

July 13, 1965

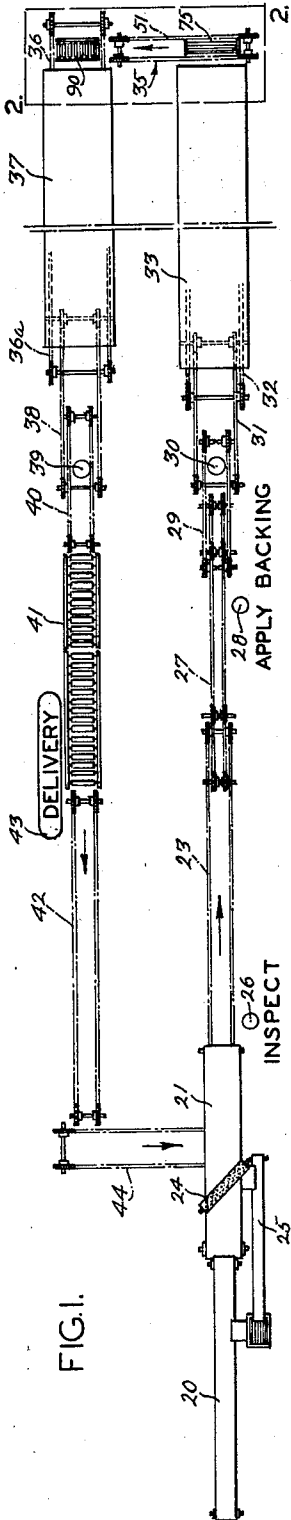
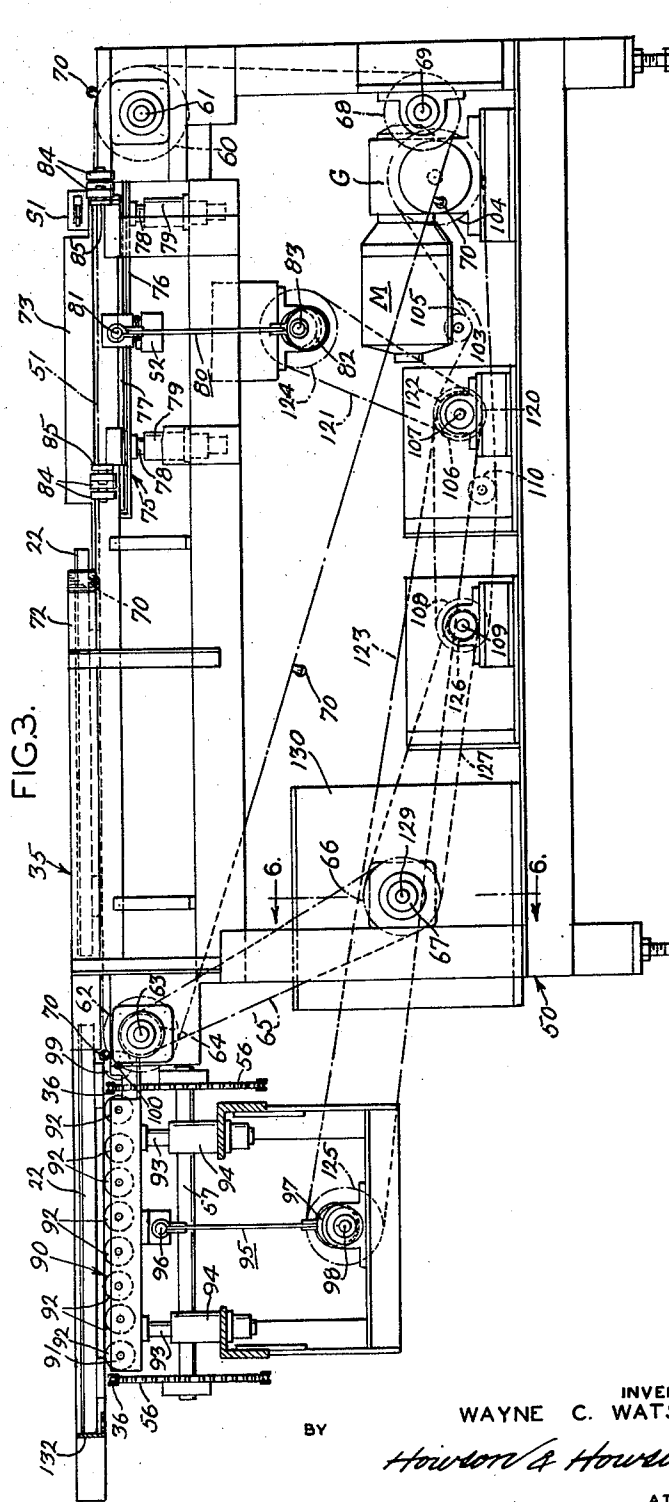
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3,194,380

