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PRESS FOR THE PRODUCTION OF HOT-PRESSED SHEETS

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2 Sheets-Sheet 2

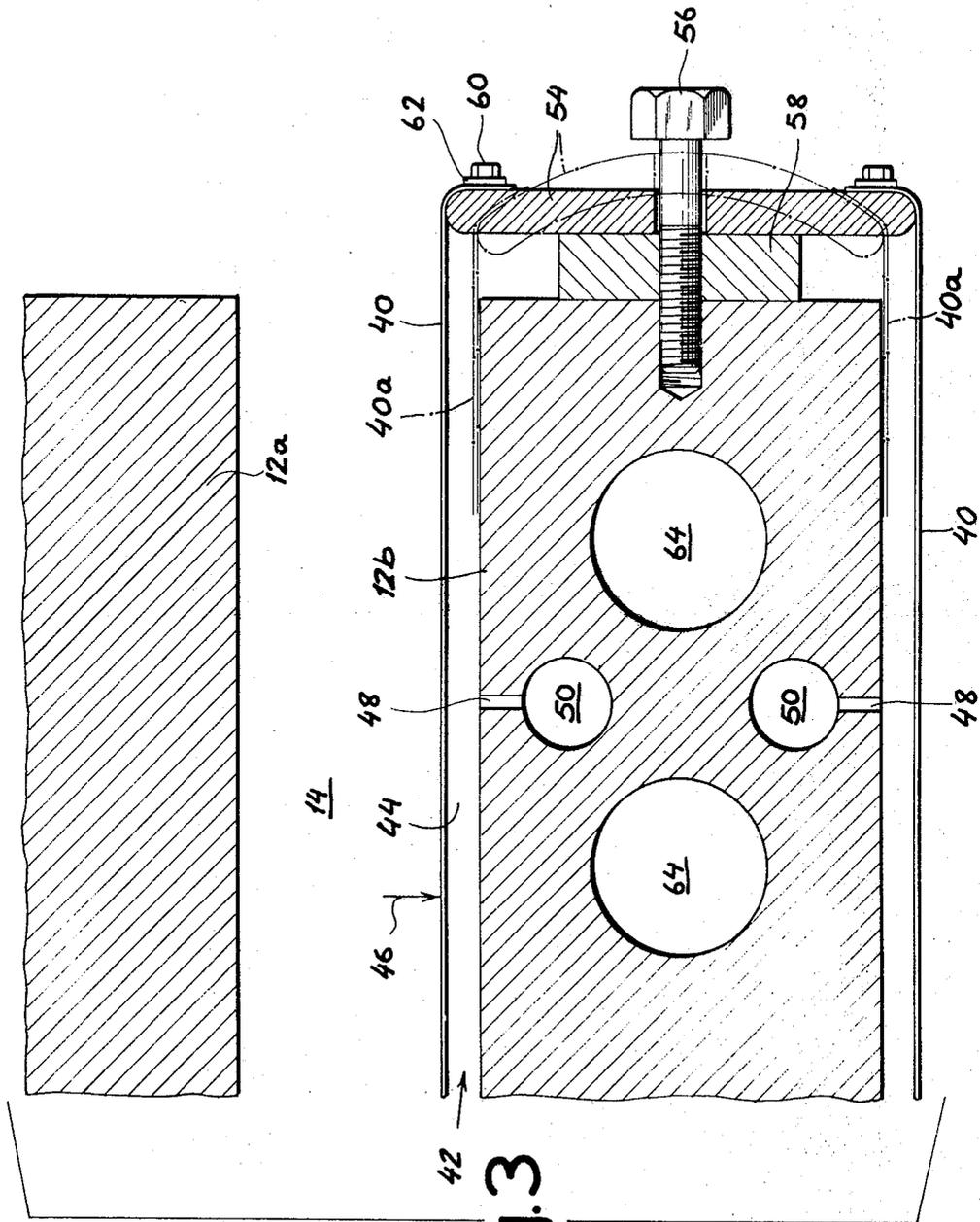


Fig. 3

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PRESS FOR THE PRODUCTION OF HOT-PRESSED SHEETS

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5 Claims

ABSTRACT OF THE DISCLOSURE

A multiplaten press for the production of hot-pressed board from comminuted material, such as wood or other cellulosic fibers with or without addition of a binder, and method of operating such press, wherein the raw layer of comminuted material is fed between the heated platens of the press with interposition of a sheet-metal heat-conductive liner in surface contact with the respective platens in the closed condition of the press, the liners being mounted to define a narrow gap breaking heat conductivity between themselves and the platens when the press is opened. An array of nozzles direct cooling gas (e.g. air) against the liners to cool them without cooling the platens which are continuously heated.

