Nov. 29, 1966 K. LOEWENFELD 3,288,057

DELIVERY SYSTEM FOR LOOSELY COHERENT SHEETS

Filed Nov. 2, 1964 6 Sheets-Sheet 1

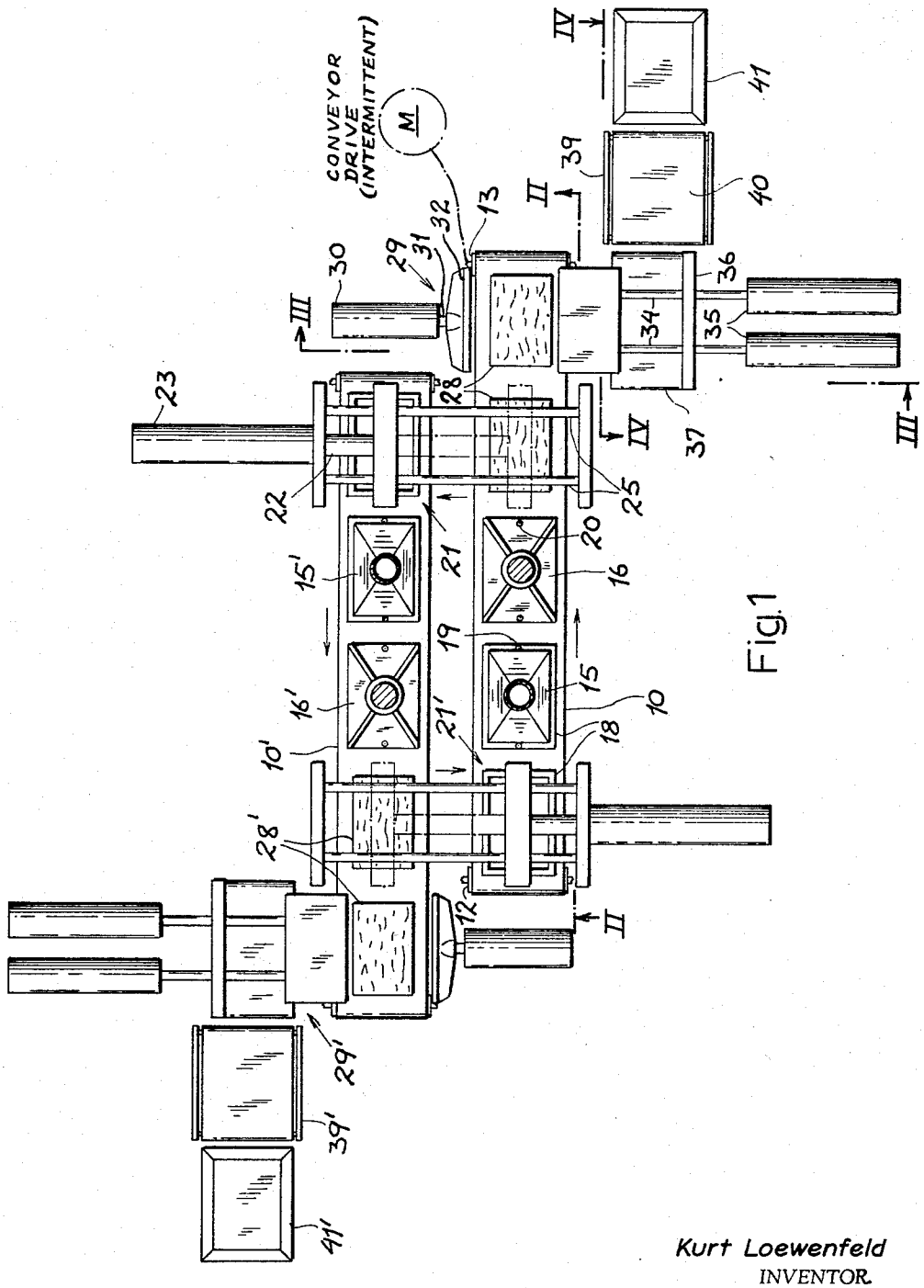

Fig. 1

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DELIVERY SYSTEM FOR LOOSELY COHERENT SHEETS

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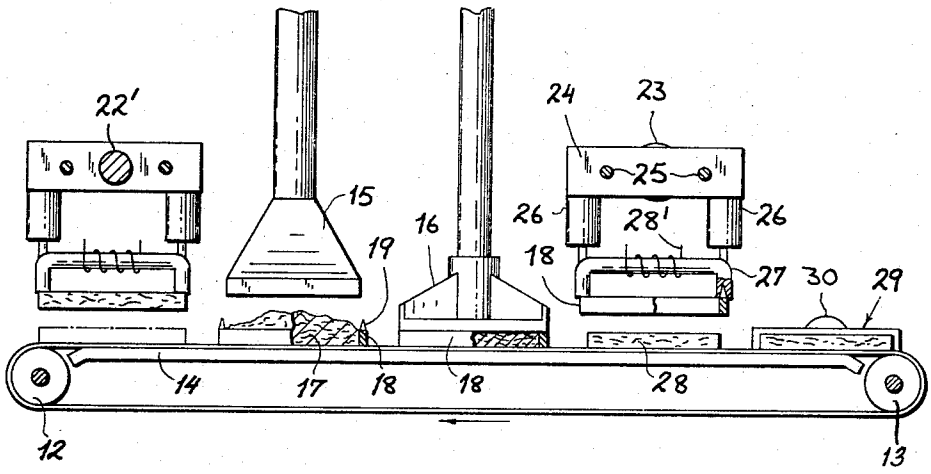
Fig.2