BOARD TRANSFER APPARATUS

Filed Jan. 15, 1963

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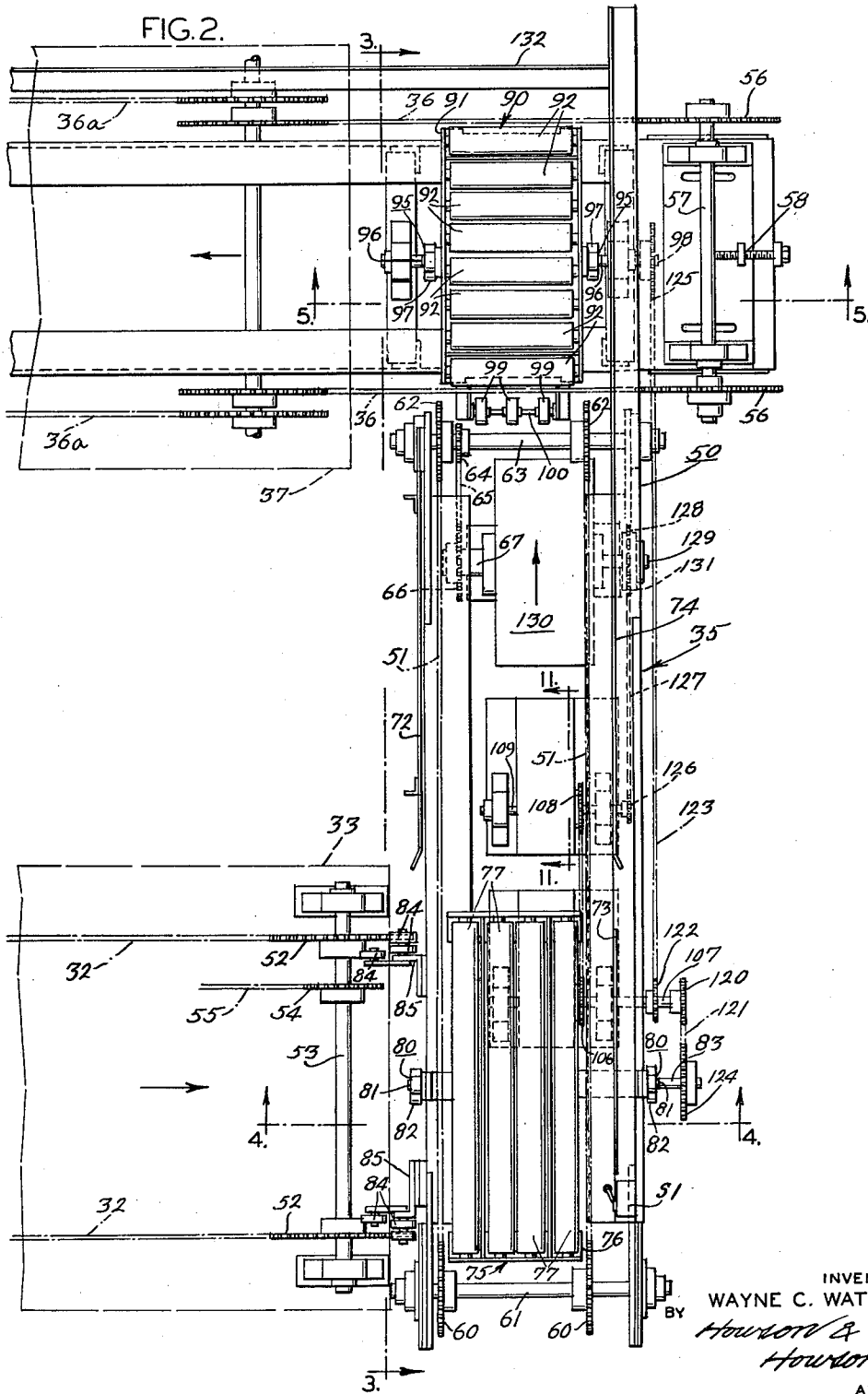
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BOARD TRANSFER APPARATUS

