

Feb. 18, 1969

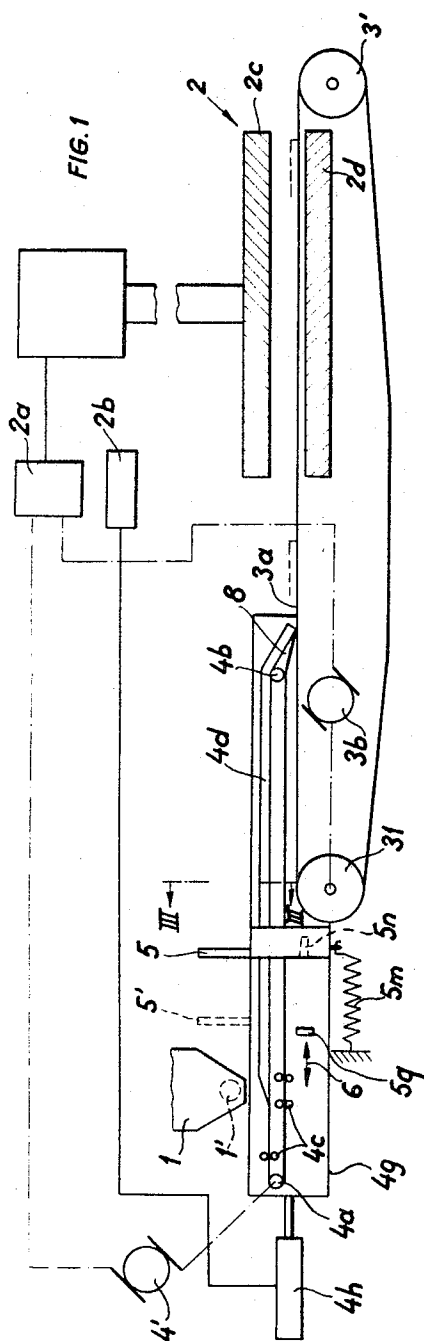
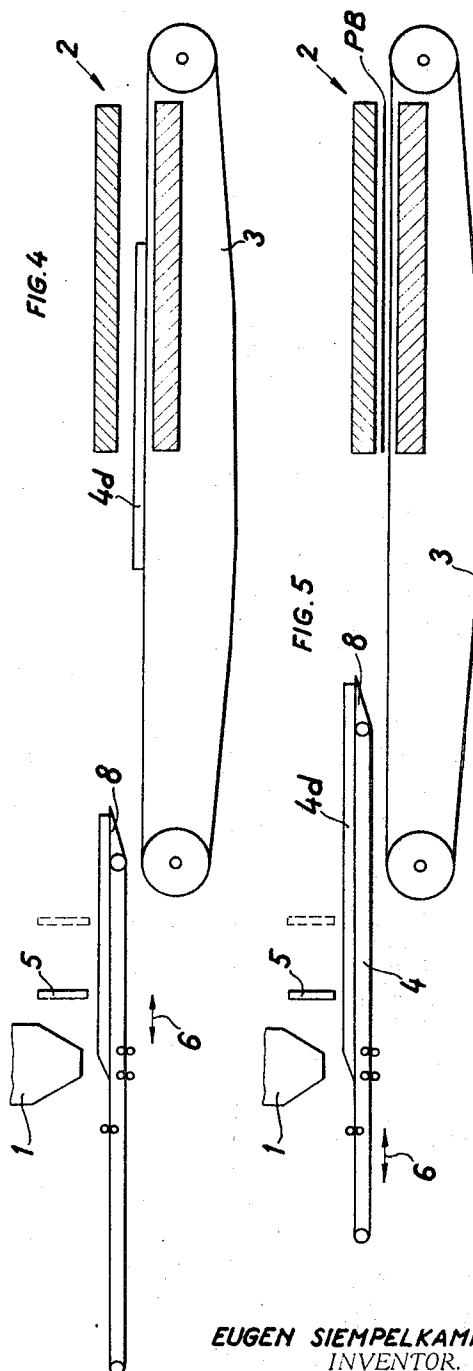
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3,428,505

