July 21, 1942. G. A. SCHETTLER 2,290,361

PRESS

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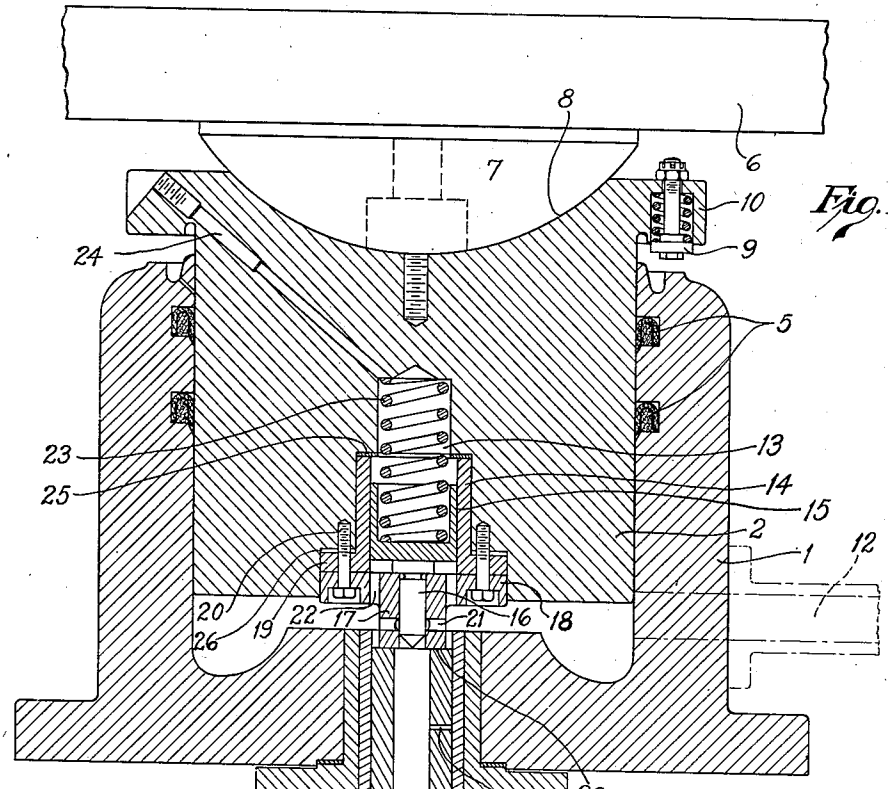


Fig. 1

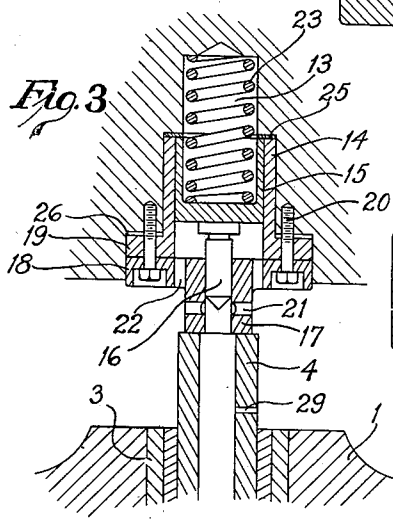


Fig. 3

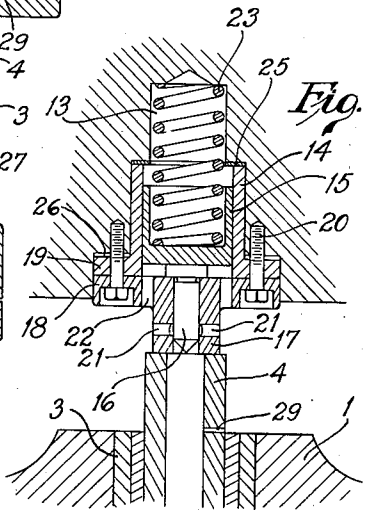


Fig. 2

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2,290,361

PRESS

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9 Claims. (Cl. 60—97)

This invention relates to presses and is illustrated in relation to a press of the type disclosed in United States Letters Patent No. 1,932,556, granted October 31, 1933, upon an application filed in the name of P. V. J. Merenda. In a press of this type, wherein a large and a small piston are provided in alinement with each other in communicating piston cylinders to effect movement of one of the platens of the press, the small piston is provided with a passageway and a port and is arranged to serve as a valve mechanism operative at the beginning of the actual pressure applying operation to provide a passage between the small piston chamber and the large piston chamber whereby pressure medium under high pressure is applied to the large piston to effect the application of pressure to the work piece undergoing treatment.

