July 6, 1943. J. A. MULLER 2,323,410

BLANKHOLDER PRESS

Filed May 31, 1941

FIG. 1

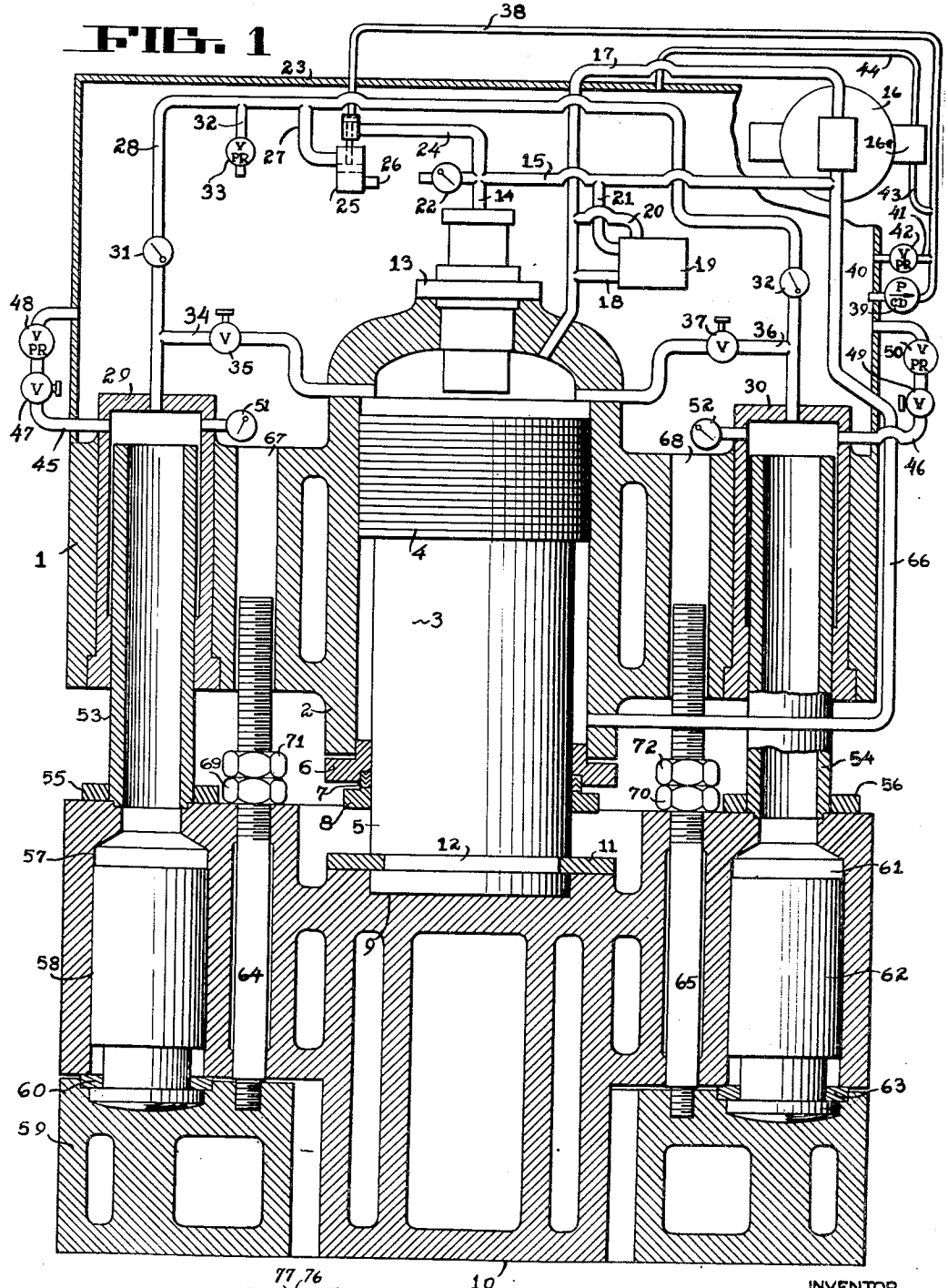
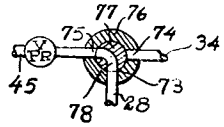


FIG 2



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Patented July 6, 1943

2,323,410

UNITED STATES PATENT OFFICE

2,323,410

BLANKHOLDER PRESS

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Application May 31, 1941, Serial No. 396,105

11 Claims. (Cl. 113—45)

This invention relates to hydraulic presses and, in particular, to so-called blankholder presses, i. e., presses in which the blank to be shaped is held at its rim portion by clamping means during the shaping operation.