METHOD OF AND APPARATUS FOR THE PRODUCTION OF PRESSED BOARD

Filed May 24, 1965

Sheet 1 of 3



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METHOD OF AND APPARATUS FOR THE PRODUCTION OF PRESSED BOARD

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Sheet 2 of 3

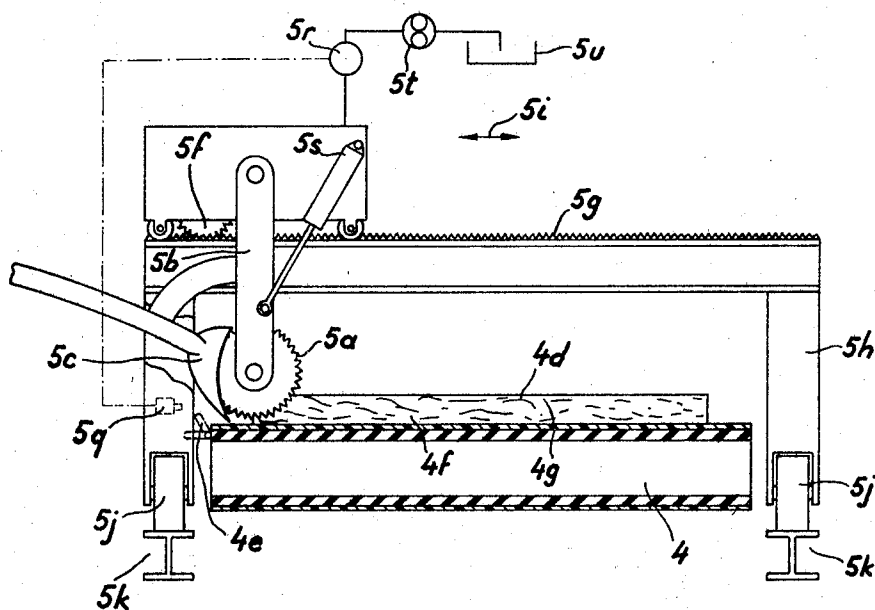


Fig.3

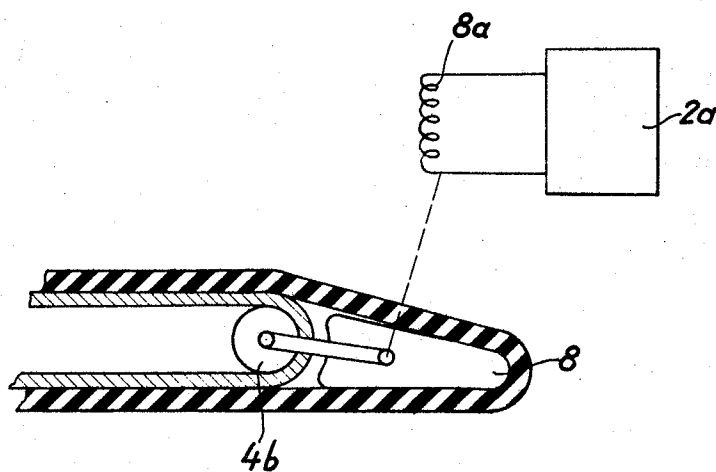


FIG. 2

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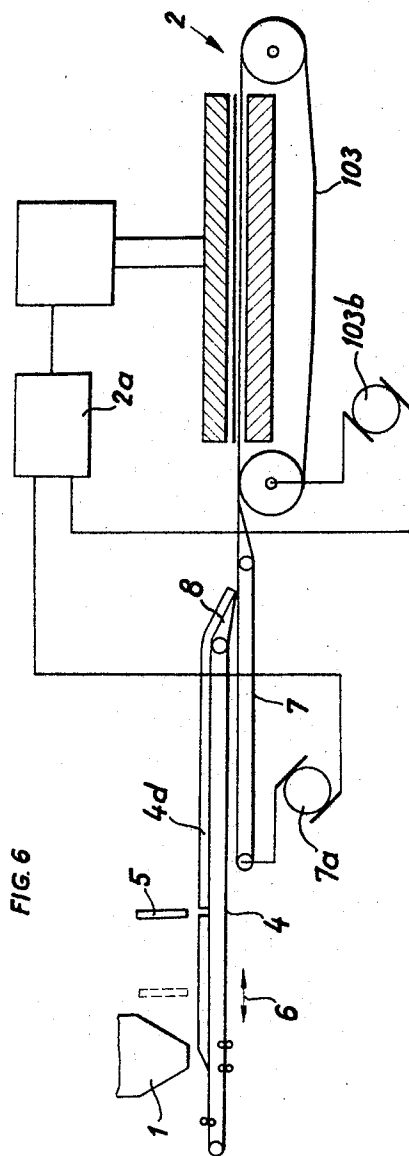
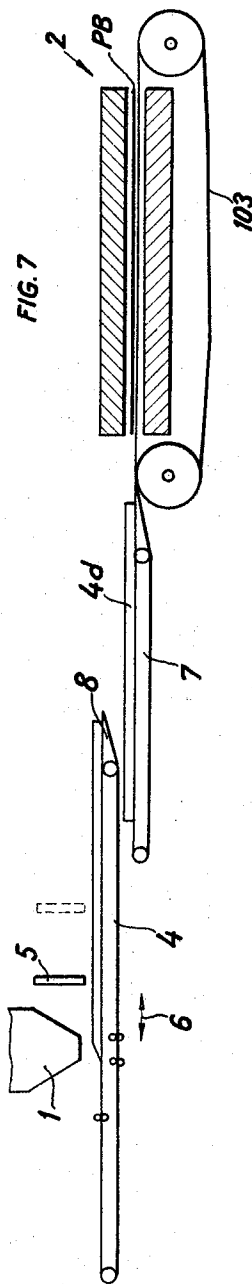
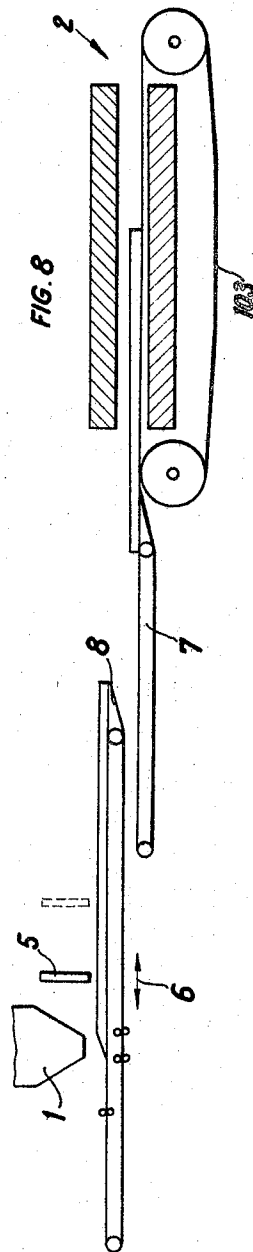
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Sheet 3 of 3



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3,428,505

METHOD OF AND APPARATUS FOR THE PRODUCTION OF PRESSED BOARDEugene Siempelkamp, Hohenzollernstrasse 69,
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Filed May 24, 1965, Ser. No. 458,228

U.S. Cl. 156-62.2

8 Claims

Int. Cl. B29j 5/08

ABSTRACT OF THE DISCLOSURE

Method of and apparatus for the production of pressed board in which a first conveyor receives a layer of fibrous material and deposits this layer upon a conveyor passing through a press by reciprocation of the first conveyor while advancing its layer-receiving surface to deposit the layer upon a press conveyor, the first conveyor being then withdrawn at a constant rate as its surface continues to advance for the deposition of a subsequent layer thereon. The press conveyor, during this period, advances the first layer into the press and is halted during the press cycle as the second layer is formed upon the surface of the first conveyor.

My present invention relates to the production of pressed board from comminuted and loosely coherent material and, more particularly, to an improved method of producing such boards as well as an apparatus for carrying out this method.

