United States Patent

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[54] **ARRANGEMENT IN SINGLE STOREY PRESSES FOR CHIPBOARD, FIBREBOARD OR THE LIKE**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **100/257,** 100/93, 100/269
[51] **Int. Cl.** **B30b 5/00**
[50] **Field of Search** 100/214, 257, 269, 35, 258; 72/441; 83/527, 529; 18/17I, 5M, 16M, 30

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ABSTRACT: A mechanism for regulating the stroke of a single opening press of the type which includes a plurality of piston and cylinder devices for moving a movable press table toward a stationary press table. Each of the piston and cylinder devices includes a bushing fixedly mounted in the cylinder for restricting the movement of the piston in the direction of movement of the movable table toward the stationary table to thereby limit the minimum separation between the opposing surfaces of the tables. The regulating mechanism includes a pair of spacers interposed between each of the pistons and the movable table, one of which insures the parallelism of the tables at the minimum separation, and the other of which controls the distance of the minimum separation.

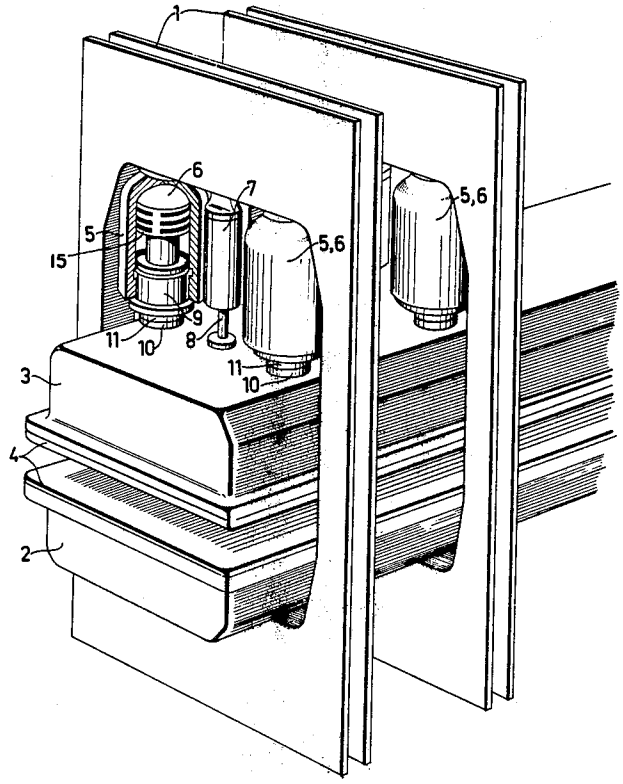


Fig. 1

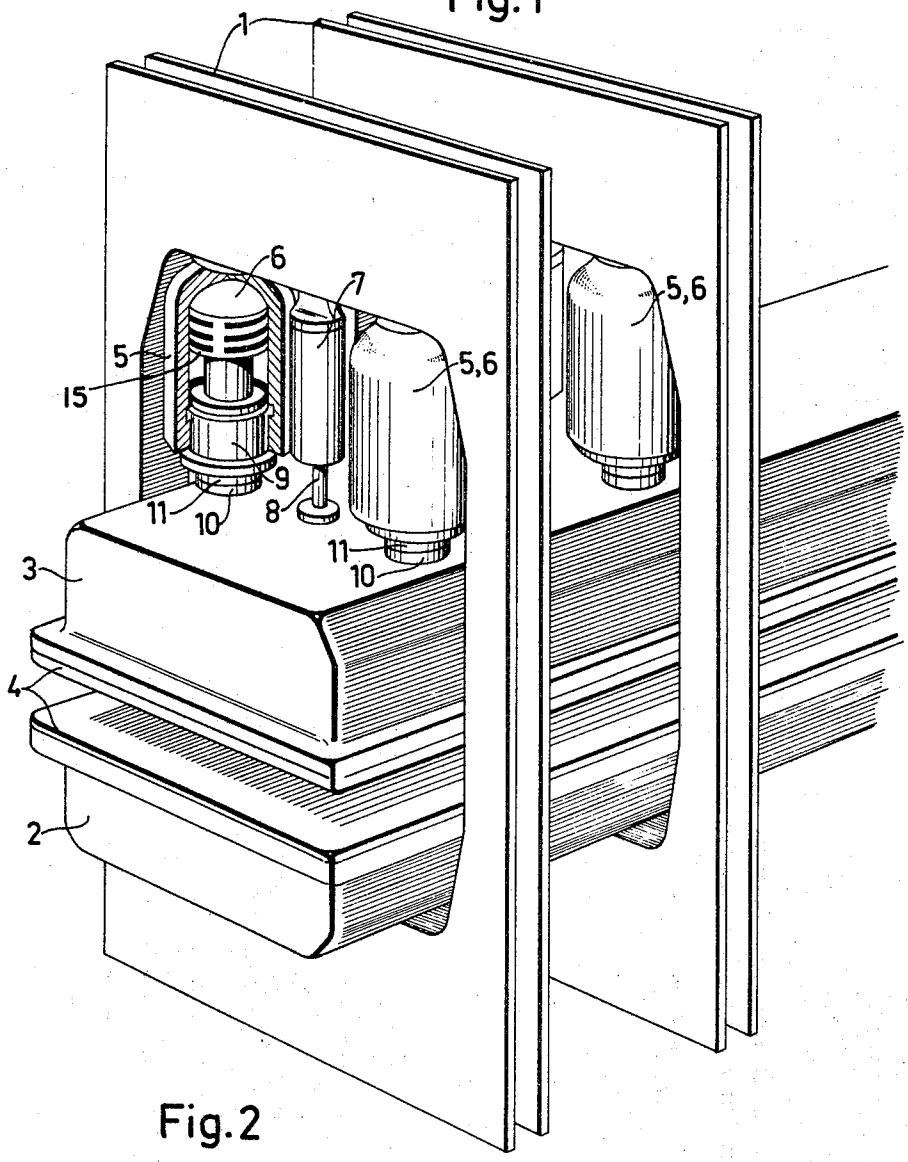
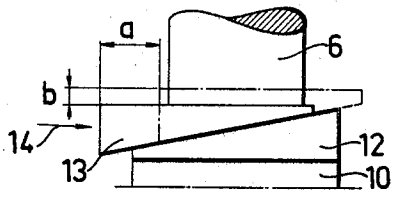