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DELIVERY SYSTEM FOR LOOSELY COHERENT SHEETS

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Fig.3a

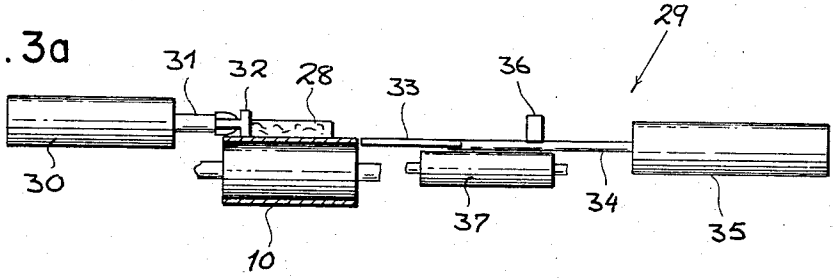


Fig.3b

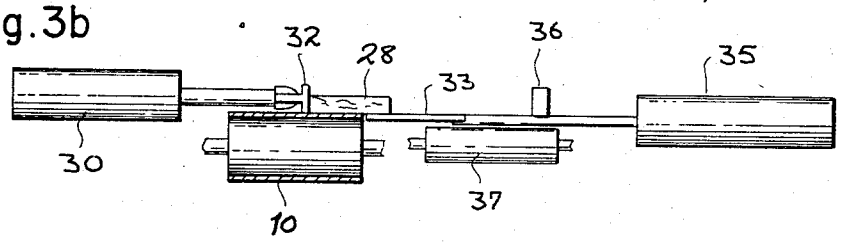
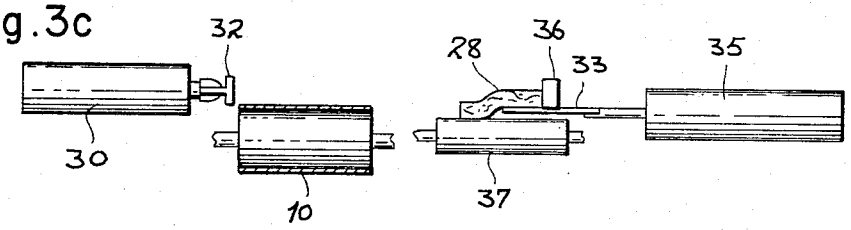


Fig.3c



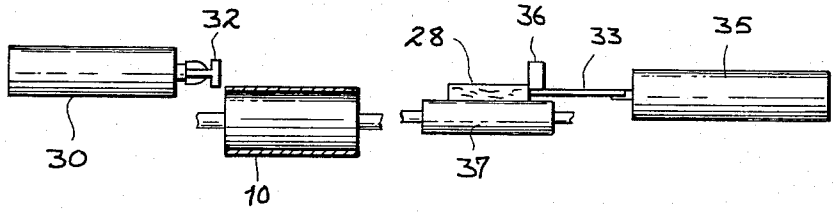


Fig.3d

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DELIVERY SYSTEM FOR LOOSELY COHERENT SHEETS

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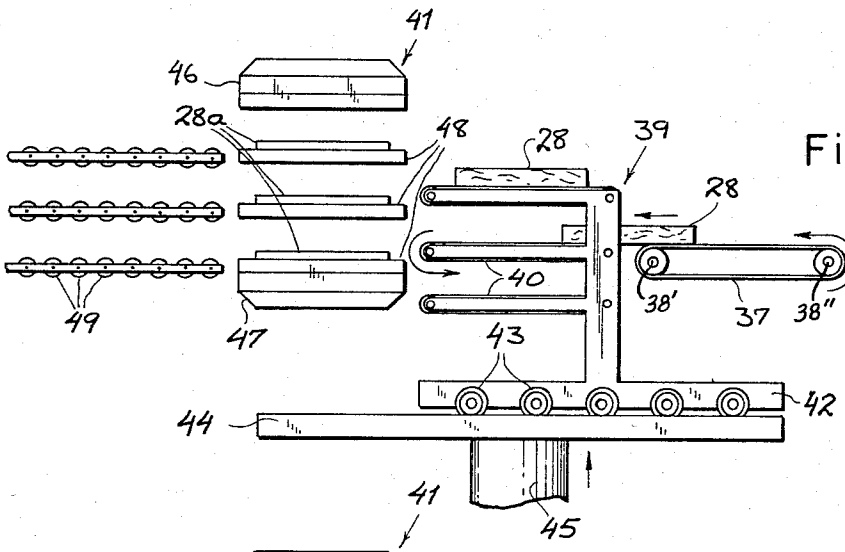

