

Oct. 12, 1943.

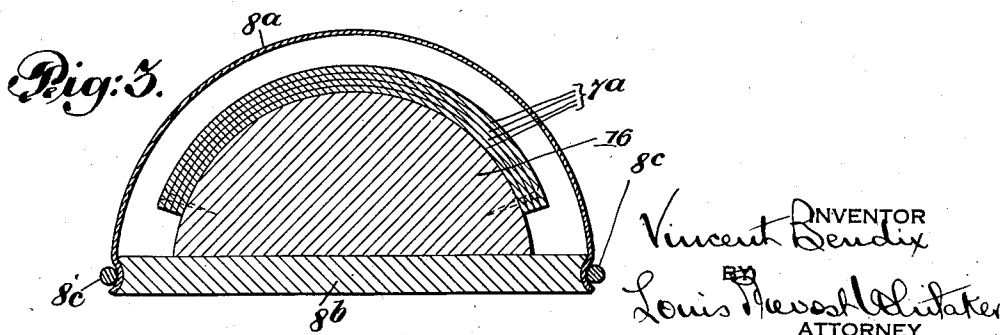
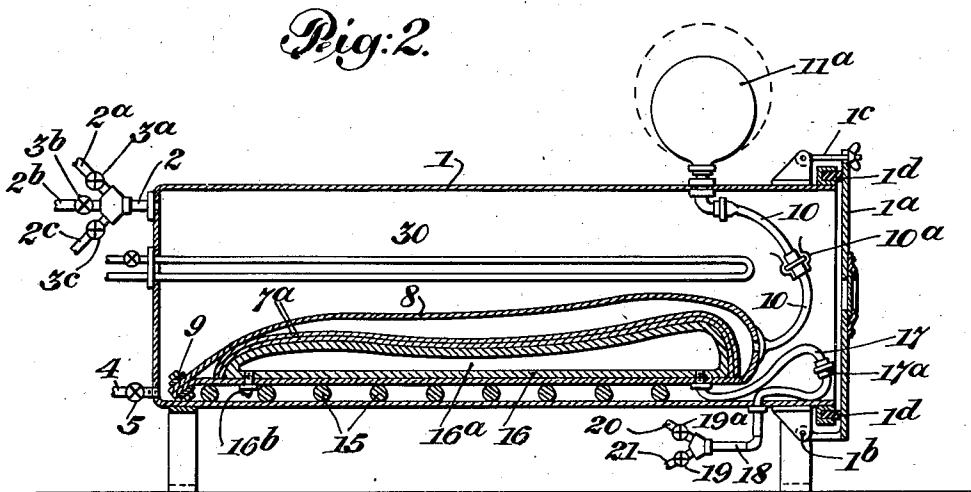
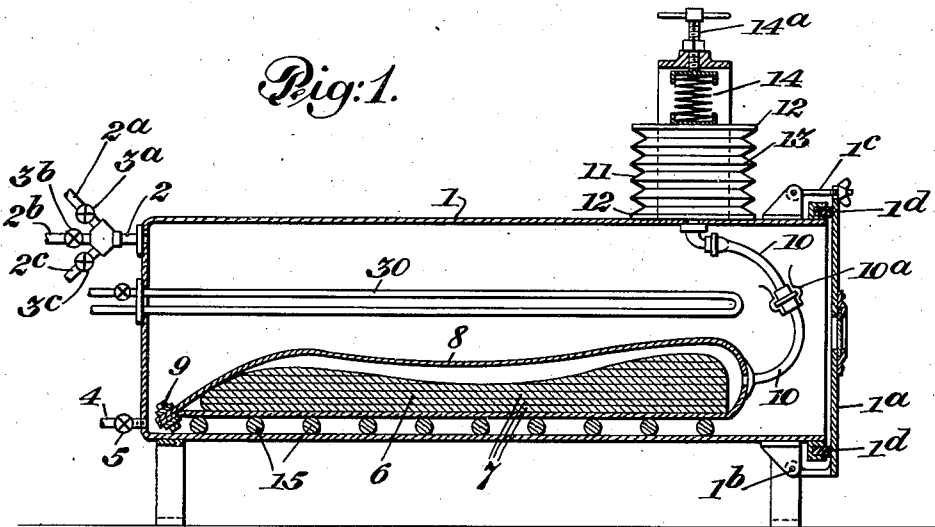
V. BENDIX