Presses of this type are primarily used for drawing and stretching purposes, and, when used for mere pressing or forging operations, have the drawback that the pressure exerted upon the clamping or blankholder means cannot be effectively made use of.

Accordingly, it is an object of the invention to provide an improved blankholder press, in which the blankholder means may selectively be used for holding a work piece during the shaping operation or for actually assisting the main pressing piston or platen in pressing or forging operations.

Another object of the invention consists in the provision of a blankholder press in which the blankholder may selectively be held stationary while a main pressing piston is performing a shaping operation, or may be moved in unison with the pressing piston to assist the latter in the shaping operation.

A further object of the invention is to provide a blankholder press in which the blankholder means form a member at least partially surrounding the press platen and is adapted to move selectively relative to said press platen, or to be locked thereto so as to form a single unit therewith for assisting the platen in its shaping or pressing operation.

Still another object of the invention consists in the provision of a press having a platen associated with a hydraulically reciprocable main pressing plunger and a hydraulically operable blankholder, in which mechanical means are provided for selectively locking the blankholder to said platen to form a pressing unit therewith, and in which hydraulic means are provided for varying the hydraulic circuit so as selectively to convey pressure acting on said main pressing plunger to said blankholder when in locked position with said platen to cause the latter to assist said main pressing plunger in its shaping operation.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which:

Figure 1 diagrammatically illustrates a blankholder press according to the present invention, while

Figure 2 shows a detail for simplifying the operation of the press.

General arrangement

The blankholder press according to the present invention comprises connecting members preferably in the form of threaded bolts for suspending the blankholder on the platen.

The connecting bolts are adapted to be received in the press bed and are provided with abutment members, for instance nuts. These abutment members or nuts may be adjusted on the connecting bolts selectively so as to cause the connecting bolts to lock the blankholder to the press platen, thereby preventing any relative movement between said blankholder and said platen, or said abutment members or nuts may be adjusted so as to allow such relative movement, but arresting said blankholder when it reaches a predetermined position during the retraction stroke of the press without impeding further retracting movement of the press platen during said retraction stroke.

Structural arrangement

Referring to the drawing in detail, the press illustrated therein comprises a press head 1 which is connected to a press bed (not shown) in any convenient manner, for instance by strain rods, likewise not shown. The press head 1 is provided with a main cylinder 2 having reciprocably mounted therein a main plunger, comprising the piston 4 and the piston rod 5. The piston rod 5 is surrounded by a closure member 6 and packing material 7 compressed by a gland 8, which is connected to the main cylinder 2 in any convenient manner.

The lower end of the piston rod 5 is received in an annular recess 9 in the press platen 10 and is connected thereto by means of a split ring 11 engaging an annular groove 12 at the lower end of the piston rod 5 and connected to the platen 10 in any convenient manner, for instance, by screws.

Mounted in the upper portion of the main cylinder 2 is a surge valve 13 which, by means of conduits 14 and 15, communicates with one side of a reversible variable delivery pump 16, the other end of which communicates through a conduit 17 with the upper portion of the main cylinder 2. The pump 16 is provided with a servomotor 16*a*, and is preferably of the type disclosed in U. S. Patent No. 2,184,665 to Ernst. Communicating with the conduit 15 is a conduit 66 leading to the lower portion of the main cylinder 2.

Branching off from the conduit 17 is a conduit 18 leading to a main cylinder release and pump by-pass valve 19 which has a connection 20, likewise leading to the conduit 17, and another connection 21 leading to the conduit 15. Communicating with the conduits 14 and 15 is a check valve 22.

According to the drawing, the surge valve 13 and the main cylinder release and pump by-pass valve 19 are located inside the surge tank 23. The surge valve 13 and the main cylinder and pump by-pass valve 19 do not form a part of the present invention, and for a more detailed description thereof reference may respectively be had to U. S. Patent No. 2,193,248 and U. S. patent application, Serial No. 286,063, filed July 24, 1939.

The surge valve 13 serves the purpose of prefilling the upper portion of the main cylinder 2 when, at the beginning of the working stroke, the ram 3 slides downwardly by gravity. The main cylinder release and pump by-pass valve 19 is provided for releasing the pressure in the upper portion of the main cylinder 2 at the initiation of the retraction stroke of the ram 3 to facilitate said retraction stroke.

