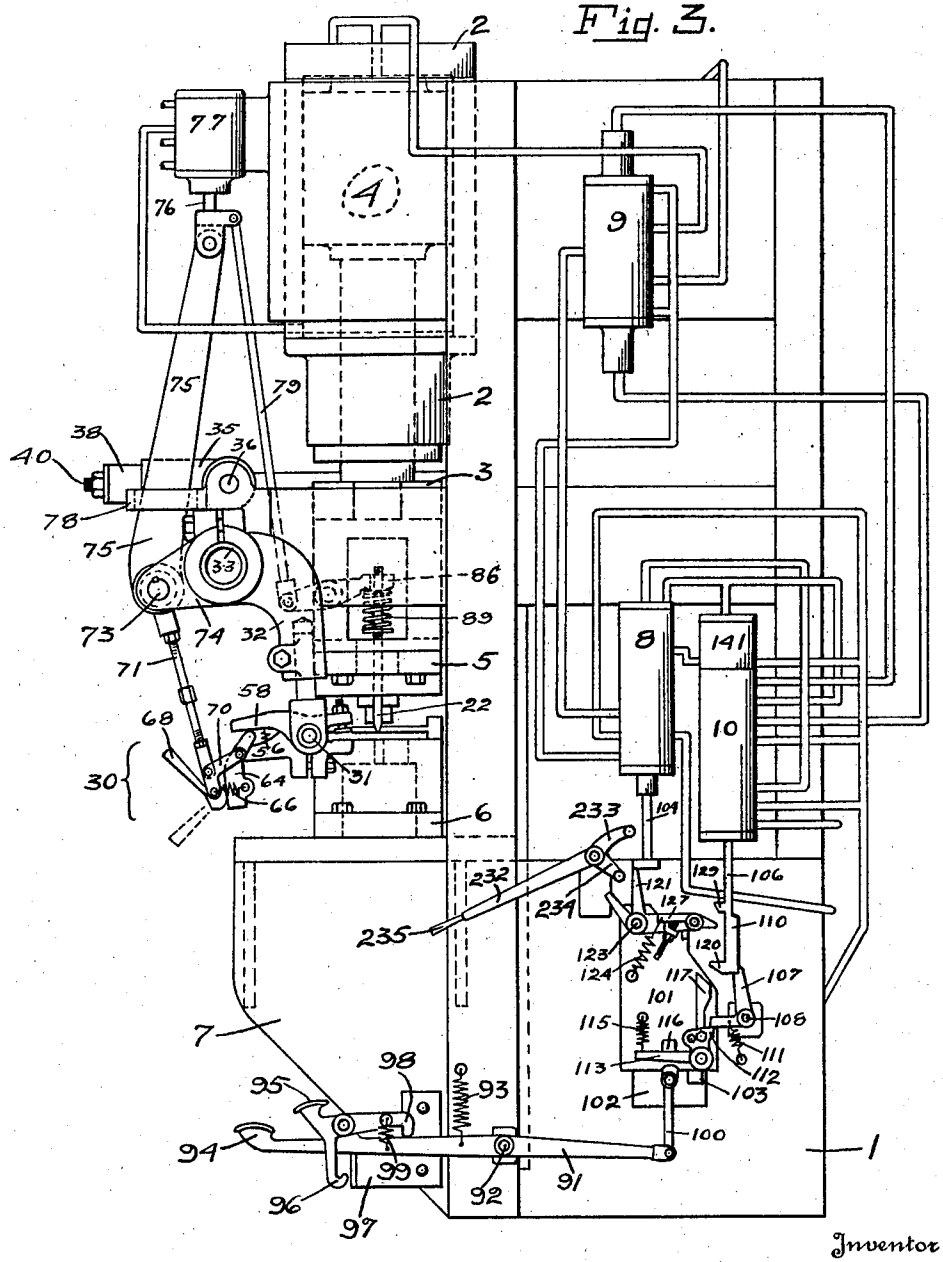
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SELF FEEDING HYDRAULIC PRESS

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Fig. 3.



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SELF FEEDING HYDRAULIC PRESS

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Fig. 4.

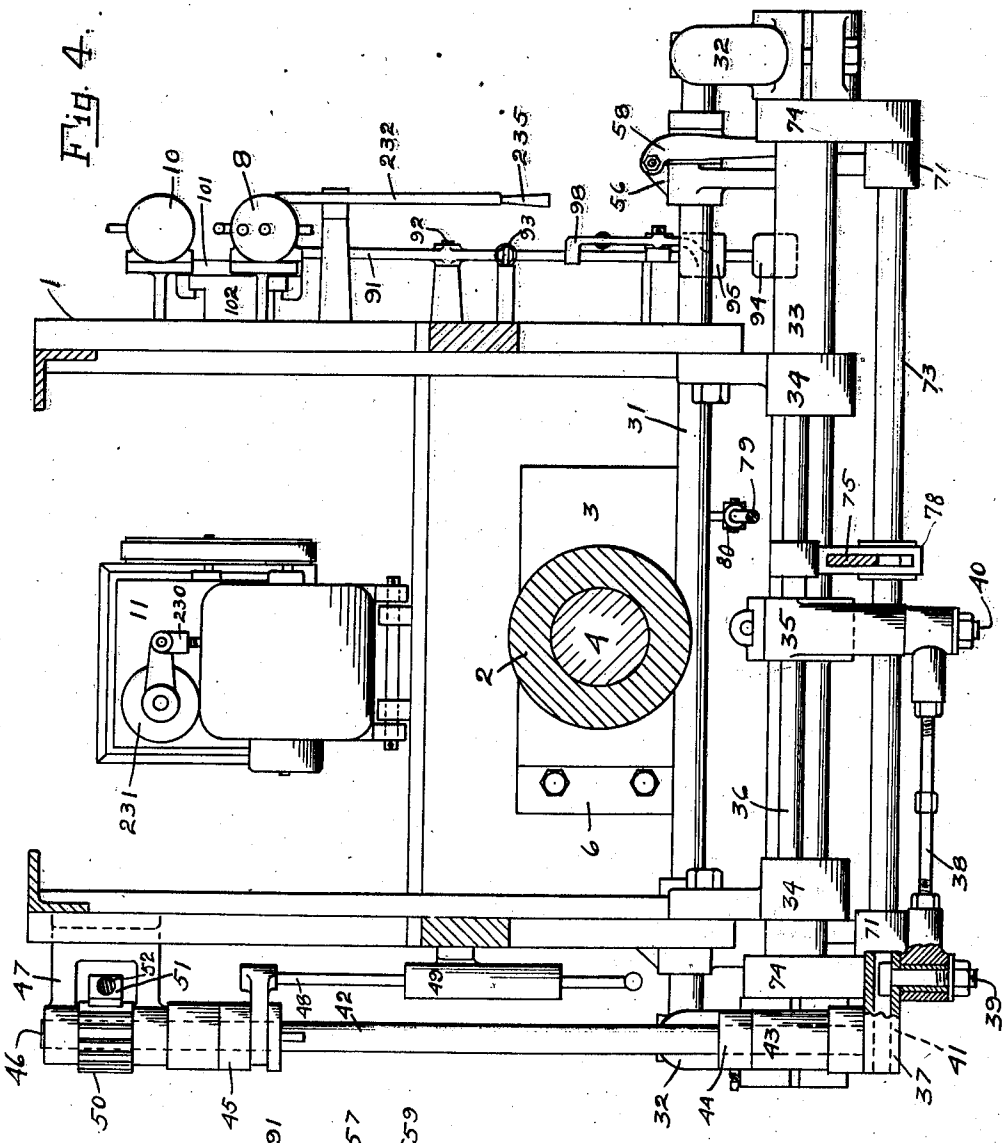
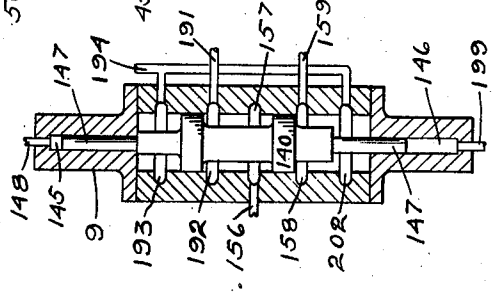


Fig. 15.



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SELF FEEDING HYDRAULIC PRESS

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Fig. 5.

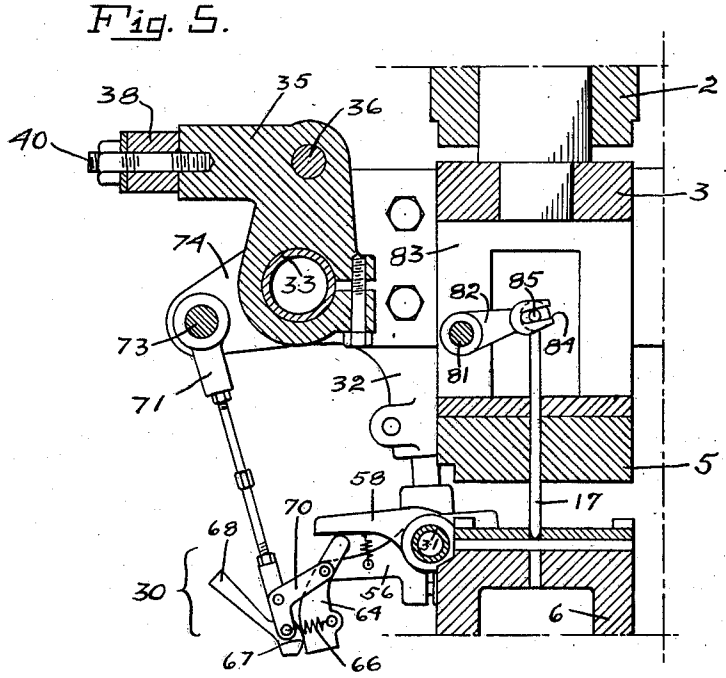
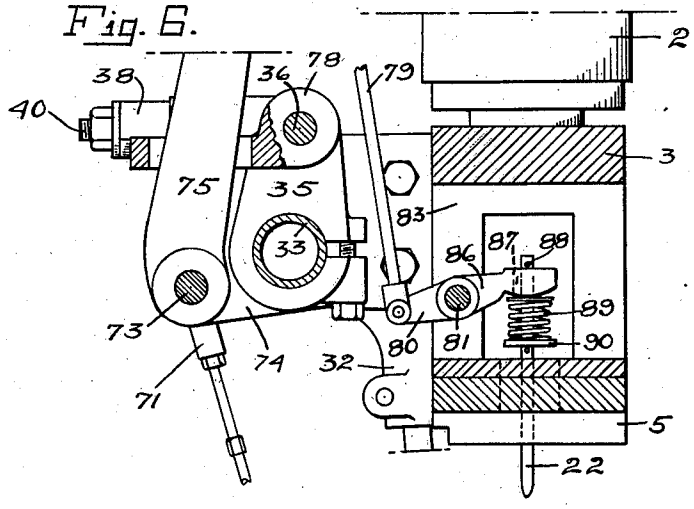


Fig. 6.