2,331,296

VENEER PRESS

Filed Aug. 31, 1940

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

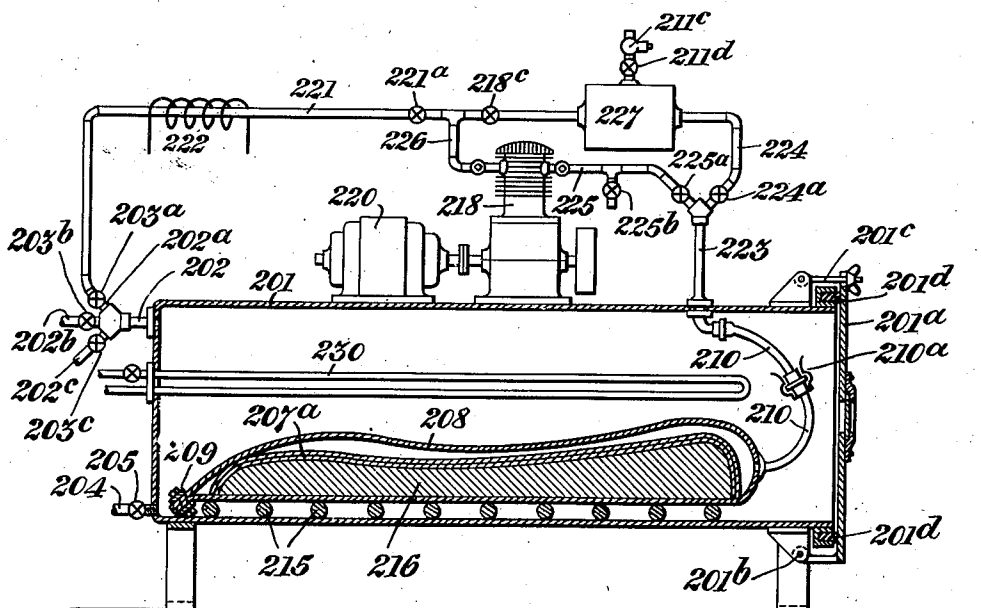
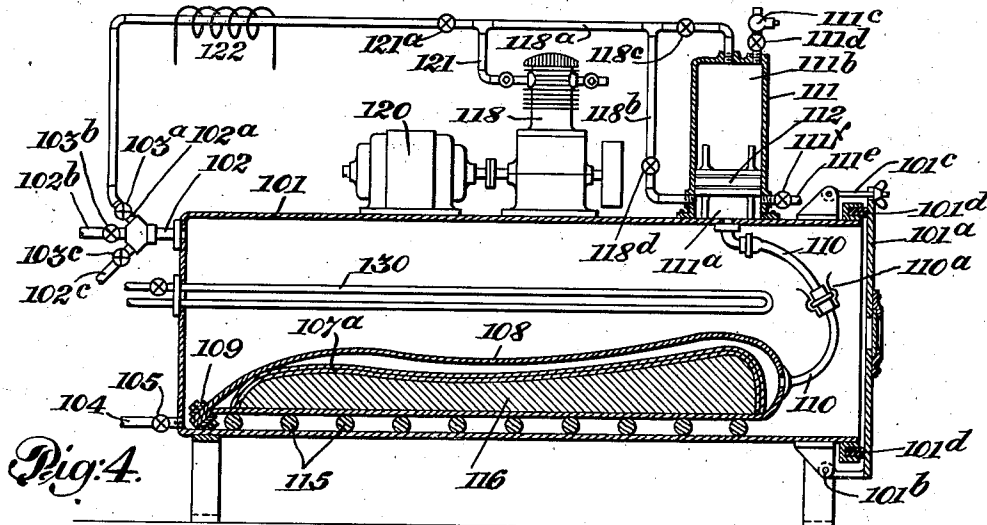


Fig. 5.

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2,331,296

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Application August 31, 1940, Serial No. 354,967

14 Claims. (Cl. 144—281)

My invention consists in the novel features hereinafter described and illustrated in the accompanying drawings, which show several ways in which my invention can be carried into effect, and my said invention is fully disclosed in the following description and claims.

In the manufacture of articles composed of plywood veneer or other separate parts of wood, or other material, capable of being united by an adhesive material, it has been proposed to insert the article after the separate parts thereof have been treated with adhesive on their contiguous surfaces and assembled in the relation they are to retain, and to enclose the completed article in a non-porous envelope, closure or bag, somewhat larger than the article, and to place the article so enclosed within a chamber capable of being hermetically sealed. The interior of the envelope is connected with vacuum apparatus to withdraw the occluded air from the envelope, or with the atmosphere, to permit the escape of occluded air from the envelope, and means are provided to supply the interior of the chamber with heat and cold and fluid pressure, the increase of pressure within the chamber collapsing the envelope upon the contained article, driving out the occluded air to the atmosphere, and applying uniform pressure to the article within the envelope, to press the treated surfaces together while the application of heat and cold sets the adhesive.

In performing this operation, the envelope, which may be conveniently formed of rubberized fabric which will have the desired flexibility to follow any irregularities of the enclosed article, is likely to become more or less wrinkled as it is forced against the article by the exterior fluid pressure within the chamber, and in most cases it adheres to the article to a greater or less extent, especially where portions of adhesive material are on the exterior of the article or along the lines of union of the plywood veneer layers or portions of the article united by the adhesive.