In my copending application Ser. No. 414,914, filed Nov. 30, 1964 (now abandoned), I disclose an arrangement for the serial production of pressed boards and sheets from comminuted and generally fibrous material which may be admixed with or inherently contains a thermally activatable binder. For the most part this disclosed method and many prior-art techniques involve the dispensing of the comminuted material onto a surface to form a generally flat and, hopefully, uniform layer thereon, the surface being conveyed into a press. When charging plates are used, the equipment required to recirculate the plates to the dispensing station becomes inordinately complex, whereas the use of continuous bands requires that these bands be brought to a standstill during the compression part of the stroke of the press. When reference is made hereinafter to "comminuted" material, it will be understood that any of the conventional substances generally employed for the manufacture of pressed board by compression of a layer of the material (i.e. with heating) are intended. The fibrous materials for this purpose are, for the most part, cellulosic and can be produced by comminuting wood (e.g., chip or sawdust formation, explosive expansion of wood fibers) or are the waste products of plants for the production of other materials.

The wood and other fibers can contain sufficient natural resins to render them coherent when the layer is pressed in the presence of heat although they will usually be admixed with thermoplastic or thermosetting resins (e.g., of the phenol-formaldehyde type), such resins constituting binders for the fibers. Depending upon the density of the product, the fibrous boards are designated as "hard-board" in which the resin proportion can be relatively high and which have a high-density and are substantially fluid impermeable, and so-called "fiberboard" of relatively high porosity and correspondingly low density. The latter are excellent insulating materials whereas the former find their greatest utility as structural or wall-forming members. Boards of this general type include "fuller board" containing scrap-fabric fibers and wood fiber residues from the manufacture of paper or other industrial processes. The present invention is, therefore, concerned with all types of pressed-fiberboards wherein a noncoherent

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mass is compressed, usually concurrently with heating, to form a coherent plate-like structure.

As previously mentioned, the continuous or high-speed production of pressed board in installations having a dispensing station and a press has hitherto been limited by the fact that any conveyor means carrying the layer of limited coherent material to the press was required to operate only intermittently and hence the dispensing means was able only to function in a periodic manner. To increase production it had been proposed to shift the press or the dispensing station relatively to one another and the conveyor means. It has been suggested that the press, during the compression stroke, be movable with the conveyor which could then continuously receive the comminuted material from the stationary dispensing means; upon conclusion of this press stroke, however, the press was returned in the opposite direction. Others have suggested that a reciprocable dispensing station shift rearwardly with respect to the direction of feed of the layer while the conveyor means was immobilized during the stroke of the stationary press and then advanced when a further sheet was supplied thereto. In both cases the apparatus required for movably supporting the dispensing station and the press was inordinately complex, expensive and space consuming. Furthermore, the forward-and-back movement of the dispensing apparatus resulted in nonuniform distribution of the material in the layer and in pressed boards of nonuniform density. Thus it has not been possible heretofore to satisfactorily produce press boards in a plant at high rate with both the dispensing station and the press substantially stationary.

It is the principal object of the present invention to provide a method of and an apparatus and plant for the production of pressed board from comminuted material wherein the rate of production is not limited by the duration of the compressed stroke of the press and yet avoids the disadvantages of the conventional system described above.

A more specific object of the invention is to provide an improved method of operating a plant for the production of pressed board from comminuted material at high production rates and relatively low expense.

A further specific object of the invention is to provide a plant wherein high production rates can be obtained without limitation by the duration of the press stroke.

This and other objects of my present invention, which will be apparent hereinafter are attained in accordance with the present invention by a method of operating a plant for the production of press boards wherein a layer of comminuted material is deposited upon a conveyor means at a stationary dispensing station and this layer is carried by the conveyor means into an intermittently operable and stationary press spaced from the dispensing station where the layer is compressed against the conveyor means; the present improvement, in its method aspects, then comprises the steps of driving a first portion of the conveyor means past the dispensing station at a substantially constant speed for continuous deposition of the comminuted material upon this first portion or first conveyor band to form the layer, intermittently driving a further portion of the conveyor means carrying the layer to carry it into the press whereby this further portion of the conveyor means may be inactivated during compression of the layer, and transferring the layer from the first portion of the conveyor means to this further portion without interrupting the continuous drive of this first portion.

