April 13, 1965 M. A. SCHWEIKER 3,177,568

DIRECT TILE FEEDING MACHINE

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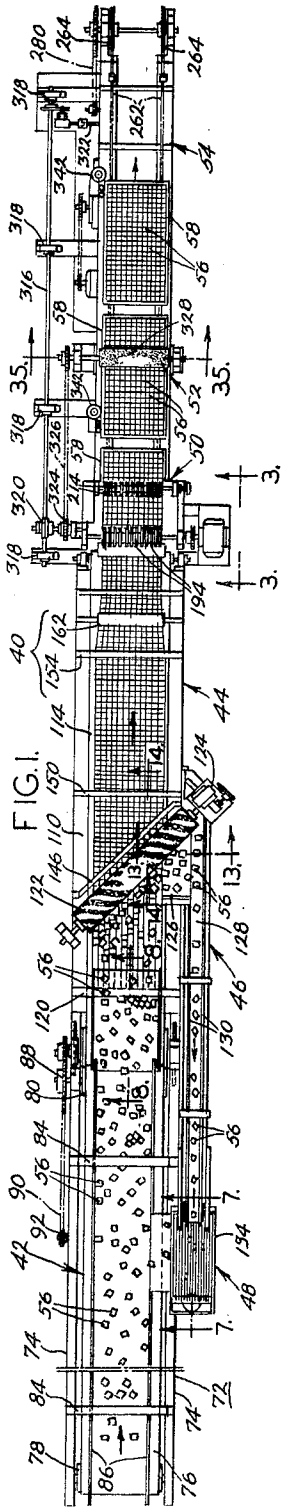


FIG. 1.

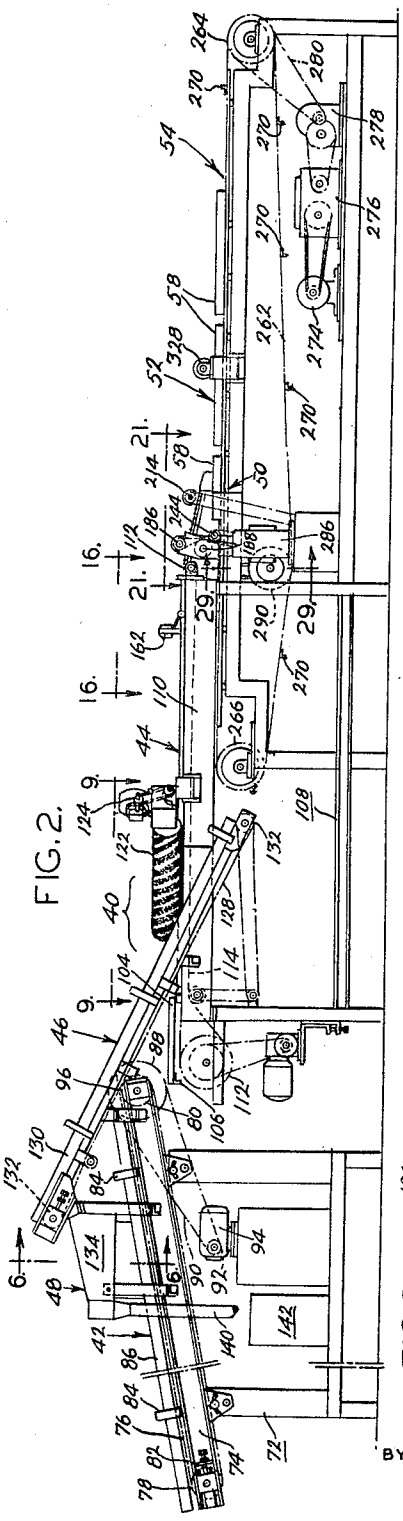


FIG. 2.

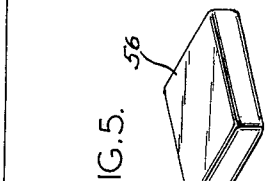


FIG. 5.

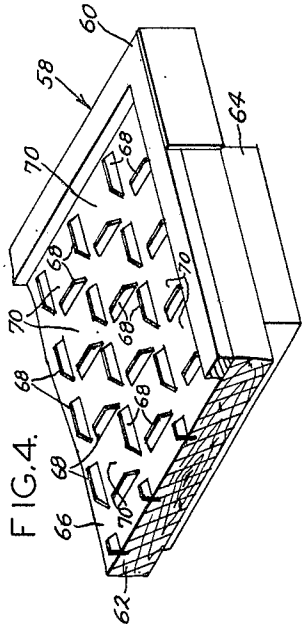


FIG. 4.

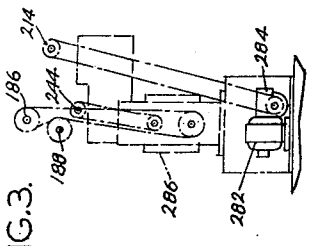


FIG. 3.

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FIG. 6.

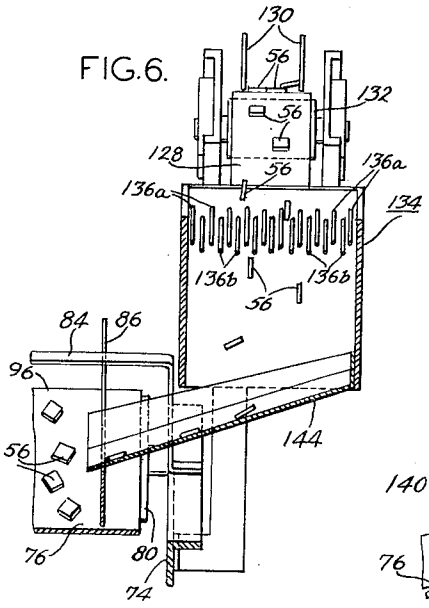


FIG. 7.

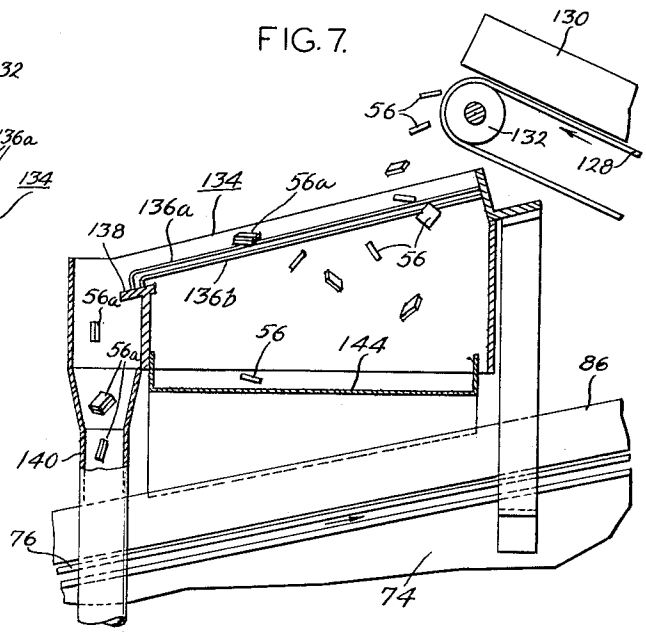


FIG. 13.

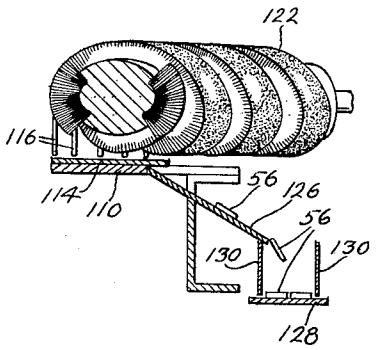


FIG. 8

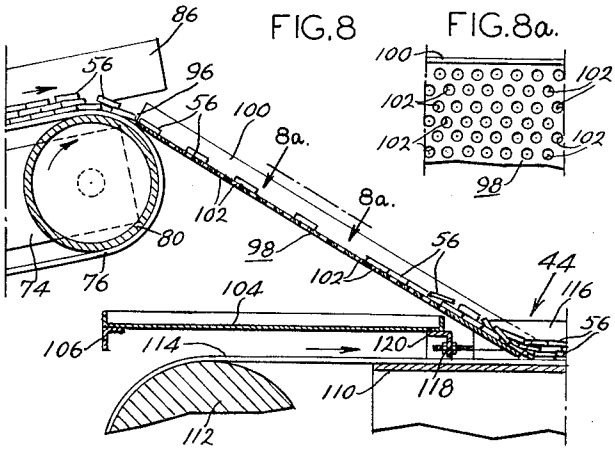


FIG. 8a.

