July 16, 1968 F. J. PEARNE ET AL 3,392,851

BRICK STACKER

Filed March 22, 1965 5 Sheets-Sheet 1

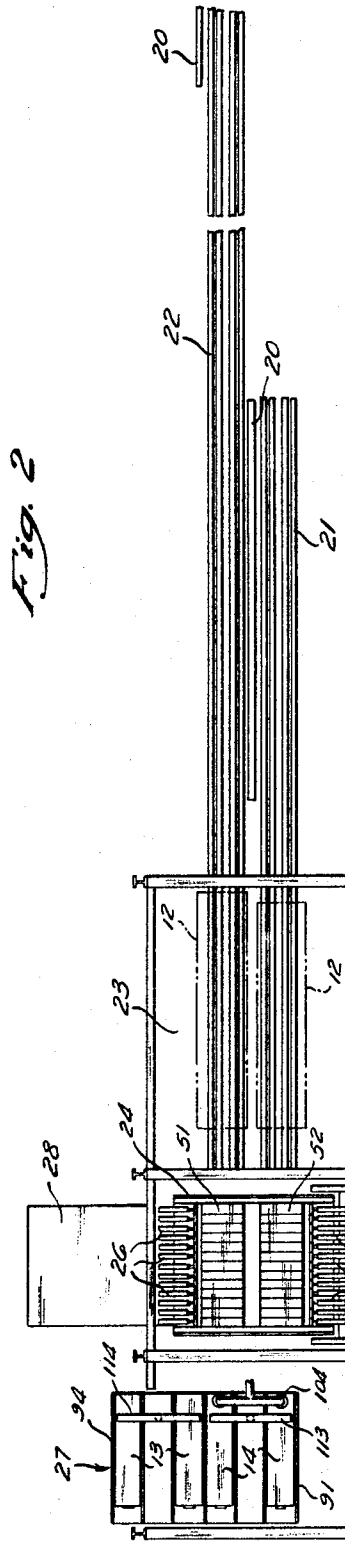


Fig. 2

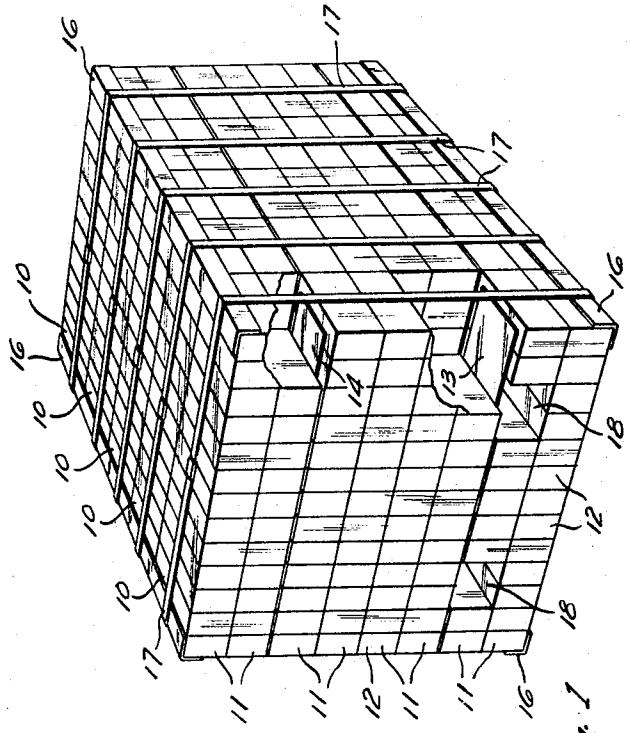


Fig. 1

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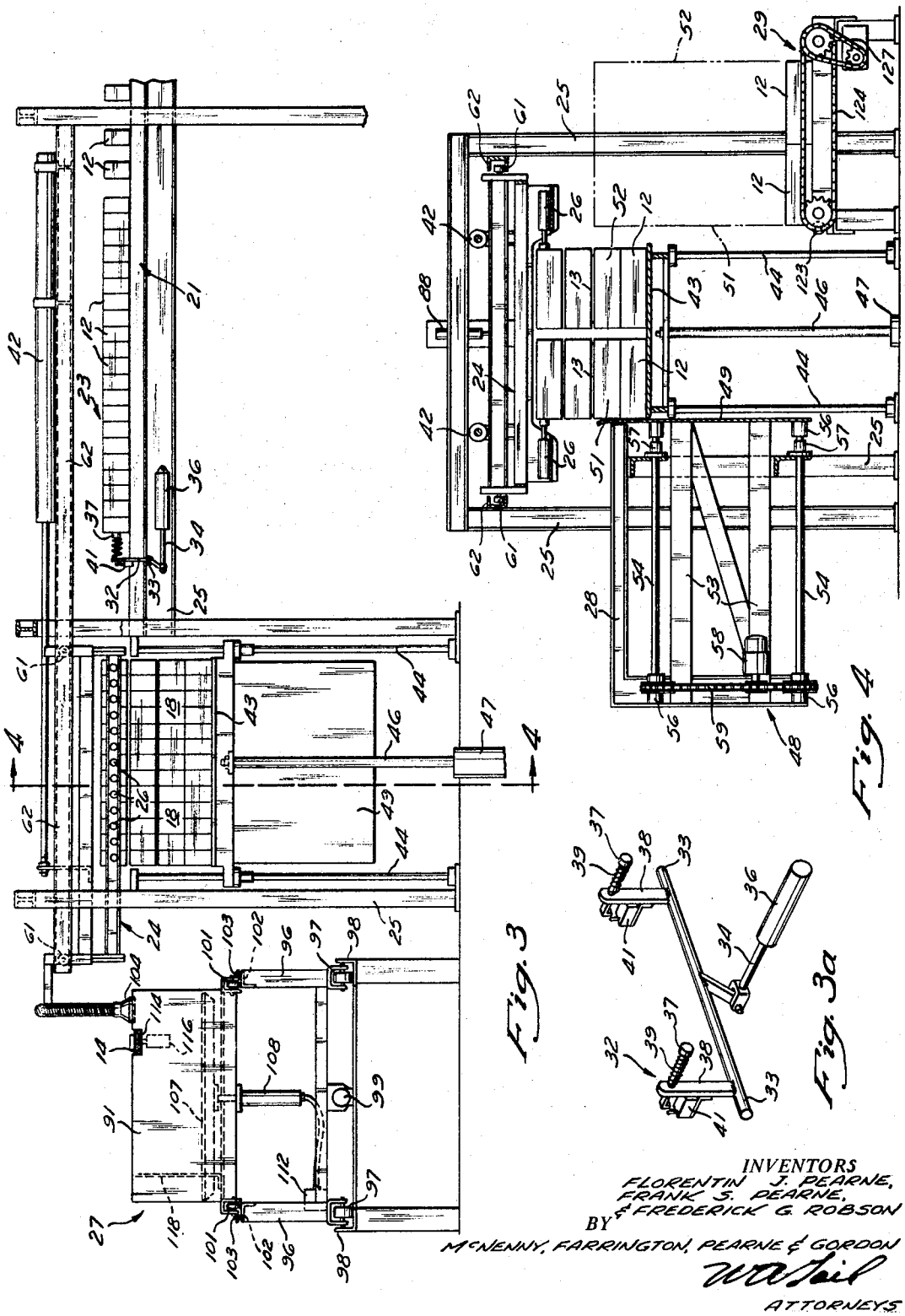


