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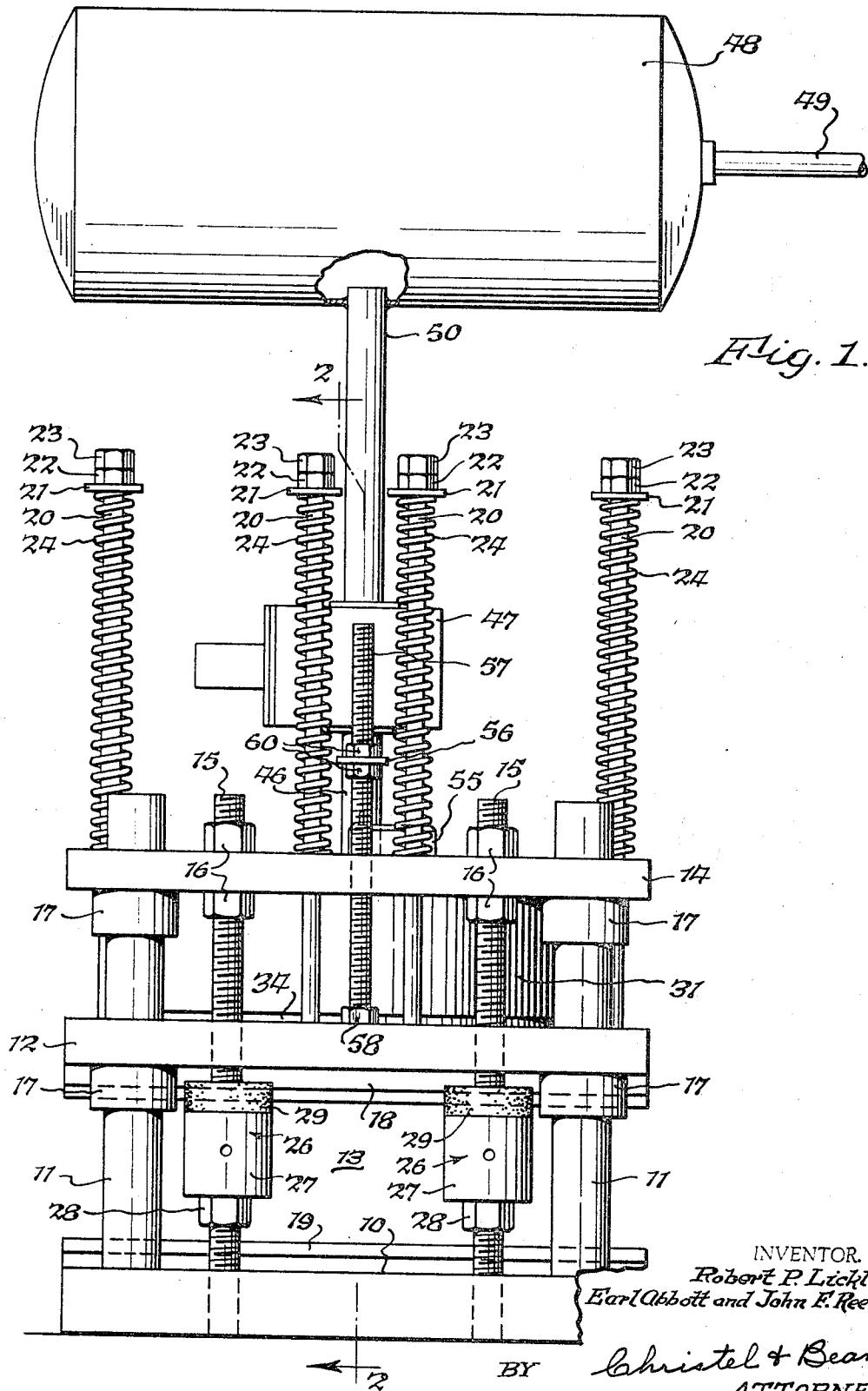
R. P. LICKLITER ET AL