Communicating with the conduit 14, connected to the surge valve 13, is a conduit 24 leading to the two-way exhaust valve 25, the conduit 26 of which communicates with the interior of the tank 23. Also connected with the valve 25 is a conduit 27 leading to the conduit 28, one end of which communicates with an auxiliary cylinder 29, while the other end communicates with the auxiliary cylinder 30.

The conduit 28 comprises a check valve 31 pertaining to the auxiliary cylinder 29 and a check valve 32 pertaining to the auxiliary cylinder 30. Communicating with the conduit 28 is a conduit 32, having therein a safety valve 33. Branching off from the conduit 28 is a conduit 34 with a shutoff valve 35 and a conduit 36 with a shutoff valve 37. The conduits 34 and 36 lead to the upper portion of the main cylinder 2. Also connected to the two-way exhaust valve 25 is a pilot line 38 leading to the pressure side of the pilot pump 39, the suction line 40 of which is connected to the tank 23. The valve 25 is normally held closed by pressure from the pilot pump 39, but is adapted to be opened by push-back pressure on the retraction stroke of the press, which push-back pressure overcomes the pressure of the pilot pump. To prevent undue pressure, a conduit 41 branches off from the pilot line 38 and comprises a pressure relief valve 42 connected to the tank 23. Also branching off from the pilot line 38 is a conduit 43 leading to the servomotor 16*a*. A conduit 44 leads from the servomotor 16*a* into the tank 23.

Each of the auxiliary cylinders 29 and 30 communicates with a conduit 45 and 46 respectively leading to the tank 23 and comprising a shutoff valve 47 and pressure relief valve 48, and shutoff valve 49 and pressure relief valve 50 respectively. The valves 48 open at a lower pressure than the safety valve 33. The upper portion of each auxiliary cylinder is furthermore provided with a check valve 51 and 52 respectively.

Reciprocably mounted in the auxiliary cylinders 29 and 30 is an auxiliary hollow plunger 53 and 54 respectively flanged by flanges 55 and 56 to the main press platen 10.

Provided in the main press platen 10 and in alignment with the auxiliary piston 53 is a clamping cylinder 57 having slidably mounted therein a clamping plunger 58, the lower end of which engages the clamping platen 59 and is connected thereto by means of a split ring 60. Similarly, the platen 10 is provided with a clamping cylinder 61 having reciprocably mounted therein a clamping piston 62, the lower end of which is connected to the clamping platen 59 by means of the split ring 63.

Threadedly connected to the clamping platen 59 are connecting bolts 64 and 65, the upper ends of which are threaded and adapted to be received in bores 67 and 68 respectively of the press head 1. Each connecting bolt 64, 65, has threaded therein an adjusting nut 69, 70, and a locking nut 71, 72 respectively. Depending on the position of the adjusting nut 69, 70, the clamping platen 59 may operate as such, or may be made ineffective as a clamping platen as shown in Figure 1. The adjusting nuts 69 and 70 have been so arranged that the clamping platen 59 is pulled against the press platen 10 and is locked thereto by the locking nuts 71 and 72. By moving the adjusting nuts 69 and 70 and the locking nuts 71 and 72 pertaining thereto upwardly, the clamping platen may be spaced from the press platen 10 and, thereby, enabled to operate as a clamping platen.

Operation

Assuming that all parts of the press are in the position shown in Figure 1, and that the valves 35 and 37 are open, whereas the valves 47 and 49 are closed, the operator starts a working stroke of the press by shifting the variable delivery pump 16 to full delivery forward stroke position. This shifting movement may be effected in any convenient manner, for instance, in the manner described in U. S. Patent No. 2,184,665.

Fluid is then withdrawn from the lower portion of the main cylinder 2 through the conduit 66 to the suction side of the pump 16 so that the ram 3 slides downwardly by gravity as fast as fluid is withdrawn from beneath the piston 4.

Fluid is supplied by the pump 16 through the conduit 17 into the upper portion of the main cylinder 2 and is supplemented by fluid passing from the tank 23 through the now open surge valve 13. Inasmuch as the clamping platen 59 is locked by the bolts 64, 65 and the nuts 69, 70 to the press platen 10, the clamping platen 59, together with the plungers 58 and 62 as well as the hollow plungers 53 and 54 connected to the main platen 10, move downwardly in unison.

During this downward movement fluid passes from the tank 23 through the check valves 51 and 52 into the cylinders 29 and 30 to fill the increasing space.