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SELF FEEDING HYDRAULIC PRESS

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Fig. 7.

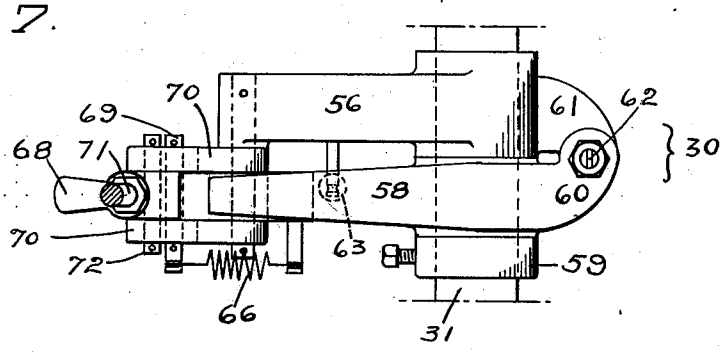


Fig. 8.

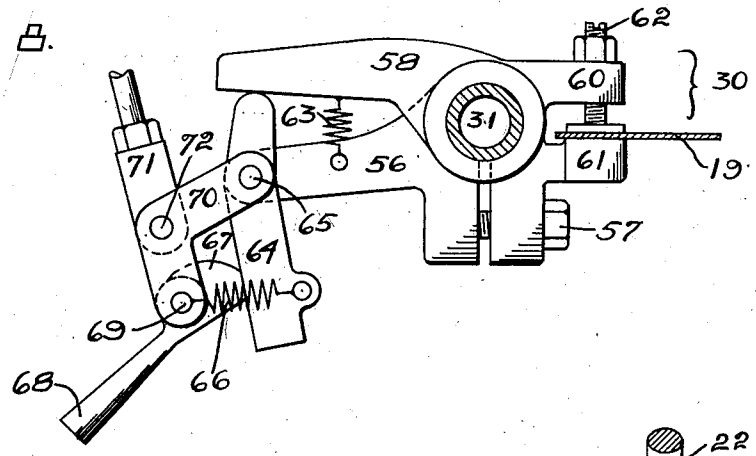


Fig. 9.

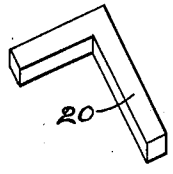


Fig. 10.

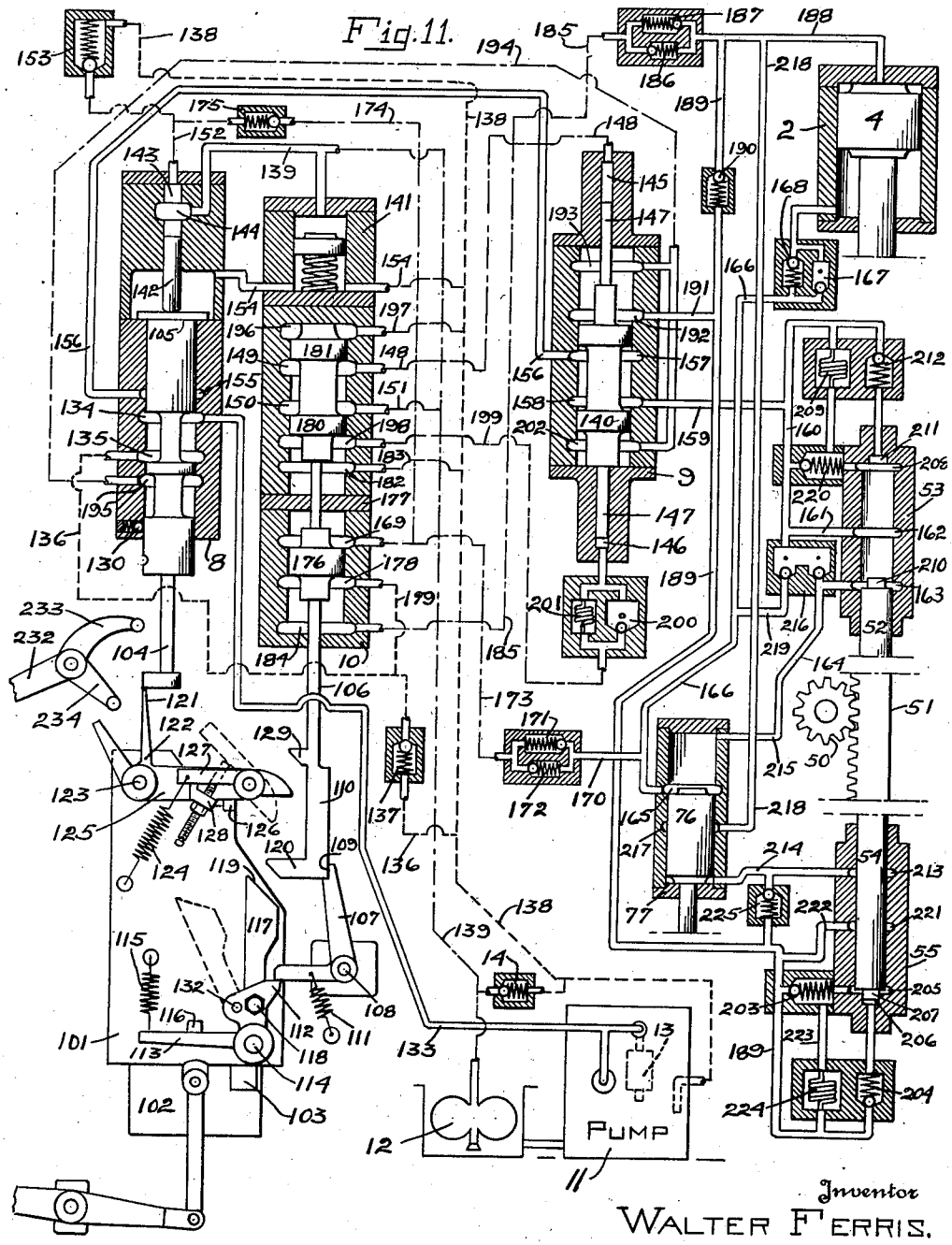
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SELF FEEDING HYDRAULIC PRESS

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Fig. 11.



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SELF FEEDING HYDRAULIC PRESS

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Fig. 12.

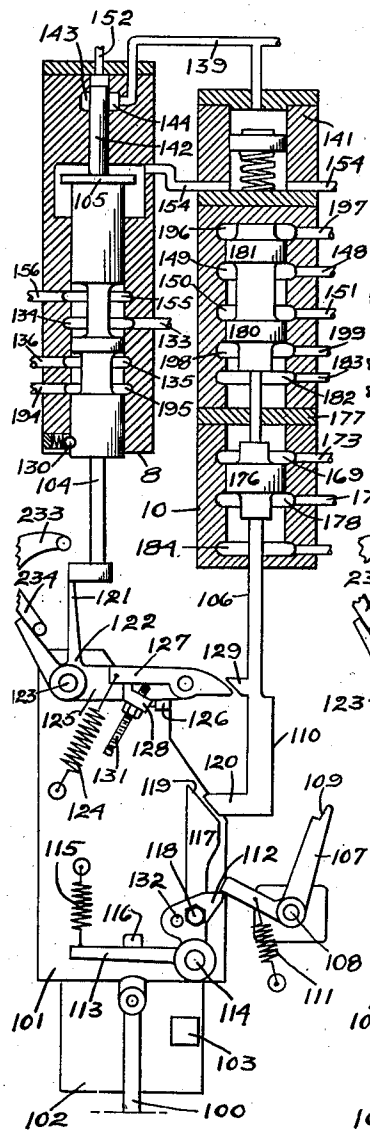


Fig. 13.

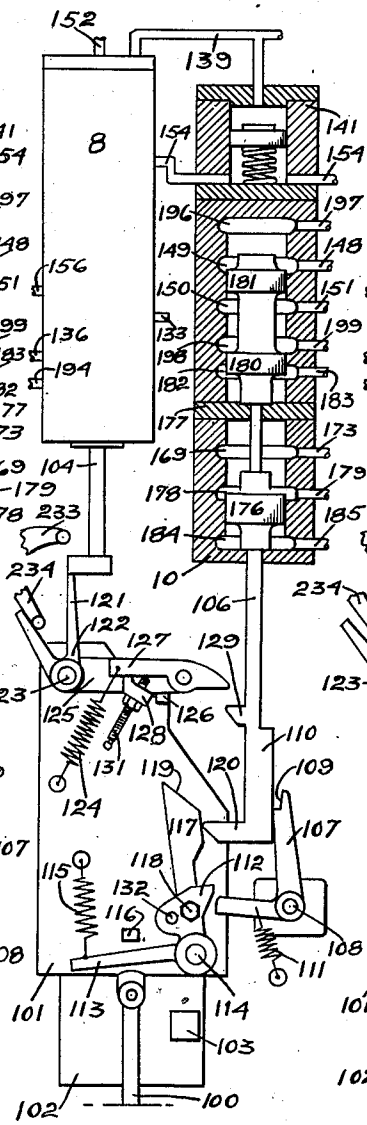
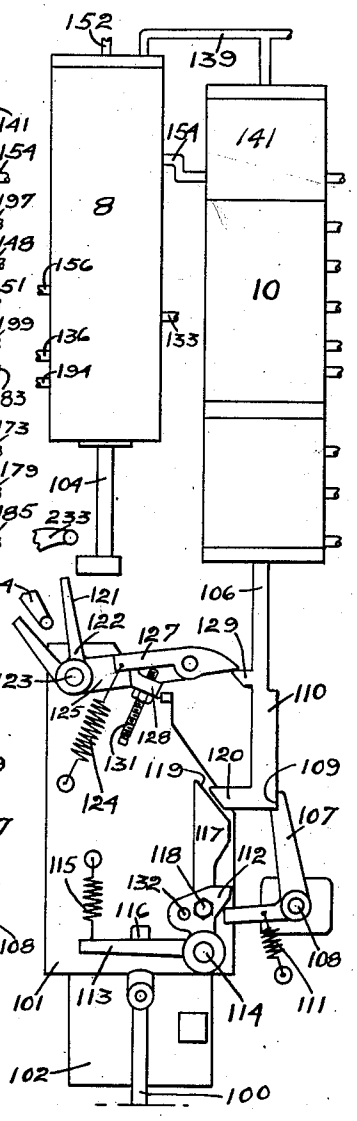


Fig. 14.