FIG. 14.

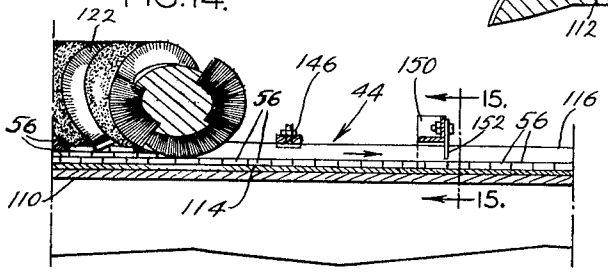
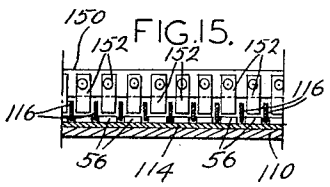


FIG. 15.



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FIG. 9.

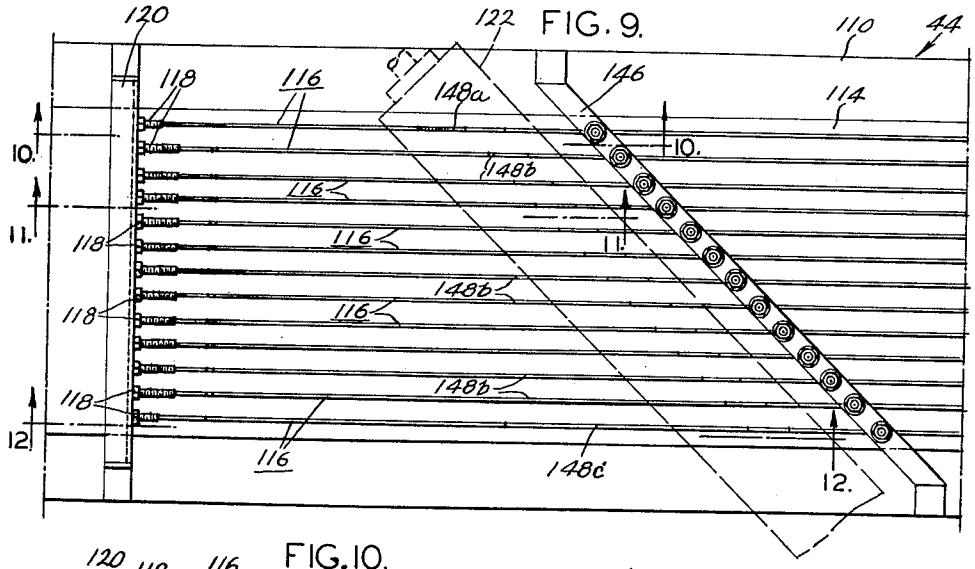


FIG. 10.

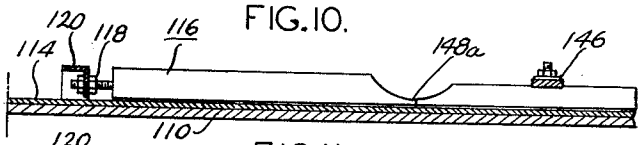


FIG. 11.

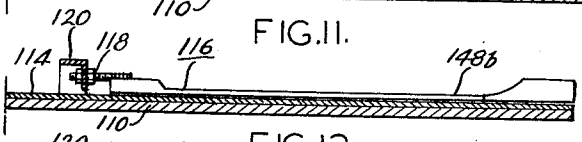


FIG. 12.

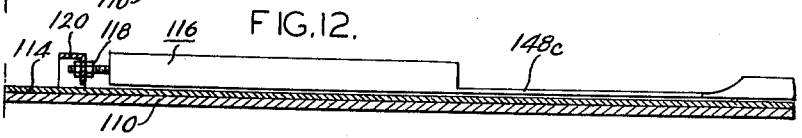
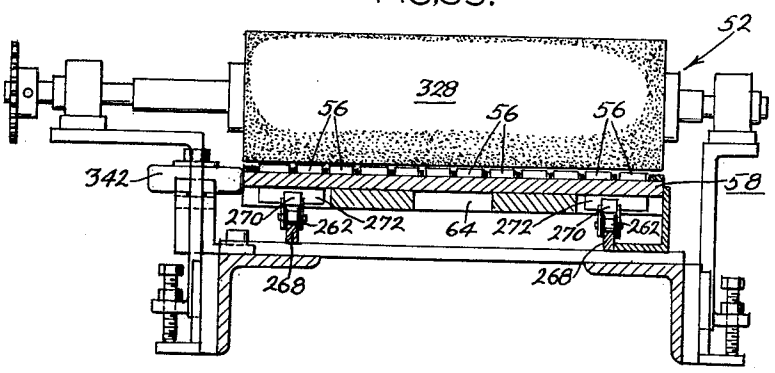


FIG. 35.



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FIG.16.

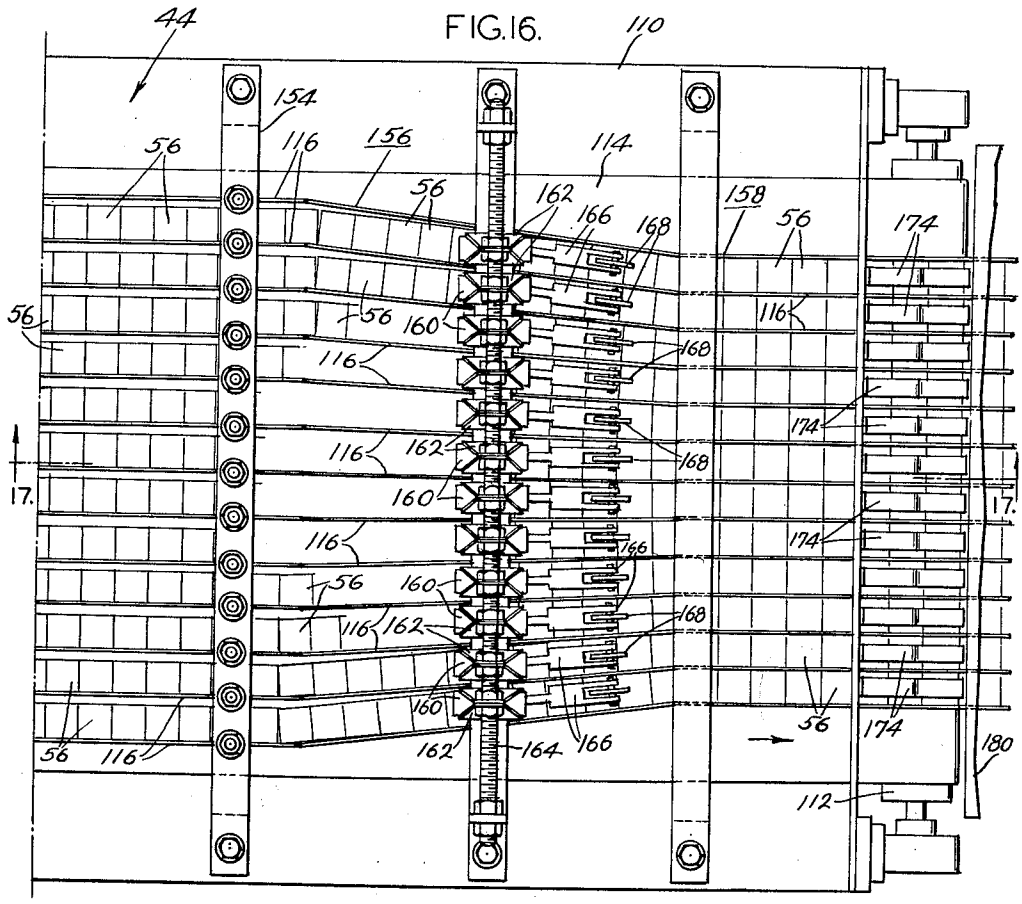


FIG.17.

