Jan. 17, 1933. W. H. MASON 1,894,777

PRODUCTION OF VEGETABLE FIBER SHEETS

Filed April 3, 1929

Fig. 1.

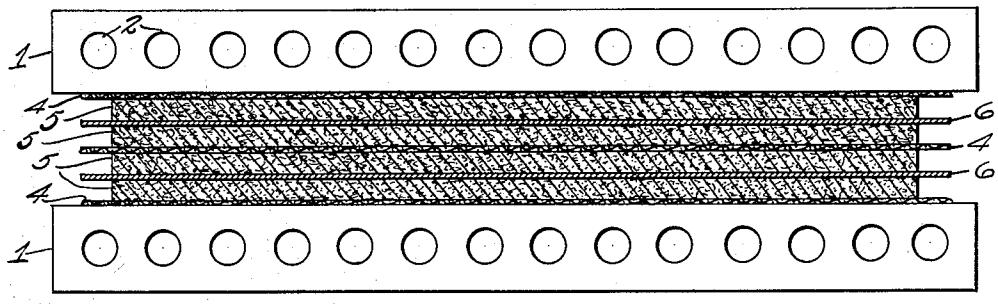
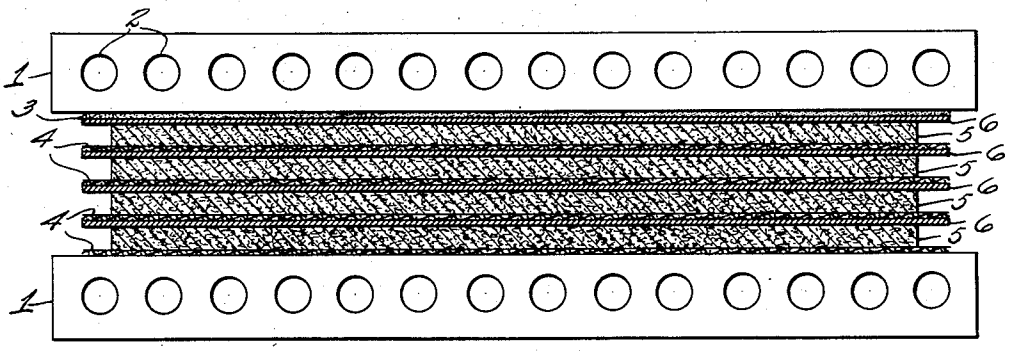


Fig. 2.



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UNITED STATES PATENT OFFICE

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PRODUCTION OF VEGETABLE FIBER SHEETS

Application filed April 3, 1929. Serial No. 352,175.

My invention relates to processes for the production of sheets by the hot pressing of wet, felted fiber obtained preferably by the explosion of wood chips, although various other fibrous materials containing cellulose and a substantial percentage of lignin may be used, and disintegrated by grinding or other method by which the lignin is retained.

A very dense strong board can be made from such material in accordance with the processes set forth in U. S. Patent No. 1,663,505, granted March 20, 1928, and my application Serial No. 293,313, filed July 16, 1928.

By reason of the fact that the material should be held under pressure while being dried, or, in other words, that the sheets should not be removed from the press until dry, it is very desirable to use presses of large capacity so that a large number of sheets may be pressed and dried simultaneously. I have for this reason used presses comprising as many as twenty-one horizontal steam-heated platens, for the pressing of twenty sheets.

The main object of the present invention is to further increase the capacity of the press by providing a process whereby a plurality of sheets of wet felted fiber, hereinafter called wet lap sheets, may be simultaneously pressed between a single pair of platens instead of only one such sheet, as heretofore.

In pressing wet lap sheets according to the processes referred to, the platens may be kept always at a high temperature, for example from 220° F. to 500° F. or higher, and the flow of heat from the platen to the material during the closing of the press retarded so that the temperature of the material will not rise above 212° F. until after a pressure thereon of 200 lbs. per sq. inch or more has been obtained. I am able to meet this requirement in the present process by reason of the fact that the wet lap sheets when compacted by the press are of such density as to have a high degree of heat conductivity, so that during the pressing operation heat flows from a platen through such sheet to another sheet which is comparatively remote from the platen with sufficient speed to dry the latter before objectionably overdrying the former. I am therefore able to press and dry a substantial number of sheets between each pair of platens at each operation of the press.

