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E. DAVIS ET AL

2,367,103

PRESS FOR CONSOLIDATING POWDER IN DETONATING CAPS AND THE LIKE

Filed April 10, 1943

2 Sheets-Sheet 1

FIG. 1

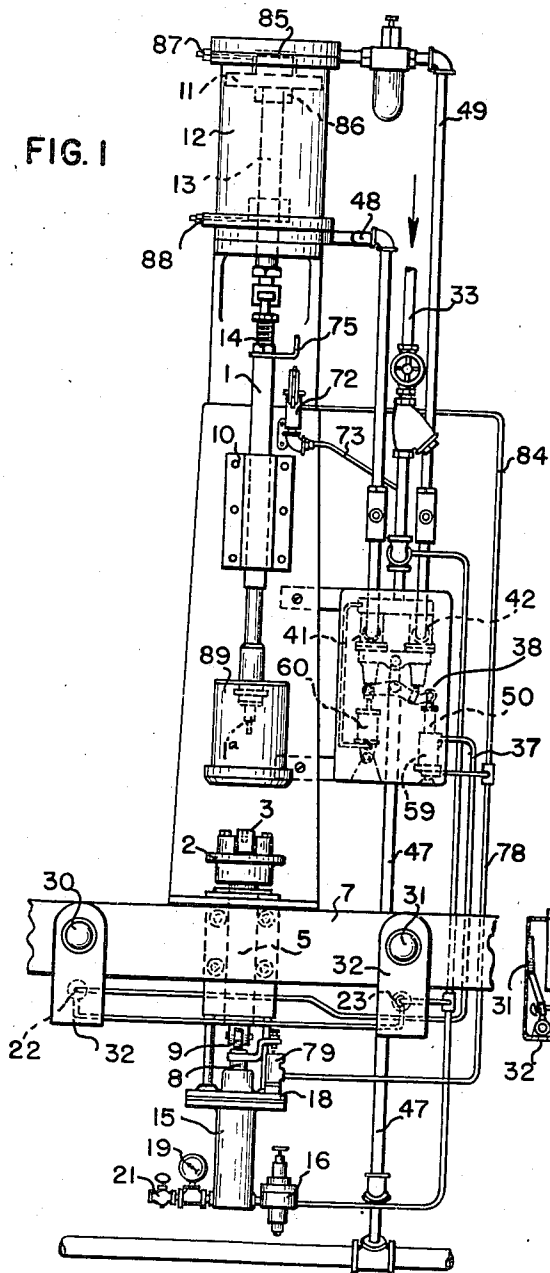
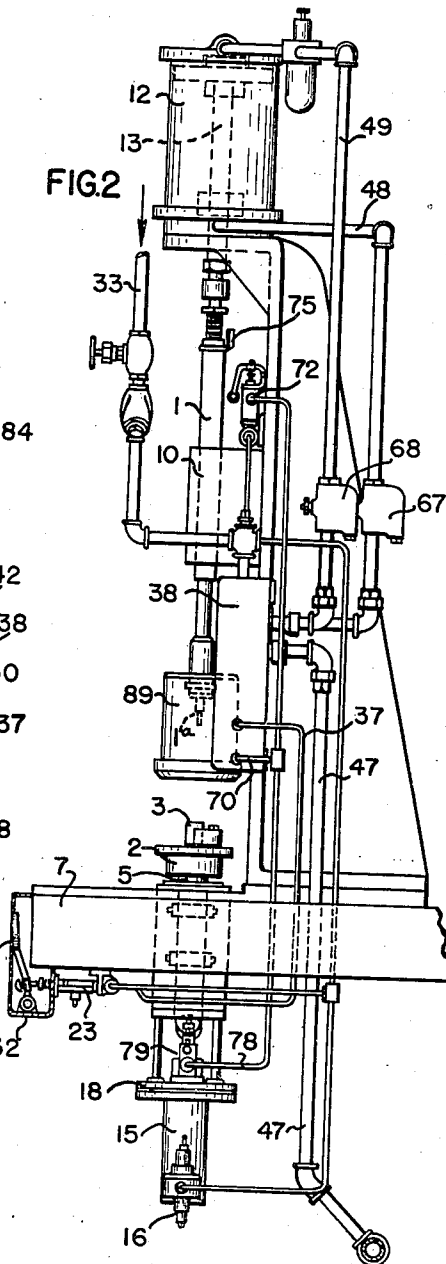