Fig. 3

Fig. 3a

Fig. 4

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Fig. 5

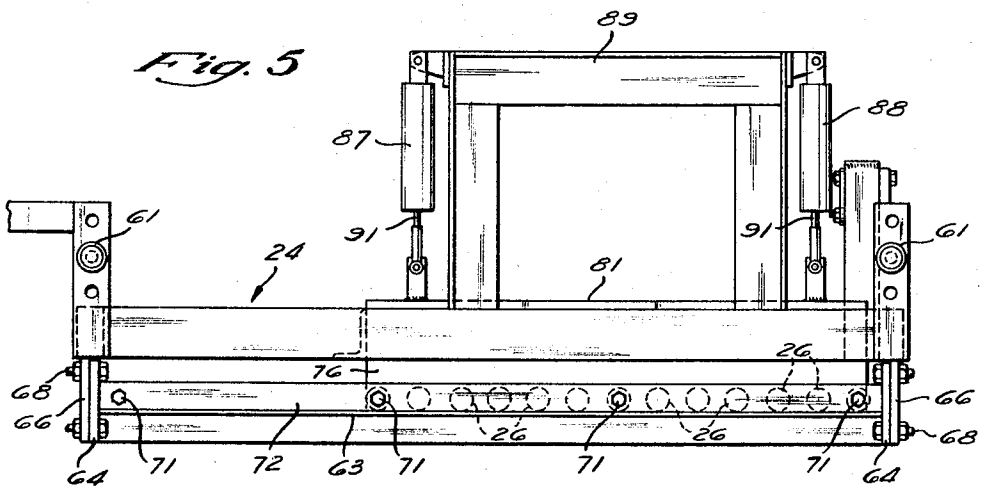
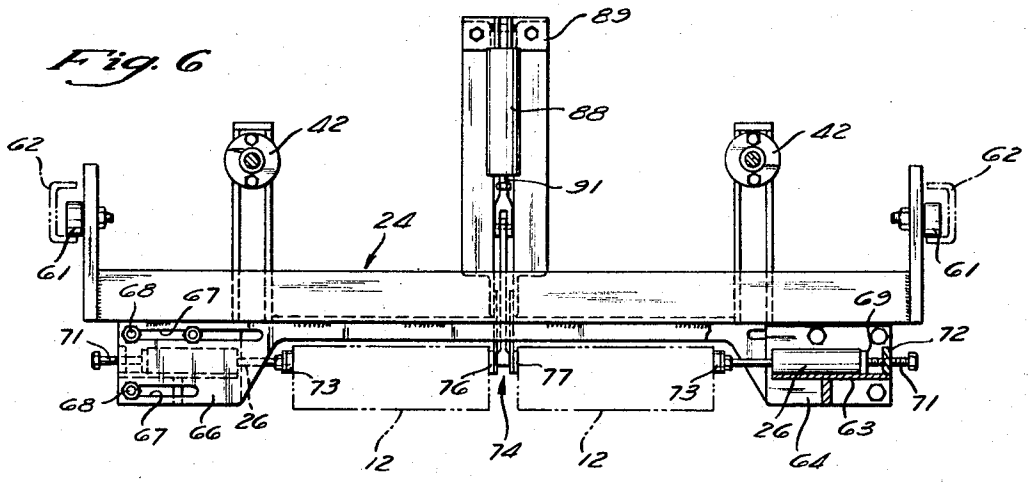


Fig. 6



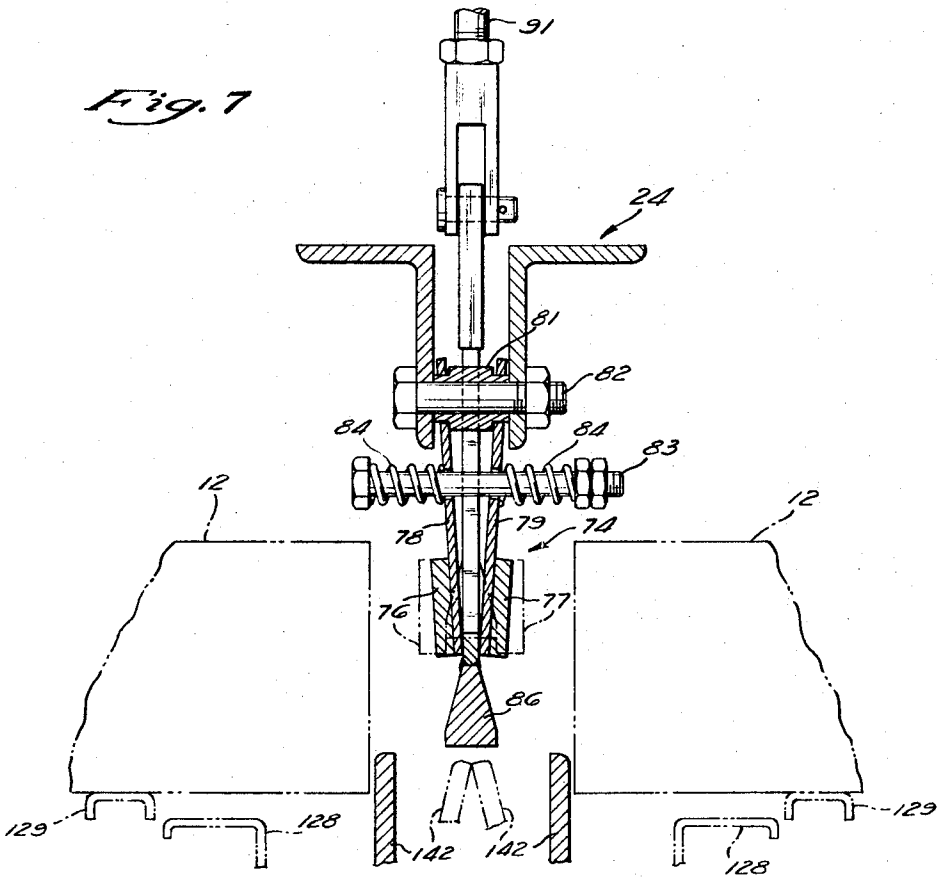
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BRICK STACKER