Fig. 4a

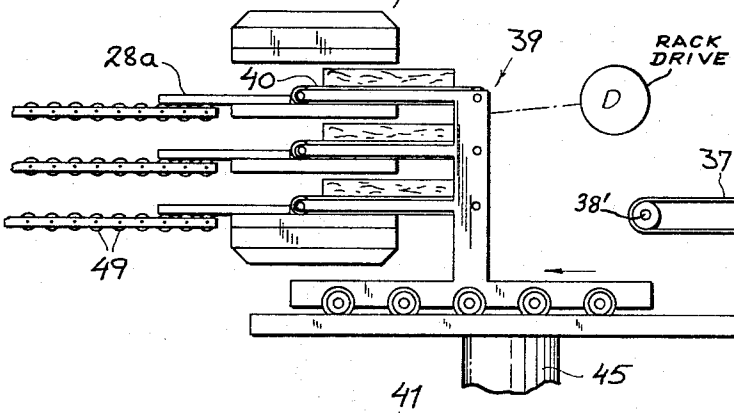

Fig. 4b

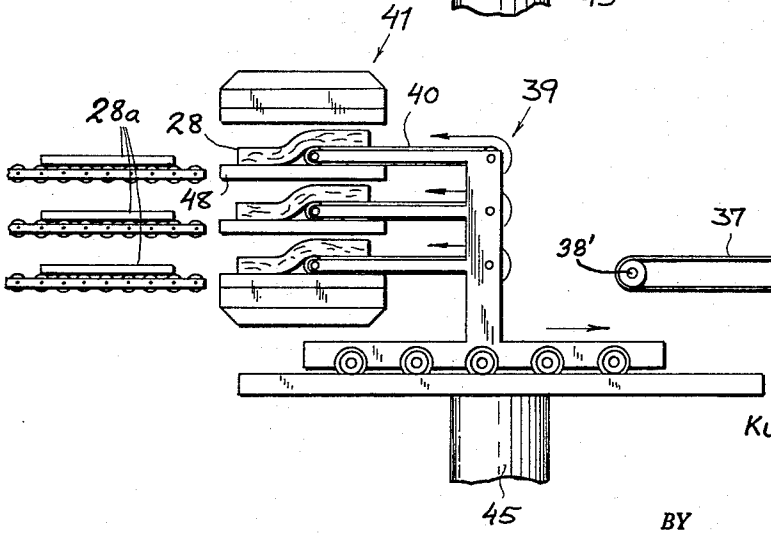

Fig. 4c

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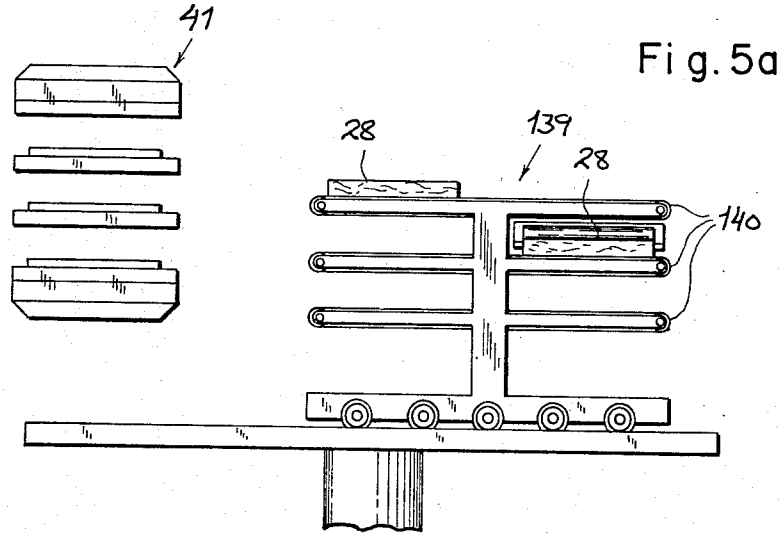