FIG. 2



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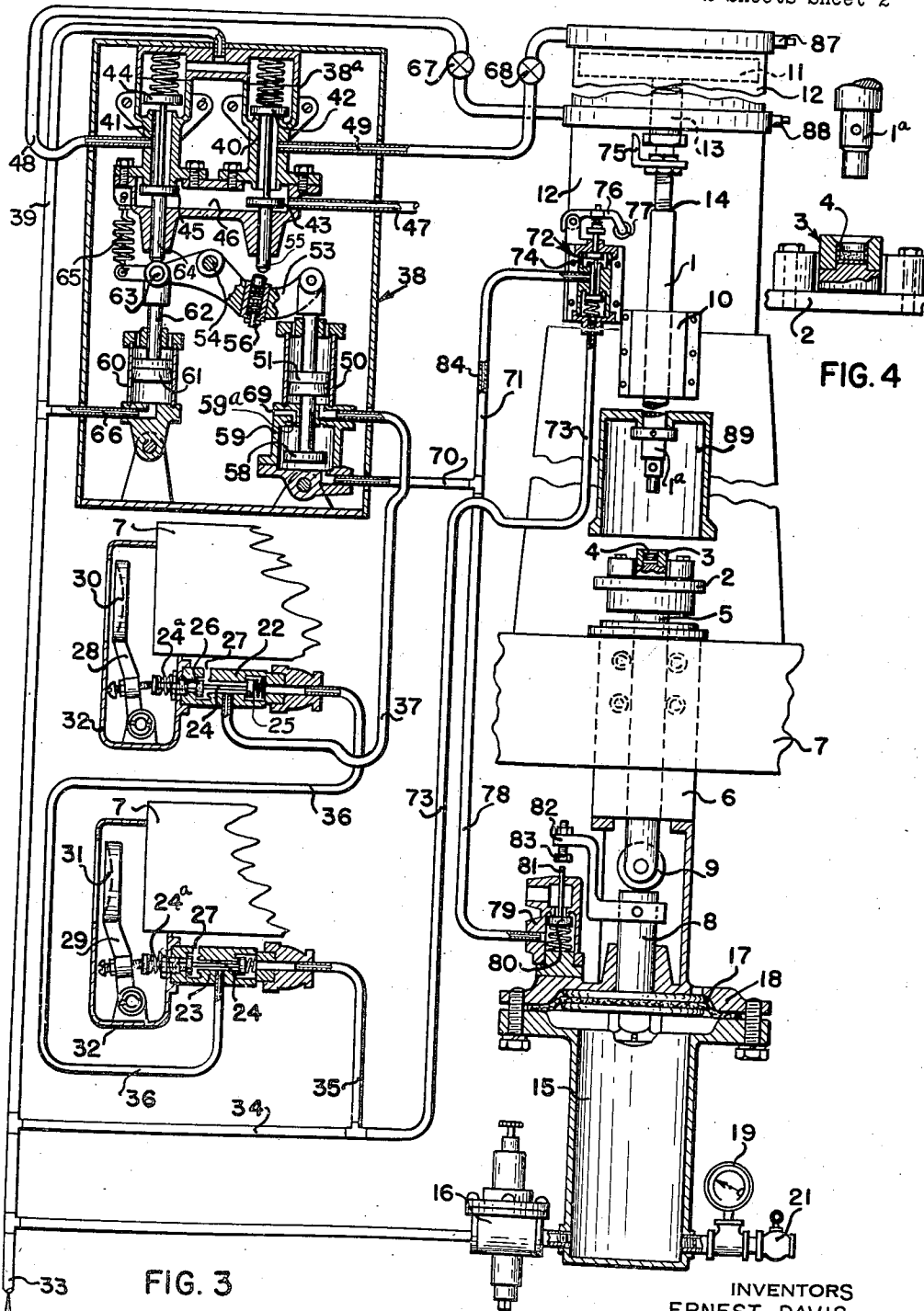


FIG. 3

FIG. 4

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PRESS FOR CONSOLIDATING POWDER IN
DETONATING CAPS AND THE LIKE

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2 Claims. (Cl. 100—71)

This invention relates, generally, to pressing machines, and particularly to machines for packing or consolidating material, as in a container or cap, as for instance, a machine for consolidating fulminating powder and the like in detonating caps. It has for its object such a machine wherein the machine is controlled by a two hand safety control and the pressure for packing the material is applied with an exact or accurate predetermined pressure, and a machine in which the consolidation is accomplished automatically, and in no way depends upon the human element of the operator.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings, in which like characters designate corresponding parts in all the views.