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Fig. 7



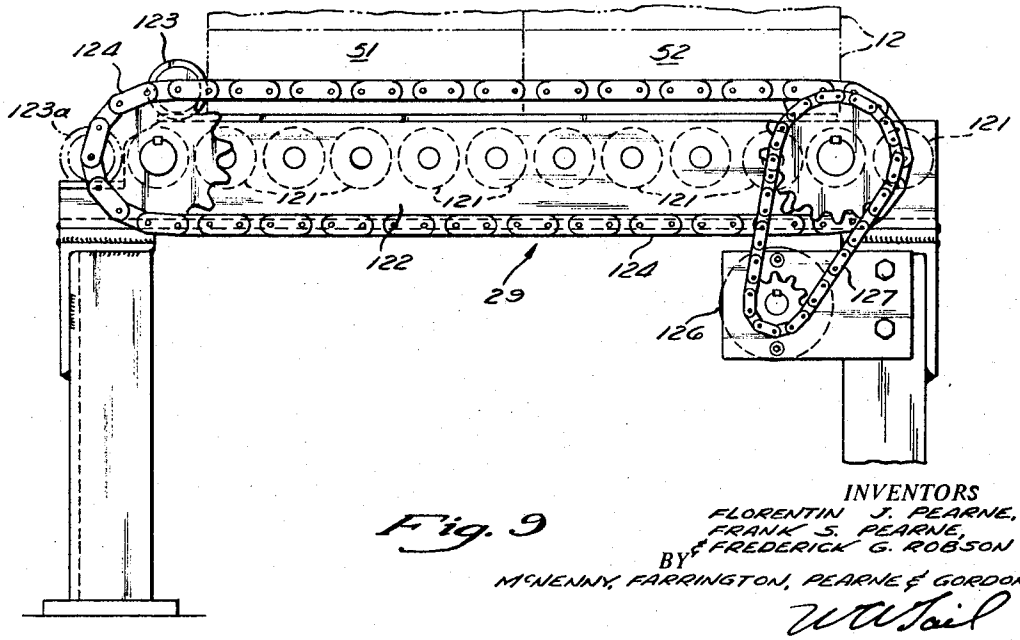


Fig. 9

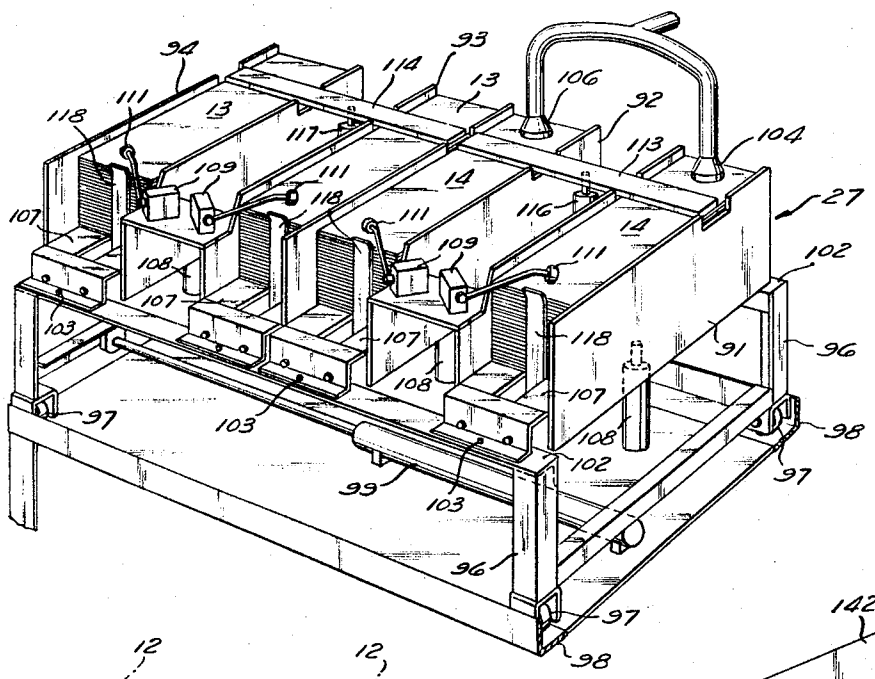
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Fig. 8



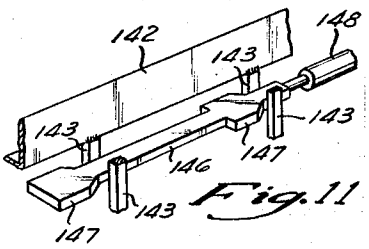


Fig. 11

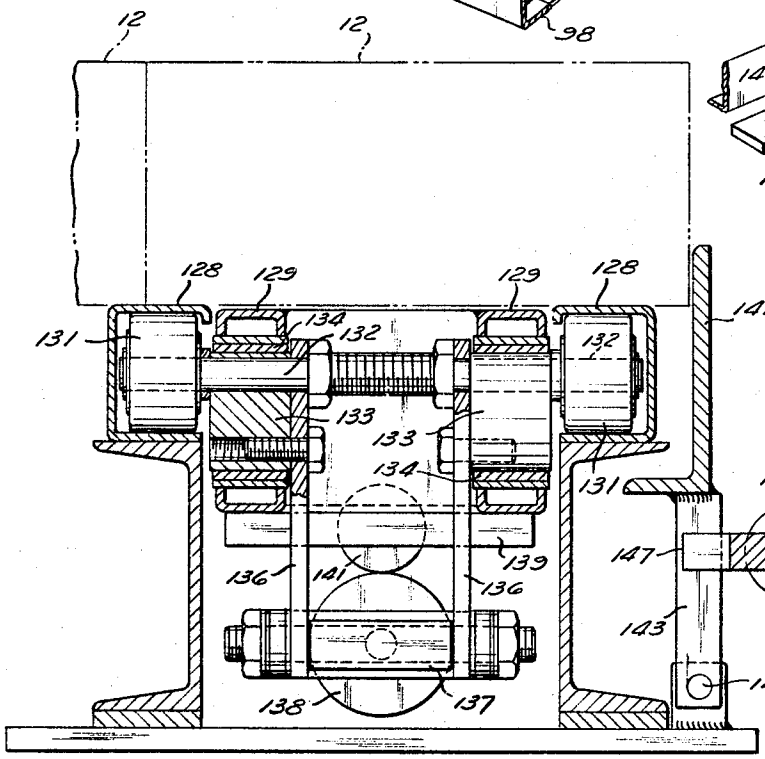


Fig. 10

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3,392,851

BRICK STACKER

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Filed Mar. 22, 1965, Ser. No. 441,496
9 Claims. (Cl. 214—6)

ABSTRACT OF THE DISCLOSURE

A brick stacking machine providing two parallel conveyors each operable to deliver brick to a gripping station. Stops are provided at the gripping station to resist movement of the brick with the conveyors so that a compacted line of abutting and aligned bricks is formed on each conveyor. The stops are arranged to sense the length of the compacted line and are interconnected with a gripper transfer to prevent the operation of the latter when the compacted lines contain insufficient brick for rows of predetermined length. The gripper transfer is mounted on a reciprocating carriage for movement from the gripping station to a stacking station over a vertically movable platform. The gripper transfer provides a plurality of separate grippers which are each operable to individually grip a brick at the gripping station and which cooperate to carry rows of brick containing aligned abutting brick to the stacking station. The gripper transfer operates with a repeating cycle to position such rows on the platform and the platform lowers as the rows are positioned thereon until a stack of rows is located on the platform. The gripper transfer is arranged to provide voids in predetermined rows, so that the resulting stack can be handled by conventional material handling equipment. A separator board transfer is mounted on the carriage and operates to position separator boards between predetermined rows within the stack and a pusher operates to slide the finished stack off of the platform so that it may be carried to a strapper or the like.

