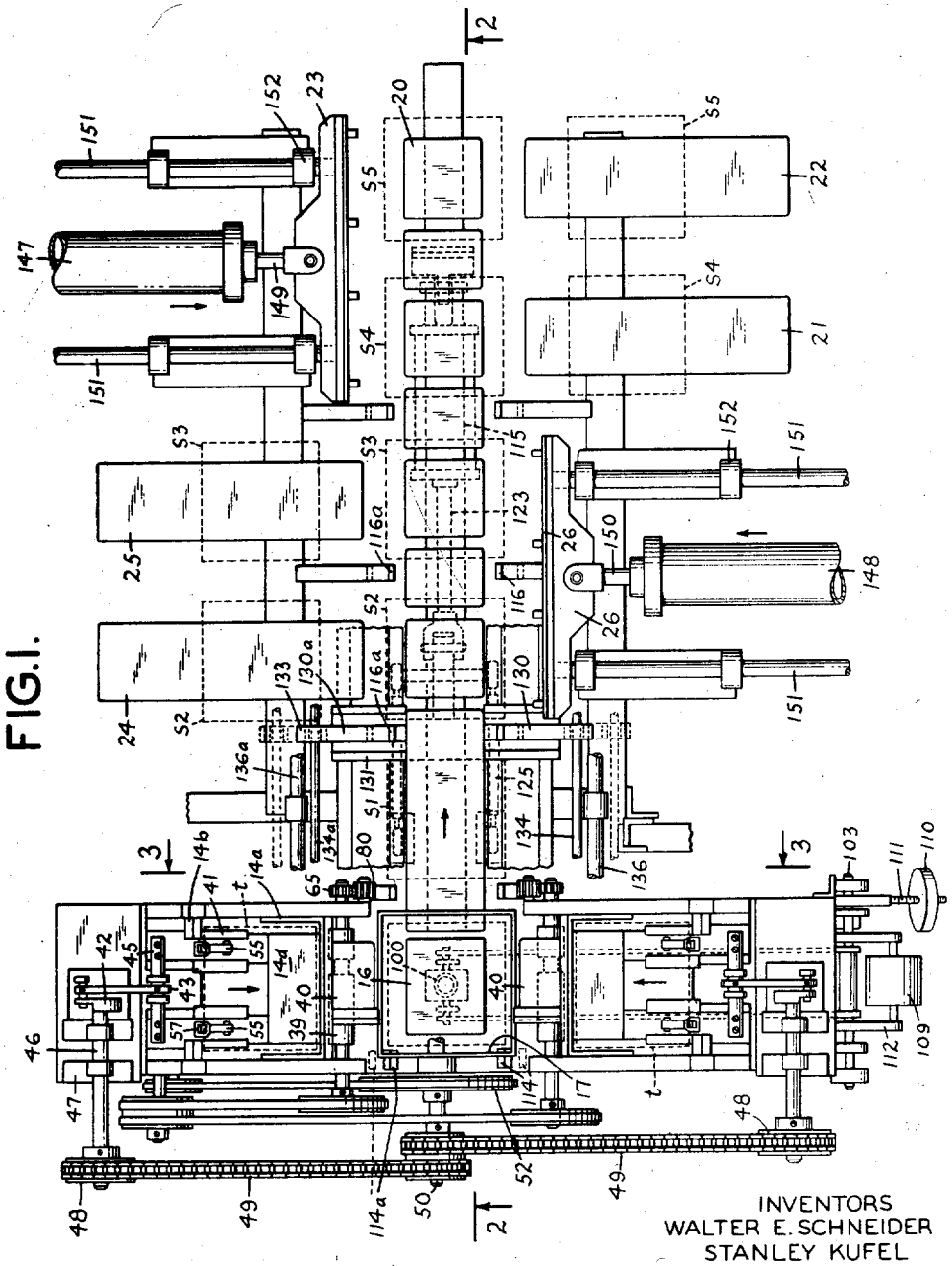
Jan. 19, 1960 W. E. SCHNEIDER ET AL 2,921,508

STACKING MACHINE

Filed July 28, 1955 8 Sheets-Sheet 1

FIG. 1.



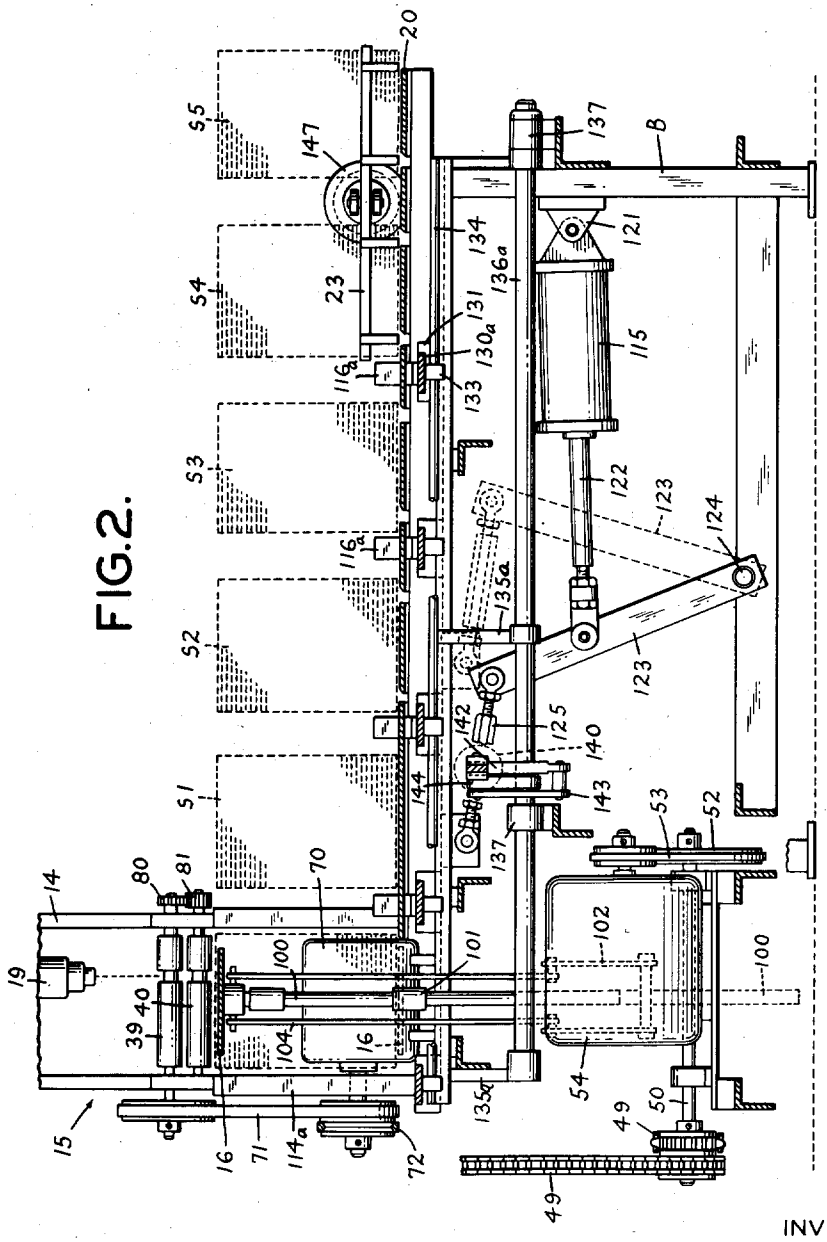
INVENTORS
WALTER E. SCHNEIDER
STANLEY KUFEL
BY
Campbell, Brumbaugh, Free & Graves
THEIR ATTORNEYS

Jan. 19, 1960 W. E. SCHNEIDER ET AL 2,921,508

STACKING MACHINE

Filed July 28, 1955 8 Sheets-Sheet 2

FIG.2.