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Patented Oct. 8, 1935 2,016,710

UNITED STATES PATENT OFFICE

2,016,710

SELF-FEEDING HYDRAULIC PRESS

Walter Ferris, Milwaukee, Wis., assignor to The Oilgear Company, Milwaukee, Wis., a corporation of Wisconsin

Application August 4, 1930, Serial No. 473,042

44 Claims. (Cl. 164—88)

This invention relates to a press of the type in which a movable die is reciprocated toward and from a stationary die to form blanks or other articles from sheet material which must be fed into the press and held in a stationary position therein while being operated upon by the dies.

Mechanically operated presses of this character are sometimes provided with a feed mechanism, which is driven from the crankshaft or other movable part of the press, but hydraulically operated presses are ordinarily fed manually when operating upon sheet material which has been cut into strips or lengths.

The invention has as an object to provide a hydraulic press with a feed mechanism which will feed strips or sheets of material through the press automatically.

Another object is to provide hydraulically operated mechanism for feeding strips of sheet material through a hydraulic press automatically.

Another object is to provide a hydraulic feeding mechanism which will feed strips into a press from one side thereof and remove the same from the other side thereof.

Another object is to provide a feeding mechanism of this character which is positive and precise in operation.

Another object is to provide a hydraulic press of this character which is susceptible of close control and adjustment and whose working stroke may be adjusted to the exact length necessary to do the work, thus obtaining the maximum possible operation with a given pump capacity.

Another object is to provide a hydraulic feeding mechanism which will feed strips through a press in either direction.

Another object is to provide a hydraulically operated feeding mechanism which is readily adjustable to vary the distance which a strip is fed forwardly during each cycle of operation of the feeding mechanism.

Another object is to provide a self-feeding press operated entirely by hydraulic motors which are interlocked in a hydraulic circuit whereby one part of the press mechanism must substantially complete its movement or operation before another part of the mechanism starts to move, whereby the several mechanisms cannot get out of phase with each other regardless of the speed at which the press is operated.

According to the invention in one of its aspects, the strip is engaged by a gripper or other means which is reciprocated alternately with the reciprocation of the ram to feed the strip through the press intermittently.

According to the invention in another aspect, the feeding mechanism is operated by a hydraulic motor and liquid is delivered to the feed motor and the ram cylinder in sequence so that the ram and the feed cannot operate at the same time but one must stop as the other starts.

According to the invention in another aspect, the strip of material is fed into the press by a gripper which is actuated by one hydraulic motor and reciprocated by another hydraulic motor, and liquid is delivered to the feed motors and the ram cylinder in sequence to cause the feed and the ram to operate in sequence.

According to the invention in another aspect, movement is transmitted to the gripper and the work through a crank which swings through approximately 180° to advance the work a predetermined step or distance, and the work reaches the end of its movement at the same time that the crank reaches the end of its semi-circular path whereby the work is advanced exactly the same distance each time the crank is operated and is gradually accelerated from a stationary position to full speed and gradually decelerated from full speed to a stationary position.

The invention further provides two grippers for engaging the work, one of which passes the work into the press and the other of which removes the work from the press.

The invention further provides control mechanism which may be adjusted to cause the press to complete one or more successive cycles of operation and which enables the operator to assume control or stop the press at any point in the cycle of operation.

The invention is embodied in the press illustrated in the accompanying drawings in which the views are as follows:

Fig. 1 is a front elevation of the press.

Fig. 2 is an elevation of the left side of the press.

Fig. 3 is an elevation of the right side of the press.

Fig. 4 is a sectional plan view, taken on a line 4—4 of Fig. 1.

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 1.

Fig. 6 is a vertical section taken on the line 6—6 of Fig. 1.

Fig. 7 is a top plan view of a gripper.

Fig. 8 is an elevation thereof.

Fig. 9 is a perspective view of a blank which may be formed by the press.

Fig. 10 is a perspective view of a strip from which the blank shown in Fig. 9 was formed and illustrating one method of forming blanks.

Fig. 11 is a schematic drawing of the hydraulic circuit and a detail view of mechanism for operating the plungers of the pilot and control valves, the parts shown being in the positions occupied when the press is idle.

Fig. 12 is a detail view showing the valve operating mechanism and the plungers of the pilot and control valves in the positions occupied to start the press.

Fig. 13 is a view similar to Fig. 12 but showing the valve operating mechanism and the valve plungers in the positions occupied just after the press has been started.

Fig. 14 is a view similar to Fig. 12 but showing the valve operating mechanism and the valve plungers in the positions occupied just before the press comes to rest.

Fig. 15 is a vertical section through the reversing valve.

The invention is shown embodied in a vertical press having a stationary lower die and a movable upper die but, with slight changes, the press may be arranged horizontally or inverted, and the terms denoting direction used herein are descriptive of the press shown and are not employed to limit the scope of the invention.

The press comprises, in general, a frame 1, a power cylinder 2 carried by the frame at the upper end thereof, a ram 3 having its piston 4 arranged in the cylinder 2, an upper die block 5 carried by the ram 3 in alinement with a lower die block 6 which is supported upon a bolster 7 arranged upon the front of the frame 1, feeding mechanism for passing the work through the press, holding means for engaging the work in advance of the movable die to hold it in a stationary position until engaged by the movable die, a control valve 8 for starting and stopping the press, a reversing valve 9 for changing the direction of the ram movement, a pilot valve 10 for controlling the operation of the reversing valve, and valve operating mechanism for operating the pilot valve.

Liquid for operating the press is supplied from a pump 11 which, preferably, is adjustable to vary the volume of liquid delivered to thereby vary the speed of the press but, when once adjusted, the volume delivered remains constant irrespective of the pressure developed. A pump which may be employed is disclosed in Patent 1,558,002, issued October 20, 1925 to Walter Ferris.

Liquid for operating the valves is supplied by a gear pump 12 which, preferably, is incorporated in the pump 11 to supercharge the same, and the pumps 11 and 12 are protected by relief valves 13 and 14, respectively, as shown in Patent 1,558,002.

For the purpose of illustration, the upper die block 5 is shown provided with a blanking die 15, for stamping blanks from strips of material, and with a punch 16 for forming pilot holes to receive a pilot pin 17 which reciprocates through the upper die block 5 and holds the strip in position while the die 15 and the punch 16 are passing therethrough. The die 15 and the punch 16 cooperate with female dies (not shown) carried by the lower die block 6, and the work is stripped from the die 15 and the punch 16 by a stripper 18 which overlies the lower die block 6 and is secured thereto.

Strips of material are fed through the press between the stripper 18 and the lower die block 6 by the feeding mechanism which is adapted to feed the work in either direction but is shown adjusted to feed from right to left.

When pilot holes are to be formed in the work, the usual practice requires that the pilot hole punch be placed close to the die and punch a pilot hole in the work at the same time that the die stamps the first blank therefrom. This practice requires dies which are expensive to make and difficult to adjust.

In the present invention, the feeding mechanism may be so accurately adjusted that the error in spacing is negligible, and the punch may be spaced from the die to punch the first pilot hole in the work at the same time that the die stamps the second blank therefrom, the pilot pin 17 preventing the accumulative effect of errors which are negligible in themselves.

The dies required for blanking strips according to this method are more substantial, less expensive and more readily adjusted.

The drawings show the punch 16 spaced from the die 15 and Fig. 10 illustrates a strip 19 being fed through the press from right to left to have stamped therefrom the blanks 20 shown in Fig. 9.

The end 21 of the strip 19 is placed against a gauging and pressure pin 22 which reciprocates through the upper die block 5 and functions as a stop for spacing the strip from the die 15 so that, when the strip is fed forwardly one step by the feeding mechanism, the end of the strip will be in the correct position relatively to the die 15 to have a blank 20 stamped therefrom. After the strip 19 has been fed between the dies, the pressure pin 22 presses it downwardly against the lower die block 5 to hold it in position while being operated upon by the die 15. This function is important when pilot holes are not provided.

The first time that the ram 3 descends, the die 15 stamps a blank 20 from the strip 19 and leaves an opening 23 therein. The next time that the ram 3 descends, the die 15 stamps another blank 20 from the strip 19 and leaves an opening 24 therein, and the punch 16 forms a pilot hole 25. The next time that the ram 3 descends, the pilot pin 17 enters the pilot hole 25 and holds the strip in position, the die 15 stamps another blank 20 from the strip 19 and leaves an opening 26 therein, and the punch 16 forms another pilot hole 27.

Thereafter, the pilot pin 17 enters a pilot hole and positions the strip, the die 15 forms a blank, and the punch 16 forms a pilot hole during each cycle of operation, Fig. 10 showing the pilot pin 17 entered in the pilot hole 27 to hold the strip 19 in position while the die 15 forms a blank 20 and the punch 16 forms a pilot hole 28.