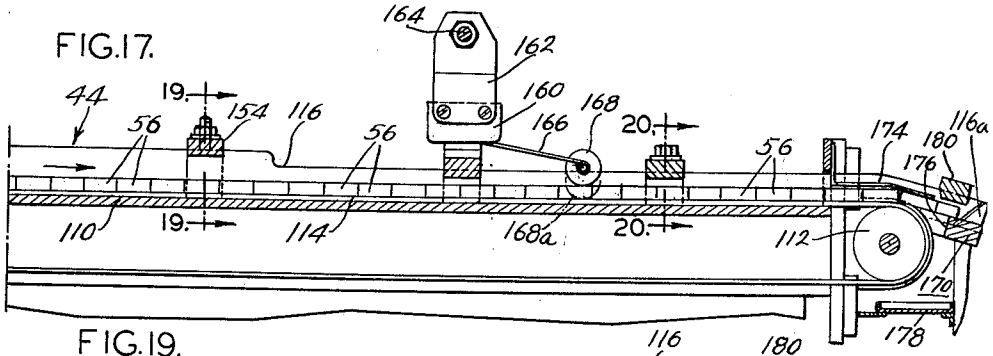


FIG.19.

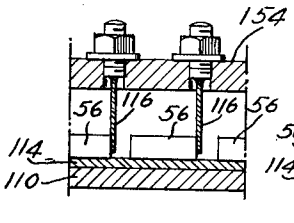


FIG. 20.

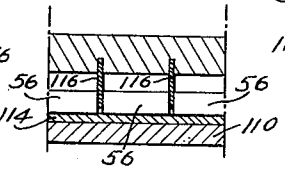
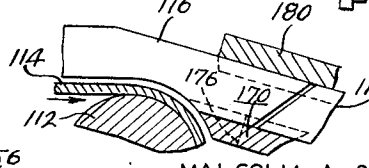


FIG.18.



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FIG. 21.

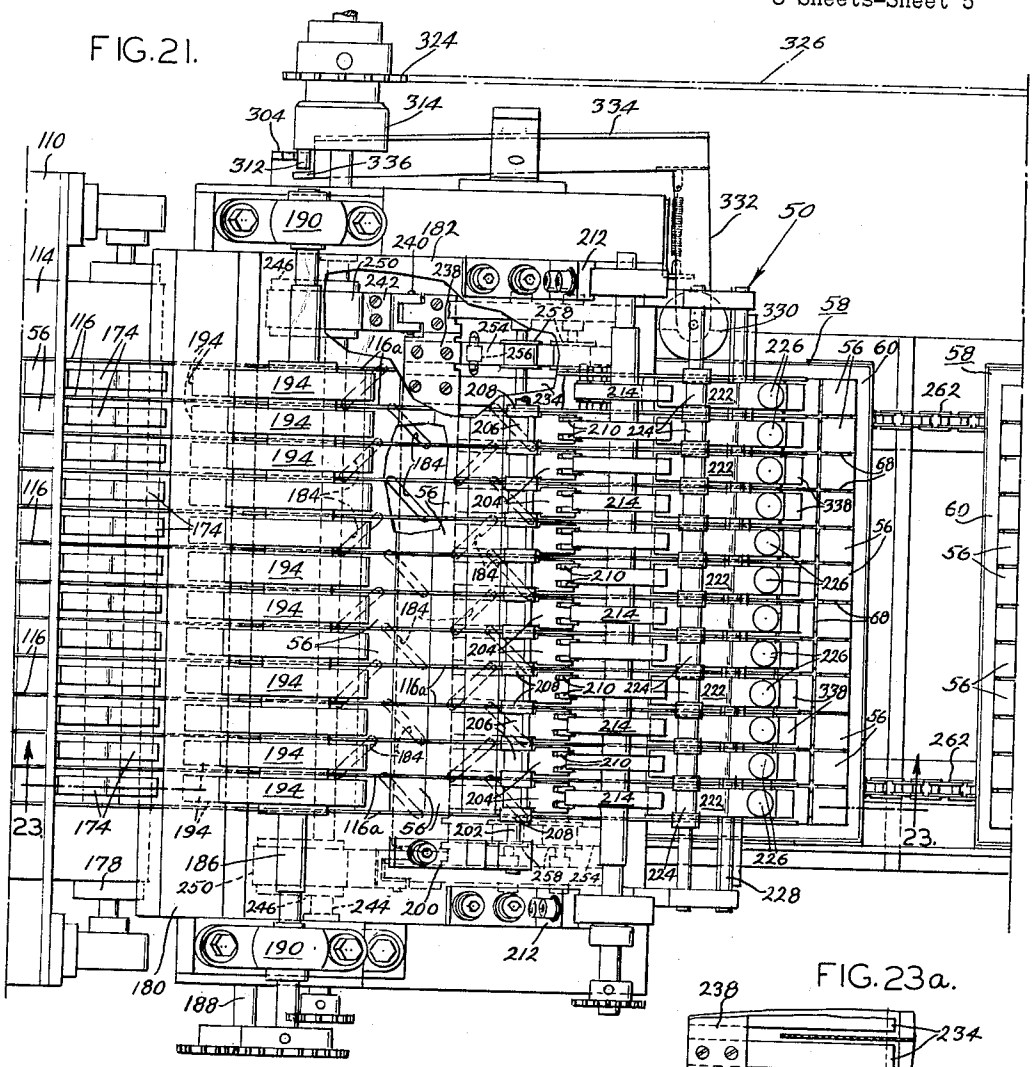


FIG. 23a.

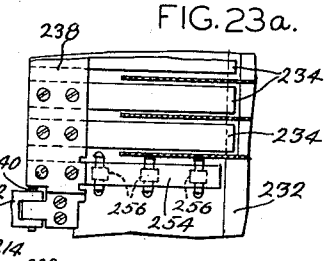


FIG. 22.

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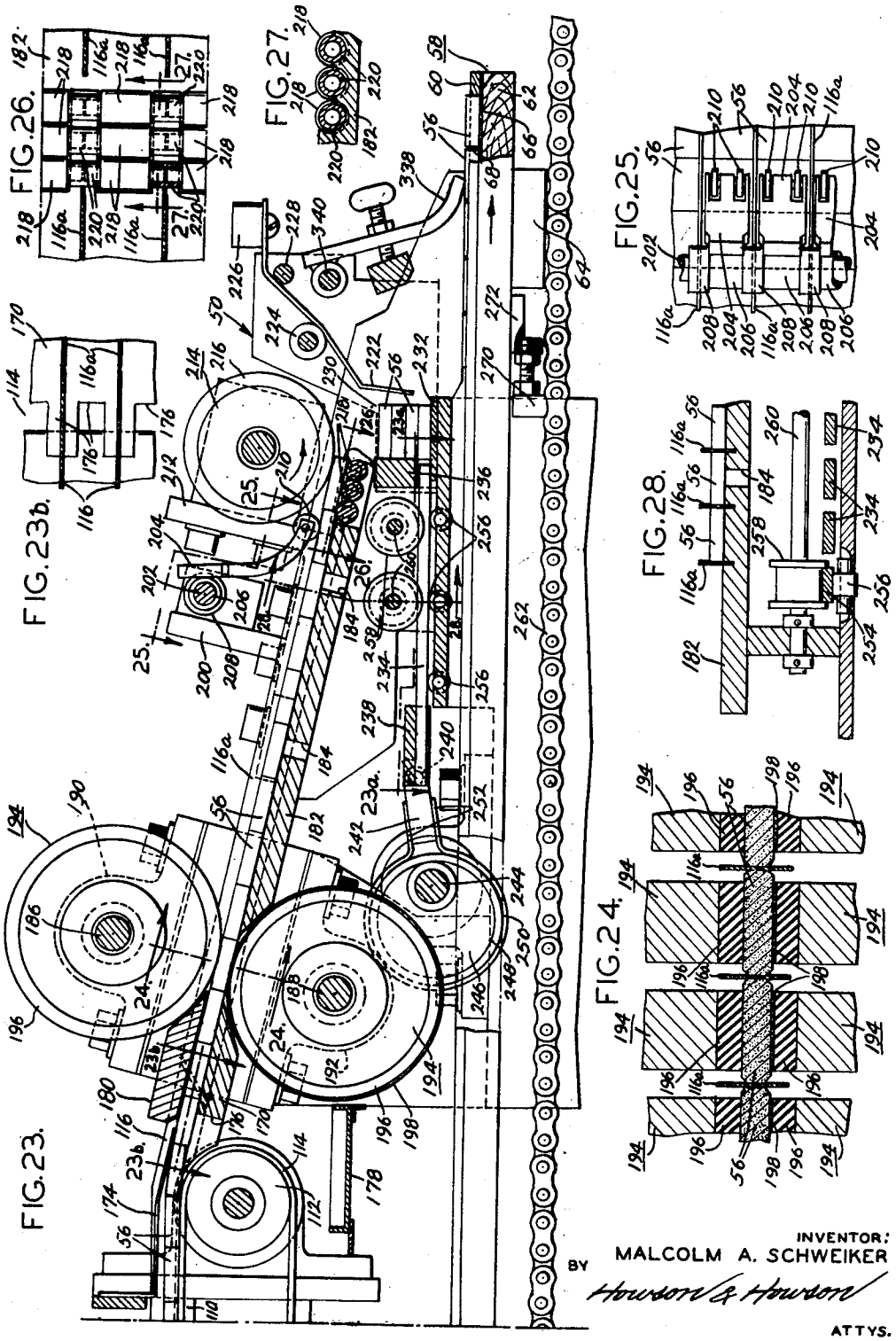


FIG. 23.