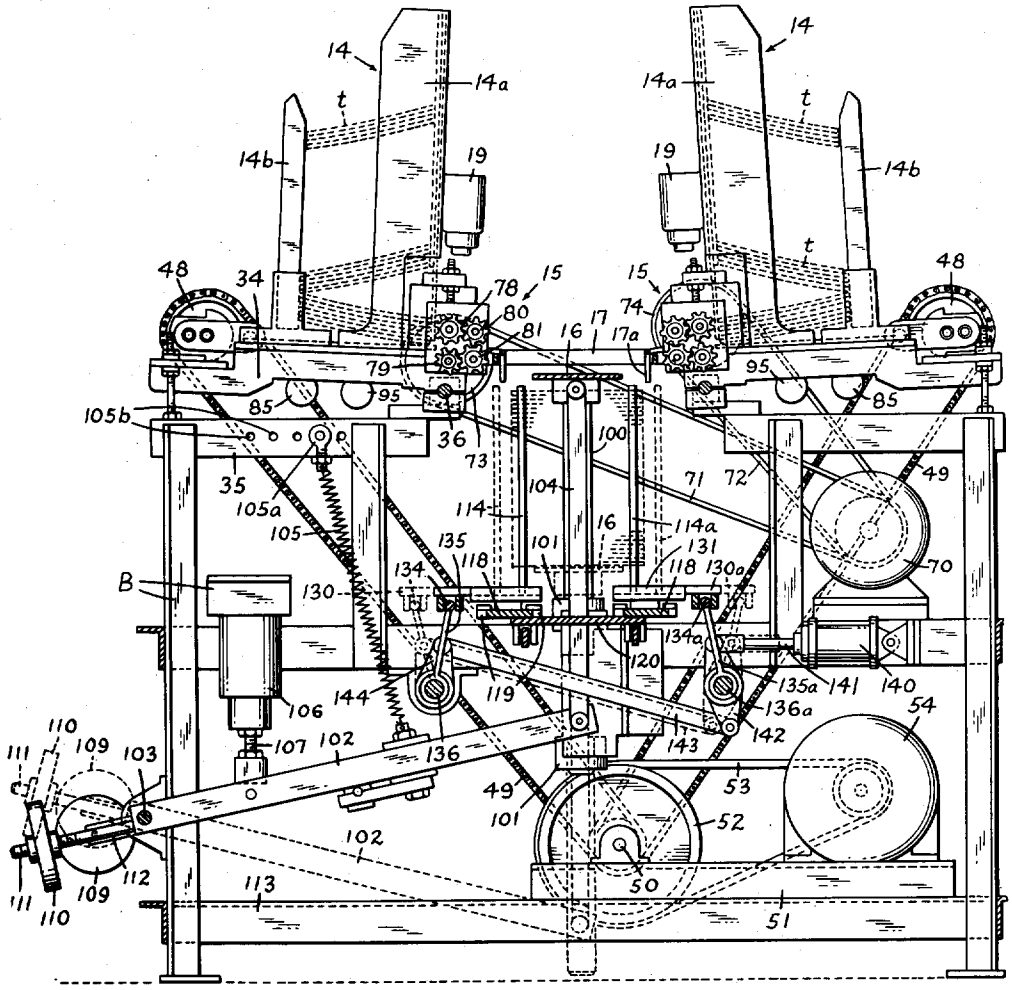
INVENTORS
WALTER E. SCHNEIDER
STANLEY KUFEL
BY
Campbell, Brumbaugh, Free & Graves
THEIR ATTORNEYS

Jan. 19, 1960 W. E. SCHNEIDER ET AL 2,921,508

STACKING MACHINE

Filed July 28, 1955 8 Sheets-Sheet 3

FIG.3.



INVENTORS
WALTER E. SCHNEIDER
STANLEY KUFEL
BY
Campbell, Brumbaugh, Free & Graves
THEIR ATTORNEYS

Jan. 19, 1960 W. E. SCHNEIDER ET AL 2,921,508

STACKING MACHINE

Filed July 28, 1955 8 Sheets-Sheet 4

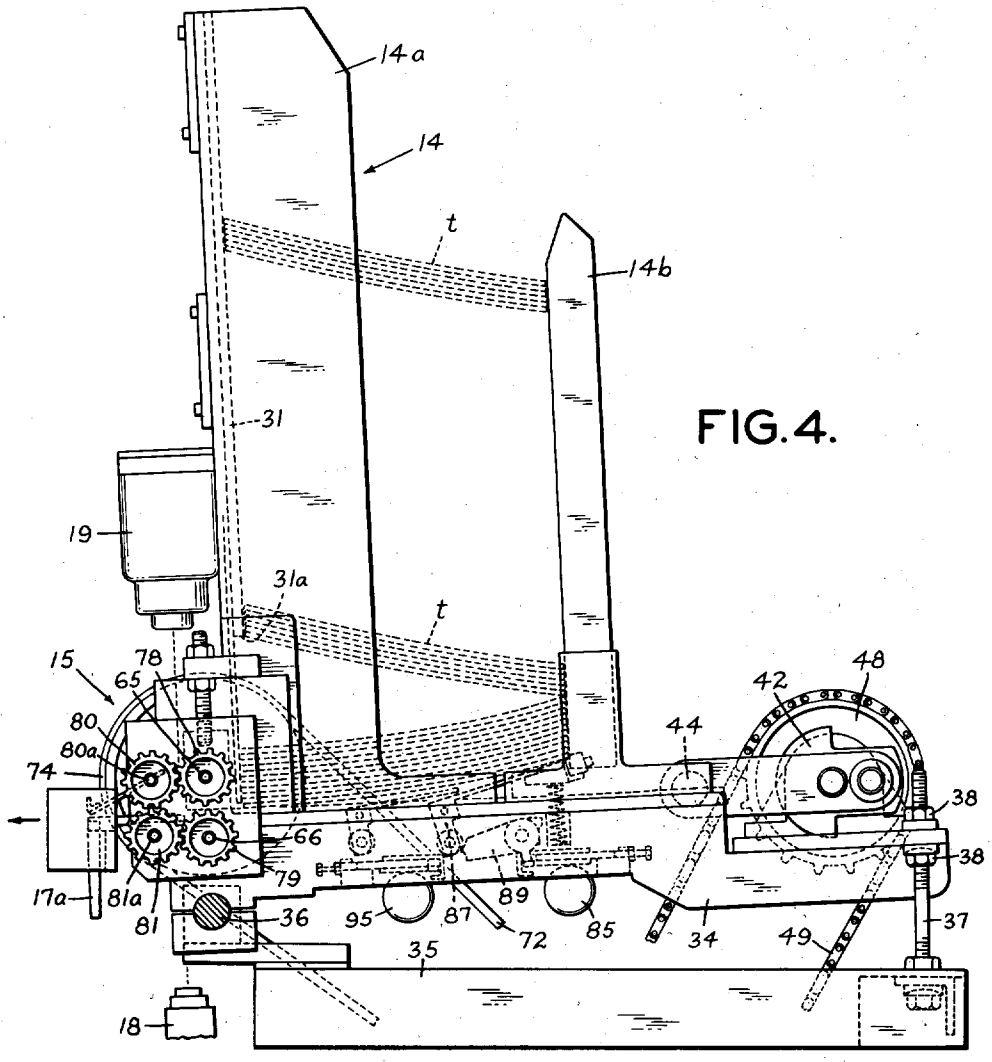


FIG.4.

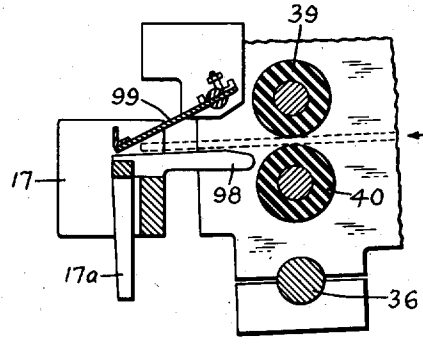


FIG.5.

INVENTORS
WALTER E. SCHNEIDER
STANLEY KUFEL
BY
Campbell, Brumbaugh, Free & Graves
THEIR ATTORNEYS

Jan. 19, 1960 W. E. SCHNEIDER ET AL 2,921,508

STACKING MACHINE

Filed July 28, 1955 8 Sheets-Sheet 5

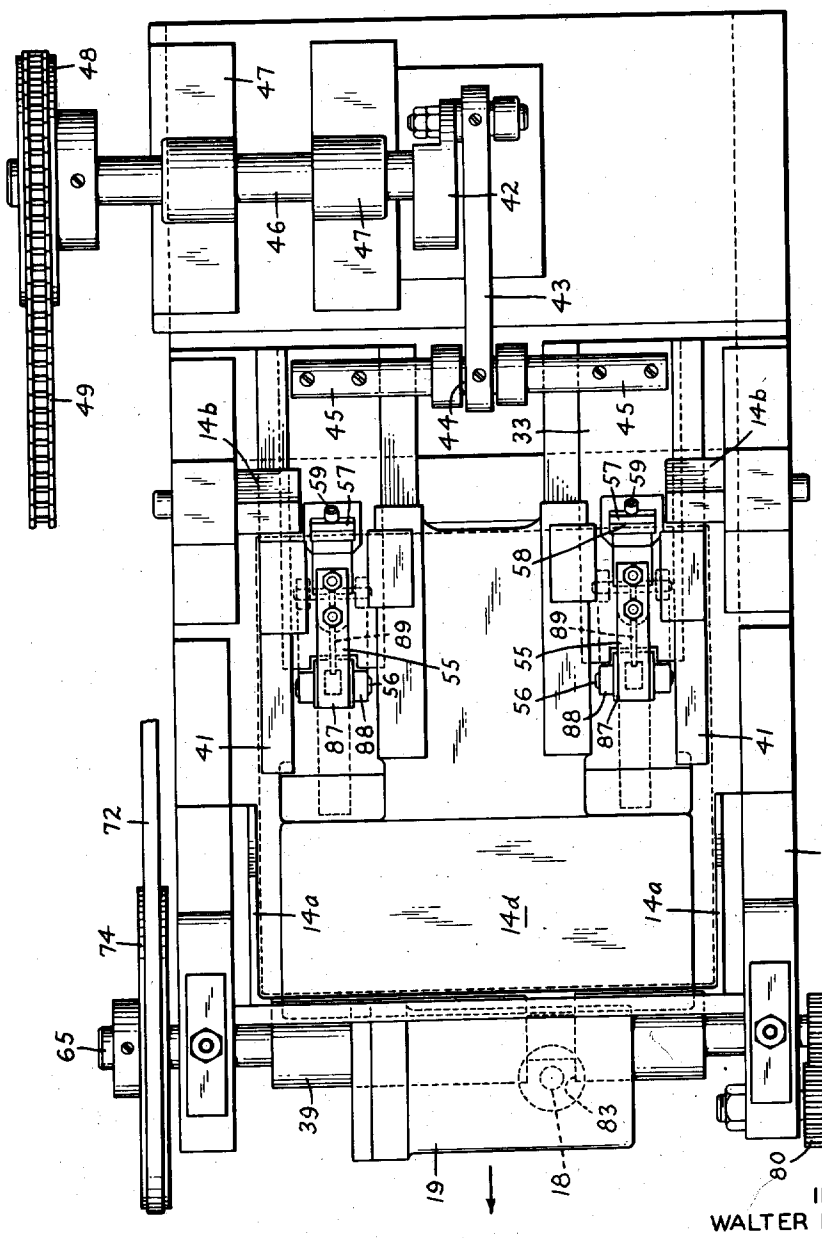


FIG.6.