This invention relates generally to machines for automatically handling rectangular block-like articles and more particularly to a machine for automatically stacking bricks or the like so that they may be packaged for convenient handling with conventional material handling machines.

In the illustrated embodiment of this invention fired brick moves along conveyors to the stacking machine which functions automatically to assemble stacks of brick having voids proportioned to receive the fork of a lift truck. The stacks are then automatically moved into a tieing machine and assembled into a unitary package consisting of several stacks.

The package of brick is very compact so that storage and shipping space requirements are minimized. The automated handling of the brick eliminates not only the manual labor and its high cost, but also eliminates the accidental damage to the brick which often occurs with such manual operations. Further, the package itself provides substantial protection to the brick which minimizes the damage occurring during shipping and storage.

A preferred embodiment of this invention includes conveyor means which automatically transport the individual brick to the stacking machine. Stop means cooperate with the conveyor means to compact the brick on the conveyor so that gripper transfers can grip a row or course of brick and then carry it to an elevator on which the stack is formed. The elevator is automatically controlled to receive a course of brick from the gripper transfer and then drop down so that a subsequent course can be placed on the previously positioned course. This operation is repeated until the required stack having the desired number of rows is formed on the elevator.

When the proper number of courses or rows are positioned on the elevator a pusher moves the stack onto a roller conveyor which carries the stack to a strapping machine. The strapping machine then automatically ties the package together. The stacking machine is arranged so that voids are formed in the stack to receive the forks of a conventional lift truck and separator boards are placed over the voids to support the brick above the voids and also tie the stack together.

The stacking machine is arranged so that it can be used for both standard brick and Norman brick and can be adjusted to form substantially any size stack within the capacity of the machine.

Although the illustrated embodiment of this invention is utilized for the stacking and packaging of bricks it should be understood that a machine incorporating this invention can also be used for the automatic handling of other articles, for example boxes in which manufactured items are packaged, shipped and sold.

It is an important object of this invention to provide a novel and improved automatic stacking machine operable to form stacks of block-like articles suitable for convenient handling and shipping.

It is another important object of this invention to provide a novel and improved stacking machine arranged to automatically receive block-like articles from a conveyor, or the like, and form stacks of such articles wherein the stacks consist of a plurality of rows with each row containing a plurality of abutting articles, and wherein voids are automatically formed in predetermined rows.

It is another important object of this invention to provide a stacking machine operable to form stacks consisting of rows of block-like articles wherein separator elements are automatically positioned between predetermined rows.

It is still another object of this invention to provide a novel and improved brick stacking machine adapted to automatically form a stack including a plurality of rows of bricks with voids formed in predetermined rows and separator boards positioned over such voids so that the stack may be handled by conventional material handling machinery.

It is still another object of this invention to provide a stacking machine according to the last preceding object which automatically inserts different types of separator elements at spaced positions in the stack.

Further objects and advantages will appear from the following description and drawings wherein:

FIGURE 1 is a perspective view of a completed package of brick consisting of a plurality of stacks formed by the illustrated stacking machine;

FIGURE 2 is a schematic plan view of the stacking machine incorporating this invention showing the general physical arrangement with parts removed for purposes of illustration;

FIGURE 3 is a side elevation of the machine;

FIGURE 3*a* is an enlarged fragmentary view of the retractable stop mechanism which limits movement of brick along the conveyor and functions to compact the brick forming a line of aligned and abutting brick;

FIGURE 4 is a section taken along 4—4 of FIGURE 3;

FIGURE 5 is an enlarged side elevation of the clamp carriage which reciprocates back and forth and transports a couse of brick from the conveyor to the stacking elevator;

FIGURE 6 is an end view of the clamping carriage illustrated in FIGURE 5;

FIGURE 7 is an enlarged fragmentary view of the center clamp mechanism of the clamping carriage illustrating the structural detail thereof;

FIGURE 8 is a perspective view of the hoppers for the board separators which are positioned between predetermined courses in the stack;

FIGURE 9 is a fragmentary side elevation of the roller conveyor along which the stacks move from the stacking elevator to the strapping machine;

FIGURE 10 is a fragmentary section of the walking beam conveyor which transports the bricks to the stacking machine and the retractable fence for guiding the brick at the clamping location; and

FIGURE 11 is a fragmentary perspective view of the cam mechanism utilized to lock the fence in its operative position and which permits retraction of the fence during the clamping operation.

Referring to FIGURE 1, a package of brick consists of a plurality of stacks **10** each of which consists of rows or courses **11** positioned one on top of the other. Each of the courses excepting the second course from the bottom includes thirteen individual bricks **12**. In the illustrated package there are thirteen bricks in seven rows and nine bricks in the second row from the bottom, therefore, each stack includes one hundred bricks. The strapping machine ties five stacks together so the complete package includes five hundred bricks. In the illustrated package a wood veneer board **13** is positioned between the second and third rows from the bottom and a chip board **14** formed of paper-like material is positioned between the second and third rows from the top. Corner pieces **16** usually formed of heavy paper or cardboard extend along the lengthwise edges of the package and metal straps **17** are wrapped around each of the stacks tieing the entire package together.

In order to permit the transportation of the package by means of a lift truck, or the like, the second course from the bottom of each stack is formed with voids **18** having a width of two bricks proportioned to receive the fork arms of a lift truck. In the illustrated package the second course consists of two bricks on the outside of each void **18** and five bricks between the two voids. Here again, various arrangements can be used as required by the handling equipment and the size of the bricks.

The veneer board **13** in each stack, extending between the second and third courses from the bottom, supports the lowermost brick above the void **18**. These boards also provide protection against damage to the brick when the package is lifted by a lift truck or the like. The chip board **14** provides a tie between adjacent bricks in the rows and the corner pieces **16** provide a tie between the stacks in the complete package.

Referring now to FIGURE 2, the overall stacking machine includes two walking beam conveyors **21** and **22**. The fired bricks are loaded onto the right end of the conveyors **21** and **22**, as viewed in FIGURE 2, from the kiln car, or the like. The conveyor **22** is normally longer than the conveyor **21** so that the loading area for the conveyor **22** is spaced from the loading area for the conveyor **21**.