This result is attained in accordance with this aspect of the present invention by shifting the first portion or band of the conveyor means in the direction of displacement of the layer over a part of the further portion of the conveyor means and thereupon retracting the first portion to progressively place this layer upon the receiv-

ing part of the further portion of the conveyor means. Since the further portion of the conveyor means will generally include a band of steel or other metal against which the layer is compressed between the platens of the press and such bands are prone to wear and are relatively expensive, the receiving part of the further portion of the conveyor means can include an intermediate conveyor disposed between the continuously operable layer-forming first band and the steel compression band. Alternatively, a somewhat longer steel band can be employed with a portion thereof forming the receiving part. In all cases, it is an essential feature of the present invention that the speed of the first band and the conveyor constituting the receiving part be synchronous (i.e. identical), so that upon transfer of the layer of sheet material, which is at most only limitedly coherent, there will be no tendency for the layer to be disrupted or distorted. It will be evident that this method of operating the plant permits both the dispensing station and the press to be stationary but nevertheless allows continuous operation of the dispensing means without the forward-and-back movement of the dispensing means hitherto required and without limitation of the dispensing operation by the compression time of the press.

The plant according to another aspect of this invention, comprises a dispensing station designed to deposit a layer of fibrous material upon a first or layer-forming conveyor belt which is operated continuously and which is provided with a separating means for subdividing the layer into a plurality of sections corresponding generally to the individual boards to be produced. While the first conveyor is continuously operable this separating means is preferably reciprocable along this conveyor so that during the separating operation it moves synchronously with the band but returns to its starting position upon conclusion of the separating operation.

According to a more specific feature of this invention, this first conveyor has a discharge extremity which can be retracted from its forward position overlying an intermediate conveyor or the steel band itself, this discharge extremity having a ramp swingable downwardly into proximity with the receiving part of the conveyor means for sliding the layer onto this part. As described in the commonly assigned copending application Ser. No. 163,114 filed Dec. 29, 1961 (now U.S. Patent No. 3,224,758), the first conveyor belt may comprise a drive band engageable by the rollers and overlain by a relatively light layer-carrying band of fabric, resin or the like, the latter band passing over the ramp or discharge flap to ensure that there will be no frictional retardation of the layer as it is transferred from the first conveyor to the receiving part.

The receiving part may be intermittently operable at a relatively high speed by comparison with the transfer speed at which it is synchronized with the first conveyor; retraction of the first conveyor concurrently with its forward movement provides a net forward velocity at which the layer is advanced. During the forward movement of the conveyor, the band can then be slowed and correspondingly speeded up during retraction. Thus means can be provided, according to this invention, for driving the further portion of the conveyor means (i.e. the intermediate conveyor or the steel band itself) at a relatively high speed after the layer is deposited thereupon to separate the individual sections of the layer from one another at a high rate. Thus the further conveyor means can be accelerated to a speed several times that at which the layer is transferred from the first portion to the further portion.

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

FIG. 1 is a somewhat diagrammatic side-elevational view showing an apparatus for producing pressed boards in accordance with my invention;

FIG. 2 is a detail view, drawn to an enlarged scale, of the transition flap of the apparatus of FIG. 1;

FIG. 3 is a cross-sectional view taken along the line III—III in FIG. 1;

FIGS. 4 and 5 are views generally similar to FIG. 1 but somewhat more diagrammatic and smaller showing alternative positions of the apparatus;

FIG. 6 is a diagrammatic side-elevational view of the apparatus in accordance with another embodiment of the present invention; and

FIGS. 7 and 8 are similar views of this embodiment illustrating alternative operative positions thereof.

Referring first to FIG. 1 of the drawing it will be seen that a plant for the production of pressed board, according to the present invention, comprises a dispensing station 1 and a press (generally designated 2) of the single-stage type. It should be understood, however, that a multi-level press can be employed (e.g., as disclosed in the aforementioned copending application Ser. No. 414,914), in which case a number of steel bands 3 will be used. The steel band 3 passed over a pair of rollers 3' and constitutes the "further portion" of a conveyor means whose first portion 4 is a conveyor belt shiftable in the direction of arrow 6. The dispensing means 1 can be any conventional device for metering comminuted material, suitable units of this type including rotary-drum dispensers, vibrating-shutter dispensers and the like. When a rotating drum 1' is employed, its drive should be synchronized with the band; the support rollers 4a and 4b at the opposite ends of the bands are supplemented by additional rollers 4c in the region of the dispenser; roller 4a being driven by a motor 4; The conveyor 4 may be carried upon a pair of lateral plates (one shown at 4g) on opposite sides of the conveyor and shifted by hydraulic means 4h and control 2b operated by the press control 2a. The plate and hydraulic means can be identical with those illustrated in my application Ser. No. 163,114 mentioned above. Like the conveyor-shifting means 2b, the variable-speed motor 4 is coupled with the control 2a which ensures that the speed of the band 4 relative to the dispenser 1 will be constant whether the conveyor as a whole is advanced or retracted. Control means capable of establishing the requisite relationship of band movement is conventional and may be of the type described in Johnston Patent No. 3,133,386.