INVENTORS
WALTER E. SCHNEIDER
STANLEY KUFEL
BY
Campbell, Brumbaugh, Free & Graves
THEIR ATTORNEYS

Jan. 19, 1960 W. E. SCHNEIDER ET AL 2,921,508

STACKING MACHINE

Filed July 28, 1955 8 Sheets-Sheet 6

FIG.7.

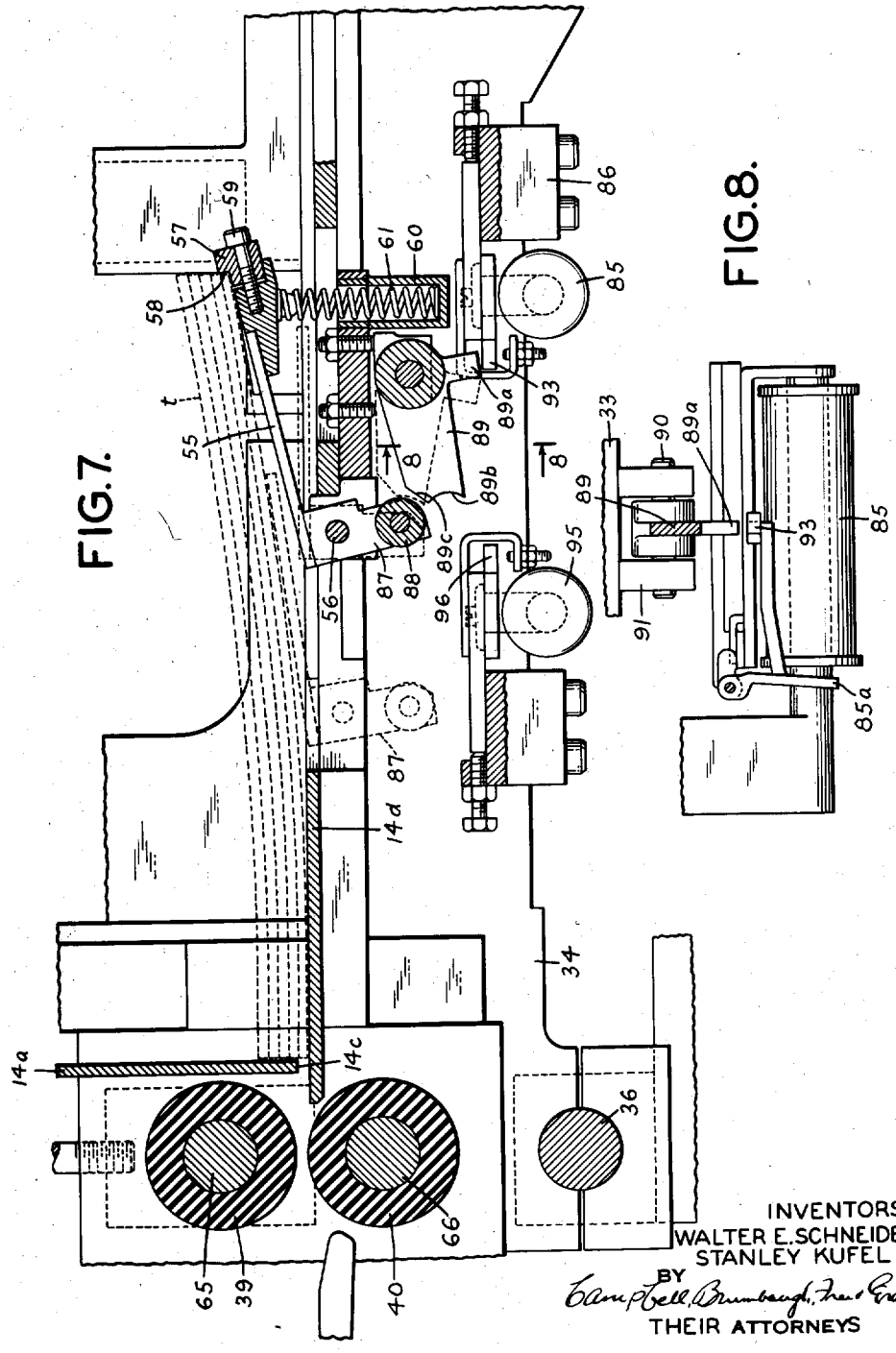


FIG.8.

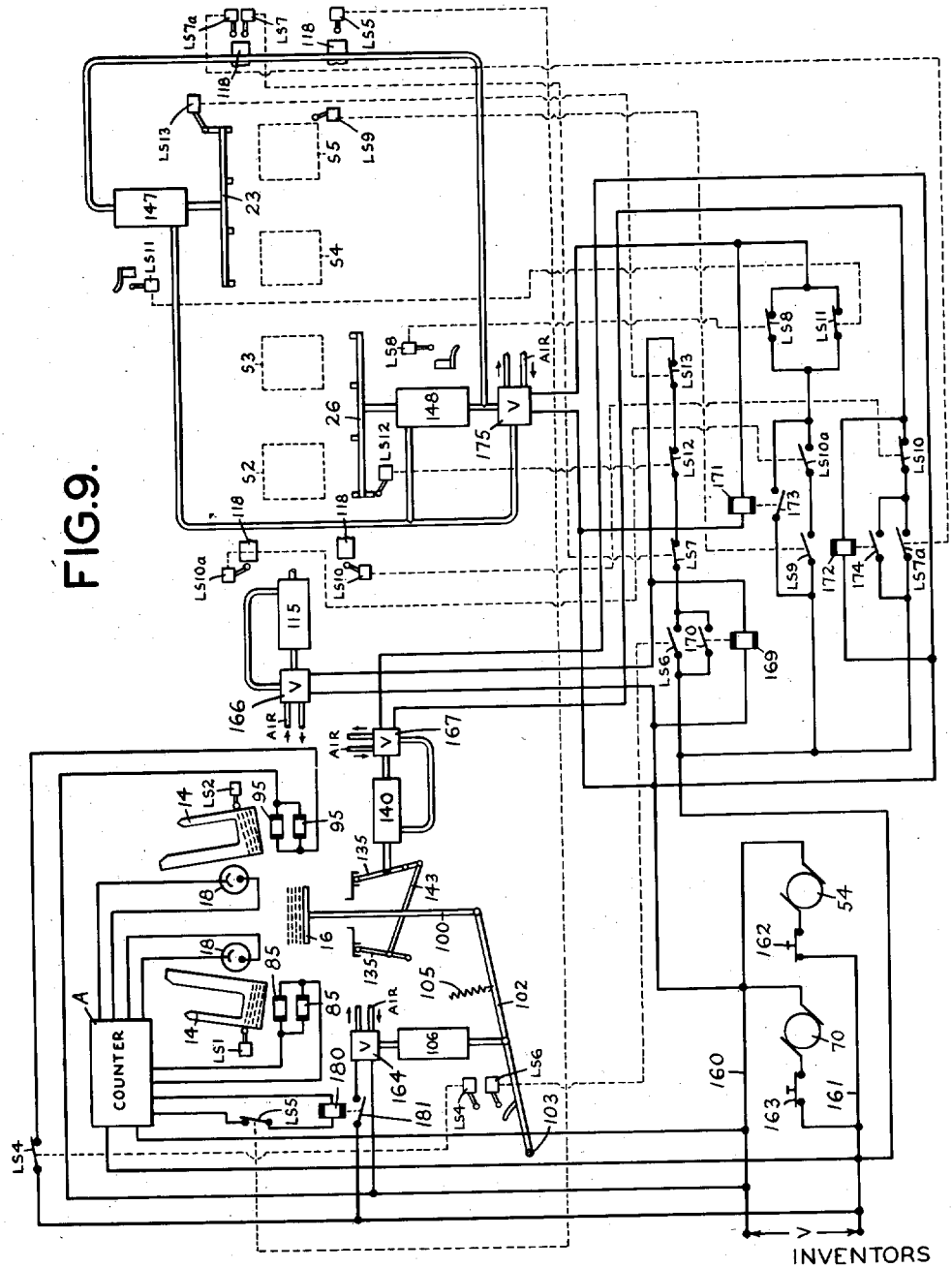
INVENTORS
WALTER E. SCHNEIDER
STANLEY KUFEL
BY
Campbell, Brumbaugh, Free & Graves
THEIR ATTORNEYS

Jan. 19, 1960 W. E. SCHNEIDER ET AL 2,921,508

STACKING MACHINE

Filed July 28, 1955 8 Sheets-Sheet 7

FIG.9.