Fig. 5a

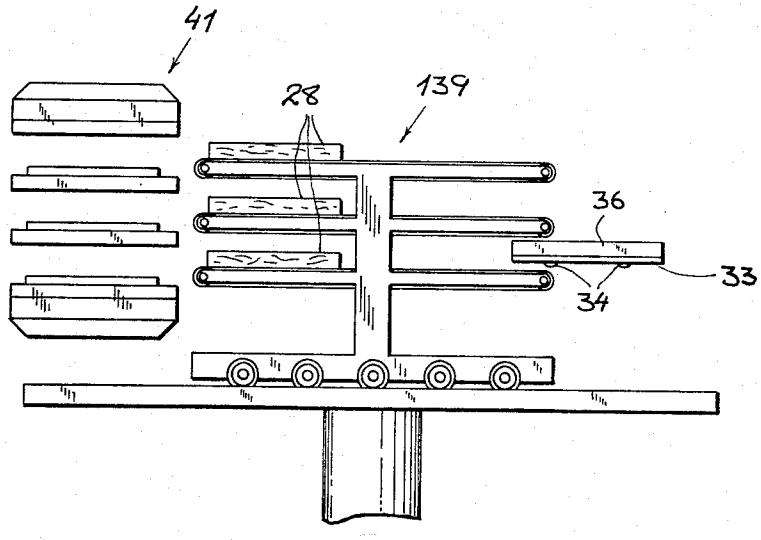

Fig. 5b

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DELIVERY SYSTEM FOR LOOSELY COHERENT SHEETS

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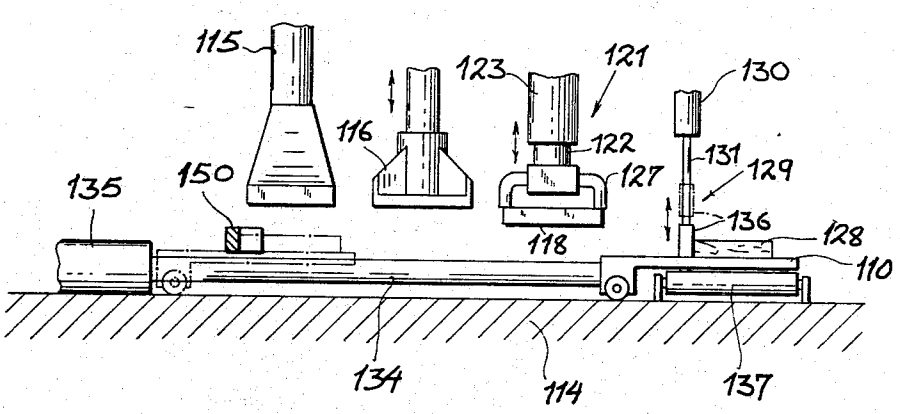
Fig. 6



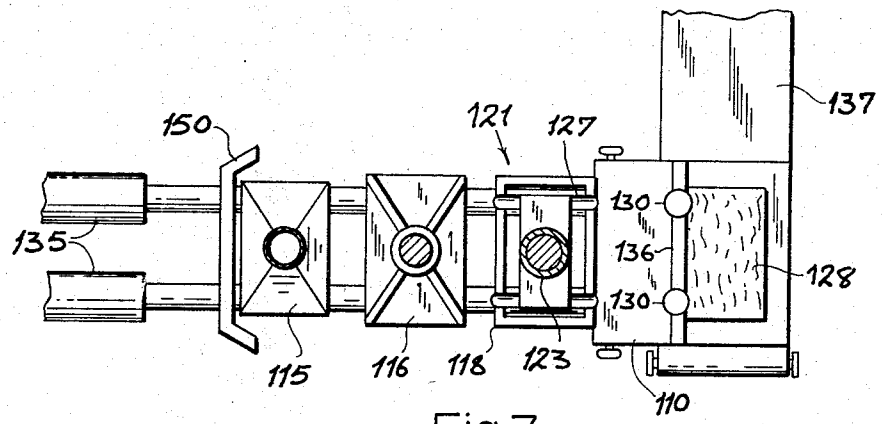


Fig. 7

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United States Patent Office 3,288,057 Patented Nov. 29, 1966

3,288,057
DELIVERY SYSTEM FOR LOOSELY COHERENT SHEETS

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Claims priority, application Germany, Nov. 7, 1963, S 88,196
8 Claims. (Cl. 100—198)

My present invention relates to a system for delivering sheets of loosely coherent material, such as so-called fiberboard sheets in their preformed state, to a press for final compacting. Systems of this general type have been described in commonly assigned U.S. Patents Nos. 3,050,200 and 3,077,271 issued August 21, 1962, and February 12, 1963, to E. Siempelkamp.

In prior systems of this type, such as those disclosed in the aforementioned patents, special means such as swingable chutes had to be provided for the purpose of removing the preformed sheets from their original transporter and distributing them onto a stack of endless bands which were moved by a common loading rack into the press, the bands being withdrawn from the press platen at the speed of their own rotation so that the sheets were deposited on the platens with only negligible stress in the direction of band motion. The chutes, however, were effective only for sheets of relatively restricted dimensions in the direction of advance; sheets of larger size in said direction, e.g. rectangular sheets placed lengthwise on the transporter, cannot be conveniently handled in that way and suffer objectionable strains on being alternately accelerated and slowed down in traveling from one conveyor to the other. Moreover, such sheets of greater length cannot be safely pushed off a stationary supporting surface (e.g. a tray) in longitudinal direction since the movement of the sheet is opposed by a large frictional resistance, proportional to the sheet length, so that the sheet is subject to deformation and may rupture.

