Sept. 22, 1970 R. C. EDWARDS, JR 3,529,395

BRICKLAYING MACHINE

Filed June 24, 1968 3 Sheets-Sheet 1

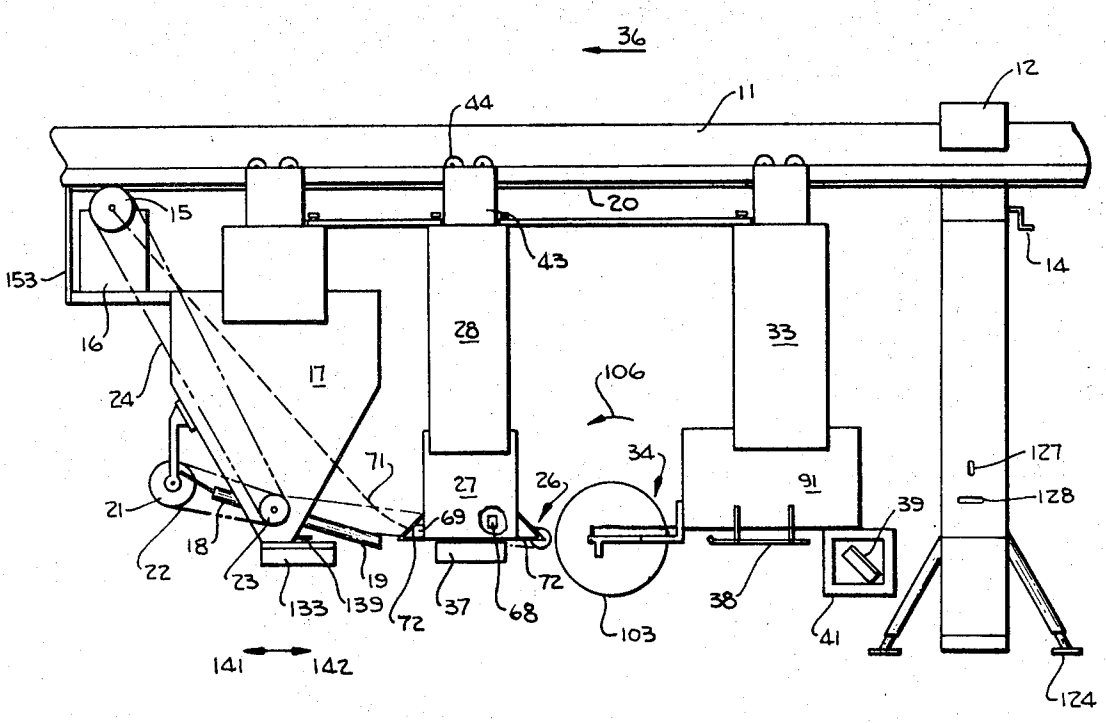


Fig. 1.

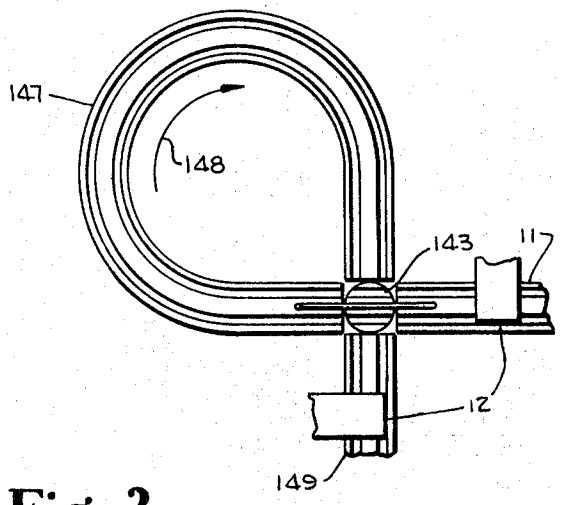


Fig. 2.

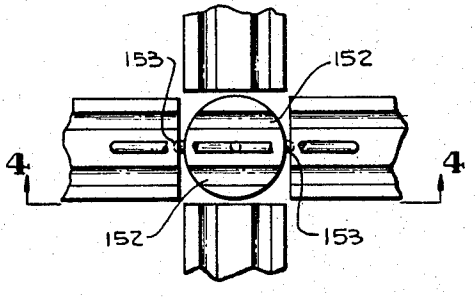


Fig. 3.