INVENTORS
WALTER E. SCHNEIDER
STANLEY KUFEL
BY
Campbell, Brumbaugh, Free & Graves
THEIR ATTORNEYS

Jan. 19, 1960 W. E. SCHNEIDER ET AL 2,921,508

STACKING MACHINE

Filed July 28, 1955 8 Sheets-Sheet 8

FIG.10.

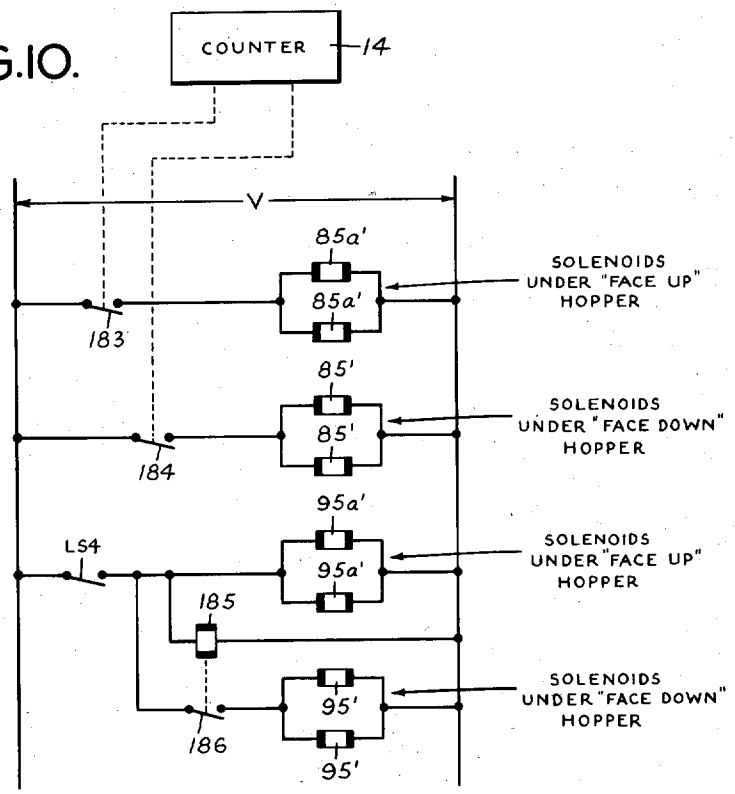
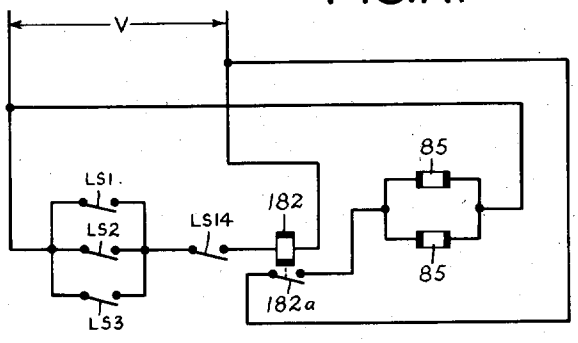


FIG.11.



INVENTORS
WALTER E. SCHNEIDER
STANLEY KUFEL
BY
Campbell, Brumbaugh, Free & Graves
THEIR ATTORNEYS

United States Patent Office 2,921,508 Patented Jan. 19, 1960

2,921,508

STACKING MACHINE

Walter E. Schneider, Pearl River, N.Y., and Stanley Kufel, Westerly, R.I., assignors to Congoleum-Nairn, Inc., Kearny, N.J., a corporation of New York

Application July 28, 1955, Serial No. 524,937

21 Claims. (Cl. 93—93)

This invention relates to stacking machines generally and more particularly, to a machine wherein articles are fed one at a time from one or more hoppers to a common receiving transporter and the articles are received by the transporter in stacked relationship.

Although subject to varied application, the machine of the present invention is particularly suited for counting automatically flat pieces of rigid or semi-rigid materials, such as floor tile, and transferring these stacks to convenient pick-up stations from which they may be removed and packaged.

In the specific embodiment of the present invention, the tile are fed from two diametrically opposed hoppers, one at a time, either alternately or in predetermined sequence, onto a vertically movable transporter. The tile discharged from each of the hoppers is counted and the information transmitted to an electronic counter, and when the desired number of tile has been stacked on the transporter, the further discharge of tile from the hoppers is interrupted. The transporter then transfers the stack of tile to a long multi-station platform and the stack of tile is automatically removed from the transporter to the first station of the platform. Thereafter, the transporter is returned to its tile receiving position and the feed of tile from the hoppers is again initiated to compile the next stack.

The multi-station platform includes a plurality of stations in line, and as each successive stack is received by the platform from the transporter, the stacks previously received are advanced along the platform from one station to the next until the platform has its full capacity of stacks, as indicated when a stack reaches the last station of the platform. Thereupon, transverse stack pushers are actuated, translating a plurality of the stacks transversely of the platform onto receiving tables located adjacent each of the respective stations of the platform from which stacks are pushed. The stacks so delivered to the receiving tables contain the desired number of tile and are ready for packing.

One important aspect of the invention is the tile feeding unit. This unit, which includes the hopper and the feeding mechanism associated therewith, is pivotally mounted to the main frame structure of the machine. This pivotal movement of the feed unit permits the direction at which the tile is discharged toward the transporter to be adjusted, and this adjustment is important, particularly if the tile is stacked at great speed.

The tile feeding mechanism comprises a reciprocating slide carrying one or more spring urged pivotal tile engaging members disposed beneath the hopper. During the rearward stroke of the slide, the pivotal tile engaging members carried by the slide engage the rear edge of the lowermost tile in the hopper, and during the forward stroke of the slide, the leading edge of the tile is advanced through the discharge opening of the hopper to a set of feed rolls. The feed rolls, in turn, discharge the tile in the direction of the transporter.

When the predetermined number of tile have been thus

stacked on the transporter, the tile engaging members carried by the reciprocating slide are pivoted to and locked in an inoperative position until the transporter has had an opportunity to deliver the completed stacks to the multi-station platform and return to the tile receiving position. When the transporter has returned to the receiving position, trip mechanism is actuated to restore the tile engaging members to operative position, thereby initiating tile feeding operation to compile another stack.

It is desirable that the tile from both feed units be stacked one above another with the edges even and the corners squared, and accordingly a tile receiving receptacle or squaring box is disposed between the feed units and above the transporter. For very rapid stacking, the tile from the two feed units are fed alternately into the upper end of the chute, and the leading edges of the tile from each feed unit strike the remote wall of the receptacle, the wall serving as a stop to register the leading edge of the tile. Preferably, the timing of the delivery of the tile to the chute from the two oppositely disposed feed units is such that the leading edge of the tile from the one feed unit engages the upper surface of the tile moving in the opposite direction beneath it in the vicinity of the trailing edge thereof, thereby facilitating the proper seating of the tile in rapid succession.

As the tile is stacked on the transporter, the transporter gradually descends under the weight of the tile to maintain the upper level relatively constant during the stacking operation. This, of course, makes it unnecessary for the tile to drop any substantial distance to the transporter and, therefore, helps to prevent jamming up or misalignment of the tile which might otherwise result from such drop.

For a complete understanding of the present invention, reference may be had to the detailed description which follows and to the drawings wherein:

Fig. 1 is a plan view of the entire machine;

Fig. 2 is a side elevation view taken along the line 2—2 of Fig. 1;

Fig. 3 is an elevation view as viewed from the delivery end of the multi-station platform; the view is taken substantially along the line 3—3 of Fig. 1, looking in the direction of the arrows;

Fig. 4 is an enlarged view of one of the tile feeding units shown in Fig. 1;

Fig. 5 is an enlarged view showing the discharge portion of the feed unit shown in Fig. 4;

Fig. 6 is plan view of the tile feeding mechanism;

Fig. 7 is a cross-sectional elevation view of the tile feeding mechanism shown in Fig. 6;

Fig. 8 is a view taken on the line 8—8 of Fig. 7, looking in the direction of the arrows;

Fig. 9 is a schematic circuit diagram illustrating the electrical control system; and

Figs. 10 and 11 are schematic circuit diagrams illustrating parts of the electrical control system in greater detail.

Referring to the drawings, particularly to Figs. 1, 2 and 3, tile *t* are stacked manually or by any suitable means into the hoppers 14 of a pair of oppositely disposed feed units, generally denoted 15. The tile are discharged from the feed units one at a time and alternately in rapid succession onto a vertically movable transporter 16 situated between the feed units. To insure that the tile stacked on the transporter will be aligned uniformly, one above another, a stationary rectangular chute or squaring box 17 is mounted between the feed units and above the transporter in such fashion as to always provide proper alignment of the tile on the transporter.

The tile are fed from the feed units into the upper end of the squaring box 17, and as the title are stacked on the transporter, the added weight thereof causes the transporter to gradually descend. The gradual descent

of the transporter insures that the upper end of the stack of tile is at approximately the same level as additional tile are stacked. Thus, the fall of the tile after discharge by the feeding unit is relatively constant as the height of the stack increases.

As best shown in Fig. 4, a photoelectric cell **18** and a light source **19** are stationed adjacent the discharge end of each of the tile feeding units **15**, and as a tile is discharged by each of the feeding units it interrupts the light beam. These interruptions are counted by an electronic counter A (see Fig. 9), and when a predetermined number of tile has been stacked on the transporter, the transporter is lowered to convey the stack to the level of a long fore-and-aft multi-station platform **20**.