My present invention relates to a platen process for the production of coherent sheet material and, more particularly, for the hot pressing of cellulosic fibers, chips, particles or the like in the presence of a natural or artificial thermally activated binder to form coherent sheets from layers of non-coherent or loosely coherent materials.

The production of pressed board has played an increasingly significant role in the structural-material field and, indeed, pressed boards of numerous types are currently available, the types depending in part upon the comminuted material used therein, the densities to which the boards are pressed and the types of binder. For example, fiberboard, chipboard, beaverboard and other coherent plates or sheets can be formed from cellulosic fibers or comminuted wood using the lignin inherently found therein as the binder or with the addition thereto of binders such as phenol-formaldehyde resins.

In most cases an apparatus for the production of such binders comprises a dispenser for depositing a layer of loosely coherent or noncoherent comminuted material upon a receiving surface which may be passed into a pre-press or which may deposit the layer upon a charging plate, movable metallic van or the like for introduction into a platen press. In my U.S. Pats. Nos. 3,050,200 and 3,077,271, I describe various apparatus of this general type for the production of pressed board in which a stack of charging levels adjacent one side of a multiplaten press feeds the raw layers of comminuted material onto respective tiers of a multiplaten or a multistage press, while means is provided on the other side of this press for leading the pressed and coherent sheets therefrom. In my U.S. Pat. No. 3,050,777, for example, I describe and claim a multilevel press of this general character while my Pat. No. 3,241,189 describes and claims the structure and technique involved in the heating of the platens.

It will be recognized that, where multiplaten presses are concerned, there are two basic methods of operating the installation. In one system, the layers charged into the press are supported upon so-called "charging trays" or plates which may be advanced into the press and deposited upon the lower platen of each tier. Heat transfer to the respective layer takes place through the rigid charging plate which, when the press is reopened, carries the

now rigid and densified sheet from the press. This system has advantages in that there is no distortion of the layer when it is advanced in the nonpressed condition into the press but involves difficulties with respect to recirculating the charging trays to the dispensing station and with respect to the cooling of the plates as is required for their further handling. In a modification of the system, the noncoherent layer of comminuted material is drawn into the press on a so-called "band support" which consists of more or less flexible sheet material characterized by ease of cooling. This band may be associated with the platen in such manner as to eliminate the need for circulation. However, complex drive arrangements are required for the band tablets and trays. In the system set forth in the first-mentioned group of patents, an alternative method of charging and discharging multiplaten presses wherein the noncoherent or loosely coherent layers of comminuted material are deposited upon the platens of the press by respective conveyor belts designed to let on the layers at a rate such that there is no substantial distortion thereon. A similar method of transporting such layers and charging the press is described in U.S. Pat. No. 3,332,819. When these methods are employed, the layer is deposited upon the lower platen of each tier of a multiplaten press, the press is closed to compact all of the layer simultaneously and, upon opening of the press, the sheets of coherent material are pushed from their layer platens onto a discharging station whose tiers correspond in number to those of the press. From the discharging station, the coherent sheet may be led to an annealing or tempering kiln or the like. Such arrangements also involve difficulties since the press platens cannot always be continuously heated and direct contact of the noncoherent layers with platens at a temperature of compression causes destruction of the layer, gas evolution or the like. Cooling of the platens before the layers are deposited thereon is uneconomical with respect to the heat balance and, because of the mass of the platens, requires considerable time, thereby limiting the rate of production of the sheets.

It is, therefore, the principal object of the present invention to provide an improved method of operating a platen-press installation for the production of hot-pressed sheets which permit an increased rate of production, reduces the possibility of thermal distortion of the pressable layers and requires low capital expense.

Another object of this invention is to provide an apparatus for the production of hot-pressed board whereby the disadvantages of earlier systems may be obviated.

These objects and others which will become apparent hereinafter are attainable in a system wherein a multiplaten press having a pair of vertically spaced horizontal platens at each press stage and with at least the lower platens thereof heated, is provided along the lower press platens with a thermally conductive (e.g. sheet metal) cooling sheet or liner adapted to form a slight gap between its major surface regions and the corresponding regions of the heated press platen when the press is open; in the closed condition of the press, this liner, which is interposed between the layer of comminuted material and the heated surface of the platen, is in heat-conductive surface contact with the platen to transfer heat to the layer during the compression stroke. Advantageously, means is provided externally of the press or within the press platen for directing a stream of cooling gas (e.g. air) along the liner surface.