3,450,037

PNEUMATIC PRESS

Filed Dec. 27, 1966

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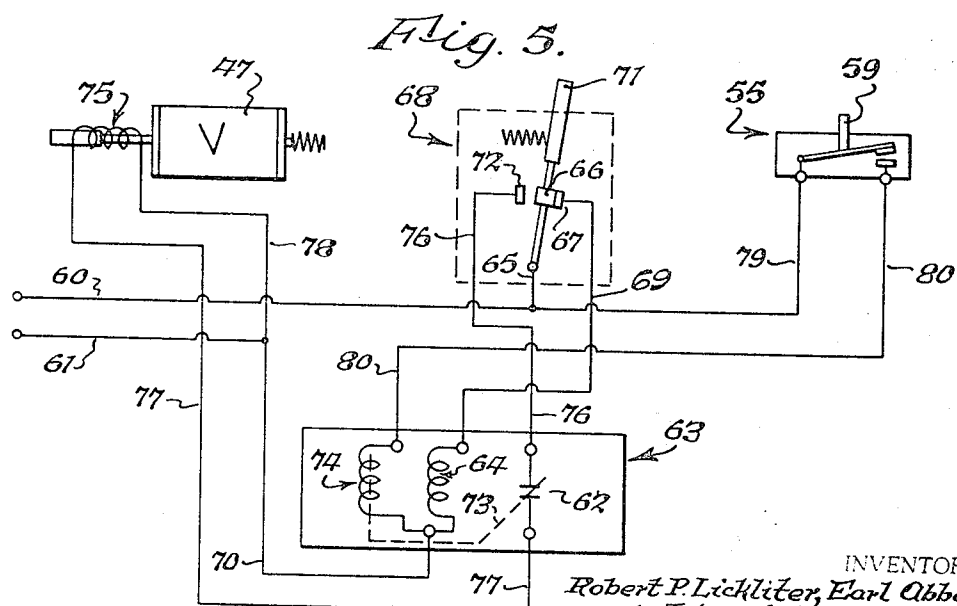
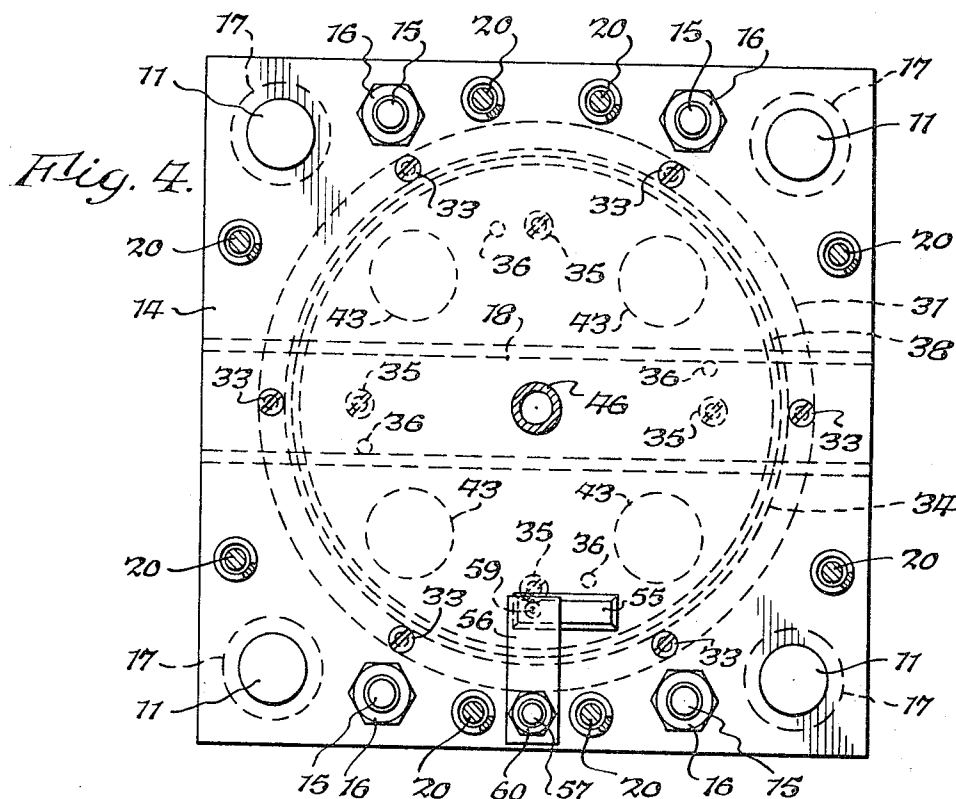
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PNEUMATIC PRESS