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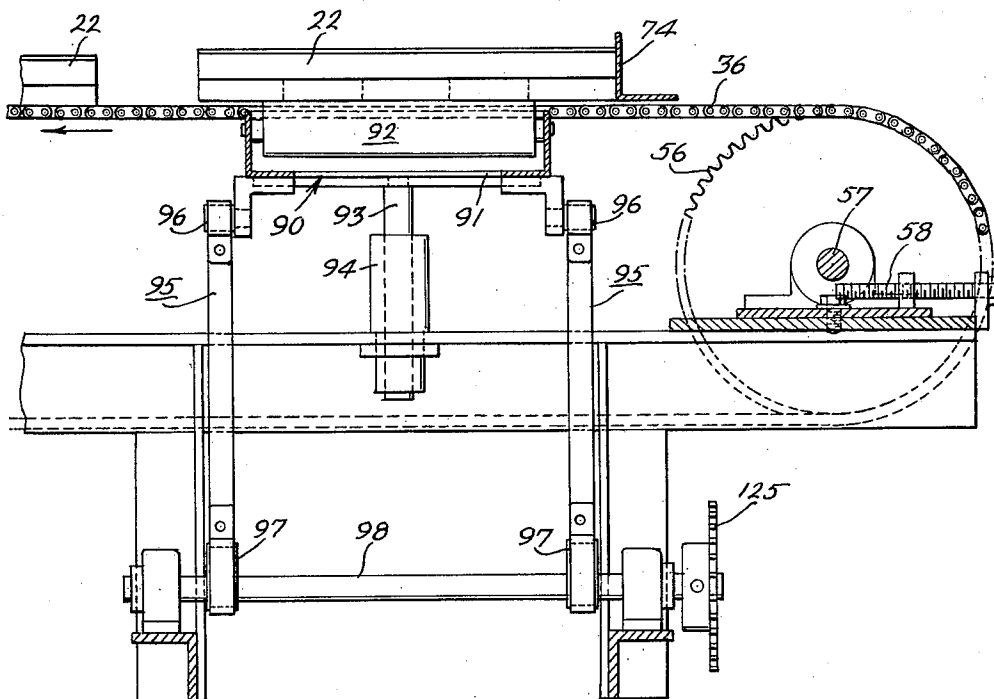


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BOARD TRANSFER APPARATUS

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FIG. 5.



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FIG. 6.

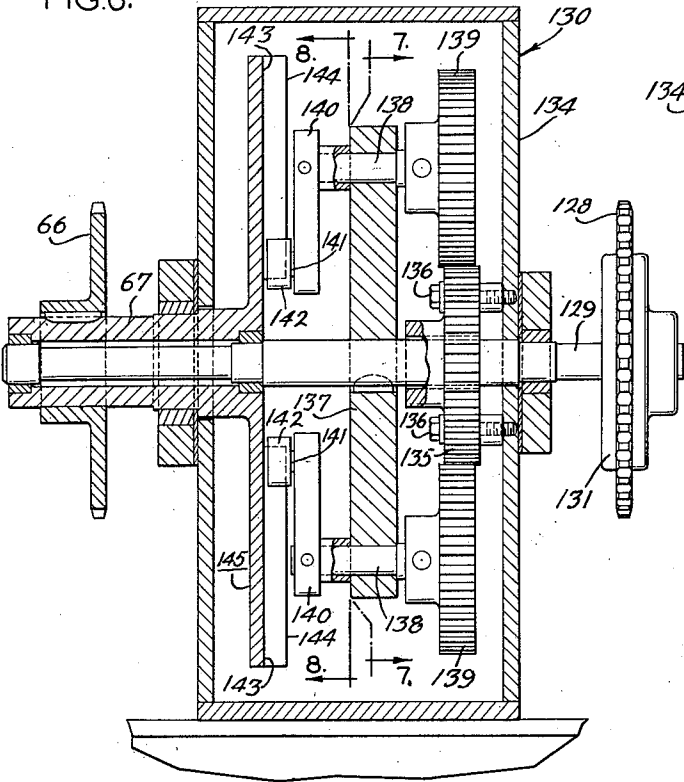


FIG. 7.

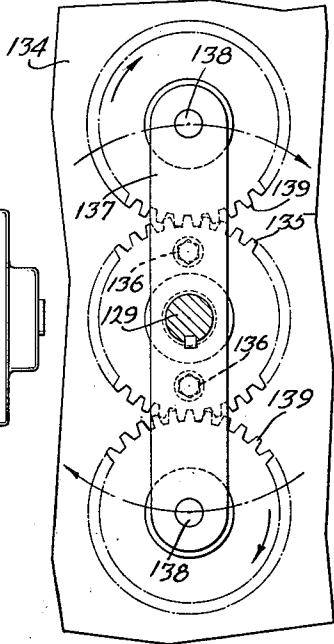


FIG. 10.

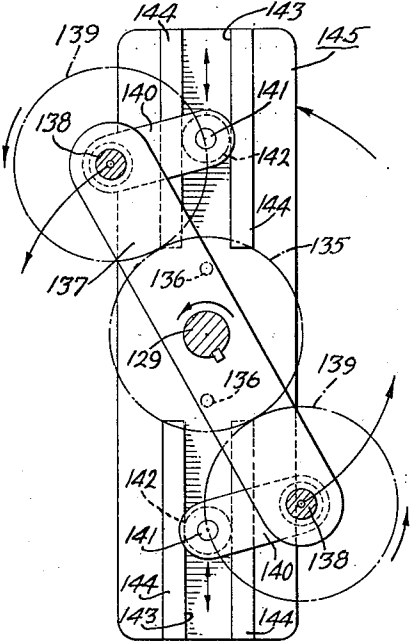


FIG. 8.

