Dec. 2, 1947. E. H. LAND ET AL 2,431,943

PRESS MECHANISM

Filed Aug. 12, 1943 2 Sheets-Sheet 1

FIG. 1

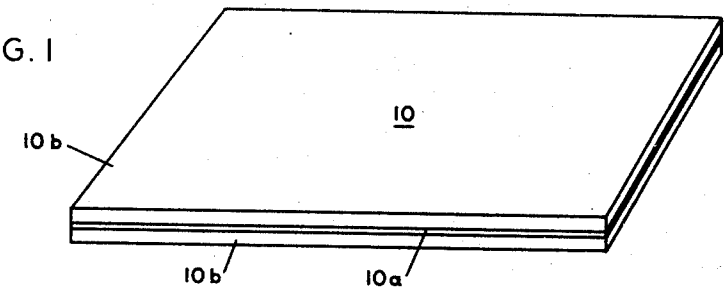

FIG. 2

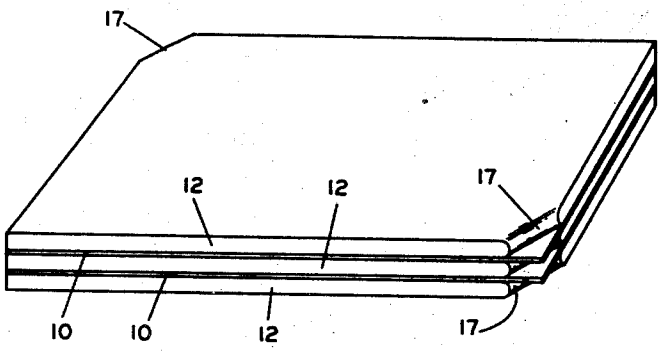

FIG. 3

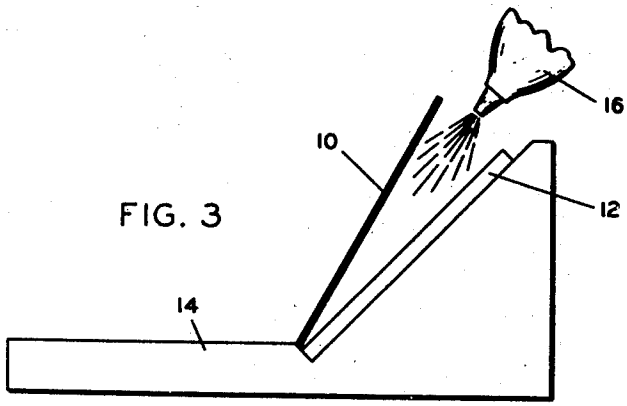

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FIG. 4

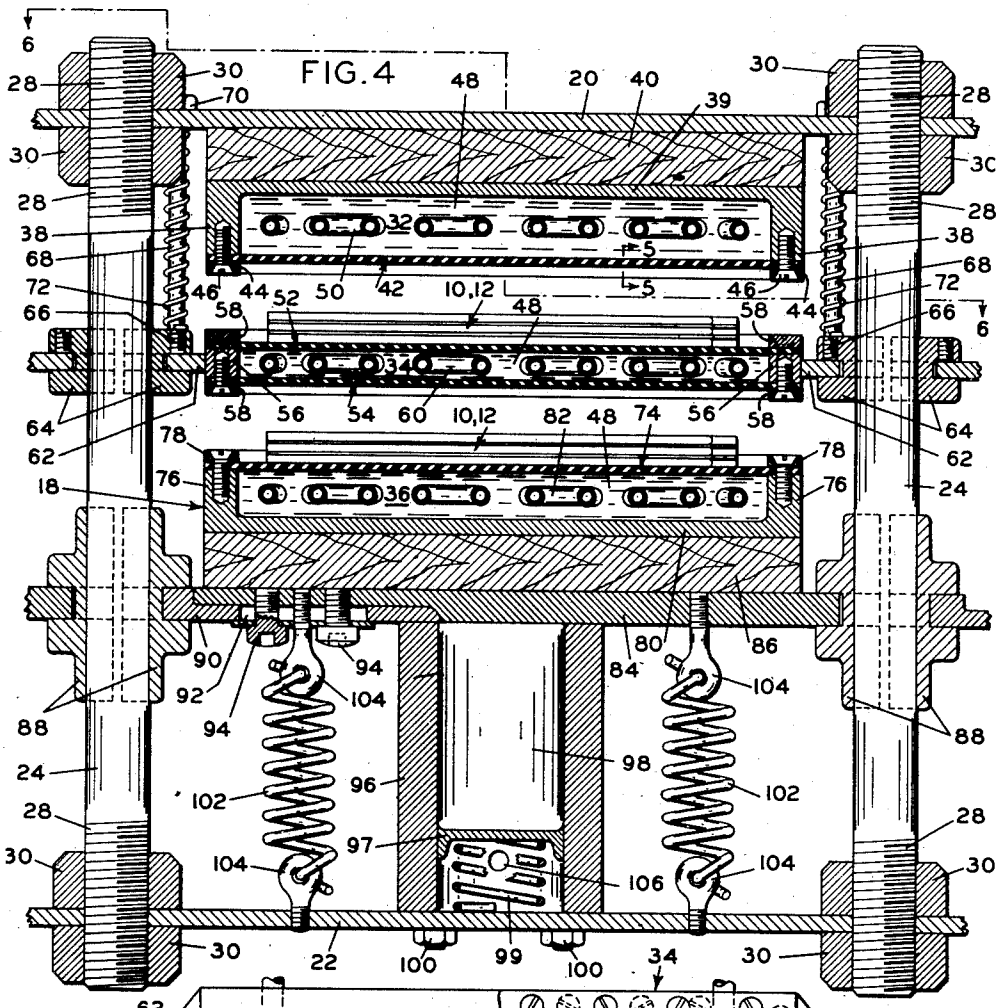


FIG. 6

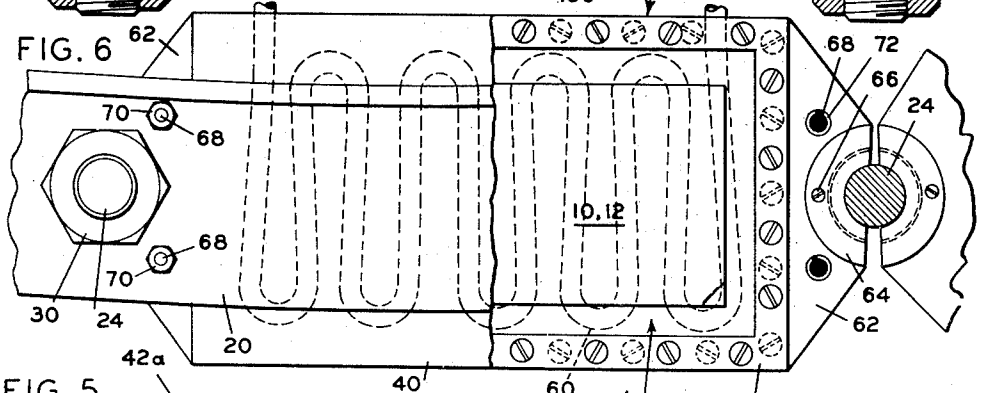
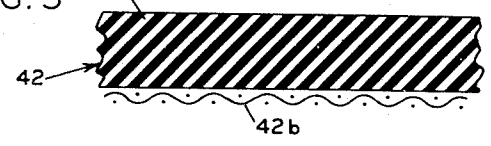


FIG. 5



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UNITED STATES PATENT OFFICE

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PRESS MECHANISM

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8 Claims. (Cl. 100—71)

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This invention relates to press mechanisms.

It is one object of the invention to provide a novel apparatus whereby assemblies, as for example, of material to be surfaced and the surfacing members therefor, may be subjected to pressure and heat.

Another object is to provide a novel press mechanism whereby a uniform pressure may be applied to a material being treated thereby, and wherein there is embodied a novel pressure-transmitting member.

A further object is the provision of novel means for operatively mounting a plurality of pressure-applying platens.