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12 Claims

ABSTRACT OF THE DISCLOSURE

The press has a pneumatically operated piston and cylinder mounted between a height adjustable upper plate and a ram plate for driving the latter downwardly on guideposts into a die set area against resilient, height adjustable, stops whereby the ram plate rebounds upwardly to assist the spring retraction thereof. The piston face carries resilient stops which, together with the die set area stops, reduce the noise at both ends of the ram plate stroke. A height adjustable control switch is actuated by the ram plate before the end of the downstroke to stop inflow of air into the cylinder.

Background of the invention

The present invention relates to a fluid actuated press and in particular to a pneumatic press actuated by a piston and cylinder mounted between a ram plate and an upper plate and having a mechanical assist for returning the ram plate.

Conventional presses include a ram head mounted for vertical sliding movement on a plurality of vertical guideposts upstanding from a stationary bed, the ram head and stationary bed defining a die set area therebetween. An upper plate is usually secured to the upper ends of the guideposts to maintain the latter in vertical alignment thereby permitting free sliding movement of the ram plate. In certain instances, the ram head is fluid actuated by a piston and cylinder arrangement located above the upper plate with a piston rod extending therethrough to drive the ram head downwardly into the die set area, the ram head being mechanically returned by springs or the like. Inaccuracies in alignment and resulting reduction in efficiency are introduced in these arrangements necessitating relatively high fluid operating pressures and heavy return springs. Moreover, lagging and inconsistent ram head response to its actuating control signal occurs in these presses whereby press set-up time is increased and variations in work in the die set area introduced. An unacceptable noise level is also created due, in a large measure, to stopping the direction of the ram head at both ends of its stroke.

Summary of the invention

It is a primary object of the present invention to provide a pneumatic press having a piston and cylinder operable at low pressures and arranged between the upper plate and the ram head to directly drive the latter.

It is another object of the present invention to provide a pneumatic press having a mechanical assist providing an initial upward thrust to return the ram head at the end of its downstroke.

It is still another object of the present invention to provide a pneumatic press having a piston and cylinder drive arrangement wherein fluid flow into the cylinder is cut off prior to the end of the ram head downstroke.

It is yet another object of the present invention to provide a pneumatic press having a ram head engageable against height adjustable stops to limit its downstroke and wherein such stops react to return the ram head.

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It is a further object of the present invention to provide a pneumatic press having a quick response to press actuating control signals whereby variations in work in the die set area is substantially eliminated.

It is yet a further object of the present invention to provide a pneumatic press having the foregoing characteristics which is constructed to reduce noise to a minimum, and wherein the shut height can be easily and readily adjusted.

In one aspect thereof, a pneumatic press constructed in accordance with the principles of the present invention is characterized by a bed plate, a plurality of vertically extending guide posts fixed at their lower ends to the bed plate, an upper plate carried on the guide posts adjacent the upper ends thereof and adjustable vertically to selectively vary its height above the bed plate, a ram plate vertically slidable on the guide posts and defining a die set area with the bed plate, means for urging the ram plate downwardly toward the bed plate including a piston and cylinder disposed between the upper plate and the ram plate, together with a valve for supplying air under pressure into the cylinder, a plurality of resiliently deformable stops carried by the bed plate to limit downward movement of ram plate and provide an initial upward return thrust to the ram plate at the end of its downstroke and spring means suspending the ram plate from the upper plate for completing the return of the ram plate.

The foregoing and other objects, advantages and characterizing features of the air actuated press of the present invention are pointed out in detail in the following description of a typical embodiment thereof considered in conjunction with the accompanying drawings depicting the same wherein like numerals represent like parts throughout the various views.

