Sept. 5, 1939. R. W. STANLEY ET AL 2,172,003

PLATEN PRESS

Filed May 20, 1937 3 Sheets-Sheet 1

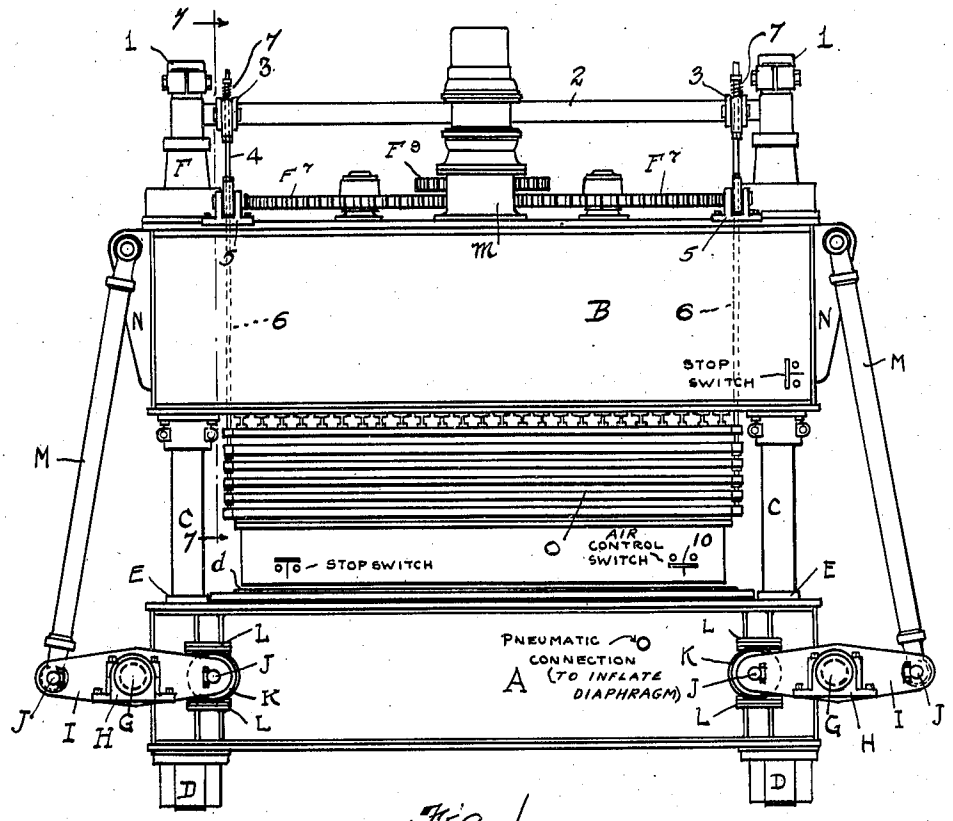

Fig. 1

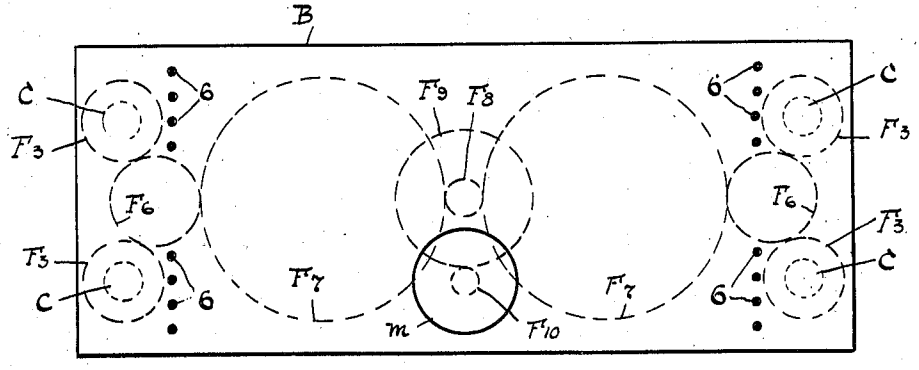

Fig. 2

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Filed May 20, 1937 3 Sheets-Sheet 2

