United States Patent

[11] 3,580,558

[72] Inventors **Robert A. Helrigel**
Hastings;
James R. Brownell, Delton; Roderick K. Ward; Harry E. Keithley, Hastings, Mich.

[21] Appl. No. **789,868**
[22] Filed **Jan. 8, 1969**
[45] Patented **May 25, 1971**
[73] Assignee **E. W. Bliss Company**
Canton, Ohio

[54] **CUSHION MOUNTING IN PUNCH PRESS**
4 Claims, 6 Drawing Figs.

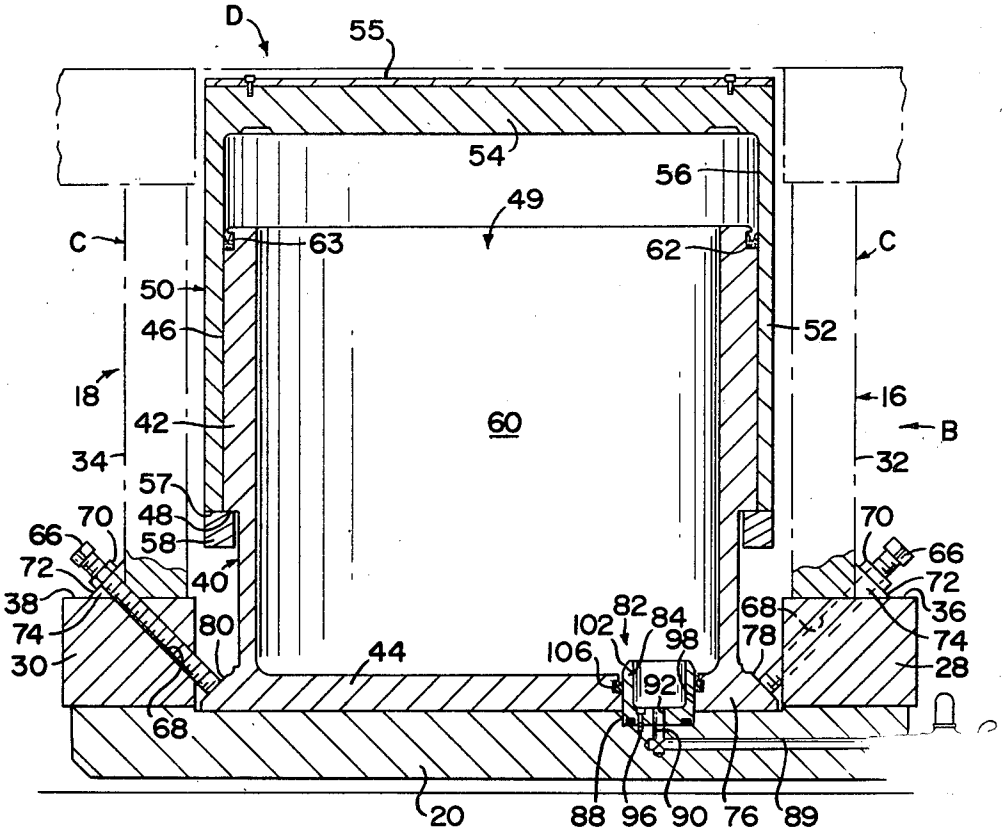
[52] **U.S. Cl.** **267/119**
[51] **Int. Cl.** **F16k 9/31**
[50] **Field of Search** 267/130, 119, 75

[56] **References Cited**
UNITED STATES PATENTS

2,417,794	3/1947	Werner	267/1(19)
3,451,667	6/1969	Anderson	267/1(30)

Primary Examiner—James B. Marbert
Attorney—Meyer, Tilberry and Body

ABSTRACT: A machine press bed assembly including an air cushion seated in the press bed, air input means integral with the press bed floor, aperture means in an end wall of the cushion accommodating said air input means, and holddown means penetrating the press bed sides engaging the cushion, the cushion being removable from said press bed by disengaging the holddown means.