In accordance with the instant invention, a new arrangement of valve mechanism is provided, so constructed as to secure operation of the press without undue wear or scouring of the ports or passageways through which pressure medium passes to the large piston chamber. To this end, the valve mechanism comprises a spring-pressed valve member located in a chamber in the large piston and arranged to operate a plunger valve to uncover, promptly at the beginning of a pressure applying operation, certain ports through which high pressure medium passes from the small piston cylinder to the large piston cylinder, whereby pressure medium under high pressure is not forced through partly obstructed ports, since such a condition would result in rapid wear or scouring of the ports. From another viewpoint, the valve member with its associated valve plunger constitutes a differential piston movable with respect to the large piston to control certain ports in such manner as to secure unobstructed passage of pressure medium from the small piston chamber to the large piston chamber, as soon as pressure begins to be applied to a work piece.

These and other important features of the invention, together with novel combinations of parts, will now be described in detail in the specification and pointed out more particularly in the appended claims.

In the drawing,

Fig. 1 represents a sectional elevation through the main and auxiliary piston cylinders, with the pistons in the position they assume at the beginning of a closing stroke;

Fig. 2 is a fragmentary sectional view of the valve means, when the pistons have nearly completed a closing stroke; and

Fig. 3 is a view similar to Fig. 2 but showing the position of the valve when the pistons are exerting maximum pressure.

In the illustrated construction, which is specially designed to effect pressing operations upon pieces of work of various thickness dimensions, reference character 1 denotes the main cylinder, 2 the main piston therein, 3 the auxiliary cylinder, 4 the hollow auxiliary ram or tubular piston therein, 5 hydraulic packings in the main cylinder, 6 the lower platen with its spherical support 7 bearing in a spherical recess 8 in the main piston or ram, and 9 a series of spring-loaded buffers supported in a collar 10 of the main ram or piston for cushioning and limiting the downward movement of the main ram. A pressure pipe line 11 connects the auxiliary cylinder 3 with the press pump (not shown) which delivers pressure liquid from a supply reservoir (also not shown), and a pipe line 12 of larger bore connects the main cylinder with the reservoir through a housing containing a return valve, as shown in Fig. 2 of the Merenda patent mentioned above.

In accordance with the present invention, the main ram or piston 2 is provided with a stepped recess or chamber 13 wherein is fitted a hollow cylinder 14 containing a slidable piston or valve member 15 having an integral plunger valve 16 co-operating with a sleeve or tubular member 17. The sleeve or member 17 and the cylinder 14 have flanges 18 and 19, respectively, and are secured together and to the ram 2 by bolts 20. The sleeve 17 has radial valve ports 21; it also has ports 22 establishing communication between the main ram cylinder 1 and the under side of the piston 15. Bearing on the top of the piston 15 is a spring 23 contained in the chamber 13 which is open to the atmosphere through a vent passage 24. The cylinder 14 is sealed at its inner end by means of a soft metal washer 25, which may be copper and which is sufficiently wide to afford a second seal for the piston 15 when this is under high liquid pressure, as shown in Fig. 3. To make the cylinder seal effective, clearance 26 is left between the cylinder flange 19 and the main ram 2.

A spring 27 in the auxiliary ram cylinder 3 and below the floating auxiliary ram or tubular piston 4 constrains the auxiliary ram or piston to abut the valve sleeve 17 and effect a seal at 28.