FIG. 23b.

FIG. 26.

FIG. 27.

FIG. 25.

FIG. 28.

FIG. 24.

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FIG. 29.

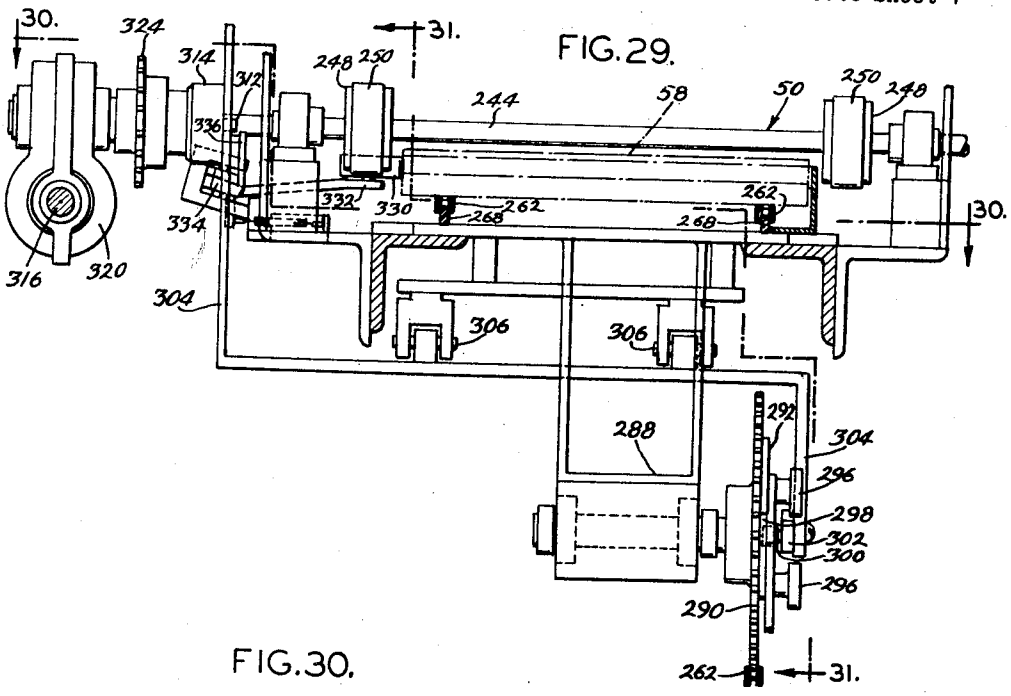
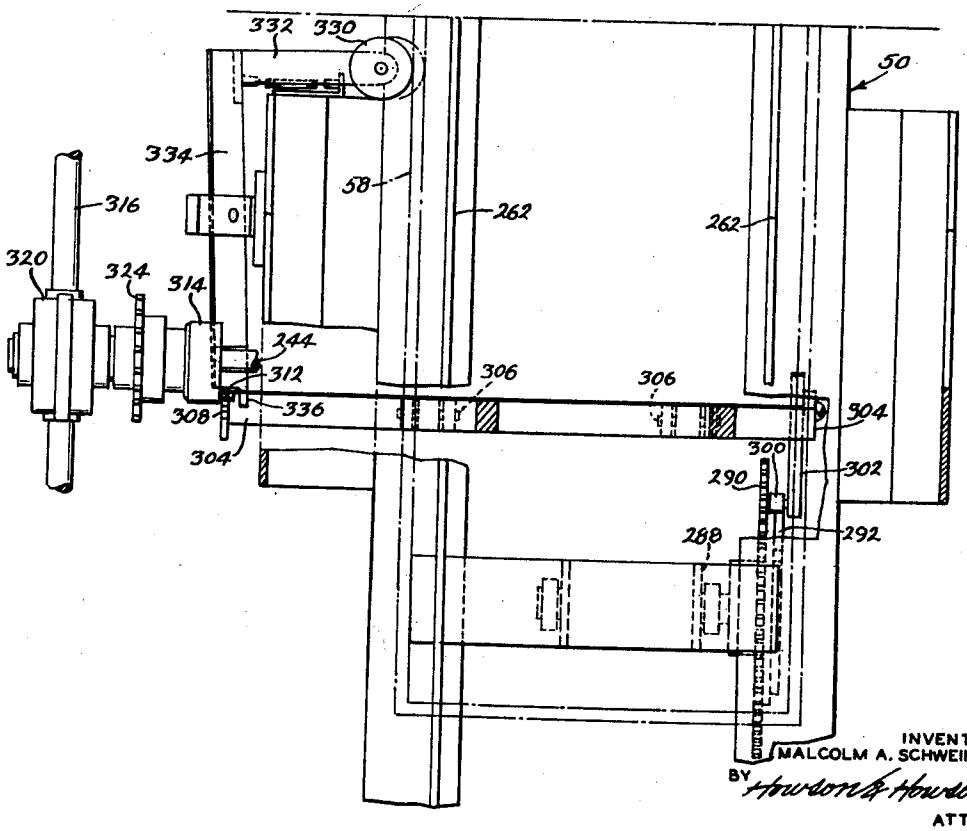


FIG. 30.



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FIG. 31.

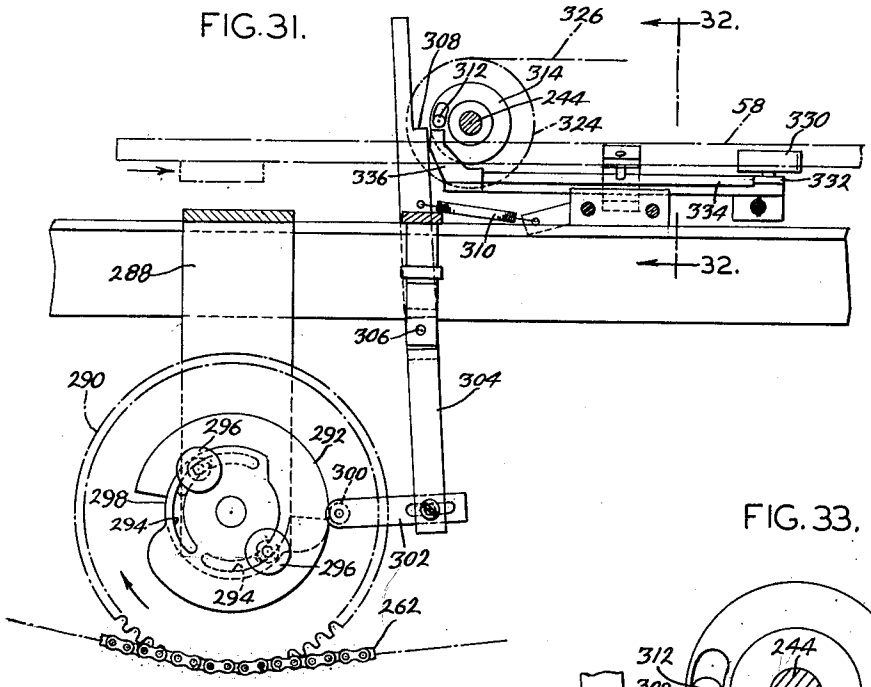


FIG. 32.

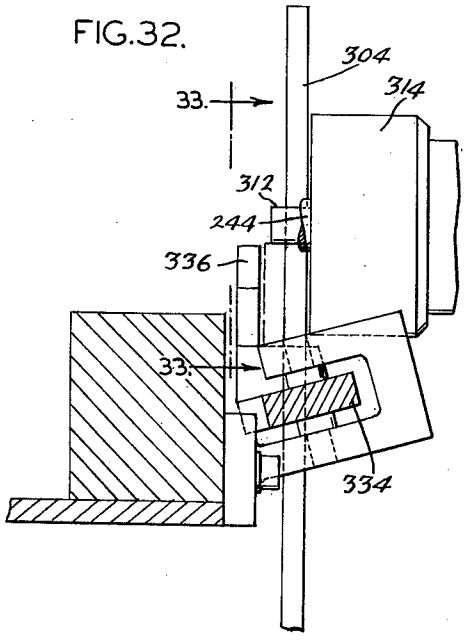


FIG. 33.