Reference is hereby made to the accompanying drawing, of which

Figure 1 is a side elevation of a pair of platens and shows in section means associated therewith for pressing a plurality of sheets in accordance with my invention.

Figure 2 is a similar view of the platens of Figure 1 and modified means for pressing a plurality of sheets.

The platens 1, 1 may be any two members arranged for relative movement toward each other to exert a high degree of pressure upon material therebetween, for example 200 lbs. to 1000 lbs. or more per square inch. They are provided with a multiplicity of bores or passages 2 for admission of steam for maintaining a high temperature, as for example 220° F. to 500° F. or more.

The press used is preferably a hydraulic press having a horizontal upper fixed platen and a large number of horizontal movable platens. One or more vertically movable rams may be arranged below the platens for applying the pressure. The platens (except the uppermost one which is stationary) are free to move in a vertical direction in order to permit the pressure of the ram to be simultaneously applied to each of the sheets. Such a press is shown in my Patent No. 1,767,539, granted June 24, 1930. In using a press of this kind, the wet lap sheets are inserted simultaneously between the various platens which are independently supported and spaced by a stepped support. As the ram rises, the bottom platen picks up the various platens in succession and does not apply substantial pressure to the sheets until the upward movement of the movable platens is resisted by the uppermost or fixed platen.

The arrangement of the parts shown in Fig. 1 is as follows: Upon the lower platen 1 are one or more layers 4 of wire cloth which may be ordinary galvanized window screen. A wet-lap sheet 5 is placed upon the wire cloth 4, and a surface plate or face plate 6 is laid upon the sheet 5.

The plate 6 is preferably of non-corrosive material, for example chromium, nickel, brass, aluminum or stainless steel, or ordinary steel which may be of $\frac{3}{16}$" thickness and provided on both upper and lower surfaces with an electrodeposited coating of chromium, nickel or other non-corosive metal.

Upon the plate 6 is placed a second wet lap sheet 5, then a layer of wire cloth 4, a third wet lap sheet 5, a face plate 6, a fourth wet lap sheet 5, and one or more layers of wire cloth layer 4, the latter contacting with the upper platen 1 as the press is closed. Such an arrangement of wet lap sheets, face plate and wire cloth layers may be termed a sandwich formation.

It will be noted that each wet lap sheet is in contact with a face plate and a wire mesh layer. The function of the latter is to provide a multiplicity of passages for the escape of expressible water from the wet lap sheet during the closing of the press and of steam thereafter until the material is dry and the finished sheet ready for removal from the press. In addition, the top and bottom wire mesh layers 4 aid in retarding the flow of heat from platens to material during the closing of the press. In order to avoid the uniting and welding together of the two wet lap sheets which are separated from each other only by a layer of wire cloth, such wire cloth may be made sufficiently fine to prevent such union, or a double layer of coarser mesh may be used.

The structure of Fig. 2 differs from that of Fig. 1 in the arrangement of the various wet lap sheets, face plates, etc., in sandwich formation which is as follows beginning at the bottom, viz., one or more layers of wire mesh 4, wet lap 5, face plate 6, wire mesh 4, wet lap 5, face plate 6, etc., continuing in the same order to the uppermost face plate 6 upon which rests an asbestos sheet 3 which makes contact with the upper platen 1. In this arrangement the flow of heat from the top platen to the material is sufficiently retarded during the closing of the press by the layer of asbestos 3 and face plate 6. However, it should be understood that, if desired, a single or double layer of wire mesh material may be used in place of or in addition to the layer of asbestos.

While I have shown in each figure of the drawing an arrangement suitable for the simultaneous pressing of four wet lap sheets, it should be understood that by a similar arrangement a greater or smaller number of sheets may be simultaneously pressed.