The operation, beginning with the press open,

i. e., with the rams or pistons approximately in the positions shown in Fig. 1, is as follows:

Pressure liquid delivered by the pump is admitted under control of an operating valve, such as that shown at 103 (Fig. 1) of the Merenda patent mentioned above, and through the pressure line 11 to the auxiliary ram cylinder 3 where it acts on and raises the auxiliary ram or piston 4, which carries the main ram 2 and platen 6 with it as shown in Figs. 1 and 2. During this step, which constitutes the closing stroke, (i. e. the stroke by which the gap between the press platens is closed) the liquid pressure on the auxiliary ram 4 and plunger valve 16 is approximately equivalent to the load of the moving parts and is insufficient to overcome the force of the spring 23 acting on the piston 15 of the plunger valve. In other words, the spring 23 is arranged to exert a force on piston or valve member 15 in excess of the liquid pressure attained in the auxiliary ram cylinder and exerted against the plunger valve 16 for the purpose of completing the closing stroke of the piston 2 and platen 6, whatever may be the extent of that stroke.

While the main ram 2 is being raised by the auxiliary ram 4 in the performance of the closing stroke, liquid enters the main ram cylinder 1 from the supply reservoir (not shown) through the large bore pipe line 12, the beforementioned return valve in this line then being open.

So soon as the closing stroke has been completed in the manner described, the lower platen 6 in pressing a work piece against the upper platen (not shown) meets resistance to further upward movement and then the further action of the pump begins to build up pressure through the pressure line 11, whereupon this increased pressure acting on the plunger valve 16, overcomes the loading spring 23 so that the plunger valve together with the piston 15 is raised and the radial ports 21 are opened. Thereupon pressure also builds up in the main ram cylinder and the beforementioned return valve closes preventing escape of the pressure medium through pipe 12 back to the reservoir. Even before the liquid pressure in the two ram cylinders balances, the rising pressure in the main cylinder acts, through the ports 22, on the under side of the piston 15, which is of larger area than the plunger valve 16, and forces the piston and plunger valve to the fully raised position shown in Fig. 3, where they remain during the whole of the pressure stroke. As the building up of pressure continues, the piston 15 is maintained sealed against the packing ring 25 (Fig. 3). This seal is against atmospheric pressure on one side via the vent 24, and on the other side against the maximum balanced liquid pressure attained in the ram cylinders, the parts then being as shown in Fig. 3.

As is evident from Figs. 1, 2 and 3, the auxiliary ram 4 abuts the valve sleeve 17 during both the closing stroke and the pressure stroke and so forms a seal at 28.

When the return or exhaust stroke is to be effected, the aforesaid operating valve in the pressure line 11 is opened to connect this line with the supply reservoir and to relieve the pressure. At this time the plunger valve 16 under pressure of the spring 23 again closes the ports 21 due to the release of liquid pressure on the piston 15. As soon as the pressure in the main ram cylinder is sufficiently reduced, the beforementioned return valve in the large bore pipe line 12 is opened and the pressure liquid from the main ram cylinder is then expelled through this line which offers less resistance than the pressure line 11. It follows that the downward movement of the main ram 2 is considerably accelerated and the return or exhaust stroke is rapidly performed.

When the pressure is completely relieved, the spring buffers 9 contact the main ram cylinder 1 to absorb the shock of the downward movement. Moreover, under the action of the spring 27, the auxiliary ram 4 again contacts the plunger valve sleeve 17 to reform the seal at 28, thus setting the press ready for the next working cycle.

For a high speed press, working under normal conditions, the described mechanism functions adequately providing the speed of the rams on the closing stroke is not so high as to cause a rebound between the platens. In order to operate the press at even higher speed while maintaining a smooth action when the platens close, a vent 29 may be formed in the auxiliary ram. This vent is located in a part of the ram which will project into the main ram cylinder (see Fig. 2) during the closing stroke.