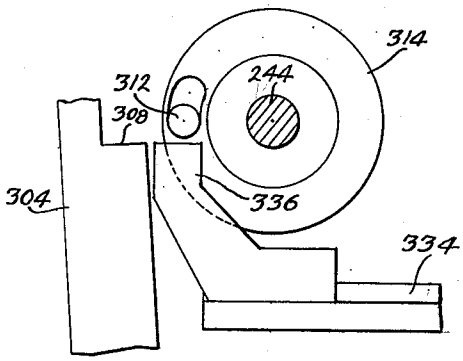
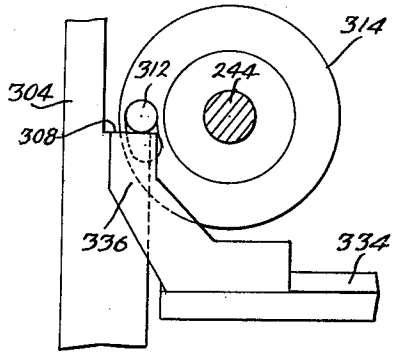


FIG. 34.



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United States Patent Office 3,177,568 Patented Apr. 13, 1965

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DIRECT TILE FEEDING MACHINE

Malcolm A. Schweiker, Worcester, Pa., assignor to American Encaustic Tiling Company, Inc., Lansdale, Pa., a corporation of New York

Filed Sept. 24, 1962, Ser. No. 225,578
16 Claims. (Cl. 29—211)

The present invention relates broadly to the manufacture of composite sheets of tile wherein a plurality of individual ceramic tiles are positioned and arranged for later application of a paper backing coated with adhesive.

These composite sheets are widely used in laying tile floors and walls, with exposed tile faces applied to previously laid cement on the surface to which applied and subsequently, after hardening of the adhesive or cement, the paper web or carrying sheet is moistened and removed and thereafter spaces between the individual tiles resulting from the method of assembly are filled in by grouting in a known manner.

The present apparatus is particularly adapted for the positioning of the individual ceramic tiles in pockets on boards of known types formed by utilizing metal having upturned areas or portions to form individual pockets, with the upturned portions of metal constituting spacers for the tiles. After the various pockets, which in a preferred embodiment are twelve in number transversely of the board and twenty-four in number longitudinally of the board are filled, then subsequently a piece of paper is pasted over the top face of the tile to hold the pieces in place when they are removed from the board. Various apparatus and methods have heretofore been utilized in an effort to automate this type of operation to obviate the necessity of individually hand placing each of the tiles in the pockets. The present invention is primarily adapted for simple one-color patterns, adapted to be placed in pattern boards of the aforementioned character and wherein the operation is continuous as regards movement of conveyors carrying spaced boards for the tiles and individual tile feed mechanisms are tied in with the drive means for the conveyor and predetermined positioned tile boards to accurately and positively insert individual tiles in the various pockets on the board.

An object of the present invention is to provide apparatus of this nature which has a high speed of operation and high efficiency in operation and results.

A further object of the present invention is to provide a tile feeding machine which is of simplicity of construction and operation and which facilitates visual inspection of the filled boards for accuracy and quality of tiles inserted therein.

A still further object of the present invention is to provide feed means for randomly disposed individual tiles and orienting means for assembling tiles in aligned transversely spaced longitudinal rows and introducing them into feed means for inserting individual tiles into individual pockets on the travelling boards on the conveyor.

Another object of the present invention is to provide means in tile feeding machines insuring an adequate supply of individual tiles in all of the aforementioned rows at all times, with means to remove excess and/or superimposed tiles so that a single thickness of tile is fed into the tile positioning station.

A still further object of the invention is to provide in a tile feeding machine means whereby an excess of tiles fed are returned to the conveyor and additionally means are provided to eliminate so called doubles, wherein two individual tiles have become adhered to one another.

A still further object of the present invention is to provide in a tile feeding machine means for removing tile chips or the like which otherwise might tend to jam up or injure the mechanism and/or operation.

Another object of the present invention is to provide means in a tile feed machine to insure the presence of individual tiles in the rows thereof being fed and upon detecting absence of a tile, the machine will be deactivated.

An additional object is to insure the feeding of one tile at a time from a given line of tiles onto a board under normal operating conditions, with additional means to remove inadvertently fed tiles and means to positively seat the tiles in the tile pockets in conjunction with positive drive means for the individual tiles.

A still further object of the invention is to provide means to detect the presence of a tile board and in its absence to stop the tile feed mechanism.

Additional advantages and objects of the present invention will be more readily apparent from the following detailed discussion of an embodiment thereof when taken together with the accompanying drawings in which:

FIG. 1 is a plan view of the tile feeding and positioning machine of the present invention;

FIG. 2 is a side elevational view of the machine of FIG. 1;

FIG. 3 is a schematic view of drive mechanisms for the machine at a position taken on line 3—3 of FIG. 1;

FIG. 4 is a fragmentary perspective view of a portion of a tile board showing the tile pockets therein;

FIG. 5 is a perspective view of a single tile as contemplated for use with the present invention;

FIG. 6 is a fragmentary sectional view on line 6—6 of FIG. 2 of a portion of excess tile return mechanisms;

FIG. 7 is a view taken at right angles to FIG. 6 and along line 7—7 of FIG. 1;

FIG. 8 is a sectional view taken on line 8—8 of FIG. 1;

FIG. 8*a* is a fragmentary sectional view taken on line 8*a*—8*a* of FIG. 8;

FIG. 9 is a fragmentary plan view taken on line 9—9 of FIG. 2 of a portion of the tile feed orienting means;

FIG. 10 is a sectional view taken on line 10—10 of FIG. 9;

FIG. 11 is a sectional view taken on line 11—11 of FIG. 9;

FIG. 12 is a sectional view taken on line 12—12 of FIG. 9;

FIG. 13 is a sectional view taken on line 13—13 of FIG. 1;

FIG. 14 is a sectional view taken on line 14—14 of FIG. 1;

FIG. 15 is a fragmentary sectional view taken on line 15—15 of FIG. 14;

FIG. 16 is a fragmentary plan view taken on line 16—16 of FIG. 2 approximately at the tile feed onto board station;

FIG. 17 is a sectional view taken on line 17—17 of FIG. 16;

FIG. 18 is an enlarged fragmentary view of a portion of FIG. 17 showing details of a portion of the mechanism at the tile feed station;

FIG. 19 is a sectional view taken on line 19—19 of FIG. 17;

FIG. 20 is a sectional view taken on line 20—20 of FIG. 17;

FIG. 21 is a fragmentary plan view taken on line 21—21 of FIG. 2 at the tile feed station of the machine;

FIG. 22 is a side elevational view of the apparatus of FIG. 21;

FIG. 23 is a sectional view taken on line 23—23 of FIG. 21;

FIG. 23*a* is a fragmentary view taken along line 23*a*—23*a* of FIG. 23;

FIG. 23*b* is a fragmentary view taken along line 23*b*—23*b* of FIG. 23;

FIG. 24 is a sectional view taken along line 24—24 of FIG. 23;

FIG. 25 is a view taken on line 25—25 of FIG. 23;

FIG. 26 is a view taken along line 26—26 of FIG. 23;

FIG. 27 is a fragmentary sectional view taken on line 27—27 of FIG. 26;

FIG. 28 is a fragmentary sectional view taken on line 28—28 of FIG. 23;

FIG. 29 is a sectional view taken along line 29—29 of FIG. 2;

FIG. 30 is a view taken along line 30—30 of FIG. 29;

FIG. 31 is a view taken along line 31—31 of FIG. 29;

FIG. 32 is a sectional view taken on line 32—32 of FIG. 31;

FIG. 33 is a sectional view taken on line 33—33 of FIG. 32, of actuating control means with a tile board in position and the tile feed conditioned for operation;

FIG. 34 is a view similar to FIG. 33 but for a condition with no board present and no tile to be fed; and

FIG. 35 is a sectional view taken along line 35—35 of FIG. 1.