The above and other objects and novel features of this invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for purposes of illustration only and are not intended as a definition of the limits of the invention, reference being primarily had for this latter purpose to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views:

Figure 1 is an exaggerated perspective view of an element adapted to be surfaced in accordance with the present invention;

Fig. 2 is an exaggerated perspective view showing two of said elements assembled in operative relation with a plurality of surfacing members.

Fig. 3 is an elevation view with parts broken away, illustrating one step in the novel method of assembling the arrangement of elements shown in Fig. 2;

Fig. 4 is a vertical sectional view, with parts broken away, of one form of apparatus embodying the present invention;

Fig. 5 is an enlarged exaggerated fragmentary sectional view taken substantially along line 5—5 of Fig. 4; and

Fig. 6 is a sectional view taken substantially along line 6—6 of Fig. 4.

One form of the invention is illustrated by way of example in connection with the surfacing of a rectangular, three-ply blank 10 (Fig. 1) of the type from which an eyepiece element for a pair of goggles may be formed. The central lamination 10a of said blank is a suitable light-absorbing element, such as a color filter or a polarizing sheet, and the outer laminations 10b are plastic sheets, such as cellulose acetate, which are adhesively or otherwise secured to said light-absorbing element. The thicknesses of the several laminations comprising blank 10 have been exaggerated for purpose of clarity in Fig. 1 and in one commercial form thereof aggregate only slightly over .030".

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A suitable surfacing medium for cellulose acetate is methyl methacrylate and a satisfactory surface smoothness is imparted to blank 10 when coated with said medium by bringing into contact therewith a surface-defining plate or member of glass. Good results are obtained with surface-defining plates 12 (Fig. 2) which are formed of a commercial grade of plate glass approximately ⅛" thick.

It is to be understood, however, that the novel method and apparatus of the present invention are not limited to the above materials nor are the thicknesses of the materials being surfaced or of the surfacing member critical. Any member may be surfaced in accordance with the invention, provided the surface material thereof has an affinity for the surfacing medium. Moreover, the surfacing medium may consist of any moldable material that can be solidified from a fluid or viscous state while in contact with the face material of the element being surfaced, and which can have a given surface smoothness imparted thereto during solidification by a surface-defining member, such as a glass plate.

In accordance with the preferred method for carrying out the invention, elements 10 are sandwiched between three surfacing plates 12 (Fig. 2), each face of said elements being coated with a thin, uniform layer of methyl methacrylate monomer. To provide layers of methyl methacrylate of the desired uniformity and thickness over the faces of elements 10, the several parts of the five-ply arrangement 10, 12 are assembled in a novel manner. One of the surfacing plates 12 is first held, for example, in a suitable support 14 (Fig. 3) at an angle to the vertical and with the lower edge thereof extending horizontally. An element 10 is then positioned in said support with its lower edge in contact with the lower edge of said plate so as to form an acute dihedral angle with the latter, and the monomeric methyl methacrylate in a suitable condition for polymerization is then introduced, as for example, by being squirted from a syringe 16, between the adjacent faces of said plate and element. Thereafter element 10 is pivoted about its lower edge into contact with plate 12, causing the surfacing medium to spread uniformly and thinly over the entire surface of said element. This step is repeated with each of the successive laminations which constitute sandwich 10, 12, the previously assembled

components in each instance serving as the base, i. e., in the same capacity as the first plate 12, and the newly added components being pivoted into position in the same manner as the first element 10, methyl methacrylate being introduced between each pair of adjoining surfaces.

In order to facilitate removal of plates 12 from elements 10 after the latter are surfaced, it is preferable to have diagonally opposite corners of said plates clipped and bevelled as at 17.

To surface elements 10, pressure is preferably applied to the outer laminations of sandwich 10, 12 to press the surface-defining elements into close contact with the surfacing medium and, while under this pressure, the surfacing medium is polymerized until hardened, preferably by the application of heat. In order to expediently and effectively accomplish this, novel means are provided and, as shown, comprise at least one press mechanism 18 (Fig. 4), which is adapted to simultaneously treat two of assemblies 10, 12. In one embodiment thereof, said mechanism comprises a suitable supporting structure, including for example, a pair of vertically spaced supports 20 and 22 which have mounted thereon so as to extend therebetween, a pair of parallel and substantially vertical rods 24, said rods being preferably threaded at 28 so as to be rigidly secured to said supports by nuts 30.