The general object of my present invention is to provide an improved delivery system for transferring such sheets from a primary transporter, which may itself be an endless conveyor, onto a secondary conveyor arrangement formed at least in part by the aforementioned endless bands which serve in the manner already known to deposit the sheets on respective press platens. More particularly, it is an object of my invention to eliminate in such system the need for swingable chutes and to replace them by a transfer mechanism adapted safely to move even long rectangular sheets from the primary transporter onto the secondary conveyor arrangement.

This object is realized, in accordance with my present invention, by the provision of transfer means engageable with a sheet edge parallel to the path of the secondary conveyor, advantageously the longitudinal edge of the sheet, for displacing the sheet onto the endless band either directly or with the aid of an intermediate conveyor (e.g. an intermediate tray and/or band) by movement transverse to the supporting surface of the primary transporter.

The primary conveyor or other transporter may pass, in the manner described in the aforementioned patents, underneath a spreader for the deposition of loose (e.g. cellulosic) fibrous material upon its surface, a rough-forming press being disposed downstream of the spreader to precompress the fibrous mass into a loosely coherent sheet of approximately the desired ultimate dimensions. Advantageously, pursuant to a further feature of my invention, this preforming operation is assisted by a rectangular frame which is removably carried on the supporting surface of the transporter and defines the outline of the precompressed sheet; before the transfer mechanism goes into operation at a location beyond the rough-forming press, the frame is lifted by magnetic or other means off the supporting surface so as to expose the lateral edges of the sheet to be transferred.

The relative transverse motion between the sheet and the supporting surface of the primary transporter may be brought about either by a displacement of the sheet across the stationary surface or by a withdrawal of said surface underneath the stationary sheet. In either case the sheet will gradually come to rest, at a level just below that of the supporting surface of the primary transporter, on another supporting surface which may be that of a secondary conveyor or of an intermediate plate or tray; in the latter instance the transfer from the intermediate plate to the secondary conveyor takes place by relative transverse motion in the same manner as before and advantageously under the control of the same transfer mechanism.

The secondary conveyor either constitutes one of the endless bands of an elevatable loading rack, such as the one described in the patents identified above, or cooperates with these bands to position successive sheets on different levels of a stack to be introduced into the spaces between the platens of the final press. The further treatment of the sheets proceeds in the well-known manner.

The invention will be described in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a somewhat diagrammatical top plan view of a delivery system embodying the invention;

FIG. 2 is an elevational view taken on the line II—II of FIG. 1;

FIGS. 3*a* to 3*d* are cross-sectional views taken on the line III—III of FIG. 1, illustrating a succession of steps in the operation of a transfer mechanism forming part of the system of FIGS. 1 and 2;

FIGS. 4*a* to 4*c* are fragmentary elevational views taken on the line IV—IV of FIG. 1 and showing successive steps in the delivery of sheets from the transfer mechanism of FIGS. 3*a* to 3*d* to a final press;

FIGS. 5*a* and 5*b* are views similar to those of FIGS. 4*a* to 4*c*, illustrating a modification;

FIG. 6 is an elevational view, similar to FIG. 2, of a further system according to my invention; and

FIG. 7 is a top plan view of the system illustrated in FIG. 6.

In FIGS. 1 and 2 I have shown a system for the mass production of fiberboard sheets by fully automatic means, this system being divided into two mirror-symmetrically arranged halves of which only one needs to be described in detail. This part of the system comprises a conveyor belt **10** that is guided around rollers **12**, **13** and driven intermittently by a motor in the direction indicated by the arrows. The upper run of belt **10** is supported by a table **14** and passes underneath a spreader **15** and a preforming press **16**, the former serving to deposit a fibrous mass **17** on the upper belt surface within the confines of a frame **18** in which this mass is subsequently flattened by the piston of press **16**. Frame **18** is shown provided with locator pins **19** receivable in tapering bores **20** of the piston face of press **16** to insure proper positioning of the frame during the precompressing step.

A lifting mechanism **21** beyond press **16** comprises a horizontal ram **22**, rigid with the piston of a hydraulic or pneumatic cylinder **23**, which terminates in a crossbar **24** riding on two horizontal rails **25**. Bar **24** supports a pair of solenoids **26** whose armatures are fixed to an electromagnet **27** having an energizing winding **28'**. Magnet **27**, which is thus lifted by the solenoids **26**, serves to pick up the frame **18**, the latter being made of a ferromagnetic material and normally resting loosely on belt **10** except for the slight residual magnetism which helps

it retain its position thereon when the belt is preferentially constituted by a steel bar. The pole faces of magnet **27** are also conically recessed to accommodate the locator pins **19** of the frame.