As a result, it is usually quite difficult to remove the envelope or bag from the article after the pressing or pressing and setting is completed, and further, such strains are imposed on the material of the envelope that it soon wears at points and cracks so that it can only be used a comparatively short number of times, necessitating frequent renewal of the envelope.

The object of my invention is to provide such presses with means for facilitating the removal of the envelopes or bags from the articles, after pressing or pressing and setting operation is

completed, so that the envelope will have a greatly increased life, and further to avoid the expenditure of time and labor now required to remove the envelope, both of which results greatly facilitate and cheapen the cost of operating this type of press, as will be readily understood.

In the preferred manner of carrying out my invention I preferably do not permit the air within the envelope to be discharged to the atmosphere, but on the contrary, the envelope is connected with a separate auxiliary pressure chamber by a pipe passing through the wall of the enclosing pressure chamber. This separate auxiliary pressure chamber is preferably expandible, so that the said air expelled from the envelope can be retained in the auxiliary pressure chamber under pressure, and will be returned to the envelope when the pressure in the main pressure chamber is relieved. It will be understood, of course, that the fluid pressure applied to the exterior of the envelope in the main pressure chamber will necessarily have to be augmented by whatever pressure is applied to and maintained on the air expelled into the secondary pressure chamber. As soon as the pressing and setting of the article has been completed, the fluid pressure in the main pressure chamber is relieved, and the air in the auxiliary chamber, maintained usually under pressure in the auxiliary pressure chamber, immediately and automatically returns to the envelope and is forced between the flexible wall of the envelope and the contained article, thus facilitating the separation of the flexible wall from the article, and thereafter sinking to atmospheric pressure.

The collecting and holding under pressure of the air within the bag or envelope, and returning it to the envelope under pressure to facilitate the separation of the envelope from the article being pressed, possesses a number of advantages. Among these are the fact that, especially where heat is applied to the article, either by using heated compression fluid in the main compression chamber, or by applying heat to the walls of the said compression chamber, or by means of heating pipes extending through the said chamber, the heat may exert a drying action on the material of the envelope, tending to make it more liable to crack or break. Where the occluded air is forced out of the envelope by the compression fluid in the main pressure chamber, it will ordinarily contain moisture, and may contain a mixture of air and fluid material added thereto, for treating the surfaces of the article

or the envelope, which may also contain moisture. When this air or mixture is returned to the interior of the bag or envelope, to facilitate its separation from the article, it also returns to the envelope the contained moisture of the air or other material, this tending to prevent the envelope from becoming dry and cracking and assisting in extending its useful life.

Further, if it is desired to treat the article with any chemical or other gas, liquid, or other substance, to facilitate the setting of the adhesive, or for treating the surface of the article, this chemical will thus be retained until the envelope is opened for the removal of the article. It will also be understood that before the opening of the envelope, it may be again subjected to heat or pressure, or both.

In some cases I may also inject a fluid into the air returned to the envelope, for the purpose of waterproofing or otherwise treating the surface of the article, or for treating the wall of the bag.

In some cases I may lead the air expelled from the envelope or bag into a closed chamber or cylinder which is provided with a movable piston or diaphragm in which the air expelled from the envelope is accumulated on one side of the piston or diaphragm and held under pressure, the movement of the piston or diaphragm compressing, if desired, air or other fluid contained in the cylinder on the other side of the piston or diaphragm, so that the exhausted air or fluid under pressure will be returned to the envelope automatically upon release of pressure in the main pressure chamber, and facilitate the separation of the envelope from the article under treatment therein. In some instances I may apply increased pressure to the returned air or fluid, if it is desirable to further facilitate the separation of the envelope from the enclosed article. This may be applied by forcing air or other fluid directly into that part of the cylinder containing the air expelled from the envelope, or by forcing air into the cylinder on the opposite side of the piston or diaphragm to impart its added pressure to the air or other fluid.

I wish it to be understood, further, that in some instances the envelope may be connected with the inlet or outlet port, or both, of a compressor, so that the fluid in the envelope may be positively withdrawn from the envelope and preferably maintained in a chamber or reservoir, so that when the setting of the article is completed air or other fluid under any desired pressure may be forced into the envelope to facilitate separating it from its engagement with the enclosed article and thus permit the article to be readily withdrawn.

In the accompanying drawings,

Fig. 1 illustrates diagrammatically and in section, one form of apparatus for carrying my invention into effect, the envelope being shown separated from the article, for greater clearness.

Fig. 2 is a similar view showing a slightly modified form of apparatus.

Fig. 3 is a detail view showing a modified form of envelope.

Fig. 4 is a diagrammatic sectional view of another form of apparatus by means of which I have contemplated carrying my invention into effect.

Fig. 5 is a diagrammatic sectional view of another form of apparatus for carrying out my invention.