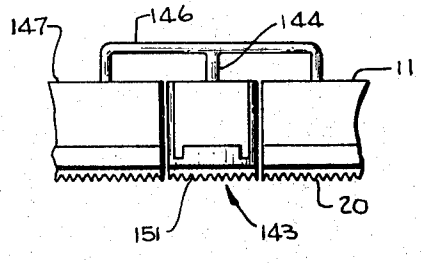


Fig. 4.

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BRICKLAYING MACHINE

Filed June 24, 1968 3 Sheets-Sheet 2

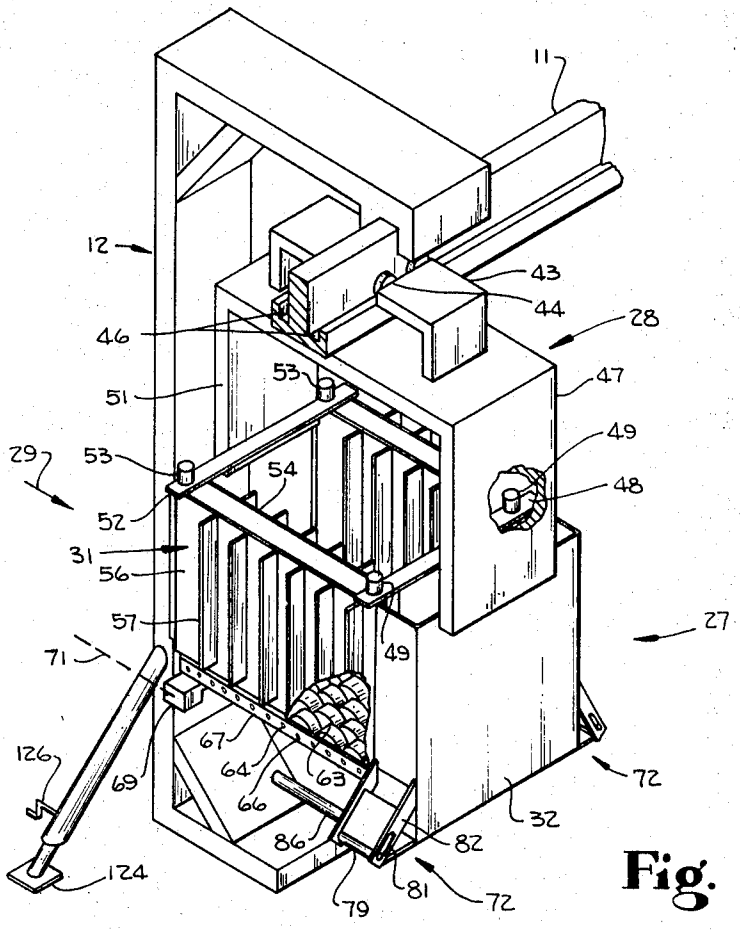


Fig. 5.

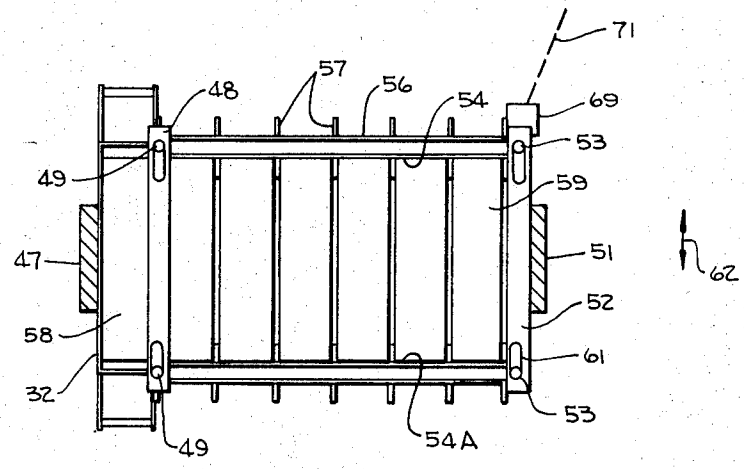


Fig. 6.

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BRICKLAYING MACHINE

Filed June 24, 1968 3 Sheets-Sheet 3

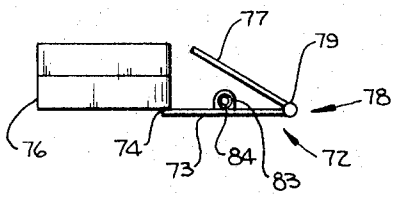


Fig. 7.