Figures 1 and 2 are fragmentary front and side elevations of a machine for consolidating material in detonating caps, embodying our invention.

Figure 3 is a fragmentary elevation, partly diagrammatic, of parts seen in Figure 2.

Figure 4 is an enlarged fragmentary detail view of the punch and die which coact to consolidate the material in the cap.

This press for packing or consolidating material to an exact, accurate or predetermined degree, includes cooperating pressing elements, one of which is a head reciprocally movable into and out of coaction with the other element to consolidate material in a container or a cap, power means for actuating the reciprocating element, yielding pressure means for applying a predetermined yielding pressure to confine the resultant pressure of the reciprocating element to an exact predetermined amount, when said elements coact, so that owing to the yielding movement, the material is consolidated to an exact degree, and means for controlling the operation of the power means. The press further includes a two hand control with means for locking the two hand control in operated position, and release means, the locking being controlled by the movement of the reciprocating element and the release being controlled by the yielding movement.

As the power used is compressed air, the motor is pneumatic or pressure operated and is of the cylinder and piston type. Preferably, the motor is double acting. The yielding resisting means, which determines the exact consolidat-

ing pressure applied to the fulminating powder in the cap, is also pneumatic and here shown as applied through a diaphragm. The two hand control controls the flow of power or compressed air to and from the motor, and hence includes manually operated valves, a reversing control valve for controlling the flow of air to one end or the other of the cylinder, a locking means and a release valve.

The pneumatic, yielding, resisting pressure to determine the exact pressure applied to the powder in the cap is the principal feature of the invention. This resisting feature compensates for inertia or momentum developed by the reciprocating head under the force of the piston, which inertia heretofore in machines of this type has been one of the causes of explosions while the powder is being consolidated.

In the illustrated embodiment of the invention, the exact consolidating pressure is pneumatic pressure applied to the element, which supports the detonating cap, so that said element or the detonating cap is held against the reciprocating element with a predetermined pressure, and yields when that pressure is reached.

1 designates one pressing element, which carries a tool or punch 1^a, and 2 the other pressing element for carrying a die 3 in which a detonating cap, as 4, is placed. The element 1 is the upper press head and the element 2 is the lower press head. The lower press head is here shown as the head of a ram, the stem 5 of which is suitably mounted in a guide 6 carried by the frame 7 of the machine, the stem being here shown as thrusting against a plunger 8 to be presently described, the stem having a roller 9 coacting with the plunger 8. The head 1 reciprocates in a suitable guide 10 on the frame and is actuated by a piston 11 working in a cylinder 12 carried by the frame, the piston 11 having its rod 13 connected at 14 with the upper end of the head 1. The flow of motive fluid, which is compressed air, to and from the cylinder 12 is controlled by a two hand control.

The other element 2 or the ram including the stem 5 is, in the form shown in Figures 1, 2 and 3, always under a predetermined pressure or acted upon by pressure operated means, which presses it upwardly with a predetermined pressure against the punch 1^a, when the head 1 is at the end of its downward movement. This pressure operated means is here shown as a cylindrical chamber 15, which is in open communication with the source of compressed air through a pressure regulating valve 16. The pressure

within the chamber 15 is effective on a movable element, preferably a diaphragm 17 suitably mounted in a diaphragm chamber 18, this diaphragm thrusting against the plunger 8. The plunger 8 is shown as connected to the diaphragm. The chamber 15 is provided with a suitable gage 19 which indicates the amount of pressure resisting diaphragm 17. 21 designates a bleed-off valve for the chamber 15. When air is admitted to the cylinder 12 by the operation of the two hand control to actuate the head 1 downward, it engages the material as fulminating powder, which has been placed in the detonating cap and presses the element 2 and the stem 5 of the ram downward against the diaphragm 17. The diaphragm 17, being pressed upwardly by a predetermined pneumatic pressure, yields when the predetermined pressure for that particular consolidation is reached. Various powders require different consolidations so that the predetermined pressure in the diaphragm chamber 15 is adjustable to various degrees of resistance. The yielding movement, as will be presently described, controls and times the retractile movement of the head 1.