From the foregoing it will be evident that the plunger valve 16 opens automatically at the beginning of each pressure stroke independently of the extent of movement of the auxiliary ram in performing the preceding closing stroke, and that the spring loading of the piston 15 determines the amount of liquid pressure to be built up in the auxiliary ram cylinder to effect such opening of the plunger valve 16. It follows that the press may take various thicknesses of work-supporting plates and also work pieces of various thickness dimensions, which give rise to closing strokes of various lengths, without in any way affecting its high speed operation.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a hydraulic mechanism, a piston, a cylinder for the piston, the latter being movable by a pressure medium, a tubular member arranged to move with said piston and having ports through which high pressure medium may enter said cylinder, a valve member slidably mounted in said piston and arranged to be exposed to the pressure medium in said cylinder, a spring between the piston and the valve member of a strength to resist movement of said valve member by the pressure medium while the piston is being moved in one direction without meeting resistance, said valve member having a plunger valve of reduced area secured thereto, said plunger valve being movable in said tubular member to close said ports which, when open, connect the piston cylinder with a source of high pressure medium, said valve member having a surface exposed to the pressure medium of an area larger than the corresponding surface of the plunger valve, and said plunger valve being exposed at its end surface to the pressure medium and being movable under a predetermined heavy pressure to open said ports, the high pressure medium in said piston cylinder then operating promptly upon said surface of the valve member to move said valve member to effect such movement of the plunger valve as will completely uncover the ports so that pressure is transmitted freely to the pressure medium in said piston cylinder.

2. In a hydraulic mechanism constructed according to claim 1, a sleeve member secured to the piston in alinement with said valve member to hold the latter in place against the pressure of said spring, said sleeve member having a bore

to receive said plunger valve and having also said ports connecting said bore with the piston cylinder at a certain point in the relative movement of the plunger valve and said sleeve when the pressure medium under heavy pressure is effecting the application of pressure through said piston.

3. In a hydraulic mechanism, a large and a small piston in line with each other, a large piston cylinder and a small piston cylinder for the large and the small pistons, respectively, said small piston having a bore therethrough and being movable by a pressure medium to effect movement of the large piston, said large piston having a valve chamber therein in line with the small piston, a spring in said valve chamber, a valve member in the form of a differential piston slidable in the valve chamber and subject to pressure of the pressure medium in the large piston cylinder and also of that in the small piston cylinder, and a member secured to the large piston to hold the differential piston in said valve chamber against the pressure of said spring, said holding member having a sleeve portion in alinement with the bore in the small piston for the reception of the reduced part of said differential piston, and said sleeve having ports normally covered by the differential piston and through which high pressure medium may escape from the small piston bore into the large piston cylinder to apply heavy pressure to the large piston, upon movement of the differential piston against the pressure of said spring when the large piston encounters sufficient resistance.

4. In a hydraulic mechanism, a large and a small piston in line with each other, a large piston cylinder and a small piston cylinder for the large and the small pistons, respectively, said small piston having a bore therethrough and being movable by a pressure medium to effect movement of the large piston, said large piston having a valve chamber therein in line with the small piston, a spring in said valve chamber, a valve member in the form of a differential piston slidable in the valve chamber, and a member secured to the large piston to hold the differential piston in said valve chamber against the pressure of said spring, said holding member having a port therethrough whereby pressure medium in the large piston cylinder may be applied to move the differential piston against the resistance of the spring in said valve chamber, said holding member having a sleeve portion in alinement with the bore in the small piston for the reception of the reduced part of said differential piston, the bore of the sleeve being in alinement with the bore of the small piston whereby the pressure medium in said small piston is applied to one end of said differential piston, and said sleeve having ports normally covered by the differential piston and through which high pressure medium may escape from the small piston bore into the large piston cylinder to apply heavy pressure to the large piston, upon movement of the differential piston against the pressure of said spring when the large piston encounters sufficient resistance.

5. In a press, a movable platen, a large and a small piston in line with each other and arranged to move said platen, a large piston cylinder and a small piston cylinder for the large and the small pistons, respectively, said small piston having a bore therethrough and being movable by a pressure medium to effect movement of the large piston and the movable platen associated therewith, a valve member in the form of a piston slidably mounted in the large piston and having a surface exposed to the pressure medium in the large cylinder, a spring between the large piston and the valve member of a strength to resist movement of the valve member by the pressure medium while the large piston is being moved in one direction without meeting resistance, said valve member having a plunger valve of reduced area secured thereto, ports through which pressure medium may pass from the bore of the small piston to the large piston cylinder, said plunger valve having a cylindrical surface normally closing said ports and being movable under a predetermined heavy pressure partially to open said ports thereby raising the pressure in the large piston cylinder with the result that said valve member is moved by the high pressure medium acting on said surface of the valve member to effect such movement of the plunger valve as will promptly and completely uncover the ports whereby pressure is freely transmitted to the pressure medium in the large piston chamber as soon as pressure is built up in the small piston cylinder to a predetermined degree.