Patented May 25, 1971 3,580,558

FIG. 1

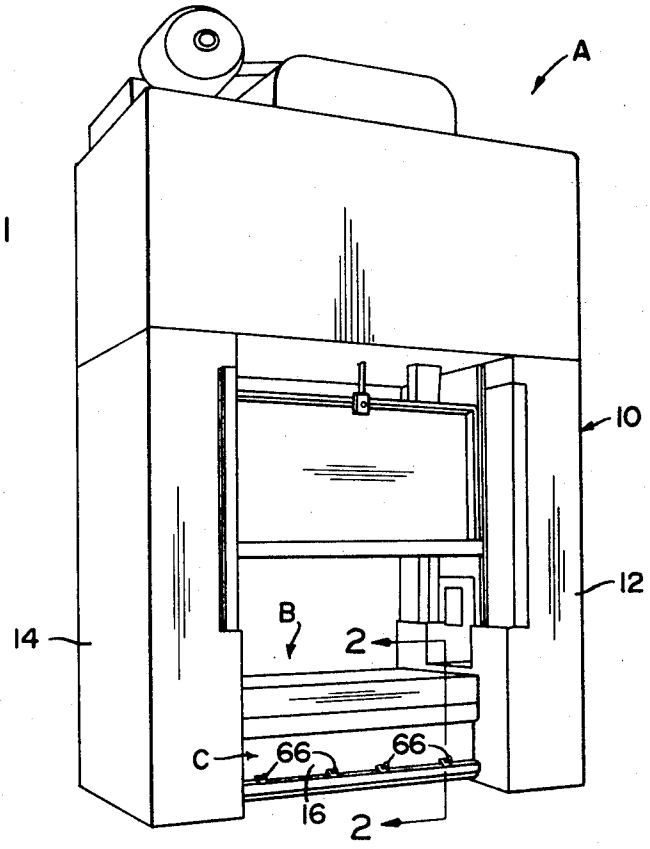
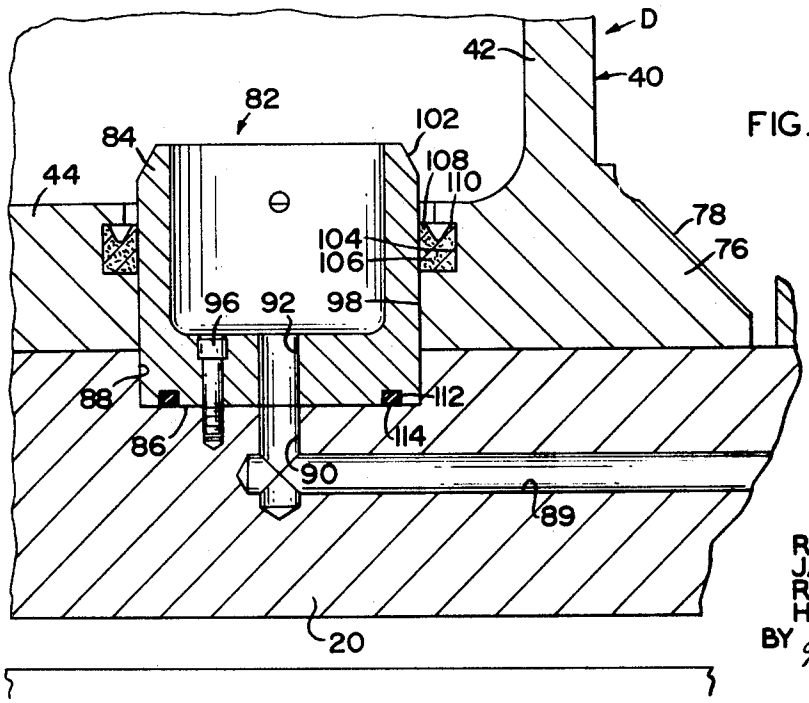
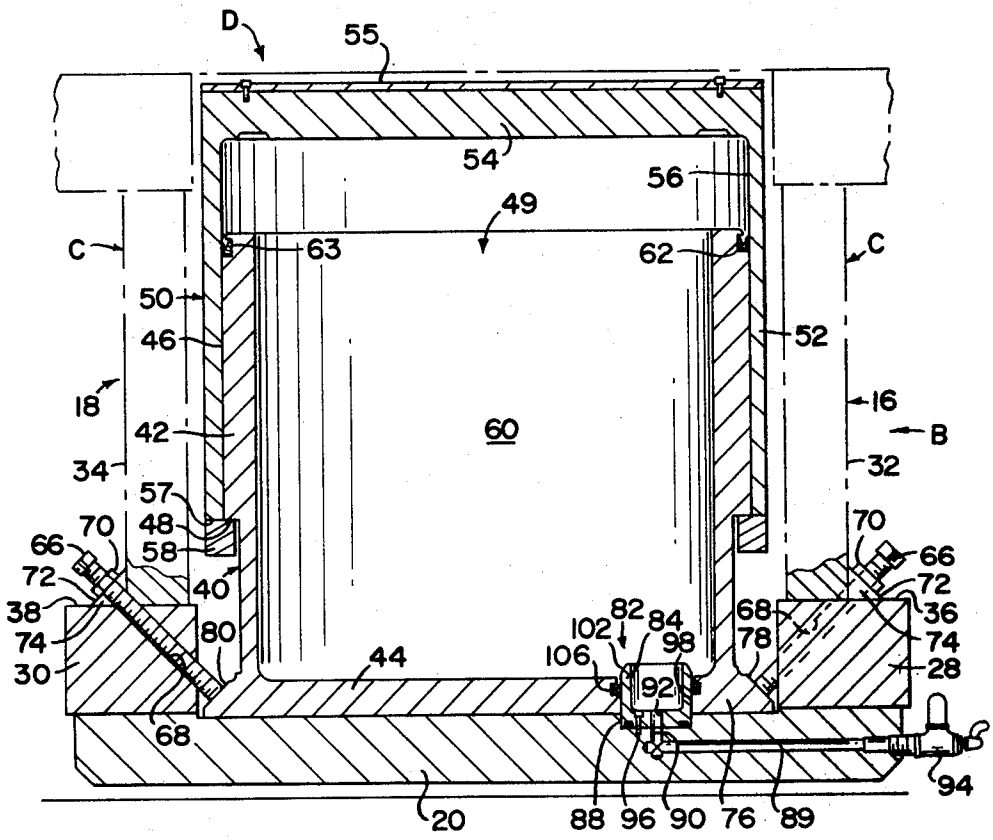