The compressed air system and the two hand control will now be described. The piston 11 in the cylinder 12 is double acting, that is, it is retracted by air pressure. The air pressure to one side or the other of the piston is controlled by a reversing control valve, which is in turn controlled by a two hand control. The two hand control, as here shown, comprises a pair of valves 22, 23 suitably mounted on the frame 7 of the machine on the front side thereof, these being connected in series in the feed system. These valves are of the combined intake and exhaust type, and each includes a casing and a movable member 24 therein, a normally-closed, spring-pressed intake valve head 25 controlling the intake of air, and a normally-open exhaust valve head 26 controlling the exhaust of air. A passage 27 allows air to exhaust to the atmosphere. The movable members 24 of the valves are operated by levers 28, 29 respectively through resilient means, as 24^a. Buttons or heads 30, 31 exposed on the front side of the machine, when operated, move the levers 28, 29. The heads 30, 31 are located in suitable boxes 32 having openings through which the heads 30, 31 are accessible. One valve casing, as the casing of the valve 23, is connected in the main feed line 33 through pipes 34, 35, and the casing of the valve 22 is connected by a pipe 36 to the intake end of the casing of the valve 22. The casing of the valve 22 is connected by a pipe 37 to means for operating the control or reversing valve. 38 designates the reversing valve, this including a casing 38^a, which is connected in the feed line 33 by a pipe 39, and valve members 40 and 41 therein, these valve members controlling respectively the downward movement of the head 1 and the retrograde movement thereof. The valve members 40, 41 are of the combined intake and exhaust type, the valve member 40 including a normally-closed intake valve head 42 and a normally-open, spring-pressed exhaust valve head 43. The member 41 contains a normally-open intake valve 44 and a normally-closed exhaust valve head 45. The passage or casings in which these valve members 40, 41 are located communicate through their exhaust valves, when open, with an exhaust chamber 46 from which leads an exhaust pipe 47. The valve member 41 is connected by a pipe 48 to the lower end of the cylinder 12.

The valve member 40 is connected by a pipe 49 to the upper end of the cylinder 12.

The intake valve head 42 and exhaust valve head 43 are operated by a pressure operated means or motor 50 supplied with compressed air through the pipes 34, 35, casing of valve 23, past the intake valve head 24 when open, pipe 36 through the valve casing 22, when operated to open the intake valve head thereof, and thence through pipe 37 to the motor 50 to actuate the piston 51 therein. The valve 41 is operated by a similar motor 60 which is in open communication with the feed pipe 33 through the pipe 66 so that normally when the manual valves are in their normal or unoperated position and the air is not free to flow to the motor 50, the intake valve head 44 of the valve 41 is open and the exhaust valve 45 closed. When, however, air is admitted to the cylinder 50, the pressure therein overcomes the pressure in the cylinder 60 and opens the valve 32 to the intake of air, closes the valve 41 to the intake of air and closes it to the exhaust of air, due to the long and short arm of the reversing lever 53.

50 designates a cylinder having a piston 51 therein, the outer end of which is connected to a lever 53 pivoted between its ends at 54 to have a long arm and a short arm, the longer arm coacting with a stem 55, which thrusts against the exhaust valve head 43 of the valve member 40, when the lever is actuated by the piston 51. As here shown, the lever 53 is provided with a spring-pressed thrust member 56 for thrusting against the stem 55. The piston 51 also is provided with a tail rod carrying the valve head 58 located in a chamber 59.

The pressure operated means for holding the valve member 41 in its operated position comprises a cylinder 60 having a piston 61 therein, the rod 62 of which is pivoted at 63 to the short arm of the lever 53. The short arm of the lever 53 also thrusts against a plunger or stem 64, which in turn thrusts against the exhaust valve head 45 of the valve member 41, and the lever 53 is acted upon by a spring 65 tending to hold it with the short arm thrusting against the stem 64 and holding the valve member 41 with its intake valve head 44 open against a returning action of its spring and its exhaust valve head 45 closed, the spring 65 augmenting the piston 61. The cylinder 60 is in constant communication with the main intake pipe 39 through a pipe 66.