To simultaneously apply a uniform and substantially equal pressure to the opposite surfaces of each of a pair of sandwiches 10, 12, press members 32, 34, and 36 are provided and are operatively mounted between supports 20 and 22. In the form illustrated (Fig. 4), the upper press member or platen 32 comprises a metallic cup-shaped member, as for example a rectangular frame 38 and a plate 39 integrally formed with, or secured to, said frame, said frame and said plate constituting the side and top walls respectively of a fluid-tight chamber. Forming the lower or pressure-applying wall of said chamber is a flexible diaphragm 42, comprising, for example, an inner layer 42*a* of neoprene and an outer layer of fine mesh screen or wire cloth 42*b* (Fig. 5), said diaphragm having the edges thereof pressed into fluid-tight engagement with the lower face of frame 38, preferably by means of a rectangular frame element 44, which is secured to said frame as by screws 46. Element 44 may consist of four separate metallic strips but is preferably a unitary structure. Platen 32 is rigidly secured to a block 40, for example of wood, and the latter is, in turn, fixed to the lower face of support 20 and serves to insulate said support from member 38, 39. The interior of the chamber thus formed by diaphragm 42, frame 38, and plate 39, is filled with a suitable fluid medium 48, as for example, oil, glycerine, or ethylene glycol. Of these oil is preferred, although any readily available fluid which will not boil at the temperature maintained during surfacing may be used. To accelerate the polymerization of the surfacing medium, suitable heating means are contained within frame 38 and may comprise a winding tube 50 which is supported by said frame and which has a suitable heating medium circulated therethrough to maintain platen 32 at a desired temperature.

Slidably mounted below platen 32 in substantial alignment therewith is platen 34 which comprises a pair of substantially parallel pressure-applying elements, such as diaphragms 52 and 54, mounted across the upper and lower faces, respectively, of a rectangular frame 56. Diaphragms 52 and 54 are preferably of the same construction and similarly mounted as diaphragm 42 by elements 58 and constitute the end walls of a fluid-tight chamber whose side walls are formed by said frame. The chamber is preferably filled with fluid 48, and has mounted therein a winding tube 60 which is supported by, and extends through, frame 56.

In order to mount platen 34 for movement in a direction perpendicular to the substantially parallel pressure-applying diaphragms 42, 52, and 54, frame 56 is preferably provided with brackets 62 (Figs. 4 and 6) adjacent rods 24, said brackets being secured to or integrally formed with said frame and carrying bearings 64 which slidably engage rods 24. Each of said bearings may be mounted for limited lateral adjustment relative to its bracket, and in the form illustrated, each is provided with a slot into which the supporting bracket associated therewith is press fitted and is held in operative position by a set screw 66. Each of bearings 64 preferably subtends less than 180° of the cylindrical peripheral surface of the rod 24 which it engages.

To predetermine the lowermost position, i. e., the disengaged central position, of platen 34, and to serve as further guides for said platen during the movement thereof into operative position, a plurality of guide rods 68 (Fig. 4) may be provided. As shown, a pair of said rods are operatively mounted on each of brackets 62 (Fig. 6), being threadably or otherwise rigidly secured thereto at their lower ends so as to extend vertically upward therefrom. At their upper ends said rods are slidably mounted in recesses provided therefor in support 20, and to limit the downward movement thereof, each of said rods has a nut 70, or other axially adjustable member secured to the upper end thereof. Suitable resilient means, such as coil springs 72 may be provided to normally bias platen 34 downward into inoperative position and in the illustrated embodiment said springs are mounted around rods 68 so as to have their lower ends bearing against platen 34 and their upper ends bearing against the lower surface of support 20.