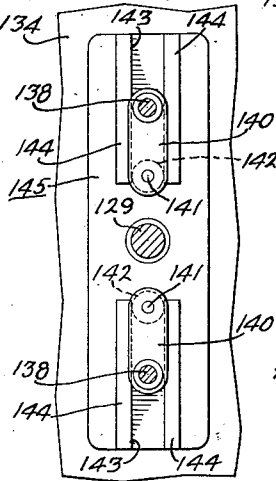
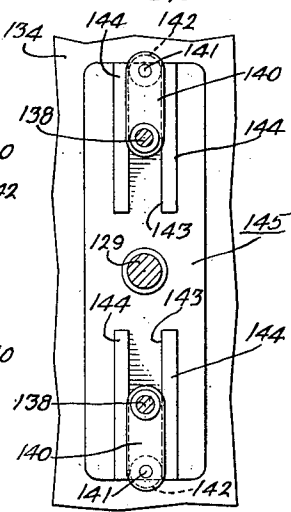


FIG. 9.



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FIG. 11.

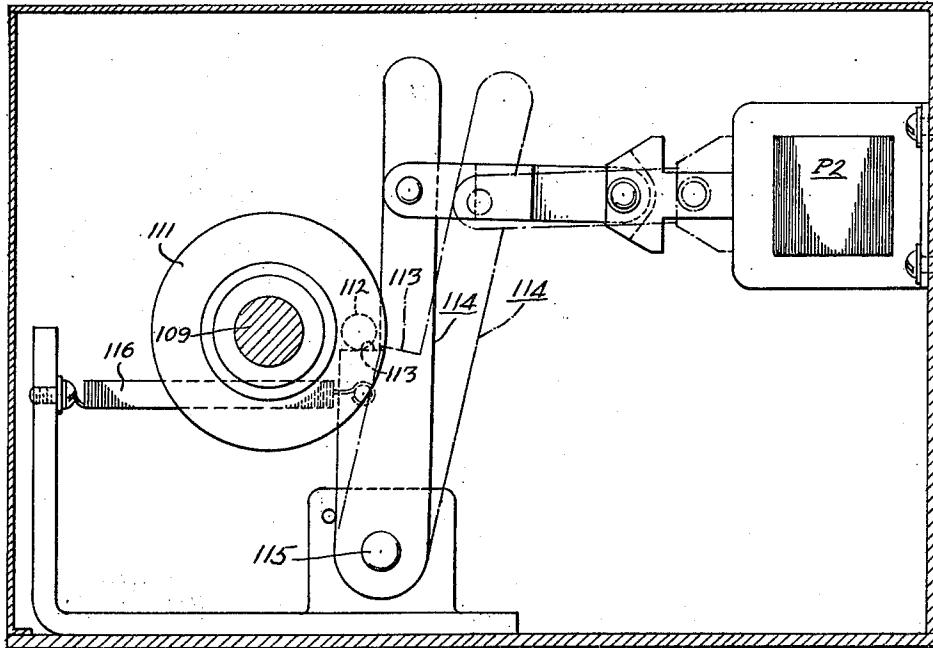
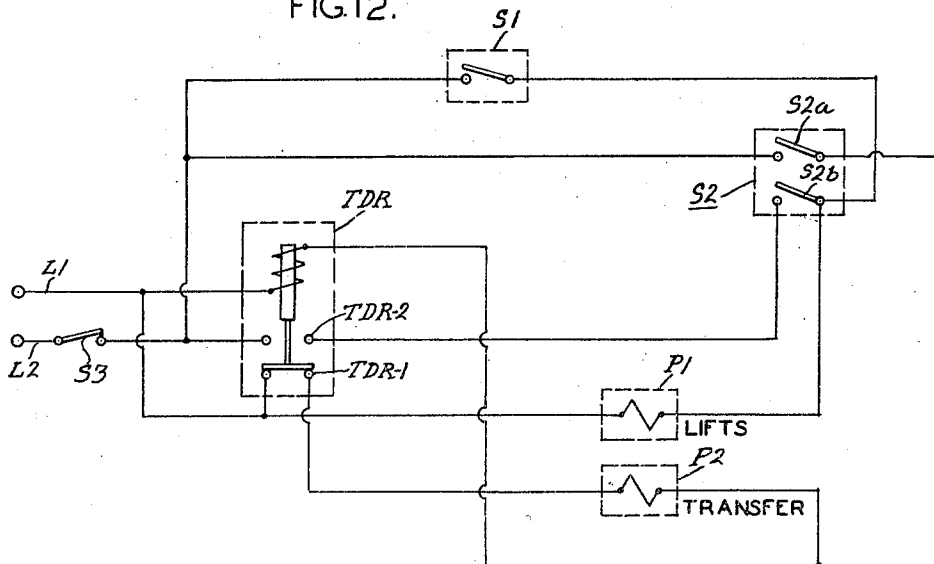


FIG. 12.