In carrying out my improved process, the wet lap sheets may be inserted between the press platens as described, and the hydraulic ram is thereupon actuated to close the press. During the interval between the contacting of the wire mesh sheets (or equivalent heat retarding means) with the platens 1 and the complete closing of the press, there will be a flow of heat from platen to material, but the rate of flow is retarded by the wire mesh sheets, and in some cases also by a face plate. The wet lap sheets contain a substantial percentage of water, so that even though a considerable number of heat units may flow into the wet lap sheets during said interval it will not raise their temperature above 212° F.

As the ram rises, it picks up the platens one by one until the uppermost one has been picked up and the load thereon is brought into contact with the fixed platen at the top of the press. Pressure is thereupon applied to the material and although the wet lap sheets may have lost some water by evaporation, they still contain expressible water which is pressed out by the action of the press and escapes through the passages formed by the wire mesh layers 4. Such expression of water continues until the full working pressure of the press has been applied to the material, which may be 200 lbs. to 1000 lbs. or more per square inch. Up to this time the temperature of the wet lap sheets has been held down by such water to 212° F., but it is now increased by reason of influx of heat from the platens which may be at a temperature of 220° F. to 500° F. or more.

The heat causes the free water content of the sheets to be gradually driven off by evaporation, and the combined heat and pressure effect a compacting of the material while still wet so as to form a dense board which is substantially non-porous and a fairly good conductor of heat.

By reason of the good heat conductivity of such sheets, heat from the platens flows quite readily through the outermost of the wet lap sheets to the innermost so as to bring the latter up to a proper temperature for being compacted and dried. Such flow of heat is sufficiently rapid to effect the complete drying and finishing of the innermost sheets without any overdrying or damaging of the outermost sheets.

When operating with highly superheated steam, for example steam at a pressure of 180 lbs. per square inch, I prefer to shut off the steam from the platens before the press is opened, and permit some cooling of the platens and the sheets while the drying of the sheets is being completed. Further cooling occurs during the opening of the press, the removing of the finished sheets, the inserting of wet lap sheets and the closing of the press, the steam being turned on only after full pressure of the press, for example 200 lbs. or more per square inch, has been applied to the material and all expressible water thereby forced out. By thus reducing the temperature of the platens and also retarding the passage of heat from the platens to the material by the interposition between platens and material of heat retarding means, I can

insure getting the full application of pressure on the material before the driving off of the moisture by evaporation and the heating of the material to a temperature over 212° F.

Having now described my invention, what I claim is:

1. The process of simultaneously pressing a plurality of sheets of wet pulpy ligno-cellulose material between a single pair of flat platens which consists in arranging the said sheets between the platens in sandwich formation with respect to smooth surface plates and wire mesh screens, the arrangement being such that one surface of each wet sheet is contacted by a surface plate and the other surface of such sheet by a wire mesh screen, their edges being freely exposed, and thereupon maintaining said platens at a temperature of substantially 220° F. or more, with continuous application of pressure of substantially 200 pounds per square inch or more for a sufficient time to compact and dry said sheets to dense, substantially non-porous boards.

2. The process of claim 1 in which the flow of heat from platen to material is sufficiently retarded to prevent the latter from reaching a temperature in excess of 212° F. prior to being subjected to a pressure of substantially 200 lbs. per square inch.

3. The cyclic process for successively compacting bodies of felted fiber containing expressible water, cellulose and a substantial percentage of lignin, which comprises the application by a press platen heated by steam to a suitably high temperature of pressure sufficient to compact and consolidate the material to a specific gravity of approximately one, substantially drying said material under such pressure, reducing the flow of heat from platen to material during the subsequent closing of the press by shutting off the steam sufficiently in advance of the opening of the press to cause the platen to drop in temperature substantially but not below 212° F., opening and recharging the press, closing the press, and readmitting steam thereto only after such pressure has been applied to the material within the press.