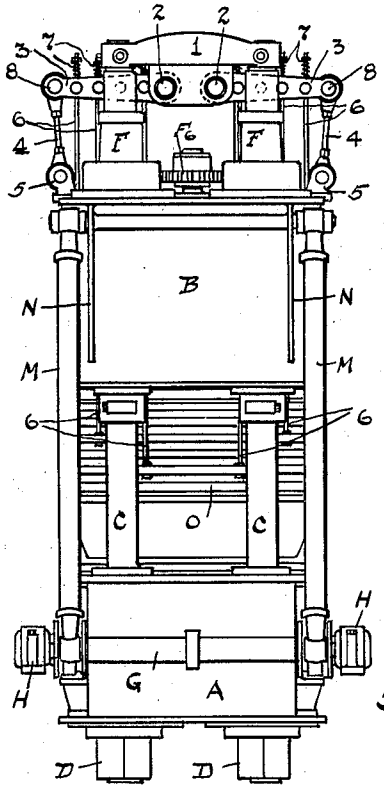


Fig. 3

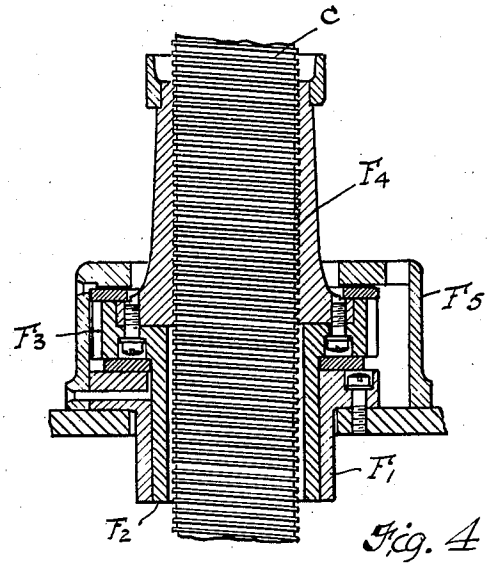
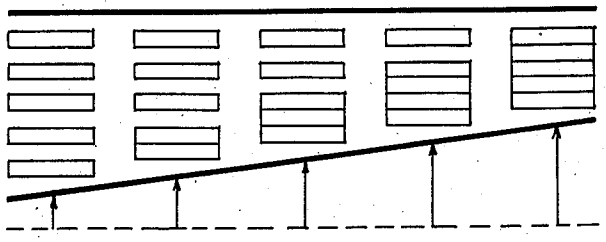


Fig. 4

Fig. 5



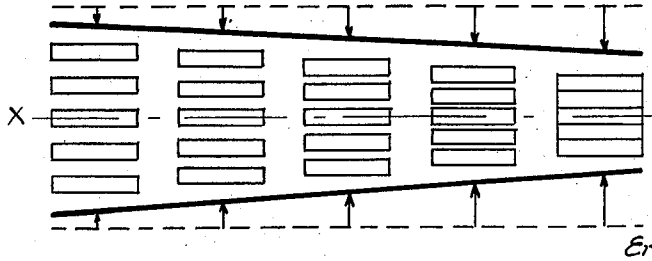


Fig. 6

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Filed May 20, 1937 3 Sheets-Sheet 3