According to a further feature of this invention, the sheet-metal liner is affixed to the respective press platen along opposite edges thereof by a resiliently deflectable support extending above the heated surface of the platen and about which the liner is turned and anchored. Thus the liner is resiliently supported on its respective platen

and can be biased by normal press closure and the elevated press pressure into surface contact therewith; upon opening of the press and removal of the coherent sheet, the liner springs into its predetermined spacing from the heated surface so that the sheet-metal liner may be cooled by the gas jet, advantageously passing in part through the gap and directed along the surface of the liner remote from the gap without materially cooling the continuously heated platen. In this manner, it is possible to cool the sheet to a temperature of 250° to 200° C. or less. The nozzles for directing the cooling air along the liners, which may be advantageously disposed along both sides of each layer and along the upper and lower platens defined in each press stage, can be oriented and arranged in various ways. For example, the nozzles can be disposed along the periphery of the platens or formed in the platens directly opposite the liners. In the latter case, the press surface of the platen is formed with the nozzles which are connected to a dispensing network of cooling channels built into the pressed platen. When the nozzles are oriented in this manner, the liner is supported upon a cushion of cooling air in addition to or aside from the resilient support means described earlier. The channels and nozzles must be so oriented that the liner is practically level and is yet subjected to uniform cooling by the gas and I have found that the cooling gas flow should be, to fulfill these conditions, stronger at the edges of the liners or platens than in the central zones thereof.

According to the method aspect of this invention, the gap between the liner and the pressed platen should be of the order of 0.8 mm. while the temperature of the liner is preferably reduced to about 200° to 150° C. Furthermore, the thickness of the liner and its total mass should be such that it can be brought to this temperature by contacting the cooling stream in a period of 10 seconds or less. Advantageously, the liner is composed of a material of high thermal conductivity (e.g. stainless steel).

It has been found that this arrangement has the significant advantage that materials of high conductivity, when serving as a liner, not only permit rapid cooling of the surface to contact the incoming layer of comminuted material but also provide rapid heating of this layer upon press closure. In addition, I have found that advantage is gained by the fact that thermal transfer through the liner takes place only when the press cycle has indeed begun to be effective upon the particular layer and not prior thereto. In effect, the liner produces a delay in the heating of the layer until compression has commenced, which delay increases the quality of the coherent sheet produced by activating the binder after initial compression. A substantial saving in thermal energy is obtained concurrently with an increase in the cycle rate of the press which has been found to be particularly effective even with so-called dry-pressed board.

The above and other objects, features and advantages of this invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a diagrammatic elevational view of a press embodying this invention;

FIG. 2 is a detailed view showing the arrangements of the nozzles of this press; and

FIG. 3 illustrates another nozzle arrangement but showing the means for supporting the liners on the platens of FIGS. 1 and 2.

As diagrammatically illustrated in FIG. 1, an apparatus for the manufacture of chipboard sheets, fiberboard sheets, and the like includes multiplaten press 10 with, in the example shown, a number of pressing plates or platens 12 vertically spaced from each other, to form, between each pair of press platens 12, pressing chambers or passageways 14 in tiers (see U.S. Pats. Nos. 3,209,405 and 3,050,777). The device also includes a press-charging station generally indicated at 16, with stacked conveyor belts or the like 18, and also a discharge appara-

tus, generally indicated at 22, for discharging or emptying the pressing chambers 14 of the finish-pressed panels or sheets 20, which have been formed from the raw or partly fabricated non-coherent layers 24 (see U.S. Pats. No. 3,050,200, No. 3,077,241, and No. 3,288,057).

The conveyor belts pass under a conventional spreading or distributing hopper station not shown, from which a quantity of fibrous or comminuted chip material or the like is deposited on them, which is to form the raw or partially fabricated sheets 24. The fibers may be dampened, supplied with a binder or otherwise treated either in the hopper or spreader or thereafter as needed, and may be subjected to an initial rough pressing operation by a rough-forming press which shapes them into the raw or rough layers 24. They are carried by band conveyors, charging plates or the like and ultimately arrive at the respective delivery apparatus station 16, in tiers one above the other.

Referring again to FIGS. 1 and 2, it is seen that there are provided cooling liners or sheets 26 of sheet metal, which extend across and over those surfaces of the pressing plates 12, which form the interior surfaces of the pressing chambers 14. Thus, when the rough-formed layers 24 are moved into their respective tier of pressing chambers 14, from station 16, with the press in opened position as shown, they are not in direct contact with the pressure plates 12, but always have liners 26 inbetween their upper and lower surfaces and the respective plates.