Fig. 2



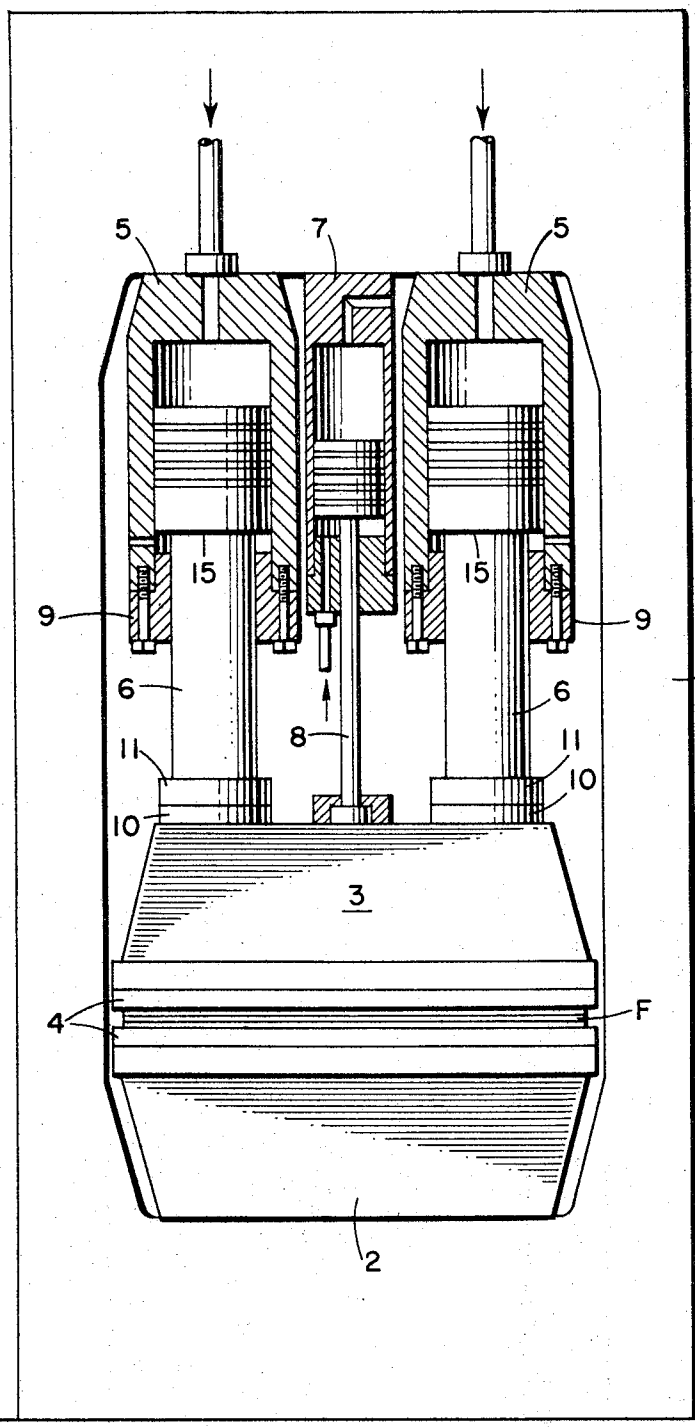


FIG. 3

ARRANGEMENT IN SINGLE STOREY PRESSES FOR CHIPBOARD, FIBREBOARD OR THE LIKE

In the manufacture of particle-board, chipboard, fibreboard, hardboard and the like thick, loosely packed fibre-mats are first formed and then converted into rigid sheets by being heated and simultaneously compressed in a hydraulic hot press. Because of deficiences in available forming machines the mass per unit area of the mats may vary by 10 percent or more. Mass distribution in the mats is not affected in principle by the pressing operation. However, the pressed sheets should have uniform thickness, and consequently it is one of the main functions of the press to convert mats of uneven thickness to sheets of even thickness.

Previously only multiple presses, i.e. presses comprising several openings, have been used for the manufacture of such articles, but it is becoming more and more common, particularly when manufacturing particle-board, to use single opening presses; among other things because the charging of such presses can be effected in a simpler manner and because such presses are more reliable in operation. Single opening presses, however, must be made very wide and long, e.g. the press tables being 2.5 x 10 meters or more, in order to obtain a sufficiently high rate of production.

In order to maximize the uniformity of thickness of the sheets from pressing operation to pressing operation it has been usual to use exchangeable spacers disposed along the long sides of the press between the pressing surfaces of the press tables, said surfaces being hereinafter referred to as pressing planes; the height of the spacers being selected according to the desired thickness of the sheets. Thus, the spacers restrict the extent to which the pressing planes can be brought together, at least along the long sides of the press. Spacers are always used when pressing particle-board and also often when pressing fibreboard. However, the use of spacers is accompanied by several disadvantages.