In Fig. 1, the numeral 1 represents a main pressure chamber of any desired size suitable for the

treatment of one or any number of articles, which may be supported therein in any preferred manner. The articles to be treated may be of any desired character, composed of layers of wood veneer, for example, or other separate pieces or laminations of wood or other materials having any desired regular or irregular forms which it may be desired to unite by means of glue, cement or other adhesive material, and to hold under appreciable pressure until the adhesive material is set, and the adjacent parts connected thereby, firmly and permanently united. The chamber 1 is provided with suitable means, here indicated as a pipe 2, for the admission therein of a fluid for the purpose of applying pressure or heat and pressure, or a cooling medium, preferably also under pressure, to the article within the chamber. In this instance I have shown the pipe 2 connected respectively with branch pipes 2a leading from a supply of compressed air or other gas, a branch pipe 2b leading to a supply of steam, and a branch pipe 2c connected with a supply of cooling or refrigerating fluid. Said branch pipes are separately controlled by valves 3a, 3b and 3c respectively, or in any other manner. The chamber 1 is also preferably provided with an exit or discharge pipe 4 normally closed by a controlling valve 5.

In the present instance, and for purposes of illustration, I have indicated at 6, an article which might be the wing of an airplane or any other part thereof, or an article of furniture or part thereof, or any other desired article, and I have shown the article 6 as composed of layers or laminations of wood veneer, for example, indicated at 7, although it is to be understood that my invention is equally applicable to effecting the adhesive union of any other materials capable of being united by an adhesive material, as well as the uniting of veneers and like materials, and simultaneously molding them to a particular form upon or in connection with an inflexible mold, of wood, metal or other suitable material, which may in some instances be provided with passages for heating or cooling fluid, as herein-after described. In order to apply the pressure equally to all portions of the article 6, it is enclosed within a flexible envelope or bag, indicated at 8, which is preferably just sufficiently larger than the article to enable the article to be placed readily therein and removed therefrom, and such envelope is formed of an impervious material, preferably a combination of rubber and fibrous reinforcing material, as woven fabric for example, although the particular composition of the envelope is not important so long as it is impervious and flexible so as to conform to the surfaces of the article contained therein. The envelope 8 is also capable of being sealed so as to completely disconnect it from the interior of the chamber 1, and this may be accomplished in any suitable way. In the present instance I have indicated at 9 clamping plates or other closing means at one end of the envelope for closing it, the other end being permanently closed.

In some instances, as where pressure is to be applied directly upon one face or side only of the article, the envelope need not be in the form of a bag, but may be a flexible wall or sheet, as shown for example at 8a in Fig. 3, having its edges hermetically sealed to an inflexible plate 8b for example, by a retaining wire or band, as indicated at 8c in Fig. 3, for clamping the edges in a grooved edge portion of the plate, or the

flexible wall may be secured to the inflexible plate in any other desired manner.

10 represents a pipe communicating with the interior of the envelope and extending to some point outside of the chamber, where it communicates with an auxiliary chamber, indicated at 11, which as shown in Fig. 1, may be conveniently made in bellows form, for example, so as to be expansible and comprising in this instance the closed heads 12 connected by the collapsible bellows section 13, mounted in a suitable frame. The expansible chamber may be provided with a spring, or springs, 14 for resisting expansion, and the said spring may be provided with a suitable adjusting means, indicated at 14a, to vary the resistance of the spring if desired, and thus control the volume of the bellows chamber with reference to the amount of air displaced from the envelope. Instead of the bellows type of auxiliary pressure chamber, a chamber composed of elastic material, as rubber, capable of expanding as the pressure within the same increases, might be used, as indicated at 11a in Fig. 2.

It will be understood that when the article 6 has been properly assembled, with the parts thereof held by suitable adhesive material with or without other means and enclosed in the envelope 8, and the envelope sealed, the envelope is placed within the main pressure chamber 1 and connected in any desired way, as by a suitable coupling 10a, with the pipe 10 leading to the auxiliary chamber. The main pressure chamber is then hermetically sealed, which may be accomplished by a removable head 1a, preferably hinged to the chamber 1, as indicated at 1b, and suitable connecting means 1c, as bolts and nuts for example, for holding it in place, sealing means 1d being provided to insure that the head shall be airtight. The compression fluid or medium is then admitted to the main pressure chamber 1, by opening the valve 3b or 3a to admit steam or compressed air or both, and create the desired pressure and temperature within the said chamber. It will be understood, as before stated, that as the pressure within the chamber 1 increases, the flexible wall of the envelope will be forced into contact with the contained article and the occluded air within the envelope surrounding the article to be treated will be forced out through the pipe 10 and accumulated in the auxiliary chamber 11. The auxiliary pressure chamber, which may be adjustable, will be of such size that the desired pressure at which the air is held therein may be controlled, and obviously the pressure within the main pressure chamber must be that desired to be exerted on the article, with the addition of the amount of pressure required to expel the air within the envelope and maintain it under the desired pressure. Thus, if it is desired to apply a pressure of, say 35 pounds per square inch to the article within the envelope, an additional amount of pressure must be applied to the chamber 1 to effect this result, and at the same time hold the air expelled from the envelope into the auxiliary chamber under the desired pressure. The flexible envelope or flexible wall thereof being forced into contact with the article to be treated, will exert pressure thereon uniformly throughout the entire surface, so as to force the surfaces of the component parts of the article which have been treated with adhesive into firm engagement and hold them firmly until the adhesive is set. As shown in Fig. 1, I may provide a series of rollers 15 in the main pressure chamber for sup-