As can best be seen from FIGS. 1 and 3, the conveyor 1 cooperates with a separating means generally designated 5 and shiftable in the direction of arrow 6, from, for example, the dot-dash position 5 of the separating means toward its solid line position as seen in FIG. 1 in the time required to cut the layer 4d of comminuted material into discrete sections designed to form respective sheets upon compression. This separating means can, for example, include a sawblade 5a carried by a swingable support 5b and driven by an electric motor (not shown) to cut through the loosely coherent mat or layer 4d and thereby define the several sections. A hood 5c is also mounted upon the support 5b and cooperates with the sawblade 5a to draw away by suction the fibrous particles or dust resulting from the cutting action of the plate. The support 5b is swingably mounted upon a drive housing 5e containing a reversible electric motor whose cogwheel 5f engages a rack 5g of a traverse frame 5h straddling the conveyor 4 upon which the layer 4d has been deposited. The housing 5e is thus reciprocable as indicated by arrow 5i across the conveyor 4 while the frame 5h is shiftable on its rollers 5g and rails 5k alongside the conveyor 4 as the latter is operated. Referring now to FIG. 1, it will be seen that a spring 5m tends to return the frame 5h to the dot-dash position 5' of the unit whenever it is released by pins 4e carried by the conveyor 4. The pins 4e are spaced along this conveyor and are swingable from their normal horizontal positions (solid lines in FIG. 3) to an upper position (dot-dash lines) by a ramp 5n as the frame 5h moves to the right

in FIG. 1. Upon release of the frame 5h by a pin 4e, the frame is drawn by spring 5m into engagement with the abutment 5b and remains in this position until it is again entrained by a pin 4e. The sequence of operations of the severing means is substantially as follows:

The continuous movement of the bands of conveyor belt 4 permits a substantially continuous layer of the comminuted material 4d to be deposited thereon. Pins 4e are spaced along the band at locations determined by the desired width of the sheets and when a pin 4e engages the frame 4h, a microswitch 5q is energized as the pin 4e entrains the frame 5h to the right (FIG. 1). Energization of switch 5q operates a valve 5r of a hydraulic circuit to permit fluid to flow into a hydraulic cylinder 5s from a pump 5t and a reservoir 5u and thereby swing the support 5b clockwise into engagement with the layer 5d. Simultaneously, the switch 5q energizes the motor of cogwheel 5f to shift the housing 5e to the right. The section of the layer 4d is separated from the main body thereof while chips and fibers dislodged by the plate 5a are withdrawn via a vacuum means 5c. When the cutting operation is completed the ramp 5m lifts the pin 4e and deenergizes switch 5q, while the springs 5m return the frame 5h to its rest position. The motor of cogwheel 5f is reversed while cylinder 5s lifts the blade 5a out of engagement with the layer as the unit returns (to left in FIG. 3) to the illustrated position. This arrangement permits the severing to be carried out without interrupting the continuous movement of the receiving surface of the conveyor 4, whether the band is driven by motor 4' or the surface is displaced solely by the hydraulic means 4h.