FIG. 6



INVENTORS
ROBERT A. HELRIGEL
JAMES R. BROWNELL
RODERICK K. WARD
HARRY E. KEITHLEY
BY Meyer, Tilberry & Body
ATTORNEYS.

FIG. 2



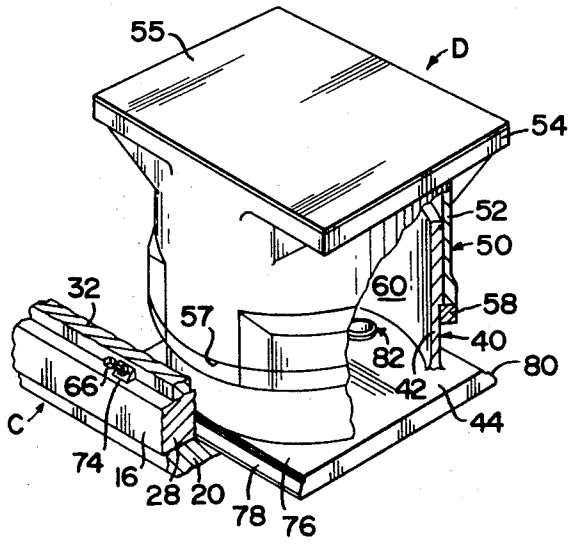


FIG. 5

INVENTORS
ROBERT A. HELRIGEL
JAMES R. BROWNELL
RODERICK K. WARD
HARRY E. KEITHLEY
BY Meyer, Tilberry & Body
ATTORNEYS.

