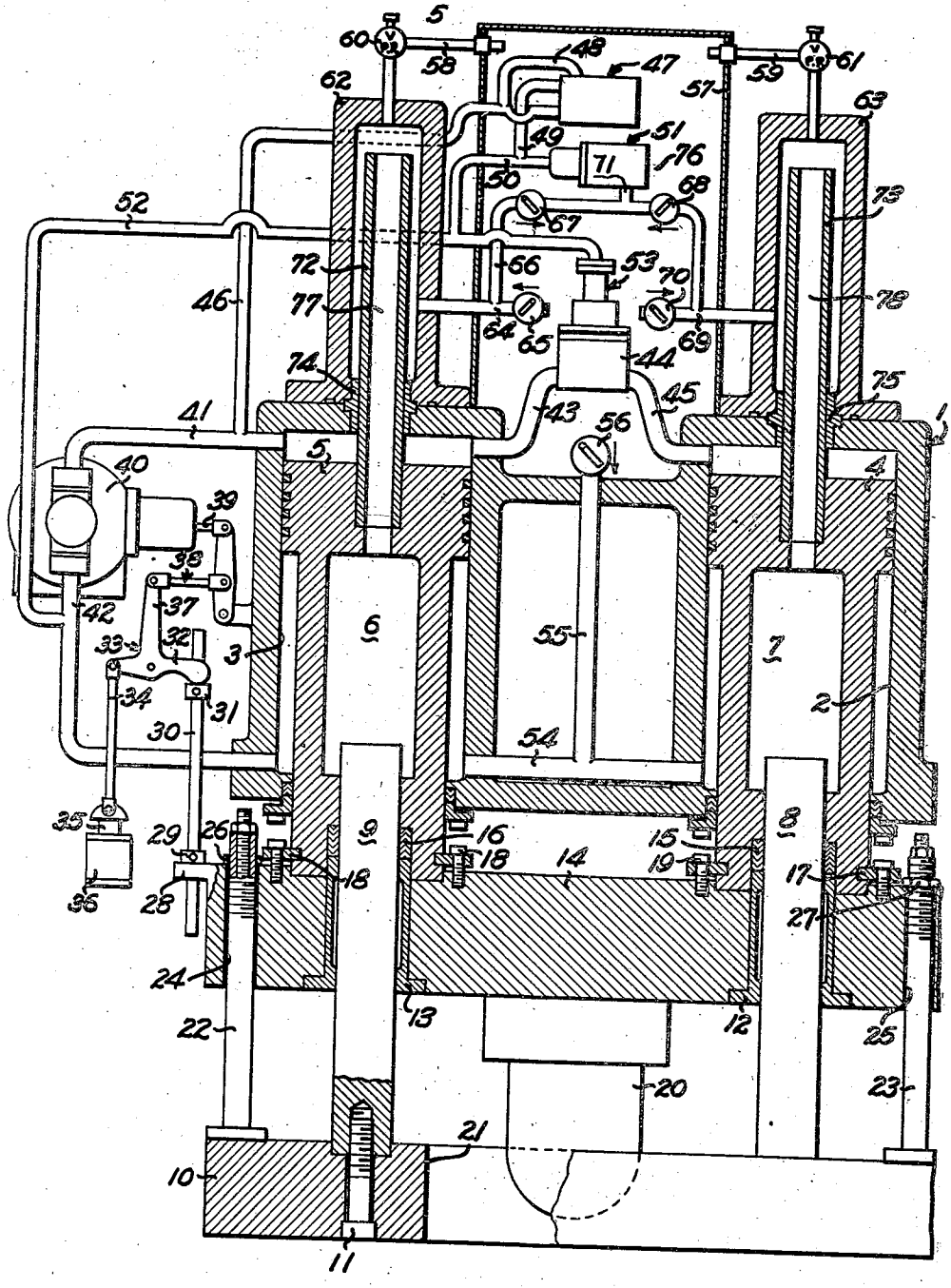
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DRAWING PRESS

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DRAWING PRESS

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This invention relates to presses and, in particular, to hydraulic presses having blank-holding arrangements in association with drawing devices.

A well known type of presses of the above character comprises a press platen operated by a ram and provided with clamping cylinders, which have reciprocably mounted therein clamping plungers for actuating a blankholder platen. While this type of presses works very satisfactorily, it has the clamping cylinders arranged separate from the ram, thereby requiring machining of the press ram and the clamping cylinders in different machining setups.