The conveyor belt 4 is provided, at its discharge extremity (FIG. 2) with a discharge ramp or flap generally designated 8. This flap 8 is swingable about the axis of the roller 4b via a solenoid 8a coupled with the press control circuit 2a and the conveyor shifting unit 2b for raising and lowering as will be apparent hereinafter. Advantageously, the conveyor 4 comprises a pair of superposed bands 4f and 4g, the former being a relatively massive drive band that passes over the rollers 4a, 4b while the band 4g is a relatively light band passing around the flap 8 to reduce any possible frictional retardation of the layer as it is transferred from the first conveyor 4 to the further conveyor 3. The latter is elongated beyond the press 2 and thus has a receiving part 3a onto which the mat is deposited. The drive roller 3' of the conveyor 3 is provided with a motor 3b which can have a plurality of operating speeds and is regulated by the press-control unit as will be apparent hereinafter. The press 2, whose plates 2c and 2d can be of the type described in my copending applications, Ser. Nos. 192,038 (now abandoned) and 192,040 (now U.S. Patent No. 3,241,189), filed May 1, 1962, is thus provided with heating means and is capable of compressing the fibrous layer 4d against the band 3 to produce the pressed-board sheets PB (FIG. 5); resin may be admixed with the comminuted material in the dispenser 1 or sprayed onto the layer.

The apparatus of FIGS. 1-5 functions as follows:

While the conveyor 4 is shifted to the right (FIG. 5) by the hydraulic means 4h, the press 2 closed and a previously inserted layer of comminuted material is formed into the pressed board. During this period, the control unit 2a terminates operation of motor 3b and thus of the band 3; motor 4' can continue its operation at a low rate of speed so that the receiving surface of band 4 is displaced to the right at constant speed while a layer 4d of the fibrous material is deposited. Since this band moves continuously a thoroughly uniform layer is produced. The motor 4' may, of course, be deenergized during operation of the hydraulic means, whereupon retraction of the conveyor requires that the motor 4' operate the band at twice the linear rate of advance of the hydraulic means. The net speed of the band surface induced by motor 4' and the hydraulic means 4h can be represented

by S and is a constant. The forward linear speed produced by the motor 4' must be $S - Vhf$ where Vhf represents the forward speed of the conveyor 4 produced by hydraulic cylinder 4h to the right. The speed of the motor 4' during retraction will then be $S + Vhr$ where Vhr is the hydraulic retraction speed. If the motor speed is zero during forward movement, $Vhf = S$. When a sufficient width of the comminuted material has been deposited a pin 4e of band 4 engages the frame 5h and the severing operation described above commences. When the severing operation has concluded and the conveyor 4 is in its extreme righthand position (FIG. 1), press-control unit energizes the solenoid 8a to permit the flap 8 to fall clockwise to a point at which the flap lies proximal to or touches the receiving stretch of the band 3. The control unit 4a then energizes motor 3b while the continuous movement of band 4 deposits the section of the layer 4d, previously severed, on the surface 3a, the conveyor-shifting unit being actuated to displace the conveyor 4 to the left (FIG. 1). The press 2 has, meanwhile, opened to permit the band 3 to carry off the finished sheet. It will be understood that the band 3 is synchronized with the layer-carrying surface of the band 4 via the control unit 2a to ensure that the layer 4d will be deposited without distortion. After the layer 4d has been transferred, the control unit 2a operates the motor 3b at an accelerated speed to shift the layer into the press 2 (FIG. 4) which closes as the conveyor 4 begins its forward stroke from the extreme left-hand position illustrated in this figure. Immediately upon deposition of the layer the control unit 2a operates the solenoid 8a to lift the flap 8 to its upper position illustrated in FIGS. 4 and 5.

In FIGS. 6 through 8 I show a system having the swingable flap and separating means as well as the conveyor means of the previously described embodiments and corresponding elements are thus identified with identical reference numerals. Since the steel band 3 of FIGS. 1 through 5 are relatively expensive and must be frequently replaced, a shorter band is desirable. In this case, the band 103 passing into the press 2 is confined to the length necessary for supporting the sheet and the receiving part of the further conveyor means is constituted by a conveyor 7 whose motor 7a is coupled with the control unit 2a and is capable of being operated at at least one speed several times that of the conveyor 4 in addition to a speed synchronized therewith. Thus while the motor 103b of the conveyor 103 is immobilized by the press conveyor 2a during the compression stroke (FIG. 6) motor 7a operates at a speed such that the conveyor 7 is synchronized with the conveyor 4 which retracts to the left (FIG. 6) with its flap 8 down to deposit the layer 4d upon the conveyor 7 without distortion. Conveyor 7 should be of a length at least equal that of the desired width of the sheets as determined by the separate means 5. After a section 4d of the comminuted material has been deposited upon the conveyor 7, flap 8 swings upwardly and the conveyor 4 is again shifted to the right (FIG. 7) as the press 2 opens and the band 103 is driven at a high rate to discharge the finished sheet PB. Control 2a then operates motor 7a at this elevated speed synchronized with conveyor 103 to transfer the layer to the steel band 103 (FIG. 8) and the cycle is repeated. Conveyor 4 operates continuously while conveyor 7 operates alternately with a speed synchronized with the conveyor 4 and a high speed synchronized with the conveyor 103.