Means are provided (see FIG. 3) whereby, when the press is in opened position as shown, the cooling liners are spaced from their related pressure plates by the small spacing indicated by *a*, forming a narrow gap or passageway between the lining and pressure plate. This feature is indicated on a larger scale in FIG. 2. Of course, when the press is actuated, so that the pressing plates move downwardly, apart from the lowermost plate, then the cooling liners 26 are pressed against their related pressing plates 12, with the raw sheets inbetween related cooling liners and out of direct contact with the pressing plates themselves. It is to be noted that the pressure plates of the press are provided with heating ducts (see FIG. 3 or my patents cited earlier) for maintaining them at a predetermined temperature suitable for the particular material and operation being worked upon.

Cooling nozzles 28 are provided around the cooling liners 26, the embodiment disclosed providing the nozzles 28 about the side edges of the cooling liners and also about their end edges, preferably as needed. Additional or supplementary nozzles 28 may also be provided as necessary. From each of the cooling nozzles 28 there is discharged a cooling gas, for example, air, at the time when the press 10 is in open position and the pressing plates 12 at their maximum interspacing.

FIG. 2 shows arrows 30 which illustrate the path of the cooling gas entering each tier of the press, so that the gas covers each entire cooling liner 26 and thus cools it off, e.g. to a temperature from 200° C. to 150° C.; that is to say, that the cooling action is to be carried out to a point at which the comminuted layers are no longer adherent to or affected by the liner surfaces.

The latter result can be reached in a few seconds, since the cooling liners 26 themselves are made of thin metal of good heat conduction qualities. According to a preferred form of the invention, each pressing chamber is lined with upper and lower cooling liners whereby, upon the closing of the main press 10, the raw-material layers 24 in the pressing chambers are subjected simultaneously to pressure on both their upper and lower surfaces from the liners. The interspacing *a* between each cooling liner and its related pressing plate upon opening of the press, may, for example, be about 0.8 mm., according to a preferred example.

In the operation of the aforementioned apparatus, the rough-material layer 24 may be fed into respective tiers of pressing chambers 14 with the aid of the belt con-

veyors 18, by causing the conveyors to move rapidly in a direction toward the main press 10, and then to suddenly stop and reverse them or by holding fast their drive belts 32. Thus, by inertia, each of the rough-material sheets 24 is thrown forwardly into its respective tier of pressing chambers 14. The pressing plates 12 are continuously heated, but cooling liners or trays 26 have experienced the above-mentioned cooling action by air blast and are spaced by the distance *a* from their related pressing plates 12. When the main press is again closed, the cooling liners press against the pressure plates 12, and the heat conduction resumes, so that the cooling liners 26 are quickly heated whereby further the closing of the main press results in effective pressing action from both the upper and lower surfaces of the pressing plates, as mentioned. When the press opens again, the blasts from the air-cooling nozzles not only exert cooling action, but also force the liners 26 away from their related pressing plates, and also from the finished pressed sheets 20, which are removed to the right as seen in FIG. 1 to suitable trays for storage or the like.

FIG. 3 shows the means for actuating the cooling liners and allowing movement to normal open-press spaced positions from their positions when the press is closed.

As illustrated in FIG. 3, there are pressure plates 12*a* and 12*b* which represent those at 12 of FIGS. 1 and 2. Upon the closure of the main press 10, as explained, any raw-material sheets in the pressing chambers 14, between adjacent overlying pressure plates, will be pressed into finished form.

At least the lower platen 12*b*, according to the embodiment shown, is provided with a cooling liner or sheet 40, generally corresponding to liners 26 of FIG. 1. The cooling liner 40 is normally maintained when the press is open, in its solid-line position, spaced to the extent of interspacing 42 to form a fluid passageway 44 therebetween. The support is such that the cooling sheets 40 are subjected to tension along their entire length. When the pressing operation takes place, the arrow 46 shows that each of the cooling sheets 40 is pressed against its related pressure plate such as 12*b*. It is also seen that each surface of the pressure plates 12*a*, 12*b* is provided with cooling gas nozzles 48 leading from gas ducts 50, for conducting from a source, a cooling pressurized gas such as air to the nozzles. When the press is opened, then the cooling gas from nozzles 48 serves to press the cooling liners 40 away from the pressure plates such as 12*b*, and exerts a cooling effect, as shown in solid lines, from their broken-line position 40*a*.