It is, therefore, an object of the invention to provide an improved blankholder press, which will enable machining of the press ram and clamping cylinders in a single machining setup.

It is another object of the invention to provide a blankholder press, in which the press ram is provided with a recess confining a clamping cylinder for receiving the clamping plunger for actuation of the blankholder platen.

It is another object to provide an improved blankholder press with an increased guiding length for guiding the blankholder means actuating the press platen.

It is still another object of the invention to provide a blankholder press having a clamping cylinder piston arrangement for actuating the blankholder platen, in which the packing heretofore required for preventing undue leakage from the clamping cylinder piston arrangement may be omitted without affecting the efficiency of said clamping cylinder piston arrangement.

A still further object of the invention consists in the provision of a blankholder press in which the clamping plungers for actuating the blankholder platen are guided in the press platen and the press ram for actuating the latter.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing diagrammatically showing a press according to the present invention.

General arrangement

The blankholder press according to the present invention comprises substantially a press ram actuated by fluid operable press plunger means and a blankholder platen for holding the work piece while it is being shaped by actuation of the press platen.

The blankholder platen is actuated by clamping plunger means guided by the press platen and extending into said press plunger means, which latter form a clamping cylinder.

The clamping cylinder in the press plunger means communicates with auxiliary cylinder means through conduit means supported by said press plunger means and adapted to telescope into said auxiliary cylinder means.

Structural arrangement

Referring now to the drawing in detail, the structure shown therein comprises a press head 1 with two main or press cylinders 2, 3, having respectively mounted therein press rams 4, 5. Each of the press rams 4, 5 is provided with a cavity 6, 7, forming a clamping cylinder for cooperation with clamping plungers 8 and 9 respectively.

The clamping plungers 8 and 9 are connected with a clamping platen 10 in any convenient manner, for instance by screws 11. Each of the clamping plungers 8 and 9 passes through bushings 12, 13 in the press platen 14 and through packing 15, 16 in the rams 4, 5. The press platen 14 is connected to the rams 4, 5 in any convenient manner, for instance by split rings 17 and 18 and screws 19.

The press platen 14 carries a press plunger or die 20 adapted to pass through an opening 21 in the blankholder platen 10, which latter has connected thereto suspension rods 22, 23 respectively extending through bores 24, 25 in the press platen 14, and having threaded thereto nuts 26, 27 for abutment with the upper surface of the press platen 14 so as to maintain the clamping platen 10 suspended when the latter is spaced from the work piece to be shaped. Also connected with the press platen 14 is a control arm 28 adapted to engage a collar 29 adjustably mounted on a push rod 30. The push rod 30 also has adjustably mounted thereon a collar 31 for cooperation with an arm 32 of a three-arm lever, generally designated 33, which lever is pivotally connected with a link 34 which, in its turn, is pivotally connected to an armature 35 controlled by a solenoid 36. The arm 37 of the three-arm lever 33 is connected through a linkage system 38 with a control rod 39 for controlling the position of the flow-control member pertaining to a reversible variable delivery pump 40 and adapted, in one position, to cause the pump 40 to deliver pressure fluid into the conduit 41, while movement of the flow-control member into another position causes the pump 40 to deliver pressure fluid into the conduit 42.

The conduit 41 leads to the upper portion of the press cylinder 3, which upper portion is in continuous fluid connection with the upper portion of the press cylinder 2 by means of a conduit 43, a casing 44 and a conduit 45, branching off from the conduit 46 and leading to a main cylinder relief and pump by-pass valve 47. Also conected with the valve 47 is a conduit 48 leading into the conduit 46 and a conduit 49 connected with the conduit 50. One end of the conduit 50 leads to a two-way valve 51, while the other end of the conduit 50 communicates with a conduit 52. The conduit 52 branches off from the conduit 42 and leads to a surge valve 53. The surge valve 53 may be of any standard design, for instance of the type set forth in U. S. Patent No. 2,193,248 to Ernst, and serves to prefill the press cylinders 2 and 3 during the first portion of the downward strokes of the rams 4 and 5, during which the rams move downwardly by gravity.

The main cylinder relief and pump by-pass valve 47 serves to initiate the retraction strokes of the press rams, and for a more detailed description of the said valve 47, reference may be had to U. S. Patent No. 2,268,205 to Ernst.