The bricks are carried along the conveyors **21** and **22** to a clamping station **23** where they are compacted to form a line of aligned abutting brick. Adjustable fences **20** are mounted adjacent to the conveyors **21** and **22** to insure proper positioning of the bricks on the associated conveyors.

A clamping carriage shown schematically at **24** is reciprocable along the machine frame **25** from a rearward position illustrated in which the carriage is located over the stacking elevator and a forward position over the loading or gripping station **23**. Piston and cylinder actuators (not illustrated in FIGURE 1) provide the power for moving the clamping carriage **24** back and forth between its two positions.

In the illustrated embodiment there are twenty-six piston and cylinder actuators **26** with thirteen actuators in a row along one side of the carriage and the other thirteen along the other side of the carriage. The spacing between adjacent actuators **26** is equal to the thickness of a brick, so each actuator is operable to engage the end of one brick and clamp it inward against a central grip bar (not illustrated in FIGURE 1) and thus grip a single brick on its ends to carry the brick from the clamping station **23** to a position over the elevator where the brick are stacked.

A board hopper assembly **27**, which will be described in more detail below, is positioned on the side of the stacking elevator remote from the conveyors **21** and **22** and provides a supply of veneer boards **13** and chipboards **14**. A pusher assembly cover **28** is located on one side of the machine at the stacking station and covers a pusher mechanism which operates to push completed stacks out of the stacking station onto a roller conveyor **29**. The roller conveyor **29** in turn carries the stacks of brick to a strapping machine **31** which puts the corner pieces **16** on the stacks and ties the straps **17** therearound to complete the package. The strapping machine per se forms no part of this invention, so it has not been illustrated in detail.

Referring now to FIGURE 3, the bricks **12** move along the two conveyors to the clamping or gripping position **23**. A retractable stop **32** is pivoted at **33** on the frame **25** and connected to a piston **34** of an actuator **36** which operates to move the stop **32** between the operative position, illustrated in FIGURE 2, and a retracted position wherein the stop is below the upper surface of the conveyors. Two stops are provided with one in alignment with each of the conveyors **21** and **22**, however, they are both pivoted on the same pivot shaft **33**, as illustrated in FIGURE 3*a*.

A spring loaded plunger **37** is slidable in the associated arm **38** in alignment with each of the conveyors and is spring loaded by a spring **39** in a direction away from the arm. As the bricks move along the conveyors they engage the associated plunger **37** and produce a force on the spring which is a direct function of the number of compacted bricks at the clamping station **23**. When sufficient bricks are compacted at the clamping station of each conveyor sufficient force is produced to overcome the action of the springs **39** and cause the plungers **37** to move into engagement with associated microswitches **41**. The microswitches **41** are connected to initiate the operation of the clamping carriage **24**. Preferably, the springs **39** are sized so that the switches **41** are not operated until there are about twenty-five or thirty bricks compacted against the stops. This insures that there will always be the necessary thirteen bricks present for clamping. A pair of actuators **42**, connected between the frame **25** and the clamping carriage **24**, then move the clamping carriage **24** forward to the clamping station **23**. A row of brick from each conveyor is then gripped and carried to the stacking position when the carriage returns to its rearward position to form two stacks.

A stacking elevator **43** is vertically movable along guide rods **44** by a piston **46** of an elevator actuator **47**. The stroke of the actuator **47** is arranged so that the upper surface of the stacking elevator **43** can be moved to an upper extreme position substantially adjacent to the plane of the conveyors **21** and **22** and a lowered position substantially in the plane of the roller conveyor **29**. After two side-by-side rows of brick **12** are positioned on the elevator **43** it drops down so that the upper surface of the top rows supported thereby is substantially in the plane of the conveyors and subsequent rows of brick can be positioned on the previous rows.

Referring now to FIGURE 4, a pusher assembly **48** includes a pusher plate **49** movable from the left extreme position, illustrated in FIGURE 4, to push the two stacks of bricks **51** and **52** off of the elevator **43** and onto the roller conveyor **29**. This does not occur, however, until

the stacking operation is completed and the elevator **43** is lowered so that its upper surface is located substantially in the plane of the conveyor **29** and below the lower edge of the pusher plate **49**. The pusher assembly includes a frame **53** carried by a plurality of screw jacks **54**. The screw jacks **54** are journaled at their ends **56** on the frame assembly **53** and extend through nuts **57** mounted on the main machine frame **25** so that rotation of the screw jacks **54** moves the frame horizontally.

In order to rotate the screw jacks a motor **58** is mounted in the frame **53** and is connected by a drive chain **59** to simultaneously rotate each of the screw jacks **54**. Therefore, rotation of the motor in one direction causes the screw jacks to move the pusher assembly **48** to the right and rotation of the motor in the opposite direction causes the pusher assembly to return to the illustrated position.

Referring now to FIGURES 5 through 7, the clamping carriage **24** is provided with rollers **61** which move back and forth along channel members **62** on the frame **25**. The clamping actuators **26** are carried by mounting plates **63**. End plates **64**, illustrated in FIGURE 5, are provided on the ends of the plates **63** and are positioned adjacent to adjustment plates **66**. Bolts **68** extend through slots **67** in the plates **66** and connect the end plates **64** to the associated adjustment plates **66** permitting adjustment of the mounting plates laterally with respect to the carriage. The mounting plates **63** are normally positioned at the outward extreme position, illustrated in FIGURE 6, when the machine is used to stack larger bricks, such as Norman bricks, and is adjusted inwardly along the slot **67** for smaller bricks, such as common bricks.

The clamping actuators **26** of each bank of actuators are mounted at their ends on an adjusting bar **69** which is adjustably relative to the adjusting plate **63** by means of screw jacks **71** threaded through a flange **72** on the mounting plate **63**. The screw jacks provide fine adjustment and coarse adjustment is provided by the bolts **68** in the slots **67**.

Each of the clamping actuators is provided with a clamping pad **73** engageable with the end of a brick **12** at the gripping station. Operation of the actuators **26** presses the bricks inwardly against a center clamping pad assembly **74**, best illustrated in FIGURE 7.

Referring now to FIGURE 7, the central clamping assembly **74** includes two elongated clamping pads **76** and **77** which are supported on their ends by strap hangers **78** and **79**. These hangers are formed with apertures at their upper end loosely fitting over the ends of a mounting sleeve **81** secured to the frame of the carriage **24** by a bolt **82**. It should be understood that similar strap hangers **78** and **79** are provided at each end of the associated clamping pads **76**. The clamping pads are carried back and forth with the carriage **24** but are movable laterally from the full line position of FIGURE 7 to the phantom line position.