The invention as described and illustrated admits of various modifications within the ability of persons skilled in the art without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a method of operating a plant for the production of pressed board from comminuted material wherein:

(a) a layer of comminuted material is dispensed onto a conveyor means at a dispensing station;

- (b) said layer is carried by said conveyor means into an intermittently operable press, spaced from said station; and
 (c) said layer is compressed by said press against said conveyor means,

the improvement which comprises the steps of:

- (A) driving a first conveyor band of said conveyor means past said station for continuous and uniform deposition of said material upon said first conveyor band to form said layer with uniform thickness;
 (B) intermittently driving a further conveyor band of said conveyor means relatively to said press and between platens thereof for carrying said layer into said press;
 (C) immobilizing said further conveyor band while compressing said layer thereagainst between the platens of said press;
 (D) transferring said layer from said first conveyor band to said further conveyor band prior to introducing said layer to the press in step (B) during movement of the latter by reciprocating said first conveyor band relatively to said further conveyor band and said station, the reciprocation of said first conveyor band retracting said layer-receiving surface in the region of said station; and
 (E) adjusting the speed of said first conveyor band in accordance with the speed and direction of reciprocation thereof so that the layer-receiving surface of said first conveyor band is retracted past said dispensing station always at a substantially constant speed for deposition of another layer of comminuted material thereon while the previous layer is carried into the press in step (B).

2. The improvement defined in claim 1, further comprising the step (F) of severing sections of said layer from one another to define the width of the pressed board during displacement of said layer by said first conveyor band.

3. An installation for the production of pressed board from comminuted material, comprising an intermittently operable stationary press, conveyor means for carrying a layer of comminuted material through said press for compression therein to form pressed board; continuously operable dispensing means fixedly disposed along said conveyor means for depositing said layer of comminuted material thereon for transport by said conveyor means to said press, said conveyor means including a first conveyor having a first endless band displaceable relatively to said dispensing means with a surface for receiving said comminuted material therefrom, a further conveyor intermittently displaceable through said press and immobilized during compression of said layer therein, said further conveyor receiving said layer from said first conveyor, and means for shifting said surface past said dispensing means

continuously at a constant speed while transferring said layer to said further conveyor without distorting said layer, said further conveyor having a receiving part disposed below said first endless band, the last-mentioned means including means for reciprocating said first conveyor relative to said receiving part whereby retraction of said first conveyor concurrently with forward displacement of said band places said layer upon said receiving cards, said first endless band having a discharge end and said first conveyor comprising flap means swingable about a horizontal axis at said discharge end for depositing said layer upon said receiving part, and control means for correlating the movement of said endless band with the reciprocation of said first conveyor to maintain the speed of said surface relative to said dispensing means constant.

4. An installation as defined in claim 3 wherein said first endless band comprises a driving belt and a layer-carrying belt overlying said driving belt, said layer-carrying belt passing over said flap means.

5. An installation as defined in claim 3, further comprising separating means along said first conveyor and shiftable synchronously therewith for subdividing said layer into sections transversely to the direction of advance of said layer.

6. An installation as defined in claim 3 wherein said further conveyor comprises an endless band passing through said press, said receiving part constituting a stretch of said further endless band.

7. An installation as defined in claim 3 wherein said receiving part of said further conveyor is an intermediate endless band operable at the speed of said surface for receiving said layer therefrom and at an elevated speed for feeding said layer to said press.

8. An installation as defined in claim 7 where said further conveyor includes a further endless band operable at said elevated speed for receiving said layer from said intermediate endless band.

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U.S. Cl. X.R.

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