Brief description of the drawings

FIG. 1 is an elevational view of one form of a pneumatic press constructed in accordance with the present invention;

FIG. 2 is a cross-sectional view thereof taken about on line 2—2 of FIG. 1;

FIG. 3 is a fragmentary, enlarged, cross-sectional view of the piston and cylinder arrangement utilized therein;

FIG. 4 is a horizontal, cross-sectional view of the press taken about on line 4—4 of FIG. 2; and

FIG. 5 is a schematic illustration of a control circuit for use with the pneumatic press.

Detailed description of a preferred embodiment

The drawings show one form of pneumatic press constructed in accordance with the principles of the present invention comprising a stationary bed 10, a plurality of vertically extending guideposts 11 suitably fixed at their lower ends to bed 10, a ram head plate 12 vertically slidable on guideposts 11 and defining a die set area 13 with bed 10, and an upper plate 14 slidably adjustable on guideposts 11. A plurality of upstanding threaded posts 15 are threaded at their lower ends into bed 10 and extend upwardly through openings in ram plate 12 and upper plate 14, the latter being secured adjacent the upper ends of posts 15, between nuts 16 to adjustably fix the height of upper plate 14 above bed 10. Bed 10 and plates 12 and 14 are preferably rectangular in plan form, and can be formed of steel plating with the bores in plates 12 and 14 receiving guideposts 11 each having the shank portion of a guide bushing 17 fixed therein in a conventional manner. Track members 18 and 19 are suitably secured on the undersurface of ram plate 12 and on the upper surface of bed plate 10, respectively and are adapted to receive the upper and lower dies of the usual die set, not shown. Of course, it will be appreciated that the press of this invention is

of general utility, and is not limited to use with die sets.

Ram plate 12 is suspended below upper plate 14 by a ram plate return assembly comprising, in the illustrated form, eight rods 20 suitably fixed at their lower ends to ram plate 12 and passing upwardly through openings in upper plate 14. The upper end of each rod 20 mounts a washer 21, a nut 22 and a lock nut 23 and a compression spring 24 encircles each rod 20 with its opposite ends bearing against washer 21 and the upper surface of upper plate 14. Ram plate 12 is thus resiliently supported for reciprocating sliding movement on guideposts 11 by springs 24 with downward movement thereof into die set area 13 being against the bias of springs 24 and limited by a plurality of stops 26 vertically adjustably mounted on rods 15 between ram plate 12 and bed plate 10. Stops 26 comprise sleeves 27 threaded on rods 15 and fixed in vertically adjusted position by jam nuts 28 engaging against their undersurfaces. The upper surface of each sleeve 27 has a resiliently deformable cushion 29 preferably formed of rubber, glued or otherwise fixed thereon for limiting downward movement of ram plate 12 and providing a noiseless initial return thrust to ram plate 12 at the end of its downstroke.

It is a significant feature hereof that with the foregoing arrangement the shut height is easily adjusted by moving nuts 16 to adjust the height of upper plate 14 which thereby adjusts the height of ram plate 12 since the latter is solely supported by the ram plate return assembly 20-24. Moreover, since stops 26 are adjustably mounted on rods 15 it will be seen that variations in height of the adjustable spacing between plate 12 and stops 26 can be provided relative to bed plate 10.

A pneumatically actuated piston and cylinder arrangement is disposed between upper plate 14 and ram plate 12 to drive the latter downwardly into die set area 13. A cylinder 31 is suitably secured to the undersurface of upper plate 14 interiorly of guideposts 11, posts 15 and rods 20 as by bolts 32 (FIGS. 2 and 4) and is provided with a suitable O-ring seal 33 (FIG. 3) sealing against upper plate 14. A piston 34 is suitably secured to the upper surface of ram plate 12 in vertical registry with cylinder 31 as by bolts 35 and dowels 36 (FIG. 4) and is formed of a heavy material providing considerable inertia to ram plate 12 during its downstroke. As illustrated in FIG. 3, the upper edge of piston 34 has a pair of peripheral flanges 37 having a suitable O-ring seal 38 carried therebetween for sealing against the inner surface of cylinder 31.