As best shown in Figs. 2 and 3, the fore-and-aft platform **20** comprises a plurality of stationary plates closely spaced to each other in line and supported by a main frame structure B. The stacks *s* delivered to the platform **20** one at a time by the transporter **16** are advanced intermittently from station to station along the platform until the platform has received its full capacity of stacks. In the embodiment shown in the drawings, there are five such stations along the platform, and the platform, therefore, may accommodate five stacks of tile. When the platform has received its full capacity of stacks of tile, the first two stacks in line are translated transversely of the platform to receiving tables **21, 22** adjacent the platform by the operation of a transverse pusher or bumper **23**, and the second two stacks in line are translated transversely in the opposite direction to receiving tables **24, 25** adjacent the platform by the operation of a transverse pusher or bumper **26**. The stacks may be removed from the tables **21, 22, 24, 25** by hand or by other suitable means.

The details of the tile feeding unit **15** are best shown in Figs. 4, 6 and 7. The hoppers **14** are defined by front and back members **14***a* and **14***b*, respectively, and, as shown in Fig. 7, a discharge opening **14***c* is provided at the lower end of the hopper between the lower end of the channel **14***a* and the base **14***d*. The height of the discharge opening **14***c* is adjustable permitting tiles of different thickness to be handled. A plate **31** (see Fig. 4) is mounted within the forward channel member **14***a*, and the plate is vertically adjustable with respect to the front wall of the channel member **14***a* in order to permit the position of the lower edge **31***a* of the plate to be adjusted. The distance between the plate **31** and the rear wall of the back member **14***b* is less than the length of the tile, and preferably the tile are inserted into upper end of the hopper on a slant with the leading edges higher than the trailing edges. As the tile are fed one at a time from the bottom of the hopper, the individual tile will gradually fall in the hopper until the leading edge drops beneath the lower edge **31***a* of the front plate **31**. The leading edge of the tile, therefore, will no longer be supported in slanted position in contact with the front wall **31**, and the tile will drop onto the top of a small group at the lower end of the hopper, which tile are slanted in the opposite direction, that is to say, with the leading edge beneath the trailing edge.

This arrangement, which produces a wedged gap in the hopper between the group of tile at the lower end of the hopper and the larger group of tile at the upper end, has the advantage that it prevents the entire weight of the tile within the hopper from resting on the bottom tile. Consequently, it makes it easier to slide the lowermost tile toward the discharge opening **14***c* from beneath the tile above it. It should be evident that the number of tile beneath this wedge-shaped gap at the bottom of the hopper can be regulated by adjusting the plate **31** to accurately position the lower edge **31***a* thereof.

The tile handled by the machine ordinarily has a pronounced curl, and care should be taken to insure that the tile is inserted with the curled edges in the leading and trailing positions and the straight edges parallel to the direction of feed.

The entire feed unit is supported by a frame **34**, and the frame **34** is pivotally supported above a base **35** of the main frame structure B of the machine. The frame **34** is pivoted at the forward end by the pivot shaft **36** and supported at the rear end by one or more threaded screws **37** upstanding from the base **34**. The adjustment of the nuts **38** on the threaded screws makes it possible to adjust the height of the rear end of the frame **34** thereby pivoting the entire feed unit **15**. The pivotal mounting of the feed unit **15**, in turn, makes it possible to adjust the direction of discharge of the tile from the feed unit.

The tile are discharged from the lower end of the hopper by sliding the leading edge of the lowermost tile across the base **14***d* and through the opening **14***c* into the bite of a pair of feed rolls **39, 40**. The tile are fed to the feed rolls one at a time by a reciprocating slide **33** which travels in guides **41** of the pivotal frame **34**. The slide **33** is driven back and forth toward and away from the discharge opening **14***c* by a rotating crank arm **42** and a link **43** which connects the crank arm to a transverse shaft **44** at the rear of the slide.

The feed rolls **39, 40** rotate at a rate faster than the slide in order to advance the tile more rapidly than the slide. This prevents the tile from impeding the forward advance of the slide and insures that a tile is discharged before the approach of a succeeding tile to prevent jamming.

The crank **42** is carried at the end of a rotating shaft **46**, and the shaft is supported in bearings **47** above the frame **34**. The extreme end of the shaft **46** carries a sprocket wheel **48** and the sprocket wheel **48**, in turn, is driven by a chain **49**. As best shown in Fig. 3, the chains **49** for both feed units are driven from sprocket wheels carried on a common shaft **50**, the shaft **50** being supported in bearings of a supporting structure **51** of the main base frame B of the machine. The shaft **50** also carries a wheel **52** which is driven by a belt or chain **53** from the motor **54**. This common drive for the feed units permits them to be operated in out-of-phase relationship so that they will feed tile alternately to the transporter **16**.

As best shown in Figs. 4 and 6, the reciprocating slide **33** carries two tile engaging fingers **55** side by side thereon, and the fingers are pivotally mounted to the slide on shafts **56**. The extreme rear end of each of the pivoted fingers **55** accommodates a block **57** having a shoulder **58** formed thereon, and the block **57** is adjustably mounted to the member **55** by screws **59**. The height of the shoulder **58**, which may be adjustable to accommodate tile of different thickness, must be less than the thickness of the tile, but great enough to afford maximum bite on the rear edge of the tile.

As best shown in Fig. 7, the slide also carries hollow housings **60** directly beneath the rearward ends of the pivotal members **55**, which housings accommodate compression springs **61** therein, and the compression springs normally urge the rear ends of the fingers upwardly to tile engaging positions. As the slide **33** is translated during its return stroke, the pivotal fingers **55** travel beneath the lowermost tile in the hopper, and as the fingers pass beyond the rear edge of the lowermost tile, the shoulders **58** of the blocks **57** will spring upwardly in position to engage the rear edge of the tile. During the forward stroke of the slide, the engagement of the shoulders **58** with the rear edge of the lowermost tile in the hopper will advance the tile forwardly through the discharge opening **14***c* and deliver the leading edge of the tile to the bite between the feed rolls **39** and **40**.

The feed rolls **39** and **40** are supported on shafts **65, 66**, respectively, supported in bearings of the frame **34**. As best shown in Fig. 3 the feed rolls of both feed units

are driven by a motor 70 supported by the main frame structure B of the machine. The motor 70 drives the feed rolls of the feed unit at the left, as viewed in Fig. 3, by means of a belt 71, and the feed rolls of the unit at the right by means of a belt 72. The belt 71 engages a sheave 73 mounted at the extreme end of the shaft 66 of the lower feed roll and the belt 72 engages a sheave 74 at the extreme end of the shaft 65 of the upper feed, thereby insuring that the feed rolls of the two feed units are driven in the proper direction. The opposite extreme ends of the shafts 65, 66, of each of the feed units carry gears 78, 79, respectively, and the gears 78, 79, although not in mesh with each other, are connected by means of idler gears 80, 81 mounted on shafts 80*a* and 81*a*, respectively, of the frame 34. The use of idler gears permits continuous gear engagement and allows for adjustment of nip opening between the rolls for tile of varying thickness.

As mentioned above, the tile discharged from the feed rolls interrupts a light beam from the light source 19 directed toward the photoelectric cell 18. The grooves 83 cut in the periphery of the feed rolls 39 and 40, as shown in Fig. 6, form a passage for the light beam, immediately adjacent the discharge end of the hopper. The interruption in the beam causes the electronic counter A to register the count of the tile which have been discharged from the feed unit, and the position of the beam immediately adjacent the discharge end of the hopper permits the tile to be counted as soon as possible after the tile has been discharged. Also, this construction permits the feed fingers to be locked out of operation as soon as possible after the last tile has been discharged and before another tile has been discharged. The count from each of the feed units is transmitted to the electronic counter A so that the electronic counter totals the tile received from both of the feed units. Thus, if during the course of operation, due to mechanical failure, one of the hoppers fails to supply a tile during a cycle of operation, there will be no count registered from that feed unit. Furthermore, should mechanical failure stop the one feed unit from operating at all, the feeding operations will continue from the other feed unit until the desired number of tile has been stacked on the transporter.

When the predetermined number of tile has been fed from the feed units, the feed fingers 55 are pivoted to an inoperative position to prevent additional tile from being discharged. Thus, the slide 33 which continues to reciprocate, is ineffective for discharging the tile. The pivotal operation of the feed fingers 55 to inoperative position is brought about by the energization of a solenoid 85 mounted to the frame structure 34 by a holder 86 beneath each of the feed fingers 55.

As best shown in Fig. 7, the tile feeding fingers 55 are provided with downwardly extending arms 87 at right angles to the fingers, and the lower ends of the arms carry rollers 88. A companion pivotal latch member 89 for each of the feed fingers 55 is carried by the slide 33. Each of the latch members 89 is pivotally mounted on a shaft 90 (see Fig. 8) beneath the slide 33, the shaft 90 being supported between a pair of bosses 91 carried by and beneath the slide, and a downwardly disposed lug or projection 89*a* is formed integrally as part of the latch 89. The latch 89 is more or less horizontally disposed, as shown in Fig. 7, and the extreme forward end thereof is formed with a concave edge 89*b* and an inclined or beveled edge 89*c* formed above the concave edge.