The cycles follow each other in succession until the strip 19 is exhausted and then it may be passed through the press a second time to stamp blanks 29 therefrom, as indicated by dotted lines in Fig. 10. The blanks 29 may be formed by turning the strip end for end and feeding it through the press from right to left, or by changing the position of the dies and feeding it through the press from left to right.

The method of forming blanks just described is substantially according to the usual practice and the present invention differs therefrom in reciprocating the pilot pin 17 independently of the dies and in providing the pressure pin 22 which functions to position the end of the strip

relatively to the die and also to hold the strip in position until it is engaged by the dies, and to hold the strip in position when it is not possible or advisable to punch pilot holes therein.

The feeding mechanism is shown provided with two grippers 30 which are carried by a tubular feed bar 31 and reciprocated thereby to feed the work into the press, one gripper advancing it step by step until the second gripper can seize it, then it is advanced by both grippers until it passes beyond the first gripper, and then it is advanced by the second gripper until it passes out of the press.

The feed bar 31 is supported and reciprocated by two arms 32 which are adjustable as to length to enable the grippers to be adjusted in accordance with the height of the lower die block 6. The lower end of each arm 32 is secured to an end of the feed bar 31 and its upper end is journaled upon an end of a crosshead 33 and clamped in adjusted positions thereon by suitable bolts which may be loosened and the feed bar 31 moved forwardly or rearwardly to thereby adjust both grippers simultaneously toward or from the path of the work to enable the press to operate upon work of different widths. The crosshead 33 is shown as being tubular in order to eliminate all unnecessary weight and is slidably supported in two bearings 34 carried by the sides of the frame 1.

The crosshead 33 is held against rotation by a slide 35 which has its lower end secured thereon and its upper end slidably supported upon a slide bar 36 carried by the bearings 34.

The slide 35 is connected to a crank 37 by a connecting rod 38 which has one of its ends journaled upon the pin 39 of the crank 37 and its other end journaled upon a pin 40 carried by the slide 35.

The crank 37 reciprocates the crosshead 33 and thereby reciprocating the feed bar 31 and the grippers 30. The crank 37 is provided with a radial slot 41 in which the head of the crankpin 39 is secured in adjusted position, and the connecting rod 38 is adjustable as to length to enable the crankpin 39 to be moved along the slot 41 to change its throw and thereby vary the distance which a piece of work will be fed through the press during each reciprocation of the crosshead 33.

The crank 37 is fixed upon one end of a shaft 42 which is journaled at one of its ends in a bearing 43 and held against axial movement therein by the crank 37 and a collar 44 which abut opposite ends of the bearing 43.

The other end of the shaft 42 is connected by a clutch 45 to a shaft 46 which is journaled in a double bearing 47 carried by the frame 1. The clutch 45 may be disengaged or engaged by operating a shifter 48 which is slidably supported in a bearing 49 carried by the frame 1.

The shaft 46 has a pinion 50 secured thereon and arranged between the two parts of the bearing 47 to hold it and the shaft 46 against axial movement.

The pinion 50 meshes with a rack 51 which is rigidly connected at one end to the piston 52 of a hydraulic motor 53 and at its other end to the piston 54 of a hydraulic motor 55.

When the motor 55 is supplied with a driving liquid to force the piston 54 outwardly, the rack 51 will be moved upwardly and rotate the pinion 50, thereby swinging the crank 37 upwardly and moving the crosshead 33 to the left to feed a piece of work through the press from right to left.

Thereafter, when the motor 53 is operated by the driving liquid, the rack 51 will be moved downwardly and the pinion 50 will be rotated to return the crosshead to its initial position.

If the clutch 45 is disengaged, the crank 37 rotated through 180 degrees and the clutch reengaged, the crankpin 39 will operate in the lower half of the crank circle and the grippers 30 will operate to feed the work through the press from left to right.

Due to the fact that the crankpin 39 is rotated through substantially a half circle to move the crosshead 33 in either direction, the feed bar 31 and the grippers 30 are gradually accelerated from a stationary position and then decelerated gradually to a stop, thus moving the work smoothly through the press.

Each of the grippers 30 has a fixed jaw 56, which is clamped upon the feed bar 31 by means of a bolt 57, and a movable jaw 58 which is journaled upon the feed bar 31 and held against axial movement thereon by the jaw 56 and a stop collar 59.

The nose 60 of the jaw 58 overlies the nose 61 of the jaw 56 and is provided with an adjusting screw 62 for adjusting the grippers to accommodate different thicknesses of material.

Each gripper is opened by a tension spring 63, which is connected between the rear ends of the jaws 56 and 58, and is closed by an actuating lever 64 which is pivoted intermediate its ends upon a pin 65 carried by the rear end of the fixed jaw 56.

The lever 64 has its upper end in engagement with the rear end of the jaw 58 and its lower end is urged by a spring 66 against a cam 67 which is provided with a handle 68 for opening and closing the grippers manually.

The cam 67 is journaled upon a pin 69 carried by the lower end of a pair of angular links 70 which are pivoted at their upper ends upon the pin 65 and connected intermediate their ends to the lower end of a connecting rod 71 by a pin 72.

The upper ends of the two connecting rods 71 are pivoted upon a cross bar 73 which extends across the front of the press and has a link 74 secured upon each of its ends and journaled upon the crosshead 33. The outer faces of the links 74 abut the inner faces of the arms 32 and fix the crossbar 73 for axial movement with the crosshead 33. The cross bar 73 is slidable through the lower end of a connecting rod 75 which is pivotally connected at its upper end to the piston rod 76 of a hydraulic motor 77 carried by the frame 1. The connecting rod 75 extends through a stationary guide 78 which is fixed to the slide bar 36 to hold the connecting rod 75 against lateral movement when the crosshead 33 is reciprocated.

Operation of the motor 77 causes the cross bar 73 to be raised and lowered and the grippers 30 to be opened and closed, the links 74 pivoting upon the crosshead 33 as the cross bar 73 moves vertically.

As the links 70 and the operating lever 64 of each gripper are both pivoted upon the stationary pin 65, raising the cross bar 73 will cause each connecting rod 71 to swing the lower ends of the links 70 and the cam 67 upwardly and outwardly and the lever 64 to be swung upon the pin 65 by the spring 66, thereby lowering the upper end of the lever 64 and enabling the spring

63 to draw the rear end of the movable jaw 58 downwardly and open the gripper.

When the cross bar 73 is lowered, the connecting rods 71 will force the lower ends of the links 70 downwardly and forwardly and the cams 67 will swing the levers 64 upon the pins 65 to raise the upper ends thereof and thereby raise the rear ends of the jaws 58 and close the grippers.

The press ordinarily stops with the cross bar 73 lowered, as shown in the drawings, and with the grippers closed, as shown in Figs. 7 and 8.

In order to insert a piece of work into a gripper at the beginning of an operation, the handle 68 is raised to rotate the cam 67 and enable the spring 66 to swing the lower end of the lever 64 toward the links 70 which are held stationary by the connecting rod 71, thereby lowering the upper end of the lever 64 and enabling the spring 63 to open the gripper, as shown in Figs. 1 to 3.

Operation of the motor 77 also causes the pilot pin 17 and the pressure pin 22 to be reciprocated alternately with the ram 3 by means of a connecting rod 79 which is connected at its upper end to the piston rod 76 and at its lower end to a lever 80 which is fixed upon a rockshaft 81 journaled in the ram 3.

The rockshaft 81 has a lever 82 fixed thereon which extends into an opening 83 in the ram 3 and is provided at its inner end with a radial slot 84 to receive a pin 85 carried by the upper end of the pilot pin 17.

The rockshaft 81 also has a lever 86 fixed thereon which extends into the opening 83 and is provided at its inner end with a vertical slot 87 through which the pressure pin 22 extends. When the inner end of the lever 86 swings upwardly, the pressure pin 22 is raised by a pin 88 which extends through its upper end and bears upon the top of the lever 86. When the inner end of the lever 86 swings downwardly, the pressure pin 22 descends until it meets a positive resistance and then the lever 86 compresses a spring 89 which is arranged below the under side of the lever 86 and held against downward movement relatively to the pressure pin 22 by an abutment 90, thereby causing the pressure pin 22 to exert a predetermined force upon the work or other object encountered.

The press is ordinarily started by operating a foot lever 91 which is pivoted upon a pin 92 carried by the frame 1 and is urged to its inoperative position by a spring 93.

If a single cycle of operation is to be performed, the operator depresses a pedal 94 which is arranged upon the outer end of the foot lever 91 but, if the press is to be operated continuously, the operator depresses a locking pedal 95 which is pivoted upon the lever 91 and provided at its forward end with a hook 96 to engage a stationary latch plate 97 and hold the lever 91 in operative position against the action of the spring 93. The locking pedal 95 has a stop 98 arranged upon its rear end which is normally urged against the top of the lever 91 by a spring 99.

When sufficient pressure is applied to the locking pedal 95, it swings upon its pivot and, when the lever 91 has been swung to its operative position, the hook 96 engages the under side of the plate 97 and holds the lever 91 against the action of the spring 93.

Thereafter, when sufficient pressure is applied to the pedal 94 to depress the lever 91, the spring 99 swings the pedal 95 upon its pivot until the hook 96 is disengaged from the plate 97 and the stop 98 abuts the top of the lever 91.

As soon as the pressure upon the pedal 94 is released, the spring 93 swings the lever 91 to its inoperative position and the press will stop as soon as it completes a cycle of operation.

The rear end of the lever 91 is connected by a link 100 is a slide 101 which carries valve operating mechanism and is arranged to slide vertically upon a guideway 102 carried by frame 1. The slide 101 is shown in its lower or inoperative position in Figs. 3 and 11 and in its upper or operative position in Figs. 12, 13 and 14, and the valve operating mechanism is shown adjusted to cause the press to stop at the end of each cycle of operation.

When the slide 101 is in its lower or inoperative position, it rests upon a stop 103 carried by the guide 102, the plunger 104 of the control valve 8 is supported in its lower or inoperative position by a flange 105 formed upon the upper end thereof, and the plunger 106 of the pilot valve 10 is held in its upper or inoperative position by a bell crank lever 107 which is journaled upon a pin 108 carried by the frame 1.