The conduit 42 leads to the lower portion of the press cylinder 3, which portion is connected by means of a conduit 54 with the lower portion of the press cylinder 2. The conduit 54 communicates with a conduit 55 comprising a check valve 56 located in a fluid reservoir or tank 57 which houses the valves 47, 51 and 53. Also connected with the fluid tank 57 are conduits 58 and 59 respectively comprising pressure relief valves 60 and 61, and leading to auxiliary cylinders 62 and 63 connected in any convenient manner with the press head 1.

The cylinder 62 communicates with a conduit 64 comprising a check valve 65 and communicating with a conduit 66. The conduit 66 comprises check valves 67 and 68 and leads to a conduit 69, which latter is connected with the cylinder 63 and comprises a check valve 70. The conduit 66 is also connected with the two-way valve 51 by means of a conduit 71. The valve 51 is normally held by means of a spring, not shown, in such a position as to prevent fluid connection between the conduit 71 and the exhaust conduit 76. However, in response to a predetermined pressure in the conduit 50, the valve 51 overcomes the thrust of the said spring, thereby establishing fluid connection between the conduits 71 and 76.

Reciprocably mounted in each of the cylinders 62 and 63 are hollow auxiliary plungers 72 and 73 respectively, which latter are connected to the rams 5 and 4, and establish fluid connection between the interior of the cylinders 62 and 63 and the cavities 6 and 7 in the rams 5 and 4.

The plungers 72 and 73 pass through bushings 74 and 75 respectively, partly located in the auxiliary cylinders and partly located in the press cylinders.

Operation

It may be assumed that all parts of the press occupy the position shown in the drawing, and that it is now desired to cause the press to perform a working cycle. To this end, the operator starts the pump 40 in any convenient manner, and energizes the solenoid 36, thereby causing the latter to actuate the armature 35 which, in its turn, shifts the three-arm lever 33 and the linkage system 38 so as to cause leftward movement of the control rod 39.

As a result thereof, the pump 40 is moved into full delivery forward stroke position so as to deliver pressure fluid through the conduit 41 into the upper portion of the press cylinder 3. From here a part of the fluid flows through the conduit 43, casing 44 and conduit 45 into the upper portion of the press cylinder 2, while simultaneously fluid is withdrawn from the lower portion of the press cylinders 2 and 3 through the conduits 54 and 42. Therefore, the rams 4 and 5 move downwardly as fast as fluid is withdrawn from the lower portion of the press cylinders 2 and 3. The fluid delivered into the upper portion of the press cylinders 2 and 3 is, at this time, supplemented by fluid passing from the tank 57 through the surge valve 53 and conduits 43 and 55 into the cylinders 3 and 2.

Downward movement of the rams 4 and 5 also causes the press platen 14, connected to said rams, to move downwardly, and inasmuch as the blankholder platen 10 is suspended on the press platen 14, also the blankholder platen 10 and the clamping plungers 8 and 9, connected thereto, move downwardly.

The vacuum created in the auxiliary cylinders 62 and 63 by downward movement of the auxiliary plungers 72 and 73 connected to the rams 4 and 5 respectively, is filled by fluid passing from the tank through the check valves 65 and 70.

As soon as the blankholder platen 10 engages the work piece to be shaped, the blankholder platen comes to a halt, thereby also halting the clamping plungers 8 and 9. While the rams 4 and 5 are continuing their downward movement, the plungers 8 and 9 enter into the clamping cylinders 7 and 6 respectively and, since the space occupied by said clamping plungers 8 and 9 is larger than the space released by the hollow plungers 72 and 73 in the cylinders 62 and 63, pressure begins to build up in the clamping cylinders 6 and 7 so as to cause the blankholder platen 10 to hold the work piece clamped at a certain pressure. Simultaneously the pressure in the clamping cylinders 6 and 7 causes the check valves 65 and 70 to close.

It will be noted that, since the valve 51 at this time prevents fluid connection between the conduits 71 and 76, no fluid can escape from the conduits 64 and 69 into the tank 57.

When the above mentioned pressure exceeds a predetermined value, corresponding to the setting of the pressure relief valves 60 and 61, the excessive pressure is released through said relief valves. The press platen 14 and press plunger 20 now continue their downward movement, thereby drawing or shaping the work piece, held by the blankholder platen 10.