The upper surface of piston 34 is slightly cylindrically recessed as at 39 providing a narrow lip 40 about its periphery, recess 39 and lip 40 defining a working chamber 41 with upper plate 14. It will be appreciated that the diameter of piston 34 is very near the lateral dimension of ram plate 12 providing a very large and substantial area on the upper surface of piston 34 against which air entering cylinder 31, as hereinafter described, can react whereby low pressure air can provide a considerable downward force. Also, the large lateral dimension of the piston and cylinder arrangement and the direct connection thereof to the ram and upper plates respectively maintain ram plate 12 in accurate vertical slidable registry on guideposts 11 without undue friction therebetween.

A plurality of cylindrical cavities 42 are formed in the recessed surface of piston 34 for receiving resilient deformable cushions 43, preferably formed of rubber. Cushions 43 extend upwardly slightly beyond lip 40 to engage against the undersurface of upper plate 14 at the end of the piston upstroke whereby metal to metal contact between piston 34 and upper plate 14 is avoided and consequent noise therefrom eliminated.

Upper plate 14 is centrally bored to threadably receive the lower end of an air conduit 46 connecting at its upper end to a three way air valve 47. An air reservoir comprising an accumulator tank 48 communicates via

pipe line 49 with an air source, not shown, which can be a conventional industrial air supply, and with air valve 47 via a conduit 50 to provide air under constant pressure through valve 47 into chamber 41 for driving ram plate 12 downwardly. The end of conduit 50 terminates above the bottom of tank 48 as shown in FIG. 1, to prevent accumulated condensate or sediment from communicating into and fouling valve 47. Air valve 47 has an exhaust conduit, not shown and can be any conventional solenoid pilot operated, spring return, three-way valve.

A valve control switch 55 is suitably mounted on upper plate 14 and positioned vertically below a switch actuating arm 56 carried by a threaded rod 57. Rod 57 is threaded at its lower end into a suitable opening in ram plate 12 and is fixed thereto by a jam nut 58. Rod 57 passes upwardly through an opening in upper plate 14 and carries actuating arm 56 above upper plate 14 in vertically adjustable position between a pair of nuts 60 whereby arm 56 can be adjusted to depress button 59 and actuate switch 55 immediately prior to the end of the piston downstroke. Switch 55 controls valve 47 to cut off the air supply to cylinder 31 whereby the timed relation between switch 55 and the end of the piston downstroke reduces press vibration and provides sufficient time for valve 47 to shift to exhaust thereby precluding piston return against air pressure remaining in cylinder 31.

In FIG. 5, there is schematically illustrated an energizing circuit including switch 55 for shifting air valve 47 between positions establishing air communication between tank 48 and cylinder 41 for driving piston 34 downwardly and exhausting the air in cylinder 31. Power is provided from suitable source, not shown, via leads 60 and 61. Spring biased, normally open contacts 62 of latching relay 63 are closed by energization of coil 64 via leads 60 and 65, normally closed contacts 66, 67 of a command switch 68, lead 69, coil 64, and leads 70 and 61. Command switch 68 may be a conventional single pole double throw switch, the switch herein having a switch operator 71 spring biased to a normally closed position with contact 67.

Command switch 68 is actuated by work passing through the die set area 13 into abutment with switch operator 71 to close a circuit through contacts 66 and 72 and open the circuit through contacts 66 and 67, whereby coil 64 is de-energized. Contacts 62 are held closed, however, by a latch 73 operated by a latching coil 74, latch 73 latching contacts 62 closed immediately upon the closing thereof via coil 64. Closing contacts 66 and 72 completes an energizing circuit to solenoid 75 of air valve 47 to shift the latter into position providing air under pressure from tank 48 into working chamber 39 to drive ram plate 34 downwardly, the energizing circuit comprising leads 60 and 65, contacts 66 and 72, lead 76, contacts 62, lead 77, solenoid 75 and leads 78 and 61.

Near the end of the downstroke of piston 34, actuating arm 56 depresses button 59 to close normally open switch 55 and complete an energizing circuit for latching coil 74 via leads 60 and 79, switch 55, lead 80, coil 74 and leads 70 and 61, to release latch 73 and thereby allow contacts 62 to open. Opening of contacts 62 interrupts the energizing circuit for solenoid 75 and valve 47 is shifted by its spring return to exhaust air from cylinder 31.