A bolt **83** extends through the strap hanger **78** and **79** and is provided with springs **84** which resiliently urge the lower ends of the strap hangers inwardly to the full line position against a wedge bar **86**. When the wedge bar **86** is in the lowermost position the clamping pads **76** and **77** are in the solid line position and when the wedge bar **86** is pulled up between the pads **76** and **77** the pads **76** and **77** are moved laterally to the phantom line positions.

In order to operate the wedge bar **86** a pair of cylinder actuators **87** and **88**, illustrated in FIGURE 5, are used. These actuators are supported at their upper ends on a support frame **89** on the carriage **24**. The pistons **91** of the actuators **87** and **88** connect to the wedge bar **86** at its ends so retraction and extension of the pistons **91** raises and lowers the wedge bar **86** to operate the clamping pads **76** and **77**.

Extension of the clamping actuators **26** slides the associated bricks **12** toward the clamping pads **76** and **77** so the ends of each brick are securely gripped permitting the carrying of the bricks from the conveyor to the stacking elevator.

The structural detail of the board hopper assembly **27** is illustrated in FIGURES 3 and 8. Since there are two stacks of bricks simultaneously formed, one from each of the conveyors **21** and **22**, it is necessary to provide two board hoppers **91** and **92** for chip boards **14** and two hoppers **93** and **94** for wood veneer boards **13**. The four board hoppers **91** through **94** are supported on a reciprocating carriage **96** provided with rollers **97** movable along fixed track members **98**. The piston and cylinder actuator **99** is connected between the base frame and the carriage **96** to move the carriage **96** back and fourth between a first position in which the hoppers **91** and **92** are in alignment with the stacks formed on the elevator **43** and a second position in which the hoppers **93** and **94** are in alignment with the stacks on the elevator. Therefore, when chip boards **14** are required between courses in the respective stacks the actuator **99** is operated to align the hoppers **91** and **92** with the stacks. When veneer boards are required the actuator **99** is operated to move the hoppers **93** and **94** into alignment with the stacks.

Each of the hoppers **91** through **94** is provided with rollers **101** (illustrated in FIGURE 3) which roll along side rails **102** on the carriage **96**. Lock pins **103** extend through a flange on each of the hoppers and through appropriately located holes in the side rails **102** to normally lock the individual hoppers against movement relative to the carriage **96**. The purpose of providing rollers and lock pins on each of the hoppers is to permit their lateral adjustment relative to each other to compensate for variations in dimensions of brick. When shorter brick, such as common brick, are to be stacked the hoppers are adjusted toward each other and when larger Norman type brick are to be stacked the hoppers are adjusted apart. However, the stroke of the actuator **99** and movement of the carriage **96** remains constant to provide proper alignment of the hoppers with the stacking elevator.

Referring to FIGURE 3, a pair of vacuum nozzles **104** and **106** carried by the clamping carriage **24** are connected through a valve to a source of vacuum. When the clamping carriage is in the rearward position (illustrated in FIGURE 3) the nozzles **104** and **106** are positioned over the ends of the boards in the hoppers aligned with the stacking elevator. When vacuum is supplied to the nozzles **104** and **106** the top boards raise up against the nozzles so that they can be carried forward onto the rows of brick located on the stacking elevator when the clamping carriage moves to the forward or clamping position to pickup subsequent row of brick. When wood veneer boards **13** are required the carriage **96** is moved to position the hoppers **93** and **94** in alignment with the stacking elevator and the nozzles operate to pickup and transport the wood veneer boards. Conversely when chip boards **14** are required the carriage **96** is moved to position the hoppers **91** and **92** in alignment with the stacking elevator and the nozzles **104** and **106** pickup and move chip boards **14** onto the rows of brick located on the elevator **43**.

In order to feed the stack of boards contained within the hoppers up to the proper position each hopper is provided with a vertically movable bottom plate **107** connected to the piston of an actuator **108** fixed to the bottom frame of each hopper. As boards are removed from the stacks the pistons of the actuators **108** extend to raise the boards and maintain the top level thereof substantially constant. A control switch **109** is mounted adjacent to each hopper and is provided with an arm **111** resting on the top of each stack of boards. When boards are removed the level of the top of the stack is lowered and the associated arm **111** drops down causing the switch **109** to close and operate a valve **112** which opens to supply fluid

under pressure to the associated actuator **108**. This causes the piston to extend and raise the bottom plate **107** and raises the stack until the associated arm **111** reaches the position which indicates that the elevel of the boards is proper. When this occurs the switch **109** opens and the associated valve **112** closes causing the actuators **108** to lock and maintain the board level.

Chip boards and veneer boards do not lay flat because of warpage and the like, therefore, a pair of clamp bars **113** and **114** are provided to compress one end of the stacks so that the vacuum nozzles **104** and **106** can move over the stacks. The clamp bar **113** extends laterally over both of the hoppers **91** and **92** and the clamp bar **114** extends laterally over the two hoppers **93** and **94**. A clamping actuator **116** supports the clamp bar **113** and a clamping actuator **117** supports the clamp bar **114**. When the actuators **116** and **117** are retracted the associated clamp bars **113** and **114**, respectively, are pulled downward to compress the associated boards and maintain the upper surface at a position immediately below the level of the vacuum nozzles **104** and **106**, preferably, a distance in the order of one half inch. When vacuum is supplied to the nozzles **104** and **106**, the associated actuator **116** or **117** is extended to raise the clamp bar and permit the stack of separator boards to expand toward the vacuum nozzles assisting the vacuum in bringing the top boards against the nozzles. Also raising of the associated clamp bar permits the sliding of the top boards out from under the bar when the boards are carried to the stacking position.

An adjustable end member **118** is provided for each hopper and extends up through a slot in the bottom plates **107**. These adjustable members **118** provide adjustment for boards of different lengths which may be used when different numbers of brick are stacked in each row.

Referring to FIGURE 9, the roller conveyor assembly **29** includes a plurality of rollers **121** journaled for rotation about their longitudinal axis on side frames **122**. The elements are proportioned so that the upper surfaces of the rollers **121** are in alignment with the surface of the stacking elevator **43** when the stacks of bricks are pushed off of the elevator by the pusher plate **49**.

In order to move the stacks of bricks **51** and **52** from the phantom position illustrated into the strapping machine, a roller **123** is journaled at its ends on a chain drive **124**. A motor **126** is connected to the chains **124** by a drive chain **127** so that rotation of the motor **126** in one direction causes the chains **124** to carry the roller **123** to the right above the rollers **121** and rotation in the opposite direction moves the roller **123** to the left. The motor **126** operates to position the roller **123** in the phantom line position **123***a* in alignment with the roller **121** as the pusher pushes the stacks of bricks **51** and **52** onto the roller conveyor. The motor **126** is then operated to move the chains **124** in a clockwise direction causing the roller **123** to move to the full line position at which time it engages the left end of the stacks of bricks **51**. Further operation of the motor causes the stacks of bricks to roll along the rollers **121** off of the conveyor **29** into the strapping machine. After the two stacks are pushed off of the roller conveyor by the roller **123** the motor **126** is operated to return the roller to the position **123***a* so that additional stacks of bricks can be pushed onto the conveyor.