When the press plunger 20 has completed its drawing or shaping operation, the operator deenergizes the solenoid 36, thereby allowing a spring, not shown, in the pump 40 to shift the flow-control rod 39 toward the right so as to move the pump 40 into full delivery retraction stroke position. Pressure fluid is now delivered by the pump 40 into the conduit 42, from where it flows through the conduit 52 to the main cylinder relief and pump by-pass valve 47 to actuate the same so as to release fluid from the upper portion of the press cylinders 2 and 3.

Furthermore, fluid from the conduit 52 is conveyed to the surge valve 53 to open the latter for establishing fluid connection through said surge valve between the upper portion of the

press cylinders and the tank 57. Fluid also flows from the conduit 52 to the two-way valve 51 and shifts the same so as to effect fluid connection between the conduits 71 and 76.

Fluid pressure delivered by the pump 40 into the conduit 42 is now conveyed to the lower portion of the press cylinders 3 and 2 where it causes upward movement of the press rams and, thereby, of the press platen 14 and the press plunger 20. The fluid expelled from the upper portion of the press cylinders during the upward movement of the press rams passes through conduits 43 and 45 and the surge valve 53 into the tank 57.

While the rams 4 and 5 move upwardly, the press platen 14 moves away from the blankholder platen 10 so that the free space in the clamping cylinders 6 and 7 increases. This space is substantially filled with fluid expelled by the hollow plungers 72 and 73 when moving into their respective cylinders 62 and 63. If the fluid expelled by the plungers 72 and 73 is not sufficient to fill the increased space in the cylinders 6 and 7, the said fluid is supplemented by fluid flowing from the tank 57 through the check valves 65 and 70 into the cylinders 62 and 63.

When the press platen 14 has moved away from the blankholder platen 10 to such an extent that the nuts 26 and 27 are engaged by the upper surface of the press platen 14, the blankholder platen 10 is picked up and likewise moved upwardly.

The fluid now expelled from the cylinders 62 and 63 escapes through the conduits 64, 69, 66 and 71 through the two-way valve 51 and exhaust conduit 76 into the tank 57.

When the press platen 14 approaches the end of its retraction stroke, the collar 29 is engaged by the platen arm 28 so that the push rod 30 is lifted and causes the collar 31 to shift the three-arm lever 33 in anti-clockwise direction to such an extent that the control rod 39 moves the pump 40 into substantially neutral or no delivery position. Consequently, no more pressure fluid is delivered to the lower portion of the press cylinders 2 and 3 so that the press rams 4 and 5 come to a halt. All parts now occupy the position shown in the drawing and the press is ready for a new cycle.

From the above it will be seen that the cavities 6 and 7 act as clamping cylinders for cooperation with the clamping plungers 9 and 8 to exert the desired clamping pressure on the blankholder platen 10. It will furthermore be noted that, since fluid pressure is conveyed through the hollow plungers 72 and 73 into the auxiliary cylinders 62 and 63 from the cavities 6 and 7, the pressure in the cavities 6 and 7 also acts upon the marginal or annular areas of the hollow plungers 72 and 73, thereby also acting on the rams 5 and 4 connected to the plungers 72 and 73. In other words, not the total pressure acting on the upper surface of the clamping plungers 8 and 9 is to be derived from the pressure acting on the rams 4 and 5, but only the pressure acting on a clamping plunger area, which equals the sectional area of the bores 77 and 78 in the hollow plungers 72 and 73.

It should also be noted that, since during the pressing operation pressure prevails in the cylinders 62 and 63 as well as in the upper portion of the press cylinders 3 and 2, it is quite sufficient to provide bushings 74 and 75 through which the plungers 72 and 73 pass and no packing is required.

Another advantage of the structure according to the present invention consists in that the bushings 12 and 13 guide the clamping plungers 8 and 9 throughout the width of the press platen, and that the clamping plungers 8 and 9 are furthermore guided by the lower end of the rams 4 and 5. In this way, the clamping plungers 8 and 9 have a relatively large portion continuously guided, so that with smaller presses no particular guiding gibs for the press platen are required. The press platen, in this instance, is rigidly connected with the clamping plungers 8 and 9.

Since the clamping cylinders 6 and 7, according to the arrangement of the present invention, are provided in the rams 5 and 4, the bore through which the clamping plungers 8 and 9 extend into the cavities 7 and 6 may be machined in the same machining setup for machining the exterior surface of the rams. The cavities 6 and 7 are cast and need no machining. In this way, the costs of manufacturing the press according to the invention are materially decreased over the costs involved in machining cylinder presses as heretofore known.