Patented May 25, 1971 3,580,558

3 Sheets-Sheet 3

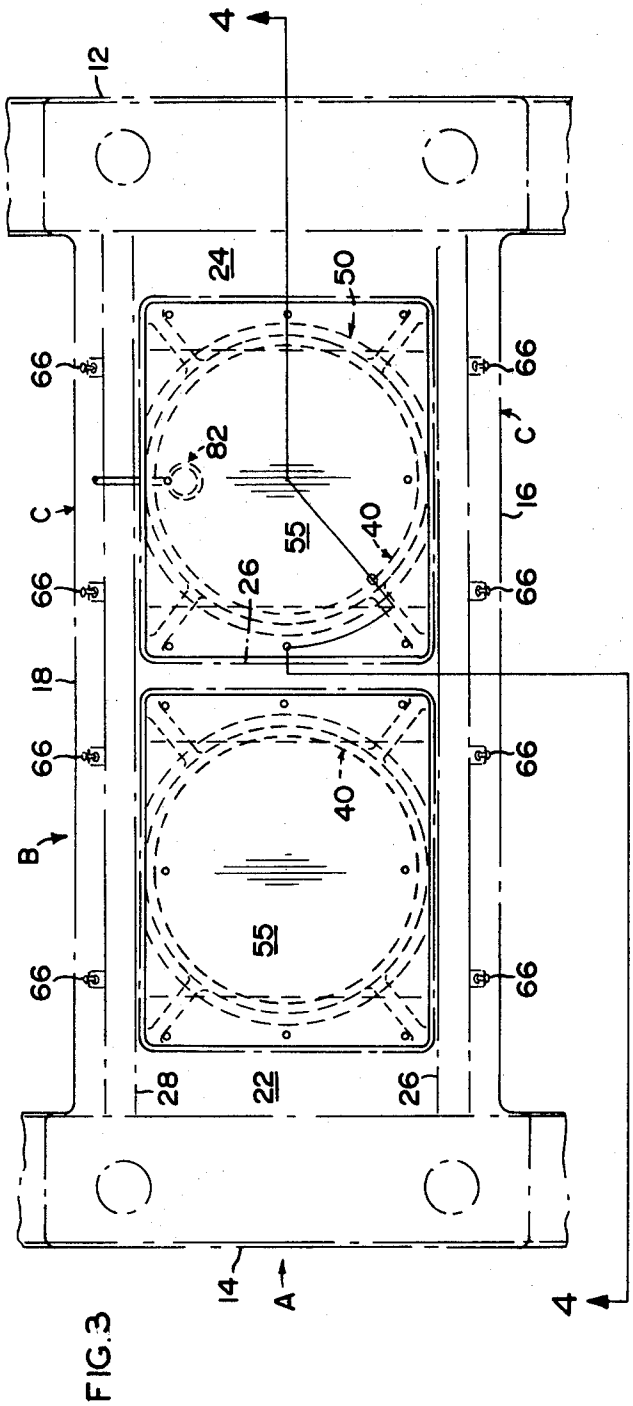


FIG. 3

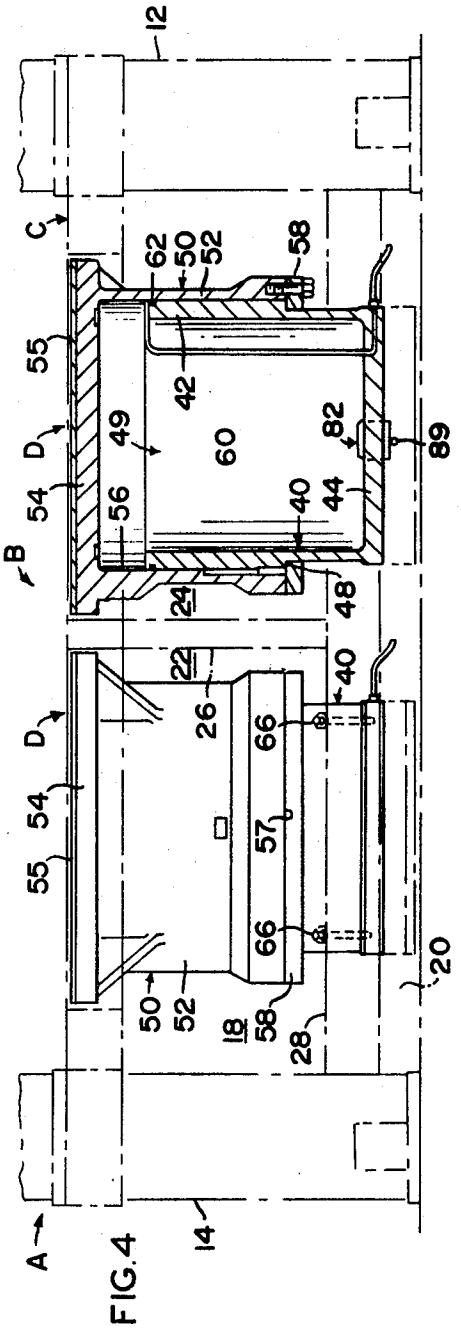


FIG. 4

INVENTORS
ROBERT A. HELRIGEL
JAMES R. BROWNELL
RODERICK K. WARD
HARRY E. KEITHLEY
BY Meyer, Tilberry & Body
ATTORNEYS.

CUSHION MOUNTING IN PUNCH PRESS

DESCRIPTION

The present invention relates to improvements in a machine press, and more particularly to a novel means for assembly and disassembly of an air cushion and press bed combination.

Air cushions of the type to which the present invention is directed are termed inverted C-type cushions, and comprise a lower, inner air piston and an upper, outer cylinder, the piston being in the form of an inner sleeve having a lower end wall which seats on the press bed floor; the upper cylinder being in the form of an outer sleeve which telescopically and reciprocally slides over the inner piston sleeve, having an upper end wall or working surface. The piston and cylinder are held in an extended relationship by a cushion of air between the opposed end walls. The invention will be described with particular reference to this type of cushion, although it will be appreciated that the invention has broader application with cushions of other types.