4. The cyclic process for successively compacting bodies of felted fiber containing expressible water, cellulose and a substantial percentage of lignin, which comprises the application by a press platen heated by steam to a suitably high temperature of pressure sufficient to compact and consolidate the material to a specific gravity of approximately one, substantially drying said material under such pressure, reducing the flow of heat from platen to material during the subsequent closing of the press by shutting off the steam sufficiently in advance of the opening of the press to cause the platen to drop in temperature substantially, but not below 212° F., opening and recharging the press, retarding the flow of heat from platen to material during the closing of the press by the use of a poor conductor between the platen and the material, closing the press, and readmitting steam thereto only after such pressure has been applied to the material within the press.

5. The cyclic process for successively compacting bodies of felted fiber containing expressible water, cellulose and a substantial percentage of lignin, which comprises applying thereto by a press platen heated by highly superheated steam a pressure of 200 lbs. per square inch or more, substantially drying said material under such pressure, reducing the flow of heat from platen to material during the subsequent closing of the press by shutting off the steam sufficiently in advance of the opening of the press to cause the platen to drop in temperature substantially, but not below 212° F., opening and recharging the press, closing the press, and readmitting highly superheated steam thereto only after a pressure of 200 lbs. per square inch or more has been applied to the material within the press.

6. The cyclic process for successively compacting bodies of felted fiber containing expressible water, cellulose and a substantial percentage of lignin, which comprises applying thereto by a press platen heated by highly superheated steam a pressure of 200 lbs. per square inch or more, substantially drying said material under such pressure, reducing the flow of heat from platen to material during the subsequent closing of the press by shutting off the steam sufficiently in advance of the opening of the press to cause the platen to drop in temperature substantially, but not below 212° F., opening and recharging the press, retarding the flow of heat from platen to material during the closing of the press by the use of a poor conductor between the platen and the material, closing the press, and readmitting steam thereto only after a pressure of 200 lbs. per square inch or more has been applied to the material within the press.

7. The process of simultaneously pressing a plurality of sheets of wet pulpy material which comprises placing said sheets in superimposed relation between the opposing heated platens of a press with an imperforate metallic surface plate in contact with one side of each sheet and a wire mesh screen in contact with the other side of such sheet, and subjecting said sheets to pressure and heat applied thereto at the ends of the stack thereof by said platens, and effecting thereby the expression of water and the escape of steam at the sides of the stack through the individual channels formed by said screens, and the pressure effecting such consolidation of the sheets that the heat is readily transmitted from the plat-

ens through the outer sheets to the inner ones.

8. The process of simultaneously pressing a plurality of sheets of wet pulpy material which comprises placing said sheets in superimposed position with a metallic surface plate in contact with one side of each sheet and a screen in contact with the other side thereof, and subjecting the ends of the stack to pressure and heat applied by heated platens, leaving the sides of the stack free for the escape of water and steam through the individual channels formed by said screens, the heat and pressure applied being such as to form dense substantially non-porous boards such that the heat is readily conveyed from the platens through the outer sheets to the inner sheets.

9. The process of claim 8 in which the material used is ligno-cellulose, and the temperature employed is of the order of 220° F., or more, and the pressure applied is of the order of 200 pounds per square inch.

10. The process of claim 8 in which the pressure and heat applied is such as to form a board having a specific gravity of approximately one or more.

11. The process of claim 8 in which the heat applied is always greater than 212° F. and the heat controlled to prevent the material heating to a temperature greater than 212° F. prior to the application of pressure.

12. The process of pressing sheets of wet pulpy material which comprises subjecting the sheet or sheets to high pressure and heating at a temperature in excess of 212° F. applied to the sheet by heated platens, and during the charging intervals of such operation reducing the temperature of the press, but not below 212° F., to prevent the material attaining a temperature of 212° F. prior to the application of pressure.

13. The process of claim 12 in which the flow of heat from the platens to the material is also retarded to prevent overheating of the material before application of pressure.

In testimony whereof, I have signed my name hereto.

WILLIAM H. MASON.