The vertical arm of the lever 107 has a notch 109 formed therein to engage the lower corner of the angular head 110 of the plunger 106 and support the same, and the horizontal arm of the lever 107 is urged downwardly by a spring 111 against the upper face of a double faced cam 112 carried by the vertical arm of a tripping lever 113 which is journaled upon a pin 114 carried by the slide 101.

The horizontal arm of the tripping lever 113 is urged upwardly by a spring 115 against a stop 116 which is carried by the slide 101 and holds the tripping lever 113 against rotation in one direction to enable the cam 112 to swing the bell crank lever 107 upon the pin 108 against the action of the spring 111 and move the notch 109 out of engagement with the head 110 of the valve plunger 106 as the slide 101 moves upwardly.

The tripping lever 113 is swung upon the pin 114 against the action of the spring 115, to move the cam 112 out of alinement with the horizontal arm of the bell crank lever 107, by a cam lever 117 which is pivoted at its lower end upon the pin 114, connected intermediate its ends to the vertical arm of the tripping lever 113 by a bolt 118, and provided at its upper end with a cam face 119 to engage a cam 120 carried by the head 110 of the valve plunger 106.

Downward movement of the head 110 causes the cam 120 to move along the cam face 119 and swing the cam lever 117 and the tripping lever 113 upon the pin 114 until the cam 112 passes out of engagement with the horizontal arm of the bell crank lever 107, thereby enabling the spring 111 to swing the vertical arm of the lever 107 against the outer face of the head 110, as shown in Fig. 13, so that the notch 109 may engage the corner of the head 110 and support the plunger 106 when it has been raised to its upper position as shown in Fig. 14.

When the plunger 106 is raised, the cam 120 moves out of engagement with the cam lever 117 and the spring 115 draws the horizontal arm of the tripping lever 113 against the stop 116 and swings the cam 112 over and into alinement with the horizontal arm of the lever 107. When the slide 101 moves downwardly, the end of the horizontal arm of the lever 107 engages the under face of the cam 112 and swings the tripping lever 113 upon its pin 114 against the action of the spring 115 until the cam 112 passes below the

horizontal arm of the lever 107 and then the spring 115 returns the tripping lever 113 to its initial position.

When the slide 101 moves upwardly, the plunger 104 of the control valve 8 is raised to its operative position, as shown in Fig. 12, by the vertical arm 121 of an angular lever 122 which is pivoted upon a pin 123 carried by the slide 101.

The vertical arm 121 of the lever 122 is initially held in alinement with the valve plunger 104 by a tension spring 124 which urges the horizontal arm 125 of the lever 122 against a stop 126 carried by the slide 101.

The spring 124 has one end attached to the slide 101 and its other end attached to the inner end of a trip 127 which is pivoted upon the outer end of the arm 125 and urged by the spring 124 against a stop 128 carried by the arm 125.

When the valve plunger 106 moves downwardly, a cam 129 carried thereby engages the outer end of the trip 127 and swings it upon its pivot against the action of the spring 124 which returns the trip 127 to its initial position as soon as the cam 129 has passed below it.

Then, when the valve plunger 106 moves upwardly, the cam 129 raises the outer end of the trip 127 and, as the inner end of the trip 127 is in engagement with the stop 128, the lever 122 is swung upon the pin 123 to move the arm 121 from beneath the valve plunger 104 which is held in its operative position by a detent 130 until it is forced downwardly by hydraulic pressure at the end of the cycle of operation.

However, the press is ordinarily operated continuously and the stop 128 is provided with a stop screw 131 which may be extended to hold the trip 127 out of alinement with the cam 129, and the lever 113 is provided with a bolt hole 132 through which the bolt 118 may be passed to hold the cam lever 117 out of alinement with cam 120 on the plunger 106, as shown in dotted lines in Fig. 11.

With the cam lever 117 and the trip 127 secured in their inoperative positions, the valve plunger 104 will be supported in its operative position, the cam 112 will hold the lever 107 out of engagement with head 110 of the valve plunger 106 which may then ascend and descend freely, and the press will continue to operate as long as the pedal 94 is held or latched down.

When the slide 101 is in its lower position, the press is idle and the liquid discharged by the high pressure pump 11 passes through a high pressure supply pipe 133 and into the control valve 8 through a port 134 formed therein, then out of the valve 8 through a port 135 and into a pressure return pipe 136 which has a resistance valve 137 connected therein, and then through a free return pipe 138 into the reservoir of the pump 11.

The liquid delivered by the gear pump 12 is discharged into a low pressure supply pipe 139 and initially holds the plunger 104 of the control valve 8 and the plunger 140 of the reversing valve 9 in their lower positions and charges an accumulator 141 which communicates with the supply pipe 139. The excess liquid delivered by the gear pump is exhausted through the relief valve 14 which is adjusted to maintain a predetermined pressure in the pipes 139 and the accumulator 141.

The valve plunger 104 is urged downwardly by a piston 142 fitted in a cylinder 143 which is arranged upon the upper end of the valve 8 and provided with a port 144 to which the supply pipe 139 is connected. The cylinder 143 is thus open to gear pump pressure which acts upon the upper end of the piston 142 when the valve plunger 104 is in its lower position.

Arranged upon the ends of the reversing valve 9 are two cylinders, 145 and 146, in which the stems 147 of the valve plunger 140 are slidably fitted to function as pistons therein. The upper cylinder 145 is connected by a pipe 148 to a port 149 in the pilot valve 10 which, at this time, is in communication with a port 150 to which the supply pipe 139 is connected by a pipe 151. The upper end of the valve stem 147 is thus open to gear pump pressure which holds the valve plunger 140 in its lower position, as shown in Fig. 11.

If it is desired that the press stop at the completion of each stroke, the cam lever 117 and the trip 127 are arranged as shown in full lines and the pedal 94 is depressed to raise the slide 101 and thereby raise the control valve plunger 104 to its upper position and swing the notch 109 in the lever 107 out of engagement with the head 110 of the pilot valve plunger 106, as shown in Fig. 12.

Raising the plunger 104 also raises the piston 142 which closes the port 144 and prevents the gear pump liquid from forcing the piston 142 downwardly, thus enabling the detent 130 to support the plunger 104 in its upper position.

The liquid in the cylinder 143 is expelled into the free return pipe 138 through a pipe 152 and a resistance valve 153, and liquid above the plunger 104 is expelled into the free return pipe 138 through a pipe 154.

The port 134 in the control valve 8 is now in communication with a port 155 which is connected by a pipe 156 to a port 157 in the reversing valve 9. The port 157 is in communication with a port 158 which is connected through a pipe 159, a pipe 160, and a pipe 161 to a port 162 in the upper feed motor 53.

The port 162 is in communication with a port 163 which is connected by a pipe 164 to the upper end of the gripper motor 77, and a port 165 arranged intermediate the ends of the motor 77 is connected to the lower end of the power cylinder 2 by a pipe 166 which has a check valve 167 and the resistance valve 168 connected in parallel therein.

The port 165 is connected also to a port 169 in the lower part of the pilot valve 10 through the pipe 166, a pipe 170, a resistance valve 171, a check valve 172 which is connected in parallel with the resistance valve 171, and a pipe 173.

The pipe 173 is connected also to the pipe 152 by a pipe 174 having a resistance valve 175 connected therein which has a greater resistance to the passage of liquid than the resistance valve 137 in the return pipe 136.

The port 169 is normally arranged between a piston 176 carried by the plunger 106 and a partition 177 which separates the upper and lower parts of the valve cylinder from each other.

Liquid delivered by the pump 11 may now flow through the supply pipe 133, the control valve 8, the pipe 156, the reversing valve 9, the pipes 159, 160 and 161, the upper feed motor 53, the pipe 164 and the motor 77 into the pipe 166. As the piston 4 is already at the top of its stroke, in which position it has been held by the check valve 167 and the resistance valve 168, the liquid passes through the pipe 170, the resistance valve 171 and the pipe 173 into the lower part of the valve 10 and acts upon the piston 176, forcing the plunger 106 downwardly and uncovering a port 178 which is connected to the

pressure return pipe 136 by a pipe 179. As the valve 175 has a greater resistance than the valve 137, the liquid passes from the lower part of the valve 10 into the reservoir of the pump 11 through the pipes 179, 136 and 138.

The valve plunger 106 has two pistons 180 and 181 arranged above the partition 177, and the liquid below the piston 180 is exhausted into the free return pipe 138 through a port 182 and a pipe 183 as the valve plunger 106 moves downwardly.

The liquid in the valve 10 below the piston 176 is exhausted through a port 184, a pipe 185, a check valve 186 which has a resistance valve 187 connected in parallel therewith and into a pipe 188 which is connected to the upper end of the main cylinder 2.

As the piston 4 is supported by the check valve 167 and the resistance valve 168, the liquid passes through a pipe 189, which has a check valve 190 connected therein, and a pipe 191 into the pilot valve 9 through a port 192 which, at this time, is in communication with a port 193. From the valve 9, the liquid passes through the port 193 and a pipe 194 into the control valve 8 through a port 195 which, at this time, is open to the port 135. From the control valve 8, the liquid passes through the port 135 and the return pipes 136 and 138 to the reservoir of the pump 11.

The pilot valve plunger 106 being lowered, the port 149 is in communication with a port 196 which is connected to the return pipe 138 by a pipe 197, and the port 150 is in communication with a port 198 which is connected through a pipe 199 and a check valve 200 to the cylinder 146 at the lower end of the reversing valve 9, the check valve 200 having a choke 201 connected in parallel therewith through which liquid is exhausted when the reversing valve plunger 140 moves downwardly.

The gear pump 12 may now deliver liquid through the pipes 139 and 151, the pilot valve 10, the pipe 199 and the check valve 200 to the cylinder 146 and force the reversing valve plunger 140 upwardly into the position shown in Fig. 15, the liquid in the cylinder 145 being exhausted into the return pipe 138 through the pipe 148, the valve 10 and the pipe 197 as the plunger 140 moves upwardly.