Referring now more specifically to the figures of the drawings, which illustrate a preferred embodiment of the invention, the tile feeding machine is generally designated **40**. The overall machine is comprised of a plurality of different sections of components wherein different phases of the overall operation are carried out. These include a tile supply section **42**; a tile orienting and aligning section **44**; a tile return section **46**; a double-single tile separator section **48**; a tile feed section **50**; a tile setting section **52** and a board discharge section **54**.

The individual ceramic tiles **56** are normally square in configuration as shown in FIG. 5 and preferably have slightly cushioned edges. These individual tiles are to be assembled in the board of a nature as fragmentarily shown in FIG. 4. This board **58** includes a frame portion **60** extending around the periphery thereof and a tile support base portion **62** with an underlying board **64** for engagement with the conveyor mechanism therefor. A metal sheet **66** covers the surface of base **62** and has a plurality of upstanding ears **68** extended out of the material. These ears are so arranged and spaced as to provide a plurality of contiguous tile pockets **70** somewhat larger than the tiles and the ears **68** also form spacers so that when individual tiles are placed in the pockets they are spaced from one another and these spaces when the tile is being assembled on a wall or floor are filled with grouting in the usual manner.

The tile supply section **42** consists of a frame generally designated **72** adjustably mounting side members **74** in an upwardly inclined position from inlet to discharge ends. An endless conveyor belt **76** is operably mounted between the side members **74** by means of rolls **78** and **80** rotatably journalled in the side members. Means are provided at **82** for adjusting tension on the belt in a usual manner. Side members **84** are mounted above the members **74** and serve as guard members for the conveyor belt. Tile guides **86** extend the length of the conveyor belt for confining tiles to a restricted transverse area of the belt. The roll **80** has a sprocket **88** mounted on the shaft thereof about which is entrained a drive chain **90** and which is also entrained over a drive sprocket **92** operatively connected to motor **94**. Speed reduction means can be utilized if desired. Any means can be used to place a plurality of tiles **56** onto the conveyor belt **76** in a random fashion and upon energization of motor **94** the conveyor belt will carry these tiles up to the discharge end **96** where they will be dumped onto the main tile conveyor belt in the tile orienting and aligning section **44** as will be described in detail hereinafter.

A downwardly inclined perforated plate **98** having side guides **100** has its leading edge placed in operative association with the discharge end of conveyor belt **76** and upon which the tiles carried thereby are discharged. The perforations as at **102** are provided to permit chips

and/or other extraneous materials to fall therethrough onto a removable chip pan **104** which is suitably mounted in any desired manner, such as by means of angles **106** or the like.

The tile orienting and aligning section includes an elongated frame such as generally designated at **108**. A longitudinally extending conveyor belt support **110** is carried by the frame and conveyor belt rolls **112** are rotatably journalled at opposite ends of the belt support **110** on the frame and have mounted thereon a conveyor belt **114** which extends the length of this section of the apparatus. The tiles discharged from the tile supply section will fall or slide down the plate **98** and onto the upper surface of the conveyor belt **114** to be carried along thereby.

A plurality of vertical longitudinal metal strips **116** are mounted just above the conveyor belt by means of nut and bolts generally indicated **118**, securing the same to angles as at **120**. As seen from FIG. 9 these are spaced transversely of the conveyor belt and serve to channel and guide tiles which are moving along with the conveyor belt to form a plurality of transversely spaced rows. These metal strips **116** which serve as tile orienting guides are spaced apart less than the greatest dimension of a tile from one corner to a diagonally opposite corner for the obvious reason of preventing jamming at this point.

As pointed out hereinbefore, it is desirable to have an excess number of tiles fed into the machine up to this point so as to insure an adequate supply of tile for operation of the machine. Means are provided at this position to remove excess tile, as also to remove doubles to return the excess tile and doubles for separating and return of the good tiles to the tile feed section. These means include a rotatably mounted spiral bristle brush **122** adapted to be suitably driven by motor **124**. It is to be noted that the brush **122** is disposed at a substantial angle to the longitudinal axis of the conveyor belt so as, when in operation, to brush the tile off to the side of the conveyor belt and doubles out of the channels formed by the metal strips. This excess of tile and/or the doubles are brushed off onto a plate **126** which is downwardly inclined and discharged onto a return conveyor belt **128** which has coacting side guide frames **130** to prevent tile from discharging over the sides thereof. Tiles carried by belt **128** which is movably mounted by means of rolls such as at **132** at each end thereof are discharged into a single-double tile separation unit generally designated **134**.

A plurality of transversely spaced wires including upper wires **136***a* and lower wires **136***b* are mounted in the separator **134** as shown in FIGS. 6 and 7 and are downwardly inclined from the inlet end to the outlet end. These wires are so arranged as to the spacing therebetween and their respective heights that only single tiles can fall between the wires due to the dimensions of the openings therebetween and all double tiles as indicated at **56***a* will be carried down to the discharge end **138** of the wires where they are discharged into a chute **140** and thence discharged into a container **142** for ultimate disposal thereof. The single tiles **56** which fall through the wires are carried by a downwardly inclined chute **144** and thence returned to the conveyor belt **76** for recirculating through the machine.

Bracing means **146** are provided for the metal strips **116** adjacent to the brush **122**. Because of the disposition of the brush and the fact that it is desirable that it extend into proximity to the upper surface of the conveyor belt **114** at an appproximate height equal to the thickness of one tile in order to perform its function, the metal strips **116** must be cut out as shown in greater detail in FIGS. 10, 11 and 12. As will be seen, the cutouts vary from a relatively small one **148***a* at the position of section line **10—10** and as shown in FIG. 10 to a greater cutout portion **148***b* at section line **11—11** as shown in FIG. 11 and **148***c* taken on section line **12—12** as shown

in FIG. 12. These are necessitated due to the angular disposition of the brush and also to position the brush in proximity to the conveyor belt.

Subsequent to the position of the brush **122**, a single thickness of tiles **56** are carried into the channels formed between the metal strips **116** as shown in FIG. 14. A crossbar **150** mounted above the conveyor belt has a plurality of fingers or lugs **152** extending downwardly into the channels formed between the metal strips **116** and serve additionally to insure only one layer of tiles passing therebetween. Additional bracing members **154** can be used in appropriate areas to hold the metal strips **116**. The tiles in the channels are carried forward by the conveyor belt and under normal operating conditions will be in abutting relationship with one another due to the excess feed principle discussed.

Toward the end of the tile orienting and aligning section **44** (FIG. 16), the channels start converging as at **156** and at the same time, the channels themselves become narrowed so that when the channels are again straight starting approximately at the position **158**, they are only slightly wider than the width of the tiles carried therein. This can be seen from a study of FIGS. 19 and 20 taken on section lines **19—19** and **20—20** respectively of FIG. 17. When the tiles are in the area of the channels at **158** they are in proper alignment for insertion into the tile pockets on the board as will appear hereinafter. A plurality of micro switches **160** corresponding to the number of channels are mounted above the channels by means of supporters **162** mounted on rod **164** suitably mounted on the frame. Arms **166** are operatively associated with each of the micro switches and carry on their outer ends rollers **168**. The purpose of the micro switches and arms carried thereby and rollers **168** is to indicate the absence of a tile in the channel at that point, at which time the roller would drop from the full line position shown in FIG. 17 to the dotted line position designated **168***a*. When this occurs, the board chains will be shut down until any troubles in the mechanism which might have existed can be corrected and/or the supply of tiles replenished at that area at which time the chains will again start up.

In proximity to the forwardmost conveyor belt roll **112** an inclined ramp **170** is mounted onto which the tiles will pass guided by metal strips or wires **116***a* which extend therealong. Spring fingers **174** are provided at this point to maintain the tiles in engagement with the conveyor belt and the ramp. The uppermost portion of the ramp **170** is provided with openings as at **176** for any chips which might be present to fall therethrough onto a removable chip pan **178**. The channels on the inclined ramp are formed by and between metal strips **116***a* which terminate (FIG. 18) in proximity to the ends of the strips **116** and the strips are maintained in place by means of support bars **180** at their upper ends. The construction of the strips is such that they can be easily inserted into position to mate with and align with the strips **116** and also the entire feed section can be removed from the remainder of the machine.