The provision of the cavities 6 and 7 in the rams 4 and 5 constitutes an important saving in the material for the rams.

While the structure shown in the drawing merely shows two press rams with two clamping cylinders therein, it is, of course, understood that the arrangement may be multiplied. If desired, the press may be provided with some rams having clamping cylinders therein, and other rams having no clamping cylinders associated therewith.

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 combination in a drawing press, a reciprocable press platen, fluid operable plunger means for actuating said platen, said plunger means having a cavity therein confining a clamping cylinder, blankholder means for holding a work piece while it is being shaped by pressure exerted on said press platen, and clamping plunger means reciprocable in said clamping cylinder for actuating said blankholder means, said clamping plunger means being arranged to create pressure in said clamping cylinder in response to the movement of said press platen toward said blankholder means.

2. In combination in a drawing press, a hollow press ram confining a clamping cylinder, fluid operable advancing and retracting means associated with said ram for reciprocating the same, blankholder means for holding a work piece while it is being shaped by pressure exerted on said press ram, and fluid operable clamping plunger means reciprocable in said clamping cylinder and operatively connected with said blankholder means for conveying pressure thereto.

3. In combination in a drawing press, a press ram having a cavity therein forming a clamping cylinder, motor means for reciprocating said ram, blankholder means for holding a work piece while it is being shaped by pressure exerted on said ram, and fluid operable clamping plunger means reciprocable in said clamping cylinder and responsive to a relative movement between said ram and said blankholder means for creating pressure in said clamping cylinder and conveying said pressure to said blankholder means.

4. In combination in a drawing press, a hollow press ram confining a main clamping cylinder, fluid operable advancing and retracting means for reciprocating said ram, blankholder means for holding a work piece while it is being shaped by pressure exerted on said ram, main clamping plunger means reciprocable in said main clamping cylinder and operatively connected with said blankholder means for conveying pressure thereto, an auxiliary clamping cylinder, and a hollow auxiliary clamping plunger hydraulically interconnecting said main and said auxiliary clamping cylinders, said main clamping plunger means being adapted in response to a relative movement between said ram and said blankholder means to create pressure in said clamping cylinders.

5. In combination in a drawing press, a press platen, a plurality of press rams connected to said platen for actuating the same, each of said rams being hollow and confining a clamping cylinder, fluid operable advancing and retracting means for reciprocating said rams, blankholder means for holding a work piece while it is being shaped by pressure exerted on said platen, and a plurality of clamping plungers arranged to move with said blankholder means and respectively reciprocable in said clamping cylinders for creating pressure therein in response to a relative movement between said press platen and said blankholder means, and for conveying said pressure to said blankholder means.

6. In combination in a drawing press, a press platen, hollow ram means confining clamping cylinder means, blankholder means for holding a work piece while it is being shaped by pressure exerted on said ram means, clamping plunger means arranged to move with said blankholder means and reciprocable in said clamping cylinder means, and means for moving said ram means relative to said blankholder means for creating pressure in said clamping cylinder means and conveying said pressure to said blankholder means.

7. In combination in a drawing press, a press platen, fluid operable hollow ram means confining clamping cylinder means and connected to said platen for reciprocating the same, blankholder means for holding a work piece while it is being shaped by pressure exerted on said platen, fluid operable clamping plunger means reciprocable in said clamping cylinder means and guided by said platen for conveying pressure to said blankholder means, said clamping plunger means being adapted in response to a relative movement between said platen and said blankholder means to create pressure in said clamping cylinder means, and means for conveying fluid into said clamping cylinder means.

8. In combination in a drawing press, fluid operable hollow drawing plunger means, a press platen operable by said plunger means, blankholder means for holding a work piece while it is being shaped by pressure exerted on said drawing plunger means, and clamping plunger means reciprocable in said drawing plunger means, said clamping plunger means being connected to said blankholder means and operable by the motion of said press platen.

9. In combination in a drawing press, drawing cylinder means, drawing plunger means therein, a press platen operated by said drawing plunger means, clamping cylinder-piston-assemblies associated with said platen and operable automatically to create pressure therein in response to the movement of said drawing plunger means in drawing direction, the cylinders of said clamping cylinder-piston-assemblies being formed by said drawing plunger means, a clamping platen operable by said clamping cylinder-piston-assemblies for holding a work piece clamped while it is subjected to shaping pressure by said drawing plunger means through said press platen, auxiliary cylinders, auxiliary plungers movable in said auxiliary cylinders, means for conducting fluid between said clamping cylinder-piston-assemblies and said auxiliary cylinders, and a pressure relief device for each auxiliary cylinder adapted to discharge fluid therefrom in response to the attainment of a predetermined pressure therein.