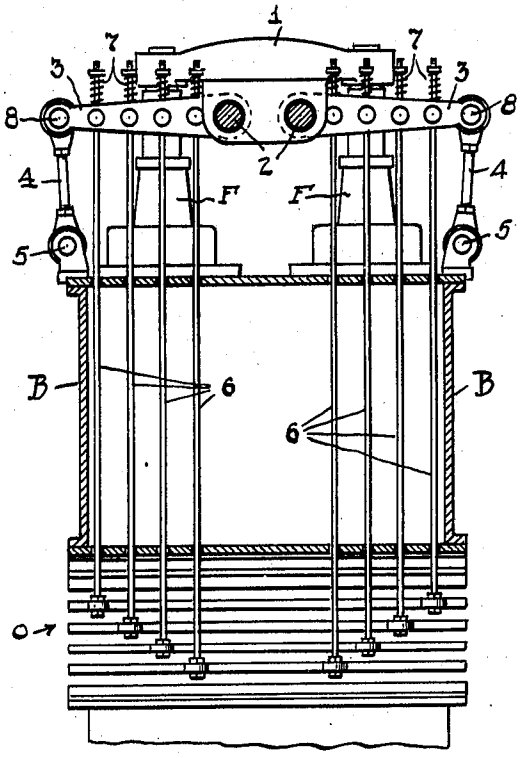

Fig. 7

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UNITED STATES PATENT OFFICE

2,172,003

PLATEN PRESS

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Application May 20, 1937, Serial No. 143,734

2 Claims. (Cl. 144—281)

The present invention relates to presses, and more particularly an improved single or multiple opening hot plate press for the manufacture of plywood and similar products requiring the simultaneous application of heat and pressure to sheet materials.

The principal objective is to provide a new form of hot plate press in which sheets of veneer, or lumber cores and face veneer, may be adhesively united by heat and pressure with a new degree of uniformity of treatment, the design being such also that the machine can operate at greatly increased speed and with proportionately increased output. Obviously this press may be used for performing any operation in which a rapid application of pressure, or heat and pressure is desirable. This press may of course also be used with unheated plates if desired. The present improved construction for securing these results also obtains a variety of other incidental advantages the nature of which will be readily understood from the subsequent detailed description of the machine.

To the accomplishment of the foregoing and related ends, the invention, then comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative however, of but a few of the various ways, in which the principle of the invention may be employed.

In presses of this character the custom for the most part, is to so design the press that the means for applying the working pressure to the load is also the means for opening and closing the press. In the present design the respective functions of opening and closing and that of pressing have been divorced from each other with an appropriate provision of separate mechanical means for performing these two distinct functions. In the present construction opening and closing is accomplished by mechanical means, while the application of working pressure which follows closing, is accomplished by fluid pressure applied either by hydraulic means but preferably applied by pneumatic means.

The present application supplements two previous applications, Ser. No. 744,132, E. H. Merritt, now issued as Patent No. 2,148,704, dated February 28, 1939, and Ser. No. 118,505, R. W. Stanley, the present construction being a development based in part upon the earlier disclosures. These prior applications described the use of a diaphragm pressure element which is also used in the present construction. The features of balancing the weight of the moving parts and of differential movement of the plates in an accordion-like action, are new elements with which the present application is concerned. In the earlier applications also, the operation of the diaphragm was by means of a liquid only, while in the present design the improvement has been added optionally operating the diaphragm by the elastic medium of air or a gas, this feature cooperating with the accordion movement.

In addition to the mechanical features and combinations of machine elements comprising the present hot plate press construction, the various new features and functions provided thereby, afford a means for the operation of a new process and treatment in laminating panels and plywood. This new process forms the subject of a separate application filed simultaneously with the present case.

In the annexed drawings:

Fig. 1 is a side elevational view of an embodiment of the invention; Fig. 2 is a diagrammatic plan view thereof showing the arrangement of the gearing on the top of the press; Fig. 3 is an end elevation of the construction shown in Fig. 1; Fig. 4 is an enlarged sectional detail of the gear-driven nut; Fig. 5 is a diagrammatic elevational view illustrating the sequence of pick-up in the closing of a platen press of usual form; Fig. 6 is a similar showing of the pick-up by a press in accordance with the present invention, and Fig. 7 is a transverse cross-sectional view of the press, taken on the line 7—7 of Fig. 1.

Referring more particularly to the drawings, it will be noted that up to the point of a means for applying working pressure, the construction primarily involves a screw press with a base A and head B. Connecting the base and the head are four strain rods C. These rods are secured wholly at their lower ends to the base by nuts D, which clamp the base against shoulders E provided on the rods. The upper ends of these rods passing through the head B are threaded for a considerable distance and engage nuts F mounted on the head such that when turned they cause the head to move up or down on the threaded rods. As seen in Fig. 4, this mounting may comprise a bushing F_1 secured to the head, and enclosing a rotatable sleeve F_2 whose upper end is provided with gear teeth F_3, and is secured by suitable means to the screw threaded nut portion F_4 which turns on the threaded rod.