As soon as the platens 10 and 59, now constituting a unit, engage the work piece, pressure builds up in the main cylinder 2, which causes the surge valve 13 to close. This pressure is conveyed through the conduits 34 and 36 into the cylinders 29 and 30, where it acts upon the hollow plungers 53 and 54 and the clamping plungers 58 and 62, which latter, however, in this instance, do not perform any clamping action.

Since the safety valve 33 has been set so as not to open at the pressing pressure now prevailing in the main cylinder 2 and the cylinders 29 and 30, and since, as previously mentioned, the valves 47 and 49 are closed, while the valve 25 is held closed by pressure from the pilot pump 39, the platens 10 and 59 now perform the actual pressing operation.

At the end of the pressing operation the pump 16 is moved from its forward position to its re-

traction position, which movement may be effected in any convenient manner, for instance, in the manner described in the above mentioned U. S. Patent No. 2,184,665. The conduit 66 then becomes the pressure side of the pump, whereas the conduit 17 becomes the suction side of the pump. As a result thereof, the pressure in the upper portion of the main cylinder 2 is released by the main cylinder release and pump by-pass valve 19 and the surge valve 13 opens, while the ram 3 and the plungers 53 and 54, together with the platens 10 and 59, start the return stroke. At this time, fluid pressure from the now pressure line 66 is conveyed through conduits 15 and 24 to the two-way valve 25, thereby opening the latter so as to establish communication between the conduit 27 and the exhaust conduit 26.

During this retraction stroke, fluid is expelled from the upper portion of the main cylinder 2 in part through the surge valve 13 and is in part withdrawn through conduit 17 to the pump 16. Fluid expelled by the hollow plungers 53 and 54 flows in part through conduits 34 and 36 and the surge valve 13 into the tank 23, and in part through conduit 28 and exhaust valve 25 into the tank 23. When the press ram 3 approaches the end of its retraction stroke, the pump 16 is shifted in any convenient manner to neutral position, thereby bringing the press to a halt.

If it is desired to operate the press as a drawing press with the clamping platen 59 holding the work piece clamped during the drawing operation, the operator loosens the locking nuts 71 and 72 and adjusts the adjusting nuts 69 and 70 so as to increase the distance between the upper surface of the clamping platen 59 and the opposite surface of the platen 10 in accordance with the desired actual drawing stroke. After this adjustment has been made, the nuts 69 and 70 are held in their position by tightening the locking nuts 71 and 72. Furthermore, the valves 35 and 37 are closed, whereas the valves 47 and 49 are opened. The press is then started in the same manner as before so that pressure fluid delivered by the pump 16 passes through conduit 17 into the upper portion of the main cylinder 2 and, while the ram 3 moves downwardly by gravity, is supplemented by fluid passing from the tank 23 through the surge valve 13 into the upper portion of the main cylinder 2. While the platen 10 thus moves downwardly, also the hollow plungers 53 and 54 connected to the platen 10 and the clamping platen 59 suspended by the bolts 64 and 65 on the platen 10 move downwardly.

During this downward movement, the increased space in the cylinders 29 and 30 is supplied with fluid from the tank 23 through the check valves 51 and 52. As soon as the clamping platen 59 engages the work piece it comes to a halt, whereas the pressing platen 10 continues its downward movement. As a result thereof, relative movement occurs between the clamping pistons 58 and 62 and the cylinders 57 and 61 pertaining thereto and provided in the pressing platen 10. Consequently, pressure is built up in the cylinders 29 and 30 which causes closure of the check valves 51 and 52 and only when a predetermined clamping pressure has been built up, the excessive pressure is released through conduits 45 and 46, the now open valves 47 and 49 and the pressure relief valves 48 and 50 into the tank 23.

As soon as the press platen 10 engages the work piece, pressure builds up in the upper portion of the main cylinder 2, thereby causing closure of the surge valve 13. The ram 3 then performs its actual drawing operation. At the end of this drawing stroke, the pump 16 is again shifted to its retraction stroke position, so that pressure fluid passes through the conduit 66 into the lower portion of the main cylinder 2, while fluid from the upper portion of the main cylinder 2 is in part withdrawn by the pump 16 through conduit 17 and in part passes into the tank 23 through the surge valve 13. At the same time, pressure fluid passes from the conduit 66 through conduits 15 and 24 to the valve 25 opening the latter so as to establish communication between the conduits 26 and 27.