One great disadvantage is that the pressing planes are first loaded relatively uniformly over their entire surfaces, while the fibre or particle mat, under the influence of pressure and temperature, is compressed and yields until the spacers arrest the movement of the planes. The press force is then successively, but irregularly, transferred to the spacers, and toward the end of the pressing operation practically all the press force, or at least a major portion thereof acts on the spacers. The pressing planes must therefore, with regard to strength and deformation, be constructed to accommodate two completely different loading conditions.

The greatest disadvantage, however, is that when the press force is transferred from the mat to the spacers, high bending moments, and therefore correspondingly high elastic deformations, occur in the press tables, which result in wide variations in the thickness of the pressed sheets. Normally, therefore, it is necessary to sand the particle-board subsequent to the pressing operation in order to obtain a satisfactorily uniform thickness; the amount of material being removed by sanding being on the order of 1—2 mm. Sanding of the pressed sheets results in an appreciable increase in both operating costs and material consumption. It is obvious that the difficulties in keeping the deformation of the press tables, and thereby variations in thickness of the pressed sheets, at a minimum, increase with increasing size and particularly for relatively wide press tables. The percentage of the operating costs consumed by the sanding operation therefore tends to increase with an increase in the size of the press.

Another disadvantage is that the spacers and the means for attaching the spacers to the press tables restrict the space available for the press loader, and also limit the possibility of attaching desirable side plates to prevent the edges of the mat from being blown outwardly upon rapid closing of the press. Also, despite the fact that in many cases compressed air is used between each pressing operation to blow the press clean it is not possible to prevent some chips from remaining on the spacers, which not only damage the spacers but alter the intended stroke restriction as well, i.e. alter the limit to which

the press tables approach one another, causing the thickness and density of the pressed sheets to vary more than would otherwise be the case.