In the illustrated machine the walking beam conveyors **21** and **22** each have a structure as shown in FIGURE 10. Each conveyor includes two parallel fixed rail elements **128** and two centrally located parallel movable or walking rails **129**. The fixed rails **128** are U-shaped in section and provide opposed tracks to receive rollers **131** journaled on a cross shaft **132**. The shafts **132** are mounted on eccentric bearings **133** journaled within sleeve bearings **134** supported in the rails **129**. It should be understood that there are a plurality of similar bearing structures along the rails which provide support for the walking rails **129**. An arm **136** is bolted to each of the eccentric bearings **133** and is connected to a longitudinally extending drive bar **137**. The bar **137** is connected to the piston of a cylinder actuator **138** carried by a plate member **139** so that extension and retraction of the piston of the actuator **138** causes the eccentric bearings **133** to rotate about the axis of the cross shaft **132**. This produces raising and lowering of the walking rails **129** because the bearings **133** have an eccentric outer surface with respect to the cross shaft. Therefore, the actuator **138** operates to raise and lower the walking rails **129**. When the rails **129** are in the lowered position illustrated bricks **12** rest on the fixed rails **128** but when the walking rails **129** are raised by the operation of the actuator **138** the bricks **12** are lifted by the walking rails **129** off of the fixed rails **128**.

A second actuator schematically illustrated at **141** is provided with a piston connected to the member **139** to reciprocate the walking rails **129** longitudinally along the conveyor. The two actuators **138** and **141** are controlled in a timed relationship so that the walking rails **129** are first raised and then moved longitudinally along the conveyor to carry the bricks **12** along the conveyor. The rails **129** are then lowered and returned axially to their original position. This process is repeated to move the bricks along the walking beam conveyor.

Retractable fence members **142** are provided between the conveyor at the clamping station to assist in guiding the bricks as they move along their respective conveyors. Support bars **143** are mounted at axially spaced points on the fence member **142** and are pivoted at **144** on the associated conveyor base. As the bricks are moving along the associated conveyors the retractable fence members **142** are held in the position illustrated in FIGURE 10 by a wedge plate **146**, best illustrated in FIGURE 11.

The wedge plate **146** is provided with spaced camming enlargements **147** proportioned so that when they are positioned between the support bars **143** the fence members **142** are maintained in the illustrated position. However, when the wedge plate **146** is moved axially so that the portions **147** are not between the support bar **143** the fence member **142** can tip inwardly. An actuator **148** is connected to move the wedge plate back and forth as required.

Referring to FIGURE 7, the fence members **142** are normally held in the position illustrated which prevents the bricks from engaging the clamping pads **76** and **77**. When the actuator **148** (illustrated in FIGURE 11) is operated to move cam portions **147** clear of the supports **143** the fence members **142** can tip inwardly as the bricks are pressed against the clamping pads **76** and **77**.

The various actuators of the piston and cylinder type are preferably hydraulically operated and controlled by solenoid valves. The rotary motors may be either hydraulic or electric motors. It should be understood that suitable limit switches are located at various places on the machine along with counters and in some cases photoelectric cells to control the operation of the various actuators and motors in a timed relationship. These limit switches have not been illustrated to simplify the understanding of this invention.

The operation of the machine is as follows. Bricks **12** are placed on the two conveyors **21** and **22** and carried thereby to the clamping station **23**. The retractable stops **32** are positioned in alignment with the associated conveyors so that the bricks are compacted at the clamping or gripping station **23**. When a sufficient number of bricks are compacted in a line of abutting bricks the friction of the bricks being urged toward the retractable stop operates the microswitches **41** which in turn causes the actuators **42** to move the clamping carriage **24** to the right, as viewed in FIGURE 3, until the clamping actuators **26** are aligned with the first thirteen bricks.

The actuator **138** then operates to raise the walking rails **129**, illustrated in FIGURE 10, to lift the brick clear of the fixed rails **128** but the actuator **141** is not operated

to move the walking rails axially. The fence actuator **148** is then operated to permit the fence members **142** to tip inward and the actuators **87** and **88** are operated to raise the wedge bar spreading the clamping pads **76** and **77** to their phantom position, as illustrated in FIGURE 7. The clamping actuators **26** are then operated to extend their clamping pads **73** and slide the bricks inwardly against the clamping pads **76** and **77**, thus gripping the ends of the first thirteen bricks on each conveyor.

The stops **32** are retracted and the actuator **138** is then operated to lower the walking rails **129** and the actuators **42** extend to move the clamping carriage **24** and the bricks carried thereby to the stacking position. At this time the bricks held in the clamping carriage are located immediately above the surface of the elevator **43** or the preceding row of bricks, as illustrated in FIGURE 3. The clamping actuators **26** are then retracted and the bricks are deposited on either the elevator or the previous row of bricks as the case may be.

In the event that a chip board or a veneer board is required at this point in the cycle of operation, the clamping actuator **116** between the hoppers aligned with the stacking station is extended and vacuum is supplied to the vacuum nozzles **104** and **106**. This causes the top board of the two selected hoppers to be picked up by the nozzles.

As soon as a new course of brick is positioned on the stacking elevator a photoelectric cell operates and the actuator **46** lowers the elevator **43** until the light beam of the photocell is reestablished indicating that the upper surface of the top layer of brick is properly positioned to receive a subsequent course of brick.

Movement of the clamping carriage **24** back to the forward gripping position causes the boards carried by the nozzles **104** and **106** to be carried to the stacking position and positioned on top of the top course of brick. The vacuum on the nozzles **104** and **106** is then released and the board is deposited on the top course of brick located on the stacking elevator.

In the event that the board projects upwardly and interrupts the light beam of the photocell the actuator **47** will operate to again lower the elevator **43** until the upper surface of the board is in the proper position to receive the subsequent course of brick. The cycle is repeated positioning a course of brick on a stack with one row on the next until the proper number of rows are stacked on the elevator. At this time the upper surface of the elevator **43** is in position in alignment with the roller conveyor **29** and the pusher plate **49** moves to the right, as illustrated in FIGURE 4, pushing the two stacks of brick off of the elevator onto the roller conveyor.

When the second row of brick from the bottom is gripped a special sequence is provided automatically by the control system to produce the voids **18**. When this course of brick is picked up the clamping carriage **24** is moved over to the full right extreme position but only the left hand two clamping actuators **26** (as viewed in FIGURE 3) are operated to pickup two brick. The actuator **42** then moves the carriage to the left a distance equal to the width of two brick and then the fifth through ninth actuators **26** of each bank of actuators is operated to clamp the five bricks between the voids **18**. The actuator **42** is then operated again to move the clamping carriage **24** to the left a distance equal to the width of two bricks and the right hand two actuators **26** of each bank of actuators is operated to grip the two brick completing that row.