porting the envelope and contained article, thus permitting the fluid pressure to be applied to all sides of the envelope, where this is desired, and facilitating the insertion of the article and the envelope into, and their removal from, the main pressure chamber.

In some instances it is desirable to apply heat to the article at the same time that pressure is applied, and this may be accomplished by introducing into the chamber a heated fluid, as steam, under pressure through the inlet pipe, under the control of valve 3b, or the chamber may be separately heated by means of heating pipes, for example, as illustrated at 30, or in any other desired manner. Where the application of heat is unnecessary, compressed air or other fluid may be applied, or compressed air and steam may be used together where desired to obtain the desired heating temperature within the chamber.

In some instances it is desirable, in order to set the adhesive, to subject the article to the action of a cooling medium after the application of heat and pressure, without decreasing or materially affecting the pressure on the envelope or the flexible wall thereof. In such cases the valve 3c may be adjusted to admit cold air, water or other cold fluid to the chamber under sufficient pressure to maintain the desired pressure therein, or an increased pressure if desired, and to compensate for the condensation of the steam, if that has been previously admitted to provide both heat and pressure.

After the adhesive material has set, the pressure within the main pressure chamber 1 is relieved by opening the relief valve 5, or by opening the door 1a, thus reducing the pressure on the exterior of the envelope, whereupon the compressed air or fluid previously expelled from the envelope, if it has been held under pressure in the auxiliary chamber, will automatically return to the envelope, initially under the pressure to which it had been raised, and maintained in the auxiliary pressure chamber, and will be forced between the envelope and the article treated, gradually returning to normal atmospheric pressure and facilitating the separation of the envelope from the surface of the article treated, and the removal of the envelope from said article, and greatly reducing the wear on the envelope and increasing its useful life.

As previously stated, in some instances it is desirable to unite veneers or other laminations and simultaneously mold them to a desired form upon a mold. In Fig. 2 I have illustrated a fluid press constructed substantially as previously described with reference to Fig. 1, the corresponding parts being designated by the same reference numerals. In this figure, however, I have shown a plurality of veneers or sheets held together with or without other means, by adhesive and applied to an inflexible mold, indicated at 16, which is formed of metal or other suitable material and may be made hollow, as shown, or provided with suitable passages for heating or cooling fluid. In this instance the mold has a chamber 16a within it and is provided with a detachable pipe 17 to extend outside of the envelope and adapted to be connected, as by a coupling 17a, with a supply pipe 18 leading to the exterior of the main pressure chamber 1, where it is connected with a steam pipe 20, and a pipe 21 for supplying a cooling fluid, said pipes being provided in this instance with separate control valves 19 and 19a. 7a represents veneers or other laminated material held together by adhesive with or

without other means and applied to the surface of the mold to which it may be suitably secured temporarily by straps or otherwise. By this means, by the admission of heated fluid to the main pressure chamber I, and also to the interior of the mold, the veneers or laminations to be united may be simultaneously subjected on both faces to heat while being also subjected to pressure of the collapsed envelope due to the pressure in the main pressure chamber, which forces the laminations into firm contact throughout, and simultaneously into contact with the mold, to unite the laminations and mold them to the surface of the mold. A cooling fluid can likewise be admitted both to the main pressure chamber, as hereinbefore described, without reducing the pressure therein, and also to the interior of the mold to cool the laminations from both sides or faces and further assist in setting the adhesive material and imparting the desired molded form to the laminations.

As previously described, when the pressure in the main pressure chamber is relieved, the air forced out of the envelope and maintained under pressure in the auxiliary pressure chamber will be automatically forced between the envelope and the outer face of the laminated material and facilitate the separation of the envelope therefrom.