During the first portion of this retraction stroke, the clamping platen 59 remains in its lower position, while fluid expelled by the hollow plungers 53 and 54 is passed into the cylinders 57 and 61 and, in case this fluid should not sufficiently fill the said cylinders, is supplemented by fluid from the tank 23 through the check valves 51 and 52. In this way the clamping platen 59 holds the work piece clamped against its support and, thereby, stripping the work piece from the press platen 10 or a die connected thereto. When the press platen 10 has retracted with regard to the clamping platen 59 to such an extent that its upper portion engages the adjusting nuts 69 and 70, further retracting movement of the platen 10 also causes retracting movement of the clamping platen 59. The fluid now expelled by the pistons 53 and 66 escapes through conduits 28, 27 and 26 into the tank 23. When the ram 3 approaches the end of the retraction stroke, the pump 16 is again shifted to neutral position, thereby bringing the press to a halt.

In order to simplify the adjustment of the press with the clamping platen from a state in which the clamping platen 59 is ineffective as a clamping platen to a state in which the platen 59 actually operates as a clamping platen, and vice versa, and to make sure that the valves 35 and 37 are closed when the valves 47 and 49 are opened and vice versa, the valves 35 and 47 and the valves 37 and 49 may respectively be replaced by a valve shown in Figure 2. The valve of Figure 2 is a three-way valve and, when taking the place of valves 35 and 47, has the ports 73, 74 and 75 of the valve casing 76 connected to the conduits 28, 34 and 45. In this instance, the conduit 45 does not directly lead to the cylinder 29. A similar replacement of the valves 37 and 49 and the arrangement of the conduits pertaining thereto would have to be effected.

The cock 77 of the valve shown in Figure 2 has a channel 78 which, in accordance with the adjustment of the cock, either connects the conduits 28 and 45 with each other, or effects communication between the conduits 34 and 28. When two valves of the type shown in Figure 2 replace the valves 34, 47 and 37, 49 respectively, the cocks of the replacing valves are preferably interconnected so that a single adjustment adjusts both cocks and, accordingly, establishes the desired pipe connection for operation of the press either with the platen 59 acting as clamping platen or as pressing platen.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a hydraulic press, a press platen, first fluid operable means for actuating said press

platen, a clamping platen, second fluid operable means for actuating said clamping platen, means mechanically interconnecting said platens but allowing said platens to move relative to each other, thereby permitting said press platen to shape a work piece while it is being clamped against a support by said clamping platen, locking means operable selectively for rigidly locking said clamping platen to said pressing platen to make said clamping platen ineffective for said clamping action, and means for hydraulically interconnecting said first and second fluid operable means for simultaneously advancing said platens when they are locked together, to thereby exert an increased pressure on the work piece to be shaped.

2. In a hydraulic press, a press platen, a first fluid operable motor for actuating said platen, blankholder means associated with said press platen and operable to hold a work piece clamped against a support during the pressing operation of said press platen, a second fluid operable motor for exerting pressure on said blankholder means, connecting means interconnecting said platen and said blankholder means and adapted to allow said platen and said blankholder means to move relative to each other by a predetermined distance, said means being adjustable for varying said predetermined distance, and means operable selectively to prevent hydraulic connection between said motors for allowing said blankholder means to remain stationary while causing said press platen to perform a drawing operation, or to establish said hydraulic connection to move said blankholder means in unison with said press platen during the actual pressing action of said press platen.

3. In a hydraulic press, a press platen, blankholder means at least partially surrounding said press platen, means interconnecting said platen and said blankholder means and operable selectively to allow relative movement of said platen and said blankholder means with respect to each other, or to lock said blankholder means to said platen so as to form a unit therewith first hydraulic motor means for actuating said press platen, second hydraulic motor means responsive to a movement of said platen relative to said blankholder means for actuating the latter, and means operable selectively to establish hydraulic connection between said first and second motor means, to actuate said blankholder means for moving the same in unison with said platen, to thereby cause said blankholder means to assist the platen in its shaping or pressing operation.

4. In a hydraulic press, a press platen associated with a hydraulically reciprocable main pressing plunger, a blankholder associated with said press platen for selectively holding a work piece during the pressing or forging operation of said press platen, a hydraulically operable auxiliary plunger for actuating said blankholder, mechanical means associated with said platen and said blankholder and operable for selectively locking said blankholder to said platen to form a pressing unit therewith, and means operable selectively to convey pressure fluid acting on said main pressing plunger to said auxiliary plunger, when said blankholder and said platen are locked to each other, for causing said blankholder to assist said pressing plunger in its shaping operation.