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BOARD TRANSFER APPARATUS

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Filed Jan. 15, 1963, Ser. No. 251,510

7 Claims. (Cl. 198—21)

This invention relates to board transfer apparatus, especially for transferring tile-holding boards from a heating oven where adhesively attached backing sheets are dried to a cooling chamber through which the boards are returned to a delivery station, and has for an object the provision of improvements in this art.

In copending commonly owned applications there is disclosed a system for feeding tiles into rectangular pockets of rectangular boards, Serial No. 225,578, filed September 24, 1962, now Patent No. 3,177,568; positioning the tiles in like corners of the pockets, applying backing sheets to the tiles on the boards, turning the boards from an endwise travel disposition to a sidewise travel disposition, and feeding the boards into a heating oven to dry the adhesive on the sheets, Serial No. 246,124, filed December 20, 1962; also means for returning empty boards to the filling line to be charged with tiles, Serial No. 246,120, filed December 20, 1962, now Patent No. 3,172,525. The product is a unit of sheet-backed tiles arranged in desired patterns ready to be set in cement. The practice of providing such sheet-backed tile units has long been known, the sheet-attached tiles being set in cement, the backing sheet being removed after setting, as by soaking and scrubbing, and the spaces between tiles filled with grouting; but the system of handling tiles and boards according to the applications referred to is believed to be new.

The present invention relates particularly to cross transfer means for moving tile boards from the delivery end of the heating or drying oven upon delivery demand and feeding them over to and into a cooling chamber on a return path parallel to the outgoing path to and through the drying oven.

The invention provides elevator means between adjacent conveyor means and fast-action conveying means for shifting boards between parallel reversely moving conveyors in the heating oven and cooling chamber respectively.

The objects of the invention as well as various features of novelty and advantages will be apparent from the following description of an exemplary embodiment, reference being made to the accompanying drawings, wherein:

FIG. 1 is a plan view of a plant or system which includes apparatus embodying the invention;

FIG. 2 is an enlarged plan view of apparatus in zone 2—2 of FIG. 1;

FIG. 3 is an elevation and section taken on the line 3—3 of FIG. 2;

FIG. 4 is an enlarged vertical section taken on the line 4—4 of FIG. 2;

FIG. 5 is an enlarged section taken on the line 5—5 of FIG. 2;

FIG. 6 is an enlarged vertical section taken on the line 6—6 of FIG. 3;

FIG. 7 is a vertical section taken on the line 7—7 of FIG. 6;

FIG. 8 is a reduced partial section taken on the line 8—8 of FIG. 6;

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FIG. 9 is a view like FIG. 8 but showing the parts in a different stage of operation;

FIG. 10 is an operational diagram of parts shown in FIGS. 6 to 9;

FIG. 11 is an enlarged vertical section and elevation of clutch operating means, the view being taken on the line 11—11 of FIG. 2; and

FIG. 12 is a wiring diagram.

Referring to FIG. 1, a tile supply conveyor belt 20 carries tiles to an arranging and feeding device 21 which feeds them into the pockets of endwise travelling boards 22 (see FIG. 5) which are moving continuously in spaced relationship on a forwarding or feed-out chain conveyor 23.

An oblique rotary brush 24 sweeps off excess tiles to a return belt conveyor 25 which returns them to the supply conveyor belt 20. The filled boards may be checked by an operator at an inspection station 26.

From the chain conveyor 23 the boards are transferred to a faster moving board-tilting chain conveyor 27 on which the tiles are rearranged so as to occupy uniform positions in the pockets with uniform grouting spacings between tiles, after which an operator at a sheet backing station 28 applies an adhesive-coated backing sheet to the tiles on each board as it passes. The increase in travel speed increases the spacing between boards to make it easier to apply the backing sheets.

From the chain conveyor 27 the boards with sheet-backed tiles are transferred to a side-tilt chain conveyor 29 which carries them over a turntable 30 which raises them, turns them ninety degrees (90°), and lowers them down upon a wide-gage high-level chain conveyor 31 which carries them sidewise to another separately driven chain conveyor 32 which carries them more closely spaced and at a slower speed through a heated drying oven 33.

From the oven 33 the boards are delivered by the conveyor 32 to transfer mechanism generally designated by the numeral 35 (forming the particular subject matter of the present invention) which moves them over upon a fast-moving chain conveyor 36 which carries them into a cooling chamber 37. The boards in the cooling chamber 37 are transferred by the conveyor 36 to a slow speed chain conveyor 36a which moves them at a slower speed and closer together through the cooling chamber.

The conveyor 36a delivers the boards from the cooling chamber upon a wide-gage high-level chain conveyor 38 which passes above a turntable 39.

The turntable 39 rises beneath a board, lifts it above the conveyor 38, turns it ninety degrees (90°), and lowers it down upon a low-level narrow-gage chain conveyor 40 on which it travels endwise to a roller conveyor table 41. The boards may be pushed by hand along the table 41 or may move by gravity, or may be pushed by oncoming boards behind until they arrive upon a return chain conveyor 42. At a delivery station or zone 43 alongside the conveyors 41 and 42 an operator lifts out the backed sheets or units of tiles and the empty boards continue their movement along the conveyor 42.