The next section of the machine is the tile feed section **50**. Reference is here made primarily to FIGS. 21–23 inclusive for an understanding of this important area of the machine. Base **182** of inclined ramp **170** has a plurality of openings such as at **184**, again for the passage therethrough of chips. The tiles **56** are supported on the ramp between the strips **116***a* forming the channels. Shafts **186** and **188** respectively mounted in bearings in trunnions **190** and **192** rotatably mount a plurality of rollers or wheels **194** having rubber or similar material in a layer **196** on the periphery thereof. As seen from FIG. 23 these lower rollers extend into each channel through openings in the bottoms thereof for engagement with the lower surface of tiles passing therebetween, the upper rolls engaging the upper surface.

Means are provided for driving these rolls as will appear hereinafter and the manner in which these rolls are mounted provides for manual operation of individual ones of the same in order to insure that each of the channels is filled and that an adequate reservoir or supply of tiles is created at the actual feed station for feed onto the board also as will appear hereinafter. The lower rollers **194** carry a neoprene layer **198** to provide for better wear characteristics.

A bracket **200** extends across the machine and mounts a shaft **202** on which are mounted arms **204** by means of collars **206** and positioned by means of spacers **208**. Rollers **210** are rotatably mounted on the lower ends of the arms and are engageable with the upper surfaces of the tiles passing through the various channels to maintain pressure on the tile in the channels so that they will not slide freely therethrough.

A bracket **212** suitably mounted above the machine at each side thereof rotatably mounts a plurality of feed rollers **214** having outer rubber layer peripheries **216**. One of these feed rollers is aligned with and extends into each of the channels formed by the strips **216***a* and the periphery of the rollers are in engagement with the upper surfaces of the tiles in the channels. At this point, a plurality of small tile support rollers **218** are freely rotatably mounted centrally of each of the channels and positioned by spacers **220**. Drive means comprising a motor **282** and gearing **284** are provided for these feed rollers **214**, as will be described hereinafter. Upon rotation of a feed roller, a single tile will be forcibly ejected from a given channel and thrown forwardly against a spring arm **222** rotatably mounted at **224**. The outer end of the arm is counterweighted at **226** and biases the arm into contact with a stationary stop **228**. As the tiles are ejected and impinge upon these spring arms, the arm might move slightly but has sufficient weight to throw the tile back into position on top of a stack of the same as shown at **230**. It has been found in operation that this arrangement prevents tiles from inadvertently assuming a position other than flat or horizontal. The tiles come to rest on a stack on a plate **232**.

The mechanism for ejecting the tiles onto a board and into the pockets thereon includes a plurality of feeder fingers **234** having the front ends thereof extending over plate **232**. The fingers **234** are attached at their rear ends to a plate **238** as shown in FIG. 23*a* which in turn is pivotably connected at **240** to an arm **242** of an eccentric drive mechanism. This includes a rotatable shaft **244** having an eccentric member **246** splined thereto around which a sleeve **248** is mounted with a slip connection therebetween. A collar or band **250** is secured to the ring **248** and has its arms **252** attached to arm **242**. Upon rotation of shaft **244** carrying therewith the eccentric **246**, the ring and collar will be eccentrically moved and thereby the arm **242** and the feeder fingers **234** in a back and forth motion. On the forward stroke this will eject a tile from the bottom of each stack formed at the end of each channel and which stacks are in alignment with pockets of boards into which they will be inserted. At the lateral sides of this feed mechanism guide fingers **254** are supported on rollers **256** and held under guide rollers **258** rotatably journalled on shaft **260**. Coaction of these means insures proper movement of the feed fingers as will be readily apparent.

For moving the boards **58** to the tile feed-in station, endless chains **262** are provided on opposite sides of the machine entrained over drive sprockets **264** at one end and idler sprockets **266** at the opposite end. Supports **268** (FIG. 29) are provided for the upper runs of the chains. The chains mount a plurality of dogs **270** (FIG. 23) which are spaced along the runs of the chains and which serve to engage bolts adjustably mounted on depending brackets **272** on the bottoms of the boards. Drive means for the chains include a motor **274**, a transmission **276** and a speed reducer **278** as shown in FIG. 2,

all operatively connected by chains or belts such as generally indicated at **280**.

Actuation of the feeder fingers **234**, as previously set forth is by means of the eccentric drive of shaft **244**. The means for driving the shaft of the feed out rolls **214** is schematically shown in FIG. 3 and includes a drive motor **282** and a speed reducer **284**. The shaft **244** which operates the feed fingers drives the shafts **186**, **188** of the feed rolls **194** through a speed control unit **286**, the shaft **244** driving the input shaft of the control unit through a sprocket chain and the output shaft of the control unit driving both of the shafts **186**, **188** of the rolls **194** through another sprocket chain. The rolls **194** are mounted on their shafts in such manner, as stated above, to permit turning individually by hand in a forward direction to feed down a line of tiles in any particular channel which may need them, the roll **214** feeding tiles down to a stack as rapidly as the line is pushed forward. Normal power turning resumes as soon as hand feed is discontinued. The feeding sequence is controlled and governed by a timing cam, as also by a board senser which indicates when a board is in proper position for feeding.

This portion of the apparatus is shown in greater detail in FIGS. 29–32 inclusive. A bracket **288** rotatably mounts a sprocket **290** which is in engagement with the lower run of one of the chains **262**. A cam **292** is secured to the sprocket. This cam **292** is adjustably mounted by means of slots **294** and thumb screws **296** or the like. A recess **298** in the cam governs a no-tile feed condition by coaction with a roller **300** which rides on the surface of the cam and which is carried by an arm **302** adjustably secured to the lower end of lever **304** pivotably mounted at **306**. The upper end of lever **304** is cut away to form an abutment at **308**. A spring **310** biases lever **304** to the right as seen in FIG. 31. As shown in FIG. 31 with roller **300** riding on the surface of the cam, the mechanism is in a tile feed condition, providing that a board is properly positioned and in place at the tile feed position. When the cam rotates and the roller falls into the recess **298** then the upper end of lever **304** will spring to the right and the abutment at **308** will engage with a pin **312** as shown in FIG. 34.

Pin **312** is a portion of a one revolution clutch **314** which is operatively connected with the eccentric shaft **244** and through it with the feed rolls **194**. When the abutment moves the pin **312** from the position shown in FIG. 33 to that of FIG. 34 the clutch is disengaged and the feed rolls and eccentric drive for the tile feed fingers are stopped. The drive for the clutch is through shaft **316** supported by bearings **318** (FIG. 1) and an interconnecting worm gear mechanism broadly designated **320**. The shaft **316** is operatively driven through shaft **322** which is driven from the speed reducer **278**. A sprocket **324** and chain **326** serve to continuously drive a rotating brush **328** which serves the purpose of seating tiles in the pockets on the board if they have not been already seated. Rotation of this brush is not affected by disengagement of the clutch as will be apparent.

As mentioned hereinbefore, the tile feed mechanism is not operable until a board is in proper position to be filled. This is controlled by means of a roller **330** carried on arm **332** which in turn is connected to lever **334** having an end **336** thereof engageable with pin **312** as shown in FIG. 34. The roller **330** is engageable with a side edge of the boards as the board is passing thereby and when so engaged this mechanism is moved so that the end **336** is in the position shown in FIG. 32, and out of engagement with the pin. This position conditions the tile feed and it will therefore be seen that both abutment **308** and end **336** must be in the open position of FIGS. 32, 33 before the tile feed and tile setting mechanism is operable. The drive for the clutch and operation of the clutch is one of the essential features of this invention. The angular disposition of the lever **334** is to insure that the end **336** will always engage with the pin due to an angular entry thereunder even if the pin is being held by the abutment **308**.

Attention is here directed to FIG. 23 wherein an adjustably mounted finger **338** is pivotally mounted at **340**, and these fingers have as their purpose engagement with the tops of tiles in the pockets to insure that they are flat and properly seated. It is also to be noted that there is always a stack of tiles at the tile feed position. If one of these tiles inadvertently is upright then the feed fingers will serve to eject the entire stack against the action of the spring arm **222**. For further accuracy and to insure that the boards are in proper alignment, a plurality of side engaging rollers **342** (FIG. 1) are provided which are spring biased against the side of the boards during operation.

The operation and construction of the present invention will be readily apparent from the foregoing description when taken together with the drawings. Tiles are fed in random orientation upon the lower end of the supply conveyor belt **76**, which dumps them off the upper end (FIG. 8) down the perforated slide or chute plate **98**. Broken fragments and other refuse fall through the perforations upon the pan **104** for removal. The conveyor belt **114** moves the tiles forward into the over-width passages or channels between the vertical partition strips **116** to orient them with two of their sides parallel to the direction of travel, the passages being too narrow to accommodate tiles in diagonal disposition.