The spacers also create a problem when applying dielectric high frequency heating to the fibre or particle mats. The spacers must be electrically insulated, but nevertheless must be capable of enduring high temperatures and be able to resist the full press force.

The spacers themselves, and particularly the handling thereof during the changing of one set of spacers for another set, require considerable space; resulting in wider press tables and press platens. Consequently the press becomes heavier and more expensive than would otherwise be necessary. Handling of the spacers when heated to a temperature of 180—200° C and securely attached to the equally hot press platens, when changing spacer sets —as is often necessary— is also a difficult and unpleasant task.

It has been suggested in the prior art that the spacers be omitted altogether, thus eliminating the disadvantages associated therewith and instead to limit the stroke of the hydraulic press devices which move the movable press table and provide the press force; generally piston and cylinder devices. According to this suggestion each press cylinder is provided with a threaded adjustable stop ring against which a shoulder on the associated press piston abuts to limit the stroke of the piston. In principle the suggestion offers the correct solution to the problem. However, the suggested arrangement presents several disadvantages.

The use of threaded adjustable stop rings requires, for reasons of material strength, that the diameter of the piston of each press device be relatively small and that the number of such devices therefore be relatively large. This, in turn, means that the press becomes more complicated and more expensive than a press having a smaller number of press devices with larger diameter pistons. The threaded adjustable stop rings also render it difficult and make it more expensive to obtain an extra seal, which preferably is associated with the press devices, so that any liquid leaking through the high pressure seals of the pistons can be collected and returned to the tanks, instead of being allowed to run out over the press.

Moreover, despite the fact that the diameter of the pistons is relatively small, the threaded portion of each stop ring will nevertheless have a relatively large diameter, and therefore be difficult to make with the desired degree of accuracy. Also, the stop rings are not tightly screwed onto the press cylinders but are only loosely screwed thereon, rendering it difficult to avoid a certain amount of "give" or yield in the threads when the stop rings are subjected to a load due to incorrect thread form, pitch or squareness between threads. The amount of yield generally varies with different press devices, and may vary in a single press device at different positions of the stop ring with respect to the press cylinder. Naturally, this detrimentally influences the possibility of obtaining sheets of uniform thickness.

It is also difficult to set the stop rings when assembling the press so that the pressing planes are parallel when the pistons abut the stop rings, i.e. the zero position of the movable press table. The settings must be made when the stroke restricting means, i.e. the stop rings are not under load since otherwise it would be impossible to turn the stop rings; but on the other hand the settings must be checked when the restricting means are under load so that the influence of yield can be eliminated as much as possible. The settings therefore must be made during repeated application and release of hydraulic pressure in the press devices. When the final settings are reached, the press cylinders and stop rings must then be marked, including suitable graduations, to enable the settings to be changed for pressing sheets of different thicknesses.

However, the most serious disadvantage associated with the suggested arrangement is the inherent uncertainty with regard to the accuracy of the setting of each stroke restriction means while the press is in operation. Settings for desired sheet thicknesses can be made individually on each press device,

following the graduations marked thereon, the operator being trusted not to make a mistake. The settings can also be made common for all press devices by providing a single setting means for all of the stop rings, e.g. worm wheels and gears interlinked in a suitable manner. However, because of the size of the press, which may be more than 10 meters in length, the dimensional tolerances required in such a setting means are extraordinarily high if undesirable yield is to be prevented. Finally, repeated adjustments of the stop rings can result in wear on the threads, thus leading to errors in the settings of the stroke restricting means.

The suggested prior art arrangement therefore, is neither as accurate, nor as rugged, nor as reliable as desired.

The object of the present invention is to solve the aforementioned problems, and to provide a mechanism which in principle functions in the same manner as the suggested prior art arrangement, thereby making it possible to eliminate the use of spacers in single opening presses for hardboard, chipboard, etc., and thus eliminate the disadvantages associated therewith, but which does not possess the limitations or disadvantages inherent in said suggested arrangement. The term single opening press is intended to mean presses in which the movement of a press table opens and closes only one opening of the press. A press provided with an upper and a lower movable press table and an intermediate fixed press table is thus also a single opening press according to this definition, although the press has in reality two openings.