In Fig. 4 I have shown a slight modification of my invention, in which the parts corresponding to those hereinbefore referred to are given the same reference numerals as those in Fig. 1, with the addition of 100. As illustrated in this figure, the pipe 110 communicating with the interior of the envelope is connected with a cylindrical chamber 111, provided with a free piston 112 (or a flexible diaphragm) which divides it into an auxiliary pressure chamber 111a on one side of the piston, and a separate chamber 111b on the other side thereof. When pressure is applied to the main pressure chamber 101, the air from the envelope will be driven out into the auxiliary chamber 111a, forcing the piston toward the opposite end of the cylinder, forming an air cushion in the chamber 111b and holding the air driven out of the envelope under the desired pressure. When the pressure in the main pressure chamber is relieved, the air in the auxiliary pressure chamber 111a will be automatically forced back into the envelope and facilitate the separation of the envelope from the enclosed article, as before described, the piston, or diaphragm, returning to its normal position, and if additional pressure is required or desired to more effectively separate the envelope from the enclosed article, I have indicated at 118 a pump or compressor operatively connected in this instance by a pipe 118a with the cushion chamber 111b, so that by operating this pump the pressure within the chamber 111b may be increased to any desired extent, and thereby impart correspondingly increased pressure to the air on the other side of the piston in chamber 111a as it is returned to the interior of the envelope. Obviously the pump 118 may be connected directly, as by a pipe 118b, with the auxiliary pressure chamber 111a instead of with the cushioning chamber 111b, or with both if that is desired, and the pipe 118a and pipe 118b are shown provided with suitable control valves 118c and 118d respectively.

I find it desirable in some instances to provide the chamber 111b on the outer side of the piston (or diaphragm) with an adjustable relief valve,

indicated at 111c diagrammatically, for regulating the maximum pressure which can be applied to the fluid expelled from the envelope into chamber 111a. This relief valve may be held out of action when desired in any suitable manner, as by closing a cock 111d between it and chamber 111b, as when added pressure is to be introduced into chamber 111b, as previously described, to maintain the pressure of the fluid returned from chamber 111a after it reaches the envelope. In this manner the maximum pressure to which the envelope is exposed can be regulated, and undue strain on its flexible wall prevented.

In case it is desired to introduce a waterproofing material or other material into the envelope to act upon the surface of the contained article when the fluid in the auxiliary chamber is returned to the envelope, I may provide the auxiliary chamber with a pipe, as indicated at 111e in Fig. 4, connected to the chamber 111a, or to the pipe leading therefrom to the envelope, and provided with a normally closed valve 111f, for this purpose.

In Fig. 4 I have shown the laminations 107a applied to a solid mold 116, which may be of wood, metal or other suitable material, the contiguous faces of which laminations are treated with adhesive material. Where a wooden mold is employed, the laminations may be tacked or otherwise temporarily secured to the mold, before the mold and laminations are placed within the envelope. In this instance I have shown a motor 120 for operating the compressor. I have also shown the compressor connected by a pipe 121 controlled by a valve 121a and supplied with heating means, as an electric coil, or steam coil, indicated diagrammatically at 122, with the pipe 102a for supplying compressed air to the main pressure chamber, and in such case the valve 103a may be omitted if desired.

In Fig. 5 I have shown another slightly modified form of my invention, in which parts corresponding with those shown in Figs. 1 and 2 are given the same reference numerals with the addition of 200. In this instance the pipe 210 leading from the envelope is connected by a pipe 223 with a pipe 225 leading to the suction port of a pump or compressor 218 and provided with a control valve 225a. The exhaust port of the compressor is shown connected by a pipe 226, under the control of a valve 218c, to a storage tank 227, which is in turn connected to the pipe 223 by a pipe 224, having therein a valve 224a. The pipe 221, provided with heating coil 222, is also shown connected to the pipe 202a, having a valve 221a, as in Fig. 4. The tank 227 is conveniently provided with an adjustable relief valve 211c and cut off valve 211d, corresponding with those parts shown in Fig. 4, and inlet pipe 225 is provided with an inlet for air or other fluid controlled by a valve 225b.

By means of this construction, when the valve 225a is opened, the occluded air in the envelope can be positively exhausted from the envelope by the compressor and the air from the envelope can be accumulated in the tank 227. When the article is fully set and the pressure in the main pressure chamber is relieved, the valve 224a can be opened to admit compressed air from the tank 227 or from the compressor by opening the valves 225b and 218c, if desired, and force it between the envelope and the article treated, to facilitate separating the envelope therefrom.

It will be understood that by lowering the pressure within the main pressure chamber at any

time during the setting of the adhesive material, the flexible wall of the envelope may be freed from the article in the manner previously described with reference to either Fig. 1 or Fig. 2, and it may be found desirable to loosen the envelope at intervals during the setting process.

It will be understood that the flexible wall of the envelope may become wrinkled when subjected to pressure and portions of the envelope forced by pressure against the article may adhere thereto. Other portions of the envelope not in contact with the article will not adhere thereto, and when fluid pressure is admitted to the envelope it finds ready access to these nonadhering wrinkled portions to expand the envelope and detach those portions which have adhered to the article.