When the cylinder **23** has aligned the bar **24** and magnet **27** with the frame **18** of a sheet **28** just produced by the press **16**, as illustrated in dot-dash lines in FIG. 1, frame **18** is lifted off the belt surface to a higher level at which it is subsequently transported by the ram **22** to a location above another conveyor belt **10'** running in the opposite direction. Belt **10'** forms part of the second half of the system shown in FIG. 1 and moves below a spreader **15'** and a preforming press **16'** which operate in the same manner as their counterparts **15** and **16**. A further lifting mechanism **21'**, identical with mechanism **21**, picks up the frame on belt **10'** and returns it to belt **10** at a location just ahead of spreader **15**. It will be seen that each frame **18** (six of which are used in system shown in FIG. 1) moves in a complete cycle, the intermittent motion of the two belts **10**, **10'** being synchronized with the operation of the lifting mechanisms **21** and **21'** in such a manner that the transfer of frames between the two belts, occurring simultaneously in opposite directions, takes place concurrently with the deposition of a pile of material **17** by the spreaders **15**, **15'** and with the flattening of another pile, formed in the cycle immediately preceding, by the presses **16** and **16'** to produce preformed sheets **28**, **28'**.

Following the removal of its frame **18**, the sheet **28** on belt **10** is advanced into a final position in line with a transfer mechanism generally designated **29**. This mechanism, as best seen in FIGS. 3*a* to 3*d*, comprises a fluid cylinder **30** whose ram **31** carries a pusher bar **32** engageable with the proximal longitudinal edge of the sheet. A receiving plate **33**, secured to rams **34** of twin fluid cylinder **35**, is horizontally displaceable by these rams on the level of the upper run of conveyor belt **10** and passes underneath a stationary stripper bar **36** secured to the base (not shown) of the machine. Another conveyor **37**, supported by rollers **38'**, **38''** as shown in FIGS. 4*a* to 4*c*, is disposed just below the level of plate **33** at a location just to the left of stripper bar **26** as viewed in FIGS. 3*a* to 3*d*.

The several views of FIGS. 3*a* to 3*d* show successive steps in the operation of transfer mechanism **29**. In FIG. 3*a* the sheet **28** has come to rest on conveyor **10** alongside pusher bar **32** which has just been moved into contact with the left-hand edge of the sheet, this being one of the major sides of its rectangular outline. FIG. 3*b* shows the advance of bar **32** as it pushes sheet **28** onto the receiving plate **33** adjacent belt **10**. In FIG. 3*c* the bar **32** has been retracted and the plate **33** has been moved toward the stripper bar **36** which acts as a stop for the sheet **28** so that the latter is gradually deposited upon the underlying belt **37**. In FIG. 3*d* the transfer has been completed and sheet **28** rests fully on belt **37** which has remained stationary during this entire cycle.

As further shown in FIGS. 4*a* to 4*c*, a rack **39** carrying a stack of endless conveyor belts **40** is disposed adjacent conveyor belt **37** between the later and a multiplaten press **41**; an identical arrangement (transfer mechanism **29'**, rack **39'** and press **41'**) is provided for the sheets **28'** arriving over belt **10'**. As more clearly shown in FIGS. 4*a* to 4*c*, rack **39** is carried on a base **42** which is movable via rollers **43** in track-forming grooves on an elevatable platform **44** supported in turn by a hydraulically or pneumatically operated ram **45**. Press **41**, as illustrated schematically in FIGS. 4*a* to 4*c*, comprises an upper and a lower bed plate **46**, **47** as well as a set of platens **48** therebetween, only three platens having been shown for the sake of simplicity. Bed plates **46** and **47** are conventionally heated and adapted to be brought together under pressure against the intervening platen **48**, and respective sheets **28** deposited thereon, to cure and compact these sheets so as to preform them into finished boards **28***a*. Rollers **49** are disposed in several tiers beyond the platens **48** to receive the finished boards **28***a* therefrom.

The several views, FIGS. 4*a* to 4*c*, illustrate the mode of operation of the conveyor arrangement **37**, **40** in loading the press **41**. In FIG. 4*a* the intermediate conveyor **37**, having received a sheet **28** from the transfer mechanism **29** of FIGS. 3*a* to 3*d*, has been set in motion for advancing this sheet onto one of the endless bands **40** of rack **39**, here the middle one of the three ilustrated bands; the conveyors **37** and **40** are moving in the same direction and at like speed to prevent any straining of the sheet **28**. This operation is repeated on successive sheets, with intervening vertical movement of rack **39** to align successive bands **40** with conveyor **37** until all three bands have been loaded. This is illustrated in FIG. 4*b* where the three loaded bands **40**, arrested once more, have been moved partly into the press **41** by a suitable drive mechanism D which advances the rack **39** horizontally across platform **34**, the leading edges of the stationary belts **40** serving at the same time to dislodge the previously completed boards **28***a* from the press **41** and onto the rollers **49**. These rollers may be driven or may lie on a slightly sloping plane in order to continue the movement of the finished boards away from the press. As illustrated in FIG. 4*c*, the sheets **28** are being deposited on the platens **48** by a withdrawal of rack **39** toward the right and a concurrent rotation of the belts **40** in a counter-clockwise direction, the linear speed of the belts equaling the rate of withdrawal of rack **39** so that again the transfer of the sheets from one supporting surface to another proceeds with a minimum of stress. Following the complete withdrawal of the rack **39**, into the position illustrated in FIG. 4*a*, press **41** is closed; though in FIG. 4*a* the press has been shown open for the sake of clarity, it will be understood that final compression and curing of the sheets may take place during the loading of the rack **39** as previously described.