A board return cross transfer feed chain conveyor 44 takes boards one at a time as it requires them from the return conveyor 42 and by intermittent speed-up movement returns them after several steps of movement back upon the outfeed or forwarding conveyor 23.

The cross transfer mechanism 35 with which the present invention is especially concerned is shown in FIGS. 2 to 5. A framework 50 of various components is ar-

ranged between the delivery end of the drying oven 33 and the receiving end of the cooling chamber 37. The chain conveyor 32 of the drying oven 33 stops at the delivery end of the oven but the conveyor 36 of the cooling chamber 37 extends out beyond the frame 50. A crossover transfer chain conveyor 51 moves boards in steps from the conveyor 32 to the conveyor 36.

The chains of conveyor 32 at the delivery end are carried by sprockets 52 of a shaft 53 driven from power means, not shown, through a sprocket 54 and a chain 55.

The chains of conveyor 36 at the outer end are carried by sprockets 56 of a shaft 57, the chains being driven by power means, not shown, and adjustment means 58 being provided to keep the chains tight.

The chains of the crossover conveyor 51 are supported at one end by sprockets 60 on a shaft 61 and are supported at the other end by sprockets 62 on a shaft 63. The shaft 63 is driven, as by a sprocket 64 thereon and a chain 65, from the sprocket 66 of a power drive shaft 67. As shown in FIG. 3, the chains of conveyor 51 extend down from the sprockets 60 of shaft 61 and pass over sprockets 68 of an adjusting idler shaft 69 which is provided with means, not shown, for making adjustments to keep the chains tight. The chains carry projections 70 with rollers thereon for engaging behind tile boards to move them forward. The chains of conveyor 51 are driven in intermittent fast-speed steps by means to be described hereinafter.

The chains of conveyor 51 travel on table guide rails 71 (FIG. 4) of the frame and the tile boards are guided on the sides by a front guide rail 72 and rear guide rails 73 and 74.

Means are provided at the delivery end of the oven 33 beyond the end of its conveyor 32 for receiving the boards one at a time and lowering them down on the crossover conveyor 51 before it starts an intermittent movement toward the cooling chamber, the means here shown comprising an elevator or lift conveyor 75 comprising a frame table 76 carrying a plurality of rollers 77 having their axes arranged transversely to the direction of movement of the emerging boards. The conveyor 51 is at a slightly lower level than the conveyor 32.

The frame table 76 is mounted on slide rods 78 mounted in guide tubes 79 secured to the frame. The frame table is moved up when a board is fed out of the oven to let the board roll out upon it and is moved down to seat the board on the crossover conveyor 51. This vertical motion in properly timed relationship is provided by connecting rods 80 pivoted at the upper end to the table by pins 81 and carried at the lower end on eccentrics 82 of a shaft 83.

Additional bridging rollers 84 carried by fixed brackets 85 are located between and partly beyond the sprockets 52 for supporting the forward edge of a board as it moves out from the oven conveyor 32. In FIG. 4 the table rollers 77 are shown in full lines in lowered position with a board 22 resting on the chains of conveyor 51. The rollers 77 provide slope outwardly. The raised position of rollers 77 is shown in broken lines.

Means are provided at the receiving end of the cooling chamber 37 beyond the end of the conveyor 51 for receiving the boards one at a time and lowering them down on conveyor 36 which is at a slightly lower level than the conveyor 51, the means here shown comprising an elevator or lift conveyor 90 comprising a frame table 91 carrying a plurality of rollers 92 having their axes arranged transversely to the direction of movement of the boards from the conveyor 51.

The frame table 91 is mounted on slide rods 93 mounted in guide tubes 94 secured to the frame. The frame table is moved up when a board is fed out on it and is moved back down to seat the board on the conveyor 36. This vertical motion in properly time relationship is provided by connecting rods 95 pivoted at the upper

end to the table by pins 96 and carried at the lower end on eccentrics 97 of a shaft 98. In FIG. 5 the table rollers 92 are shown in raised position with a board 22 resting thereon ready to be lowered down upon the conveyor 36.

Additional short bridging rolls 99, carried on a shaft 100 mounted on supports on the frame, bridge the space between the conveyor 51 and the elevator rolls 92.

Means are provided for initiating the action of the lifts and crossover conveyor 51 as needed by boards delivered from the continuously moving conveyor 32 of the oven, the means here provided comprising a limit switch S1, FIG. 2, positioned at the side rail 73 where it will be engaged by the side of an emerging board. Another limit switch device S2, having two contact switches S2a and S2b, is located in a position, FIG. 4, where it will be operated when the first lift device 75 is lowered to deposit a board on a crossover conveyor.