One advantage of the inverted C-type cushion is that the upper cylinder, being on top, encompasses the lower piston and prevents chips and dirt from getting between the piston and cylinder sleeves scoring the walls of the same. Dirt may collect on the piston, but it is wiped down in the cushion downstroke.

Although air cushions are used with different types of presses, for different press operations, a typical press using air cushions is a draw press. In order to contain the air cushion or cushions, the press bed is provided with a bed floor and upstanding sides, the air cushion being seated on the floor and encompassed by the bed sides. Depending upon the size of the press, several cushions may be employed in a side-by-side relationship within the press bed. A press bolster then seats on top of the press bed sides and the air cushion working surface or upper end wall acts on components of the press dies which penetrate the bolster. These components under the force of the cushion working surface or end wall provide substantially uniform pressure on all parts of the blank or workpiece during the drawing operation.

It is apparent that because of the function which the air cushions serve, they must occupy substantially the full space encompassed by the bed sides, and in particular the air cushion working surface or end wall must extend substantially completely across this space. The result is that clearances between the bed sides and the cushion, particularly the upper working surfaces thereof, will be small.

In addition, the cylinder or upper sleeve often is guided in its up and down motion by internal guide strips on the press bed sides, so that for this reason as well, clearances between the cylinder or upper sleeve and the press bed sides will be small.

Assembly of an air cushion to a press bed requires two steps or operations which heretofore have caused substantial problems. It is a relatively simple matter to drop or position an air cushion within the bed, but then the cushion must be secured to the bed, and the pressure chamber of the cushion must be connected to a source of air. The limited clearance between the cushion and the bed sides has made it difficult to arrive at a satisfactory solution to the assembly problem, and in particular, to a satisfactory means for securing the cushion to the bed and connecting the cushion to a source of air.

The reason why it is important to secure the air cushion to the press bed, particularly in the case of a cushion of the inverted C-type, is that the upper cylinder reciprocates rapidly under the force of the die components, with substantial inertia, causing the cushion on the upward stroke to jump upwardly on the bed floor. This is bad for reasons which will become apparent, but in addition, it is important that the cushions be accurately centered or positioned in the press bed, and this motion of the cushions makes it difficult to maintain the desired centering or positioning.

It is known to bolt the air cushion to the press bed floor from beneath the press bed, the bolts extending upwardly through the bed floor and engaging the piston member. One problem is that in order to have access to the bolts, it is necessary to excavate a pit beneath the press, or alternatively provide a means for tipping the press to obtain access to the underside thereof. The use of a pit clearly is employed in the case of larger presses. Whereas these were satisfactory solutions some years ago, high labor costs now make it prohibitive to use either recourse.

It also has been proposed to use a plurality of upstanding dowels positioned in the press bed floor, cooperating with holes in the bottom of the piston member end wall to locate the latter in the press bed, but permitting the cushion to be lifted readily from the bed. This proposal has proven unsatisfactory, since the upward forces of the cushion upper cylinder, on upward stroking of the press slide, still cause the piston member to jump up and down on the bed floor, shaving and wearing the dowels, ultimately causing them to break. After the dowels have worn, wear also begins to occur on guide strips for the upper cylinder, and scoring of the cylinder and piston sleeves can also occur.

In a rapid cycling press, up to 100 cycles per minute, the life time for dowels clearly is short.

The seriousness of this problem is such that manufacturers have gone to the extent of suggesting that operation or use of the press be modified to overcome the problem. The highest velocity of the press slide occurs at the slide up or down midstroke, and pressure is usually released from the air cushion at about the midupward stroke. To obtain release of the cushion at a point of lesser velocity, and reduce the intensity of the cushion movement, manufacturers have suggested adjustment of the press slide so that the pressure is released at about one-third stroke, but this clearly restricts versatility of the press.

It has also been proposed to cut holes in the press bed sides to facilitate assembly or removal of the cushion from the press bed, or to vary dowel design, but in all instances, the solutions have been either expensive or unsatisfactory.

Part of the problem of easy assembly of an air cushion to the press bed is the need to connect and disconnect air hoses with the cushion chamber. It is apparent that standard connections will interfere with ease of removal of the cushion, partly because of limited access between the cushion and press bed sides, and partly because of the time generally required for connecting and disconnecting conventional couplings.