The invention will now be described in detail with reference to accompanying drawings, wherein:

FIG. 1 is a perspective view, partially in section, of a portion of a single opening press provided with the mechanism of the invention;

FIG. 2 is a side view of a modification of a portion of the mechanism shown in FIG. 1; and

FIG. 3 is a sectional view of the press shown in FIG. 1.

A single opening press is shown in FIG. 1, including a frame 1, a lower stationary press table 2 affixed to the frame and an upper movable press table 3 movably connected to the frame for movement toward and away from stationary table 2. Secured to each press table is a press platen 4 provided with suitable heating means (not shown) operating on hot water, steam or the like. Movable press table 3 is moved in the direction toward stationary table 2 by hydraulic press devices acting between table 3 and frame 1, such devices comprising press cylinders 5 secured to frame 1 and press pistons 6 movably mounted within cylinders 5. The return movement of the table 3, or movement in the direction away from table 2, is effected by hydraulic return devices comprising return pistons 8 affixed to table 3 and return cylinders 7 affixed to frame 1 and in which pistons 8 are movably mounted.

As shown in FIG. 3, hydraulic fluid is introduced into and removed from cylinders 5 through the upper portions of the cylinders, while the lower portions of the cylinders are vented to atmosphere. Conversely, hydraulic fluid is introduced into and removed from cylinders 7 through the lower portions of the cylinders, while the upper portions of the cylinders are vented to atmosphere. The fluid within cylinders 7 is maintained at a constant pressure sufficient to move table 3 away from table 2 when the pressure of the fluid within cylinders 5 is relieved. The pressure of the fluid within cylinders 5 is successively increased and relieved to successively move table 3 toward table 2. The force applied by the return devices is insignificant compared to the force applied by the press devices so that the press devices override the return devices during the downward stroke of each pressing cycle.

The extent to which the press tables can approach each other is restricted by bushings 9 fixedly mounted in press cylinders 5 and which constitute stroke restricting members against which abutment surfaces 15 on press pistons 6 abut.

A regulating mechanism is provided for adjusting the distance between the lower end of cylinders 6 and the upper surface of table 3 so that upon each downward stroke of the press devices the desired minimum spacing between platens 4 will occur exactly when abutment surfaces 15 abut bushings 9. Such mechanism comprises an alignment spacer 10 and an exchangeable spacer 11 disposed between the end of each cylinder 6 and the upper surface of table 3.

Alignment spacers 10 are positioned and adjusted when assembling the press in such a manner that when all of press pistons 6 are in contact with the stroke restricting bushings 9 under the actuation of a suitable hydraulic pressure in press pistons 5, the two pressing planes defined by platens 4 are as near to being parallel as possible with no clearance existing between the lower end of any of pistons 6 and the upper surface of press table 3. To accomplish this result, press table 3 is brought to a starting or zero position by being carefully lowered onto a number of spacers of equal thickness which are evenly spaced on the pressing plane of press table 2. Each spacer preferably comprises one exchangeable spacer 11 for the largest desired sheet thickness and one spacer 11 for the smallest desired sheet thickness, placed one upon the other. A relatively high pressure is then applied in the press devices, for example, a pressure reaching 75 percent of the maximum. The distance between the lower end surface of each piston 6 and the upper surface of table 3 is then measured, whereafter each alignment spacer 10 can be ground exactly to the measured distance between the associated cylinder 6 and table 3, and inserted therebetween. Any lack of parallelism between the lower end of a piston 6 and the upper surface of table 3 can be compensated for by grinding the associated spacer 10 to a corresponding wedge shape. Preferably, spacers 10 are affixed to the upper surface of table 3 after the spacers have been adjusted, as by tack welding or the like.

Exchangeable spacers 11 are, within practical tolerances, each of uniform thickness and all of the spacers for a particular sheet thickness are of equal thickness. As will be apparent, a certain thickness of spacers 11 corresponds to a particular distance or spacing between the pressing planes when press pistons 6 are in abutment with stroke restricting bushings 9, i.e. a particular thickness of the pressed sheet. Adjustment of the press for a different sheet thickness can be effected by changing all of the spacers 11 for spacers of another thickness. The thinner the sheets to be pressed, the thicker are spacers 11.

Prior to a pressing operation, the desired spacers 11 are placed on top of spacers 10. Constant pressure fluid is then introduced into cylinders 7 to raise table 3 until the upper surfaces of spacers 11 abut the lower surfaces of pistons 6. The press is then ready for pressing sheets F as shown in FIG. 3.