In FIGS. 5*a* and 5*b* I have illustrated a modified rack **139** whose belts **140** are longer than the bands **40** of rack **39** and are themselves positionable directly below the plate **33** of FIGS. 3*a* to 3*d* so as to eliminate the need for an intermediate conveyor **37**. The plate **33** may be withdrawn in this case completely beyond the belts **140** so as not to interfere with the vertical motion of the elevatable rack **39**. FIG. 5*a* shows how a sheet on the uppermost belt **140** has been moved into proximity with the press **41** while another sheet is just being deposited on the middle belt; FIG. 5*b* shows all three belts loaded and ready to deliver their respective sheets **28** to the press.

In FIGS. 6 and 7 I have illustrated a considerably simplified system designed for reduced production rates. The primary transporter is here constituted by a tray **110** which is horizontally reciprocable on a base **114** by the rams **134** of twin fluid cylinders **135**. The path of tray **110** passes again underneath a spreader, here designated **115**, and a preforming press here indicated at **116**, there being also provided a lifting mechanism **121** which is a simplified version of mechanism **21** and comprises a pair of electromagnets **127** supported by the ram **122** of a vertical cylinder **123**. A yoke **150** disposed immediately above the path of tray **110** just ahead of spreader **115** serves as an abutment for a frame **118** freely supported on said tray (except for the effect of residual magnetism as previously discussed); the presence of this yoke insuring that the frame **118** is always properly positioned on the tray **110** after the latter has been completely withdrawn toward the left; the yoke, of course, also establishes the proper position of the frame with respect to the tray as it proceeds to the press. Thus, the locator pins **19** of frame **18** may here be omitted.

A transfer mechanism **129** comprises a stop bar **136** which is vertically movable by twin cylinders **130** and rams **131** in order to descend upon the surface of tray **110** after the latter has been positioned above the secondary conveyor **137**; it will be understood that, as described in conjunction with FIGS. 5*a* and 5*b*, this secondary con-

veyor may be replaced by one of the endless belts **140** of rack **139**.

The system of FIGS. 6 and 7, using only a single frame **118**, has an operating cycle in which mechanism **121** initially deposits this frame on the tray **110** aligned with it, the tray being subsequently withdrawn (dot-dash lines in FIG. 6) underneath the spreader **115** which fills the frame **118** with fibrous mass. Next, the tray **110** advances into a position below press **116** which descends to compact the mass within frame **118**. Thereafter tray **110** steps once more under the lifter **121** which picks up the frame **118**, the tray then moving past the bar **126** which at this time is held in its elevated position indicated in dot-dash lines. Subsequently, bar **136** is lowered to arrest the sheet **128** by engaging one of its major edges, tray **110** being concurrently withdrawn so that the sheet drops onto conveyor **137** whereupon the cycle is repeated. The further sheet-feeding operation proceeds in the manner already described.

The piston of the preforming press **16** or **116** could be designed with a recessed underside, as shown in the aforementioned U.S. patents, if the frames **18**, **118** and the associated lifting mechanisms **21**, **121** were omitted; the presence of such frames, however, insures accurate dimensioning of the preformed sheets **28** or **128**. Naturally, the lifting mechanism could also operate by other than electromagnetic means and the entire system may be further modified in regard to its structural detail without departing from the spirit and scope of my invention as defined in the appended claims.

I claim:

1. A system for advancing substantially rectangular sheets of loosely coherent material toward a press having a platen and adapted to consolidate said sheets into rigid boards, comprising:

transport means forming a supporting surface for carrying a loosely coherent sheet along a predetermined path;

conveyor means disposed adjacent said path for receiving said sheet from said supporting surface;

transfer means engageable with an edge of said sheet for displacing said sheet onto said conveyor means by transverse movement relative to said supporting surface ;

and a movable carrier provided with an endless band parallel to said edge forming part of said conveyor means and shiftable into a position overlying said platen for delivering said sheet to said press platen by a positioning of said band above said platen and subsequent unloading of said sheet from said band with concurrent withdrawal of said carrier at a speed substantially equaling the band speed.