Platen 36 is slidably mounted below and directly opposite platen 34 and comprises an upper pressure-transmitting member, such as a diaphragm 74, which is preferably of the same construction and similarly mounted as diaphragm 42 on a frame 76 by means of an element 78. Integrally formed with said frame or mounted thereon in fluid-tight engagement therewith is a bottom plate 80 and the chamber thus formed within said frame is filled with fluid 48 and contains heating means in the form of a winding tube 82 for circulating a suitable heating medium through platen 36. The latter is secured to a platform 84, for example by an insulating member such as a wooden block 86, and said platform is provided with bearings 88 which are in sliding engagement with rods 24 to mount the entire platen assembly for vertical movement. Bearings 88 are rigidly secured to platform 84 in any suitable manner and it is preferable to provide means for laterally adjusting at least one of said bearings relative to said platform. For example, the left bearing as shown in Fig. 4, may be mounted on an element 90 which has a slot 92 provided therein and is normally held fixed relative to platform 84 by screws 94 extending through said slot. The lateral position of said element may thus be readily adjusted to predetermine the lateral separation of bearings 88, the latter being constructed to en-

gage less than 180° of the peripheral surface of rods 24.

To predetermine the lowermost position of platen 36 and provide means for actuating said platen and platen 34 to effect the pressure application to sandwiches 10, 12, suitable means, as for example a cylinder 96 and a piston 98 reciprocally mounted therein, are provided, said cylinder in the form illustrated being centrally located below platform 84 and being secured at its lower end as by bolts 100 to support 22. Suitable sealing means are provided for rendering oil tight the pressure chamber formed in said cylinder by said piston, and in the form shown, said means comprise a conventional hydraulic oil cup 97 held in operative engagement with the lower end of said plunger as by a spring 99. The latter also serves to maintain said plunger at all times above a fluid inlet port 106 provided adjacent the lower end of cylinder 96. In the inoperative or disengaged position of platen 36, platform 84 rests on the upper end of said cylinder, being normally urged into said inoperative position by suitable resilient means, such as coil springs 102, which are under tension and are secured at their lower ends to support 22 and at their upper ends to said platform as by eyes 104. To move platen 36 into operative position, means are adapted to admit a suitable fluid, such as oil, under pressure into port 106 whereby the piston is moved upward to raise platen 36. It is to be understood that the lowermost position of platen 36 may be predetermined, for example by means, such as collars, (not shown) fixedly mounted on rods 24 whereby said platen is normally held above the upper edge of said cylinder.

In operation, a surfacing assembly 10, 12 is disposed on both of platens 36 and 34 while the latter are held in their lowermost or inoperative position. Each of tubes 50, 60, and 82 has a suitable heating medium, such as water, at a pressure in excess of the steam saturation pressure for its temperature, continuously circulated therethrough. Fluid is admitted into cylinder 96 to raise platen 36 until the assembly mounted thereon engages and raises platen 34 to cause the latter or the assembly mounted thereon to be pressed into engagement with platen 32. Assemblies 10, 12 are pressed between diaphragms 74 and 54, and diaphragms 52 and 42 which, because of their flexibility, apply uniformly the uniform pressure transmitted thereto by the fluid content 48 of each of said platens. When the pressure is relieved at the completion of the polymerization of the surfacing agent, springs 72 and 102 act to move platens 34 and 36, respectively, into inoperative position against the fluid and mechanical frictional resistance and the assemblies 10, 12 are removed. Thereafter said assemblies are cooled and plates 12 are separated from the surfaced blanks 10 and used again as surfacing members.

By controlling the pressure of the fluid admitted into cylinder 96, any predetermined pressure may be applied to assemblies 10, 12 and the temperature of the fluid in tubes 50, 60 and 82 can also be controlled to provide a desired temperature at the surfaces of said assemblies. The time required to satisfactorily effect a given surfacing depends on the time the surfacing agent has been permitted to soak into the surface of the member being surfaced after it is applied thereto and before it is inserted into the press mechanism, on the temperature at which the assembly is maintained during the soaking, on the pressure applied by platens 32, 34, and 36 of the press mechanism when the assemblies are inserted therein, on the temperature of said platens during the pressure application, and on the amount of polymerization catalyst mixed with the surfacing agent.