Air flow from tank 48 into cylinder 31 is thus interrupted and spring return assembly 20-24 and cushioned stops 26 act to return ram plate 12. Return of ram plate 12 opens switch 55 and command switch 68 is thereafter automatically reset upon removal of the work to re-establish the energizing circuit hereinbefore described through contacts 66 and 67 whereby contacts 62 are again closed and the air press is cocked ready for another downstroke. Air can thus be provided into cylinder 31 substantially instantaneously with actuation of switch 68 whereby lag in ram plate response is substantially eliminated.

Thus it is apparent that the objects of my invention have been fully accomplished. Direct driving force is applied to the ram plate due to the mounting of the piston and cylinder on and between the ram and upper plates respectively. Low air pressure can be used due to the large lateral dimensions of the cylinder. Lighter springs are utilized to return the ram plate since an initial return thrust is provided by the rebound effect of the ram plate against stop cushions 29, thus further reducing the air pressure required to drive the ram plate downwardly against the bias of springs 24. Noise at either end of the stroke is substantially eliminated and vibration greatly reduced by the provision of the rubber cushions 29 and 43. Cutting off the air supply to the pneumatic cylinder prior to the end of the downstroke reduces press vibration and provides sufficient time for valve 47 to shift whereby the return stroke does not operate against air pressure in cylinder 31. Switch button 59 has sufficient travel to accommodate closure of switch 55 prior to the end of the power stroke.

Having thus described and illustrated a preferred embodiment of our invention, it will be understood that such description and illustration is by way of example only and that such modifications and changes as may suggest themselves to those skilled in the art are intended to fall within the scope of the present invention as limited only by the appended claims.

What we claim as new is:

1. In an air actuated press, a bed, a plurality of upright guideposts fixed at their lower ends to said bed, an upper plate engaging said guideposts adjacent the upper ends thereof, means mounting said upper plate for vertical adjustment to selectively vary the height thereof above said bed, a ram plate vertically slidable on said guideposts and defining a die set area with said bed, pneumatically operated means for urging said ram plate downwardly toward said bed including a piston and cylinder disposed between said upper plate and said ram plate, valve means operable to supply air under pressure into said cylinder and to exhaust the same, a plurality of resiliently deformable stops positioned to limit downward movement of said ram plate and provide an initial upward return thrust thereto at the end of the downstroke thereof, and spring means suspending said ram plate from said upper plate for completing the return of said ram plate, wherein said cylinder is directly mounted on the undersurface of said upper plate and said piston is directly mounted on the upper surface of said ram plate in vertical registry with said cylinder, the lateral dimension of said piston being very near the lateral dimension of said ram plate thereby providing a large piston surface area against which air under pressure introduced into said cylinder can react.

2. An air press according to claim 1 said mounting means including a plurality of upright rods fixed at their lower ends to said bed and extending upwardly through said ram plate and said upper plate, and means releasably clamping said upper plate in vertically adjusted position along said rods.

3. An air press according to claim 1 including means mounting said stops on said bed, said stops being vertically adjustable relative to said bed.

4. An air press according to claim 1 including resilient means disposed between said upper plate and said ram plate for cushioning said ram plate at the end of its upstroke.

5. An air press according to claim 4, said resilient means being carried on the face of said piston and engageable against the undersurface of said upper plate.

6. In an air actuated press, a bed, a plurality of upright guideposts fixed at their lower ends to said bed, an upper plate engaging said guideposts adjacent the upper ends thereof, means mounting said upper plate for vertical adjustment to selectively vary the height thereof above said bed, a ram plate vertically slidable on said guide-