Power drive means are provided for the crossover conveyor and lifts, the means here shown comprising, FIG. 3, a motor M, a gear drive G therefor, and a chain drive belt 103 passing over a sprocket 104 of the gear drive, thence over an idler sprocket 105, thence over a sprocket 106 of a left drive shaft 107, thence over a sprocket 108 of a crossover conveyor drive shaft 109, and back over an idler sprocket 110.

The lift drive shaft 107 and the conveyor drive shaft 109 are each provided with a one-revolution clutch arrangement like that shown in FIG. 11 for the conveyor drive shaft 109. The one-revolution clutch which is referred to by the numeral 111 has a pin 112 which is normally held by the notch 113 of an arm 114 pivoted at 115 and held over in position to hold the pin by a spring 116. When a solenoid P2 is energized it pulls the arm 114 over to the broken line position to release the pin 112 and engages the clutch to make one revolution before the notch 113 again engages the pin 112 and stops operation. It is only necessary to show this clutch operating mechanism for one of the shafts 107, 109, since the other is the same.

Returning to FIG. 3, it will now be seen that when the solenoid and clutch for shaft 107 are operated this will cause a sprocket 120 for a drive chain 121 and a sprocket 122 for a drive chain 123 to be operated. The chain 121 drives a larger sprocket 124 on the cam operating shaft 83 of the first lift device 75; and the chain 123 drives a larger sprocket 125 on the cam operating shaft 98 of the second lift device 90. The drive ratios and connections are so designed that both lifts are operated simultaneously and in opposite phase through a movement in one direction for each full rotation of the common clutch controlled operating shaft 107.

When the solenoid and clutch for shaft 109 for the conveyor are operated this will cause a sprocket 126 for a drive chain 127 to drive a sprocket 128 of a shaft 129 of a fast-speed drive device generally indicated by the numeral 130.

The high speed drive device for the conveyor 51 is shown in FIGS. 6 to 10. Its function is to drive the conveyor chain very rapidly through one step of travel to take a board from the oven, to deliver another board to the cooling chamber conveyor, and to move one or more boards (the number depending on the distance between the oven and cooling chamber and the length of the crossover conveyor) one step forward. In moving boards the projections 70 of the conveyor chain engage behind their rear ends. The high speed drive device which is provided starts the conveyor into motion gradually, a slip drive 131 at the sprocket 128 being provided to prevent breakage, and to accelerate rapidly and smoothly to high speed, then decelerate rapidly and smoothly to a stop. A rail 132 stops the boards.

The high speed drive device is largely housed in a casing 134. It is of the epicyclic crank-and-slot type having a fixed sun gear 135 fixed in the casing, as by cap screws

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136. The shaft 129 extends through the casing and the bore of the sun gear into bearings in the shaft 67, which is tubular. Within the casing the shaft 129 is keyed to a carrier member or a disk 137 which rotatably supports opposite crankshafts 138 having each a planetary gear 139 meshing with the sun gear 135 and a crank arm 140 carrying a crank pin 141 with a sleeve roller 142. The rollers 142 slide along slots 143 formed by guides 144 carried by a bar or disk member 145 which is rigid with the tubular shaft 67.

FIG. 10 shows diagrammatically how this device operates. The stopped position is that shown in full lines in FIG. 10. For each cycle of movement each roller 142 moves from a mid position in its slot 143 to one end and back to mid position, on one cycle moving radially outward and back, as indicated by the double arrow lines in FIG. 10 and the outer position of FIG. 9, and on the alternate cycle moving radially inward and back, as indicated in FIG. 8. The curve of speed would be generally of sine form, starting from zero, reaching maximum at mid-stroke, and returning to zero. FIGS. 6, 8 and 9 do not show the stop position, the intermediate stage of these figures being shown for clarity of illustration.

Operation can be followed by reference to the wiring diagram of FIG. 12. Power is supplied at lines L1, L2 when the operating switch S3 is closed. When a board 22 moves over on the rollers of lift 75 and closes the switch S1 this energizes solenoid P1 to lower the lift 75 and raise the lift 90. When the lift 75 descends it deposits a board on the conveyor 51 and operates switch S2 to close its contact switches S2a and S2b.

Closure of switch S2a energizes the solenoid P2 and causes the conveyor 51 to move forward one step to move a board out upon the rollers of lift 90 and to move forward by one step the other boards on the conveyor, including the one just entrained thereon.

Closure of switch S2a also energizes the coil of an adjustable time delay relay TDR to start its timing action. This relay has a normally closed contact switch TDR-1 in the circuit of solenoid P2 and a normally open contact switch TDR-2 in series with switch S2b (now held closed but not active) and the solenoid P1 of the lifts.

As soon as a board starts moving forward the switch S1 is opened but solenoid P2 is kept energized through switch S2a and TDR-1.

When the time delay relay TDR shifts position it opens TDR-1 and closes TDR-2. Opening of TDR-1 de-energizes solenoid P2 and assures the proper one-step movement of the conveyor. Closure of TDR-2 again energizes solenoid P1 (through S2b, now closed) and produces another operation of the lifts, lift 75 rising to receive another board and lift 90 descending to deposit a board on the conveyor 36.