To avoid the use of conventional couplings, an air connector has been employed seated on and part of the press bed floor, the air cushion piston being provided with an aperture which receives the air connector. The end wall of the air cushion piston slides over the air connector, the latter being connected with a source of air. This solution, however, has proved unsatisfactory since the up-and-down motion of the air cushion piston member on the locating dowels wears the air connector, and any packing seals between the connector and cushion piston end wall. This in turn results in air leakage and ultimately, after substantial wear of the dowels, in wearing of the air connector itself.

In accordance with the present invention, the above disadvantages are overcome by providing in a machine press which comprises a press bed including a floor and upstanding bed sides defining inner and outer surfaces, an air cushion including a lower piston member and an upper cylinder member, the lower piston member comprising an end wall seated on the press bed floor, the upper cylinder member being telescopically and reciprocally received on said piston member and including an upper end wall, wherein the clearance between the cylinder member and press bed sides is small, the cylinder member and piston member combining to define a cushion chamber for compressing a fluid between said end walls, which fluid biases the cylinder member upward; the improvement comprising in combination fluid input means seated on the press bed floor integral therewith, aperture means in the piston member end wall to accommodate said fluid input means; packing means sealing said aperture means in the space between said fluid input means and said piston member

end wall, said piston member further defining peripheral outwardly extending flange means adjacent the press bed sides; and holddown means penetrating the press bed sides from the outer surface inwardly engaging said flange means.

For purposes of this application, the fluid input means is integral with the press bed floor in the sense that it is bolted, welded or otherwise substantially permanently affixed to the floor.

It is a primary object of the present invention to provide a means for assembly and disassembly of an air cushion and a press bed by which the cushion is securely anchored within the bed, but is easily disassembled from the bed.

It is further an object of the present invention to provide a means for securing an air cushion to a press bed by which wearing of parts or surfaces is prevented, but which does not unduly interfere with assembly and disassembly of the cushion and the bed.

The invention, and the advantages thereof, will become apparent upon consideration of the following specification, with reference to the accompanying drawings, in which

FIG. 1 is a perspective view of a press assembly in accordance with the invention;

FIG. 2 is a section view taken along lines 2–2 of FIG. 1;

FIG. 3 is a top view of a press assembly bed and air cushion assembly in accordance with the invention;

FIG. 4 is a section view taken along line 4–4 of FIG. 3;

FIG. 5 is a perspective partially broken away view of an air cushion and press bed in accordance with the invention; and

FIG. 6 is an enlarged view of an air connector in accordance with the invention.

Referring now to the drawings, wherein the showings are for the purpose of illustrating the preferred embodiment of the invention only and not for the purpose of limiting the same, the figures show a press A which has a press bed B, the bed B including upstanding sides C which contain a pair of air cushion assemblies D (FIGS. 2—5). The design of the press and its use of air cushions is well known in the press art, as is the use of cushions in other types of presses, and further discussion of the press itself is not necessary, except with regard to the assembly and disassembly of the air cushion from the press bed in accordance with the present invention.

Turning to the drawings in detail, the press includes a frame 10 comprising vertically extending frame sides 12 and 14, the press bed B including, between the sides, front and rear upstanding walls 16 and 18 (of shorter height than the press sides) which will hereinafter be referred to as the bed sides.

Between the bed sides 16 and 18 and frame sidewalls, the bed is provided with a lower floor 20 (FIGS. 2—5), the bed sides and frame walls defining a pair of bed cavities 22 and 24 separated by an upstanding dividing wall 26 which extends between the sides 16 and 18. Each of the bed cavities is sized to house an air cushion D.

As shown in FIG. 2, the press bed sides 16 and 18 are comprised of longitudinally extending flanges or blocks 28 and 30, seated on the press bed floor 20, along the side edges thereof, and upstanding heavy flat plate members or ribs 32 and 34 secured to the upper surfaces 36 and 38 of the flanges. These components of the press bed preferably are all welded together to provide an integral unit.

Each air cushion D comprises a lower cylindrical piston member 40 (FIG. 2) including a cylindrical sleeve 42 and a lower end wall 44 which seats on the floor 20 of the press bed, between the press bed flanges 28 and 30. The sleeve includes an outer cylindrical bearing surface 46 terminating in a lower annular abutment surface 48. Defined by the sleeve 42 is an upwardly facing large opening 49.

Reciprocally and telescopically received on the lower piston member 40 and sleeve 42 is a movable cylinder member 50 including an upper, outer, cylindrical sleeve 52 and an upper flat end wall 54, the latter defining a working surface 55. The upper sleeve 52 is provided with an inner cylindrical bearing surface 56 which slidingly engages the bearing surface 46 of the piston member, and at the free lower annular edge 57 of the upper sleeve 52, the sleeve is provided with an annular stop 58 bolted to the sleeve and protruding inwardly from the bearing surface 56 to engage the abutment surface 48 of the piston member. This prevents upward withdrawal of the cylinder member 50 from the piston member 40, the upper cylinder member and lower piston member combining to define an internal cushion chamber 60 between the end walls 44 and 54 of the two members.