5. In a hydraulic press, a press platen, a clamping platen, a fluid operable main cylinder-piston-assembly for actuating said press platen, a fluid operable auxiliary cylinder-piston-assembly for actuating said clamping platen, means operable selectively to connect said clamping platen to said main platen for relative movement with respect to each other, or to rigidly connect said platens to each other for operating as a single unit, and means for selectively actuating said platens by simultaneously admitting pressure fluid into said main and said auxiliary cylinder-piston-assembly, or by admitting pressure fluid into said main cylinder-piston-assembly and building up an independent pressure in said auxiliary cylinder-piston-assembly.

6. In a hydraulic press, a press platen, a clamping platen, said press platen being provided with a recess for selectively receiving said clamping platen so that the lower surfaces of said platens are flush with each other, and locking means operable selectively for rigidly locking said clamping platen to said press platen when the former has been received in the recess of said press platen, or for allowing relative movement between said clamping platen and said press platen.

7. In a hydraulic press, a press platen, a clamping platen at least partially surrounding said press platen, means operable selectively to allow said platens to move relative to each other during the actual pressing operation of said press platen or to maintain said platens in a predetermined relative position during the actual pressing operation of said press platen, hydraulic motor means respectively associated with said platens for actuating the same, and means operable selectively to hydraulically interconnect said motor means for simultaneously advancing said platens and causing them to exert an increased shaping pressure on a work piece, or to prevent said hydraulic interconnection, to thereby allow said clamping platen to clamp a work piece against the support while shaping pressure is exerted upon said work piece by said press platen.

8. In a hydraulic press, a press platen, a clamping platen, a main cylinder-piston-assembly for reciprocating said press platen, an auxiliary cylinder-piston-assembly for reciprocating said clamping platen, a fluid source for supplying pressure fluid to said main cylinder-piston-assembly, conduit means for effecting hydraulic communication between said cylinder-piston-assemblies, valve means in said conduit means for selectively establishing or interrupting said hydraulic communication, means for selectively connecting said auxiliary cylinder-piston-assembly with an exhaust, and means for selectively locking said platens to each other and maintaining the same locked during a complete cycle of the press.

9. In a hydraulic press, a press platen, first hydraulic motor means for actuating said press platen, a clamping platen adapted selectively to be received in a recess in said press platen, second hydraulic motor means for actuating said clamping platen, connecting rods having one end connected to said clamping platen and passing slidably through said press platen, threaded means engaging the free ends of said connecting rods for varying the maximum distance between said platens and for selectively maintaining said platens locked to each other during a complete cycle of the press, and means for selectively preventing or establishing hydraulic connection between said first and second motor means during a complete cycle of the press.

10. In a hydraulic press, a main cylinder, an auxiliary cylinder, a press plunger reciprocably mounted in said main cylinder and connected with a press platen, an auxiliary plunger recipro-

cably mounted in said auxiliary cylinder and connected with said press platen, a clamping plunger reciprocably mounted in said press platen and arranged in alignment with said auxiliary plunger, fluid means for actuating said plungers, a clamping platen connected to said clamping plunger and adapted to be received in a recess in said press platen, a connecting rod connected to said clamping platen and passing through said press platen, abutment means adjustably engaging the free end of said connecting rod and operable selectively for varying the distance between said platens, or for locking said platens together to operate as a unit during a complete cycle of the press, and means operable selectively to establish hydraulic connection between said cylinders when said platens are locked together, and to maintain said hydraulic connection during a complete cycle of said plungers.

11. In a hydraulic press, a press platen, a clamping platen, a main cylinder-piston-assembly for reciprocating said press platen, an auxiliary cylinder-piston-assembly for reciprocating said clamping platen, a fluid source for supplying pressure fluid to said main cylinder-piston-assembly, conduit means for effecting hydraulic communication between said cylinder-piston-assemblies, first controlling means in said conduit means for selectively establishing or interrupting said hydraulic communication, second controlling means for selectively connecting said auxiliary cylinder-piston-assembly with an exhaust, said controlling means being interconnected so as positively to interrupt said hydraulic communication when said auxiliary cylinder-piston-assembly is connected to the exhaust, or to positively interrupt said communication between said exhaust and said auxiliary cylinder-piston-assembly in response to establishing hydraulic communication between said cylinder-piston-assemblies, and means for selectively locking said platens to each other and maintaining the same locked during a complete cycle of the press.

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