When methyl methacrylate monomer containing 3% of a suitable catalyst, such as benzoyl peroxide, is employed as the surfacing medium, it has been found satisfactory to circulate water at a temperature of approximately 250 to 350° F. through tubes 50, 60, and 82, and to apply a sufficient fluid pressure to the platens to have the latter exert a uniform pressure of approximately 5 to 50 lbs. per square inch on the opposite surfaces of assemblies 10, 12.

There is thus provided novel apparatus whereby a material, such as a transparent, resinous sheet, having an affinity for a plastic medium, may be surfaced by having a surface layer of said medium polymerized thereon while a suitable surface-defining member is maintained in contact with said medium, said apparatus comprising novel press means for bringing and holding said material and said member in contact.

It will now be apparent to those skilled in the art that the novel pressure-applying means may be used for other purposes than in connection with the surfacing of sheet materials. It is to be understood also that other heating means, such as electrical coils, may be embodied in the platens for heating the latter.

Since certain changes in the constructions set forth which embody the invention and in the steps for carrying out the process of the invention may be made without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. In apparatus of the character described, a press mechanism comprising, in combination, at least three fluid-tight platens filled with an incompressible fluid, adjacent walls of adjacent platens being deformable and in engagement with the fluid filling said platens, means fixing one of said platens against movement, means for mounting the other platens for movement relative to said fixed platen, means for rendering adjacent platens operative to apply a pressure to material disposed between said adjacent walls, said last-named means comprising a member adapted to engage one of said movable platens and cause the movement of said movable platens in the direction of said fixed platen and a mechanism for applying fluid pressure to said member to actuate the latter, and means for biasing said movable platens in a direction opposing movement thereof into operative position, said biasing means causing said platens to assume a predetermined inoperative position wherein said platens are sufficiently spaced apart for removal and insertion therebetween of the material to be processed thereby.

2. In apparatus of the character described, a press mechanism comprising, in combination, at least three fluid-tight platens filled with an incompressible fluid, adjacent walls of adjacent platens being deformable and in engagement with the fluid filling said platens, means for mounting

one of the two outermost of said platens against movement, means for mounting the other of said platens for movement relative to said fixed platen, means for rendering adjacent platens operative to apply a pressure to material disposed between said adjacent walls, said last-named means comprising a member adapted to engage the other outermost platen and to engage and move said platen and a mechanism for actuating said member, means for biasing said movable platens in a direction opposing movement thereof into operative position, said last-named biasing means causing said platens to assume a predetermined inoperative position wherein said platens are sufficiently spaced apart to permit removal and insertion therebetween of the material to be processed thereby, and means for circulating a heating medium through each of said platens.

3. In apparatus of the class described, three vertically spaced platens, each said platen comprising a frame member formed of a rigid, nondeformable material and at least one wall of a deformable material, adjacent walls of adjacent platens being deformable, means for holding the upper platen stationary, means for mounting the central platen for vertical movement, means for normally biasing said central platen away from said upper platen, means for mounting the lower platen for vertical movement, means for normally biasing said lower platen away from said central platen, and means for moving said lower platen in the direction of said upper platen to render all of said platens operative to compress material disposed therebetween, said biasing means being operative to cause said platens to assume, when said means for moving said lower platen is inoperative, a predetermined inoperative position wherein said platens are sufficiently spaced apart for removal and insertion therebetween of the material to be processed thereby.

4. In apparatus of the character described, three vertically spaced platens, each said platen comprising a frame member formed of a rigid, nondeformable material and at least one wall of a deformable material, adjacent walls of adjacent platens being deformable, means for fixing the upper platen against movement, means for mounting the central platen for vertical movement, means for normally biasing said central platen away from said upper platen, means for predetermining the normal separation between said upper and central platens, means for mounting the lower platen for vertical movement, means for normally biasing said lower platen away from said central platen, means for predetermining the normal separation between said central and lower platens, and actuating means for moving said lower platen in the direction of said upper platen to render all of said platens operative to compress material disposed therebetween, said biasing means being operative, whenever said actuating means is inoperative, to cause said platens to assume a predetermined inoperative position wherein said platens are sufficiently spaced apart for removal and insertion therebetween of the material to be processed thereby.