In a manner to be described, the chamber is pressurized with a suitable fluid, the pressure biasing the cylinder upwardly and being maintained by means of an O-ring seal 62 seated in the upper outer edge 63 of the piston member sleeve 42 between the piston member and the inner bearing surface 56 of the upper sleeve 52.

The type air cushion shown is a pneumatic inverted C-type cushion characterized in that the cylinder member is on top and the piston member below. The main advantage with this type cushion is that it is relatively free of contamination, since with the cylinder on top, chips and dirt cannot get between the piston and cylinder and score the bearing surfaces of the two members. Dirt may collect on the piston, but means not shown can be provided for wiping down the piston on the cushion downstroke.

On top of the press bed sides 16 and 18 it is conventional practice to position a press bolster, a large heavy plate member to which the press dies are attached. The cushion working surface 55 is spaced slightly below the bolster lower surface (when the cushion is fully extended), the working surface engaging components of the dies which penetrate the press bolster. The purpose of the cushion is to maintain a substantially constant force on the die components and thereby on the blank being formed. Because of this function, it is apparent that the working surface at least must substantially completely occupy the space between the bed sides as shown, and the clearance between the bed sides and the end wall 54 of the cylinder will be minimal.

Not shown are guides or guideways for movement of the cylinder member 50. Although the type of guiding utilized is not part of this invention, if the cylinder is externally guided with guideways on the inner sides of the press bed, for this reason as well the clearance between the press bed sides and the cushion will be minimal, and inadequate to obtain access to the inside of the press bed or into the press bed cavity once the cushion has been placed in the bed cavity.

Because the cushion is of the inverted C-type, it also is evident that it must be preassembled before being placed in the press bed, i.e., the cushion cylinder must be slipped over the cushion piston and lowered sufficiently below the piston abutment surface 48 to attach the stop 58 to the cylinder.

These two conditions, minimal access to the press bed cavity and no access to the cushion chamber, make it impossible to bolt the cushion to the bed floor from the upper side downwardly; i.e., either through the piston end wall 44, or from the inside of the bed cavity.

In accordance with the present invention, the cushion is secured to the press bed by means of a plurality of holddown pins 66 positioned at spaced intervals along the press bed sides (Notice FIG. 3, in which four holddown pins are shown along each side of the press bed.). The holddown pins penetrate the press bed sides at about 45°, and for this purpose, holes 68 are drilled through the flanges 28 and 30 of the press bed sides starting at about the outer junction point of the flanges 28 and 30 with the ribs 32 and 34, angled inwardly and downwardly to enter the bed cavity at a point slightly above the press bed floor. The holes are threaded to receive the holddown pins, which also are threaded, and to lock the holddown pins once threaded into place, they are provided with locknuts 70 bearing against angled surfaces 72 of wedged-shaped members 74 welded between the upper surfaces 36 and 38 of the flange members and the press bed ribs 32 and 34.

The air cushion piston end wall 44 is extended beyond the circumference defined by piston sleeve 42 so as to define a rectangular flange 76 occupying substantially the full floor

area of each press bed cavity. On opposite sides, adjacent the sides **16** and **18** of the press bed, the flange **76** is provided with opposed sloped flange surfaces **78** and **80** against which the holddown pins bear. This arrangement holds the cushion securely in place, and in operation, no difficulty has been experienced with the piston jumping up-and-down on the press bed.

Adjacent the rear side **18** of the press bed, secured to the bed floor **20**, is an air connector **82** comprised of a U-shaped hollow block member **84** having an end face **86** which is seated in a circular depression **88** in the upper surface of the press bed floor, the depression being sufficiently shallow so that the connector extends above the elevation of the bed floor. The press bed is drilled from the outside inwardly with a horizontal channel **89** which is in flow communication with a vertically extending drilled passageway **90** drilled downwardly into the bed floor. A centered opening **92** in the air connector block communicates with the vertically extending passageway **90**. At the outward exposed end of the horizontal channel **89**, a suitable valve nipple **94** is secured, adapted to be attached to a source of air.

Details on the air connector are shown in FIG. **6**.