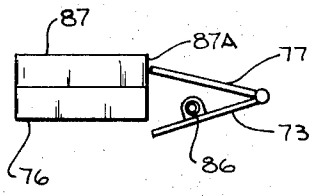


Fig. 8.

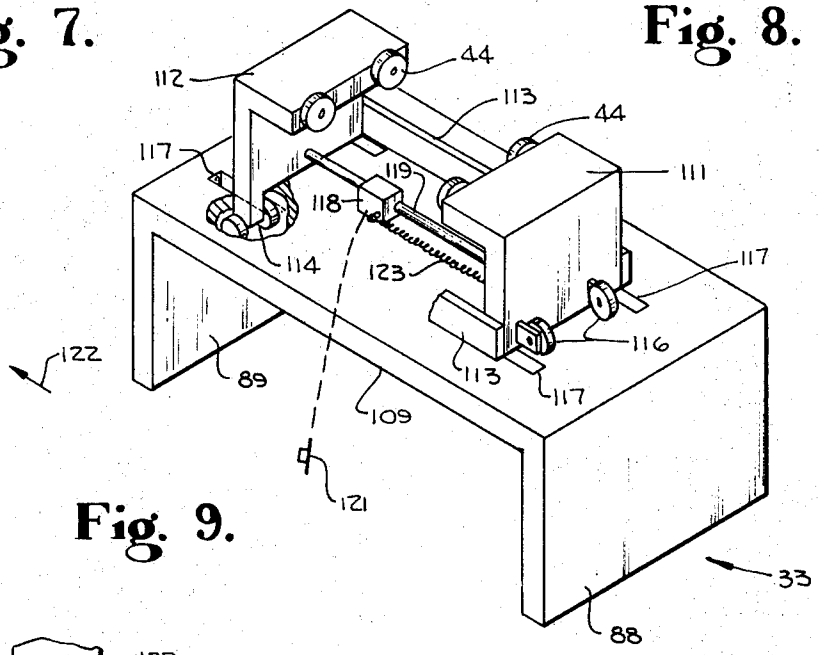


Fig. 9.

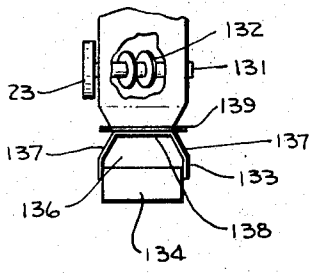


Fig. 10.

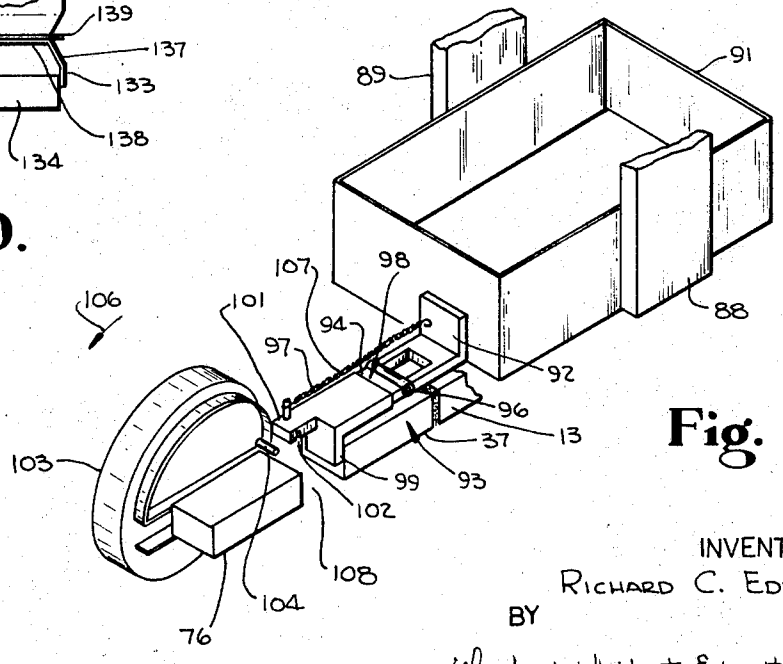


Fig. 11.