10. In combination in a drawing press, a press head having a drawing cylinder, a hollow drawing plunger therein confining a clamping cylinder, a platen operated by said drawing plunger, blankholder means for holding a work piece while it is being shaped by pressure exerted on said drawing plunger, a clamping plunger reciprocable in said clamping cylinder and connected to said blankholder means for conveying pressure thereto, an auxiliary cylinder mounted on said press head, an auxiliary plunger movable in said auxiliary cylinder and connected to said drawing plunger, means for conducting fluid between said clamping cylinder and said auxiliary cylinder, and a pressure relief device associated with said auxiliary cylinder and adapted to discharge fluid therefrom in response to the attainment of a predetermined pressure thereon, the working surface of the head of said auxiliary plunger and said drawing plunger being positioned in similar direction relative to said platen, whereby the pressure fluid generated in said clamping cylinder during the clamping operation acts against the auxiliary plunger in the same direction as the pressure exerted on said platen by said drawing plunger during the pressing operation thereof.

11. In combination in a drawing press, a drawing cylinder, a hollow drawing plunger therein confining a clamping cylinder, a press platen operated by said drawing plunger, blankholder means for holding a work piece while it is being shaped by pressure exerted on said platen, a clamping plunger reciprocable in said clamping cylinder and operable by movement of said platen relative to said blankholder means for exerting pressure on the latter, an auxiliary cylinder, an auxiliary hollow plunger connected to said clamping cylinder and reciprocable in said auxiliary cylinder, and a pressure relief device associated with said auxiliary cylinder and adapted to discharge fluid therefrom in response to the attainment of a predetermined pressure therein.

12. In combination in a drawing press, a drawing cylinder, a hollow drawing plunger therein confining a clamping cylinder, a press platen operated by said drawing plunger, blankholder means for holding a work piece while it is being shaped by pressure exerted on said platen, a clamping plunger reciprocable in said clamping cylinder and operable by movement of said platen relative to said blankholder means for exerting pressure on the latter, an auxiliary cylinder, an auxiliary hollow plunger connected to said clamping cylinder and reciprocable in said auxiliary cylinder, a pressure relief device associated with said auxiliary cylinder and adapted to discharge fluid therefrom in response to the attainment of a predetermined pressure therein, a fluid reservoir, and valve means arranged automatically to prevent fluid connection between

said clamping cylinder and said fluid reservoir during the pressing operation of said drawing plunger and adapted in response to the retraction stroke of said drawing plunger to establish fluid connection between said clamping cylinder and said fluid reservoir.

13. In combination in a drawing press, a drawing cylinder, a hollow drawing plunger reciprocable in said drawing cylinder and confining a clamping cylinder, blankholder means for holding a work piece while shaping pressure is exerted thereupon by said drawing plunger, an auxiliary cylinder arranged in alignment with said drawing cylinder, a hollow auxiliary plunger movably connected to said drawing plunger and continuously establishing hydraulic communication between said clamping cylinder and said auxiliary cylinder, means for conveying fluid to said clamping cylinder, and a pressure relief valve associated with said clamping cylinder for releasing pressure therefrom in excess of a predetermined pressure therein, said clamping plunger being adapted in response to a relative movement between said drawing plunger and said blankholder means to create pressure in said clamping cylinder.

14. In combination in a drawing press, a press platen, a drawing cylinder, a hollow drawing plunger reciprocable in said cylinder for actuating said press platen, said drawing plunger confining a clamping cylinder, blankholder means for holding a work piece while it is being shaped by pressure exerted on said press platen, a fluid operable clamping plunger reciprocable in said clamping cylinder for conveying pressure to said blankholder means, said clamping plunger extending through said press platen and being movable relative thereto, means in said press platen for guiding said clamping plunger, an auxiliary cylinder, means for admitting fluid to said auxiliary cylinder, and a hollow auxiliary plunger supported by said drawing plunger and reciprocable in said auxiliary cylinder for continuously establishing hydraulic connection between said clamping cylinder and said auxiliary cylinder, said clamping plunger cooperating with said clamping cylinder for creating pressure therein in response to the movement of said press platen toward said blankholder means.

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