The air connector **82** is bolted to the press bed floor by means of a plurality of annularly spaced bolts **96**, and it thereby becomes a substantially permanent or integral part of the bed. The cushion piston is provided with an aperture **98** in the end wall **44** thereof which aligns with the air connector, so that when the cushion is placed in the bed cavity and the piston end wall seats against the bed floor, the end wall passes over the air connector, the latter having a height sufficient so that it extends completely through the end wall, and has an exposed outer peripheral edge **102**. This edge is chamfered, so that when the piston member is lowered on to the press floor, it slides into position on the chamfered edge.

The inside wall of the aperture **98** in the piston end wall **44** is machined to define an annular seat **104** containing an O-ring packing **106**. Preferably, the packing has two upstanding flaring opposed lips **108** and **110** which bear against the opposed surfaces of the piston member end wall and air connector block to provide a pressure seal against these two surfaces. This prevents air from escaping in the space between the air connector and the piston member end wall. In addition, the air connector block is provided in its seated face with an annular groove **112** containing an O-ring seal **114** making the connection between the bed and air connector airtight.

It should now be apparent that the air connector and holddown pins of the invention cooperate to provide a novel means for assembly and disassembly of an air cushion in a press bed, which means overcomes the disadvantages of prior means of assembly. In particular the invention provides a means for securely holding the cushion in the press bed, one which does not interfere with connection or disconnection of the cushion. When it is desired to assemble an air cushion in the press bed cavity, it is a simple matter to lower the cushion into the cavity, over the air connector, and to turn the holddown pins, the latter securing the cushion to the extent that shaving and wear of the connector does not occur. To expand the cushion assembly, it is not necessary to connect air lines. To remove the air cushion, it is a simple matter to reverse the holddown pins, and withdraw the cushion from the bed cavity. By virtue of the holddown pins, use of the air connector becomes feasible both for assembly and disassembly of the cushion and bed. If the press were held in place by means of dowels, the up-and-down movement of the piston member on the press bed would quickly wear the packing **106**, causing leakage between the air connector and piston member end wall.

It is apparent that the advantages of the invention are achieved without the need of a pit beneath the press for access to the underside of the press bed, or without the need of a means for tipping the press.

It is further apparent that the means for assembly and disassembly of the air cushion and press bed in accordance with the present invention avoids the costs, time, and maintenance problems of the prior art.

Although the invention has been described with reference to specific embodiments, variations within the scope of the following claims will be apparent to those skilled in the art.

What we claim is:

1. A press assembly comprising

a press bed including a floor and upstanding bed sides;

a lower piston including an end wall on said press bed floor and an upstanding cylindrical sleeve;

an upper cylinder including an end wall and a downwardly extending sleeve telescopically and reciprocally received on said piston sleeve, the clearance between said upper cylinder and press bed sides being small;

said piston and upper cylinder combining to define a cushion chamber for compressing a fluid between the end walls thereof;

fluid input means integral with the press bed floor comprising a block member extending above the floor and passageway means in communication with a source of air;

aperture means in the end wall of said piston to accommodate said fluid input means; and

holddown pin means to hold said piston to the press floor, said holddown pin means comprising a plurality of pins penetrating the sides of said press bed and engaging surfaces of said air cushion piston.

2. A press assembly comprising:

a press bed including a floor and upstanding bed sides;

a lower piston including an end wall on said press bed floor and an upstanding cylindrical sleeve;

an upper cylinder including an end wall and a downwardly extending sleeve telescopically and reciprocally received on said piston sleeve, the clearance between said upper cylinder and press bed sides being small;

said piston and upper cylinder combining to define a cushion chamber for compressing a fluid between the end walls thereof;

fluid input means integral with the press bed floor comprising a block member extending above the floor and passageway means in communication with a source of air;

aperture means in the end wall of said piston to accommodate said fluid input means; and

holddown pin means to hold said piston to the press bed floor, said holddown pin means comprising a plurality of pins penetrating the sides of said press bed and engaging surfaces of said air cushion piston;

said piston end wall comprising flange surfaces extending outwardly beyond the circumference of the piston sleeve, said pin means engaging said flange surfaces.

3. The assembly of claim **2** wherein said press bed sides comprise flange means seated on opposed front and rear edges of the press bed floor, upstanding ribs seated on said flange means, said pin means extending downwardly and inwardly through said flange means from the upper surface of the flange means to an elevation slightly spaced from the press bed floor to engage said piston flange surfaces.

4. The press assembly of claim **2** wherein the press bed sides are in the front and back of the press, said piston end wall flange surfaces being adjacent the press bed sides, comprising at least two pins engaging each of the end wall flange surfaces.