6. In a press constructed according to claim 5, a sleeve member secured to the large piston in alinement with said valve member to hold the latter in place against the pressure of said spring, said sleeve member having a bore to receive said plunger valve and having also said ports connecting said bore with the large piston cylinder at a certain point in the relative movement of the plunger valve and said sleeve when the pressure medium under heavy pressure is effecting the application of pressure upon a work piece by said movable platen.

7. In a press, a movable platen, a large and a small piston in line with each other and arranged to move said platen, a large piston cylinder and a small piston cylinder for the large and the small pistons, respectively, said small piston having a bore therethrough and being movable by a pressure medium to effect movement of the large piston and the movable platen associated therewith, said large piston having a valve chamber therein in line with the small piston, a spring in said valve chamber, a valve member in the form of a differential piston slidable in the valve chamber, a member secured to the large piston to hold the differential piston in said valve chamber against the pressure of said spring, said holding member having a port therethrough whereby pressure medium may be applied to move the differential piston in one direction in said valve chamber, said holding member also having a sleeve portion for the reception of the reduced part of said differential piston, the bore of the sleeve being in alinement with the bore of the small piston whereby the pressure medium in said small piston is applied to one end of said differential piston, and said sleeve having ports through which pressure medium may escape from the small piston bore into the large piston cylinder upon movement of the differential piston against the pressure of said spring at the end of the closing movement of the large piston and the platen associated therewith.

8. In a press, a movable platen, a large and a small piston in line with each other and arranged to move said platen, a large piston cylinder and a small piston cylinder for the large and the small pistons, respectively, said small piston having a bore therethrough and being movable by a pressure medium to effect movement of the large piston and the movable platen associated therewith,

said large piston having a valve chamber therein in alinement with the bore in the small piston, a differential valve piston slidable in said valve chamber and subject to pressure on two different areas thereof by the pressure medium in the large piston cylinder and in the small piston cylinder, respectively, a member for holding said valve piston in the valve chamber, a spring in the valve chamber tending constantly to hold the differential piston against said holding member and against pressure by the pressure medium, a port or ports covered by the differential piston in the open position of the press and adapted for the passage of pressure medium from the bore of the small piston to the large piston cylinder, said spring being of a strength sufficient to resist movement of the differential piston by the pressure medium in the small piston cylinder until the beginning of a pressure applying operation, the spring then yielding so that the differential piston moves to uncover said port or ports whereby pressure medium under high pressure enters the large piston cylinder to effect the application of pressure through the large piston.

9. In a press, a movable platen, a large and a small piston in line with each other and arranged to move said platen, a large piston cylinder and a small piston cylinder for the large and the small pistons, respectively, said small piston having a bore therethrough and being movable by a pressure medium to effect movement of the large piston and the movable platen associated therewith, said large piston having a valve chamber therein in alinement with the bore in the small piston, a differential valve piston slidable in said valve chamber, a member for holding said valve piston in the valve chamber, a spring in the valve chamber tending constantly to hold the differential piston against said holding member, said holding member having a port through which pressure medium may pass to press the differential valve piston against said spring, said holding member having further a sleeve portion for the reception of the reduced part of the differential piston, said sleeve having further a port or ports for the passage of pressure medium from the bore of the small piston to the large piston cylinder, said spring being of a strength sufficient to resist movement of the differential piston by the pressure medium in the small piston cylinder until the beginning of a pressure applying operation, the spring then yielding whereby the differential piston moves to uncover the port or ports in the sleeve whereby pressure medium under high pressure enters the large piston cylinder to effect the application of pressure through the large piston.

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