Normally air passes from the main line 33 through the pipe 39, the valve casing 38^a and the valve head 44 being open, past the valve member 44 and through the valve member 41, pipe 48 to the lower end of the cylinder 12, and thus holds the piston 11 in its elevated or retracted position, wherein the head 1 is held in its upper or open position. When the operator depresses both manuals 30, 31, air passes from the line 33 through the hand controlled valve 23, pipe 36, valve 22 and pipe 37 to the cylinder 50 actuating piston 51 therein, elevating the long arm of the lever 53, and thus overcoming the pressure against the piston 61 in the cylinder 60, which is connected to the short arm, and also the spring 65. This movement of the lever opens the intake valve head 42, closes the exhaust valve head 43 of the valve member 40, and also closes the normally-open intake valve head 44 and opens the exhaust valve head 45 of the valve member 41, so that air now passes from the pipe 39, past the open valve head 42 of the valve member 40 through pipe 49 to the upper end of the cylinder 12 to actuate

the piston 11 downward. The air on the lower side of the piston then exhausts back through the pipe 48 out past the now open exhaust valve head 45, exhaust chamber 46 and exhaust pipe 47. There are throttle valves 67 and 68 in the pipes 48 and 49 respectively to control the speed of the head 1.

Means controlled by the movement of one of the pressing elements, as the movement of the head 1, is provided for locking the valve members 40, 41 in their operated positions, or the position assumed when the two hand controls are operated. The locking means are controlled by the downward movement of the head 1 to be described. The operator, after depressing the buttons, and after the head 1 has moved a predetermined distance, can release the manuals 30, 31 and the press will continue through its consolidating operation and release automatically, after applying the predetermined pressure to the powder in the cap 4, in the construction shown in Figures 1, 2 and 3, when the diaphragm 17 is depressed against the predetermined pressure in the chamber 15. The locking means is here shown as the valve head 58 in the chamber 59, the valve head coacting with the seat 59^a at the upper end of the chamber 59, and an outlet passage 69 leading to the atmosphere from within the valve chamber. The chamber 59 communicates through the pipes 70, 71 and a valve 72 and pipe 73 with the feed pipes 33, 34. The valve 72 is of the combined intake and exhaust type and is normally arranged with its intake closed and its exhaust open, as shown in Figure 3, and this valve is operated by cam 75 carried by the head 1. After the head 1 has been actuated downward a predetermined distance, the valve 72 is operated to open its intake head and close its exhaust head, so that air will pass from the main feed pipes 33, 34, pipe 73, through the valve 72, pipes 71 and 70 to the chamber 59, and thus the pressure in the chamber 59 acting on the valve head 58 will hold it against its seat 59^a, it having been moved against its seat by the action of the piston 51 previously described. When the operator hears the momentary exhaust of air out through the exhaust passages 74 of the valve 72, she releases the manuals and the valves in the casing 38 will be temporarily locked in their operated positions, wherein air enters the upper end of the cylinder 12 through the pipe 49 and exhaust from the lower end through the pipe 48. The valve 72 is operated by a cam 75 on the piston rod 13 and normally spaced from a lever arm 76 pivoted on the casing of the valve 72 and coacting with the movable valve members of the valve 72. The lever 76 has an end arranged in the path of the cam 75, said end usually having a roller 77 for coacting with the cam. The cam 75 is so spaced from the roller, as to engage, after the head 1 is well on its stroke and before the head 1 reaches the powder in the cap.

The valves are locked in their operated positions before consolidation takes place. The pressure in the chamber 59 is released automatically by the relative movement of the head 1 and die-carrying element 2, and as shown in Figures 1, 2 and 3, it is operated by the movement of the stem 5 of the ram under the action of the head 1 and against the resistance of the predetermined pressure against the diaphragm 17. As shown, the pipe 70 is connected by a pipe 78 to an exhaust valve 79 having a normally-closed, spring-pressed, exhaust valve head 80, the stem 81 of which is arranged in the path of an arm 82 movable with