The reversing valve plunger 140 being raised puts the port 157 into communication with the port 192 and the port 158 into communication with a port 202 to which the pipe 194 is also connected. The liquid flowing in the pipe 156 is thus directed through the valve 9 and the pipe 191 into the pipe 189 and, as the check valve 190 prevents the liquid from entering the pipe 187, it flows through this pipe and through two check valves 203 and 204 into the lower end of the bore of the motor 55 to force the piston 54 upwardly.

The check valve 203 communicates with a port 205 formed in the bore of the motor 55 adjacent the reduced lower end 206 thereof in which a projection 207 on the piston 54 is fitted when it is in its lowermost position, and the check valve 204 communicates with the reduced end 206 in order that the entire cross-sectional area of the piston 54 may be subjected to the hydraulic pressure.

Upward movement of the piston 54 causes the rack 51 to rotate the crank 37 through the pinion 50 and the shafts 42 and 46 and thereby causes the connecting rod 38 to move the crosshead 33 and the feed bar 31 toward the left. If the gripper 30 has been closed upon a piece of work, it will be fed into or through the press a distance corresponding to the adjustment of the crankpin 39 in the slot 41.

When the piston 54 moves upwardly, the piston 52 expels the liquid in the motor 53 through the port 162 into the pipes 161 and 160 until it covers the port 162 and then it expels the liquid through a port 208 and a choke 209 into the pipe 160.

The rack 51 is thus moved at a high speed during the first part of its movement and then moves at a gradually reduced speed due to the action of the choke 209, which gradually absorbs the energy of the moving parts.

As the plunger 52 approaches the limit of its movement, a projection 210 on its upper end enters the reduced end 211 of the bore of the motor 53 in which the liquid is trapped by a check valve 212 connected between it and the pipe 160. The small quantity of trapped liquid is squeezed out around the projection, thus stopping the piston 52 without appreciable shock.

From the pipe 160, the liquid flows through the pipe 159, the ports 158 and 202 in the valve 9, the pipe 194, the ports 195 and 135 in the valve 8, and the pipes 136 and 138 to the reservoir of the pump 11.

As the piston 54 reaches the limit of its upward movement, it uncovers a port 213 and the high pressure liquid flows through this port and through a pipe 214 into the lower end of the motor 77 and raises its piston 76, thereby opening the grippers 30 and lowering the pilot pin 17 and the pressure pin 22 as previously described.

The liquid in the upper end of the motor 77 is exhausted through the pipe 164, a double check valve 216, the pipes 160 and 159, the valve 9, the pipe 194, the valve 8 and the pipes 136 and 138.

As the piston 76 reaches the limit of its upward movement, it uncovers a port 217 and the high pressure liquid passes through this port, a pipe 218 and the pipe 188 into the upper end of the main cylinder 2 and forces the piston 4 and the ram 3 downwardly, thus passing the die 15 and the punch 16 through the piece of work 19 if it has been fed into the press a sufficient distance.

The liquid in the lower part of the cylinder 2 is exhausted through the resistance valve 168, the pipe 166, a pipe 219, the check valve 216, the pipes 160 and 159, the valve 9, the pipe 194, the valve 8 and the pipes 136 and 138.

When the ram 3 stalls at the limit of its downward stroke, the pressure in the pipe 188 rises and the high pressure liquid breaks through the resistance valve 187, enters the lower end of the pilot valve 10 through the pipe 185 and raises the plunger 106.

On its downward movement, the cam 120 on the plunger 106 engaged the cam lever 117 and swung the cam 112 out of alinement with the horizontal arm of the lever 107 and the spring 111 then swung the vertical arm of the lever 107 against the head 110 of the plunger 106, and the cam 129 passed below the trip 127, as shown in Fig. 13.

As the plunger 106 moves upwardly, the cam 129 engages the trip 127 and swings the arm 121 of the lever 122 from beneath the plunger 104 of the valve 8 and, as the plunger 106 reaches its upper position, the spring 111 swings the lever 107 to engage the notch 109 with the corner of the head 110 and support the plunger 106.

When the plunger 106 rises, the liquid in the valve 10 above the piston 181 is exhausted through the pipe 197 into the return pipe 138, and the

liquid in the lower part of the valve 10 above the piston 176 is exhausted through the pipe 173, the check valve 172, the pipes 170, 166, and 219, the check valve 216, the pipes 160 and 159, the valve 9, the pipe 194, the valve 8 and the pipes 136 and 138.

Liquid from the gear pump 12 now flows through the pipes 139 and 151, the valve 10 and the pipe 148 to the cylinder 145, forcing the plunger 140 of the reversing valve 9 downwardly and exhausting the liquid in the cylinder 146 through the choke 201, the pipe 199, the valve 10 and the pipes 183 and 138.

Lowering the plunger 140 causes the high pressure liquid flowing in the pipe 156 to pass through the valve 9, the pipes 159 and 160 and the check valve 212 into the upper end of the motor 53 and to pass also through a check valve 220 into the port 208 and force the piston 52 and the rack 51 downwardly.

Downward movement of the rack 51 rotates the pinion 50, the shafts 42 and 46 and the crank 37, thereby moving the feed bar 31 and the grippers 30 to their initial positions.

During the first part of the downward movement of the rack 51 the liquid in the motor 55 is expelled freely by the piston 54 through a port 221 and a pipe 222 into the pipe 189, thus enabling the rack 51 to move at high speed. During the latter part of the rack movement, the liquid in the motor 55 is expelled into the pipe 189 through the port 205, a pipe 223 and a choke 224. The speed of the rack 51 is first decelerated by the action of the choke 224, and then the movement of the rack is arrested by the liquid trapped in the lower end of the motor 55 by the check valve 204 and the projection 207 on the piston 54, as previously described with reference to motor 53.

From the pipe 189, the liquid is returned to the reservoir of the pump 11 through the pipe 191, the valve 9, the pipe 194, the valve 8 and the pipes 136 and 138.

When the piston 52 has reached its lower position and uncovered the port 163 in the motor 53, the high pressure liquid flows through the pipe 164 into the upper end of the motor 77 and forces the piston 76 downwardly to close the grippers 30 and raise the pilot pin 17 and the pressure pin 22.

The liquid in the lower part of the motor 77 is exhausted through the pipe 214 and a check valve 225 into the pipe 189 from whence it is returned to the pump reservoir through the same channels as the exhaust liquid from the motor 55.

When the piston 76 has reached its lower position and uncovered the port 165, the high pressure liquid flows through the pipe 166 and the check valve 167 into the cylinder 2 and raises the piston 4 and the ram 3 to their upper positions.

The liquid in the upper part of the cylinder 2 is exhausted through the pipes 188 and 189, the check valve 190 and the pipe 191 which is open to the return pipe 138 as previously described.

When the ram stalls at the end of its up stroke, the pressure in the pipes 166 and 170 rises and the liquid breaks through the resistance valve 171, flows through the pipe 173, exerts a pressure upon the piston 176 and tends to force the plunger 106 downwardly but it is held in its upper position by the lever 107. Consequently, the pressure rises in the pipe 174 and the liquid breaks through the resistance valve 175 and enters the cylinder 143 through the pipe 132, overcoming the resistance of the detent 130 and forcing the piston 142 and the plunger 104 downwardly.

As soon as the piston 142 has uncovered the port 144, the full flow of liquid from the pump 12 and the volume of liquid stored in the accumulator 141 is available to accelerate the downward movement of the piston 142 and the plunger 104 which are then held in their lower positions by gear pump pressure.

When the plunger 104 descends, it interrupts the delivery of liquid from the pump 11 and causes it to be returned to the reservoir of the pump 11 through the pipes 136 and 138. The press is now at rest and the same condition prevails as previously described.

The gripper motor 77 is thus connected in series with each of the feed motors 53 and 55 and with the ram cylinder 2. Liquid flows first to one of the feed motors and moves its plunger to the limit of its movement, then flows through the feed motor to the gripper motor and moves its piston to the limit of its movement, then flows through the gripper motor to the ram cylinder and moves the ram until it stalls, and then liquid breaks through a resistance valve and operates the valves to cause the feed, gripper and ram to operate in the same order but in reverse direction.

Therefore, the feed, gripper and ram must operate in the correct sequence and each complete its movement before one of the others can move.

The stroke of the press is long enough to perform any work for which such presses are adapted, such as stamping and drawing, but the stroke may be adjusted by moving the faces of the dies closer together until it is just long enough to perform a particular operation, thereby enabling the press to be operated at maximum speed by liquid delivered from a pump of given volumetric capacity.

The faces of the dies may be moved closer together by employing dies or die blocks of greater height or by inserting packing plates behind one or both die blocks, as is customary in adjusting presses of this character.

If the press is to be operated continuously, the cam lever 117 and the trip 127 are secured in their inoperative positions, as shown in dotted lines in Fig. 11, and the foot lever 91 is operated to raise the slide 101 and is then either held or latched in this position.

The lever 122 holds the control valve plunger 104 in its operative position and the cam 112 holds the lever 107 out of engagement with the head 110 of the pilot valve plunger 106, so that each time that the ram stalls at the limit of its upstroke, the liquid which breaks through the resistance valve 171 will enter the valve 10 through the pipe 173 and the port 169 and force the pilot valve plunger 106 downwardly to start another cycle of operation.

The press is capable of operating at high speed and, in order to facilitate placing a new strip of material in position to be engaged by the nearest gripper when the strip being operated upon passes beyond its reach, a control lever 226 is provided for regulating the stroke of the pump 11 to reduce its delivery and thereby drive the press as slowly as required to enable the operator to introduce the new strip and locate it accurately against gage pin 22 before the gripper closes upon it.

The lever 226 is secured upon a shaft 227 which is journaled in the frame 1 and connected by a link 228, a bell crank lever 229 and a connecting

rod 230 to control mechanism 231 which is standard equipment on the pump 11 and forms no part of the present invention.

When the foot lever 91 is released and the slide 101 is lowered, the press will complete the current cycle of operation and then come to rest with the ram in its upper position and the grippers closed.

In order that the press may be stopped instantly at any point in a cycle of operation, an emergency lever 232 is pivoted upon the frame 1 and ordinarily latched in a neutral position with its two arms 233 and 234 out of alinement with the enlarged lower end of the control valve plunger 104 to permit it to ascend and descend independently of the lever 232.