The toothed portions F_3, constituting pinions, may be partially housed in by casings F_5 having sufficient openings for the meshing of a driving pinion F_6 (see Fig. 2). One driving pinion F_6 serves the two nuts at each end of the press, and these pinions in turn are driven by suitable gearing, such as F_7, F_8, F_9, F_{10} from a motor *m* conveniently located on the press-head. Rotation of the motor shaft, thus through the gearing F_{10} to F_6 rotates the nuts F in appropriate direction as desired, depending upon whether the press is to be closed or is to be opened.

If this machine were to operate as a conventional screw press the base would rest directly upon the foundation and power means would be provided adequate not only to close the press but to exert the required maximum pressure upon the work. However, in the present invention, the screw press action is limited in its function to the mere work of bringing the plates into mutual contact, while working pressure is supplied subsequently by separate means, preferably, for example, by a diaphragm as described in said copending applications, Ser. No. 744,132 now issued as Patent No. 2,148,704, dated February 28, 1939, and Ser. No. 118,505.

Since one of the principal objects of the present invention is to facilitate using maximum opening and closing speed, means have been provided for balancing the weight of the necessarily massive and heavy moving parts against each other. The head weight is balanced against the weight of the base and strain rods, and half the plates are also balanced against the other half. To accomplish this the base A does not rest upon the foundation but is suspended in very much the same manner as a scale platform. The foundation members carrying the entire weight of the press are two non-revolving shafts G, one at each end of the press, and the ends of each shaft are keyed to blocks H which, in turn, are bolted to the foundation, which may be of concrete for example.

Upon each shaft are mounted two spaced rocker arms I carrying pivot pins J, equally spaced on opposite sides of its center. The pivot pins in the inwardly-extending ends of the rocker arms carry rollers K which bear above and below on shoulders L on the base. These shoulders are faced with hardened steel plates to reduce wear. The pivot pins in the outwardly-extending ends of the rocker arms carry connecting arms M pivoted likewise at their upper ends in ears N welded or otherwise secured to the head B.

Disregarding for the moment the threaded nut connection of the head to the strain rods, it is seen that the weight of the base, together with the attached strain rods, is carried by the rollers K, while the weight of the head, together with its operating elements, is transmitted through the connecting rods M to the pivot pins in the outer ends of the rocker arms I. Thus, if it is assumed that the weight of the base and head are equal they are in balance with each other. To insure equality, the head, which is naturally somewhat lighter due to the strain rods being carried by the base, is provided with a hollow space into which can be poured sufficient concrete to equalize the weight with the base. However, because of the threaded connection of the strain rods to the head, the balanced parts are not free to move, but are restrained by the threads of the strain rods. Nevertheless, the head is not a dead weight supported by the threads of the strain rods. This weight is carried by the connecting rods M. Consequently when the nuts F are revolved in a direction to cause the head to descend on the rods C, the connecting rods M depress the rocker arms I at their outer ends and raise the rollers K pivoted to their inner ends. Therefore, as the head descends the base ascends an equal distance and at the same speed, and although the head and the base are moving in opposite directions they are moving in balance.

The result of this relationship is that since head and base are moving at the same time in opposite directions toward a common middle point, the time of closing has been reduced by one half without having increased the rate of travel of the head or base members beyond that commonly used in a press wherein only one of these members travel. Furthermore, since head and base are balanced the only limitation to quick movement of these massive parts is their inertia, and the very desirable result has been attained of reducing the power required to open and close the press to the lowest terms with a simultaneous 50 per cent decrease in the time interval required for the opening and closing movement.

In the conventional type of hot press the plates are suspended from the press head, usually by hanger rods in such a way that when the press is open there is an equal opening between each pair of adjacent plates. This open space or daylight, as it is commonly called, ordinarily varies from one to four inches according to the kind of work the press is designed to handle. If in the press here shown, the plates were hung from the head in the usual manner and the press was closed from below by the upward movement of a ram which raised the base towards the head, the closing up of the daylight spaces would be a successive movement starting with the lowest space and ending with the uppermost one. The base, in other words, would ultimately pick up all the plates and close all the spaces one after another beginning with the bottom space and ending with the top one. This might be described as a progressive closing of the spaces and is as shown in Fig. 5.