the plunger 8, and hence with the stem of the ram 5. The arm 82 has an adjustable head 83 thereon for coacting with the stem 81 and the head 83 is normally spaced from the end of the stem 81. The spacing is such that after the head 1 coacts with the material in the cap 4 and compresses it against the resistance of the diaphragm 17 and the diaphragm depresses a predetermined amount, the head 83 will open the exhaust valve 80, permitting air to exhaust from the valve chamber 59 through the pipes 70 and 78 and out through the exhaust passage of the valve 79. Thus, the piston 51 and lever 53 are free to return to their normal positions (Figure 3), due to the fact that the air has exhausted from the cylinder 50 through the pipe 37 and through the exhaust passage 27 of the hand controlled valve 22, as the operator has already released these valves 30, 31 upon hearing the momentary exhaust through the ports 74 of the valve 72. This momentary exhaust takes place while the exhaust valve head is moving to closed position, and the intake valve head is moving to open position, and both are in intermediate positions. At about this time, the guard 89 is in position and resting on element 2 protecting the operator from any explosion that might take place.

In the operation shown in Figures 1, 2 and 3, a detonating cap 4 is placed in the die 3 and a certain amount of material filled therein; the operator operates the manuals 30, 31, thus causing air to enter the top of the cylinder 12 and permit the air below the piston 11 to exhaust, and thus the head 1 begins its downward movement. During its downward movement and before the head 1 has reached the charge in the detonating cap, the cam 75 opens the valve 72, permitting air to enter the chamber 59 and lock the transfer valve in its operated position. The operator can now release the manuals 30, 31. The head 1 continues its downward movement whereupon the head contacts the material in the cap and is pressed against the predetermined resistance of the diaphragm 17, and after such movement, the head 83 opens the exhaust valve member 80, and thus exhausts the air from the locked chamber 59, permitting the reversing valve to return to its normal position, wherein air enters the cylinder 12 below the piston and the air exhausts from the cylinder above the piston. The compression applied to consolidate the material in the cap is that applied to the diaphragm 17 which is controlled by the regulating valve 16. By reason of this construction, the consolidation and proper height or compression may be extremely and accurately determined.

A pressure reducing valve or orifice 84 is provided in the pipe 71. Owing to the outlet 69 from the chamber 59, which is controlled by the valve head 58, immediately upon momentary opening of the valve, air will exhaust from the cylinder 59, and there is no liability of the pressure again building up in the chamber 59 to again close the valve 58, and hence operate the piston 51, because of merely a momentary opening of the exhaust valve 80. Also, to control the movement of the head, dash pots are provided at the upper and lower heads of the cylinder 12 for cooperating with plugs or projections 85, 86 on the piston above and below the piston head, these entering the dash pots at the ends of the strokes of the piston to cushion the strokes. These are air dash pots and the pressure there-

is controlled by check valves 87, 88 communicating with the dash pots.

In order to protect the operator from explosions that may occur during consolidation or compression of the material in the detonating cap, a shield 89 is provided on the head 1, which covers therewith, and which encloses the die element 2 before the head coacts with the material in the detonating cap to compress it.

The feature of this invention is, however, the control of the pressure applied to the material in the detonating cap by the pressure chamber 1 and the two hand safety control for controlling the operation of the head 1 and the machine. Various consolidations may be had by varying the amount of resistance in chamber 15. This pressure is controlled by pressure reducing valve 16.

What we claim is:

1. In a press for packing or consolidating material to a predetermined degree, the combination of cooperating pressing elements, each having a movement relatively to the other, one sliding movable toward the other, means for yieldingly resisting movement of the latter element, pressure operated actuating means for said movable element, a power fluid system connected to the pressure operated actuating means to supply power fluid thereto, said system having a control valve therein, fluid operated means for operating the control valve, a two hand control for controlling the operation of said control

valve operating means, means operated by the movement of said movable element for locking the control valve operating means in its operated position, and means operated by the other element during the yielding movement thereof for releasing the locking means.

2. In a press for packing or consolidating material to a predetermined degree, the combination of cooperating pressing elements coacting to have a yielding consolidating compressing movement, one of said elements being reciprocally movable toward and from the other, a cylinder and double acting piston for actuating the same, pressure operated means for applying a yielding compressing movement with a predetermined pressure to the other element, when said one element has been moved into coaction with the other element, a power fluid system having a reversing valve therein for controlling the flow of motive fluid to the cylinder and being normally in position to permit the flow of fluid to one end of the cylinder, fluid operated means for operating the reversing valve, two hand control for controlling the operation of the reversing valve operating means, means operated by the reciprocating element during its movement toward the other element for locking the reversing valve in its operated position, and means operated by the other element during its yielding movement for releasing the locking means.

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