If the handle 235 of the lever 232 is raised, the arm 233 will engage the plunger 104 and move it downwardly, thereby interrupting the delivery of high pressure liquid and stopping the press instantly. The handle of the lever 232 may then be depressed and the arm 234 will raise the plunger 104 to start the press.

The lever 232 is also employed for operating the press through parts of a cycle of operation for the purpose of making adjustments.

The invention herein set forth is susceptible of various modifications and adaptations without departing from the scope thereof as hereafter claimed.

The invention is hereby claimed as follows:

1. A hydraulic press, comprising a ram and a cylinder, means for delivering a driving liquid to said cylinder to reciprocate said ram, reciprocable means for intermittently engaging a strip of material, and means operating independently of ram movement for reciprocating said strip engaging means each time said ram is reciprocated but out of phase therewith to thereby feed said strip through said press intermittently and including means for gradually accelerating and decelerating said strip.

2. A hydraulic press, comprising a ram cylinder, a ram arranged in said cylinder to reciprocate therein, reciprocable means for intermittently engaging a strip of material, hydraulic means for reciprocating said strip engaging means to feed said strip through said press intermittently and including means for gradually accelerating and decelerating said strip and means for delivering a driving liquid to said hydraulic means and said ram cylinder sequentially to reciprocate said ram and said strip engaging means alternately.

3. A hydraulic press, comprising a ram and a cylinder, means for delivering a driving liquid to said cylinder to reciprocate said ram, reciprocable means for intermittently engaging a strip of material, means operating independently of ram movement for reciprocating said strip engaging means each time said ram is reciprocated but out of phase therewith to thereby feed said strip through said press intermittently and including means for gradually accelerating and decelerating said strip, and means for adjusting said reciprocating means to feed said strip through said press in either direction.

4. A hydraulic press, comprising a ram cylinder, a ram arranged in said cylinder to reciprocate therein, a feed having means for engaging a strip of material, hydraulic means connected in series with said ram cylinder for operating said feed and reciprocating said strip engaging means to feed said strip through said press intermittently, means for delivering a driving liquid to said hydraulic means and said ram cylinder sequentially to reciprocate said ram and said strip engaging means alternately, and means for adjusting said feed to advance said strip in either direction.

5. A hydraulic press, comprising a ram cylinder, a ram arranged in said cylinder to reciprocate therein, a reciprocable feed having means for intermittently engaging a strip of material, hydraulic means for operating said feed and reciprocating said strip engaging means to feed said strip through said press intermittently and including means for gradually accelerating and decelerating said strip, means for delivering a driving liquid to said hydraulic means and said ram cylinder sequentially to reciprocate said ram and said strip engaging means alternately, and means for adjusting said feed to vary the distance said strip will be advanced during each reciprocation of said strip engaging means.

6. A hydraulic press, comprising a ram and a cylinder, a die carried by said ram, a feed for advancing a piece of material into said press and having a gripper for engaging said material, hydraulic means for operating said gripper, hydraulic means for operating said feed, and means for delivering a driving liquid to both of said hydraulic means and said cylinder to cause said material to be engaged by said gripper, then advanced by said feed, then released by said gripper and then engaged by said die, and then to cause said ram and feed to resume their initial positions.

7. A hydraulic press, comprising a ram and a cylinder, a die carried by said ram, a feed for advancing a piece of material into said press and having a gripper for engaging said material, holding means for securing said material in position after it has been advanced, hydraulic means for operating said gripper, hydraulic means for operating said feed, and means for delivering a driving liquid to both of said hydraulic means and said cylinder to cause said material to be engaged by said gripper, then advanced by said feed, then released by said gripper and engaged by said holding means, and then engaged by said die, and then to cause said ram, holding means and feed to resume their initial positions.

8. A hydraulic press, comprising a ram and a cylinder, a die carried by said ram, a feed for advancing a piece of material into said press and having a gripper for engaging said material, a hydraulic motor for advancing said feed, a hydraulic motor for retracting said feed, a hydraulic motor for operating said gripper, means for directing driving liquid through one of said feed motors and through said gripper motor to said cylinder to advance said feed, open said gripper and advance said ram in sequence, and means for then directing driving liquid through the other feed motor and through said gripper motor to said cylinder to retract said feed, close said gripper and retract said ram in sequence.

9. A hydraulic press, comprising a ram and a cylinder, a die carried by said ram, a feed for advancing a piece of material into said press and having a gripper for engaging said material, a hydraulic motor for advancing said feed, a hydraulic motor for retracting said feed, a hydraulic motor for operating said gripper, means for directing driving liquid through one of said feed motors and through said gripper motor to said cylinder to advance said feed, open said gripper and advance said ram in sequence, means for then directing driving liquid through the

other feed motor and through said gripper motor to said cylinder to retract said feed, close said gripper and retract said ram in sequence, and means for adjusting said feed to enable the same to advance said material through said press in either direction.

10. A hydraulic press, comprising a ram and a cylinder, a die carried by said ram, a feed for advancing a piece of material into said press and having a gripper for engaging said material, a hydraulic motor for advancing said feed, a hydraulic motor for retracting said feed, a hydraulic motor for operating said gripper, means for directing driving liquid through one of said feed motors and through said gripper motor to said cylinder to advance said feed, open said gripper and advance said ram in sequence, means for then directing driving liquid through the other feed motor and through said gripper motor to said cylinder to retract said feed, close said gripper and retract said ram in sequence, means for controlling the delivery of said driving liquid, and means for adjusting said control means to cause said press to operate continuously or to stop at the end of each cycle of operation.

11. A blanking press, comprising a ram having a die attached thereto, means for feeding a piece of material through said press intermittently, means for operating said ram to advance said die into engagement with said material and to retract it therefrom, means carried by said ram for holding said material in position beneath said die, means for operating said holding means independently of said ram operating means to cause the same to secure said material in position before said ram advances and for operating said holding means to release said material after said die engages the same.

12. A blanking press, comprising a ram, a die and a pilot carried by said ram, means for feeding a piece of material through said press intermittently, means for advancing and retracting said ram to pass said die through said material and to then withdraw the same, and means independent of said ram operating means and operable in response to operation of said feeding means for advancing said pilot before said ram advances.

13. A blanking press, comprising a ram, a die and a pressure member carried by said ram, means for feeding a piece of material through said press intermittently, means for advancing and retracting said ram to pass said die through said material and to then withdraw the same, and means operable in response to operation of said feeding means and independent of said ram operating means for advancing said pressure member to exert pressure upon said material before said ram advances and thereby hold the same against movement while said ram advances and to retract said pressure member after said die engages said material.

14. A blanking press, comprising a ram, a die and a pressure member carried by said ram, means for feeding a piece of material through said press intermittently, means for advancing and retracting said ram to pass said die through said material and to then withdraw the same, hydraulic means operable in response to operation of said feeding means and independent of said ram operating means for advancing said pressure member before said ram advances to exert pressure upon said material and thereby hold the same against movement while said ram advances and to retract said pressure member after said die engages said material, and resilient means for limiting the pressure exerted by said pressure member.

15. In a press having a ram and a cylinder, the combination of a feed bar arranged transversely of ram movement, means for supporting said feed bar, hydraulic means for reciprocating said feed bar alternately with the stroke of said ram, a gripper carried by said feed bar, hydraulic means for operating said gripper, and means for connecting said hydraulic means in series with each other and with said ram cylinder to cause said ram, feed bar and gripper to be operated in predetermined sequence.

16. In a hydraulic press having a ram and a cylinder, the combination of a feed bar arranged transversely of said ram, means for supporting said feed bar, hydraulic means for reciprocating said feed bar alternately with the stroke of said ram, a gripper carried by said feed bar, and hydraulic means for closing said gripper before said feed bar is moved in one direction and for opening said gripper before said feed bar is moved in the opposite direction.

17. In a hydraulic press having a ram and a cylinder, the combination of a feed bar arranged transversely of said ram, means for supporting said feed bar, means for reciprocating said feed bar alternately with the stroke of said ram, two grippers carried by said feed bar and arranged upon opposite sides of said ram, and means for closing said grippers before said feed bar is moved in one direction and for opening said grippers before said feed bar is moved in the opposite direction.

18. In a blanking press having a ram and means for reciprocating said ram, the combination of a feed member for engaging a piece of work, means for supporting said feed member, and means independent of said ram reciprocating means for harmonically reciprocating said supporting means transversely of the movement of said ram to gradually accelerate and decelerate said feed member and cause the same to feed said work through said press.

19. In a press having a ram, the combination of a feed bar arranged transversely of said press, means for supporting said feed bar, a crank for reciprocating said feed bar alternately with the stroke of said ram to feed the work through the press intermittently, means including a rack and a pinion for rotating said crank, means for changing the throw of said crank to thereby vary the distance said feed bar is reciprocated, a gripper carried by said feed bar to engage the work, means for opening and closing said gripper, and means for adjusting said crank rotating means to change the direction of feed.

20. In a hydraulic press having a ram and a cylinder, the combination of a feed bar arranged transversely of said press and having a gripper for engaging a piece of material to advance the same through said press, a crosshead supporting said feed bar, a crank for reciprocating said crosshead and said feed bar alternately with the stroke of said ram, a pinion for rotating said crank, shafts carrying said crank and said pinion and connected to each other by a clutch, a rack for rotating said pinion, a hydraulic motor for moving said rack axially, a hydraulic motor for operating said gripper, and means for delivering driving liquid to said gripper and feed motors and said cylinder in sequence.

21. A hydraulic press, comprising a ram cylinder, a ram arranged in said cylinder to reciprocate therein, reciprocable means for intermit-

tently engaging a strip of material, hydraulic means for reciprocating said strip engaging means to feed said strip through said press intermittently and including means for gradually accelerating and decelerating said strip, and means for delivering a driving liquid to said hydraulic means and said ram cylinder sequentially to reciprocate said ram and said strip engaging means alternately with each other in each direction and to cause each of said reciprocating members to come to rest at the end of its movement in each direction before the other of said members starts to move.