If it is desired to subject the article within the envelope to a treating fluid or other fluid pressure, I may maintain the pressure in the pressure chamber at any desired degree, while the pressure fluid is forced into the envelope, thereby relieving the flexible wall of the envelope of the outward strain to a greater or less extent according to the differential of pressures on opposite faces of the flexible wall.

If it is desired to circulate the heating or cooling medium within the hollow chamber 16a of the mold 16, the chamber may be provided with a detachable pipe 16b, having the necessary valves, etc., similar to the pipe 17, as shown in Fig. 2 of the drawings.

What I claim and desire to secure by Letters Patent is:

1. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, and means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of the contained article and to apply pressure uniformly thereto, an expansible auxiliary chamber out of communication with said pressure chamber, and having yielding elastic means for resisting expansion, a tubular connection from the interior of said envelope to said auxiliary chamber for venting the occluded fluid in said envelope into and holding it under pressure in said auxiliary chamber, and means for relieving the fluid pressure in said compression chamber to permit the fluid from said auxiliary chamber to automatically force itself between the wall thereof and the surface of said article.

2. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber containing an article to be treated, and means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of said article and to apply pressure uniformly thereto, an expansible auxiliary chamber out of communication with said compression chamber, springs for resisting the expansion of said auxiliary chamber, means for adjusting said springs, a vent passage from the interior of said envelope to said auxiliary chamber, and means for relieving the fluid pressure in said compression chamber, to permit the fluid under pressure in said auxiliary chamber to automatically return to said envelope

and force itself between the flexible wall of the envelope and the enclosed article.

3. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, and means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of said article and to apply pressure uniformly thereto, an auxiliary chamber out of communication with said pressure chamber, a connection between said envelope and said auxiliary chamber for venting the occluded fluid in said envelope to and holding it under pressure in said auxiliary chamber, means for reducing the fluid pressure in said pressure chamber to a value below that in said auxiliary chamber, to permit the fluid under pressure in said auxiliary chamber to automatically return to said envelope and force itself between the flexible wall of the envelope and the surface of said article, and means for increasing the pressure of the fluid in said auxiliary chamber.

4. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, and means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of said article and to apply pressure uniformly thereto, an auxiliary chamber out of communication with said pressure chamber provided with a movable piston, a closed cushioning chamber on one side of the piston, and an expansible auxiliary pressure chamber on the opposite side thereof, a vent passage from the interior of said envelope to said expansible pressure chamber, for venting occluded fluid in said envelope thereto and holding it under pressure, means for relieving the fluid pressure in said pressure chamber to permit the fluid in said expansible pressure chamber to be forced between the flexible wall of said envelope and the surface of the enclosed article, and fluid forcing means connected with said expansible pressure chamber for increasing the pressure of the fluid returned to the envelope.

5. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, and means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of said article and to apply pressure uniformly thereto, an auxiliary chamber out of communication with said pressure chamber provided with a movable piston, a closed cushioning chamber on one side of the piston, and an expansible auxiliary pressure chamber on the opposite side thereof, a vent passage from the interior of said envelope to said expansible pressure chamber, for venting occluded fluid in said envelope thereto and holding it under pressure, means for relieving the fluid pressure in said pressure chamber to permit the fluid in said expansible pressure chamber to be forced between the flexible wall of said envelope and the surface of the enclosed article, and fluid forcing means connected with said cushioning chamber for increasing the pressure therein and transmitting said increased pres-

sure to the fluid in said expansible pressure chamber, returned to said envelope.

6. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, and means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of said article and to apply pressure uniformly thereto, an auxiliary chamber out of communication with said pressure chamber provided with a movable piston, a closed cushioning chamber on one side of the piston, and an expansible auxiliary pressure chamber on the opposite side thereof, a vent passage from the interior of said envelope to said expansible pressure chamber, for venting occluded fluid in said envelope thereto and holding it under pressure, means for relieving the fluid pressure in said pressure chamber to permit the fluid in said expansible pressure chamber to be forced between the flexible wall of said envelope and the surface of the enclosed article, adjustable means for relieving and regulating the pressure in said cushioning chamber, and fluid forcing means connected with said cushioning chamber.

7. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, and means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of said article and to apply pressure uniformly thereto, an auxiliary chamber out of communication with said pressure chamber provided with a movable piston, a closed cushioning chamber on one side of the piston, and an expansible auxiliary pressure chamber on the opposite side thereof, a vent passage from the interior of said envelope to said expansible pressure chamber, for venting occluded fluid in said envelope thereto and holding it under pressure, means for relieving the fluid pressure in said pressure chamber to permit the fluid in said expansible pressure chamber to be forced between the flexible wall of said envelope and the surface of the enclosed article, a relief valve for said cushioning chamber, means for rendering said relief valve inoperative, and fluid forcing means connected with said cushioning chamber.

8. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, and means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of the contained article and to apply pressure uniformly thereto, an auxiliary chamber, means for connecting the envelope with said auxiliary chamber, means for relieving the fluid pressure in said pressure chamber, and means for returning fluid from said auxiliary chamber to said envelope and forcing it between the flexible wall thereof and the contained article, and means for introducing into said envelope, with the fluid under pressure returned thereto, an auxiliary substance for treating the interior surface of the envelope or the exterior surface of the article contained therein.

9. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, said envelope having an impervious flexible wall, means for sealing said envelope, an auxiliary pressure chamber, means for establishing communication between the envelope and said auxiliary chamber, means for supplying pressure fluid to said first mentioned pressure chamber, to apply pressure to the exterior of the envelope for forcing the flexible wall of said envelope into contact with the surface of the contained article, to apply pressure uniformly to the article and to automatically force occluded fluid out of the envelope into said auxiliary pressure chamber, means for relieving the pressure on the exterior of said envelope, and means associated with said auxiliary chamber for forcing fluid under pressure from said auxiliary chamber back into said envelope between the wall of the envelope and the surface of the article, when the pressure on the outside of the envelope has been reduced.

10. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, said envelope having an impervious flexible wall, means for sealing said envelope, means for supplying fluid under pressure to said chamber to apply fluid pressure to the exterior of said envelope, an auxiliary pressure chamber, means for venting occluded fluid from within said envelope and forcing it under pressure into said auxiliary chamber, means for maintaining pressure on the fluid in said auxiliary chamber, and means for reducing the fluid pressure on the exterior of the envelope to a value less than the pressure in said auxiliary pressure chamber to automatically cause return of fluid from said auxiliary chamber to said envelope.

11. In a press of the kind described, the combination with a pressure chamber, of an envelope having an impervious flexible wall within said chamber, and means for sealing said envelope, a mold within said chamber, having a surface opposed to said flexible wall of said envelope and adapted to receive laminated material, the laminations of which are united by adhesive material, means for admitting pressure fluid to said chamber for forcing said flexible wall into engagement with the laminated material and the laminated material against the mold to set said adhesive material and mold said laminated material to the form of the adjacent face of the mold, a variable capacity auxiliary pressure chamber, means for conducting occluded fluid from between said flexible wall and the laminated material and mold, and introducing it under pressure into said auxiliary chamber, means associated with said auxiliary chamber for maintaining pressure greater than atmospheric pressure on the fluid in said auxiliary chamber, and means for relieving the pressure in said first mentioned pressure chamber to a value below that in said auxiliary chamber whereby fluid is automatically returned from said auxiliary chamber to said envelope.

12. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting a fluid under pressure to said chamber for forcing the flexible wall of said

envelope into contact with the surface of said article, a tubular passageway from said envelope to a point outside of the said pressure chamber, a pump having inlet and outlet ports, means for connecting the said inlet port with said tubular passageway to positively withdraw occluded gaseous fluid from the said envelope, an auxiliary chamber out of communication with said pressure chamber, and connected with said pump to receive fluid withdrawn from said envelope, means for relieving the pressure within said pressure chamber, and means for connecting the outlet port of said pump and said auxiliary chamber with said passageway to force fluid under pressure between the flexible wall of the envelope and said article.

13. In a press of the kind described, the combination with a pressure chamber, of an envelope in said chamber for containing an article to be treated, means for sealing said envelope, said envelope having an impervious flexible wall, means for admitting a fluid under pressure to said chamber for forcing the flexible wall of said envelope into contact with the surface of the article, a tubular passageway from said envelope to a point outside of the said pressure chamber, a compressor having inlet and outlet ports, means for connecting the said inlet port with said tubular passageway to positively withdraw occluded gaseous fluid from the said envelope, an auxiliary chamber out of communication with said pressure chamber and connected with said compressor to receive fluid withdrawn from said envelope, means for relieving the pressure within said

pressure chamber, means for connecting the outlet port of said compressor and said auxiliary chamber with said passageway to force fluid under pressure between the flexible wall of the envelope and said article, and means for connecting the outlet port of said compressor to the said means for admitting fluid pressure to the pressure chamber when desired to supply pressure fluid thereto.

14. In a press of the kind described, the combination with a compression chamber, an enclosure in said chamber for containing an article to be treated, said enclosure having an impervious flexible wall, means for supplying pressure fluid to said compression chamber to apply fluid pressure on the exterior face of said flexible wall to force said wall to conform to the surface of the article and to apply pressure uniformly thereto, and means for relieving said pressure, of an auxiliary pressure chamber out of communication with said compression chamber, and a passageway connecting said auxiliary chamber with the space between said flexible wall and the surface of the article, whereby occluded fluid in said space is conducted by said passageway to said auxiliary chamber upon application of pressure to the exterior surface of said flexible wall, is stored in said auxiliary chamber under pressure and is returned to said enclosure upon reduction of pressure on said exterior surface to a value lower than the pressure in said auxiliary chamber.

VINCENT BENDIX.