5. In a press mechanism, at least three substantially parallel platens, the uppermost platen being stationary and the other platens being movable relative thereto in a direction substantially perpendicular thereto, each said platen comprising a frame member of a rigid, nondeformable material, at least one wall of a deformable material mounted on said frame member, an incompressible fluid contained therein and in contact with the deformable wall thereof and conduits mounted in said frame member for circulating a heating medium through said platen, adjacent walls of adjacent platens being deformable, means for applying pressure to the lowermost platen whereby all of said platens are rendered operative, means for predetermining the separation of said platens in inoperative position, and resilient means normally biasing said platens into inoperative position, said resilient means causing said platens to be sufficiently spaced apart when inoperative to permit of the ready removal and insertion therebetween of the material to be processed thereby.

6. In apparatus of the character described, a press mechanism comprising, in combination, at least three fluid-tight platens filled with an incompressible fluid, adjacent walls of adjacent platens being deformable and in engagement with the fluid filling said platens, means for fixing one of said platens against movement and means for mounting the others of said platens for movement with respect to said fixed platen, means for rendering adjacent platens operative to apply pressure to material disposed between said adjacent walls, said last-named means comprising a member adapted to engage one of said movable platens and cause movement of said movable platens and a mechanism for actuating said member, and spring means for biasing said movable platens in a direction opposing movement thereof into operative position, said spring means causing said platens to be sufficiently spaced apart when inoperative to permit of the ready removal and insertion therebetween of the material to be processed thereby.

7. In a press mechanism, at least three substantially parallel platens, the upper-most platen being stationary and the other platens being movable relatively thereto in a direction substantially perpendicular thereto, each said platen comprising a frame member of a rigid, nondeformable material, at least one wall of a deformable material mounted on said frame member, an incompressible fluid contained therein and in contact with the deformable wall thereof and conduits mounted in said frame member for circulating a heating medium through said platen, adjacent walls of adjacent platens being deformable, means for applying pressure to the lowermost platen whereby all of said platens are rendered operative, means for predetermining the separation of said platens in inoperative position, and spring means normally biasing said platens into inoperative position, said spring means being operative, whenever said actuating means is inoperative, to cause said platens to assume a predetermined inoperative position wherein said platens are sufficiently spaced apart for removal and insertion therebetween of the material to be processed thereby.

8. In a press mechanism, three substantially parallel platens, the upper-most platen being stationary and the other platens being movable relatively thereto in a direction substantially perpendicular thereto, each said platen comprising a frame member of a rigid, nondeformable material, at least one wall of a deformable material mounted on said frame member, an incompressible fluid contained therein and in contact with the deformable wall thereof and conduits mounted in said frame member for circulating a heating medium through said platen, adjacent walls of adjacent platens being deformable, means for applying pressure to the lowermost platen where-

by all of said platens are rendered operative, stop members for predetermining the separation of said movable platens in inoperative position, compression spring means for biasing the intermediate platen into inoperative position, and tension spring means for biasing said lowermost platen into inoperative position, both said spring means causing said platens to be sufficiently spaced apart when inoperative to permit of the ready removal and insertion therebetween of the material to be processed thereby.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
280,745	Hyatt	July 3, 1883
697,287	Spaulding	Apr. 8, 1902
1,516,596	Gammeter	Nov. 25, 1924
1,537,697	Roberts	May 12, 1925
1,671,648	McCarthy	May 29, 1928
1,754,853	Fox et al.	Apr. 15, 1930
1,806,861	Owen	May 26, 1931
1,844,098	Lytle	Feb. 9, 1932
1,870,517	Lacy	Aug. 9, 1932
1,872,692	Drake	Aug. 23, 1932
1,900,456	Mead	Mar. 7, 1933
1,932,556	Merenda	Oct. 31, 1933
1,950,436	Williams	Mar. 13, 1934
2,000,430	Willshaw et al.	May 7, 1935
2,056,331	Shutt	Oct. 6, 1936
2,109,558	Waters	Mar. 1, 1938
2,155,316	Lauterbach	Apr. 18, 1939
2,332 023	Stacy	Oct. 19, 1934