22. A hydraulic press, comprising a ram cylinder, a ram arranged in said cylinder to reciprocate therein, a reciprocable feed having means for intermittently engaging a strip of material, hydraulic means for operating said feed and reciprocating said strip engaging means to feed said strip through said press intermittently and including means for gradually accelerating and decelerating said strip, means for delivering a driving liquid to said hydraulic means and said ram cylinder sequentially to reciprocate said ram and said strip engaging means alternately with each other in each direction and to cause each of said reciprocating members to come to rest at the end of its movement in each direction before the other of said members starts to move, and means for adjusting said feed to advance said strip in either direction.

23. A hydraulic press, comprising a ram and a cylinder, means for delivering a driving liquid to said cylinder to advance and retract said ram, a gripper for alternately engaging and disengaging a strip of material, means for advancing said gripper while it is engaged with said strip and for retracting said gripper while it is disengaged from said strip to thereby feed said strip through said press intermittently, and means operated independently of said ram for holding said strip stationary while said gripper is being retracted.

24. A hydraulic press, comprising a ram and a cylinder, means for delivering a driving liquid to said cylinder to advance and retract said ram, a gripper for alternately engaging and disengaging a strip of material, fluid actuated means for advancing said gripper while it is engaged with said strip and for retracting said gripper while it is disengaged from said strip to thereby feed said strip through said press intermittently, and fluid actuated means for holding said strip stationary while said gripper is being retracted.

25. A hydraulic press, comprising a ram and a cylinder, means for delivering a driving liquid to said cylinder to advance and retract said ram, a gripper, means for operating said gripper to alternately engage and disengage a strip of material, means for advancing said gripper while it is engaged with said strip and for retracting said gripper while it is disengaged from said strip to thereby feed said strip through said press intermittently, and means operated by said gripper operating means for holding said strip stationary while said gripper is being retracted.

26. A hydraulic press, comprising a ram and a cylinder, means for delivering a driving liquid to said cylinder to advance and retract said ram, a gripper, fluid actuated means for operating said gripper to alternately engage and disengage a strip of material, fluid actuated means for advancing said gripper while it is engaged with said strip and for retracting said gripper while it is disengaged from said strip to thereby feed said strip through said press intermittently, and means operated independently of said ram for holding said strip stationary while said gripper is being retracted.

27. A hydraulic press, comprising a ram and a cylinder, a gripper, hydraulic means for operating said gripper to alternately engage and disengage a strip of material, hydraulic means for advancing said gripper while it is engaged with said strip and for retracting said gripper while it is disengaged from said strip to thereby feed said strip through said press intermittently, means operated by said gripper operating means for holding said strip while said gripper is retracted, and means for delivering driving liquid to said cylinder and said hydraulic means in sequence to operate and reciprocate said gripper and reciprocate said ram and thereby cause one to stop before another starts.

28. A blanking press, comprising a ram for reciprocating a movable die toward and from a stationary die, two grippers arranged upon opposite sides of said dies, means for opening and closing said grippers to alternately engage and disengage a strip of material, and means operated alternately with the movement of said ram for advancing said grippers while closed and for retracting said grippers while open whereby one of said grippers will feed said strip into said press and into position for the second gripper to engage the same and said second gripper will remove said strip from said press after it has passed beyond the reach of said first gripper.

29. A blanking press, comprising a ram for reciprocating a movable die toward and from a stationary die, two grippers arranged upon opposite sides of said dies, means for opening and closing said grippers to alternately engage and disengage a strip of material, means operated alternately with the movement of said ram for advancing said grippers while closed and for retracting said grippers while open whereby one of said grippers will feed said strip into said press and into position for the second gripper to engage the same and said second gripper will remove said strip from said press after it has passed beyond the reach of said first gripper, and means operated independently of said ram for holding said strip stationary while said grippers are being retracted.

30. A blanking press, comprising a ram for reciprocating a movable die toward and from a stationary die, two grippers arranged upon opposite sides of said dies, means for opening and closing said grippers to alternately engage and disengage a strip of material, means operated alternately with the movement of said ram for advancing said grippers while closed and for retracting said grippers while open whereby one of said grippers will feed said strip into said press and into position for the second gripper to engage the same and said second gripper will remove said strip from said press after it has passed beyond the reach of said first gripper, and means operated in conjunction with said gripper operating means for holding said strip stationary while said grippers are being retracted.

31. A blanking press, comprising a ram for reciprocating a movable die toward and from a stationary die, a hydraulic motor for operating said ram, two grippers arranged upon opposite sides of said dies, hydraulic means for opening and closing said grippers to alternately engage and disengage a strip of material, hydraulic means operated alternately with the movement of said ram for advancing said grippers while

closed and for retracting said grippers while open whereby one of said grippers will feed said strip into said press and into position for the second gripper to engage the same and said second gripper will remove said strip from said press after it has passed beyond the reach of said first gripper, and means for delivering driving liquid to said hydraulic means and said motor in sequence.

32. A blanking press, comprising a ram for reciprocating a movable die toward and from a stationary die, a hydraulic motor for operating said ram, two grippers arranged upon opposite sides of said dies, hydraulic means for opening and closing said grippers to alternately engage and disengage a strip of material, hydraulic means operated alternately with the movement of said ram for advancing said grippers while closed and for retracting said grippers while open whereby one of said grippers will feed said strip into said press and into position for the second gripper to engage the same and said second gripper will remove said strip from said press after it has passed beyond the reach of said first gripper, means for delivering driving liquid to said hydraulic means and said motor in sequence, and means operated in conjunction with said gripper operating means for holding said strip stationary while said grippers are being retracted.

33. In a press having a ram for moving a movable die into and out of engagement with work supported upon a stationary die, the combination of a lever pivoted to said ram, work holding means carried by said lever, and means for oscillating said lever to advance said holding means into engagement with said work and secure said work in a stationary position before said movable die engages the same and to retract said holding means after said die has engaged said work.

34. In a press having a ram for moving a movable die into and out of engagement with work supported upon a stationary die, the combination of a lever pivoted to said ram, work holding means carried by said lever, and means operating independently of the movement of said ram for oscillating said lever to advance said holding means into engagement with said work and secure said work in a stationary position before said movable die engages the same and to retract said holding means after said die has engaged said work.

35. In a press having a ram for moving a movable die into and out of engagement with work supported upon a stationary die, the combination of a shaft carried by said ram, a lever fixed upon said shaft, work holding means carried by said lever, and means for rocking said shaft to cause said lever to advance said holding means into engagement with said work and secure said work in a stationary position before said movable die engages the same and to retract said holding means after said die has engaged said work.

36. In a press having a ram for moving a movable die into and out of engagement with work supported upon a stationary die, the combination of a shaft carried by said ram, a lever fixed upon said shaft, work holding means carried by said lever, and means operating independently of the movement of said ram for rocking said shaft to cause said lever to advance said holding means into engagement with said work and secure said work in a stationary position before said movable die engages the same and to retract said holding means after said die has engaged said work.

37. A self-feeding hydraulic press as set forth in claim 6 further characterized by control means for causing said press to automatically complete a cycle of operation, and means for adjusting said control means to either cause said press to stop at the end of each cycle or to cause it to operate continuously.

38. A self-feeding hydraulic press as set forth in claim 6 further characterized by control means for causing said press to automatically complete a cycle of operation, means for adjusting said control means to either cause said press to stop at the end of each cycle or to cause it to operate continuously, and manually operated means for stopping and restarting said press at any point in a cycle of operation.

39. In a self-feeding press, the combination of means for engaging a piece of work to feed it through the press, means for adjusting said work engaging means toward or from the path of the work to enable the press to operate upon work of different widths, hydraulic means for operating said work engaging means to cause the same to alternately engage and release the work, hydraulically operated means for reciprocating said work engaging means and operating alternately with said hydraulic means to thereby cause said work engaging means to be advanced while engaged with the work and to be retracted while disengaged therefrom.

40. In a self-feeding press, the combination of two or more grippers for engaging a piece of work to feed it through the press, means for adjusting said grippers simultaneously an equal distance toward or from the path of the work to enable the press to operate upon work of different widths, hydraulic means for operating said grippers to cause the same to alternately engage and release the work, hydraulically operated means for reciprocating said grippers and operating alternately with said hydraulic means to thereby cause said grippers to be advanced while engaged with the work and to be retracted while disengaged therefrom.

41. The combination, with a press having a ram arranged in a cylinder and reciprocated by liquid delivered to said cylinder, of a gripper to engage the work to be operated upon and reciprocable transversely to ram movement, hydraulic means for reciprocating said gripper alternately with the stroke of said ram, and hydraulic means for closing said gripper before it is moved in one direction and for opening said gripper before it is moved in the other direction.

42. The combination, with a press having a ram arranged in a cylinder and reciprocated by liquid delivered to said cylinder, of two grippers to engage the work to be operated upon and reciprocable transversely to ram movement, hydraulic means for reciprocating both of said grippers alternately with the stroke of said ram, hydraulic means for closing said grippers before the same are moved in one direction and for opening said grippers before the same are moved in the other direction, and means for adjusting said grippers relatively to each other and to the path of said ram.

43. The combination, with a self-feeding press, of feed mechanism comprising means for engaging the work, a crank for reciprocating said work engaging means, means connecting said crank to said work engaging means, hydraulic means for rotating said crank through approximately

180° during each actuation thereof whereby said crank and said work engaging means reach the ends of the movements thereof simultaneously and said work engaging means is gradually accelerated and decelerated during each actuation thereof, and means for controlling said hydraulic means to cause the same to rotate said crank in opposite directions alternately.

44. The combination, with a self-feeding press, of feed mechanism comprising means for engaging the work, a crank for reciprocating said work engaging means, means connecting said crank to said work engaging means, hydraulic means for rotating said crank through approximately 180° during each actuation thereof whereby said work engaging means reaches the end of its travel as said crank reaches the end of its semi-circular movement, means for controlling said hydraulic means to cause the same to rotate said crank in opposite directions alternately, and means for adjusting the effective throw of said crank to thereby vary the distance through which said work engaging means is reciprocated.

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