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3,529,395

BRICKLAYING MACHINE

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Filed June 24, 1968, Ser. No. 739,309
Int. Cl. E04g 21/22
U.S. Cl. 52—749 12 Claims

ABSTRACT OF THE DISCLOSURE

A plurality of carriages connected together and suspended from a rail supported by stands vertically adjustable and outside a line of a wall to be built. A drive motor for carriage movement in unison along the rail and driving various components including a mortar pump, brick release latch, a brick stack conveyor, and a joint closer.

BACKGROUND OF THE INVENTION

Field of the Invention.—This invention relates generally to building construction apparatus, and more particularly to a machine for depositing discrete building units together with a suitable bonding agent for wall construction.

Description of the Prior Art.—Examples of prior art patents are as follows: 1,606,001, Thomson, Nov. 9, 1926; 1,666,555, Cottier, Apr. 17, 1928; 1,686,279, Kaye, Oct. 2, 1928; 1,786,622, Layer, Dec. 30, 1930; 3,177,621, Demarest, Apr. 13, 1965; 3,325,960, James, June 20, 1967.

Apparently for some one or multiplicity of reasons, prior art machines have not achieved widespread success. Some of them are awkward and cumbersome and susceptible to malfunction. Others require the wall itself for their support, which imposes certain limitations on the number of courses which can be laid within a given time to allow for mortar setting. The present invention is believed to meet the requirements for an acceptable and feasible bricklaying machine.

SUMMARY

Described briefly, in a typical embodiment of the present invention, a suspended carriage assembly is mounted to an overhead rail and driven along by a motor. A supply of bricks and mortar is maintained on the assembly, and suitable mechanisms are provided for operation by the motor for deposit of mortar and bricks at the proper location and sequence to construct a brick wall. Gapping, leveling, and trimming means are also provided, and an adjustable conveyor is incorporated for controlling brick movement in the carriage for maintenance of a continuous supply.

BRIEF DESCRIPTION OF THE DRAWINGS

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

FIG. 1 is a schematic elevational view of a typical embodiment as seen from inside the line of the wall to be built.

FIG. 2 is a top plan view of corner loop in the support rail.

FIG. 3 is an enlarged top plan view of a switch at the loop intersection.

FIG. 4 is an elevation at line 4—4 in FIG. 3.

FIG. 5 is an enlarged perspective of the brick hopper as seen from inside the wall line.

FIG. 6 is a top plan view of the brick hopper.

FIG. 7 is a further enlarged elevation of one of the brick latches holding a brick to be deposited.

FIG. 8 is a view like FIG. 7 but showing the latch operated to release a brick.

FIG. 9 is a highly enlarged view of hanger details for shifting of a unit to traverse window openings.

FIG. 10 is an enlarged end view of the lower portion of the mortar hopper, and the mortar shaper.

FIG. 11 is an enlarged perspective of the joint closer.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in detail, and particularly the assembly drawings, a group of hangers is mounted on a rail **11** which extends parallel to the proposed building wall and is supported by a number of C-shaped stands **12** mounted on the ground and spaced along the proposed wall to the exterior thereof. A suitable crank **14** is provided on each of the stands for raising the rail **11** for each subsequent course of brick. A suitable gear mechanism (not shown) can be provided in each of the stands for use with a story pole thereon to facilitate determination of the appropriate change of elevation as each course of brick is laid.

The machine includes a motor **16** driving the gear **15** engaging a gear rack extending along the underside of the rail **11**. This moves the carriage assembly along the rail in the direction of arrow **36** and rack **20**.

In one of the carriages a mortar hopper **17** is provided and has an outlet at its bottom for depositing mortar on the top of the previously laid course of brick, as the carriage is moved along by the motor. It also has a pump **18** extending therethrough with a discharge pipe **19** for depositing some mortar at the end of each brick for the butt joint. This pump is driven by an eccentric or some other such mechanism **21** driven by a chain **22** from sprockets **23** on an auger-shaft driven by chain **24** from the motor **16**.

An additional chain and eccentric mechanism **26** is provided to release one brick-at-a-time from a brick "hopper" **27** mounted on another carriage **28** connected to the mortar hopper carriage to be pulled along therewith. The bricks are loaded into the outside end if this hopper in the direction of arrow **29** and a belt-type advancing means **31** (which will be described in more detail at a later point) is effective to move each stack of bricks into the vertical discharge column or drop chute **32** at the inner end of the hopper as soon as all of the bricks have been discharged from the stack in the discharge column. A suitable switch structure can be mounted in the discharge chute to sense the absence of a stack of bricks therein and engage a clutch to cause the conveyor to drive a new stack of bricks into position in the discharge column.