In contrast to such type of closing, the present invention involves a differential closing movement as is illustrated by Fig. 6. In this differential movement it will be seen that all the plates are in motion from beginning to end, that all spaces begin to close at the same time, are all finally closed at the same instant, and are at all times open to the same extent before closing is completed.

Referring to the press assembly as in Figs. 1 and 2, it is seen that the strain rods C at opposite ends of the press are rigidly connected at the upper end by a yoke 1. Mounted in these yokes are two shafts 2. Thus the upper ends of the strain rods are held together in a frame in much the same way as they are held together at their lower ends by the base. The strain rods, therefore, can act as rigid guides for movements of the head. At each end of the press a pair of arms 3 is keyed to shafts 2, and there are connecting rods 4 with pivots at 8 which connect their outer extremities with ears 5 bonded to the head B. At equal intervals along the arm 3 between the shaft 2 and the connecting rod pivot 8 are attached hanger rods 6 of varying length, each plate in the press being supported by a group of four of these rods all of an equal length which is adjusted to provide the desired spacing or maximum daylight between the plates when the press is fully open. Each hanger rod at its

pivot connection with the arm 3 is provided with a coil spring 7 to provide a cushion for taking up any inequalities in the thickness of the panel assemblies in the several openings and thus avoid accidental stresses which otherwise might cause breakage.

The arms 3 are shown at the middle point of their movement in these drawings. As the head B descends towards the base A the connecting rods 4 carry with them the outer extremities of the arm 3, while the shaft is made to revolve in its bearings in the yokes 1. If these yokes were stationary the rocking movement of arm 3 would cause the plate hanger rods 6 to move vertically various distances depending upon the distance each rod is pivoted from the center of shaft 2. This in turn would cause the plates to move vertically various distances depending upon the position of the point of attachment of their particular hanger rods. The lowest hung plate would be supported by rods pivoted farthest from shafts 2 and would move the greatest distance, while the top hung plate supported by rods pivoted closest to the shaft 2 would travel the least distance. However, yoke 1 is not stationary since it is attached to the strain rods, which, in turn, are attached to the movable base. It is seen that when the head descends the base ascends and carries the yokes 1 and shafts 2 with it. The arm 3 at the middle point of its length is therefore a dead center and one end of the arm moves up while the other end moves down an equal distance. Transferring this movement of the arms 3 to the plates in the press, the movement is likewise towards a neutral center point, the topmost plate moving downward and the bottom plate moving upward while the middle plate in the group remains stationary as shown in Fig. 6 at center line XY.

In connection with the foregoing description of the means for giving the plates an accordion movement during the opening and closing, it is particularly pointed out that the maximum opening between the plates is adjustable at will since it depends on the amount of movement of head and base, which can be limited at any desired travel short of the full movement. If the maximum space or daylight between the plates is three inches when head and base are separated the maximum distance from each other, the space between the plates will be one and one-half inches when head and base are at the middle point of their approach. Under operating conditions if it is assumed that the thickness of panels to be pressed runs from one-sixteenth of an inch to two inches, it is obvious that a maximum opening of three inches between plates is not always necessary. Obviously also it is needless to provide more than about a one-inch opening when operating on panels only one-sixteenth inch thick. Therefore it is desirable to limit the movement of head and base in conformity with the space requirement as regards opening for the work in hand. This prevents unnecessary travel in opening and closing and saves both time and power. With the present design this adjustment of the daylight spaces to the work in hand becomes merely a matter of stopping the actuating motor at the right time. Automatic means for accomplishing this will be described later.