Normally, the weight of the latch 89 is such as to maintain the operative concave edge 89*b* in a downward inoperative position during the reciprocation of the slide 33. Upon the actuation of the solenoid 85, the armature 85*a* thereof is pivoted (see Fig. 8), raising the stop or pawl 93 into the path of the projection 89*a* of the latch during the return or inoperative stroke of the slide. The engagement of the projection 89*a* with the stop 93 pivots the latch 89 in a clockwise direction, as viewed in Fig. 7, and this pivotal action of the latch 89 brings the beveled edge 89*c* thereof into contact with the roller 88, camming it in such manner as to pivot the feed fingers 55 in a clockwise direction, as viewed in Fig. 7, against the action of the compression springs 61. The roller 88 ultimately is brought into contact with the concave edge 89*b* of the latch, which concave edge serves to lock the finger 55 in its retracted, inoperative position. It is evident that while the fingers 55 are thus locked in retracted positions by the latches 89, the fingers will be held out of contact with the bottom tile in the hopper, and, therefore, the further reciprocation of the slide 33 will not advance additional tile toward the feed rolls.

The slide continues to reciprocate without feeding tile from the hopper until the transporter 16 has had an opportunity to deliver the stack previously compiled to the platform 20 and to return to tile receiving position. When the transporter 16 has returned to the tile receiving position, a solenoid 95 (see Fig. 7) is energized. The energization of the solenoid 95 pivots the armature thereof and raises a trip 96 into operative position to engage the projection 89*a* of the latch 89 during the next forward travel of the slide 33. The engagement of the projection 89*a* with the trip 96 pivots the latch 89 in a counterclockwise direction, disengaging the concave edge 89*b* of the latch and the roller 88. As soon as the respective tile feeding finger 55 is released by the latch 89, the compression spring 61 is free to urge the operative end of the finger 55 upwardly, so that during the next cycle of operation of the slide, the shoulder 58 thereof will be permitted to engage the rear edge of the lowermost tile in the hopper and advance it toward the bite of the feed rolls 39, 40. The feed of tile by the feed unit continues until the next stack of tile is completed and the solenoid 85 is once again energized.

As best shown in Fig. 5, the tile are fed by the rolls 39, 40 across a ledge 98 and beneath spring guides 99 before they are delivered into the upper end of the squaring box 17, and these spring guides 99 slap the tile into position in the squaring box 17 in a quick and efficient manner. Since the tile are fed at great speed, the opposite remote walls 17*a* of the box 17 serve as backboards against which the leading edges of the tile strike. Preferably the timing of the delivery of the tile to the squaring box 17 from the two oppositely disposed feed units is such that the leading edges of the tile from the one feed unit engages the upper surface of the tile beneath it fed from the opposite feed unit in the vicinity of the trailing edge of the tile. This impact aids the proper seating of the trailing edge of the lower tile and overcomes any tendency of the tile to overturn or to seat improperly as they are fed in rapid alternate succession from the two feed units.

The transporter 16 is mounted at the upper end of a long vertically disposed rod 100 (see Fig. 2) which is guided for vertical movement by the bearing guide brackets 101 (see Fig. 3) of the main frame structure B. The transporter 16 is moved upwardly and downwardly by a pair of levers 102 (see Fig. 3) tied together to move in synchronism and pivotally mounted to the main frame structure B on a shaft 103. The free ends of the levers 102 are connected by means of vertically disposed links 104 with the upper end of the transporter 16. As shown in Fig. 3, tension spring 105 is connected to the levers 102 to normally maintain the transporter 16 in the raised position. A pneumatic cylinder 106 is mounted to the main frame B, and the downward stroke of the piston rod 107 pivots the levers 102 in a clockwise direction, as viewed in Fig. 3, to lower the transporter 16.

A fixed weight 109 and an adjustable weight 110 are carried eccentrically of the axis of the shaft 103 to counterbalance the weight of the transporter 16. The

adjustable weight **110** is threadably carried at the end of a shaft **111**, and the stationary weight **109** is supported from the shaft **103** between a pair of arms **112**. The adjustable counterweight **110** provides a fine adjustment for counterbalancing the weight of the transporter **16** so that a sensitive calibrated spring **105** can be employed. The upper end of the spring **105** is connected to the beam **35** by a spring retaining member **105***a* (see Fig. 3), and the tension of the spring **105***a* can be adjusted by attaching the member **105***a* to one of a series of holes **105***b* formed in the beam. Thus, adjustments can be made for handling tile of different weight by varying the tension of the spring and by adjusting the counterbalancing weight **110**.

During the stacking of the tile on the transporter, the spring **105** is elongated under the weight of the incoming tile, allowing the transporter to descend gradually. Therefore, as mentioned above, the upper level of the stack is always approximately substantially constant, and the tile discharged from the feed units always travels approximately the same distance to the stacking position, regardless of the height of the stack.

When a stack *s* of a predetermined number of tile has been compiled on the transporter **16**, the air cylinder **106** is actuated to lower the transporter to the level of the platform **20**. The stack is then removed from the transporter by the operation of a pair of upstanding pusher members **114**, **114***a* operated by the air cylinder **115** (see Fig. 2). Meanwhile, the transporter is raised to the tile receiving position by the tension spring **105** in order that the compilation of the next stack of tile can be begun.

As best shown in Figs. 1 and 2, the long multistation platform **20** may accommodate as many as five stacks of tile, *s*1, *s*2, *s*3, *s*4 annd *s*5, thereon. As each successive stack is delivered to the platform **20**, each of the stacks previously received is advanced one station by a plurality of pusher members **116**, **116***a*.

Each pair of the pusher members **116**, **116***a* serves to advance a stack of tile from one station of the platform **20** to the next. Accordingly, they are moved longitudinally of the platform to slide the stack to the next station, then they are moved apart preparatory to their return stroke, so that they will pass outboard on opposite sides of the stack behind. After completing their return stroke, the pusher members **116**, **116***a* are moved toward each other in position to engage the next stack in line.

The pusher members **114**, **114***a*, **116**, **116***a* are carried by longitudinally movable slides **118** which travel within channel guides **119** of the platform (see Fig. 3) and the reciprocation of the slides **118** moves the aforesaid pusher members during their stack advancing and return strokes. The slides **118** are connected by a plate **120** to insure simultaneous movement thereof.

The slides **118** are reciprocated in longitudinal directions forward and rearward by the air cylinder **115**. The air cylinder **115** is connected by brackets **121** to the main frame structure B of the machine, and the piston rod **122** of the cylinder is connected to a vertically disposed lever **123** which, in turn, is pivoted at its lower end on a shaft **124** supported by the main frame structure. The extreme upper end of the pivotal lever **123** is connected by turnbuckles **125** to the plate **120** beneath the slides **118**. Thus, the stroke of the piston rod **122** in one direction advances the slide, and the stroke of the piston rod in the other direction retracts the slide.

In order to permit the pusher members **116**, **116***a* to be moved toward each other before the forward longitudinal movement of the slides **118** and apart before the rearward longitudinal movement of the slides, the pusher members **116**, **116***a* are carried by slides **130**, **130***a*, respectively, which are accommodated in transverse ways or guides **131** above the slides **118**. As best shown in Figs. 2 and 3, the transverse slides **130**, **130***a* are formed with saddles which extend downwardly and straddle long fore-and-aft rods **134**, **134***a*, respectively. The rod **134** which controls the operation of the pushers **116** at the left, as viewed in Fig. 3, is supported by arms **135** carried by a long fore-and-aft rock shaft **136**, and the rod **134***a* which controls the operation of the pushers **116***a* at the right, as viewed in Fig. 3, is supported by arms **135***a* carried by a long fore-and-aft rock shaft **136***a*. The shafts **136** and **136***a* are rotatably supported in bearings **137** of the main frame structure B of the machine. Thus, the rotation of the two shafts **136**, **136***a* simultaneously in opposite directions moves the pusher bars **116**, **116***a* toward and away from each other simultaneously.

The shafts **136**, **136***a* are adapted to be rotated simultaneously by the movable piston of an air cylinder **140** (see Fig. 3) which cylinder is connected to the main frame structure B of the machine. The piston rod **141** of the cylinder is connected to a lever **142** rigidly mounted on the fore-and-aft shaft **136***a*, and the reciprocation of the piston rod **141** rocks the shaft **136***a*, moving the pusher **116***a* inwardly and outwardly. The lower end of the lever **142** is connected by means of a diagonal link **143** to an arm **144** rigidly mounted on the fore-and-aft shaft **136**. Thus, the oscillation of the shaft **136***a* imparts oscillation in opposite directions to the shaft **136**, moving the pusher elements **116** in opposite transverse directions to the pusher elements **116***a*.

The operation of the pusher bars **116**, **116***a* advances the stacks of tile from one station to the next along the entire length of the platform **20** until the platform has received its full complement of five stacks. The sequence of operation is as follows. The operation of the air cylinder **115** moves the slides **118** in a forward direction, and the pusher bars **116**, **116***a* which are carried along with the slides move the stacks from one station of the platform to the next. The pusher bars **114**, **114***a* which also are carried along with the slides move the stack from the transporter **16** to the first station of the platform. When the pusher elements **116**, **116***a* have completed their forward stroke, the operation of the aid cylinder **140** moves the pusher elements to a spread-apart position, so that during the return stroke thereof, they will pass on outboard of the succeeding stacks of tile. The operation of the air cylinder **115** thereupon moves the slides **118** in the reverse direction, translating the pusher bars **116**, **116***a*, **114**, **114***a* to their start position. At the completion of the return stroke of the slides **118**, the cylinder **140** moves the pusher bars **116**, **116***a* toward each other and behind the succeeding stacks of tile on the platform preparatory to the next tile advancing stroke of the slides **118**.