In order to place the cooling liners under tension as mentioned, supports include at the opposite edges of each platen, a spring plate 54 which is wider than the thickness of the pressure plate as shown in full lines, and is slidably mounted on the bolt 56 which in turn is threaded into the respective edge of the pressure plate. The spring plate 54 is spaced from the edge of the pressure plate by the block 58, as shown, and each of the edges of each cooling liner sheet 40 is bent over and secured to the edges of the spring plate 54 by means of screws 60 and washers 62. Ducts 64 serve to heat the platen.

It is thus seen that when the press is open, the spring plate 54 is relatively flat and maintains the cooling liners 40 in tension and flat and spaced from the related pressure plate. When the press is closed, the cooling liners 40 are pressed to positions 40*a* against the pressure plate, and the spring plate 54 assumes the convex position shown in broken lines. Upon opening of the press, the spring plate immediately returns to flat position, and places the liner sheets 40 under tension and spaced from the pressure plates. The blocks 58 are narrower than the pressure plates, and are secured thereby by the same bolts 56.

The invention described and illustrated is believed to admit of many modifications within the ability of persons

skilled in the art, all such modifications being considered within the spirit and scope of the invention.

I claim:

1. In an installation for producing pressed board wherein a layer of comminuted material is hot-pressed to form a coherent sheet and including a platen press having at least one pressing stage and at least two platens receiving said layer between them, means for heating at least one of said platens, means for relatively shifting said platens toward and away from one another to compress said layer and release same, the improvement which comprises:

at least one sheet-metal liner interposed between said layer and said one of said platens for heat-conductive surface contact therewith upon movement of said platens toward one another for transferring heat to said layer;

means operatively connected with said liner and effective upon movement of said platens away from one another to space said liner from said one of said platens and break heat-conductive contact therebetween at least along the major portions of the surfaces of said liner and said one of said platens; and means for subjecting said liner to a stream of a cooling fluid including nozzle means disposed along an edge of said liner and trained toward said liner for directing said stream of cooling fluid at least in part between said liner and said one platen.

2. The improvement defined in claim 1 wherein each of said platens is provided with a respective sheet-metal liner interposed between it and said layer and provided with respective means for spacing the liner from the respective platens and for subjecting each of said liners to a respective stream of said cooling fluid.

3. The improvement defined in claim 1 wherein said press is a multilevel press having a plurality of vertically spaced horizontal platens defining respective stages between respective upper and lower platens, at least the lower platen of each stage being heated and being provided with a respective liner, respective means for spacing each of said liners from the respective lower platen upon opening of the press, and respective means for subjecting each of the liners to a respective stream of cooling fluid.

4. The improvement defined in claim 3 wherein the means for spacing each of said liners from the respective lower platen of the respective stages is constructed and arranged to form a gap of the order of 0.8 mm. between each liner and the respective lower platen, said means for subjecting said liners to a respective stream of cooling fluid being formed as respective arrays of nozzles directing respective jets of air over the upper surfaces of said liners.

5. In an installation for producing pressed board wherein a layer of comminuted material is hot-pressed to form a coherent sheet and including a platen press having at least one pressing stage and at least two platens receiving said layer between them, means for heating at least one of said platens, means for relatively shifting said platens toward and away from one another to compress said layer and release same, the improvement which comprises:

at least one sheet-metal liner interposed between said layer and said one of said platens for heat-conductive surface contact therewith upon movement of said platens toward one another for transferring heat to said layer;

means operatively connected with said liner and effective upon movement of said platens away from one another to space said liner from said one of said platens and break heat-conductive contact therebetween at least along the major portions of the surfaces of said liner and said one of said platens; and means for subjecting said liner to a stream of a cooling fluid, said means for spacing said liner from said

one of said platens comprising a respective elastic support at opposite edges of said one of said platens, said liner spanning said support while being retained thereby in spaced relationship from said one of said platens in an open condition of the press but being resiliently urged into surface contact with said one of said platens to stress said supports upon closure of the press with a layer between said platens, said supports being respective elastic members extending transversely of said one of said platens and projecting therebeyond by a distance approximately corresponding to the spacing between said liner and said one of said platens in said open condition of the press, said members being deflectable inwardly toward said press stage upon press closure, said one of said platens being provided along its opposite surfaces with a pair of said liners, said members lying generally in planes perpendicular to said one of said platens and extending in the respective planes over a width exceeding that of said platens, said means for spacing said liners from said one of said platens further comprising bolt means slidably extending through said members for securing same to said one of said platens at said opposite edges, and spacer elements between said edges and the respec-

tive members, said spacer elements having widths less than the thickness of said one of said platens, said bolt means passing through the respective member and element.

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