For applying working pressure after the press is closed by mechanical means, use is made of diaphragm *d* incorporated in a retainer with a cover free to move up and down with the expansion or contraction of the diaphragm. This is shown and described in our co-pending applications 744,132 and 118,505. In the press here shown the expansion medium in the diaphragm may be either air or a liquid. One purpose of the press design here shown is as already stated to secure the maximum speed of opening and closing, hence pneumatic means for applying the operating pressure is preferred. Increased speed of movement means increased shock when the plates come together on the panels lying in the open spaces. In co-pending application Ser. No. 118,505 provision is described for introducing a small amount of liquid in the diaphragm just before the plates completely close upon the panels. The purpose of this is to facilitate the opening of the press. When the press is pneumatically operated, the introduction of a small amount of air in the diaphragm performs this function as well as an additional one.

Air is elastic and compressible while liquids are rigid and incompressible. Consequently air in the diaphragm as compared to liquid, converts the latter into a cushion which absorbs and dissipates shock occurring when the plates make contact at the end of a relatively rapid closing movement. Furthermore, compressed air is a quick acting medium, and its use cooperates with and supplements quick opening and closing movement by providing also quick application and withdrawal of high working pressure. To this must also be added the advantage derived from the cushioning effect of the pneumatic shock absorber permitting the use of high closing speed.

While a diaphragm and particularly a pneumatic diaphragm, is preferred as a means of applying working pressure, the use of other pressure means is not excluded. With the balanced accordion movement of the press plates which provides for simultaneous closing of the various openings with the head and base both approaching a common centre and while the moving parts involved are maintained in a condition of balance, it is obvious that many advantages will be secured with almost any apparatus for applying working pressure. For example with a hydraulic ram, only working pressure has to be applied by the ram and consequently only slight ram movement is needed permitting quick pressing. However, this lacks the very desirable cushioning effect supplied by the pneumatic diaphragm.

To co-relate the mechanical opening and closing with high pressure pneumatic or hydraulic operation, automatic electric stops and controls are desirably provided, essentially the same as shown in co-pending application Ser. No. 118,505, and not requiring detailed showing here.

In operation, the cycle starts with the press open, the amount of daylight between plates having been determined by the thickness of panels to be pressed, and the automatic stop having been set to discontinue the opening movement at the end of each cycle after the predetermined amount of travel has occurred. The panel assemblies are loaded into the individual press openings, either singly or simultaneously by a loading device, whereupon the operator presses a control button which energizes the motor and causes revolution of the nuts, which bring the base and head towards each other until the spaces are fully closed. Just before the instant when the motor is automatically cut out and the closing movement ends, the air valve is automatically opened by electric control 10

and a small amount of air is admitted to the diaphragm which becomes partly inflated and acts as a cushion to take up the shock of mechanical closing. Almost instantly thereafter full working pneumatic pressure is built up within the diaphragm, and the panels are then kept under pressure until the action of the heat in the plates has set up the adhesive and the bonding is finished. If the pressing is repetition manufacture of the same units so that the same press-time is repeated with each press load, automatic means may be provided for timing, pressing, and starting the opening cycle, or at the end of the pressing the operator may press a push button which closes the air valve and opens the exhaust. As soon as the diaphragm is deflated the motor is energized and the press is opened by the mechanical movements actuated by the motor. The plates return to their original position at which the pre-determined daylight is again provided.

From the construction and operation of the improved press it will be particularly noticed that some of the major advantages secured by the invention are as follows:

Hot presses are relatively costly machines and must attain maximum output to justify themselves. Speed in opening and closing is a major feature in production. Any reduction in the relatively idle time consumed in closing and opening, as in the present invention, increases the number of pressings per hour or per day.

Heat begins to act upon an adhesive as soon as it penetrates to the glue line. If the heat-reaction proceeds far before the application or full bonding pressure, the bond is either absent or inferior. This is especially true with recently developed quick setting adhesives. The quick closing features of this press design avoids this defect.