When all of the stations of the platform **20** are occupied, as indicated when a stack of tile reaches the last position on the platform, the bumpers **23** and **26** are actuated, as mentioned above, to slide the stacks transversely of the platform onto the receiving tables **21**, **22**, **24** and **25**. The bumper element **23** is actuated by a pneumatic cylinder **147**, and the bumper element **26** is actuated by a pneumatic cylinder **148**. The piston rods **149** and **150**, respectively, of the cylinders **147**, **148** are connected to the pusher elements **23**, **26**. Rods **151** are connected to the pusher elements **23** and **26**, and the rods movable in guides **152** so that the pusher elements **23**, **26** will be moved evenly in a transverse direction across the respective stations of the platform.

The sequence of operation of the various elements of the machine is controlled by an electrical control system which is only schematically represented in Fig. 9. Referring to that figure, a voltage V is impressed across the lines **160**, **161**, and a switch **162** closes a circuit to the motor **70** which drives the feed rolls and a switch

163 closes a circuit to the motor 54 which reciprocates the slide 33.

As mentioned above, each time a tile is discharged from one of the hoppers to be added to the stack, it interrupts the light beam directed toward the photoelectrtic cell 18 stationed at the discharge opening of the hopper, and these interruptions in the light beam are counted by an electronic counter A. When the predetermined number of tile has been stacked on the transporter 16, a pulse is emitted from the counter to energize momentarily the solenoids 85 which lock the feed fingers 55 in inoperative position, thereby stopping the further discharge of tile. Also, a circuit is completed via the closed switch LS5 to energize a time relay 180 which closes contacts 181, completing a circuit to energize the solenoid controlled valve 164. The time delay affords ample opportunity for the last tile to settle before the transporter 16 is lowered. When the circuit is completed, the solenoid controlled valve 164 admits air to the cylinder 106, driving the piston rod downwardly to pivot the lever 102 in a clockwise direction, as viewed in Fig. 3, thereby lowering the transporter 16.

The lever 102 controls switches LS4 and LS6. When the transporter is in its lowermost position, the switch LS6 is closed, thereby completing a circuit via the closed switches LS7, LS12 and LS13 to the solenoid controlled valve 166 of the cylinder 115. The switches LS12 and LS13 are maintained closed by the bumpers 23, 26 in their inoperative position. When the solenoid controlled valve 166 is thus operated, the cylinder 115 moves the slides 118 longitudinally in the forward direction, causing the pusher bars 114, 114*a* to slide the stack on the transporter to the platform 20 and the pusher bars 116, 116*a* to advance each of the stacks on the platform from one station to the next.

When the switch LS6 is closed, the relay 169 is also energized, closing a by-pass switch 170 for the switch LS6. Thus, the switch LS6 can be opened when the transporter rises without breaking the circuit to the solenoid controlled valve 166.

The switch LS5 is opened by the forward advance of the slides 118, thereby breaking the circuit to the solenoid controlled valve 164, and the transporter is permitted to be raised by the spring 105. If desired, the breaking of the circuit to the solenoid controlled valve 164 may cause the solenoid controlled valve 164 to reverse the direction of the stroke of the piston of the cylinder 115 to raise the transporter 16.

The switch LS4 is closed when the transporter 16 is in its uppermost position, and the switch LS4 completes a circuit to energize momentarily the solenoids 95 which release the feed fingers 55 and initiate the feed of tile to compile the next stack on the transporter.

At the completion of the forward stroke of the slides 118, the solenoid controlled valve 167 of the cylinder 140 is actuated to operate the cylinder in order to effect the separation of the tile pushers 116, 116*a*. The circuit is completed via the switches LS7*a* and LS10. The switch LS10 is normally closed, except when the slides 118 are in their rearward or start position, in which position the switch is held open. The switch LS7*a* is closed by the slides 118 in their extreme forward position.

The circuit completed by closing the switch LS7*a* also energizes a relay 172 which closes a by-pass switch 174 for the switch LS7*a*. The by-pass switch 174 will maintain the circuit to the solenoid controlled valve 167 even though the switch LS7*a* is again opened after the slides 118 begin their rearward stroke.

When the slides 118 reach their extreme forward position, the switch LS7 is opened, breaking the circuit to the solenoid controlled valve 166, and thereby adjusting the valve to reverse the direction of operation of the cylinder 115. The opening of the switch LS7 also breaks the circuit to the relay 169 and the deenergization of the relay opens the by-pass switch 170. Thus, even though the switch LS7 is again closed when the slides 118 begin their return, the circuit to the solenoid controlled valve 166 will not be established.

When the slides 118 reach their rearmost position, the switch LS10 is opened, breaking the circuit to the solenoid controlled valve 167. This causes the pusher bars 116, 116*a* to be moved toward each other in position and behind the next stack on the platform. The opening of the switch LS10 also breaks the circuit to the relay 172, and the deenergization of the relay opens the switch 174.

When the platform 20 has received its full complement of stacks, as indicated when the stack *s*5 closes the switch LS9, a circuit will be conditioned to actuate the solenoid controlled valve 175. The switch LS9 will remain closed while the stack *s*5 remains in position at the last station of the platform. When the slides 118 reach their rearmost position, a switch LS10*a* will be closed. Thereupon, a circuit will be completed through the closed switches LS9, LS10*a*, LS8 and LS11 to the solenoid controlled valve 175, and when this valve is actuated, air is introduced to the cylinders 147, 148 to move the bumpers 23, 26 transversely to slide the stacks *s*2, *s*3, *s*4 and *s*5, respectively, onto the tables 21, 22, 24 and 25.

The completion of the circuit to the solenoid controlled valve 175 also energizes a relay 171 which closes a by-pass switch 173 for the switches LS9, LS10*a*.

When the bumpers 23, 26 reach the end of their strokes, they open the switches LS8, LS11, respectively, breaking the circuit to the solenoid controlled valve 175, as well as to the relay 171. This effects the return stroke of the bumpers 23, 26 and when the bumpers reach their start positions, they again close the switches LS12 and LS13 to condition the circuit for the actuation of the solenoid controlled valve 166 for operation, thus completing the cycle of operation.

If desired safety switches LS1 and LS2 (see Figs. 9 and 11) may be provided for each of the hoppers to stop the feeding of tile from either or both hoppers when the tile in one of the hoppers approaches exhaustion. The switches LS1 and LS2 are normally held open by engagement with the tile in the hoppers, but when the tile in one of the hoppers falls below a predetermined height, the respective switch is closed, energizing a relay 182. The energization of relay 182 closes a circuit to energize the solenoids 85, thereby stopping the further feed of tile from both hoppers until the supply in the low hopper is replenished. A switch LS3 may be placed in parallel with switches LS1 and also LS2 to stop the feed in the event of an overcount, that is, when tile above the predetermined number have been delivered to the transporter. The switch LS3, like switches LS4 and LS6, is closed by the lever 102 when the transporter 16 descends below a predetermiend level. Also, a switch LS14 may be placed in series with switches LS1, LS2 and LS3 to render the circuit inoperative between certain ranges. This switch, like switches LS4 and LS6, may be controlled by the lever 102 so that it will be closed to render the circuit in condition for operation when the count reaches a certain number, then opened until the count is reached and thereafter closed in the event of an overcount.

It may be desirable to stack tile in a predetermined sequence from each of the two hoppers, such as where each of the hoppers feeds tile of a different design and the design is to be combined in a predetermined ratio, for example, 2 to 1.

Furthermore, in order not to mar or scratch the smooth (face up) surface of tile, it is sometimes desirable to have a stack made up with the first few tile (on the bottom of the stack) face up and the last few tile (on the top of the stack) face down. The surface can be marred by sliding a stack of tile from station to station on the platform 20, or by some over anxious customer opening a box of tile with a knife, screwdriver, or

some blunt instrument. Accordingly, the tile may be loaded face down in one hopper and face up in the other hopper, and one or more tile are fed initially from the hopper in which they are stored face up to insure that the lowermost tile in a stack is face up before the feed of tile from the other hopper is started. Also, just before the compilation of a stack, the feed of tile from the hopper in which they are stored face up is stopped before the feed of tile from the hopper in which they are stored face down, thereby insuring that the uppermost tile in the stack is face down.

Referring to the circuit diagram of Fig. 10, the energization of the solenoids **85'** operate to stop the feed of tile from the one hopper and the energization of the solenoids **85***a'* operate to stop the feed of tile from the other hopper. Also, the energization of the solenoids **95'** operate to initiate the feed of tile from one hopper and the energization of the solenoids **95***a'* operate to initiate the feed of tile from the other hopper. A switch **183** closed by the counter A completes the circuit for the energization of the solenoids **85'**, and a switch **184** also closed by the counter completes the circuit for the energization of the solenoids **85***a'*.

When the switch LS4 is closed to initiate the feed of tile, the solenoids **95***a'* will be energized immediately, feeding the tile face down. The time delay relay **185** is also energized, closing the contacts **186**, and thereafter the tile will be fed alternately until a preliminary count for which the counter has been set is reached. Thereupon, the switch **183** will be closed, stopping the further feed of face-up tile, and subsequent thereto, when the predetermined count has been reached, the switch **184** will be closed, stopping the feed of face-down tile. This arrangement assures that the lowermost tile in the stack is face up and the uppermost tile in the stack is face down.