2. A system for advancing substantially rectangular sheets of loosely coherent material toward a press having a platen and adapted to consolidate said sheets into rigid boards, comprising:

transport means forming a supporting surface for carrying a loosely coherent sheet along a predetermined path;

conveyor means disposed adjacent said path for receiving said sheet from said supporting surface;

transfer means engageable with an edge of said sheet for displacing said sheet onto said conveyor means by transverse movement relative to said supporting surface;

and a movable carrier provided with an endless band parallel to said edge forming part of said conveyor means and shiftable into a position overlying said platen for delivering said sheet to said press platen by a positioning of said band above said platen and subsequent unloading of said sheet from said band with concurrent withdrawal of said carrier at a speed substantially equaling the band speed, said transfer means comprising a movable pusher member engageable with said edge, a horizontal plate positionable adjacent said transport means substantially at the level of said supporting surface for receiving said sheet therefrom, stop means immediately above said level, and mechanism for operating said pusher member to move said sheet onto said plate and subsequently displacing said plate past said stop means whereby the latter prevents said sheet from following said plate, said conveyor means including a band disposed immediately below said level adjacent said stop means.

3. A system for advancing substantially rectangular sheets of loosely coherent material toward a press having a platen and adapted to consolidate said sheets into rigid boards, comprising:

transport means forming a supporting surface for carrying a loosely coherent sheet along a predetermined path;

conveyor means disposed adjacent said path for receiving said sheet from said supporting surface;

transfer means engageable with an edge of said sheet for displacing said sheet onto said conveyor means by transverse movement relative to said supporting surface;

and a movable carrier provided with an endless band parallel to said edge forming part of said conveyor means and shiftable into a position overlying said platen for delivering said sheet to said press platen by a positioning of said band above said platen and subsequent unloading of said sheet from said band with concurrent withdrawal of said carrier at a speed substantially equaling the band speed, said transfer means comprising a stop member positionable immediately above said supporting surface alongside said edge for preventing said sheet from following said supporting surface upon displacement thereof past said stop member, said conveyor means including a band disposed immediately below the level of said supporting surface adjacent said stop means.

4. A system for advancing substantially rectangular sheets of loosely coherent material toward a press having a platen and adapted to consolidate said sheets into rigid boards, comprising:

a frame for retaining loosely coherent material;

transport means forming a supporting surface for carrying a loosely coherent sheet together with a respective surrounding frame along a predetermined path;

conveyor means disposed adjacent said path for receiving said sheet from said supporting surface;

lifting means disposed along said path for removing said frame from said supporting surface;

transfer means engageable with an edge of said sheet upon removal of said frame for displacing said sheet onto said conveyor means by transverse movement relative to said supporting surface;

and a movable carrier provided with an endless band parallel to said edge forming part of said conveyor means and shiftable into a position overlying said platen for delivering said sheet to said press platen by a positioning of said band above said platen and subsequent unloading of said sheet from said band with concurrent withdrawal of said carrier at a speed substantially equaling the band speed.

5. A system as defined in claim **4**, further comprising spreader means above said path for depositing a mass of loose fibers on said supporting surface within said frame, and preforming means above said path adapted to produce said sheet by compacting said mass within said frame, said transport means being intermittently operable to advance said frame from said spreader means past said preforming means and said lifting means to said transfer means.

6. A system as defined in claim **5** wherein said transport means comprises an endless conveyor member successively movable past a first location ahead of said spreader means, a second location below said spreader means, a third location below said preforming means, a fourth location beyond said preforming means and a fifth location

adjacent said transfer means, said lifting means being operable to remove said frame from said member at said fourth location and to return it to said member at said first location.

7. A system as defined in claim 6 wherein said lifting means includes another endless conveyor member movable in a direction opposite that of the first-mentioned conveyor member.

8. A system for advancing substantially rectangular sheets of loosely coherent material toward a press adapted to consolidate said sheets into rigid boards, comprising:

a frame for retaining loosely coherent material;

transport means forming a supporting surface for carrying a loosely coherent sheet together with a respective surrounding frame along a predetermined path;

conveyor means disposed adjacent said path for receiving said sheet from said supporting surface;

lifting means disposed along said path for removing said frame from said supporting surface;

transfer means engageable with an edge of said sheet parallel to said path upon removal of said frame for displacing said sheet onto said conveyor means by transverse movement relative to said supportnig surface;

and a movable carrier provided with an elevatable rack, said conveyor means including a stack of endless bands mounted on said rack for receiving successive sheets from said supporting surface and delivering said sheets to respective press platens by a positioning of said bands above said platens and subsequent unloading of said sheets from said bands with concurrent withdrawal of said carrier and rack at a speed substantially equaling the band speed.

References Cited by the Examiner

UNITED STATES PATENTS

2,017,535	10/1935	Hammer	214—16.6
2,728,468	12/1955	Siempelkamp.	
2,989,774	6/1961	Erickson et al.	18—4 X
3,050,200	8/1962	Siempelkamp	214—16.6
3,077,271	2/1963	Siempelkamp	214—16.6

FOREIGN PATENTS

1,311,915	11/1962	France.
356,874	9/1931	Great Britain.
655,952	8/1951	Great Britain.
858,412	1/1961	Great Britain.

WALTER A. SCHEEL, *Primary Examiner.*

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