Alternatively, each exchangeable spacer 11 may be made in two portions and the thickness thereof adjusted by displacing or rotating one portion with respect to the other. A spacer of this type is shown in FIG. 2. The spacer comprises two superimposed wedge-shaped portions 12 and 13. By displacing the upper portion 13 through a distance *a* in the direction of arrow 14 relative to the lower portion 12, i.e. from the full line position to the dot-dash line position, the thickness of the spacer is increased by the amount *b*. The two portions 12 and 13 can be marked so that the desired thickness of the assembled spacer can be set directly. Adjustment can also be effected by means of distance maneuvering in a known manner.

The adjustable spacers shown in FIG. 2 are more liable to result in incorrect settings than are spacers 11, which are made in one piece. However, this risk is slight in comparison with the suggested prior art arrangement, previously described. The wedge angle between portions 12 and 13 is small enough to prevent any sliding therebetween. If desired, the adjusted thickness of portions 12 and 13 can easily and accurately be checked, e.g. by means of a caliper gauge.

Also, the invention is adaptable for use with other press designs, for example a press having a lower movable press table or employing other means for imparting return movement to the movable press table.

The invention enables the means for restricting the movement of movable table 3, i.e. bushings 9, to be rugged enough so that the diameter of pistons 6 is arbitrary. Also, it is quite

simple to employ an extra seal with the press devices to prevent hydraulic fluid which may leak through the high pressure seals of pistons **6** from running out over the press. The stroke restricting means, i.e. bushings **9**, the means for adjusting the parallelism of the pressing planes, i.e. alignment spacers **10**, and the means for setting the desired distance between the pressing planes, i.e. spacers **11**, can be made with a very high degree of accuracy; and the amount of yield in these elements when subjected to a load is so insignificant that no unacceptable variations in the amount of yield between different press devices or for different sheet thickness settings result. Spacers **10** permit accurate and reliable adjustments to be made with respect to the parallelism of the pressing planes in a simple and work-saving manner during assembly of the press, which adjustments are not later changed by varying degrees of yield or by wear resulting during the operation of the press. Adjustment of the press for different sheet thicknesses is achieved with accurate and reliable settings and is effected in a manner which excludes practically all incorrect settings. Also, when the spacers shown in FIG. **2** are used, no wear occurs which can affect the accuracy of the settings, and the correctness of the settings can be checked using simple and reliable means.

The mechanism of the invention enables such a high degree of parallelism to be obtained and maintained between the pressing planes that sanding of the pressed sheets is substantially rendered unnecessary, and in any event in those instances in which sanding is considered necessary, the amount of material which need be removed is considerably less than previously required, thus also considerably reducing the costs of the operation.

I claim:

1. A single opening press comprising:

a frame;

a stationary press table affixed to said frame;

a movable press table movably connected to said frame for movement toward said stationary table, the opposing surfaces of said tables defining pressing planes;

a plurality of press devices interposed between said movable table and frame for moving said movable table toward said stationary table, each of said press devices comprising a cylinder, a piston movably mounted therein, means for introducing fluid into said cylinder for moving said piston in the direction of movement of said movable table toward said stationary table, and means for restricting the movement of said piston in said direction to thereby limit the minimum separation between said pressing planes; and

a regulating mechanism interposed between said movable table and frame for insuring the parallelism of said pressing planes at said minimum separation and controlling the distance of said minimum separation, said regulating mechanism comprising a parallelism-insuring means and a distance-controlling means associated with each of said press devices.

2. A press as recited in claim **1**, wherein each of said parallelism-insuring means comprises an alignment spacer interposed between said movable table and the associated piston.

3. A press as recited in claim **1**, wherein each of said distance-controlling means comprises an exchangeable spacer interposed between said movable table and the associated piston, all of said exchangeable spacers being of uniform thickness.

4. A press as recited in claim **1**, wherein each of said distance-controlling means comprises a pair of superimposed wedge-shaped portions interposed between said movable table and the associated piston, said portions being movable with respect to each other so that the minimum separation distance may be adjusted without removing the portions from the press.

5. A press as recited in claim **1**, wherein each of said restricting means comprises a bushing fixedly mounted in the associated cylinder and an abutment surface defined by the associated piston, whereby the movement of said piston in said direction is restricted by the abutment of said surface against said bushing.