During this time the retractable stop **32** is retracted to clear the brick being carried to the left by the clamping carriage **24**. The actuator **42** is then operated to move the clamping carriage to the left extreme position, as viewed in FIGURE 3, over the stacking elevator **42**. During this operation the hopper operating actuator **99** moves the hoppers **93** and **94** containing the veneer boards **13** into alignment with the stacking elevator and veneer boards are picked up by the vacuum nozzles **104** and **106**. These boards are deposited above the row containing the voids **18** when the clamping carriage **24** returns to pick up the subsequent row of brick.

The machine can be programmed by suitable controls to form stacks of bricks containing rows with any number of brick up to thirteen and stacks having any number of rows up to eight. Also, the operation of the hopper controls and the vacuum controls can be programmed to position a chip board of any predetermined row or rows of brick in the stack.

In the illustrated package of FIGURE 1 a chip board is located between the rows number two and three from the top and the voids **18** are located in the second row from the bottom with a veneer board **13** over the voids **18**.

After the stacks **51** and **52** are completed and pushed onto the roller conveyor **29** the elevator **42** automatically raises to its upper extreme position and a subsequent stack is formed. The roller conveyor **29** operates to push the previously formed stacks into the strapping machine.

With a machine incorporating this invention uniform handling is achieved with full automation. Therefore, damage due to the inconsistent handling of the articles is substantially eliminated and the handling costs are greatly reduced.

Although a preferred embodiment of this invention is illustrated, it is to be understood that various modifications and rearrangements of parts may be resorted to without departing from the scope of the invention as defined in the following claims.

We claim:

1. A system for stacking rectangular articles comprising a platform, conveyor means forming a compacted line of aligned abutting articles at a gripping station, a transfer provided with a plurality of individually operable grippers, each gripper being operable to grip a single article on said conveyor means and cooperating with the other grippers to sequentially move rows of abutting articles to said platform and form a stack of such rows of abutting articles thereon, predetermined gripper being inoperative when gripping articles in predetermined rows thereby leaving voids intermediate the ends of said predetermined rows, said predetermined rows including abutting articles on each side of said voids.

2. A brick stacking machine comprising a conveyor operable to deliver bricks to said machine, a vertically movable stacking platform, transfer means operable to move rows of bricks each containing a plurality of aligned and abutting bricks from said conveyor and stacking such rows on said platform with subsequent rows placed on top of preceding rows, said platform lowering as rows are stacked thereon so that the top row thereon is in position to receive subsequent rows, said transfer means producing voids in a predetermined row in said stack, means positioning a separator board over said voids, and pusher means moving the completed stack having a predetermined number of rows off of said platform.

3. A brick stacking machine comprising a conveyor operable to deliver bricks to said machine and form a compacted line of abutting brick at a gripping station, a vertically movable stacking platform, transfer means operable to move rows of bricks each containing a plurality of aligned and abutting bricks from said gripping station and stacking such rows on said platform, said transfer means including gripping means operable to grip opposed lateral faces of each brick in said row, said platform lowering as rows are stacked thereon so that the top row thereon is in position to receive a subsequent row, said transfer means producing voids intermediate the ends of a predetermined row in said stack, said predetermined row containing abutting and aligned bricks, means positioning a separator board over said predetermined row and a separator element formed of a material different than said separator board on at least another row spaced from said predetermined row.

4. A system for stacking rectangular block-like articles comprising a stacking elevator adapted to support a stack of articles, said stacking elevator being vertically movable to automatically position the upper surface of supported articles at substantially a predetermined level, gripper means operable to successively grip a course of articles consisting of a plurality of aligned abutting articles at a first location and horizontally carry such course to a position over said elevator immediately above said predetermined level and thereafter release said course of articles for support by said elevator, repeated lowering of said elevator and repeated operation of said gripper means producing a stack of courses on said elevator, and pusher means operable to push said stack of courses laterally from said elevator after said stack contains a predetermined number of courses, said gripper means producing a void intermediate the ends of a predetermined course in each stack, said predetermined course including abutting articles on at least one side of said void, and means positioning a separator board over said void.

5. A stacking machine for block-like articles comprising a pair of parallel conveyors each operable to produce a compacted line of aligned and abutting articles, a stacking platform, transfer means operable to simultaneously grip a row of articles from each conveyor and release each row over said platform to simultaneously form two stacks, each row having a predetermined length, said platform lowering as rows are positioned thereon so that the top row thereon is in position to receive a subsequent row, said transfer means producing voids intermediate the ends of corresponding predetermined rows on said platform, said predetermined rows including aligned abutting bricks on each side of the voids therein, separator means positioning a separator board on each predetermined row, and pusher means pushing both stacks of rows off said platform after each stack has a predetermined number of rows.

6. A system for handling rectangular block-like articles comprising a conveyor operable to move a plurality of spaced generally aligned articles toward a gripping station, stop means at said gripping station operable to prevent movement of said articles with said conveyor and cause a plurality of such articles to form a compacted line of aligned and abutting articles, sensing means operable to sense the length of said compacted line, a stacking platform, a gripper carriage movable from a forward position to a rearward position, gripper means on said carriage operable when said carriage is in said forward position to grip a row of abutting articles of a predetermined length at said gripping station and carry such row to a position over said platform as said carriage moves to its rearward position, then releasing such row for support by said platform, said sensing means preventing operation of said gripper means when said compacted line does not contain sufficient articles to form a full row, separator element storage means, a separator element transfer positioned over said storage means when said carriage is in said rearward position and over said platform when said carriage is in said forward position, said separator transfer being operable to grip a separator element at said storage means and position such element on a row of articles supported by said platform as said carriage moves from its rearward position to its forward position.

7. A system for stacking rectangular articles comprising means producing a compacted line of abutting articles at a gripping station, a gripper movable from said gripping station to a stacking station operable to grip a row consisting of a plurality of said articles at said gripping station and transfer such row to said stacking station, a vertically movable platform at said stacking station adapted to receive a stack of rows with the platform lowering as rows are stacked thereon, said gripper when gripping predetermined rows operating to leave selected articles at said gripping station thereby producing voids intermediate the ends of said predetermined rows, said predetermined rows including abutting and aligned articles between said voids, a source of separator boards, and means operable to position a separator board over said voids.

8. A system as set forth in claim 7 wherein said last named means is operable in response to movement of said gripper away from said stacking station.

9. A brick stacking machine as set forth in claim 2 wherein said conveyor includes stop means operable to resist movement of said articles with said conveyor to form a compacted line of aligned abutting articles, said stop means operating to permit operation of said transfer means only when said compacted line includes a sufficient number of articles to form said rows.

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