The invention has been shown and described in preferred form and by way of example only, and various modifications and variations may be made therein without departing from the spirit of the invention. It is to be understood, therefore, that the invention is not to be limited to any specified form or embodiment except insofar as such limitations are specified in the appended claims.

We claim:

1. In a machine for stacking articles, a hopper for storing the articles to be stacked, a discharge opening therein, article receiving means spaced outside of the hopper and spaced from said discharge opening, a reciprocating slide, a pivotal member carried by said reciprocating slide for engaging the rear edge of the lowermost article in the hopper and advancing it through said discharge opening in the direction of said article receiving means, means for locking said pivotal member in inoperative position after a predetermined number of articles have been delivered to the article receiving means, and trip means operable to restore the pivotal member to operative position.

2. In a machine for stacking articles, oppositely disposed hoppers for accommodating the articles to be stacked, a transporter spaced between the oppositely disposed hoppers, yielding means acting on the transporter to urge the transporter upwardly but yielding under the weight of the incoming articles stacked on the transporter so as to gradually descend and maintain the uppermost stacked article at substantially the same height, article feeding means associated with each of the hoppers, the article feeding means of the oppositely disposed hoppers delivering the articles to the transporter in alternate succession from opposite directions, a surface supported independently of the transporter for engaging and registering the leading edge of the articles discharged from one hopper, a surface supported independently of the transporter for engaging and registering the leading edge of the articles discharged from the other hopper, the transporter being disposed between the said surfaces, and means independent of said yielding means to impart vertical motion to the transporter.

3. In a machine for stacking articles, a hopper for storing articles to be stacked, and means for discharging the articles from the hopper comprising a pair of feed rolls, a reciprocating slide, a pivotal finger carried by said slide, a shoulder formed in the finger for engaging the rear edge of the lowermost article in the hopper and advancing the leading edge of the article toward the feed rolls, spring means carried by the slide urging the pivotal finger to operative position, a pivotal locking member carried by said slide, said pivotal locking member being normally in an inoperative position but movable to operative position, a cam edge formed on said pivotal locking member which, upon actuation, engages the pivotal finger, pivoting the finger to inoperative position, and recessed means formed in the pivotal locking member engageable with a companion portion of the pivotal finger to maintain the pivotal finger in inoperative position, thereby stopping the discharge of the articles from the hopper.

4. A machine for stacking articles as set forth in claim 3 including trip means operative to disengage the recessed means of the pivotal locking member from the pivotal finger.

5. In a machine for handling stacked articles, a vertically movable transporter for transporting the articles in stacked relationship thereon, a stack receiving platform having a plurality of stations in sequence for accommodating stacks, means for moving the transporter to stack discharging position, means operable to move the stack from the transporter to the stack receiving platform, stack advancing means associated with the stack receiving platform for intermittently advancing the stacks from one station to the next, whereby the stack receiving platform may accommodate a predetermined number of stacks, stack receiving means situated adjacent certain stations of the stack receiving platform, and stack removing means adjacent each of said stations on the side opposite the stack receiving means of said station, and means operable when a stack is advanced to the last of said stations of the platform to initiate the operation of all of the stack removing means simultaneously, thereby moving a plurality of the stacks at different stations on the platform from the respective station to the stack receiving means associated with said station.

6. A machine as set forth in claim 5 wherein the stack advancing means includes a movable slide, means for guiding the movement of the slide, and stack pusher members carried by the slide and being independently movable with respect to the slide at an angle from the direction of movement of the slide.

7. A machine as set forth in claim 6 including means for moving the slide to advance the stacks from one station to the next when the transporter has reached stack discharging position.

8. A machine as set forth in claim 6 including means for moving the stack pusher members after the advance of the stacks from one station to the next on the platform.

9. A machine as set forth in claim 5 including means for detecting the discharge of an article from each of the hoppers, a counter for totaling the number of articles thus stacked on the transporter, and means responsive to a predetermined number of articles counted to render the feed means associated with each hopper inoperative and for conditioning the transporter for operation.

10. A machine as set forth in claim 9 including means responsive to the return of the transporter to article receiving position to render the feed means associated with each hopper operative.

11. A machine as set forth in claim 5 wherein the stack removing means which moves the stacks from the platform to the stacking receiving means adjacent the

platform is a pusher member movable across the platform, and including means for operating the pusher member, and means engaged by a stack at the last station on the platform for conditioning the pusher member for operation.

12. In a machine for stacking flat articles, a transporter movable from a receiving position to a delivery position, a feeding unit for delivering the articles one at a time to the transporter in stacked relationship, a platform to which the stacks are delivered by the transporter, a counter, means controlled by the counter for rendering the feeding unit inoperative after a predetermined number of articles have been discharged thereby, means controlled by the counter for moving the transporter to a delivery position, first pusher members for sliding the stack from the transporter to the platform, means controlled by the transporter in the delivery position for operating said first pusher members, and means controlled by the operation of the first pusher members for conditioning the transporter for operation to its receiving position.

13. A machine as set forth in claim 12 including second pusher members movable to advance the stacks received by the platform from one position to the next, and means controlled by the transporter to actuate the second pusher members to advance the stacks.

14. A machine as set forth in claim 12 including a pair of second pusher members movable to advance the stacks received by the platform from one position to the next, means controlled by the transporter to advance the pusher members, means for supporting the pair of second pusher members for movement at right angles to the direction of advance of the stacks, means for moving the second pusher members toward and away from each other, and means responsive to the pusher members in the fully advanced position to effect the movement of the pusher members to spread apart position preparatory to the return stroke thereof.

15. A machine as set forth in claim 12 including a third pusher member movable transversely of the direction of advance of the stacks, means engageable by a stack at the last station of the platform, and means controlled by the engagement of the stack with said means to actuate the third pusher member.

16. In a machine for stacking articles, a hopper for storing the articles to be stacked, article receiving means, feed means for discharging the articles one at a time from the hopper toward the article receiving means, means for rendering said feed means inoperative when a predetermined number of articles have been delivered to the article receiving means, and means for rendering said feed means inoperative when the supply of articles stored in the hopper falls below a predetermined level.

17. In a machine for stacking articles, a transporter movable from a receiving position to a delivery position, a feeding unit for delivering articles one at a time to the transporter in stacked relationship, a counter, means controlled by the counter for rendering the feeding unit inoperative after a predetermined number of articles have been fed thereby, means controlled by the counter for moving the transporter to a delivery position, and delay means for delaying the movement of the transporter to the delivery position to insure that the last article to be stacked is received by the transporter.

18. In a machine for stacking flat articles, a pair of hoppers, the articles being stored face up in one of said hoppers and face down in the other of said hoppers, feed means associated with each hopper, article receiving means for receiving articles discharged from both hoppers, a counter for counting the articles discharged by said hoppers, means for initiating the operation of said feed means, delay means whereby the feed means associated with one hopper is initiated subsequent to the initiation of the feed means associated with the other hopper, means controlled by the counter for stopping the operation of the feed means associated with one of said hoppers before a predetermined number of articles have been received by the article receiving means, and means controlled by the counter for stopping the operation of the feed means associated with the other hopper when a predetermined number of articles have been received by the article receiving means.

19. In a machine for handling articles, a hopper for storing the articles to be stacked, a transporter for receiving the articles fed from the hopper in stacked relationship, feed means for feeding the articles one at a time from the hopper to the transporter, means for rendering said feed means inoperative after a predetermined number of articles has been delivered to the transporter, means for initiating the movement of the transporter to a delivery position after a stack has been compiled thereon, pusher means for removing the said stack from the transporter, means controlled by the movement of the transporter to delivery position for conditioning the pusher means for operation, means controlled by the movement of the pusher means for initiating the return movement of the transporter to article receiving position, and means controlled by the return of the transporter to article receiving position for rendering said feed means operative to compile another stack of articles on the transporter.

20. In a machine for handling articles, the combination set forth in claim 19 including pusher members synchronized with the movement of the above-mentioned pusher means for advancing the stack of articles from one station to another, means for imparting reciprocating movement to said pusher members, and means for moving said pusher members into position to engage a stack of articles before the advance stroke thereof and for moving said pusher members out of position to engage a stack advanced by the above-mentioned pusher means before the return stroke thereof.

21. In a machine for stacking articles, a hopper for storing the articles to be stacked, a discharge opening therein, article receiving means spaced outside of the hopper and spaced from said discharge opening, a reciprocating slide, a pivotal member carried by said reciprocating slide for engaging the rear edge of the lowermost article in the hopper and advancing it through said discharge opening in the direction of said article receiving means, means for locking said pivotal member in inoperative position after a predetermined number of articles has been delivered to the article receiving means, means for counting the articles discharged from the hopper, and means controlled by the counting means for rendering the locking means operative.

References Cited in the file of this patent

UNITED STATES PATENTS

1,412,795	Pfohl	Apr. 11, 1922
1,514,929	Ray	Nov. 11, 1924
1,592,367	Hren et al.	July 13, 1926
1,957,318	Bush	May 1, 1934
2,226,588	Simpson	Dec. 31, 1940
2,228,887	Peterson	Jan. 14, 1941
2,294,718	Carroll	Sept. 1, 1942
2,551,685	McAleer et al.	May 8, 1951
2,677,543	Ohrn	May 4, 1954