To obtain a product which is both uniform and of the highest quality it is essential that the panels in all spaces of a hot press receive identical and ideal heat and pressure treatment. The present invention provides this uniformity because all press openings begin to close at the same instant and close uniformly and simultaneously at the same rate. This is the result of the differential closing movement and is an important advance over the conditions which prevail in a press having the prior art progressive closing movement. In the latter, a panel lying in the opening that closes first, receives the weight of the plate above it and is in contact with the hot plates throughout both of its surfaces, but the mechanical pressure is only very low and consequently the heat quickly penetrates to the glue line from the plates causing the adhesive to begin to react in the absence of bonding pressure. Still without bonding pressure the weight of successive plates is added as successive openings above the bottom one are closed up. Thus with progressive closing great inequality exists as regards the heat treatment of the adhesive in the panels obtained from the several openings. A further objection lies in the shocks or bumps received by the panels in the lower spaces as each space is closed and the plate next above it picked up. With any high closing speed these bumps act to compress the wood affecting the final thickness of the finished panels, and the adhesive is also disturbed and displaced by the same effect. The construction here described not only eliminates these bumps or shocks occurring before the application of final pressure, but also assures an easy and even shockless contact when final pressure is applied.

The use of mechanical means for opening and closing is fast as compared to hydraulic means and, furthermore, requires less power to operate.

Balancing the weight of the heavy massive members in motion reduces the power consumption.

Movement of balanced weight contributes to higher closing speed.

Since the means employed to balance weight involves simultaneous movement of the head and base towards each other, the distance traveled by each and the time consumed in closing is cut in half. This is a further important contribution to closing speed.

Movement of balanced moving members reduces wear and tear and increases the life of the press.

The accordion movement, by providing simultaneous contraction of the press openings terminating in simultaneous pressure contact, provides an advantageous means of adjusting the daylight to the thickness of the panels to be pressed. This eliminates unnecessary travel and the waste of opening and closing time in such idle movement. This, in turn, increases production and provides a further gain in a quicker application of bonding pressure, which assists in avoiding injury to the heat sensitive adhesive.

Where all the spaces begin to open up at the same time and at the same rate, the unloading of the press can begin the moment the panels are released from pressure, and in turn, reloading can start before the spaces are fully opened and can continue after the spaces begin to close. This is a further economy in the time cycle required for each pressing.

While movement of the heavy members of the press has been speeded up by balancing the weight, and while the time of opening and closing has been halved by moving head and base simultaneously, the rate of closing the individual openings has been greatly slowed down. This seeming paradox is explained as follows: If in a five opening press panels one half inch thick are being treated the space should be about one and one half inches in height if one inch of space is provided above each panel for ease in entering into the press. It would then require a movement of five inches to close all five spaces. The head would travel two and one half inches, and the base two and one half inches. Since all spaces close together and since each space to be closed is one inch, the space closing rate compared with the head and base rate of movement is as one is to two and one half or as two is to five. The plates in closing, approach each other at only two fifths the speed of the head and base movement. In other words the plates come together in the same elapsed time as the head and base, but the latter travels two and one half times as far and two and one half times as fast. Thus a very gentle and slow closing of the individual spaces have been obtained notwithstanding the great increase in total closing speed of the press.

The use of a diaphragm as a separate means for applying working pressure has advantages fully set forth in co-pending applications, but a further advantage has been secured by substituting air for liquid as the pressure instrument in the diaphragm. The speed at which air builds up operating pressure as compared to liquids

contributes to speed of operation and consequent increased output.

A further advantage is the shock absorbing cushioning effect of the air as compared to liquid in absorbing the shock of closing on the panels. This both relieves the mechanism of wear and tear and makes greater closing speed permissible.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

We therefore particularly point out and distinctly claim as our invention:

1. In a platen press adapted for laminating plywood, upper and lower press-heads, a series of plates therebetween, and means for movably supporting said plates, including hanger rods for each plate, and arms swingably mounted on the upper press-head for arcuate movement in a vertical plane, the upper ends of said plate hanger rods being carried by said arms, and means for arcuately moving said arms in relation with the press-head movement.

2. In a platen press adapted for laminating plywood, upper and lower press-heads, a series of plates therebetween, and means for movably supporting said plates, including hanger rods for each plate and arms swingably mounted on the upper press-head for arcuate movement in a vertical plane, the upper ends of said plate hanger rods being carried by said arms, take-up springs interposed between the upper ends of said plate hanger rods and said arms, and means for arcuately moving said arms in relation with the press-head movement.

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