The ascent of lift 75 allows switches S2a and S2b to open again to de-energize solenoid P1 and also to de-energize the time delay relay TDR to open TDR-2 and close TDR-1.

The parts are now in a position to receive another board from the oven. If no board arrives to operate the limit switch S1 and produce another cycle of operation, the parts will remain in this position. If, for shut-down, it is desired to remove all boards from the conveyor 51 and into the cooling chamber, this can be done by operating the switch S1 repeatedly until the last board has been transferred to the continuously moving conveyor 36.

It is thus seen that the invention provides a plant for feeding out tile-filled boards which, after re-arrangement and the application of a backing sheet, are turned sidewise and fed through a drying oven, then across to a cooling chamber, then past a delivery station where they can accumulate, then for returning boards, as required to the feed-out line. Also that it provides improved means for transferring boards delivered from the drying oven over to a cooling oven on a return trip past the delivery station and board return.

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While one embodiment of the invention has been described for purposes of illustration, it is to be understood that there may be various embodiments and modifications within the general scope of the invention.

I claim:

1. Board transfer apparatus for tile assembly boards which have a considerably greater dimension in length than width, comprising in combination, a narrow feedout belt conveyor for feeding out tile-filled boards endwise in spaced-apart relationship, a second narrow conveyor belt for taking boards from said feed-out conveyor and moving them endwise thereon in spaced-apart relationship, the tiles being rearranged and having a wet adhesive backing sheet applied thereto while on said second narrow conveyor, a wide oven belt conveyor for moving boards sidewise in closely-spaced relationship from the second narrow conveyor through an oven to dry the adhesive, an elevator turntable for raising boards from said second narrow conveyor and turning and depositing them on said wide oven conveyor, a wide return cooling belt conveyor for passing dried boards sidewise in closely-spaced relationship through a cooling chamber, a narrow crossover belt conveyor for moving boards endwise in spaced-apart relationship from said oven conveyor to said cooling conveyor, a narrow return belt conveyor for moving boards endwise in spaced-apart relationship from said wide return cooling conveyor, an elevator turntable for raising boards from said wide cooling conveyor and turning and depositing them on said narrow return conveyor, a roller table conveyor for taking boards from said narrow return conveyor and allowing them to move into end-to-end relationship at a delivery station, a narrow second return belt conveyor for taking empty boards from said roller table conveyor, and a return cross conveyor for taking empty boards from said second return conveyor and returning them sidewise in spaced-apart relationship to said feed-out conveyor.

2. Board transfer apparatus, comprising in combination, a first continuously moving spaced-side endless belt type board conveyor, a second continuously moving spaced-side endless belt type board conveyor spaced laterally from said first conveyor, a high-speed intermittently moving spaced-side endless belt type crossover board conveyor disposed between said first and second conveyors, said first conveyor having its delivery end located at the near side along the length at the receiving end of said crossover conveyor, and said crossover conveyor having its delivery end located at the near side along the length at the receiving end of said second conveyor, a lift disposed between the sides of said crossover conveyor beyond the end of said first conveyor, said lift having idle rollers, means controlled by the delivery of a board on said lift for lowering the lift to deposit the board on the crossover conveyor, and means controlled by the descent of said lift for operating said crossover conveyor through a movement of limited length a second lift disposed between the sides of said second conveyor at the delivery end of the crossover conveyor, and means for operating said second lift simultaneously with the operation of the first said lift but in opposite phase therewith to deposit a board on said second conveyor at a time while said crossover conveyor is at rest.

3. Board transfer apparatus, comprising in combination, an intermittently moving crossover belt conveyor, means for moving said crossover conveyor intermittently at high speed with acceleration and deceleration between high speed and stopped positions, a lift at each end of the conveyor, and means for operating said lifts simultaneously in opposite directions at each end of a movement of said crossover conveyor.

4. Board transfer apparatus as set forth in claim 3, which further includes a power control device at the receiving end of said crossover conveyor operated when a board is placed thereon for causing the lift at that end to descend and deposit a board on the conveyor and to cause

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the lift at the delivery end of the conveyor to rise to receive a board, a power control device operated when the lift at the receiving end descends for causing said crossover conveyor to move one step to deposit a board on the lift at the delivery end of the conveyor, and power control means for causing said lifts to move together reversely at the end of the crossover conveyor movement.

5. Apparatus as set forth in claim 4, wherein said last-mentioned power control device is a time controlled device providing for the start of return movement of the lifts while the conveyor is coming to a stop.

6. Apparatus as set forth in claim 3, which further comprises, a slow moving conveyor for delivering a board to the receiving end of the crossover conveyor, and a faster moving conveyor for taking a board from the delivery end of the crossover conveyor.

7. Apparatus as set forth in claim 6, which further com-

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prises, a slower moving conveyor taking boards from said faster moving conveyor to carry them in closely spaced relationship thereon.

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