The rearwardly sweeping brush **122** removes tiles down to a single layer in the passages and forces excess tiles, chips and trash which may be swept off to the sloping side plate **126** (FIG. 13) and return conveyor belt **128**. The inner strips **116** (FIGS. 10–12) are progressively cut out longer and longer from one side to the other of the belt width but the final strip (FIG. 12) has a shorter cut-out to allow as many tiles as possible to drop into position in the passages and move forward with the belt before those remaining are swept off.

The returned tiles (FIGS. 6 and 7) are sorted to remove all except singles and these are fed back upon the elevating conveyor **76**.

The oriented tiles are pushed into narrower passages between strips **116***a* (FIGS. 16 and 17) to provide the same transverse spacing as the pockets of the boards into which they are to be inserted. As may be seen in FIG. 2, empty boards are inserted at about this point upon the top run of the conveyor chains **262** and move forward at a steady continuous rate of travel therewith. If there is a good supply of tiles and proper operation there will be a continuous line of tiles in each and every passage, the tiles being in abutting edge-to-edge relationship and being crowded forward by the belt **114** beneath them, the belt, as stated, moving at a rate to urge tiles forwardly faster than they can be deposited on boards but being free to slip frictionally beneath them. Switches **160** provide an alarm and shut down operation if the passages are not all filled at this point.

As they leave the belt **114** (FIG. 23) the tiles enter between the rollers **194** which feed them forward at the rate needed by the boards. The rollers **194** turn at just the rate to supply tiles to the pockets of the boards as fast as they can be taken.

Further forward, the friction feed-out rollers **214**, which are turning at a much faster rate than the lines of tiles are moving, engage the end tile of all lines and move them out over the supporting rollers **218** to drop down on the stacks **230** which have been built up on the support plate **232**. The rollers **210** of the pressure arms **204** prevent the next-to-end tiles from sliding freely forward when the end tiles are moved out. Due to the difference in line speed and feed out speed, this causes tiles to be fed out one-by-one with enough time interval between to produce vertical stacking.

If a board is not present and in proper position to re-

ceive tiles the feed fingers and line-moving rolls **194** cease operation and, while the rolls **214** continue to turn, they do not feed tiles because the lines are not being pushed forward by the rolls **194** and the pressure arms **204** prevent the tiles from sliding forward by gravity. The device **206** provides for adjusting the speed of the rolls **194** to the rate of feed by the feed fingers. If tiles are needed in any line the roll **194** can be turned by hand to feed the line forward as needed. Cam **292** can be adjusted to match the feed with the board presence in feeding position.

The fingers **234** feed out tiles at exactly the right time and position to project them forward and deposit them in the pockets of the advancing boards. It has already been explained how the presence of a board at filling position controls the operation of the mechanism which actuates the feed fingers and feed rolls **194**; also how the board must be in proper lateral position for the pockets to line up with the tiles fed out by the fingers. If the rear edges of tiles are slightly out of alignment this will not interfere with their proper deposit in the board pockets since they will all be entrained and moved forward together in proper position by the front ends of the feed fingers.

After the various boards have been sequentially filled, they can be removed by any desired means at the board discharge section and such means, not constituting a part of the present invention, have not been shown. Subsequently, the so removed boards, following inspection for completeness of filling and quality of tile, are then subjected to the application of adhesive coated paper and after drying are removed for packaging and dissemination to the field.

Manifestly, minor changes in details of construction can be effected without departing from the spirit and scope of the invention as defined in and limited solely by the appended claims.

I claim:

1. Apparatus for depositing tiles in individual positions of patterns having a plurality of longitudinal and transverse rows each including a plurality of tile-receiving positions, comprising in combination, means for moving a tile receiving pattern longitudinally in continuous travel to present said transverse rows of tile-receiving positions successively in a position to receive tiles, means for holding ready tiles in laterally spaced positions corresponding to the positions in a transverse row on said pattern, and power operated feed-out mechanism adjacent the continuously moving pattern which is timed with the movement of said pattern for moving said ready tiles forward positively out upon said pattern in a direction parallel to and in coordination with the passage of said pattern for depositing said ready tiles in the positions of a transverse row of said forwardly moving pattern.

2. Apparatus as set forth in claim 1, which further comprises, means for depositing tiles from said lines of tiles in stacks on said means for holding the tiles ready for deposit, said means for depositing tiles in said pattern positions comprising fingers which move out the lowermost tile of all stacks together.

3. Apparatus as set forth in claim 1, which further comprises, means for orienting randomly arranged tiles and power actuated mechanism for feeding them forward in parallel lines to said means for holding tiles ready for deposit upon said patterns.

4. Apparatus as set forth in claim 3, in which said means for feeding lines of tiles forward operates upon them frictionally at a rate to urge lines of tiles along faster than the rate at which tiles are deposited on said pattern.

5. Apparatus as set forth in claim 4, which further comprises, power actuated mechanism for removing tiles one-by-one from the forward end of each line of tiles and depositing them in vertical stacks on said means for holding tiles ready for deposit, said tile removing mechanism moving an end tile of a line of tiles forward at a faster rate than the line of tiles is being urged forward.

6. Apparatus as set forth in claim 5, which further comprises, power actuated means disposed between said friction feeding means and said tile removing mechanism which is timed with the movement of the pattern to regulate the speed of travel of the lines of tiles to the speed of movement of the pattern to supply a tile for each transverse row of the pattern.

7. Apparatus for feeding tiles, as for the deposit of tiles in the pockets of travelling patterns, comprising in combination, means for feeding out tiles for deposit at a predetermined rate matched with the pattern travel rate, means for urging forward a line of tiles, power actuated means for successively moving out the forward tile of the line to said feed means at a faster rate than the line is moving, and means for holding the next-to-forward tile in the line against free forward movement when the forward tile is moved out.

8. Apparatus for feeding tiles into individual pockets of pattern boards, comprising in combination, means for moving pattern boards with tile receiving pockets along a path, means for depositing tiles in the pockets of the pattern boards, and means for removing from the loaded pattern boards any tiles which may be present except the desired single layer of tiles, said tile removing means also acting to properly seat tiles in the pockets of the boards.

9. Apparatus for feeding tiles as set forth in claim 8, in which said tile removing means comprises a diagonal rotary brush which sweeps above the single layer of tiles in the pockets.

10. Apparatus for feeding tiles into individual pockets of pattern boards, comprising in combination, a conveyor which moves pattern boards along a path to have tiles deposited into the pockets, tile holding means above the path of travel having tiles arranged to match the alignment of the pockets when the boards are in proper transverse alignment, and means responsive to the transverse alignment of the boards to assure operation when the boards are in proper alignment to receive tiles in the pockets and to stop operation when the boards are not in proper alignment.

11. Apparatus for feeding tiles into individual pockets of pattern boards, comprising in combination, a conveyor carrying a plurality of longitudinally spaced pattern boards in a path past a tile feeding position, means at said tile feeding position for feeding tiles into the pockets of said boards, and means responsive to the presence or absence of pattern boards in feeding position for controlling the starting and stopping of said feeding means to cause tiles to be fed only when a board is present with pockets in proper longitudinal position to receive tiles.

12. Apparatus as set forth in claim 11, which further includes means responsive to the lateral position of pattern boards at the feeding position for halting the feeding of tiles when the pockets are not lined up laterally with the tiles to be fed thereunto.

13. Apparatus for feeding tiles, as for deposit of tiles in the pockets of travelling pattern boards, comprising in combination, means for moving a plurality of lines of tiles to be fed, means for guiding said tiles in adjacent separate lines, and means arranged to engage the tops of tiles in the lines for controlling the operation of said tile moving means in response to the presence or absence of tiles in any line.

14. Apparatus for feeding tiles, as for deposit of tiles in the pockets of travelling pattern boards, comprising in combination, means for moving forward a plurality of adjacent parallel lines of tiles to be fed, spacer guide plates for guiding the lines of tiles, means disposed above said lines of tiles constructed and arranged to remove all excess tiles except a single layer on said moving means

to one side of the moving means, and means for returning the tiles so removed for re-processing.

15. Apparatus as set forth in claim 14, which further includes means for separating multi-thickness tiles from single-thickness tiles.

16. Apparatus as set forth in claim 15, in which said separating means comprises adjacent laterally spaced sloping wires at different elevations arranged in the path of falling tiles.

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