posts and defining a die set area with said bed, pneumatically operated means for urging said ram plate downwardly toward said bed including a piston and cylinder disposed between said upper plate and said ram plate, valve means operable to supply air under pressure into said cylinder and to exhaust the same, a plurality of resiliently deformable stops positioned to limit downward movement of said ram plate and provide an initial upward return thrust thereto at the end of the downstroke thereof, and spring means suspending said ram plate from said upper plate for completing the return of said ram plate, including means responsive to a predetermined downward movement of said ram plate and controlling said valve means to interrupt the supply of air into said cylinder, wherein said control means includes a switch mounted on said upper plate, and a switch actuator carried by said ram plate and extending above said switch whereby downward movement of said ram plate carries said actuator into engagement with said switch to actuate the same, wherein said actuator includes a rod carried by said ram plate and extending upwardly above said upper plate, and an arm carried by said rod above said switch, together with means mounting said arm on said rod for vertical adjustment therealong, thereby to vary the point in said downstroke at which said switch is actuated.

7. An air press according to claim 6 said mounting means including a plurality of upright rods fixed at their lower ends to said bed and extending upwardly through said ram plate and said upper plate, means releasably securing said upper plate in vertically adjusted position on said rods above said bed, means mounting said stops on said rods for vertical adjustment therealong, said cylinder being directly mounted on the undersurface of said upper plate and said piston being directly mounted on the upper surface of said ram plate in registry with said cylinder, and resilient cushions carried on the face of said piston and engageable against the undersurface of said upper plate.

8. In an air actuated press, a bed, a plurality of upright guideposts fixed at their lower ends to said bed, an upper plate engaging said guideposts adjacent the upper ends thereof, means mounting said upper plate for vertical adjustment to selectively vary the height thereof above said bed, a ram plate vertically slidable on said guideposts and defining a die set area with said bed, pneumatically operated means for urging said ram plate downwardly toward said bed including a piston and cylinder disposed between said upper plate and said ram plate, valve means operable to supply air under pressure into said cylinder and to exhaust the same, a plurality of resiliently deformable stops positioned to limit downward movement of said ram plate and provide an initial upward return thrust thereto at the end of the downstroke thereof, and spring means suspending said ram plate from said upper plate for completing the return of said ram plate, wherein said cylinder is directly mounted on the undersurface of said upper plate and said piston is directly mounted on the upper surface of said ram plate in vertical registry with said cylinder, and means responsive to a predetermined downward movement of said ram plate and controlling said valve means to interrupt the supply of air into said cylinder prior to the end of said downstroke and before said ram plate engages said stops.

9. An air press according to claim 8 wherein said control means includes a switch mounted on said upper plate, and a switch actuator carried by said ram plate and extending above said switch whereby downward movement of said ram plate carries said actuator into engagement with said switch to actuate the same.

10. In an air actuated press, bed means, upper plate means, a plurality of guideposts extending from said bed means toward said upper plate means, ram plate means slidable on said guideposts between said upper plate means and said bed means, a plurality of rods extending

from said bed means toward said upper plate means, means releasably clamping said upper plate means in vertically adjusted position along said rods, pneumatically operated means for urging said ram plate means toward said bed means including a cylinder directly mounted on the undersurface of said upper plate means and a piston movable in said cylinder and directly mounted on the upper surface of said ram plate means, valve means operable to supply air under pressure into said cylinder and to exhaust the same, a plurality of resiliently deformable stops mounted on said rods for vertical adjustment therealong, said stops being positioned to limit movement of said ram plate means toward said bed means and provide an initial return thrust thereto, and spring means for completing the return of said ram plate means.

11. In an air actuated press, bed means, a plurality of guideposts extending upwardly from said bed means, upper plate means, ram plate means vertically slidable on said guideposts between said upper plate means and said bed means, means releasably securing said upper plate means in vertically adjusted position, pneumatically operated means for urging said ram plate means downwardly toward said bed means including a cylinder directly mounted on the undersurface of said upper plate means and a piston movable in said cylinder and directly mounted on the upper surface of said ram plate means, valve means operable to supply air under pressure into said cylinder and to exhaust the same, resiliently yieldable

cushion means positioned for engagement by said ram plate means upon predetermined downward movement thereof, and return spring means for said ram plate means.

12. An air press according to claim 11, the lateral dimension of said piston being very near the lateral dimension of said ram plate thereby providing a large piston surface area against which air under pressure introduced into said cylinder can react.

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