A joint closer is mounted on the last carriage **33** at **34** and will be described in more detail hereinafter. Its purpose is to be sure that each brick dropped from the brick hopper discharge column **32** is moved snugly into place at the proper end gap distance from the immediately preceding brick. For example, brick **37**, the one still below the brick hopper column from which it was deposited, might have its end two inches from the end of the previously laid brick. The joint closer will move this brick closer to the preceding brick to close up the gap for an appropriate ⅜ inch butt joint spacing, for example. The joint closer is driven by appropriate chains and sprockets driven by the motor **16**.

The last carriage suspended from the rail supports the brick leveler **38** and that is followed by a trowel **39** for finishing the joint at the exterior of the wall, the trimmed mortar being deposited in the box **41** for occasional removal by a hod carrier.

All of the carriages are connected together so that a constant axial or longitudinal spacing is maintained between them and they are moved along in unison by the drive motor **16**. It is to be noted in FIG. 2, however, that

a loop is provided in the rail, the loop being disposed in a horizontal plane. The purpose of this loop is to enable the machine to go around a corner of a building. The lineal distance around the loop from the point of intersection of the two intersecting runs of carriage support rail, is adequate to enable the entire assembly of carriages to traverse the loop without collision of the mortar hopper with the leveler and trimmer carriage. It must be recognized, of course, that the connection between the various carriages must be such that while it prevents any variation in axial or linear distance between the various carriages, it will permit them to traverse the loop without difficulty. Once the loop has been traversed, the machine begins laying the intersecting wall. It can be recognized, of course, that virtually any angle of intersection can be provided and the included angle of intersection of the loop would be selected accordingly.

Referring now to certain features in more detail, the pump **18** can be a simple piston-type pump having an inlet in the mortar hopper for entry of mortar into the cylinder of the pump, and discharge therefrom to the pipe **19** by advance of the plunger in the pump. A more sophisticated type of pump, with valves and the like might be provided, but it is preferred to keep the apparatus as simple and inexpensive as possible.

Referring now particularly to the brick hopper **27**, the carriage **28** therefor, much like the other carriages, is suspended from the rail **11** by two hangers **43** each having two rollers **44** thereon received in the grooves **46** in the rail **11**. The downwardly projecting arm **47** of the carriage supports a generally box-like structure which forms the vertical discharge column or drop chute **32**. At the upper and lower ends of this chute, horizontal plates **48** are provided and serve as upper and lower supports for conveyor belt idler shafts **49**.

At the outer end of the brick hopper, the downwardly extending arm **51** of carriage **28** also supports upper and lower plates **52** which serve as upper and lower pivots for conveyor belt spools **53**. Each of these spools **49** and **53** supports two runs of a conveyor belt. For example one of the spools **49** and **53** supports an inner run **54** and outer run **56** of a woven metal belt having a plurality of horizontally spaced upstanding cleats **57** thereon. The spacing between these cleats is just a bit greater than the width of the bricks to be disposed in the hopper so that the inner runs **54** and **54A** of the facing belts serve to locate seven stacks of bricks in the illustrated embodiment, the stack **58** being in the vertical discharge column, and the stack **59** being at the outer end of the hopper, most remote from the discharge column. The upper and lower bars at each end of the hopper are horizontally slotted as at **61**, for example, to enable movement of the belt **54–56** in the direction of arrow **62** to accommodate longer or shorter bricks, such as eight inch long bricks or twelve inch long bricks, as desired. Suitable locating clips can be provided on the bars **48** and **52** to enable positioning of the spools **49** and **53** at the desired location for the length of bricks to be used.

In order to support the bricks so that they can be readily moved by the conveyor from the outer end toward the inner end of the brick hopper, the bottom surface may be made of a series of anti-friction bearings **63** in a staggered arrangement, alternate rows being mounted on common shafts **64** and **66**, respectively, the latter being supported in horizontal frames **67** connected to the carriage members **47** and **51**, through appropriate end plates. The type of anti-friction bearings contemplated is a sealed ball bearing. Other devices might also be used to facilitate movement of the bricks by the brick hopper conveyor belts.

A switch **68** may be located in the discharge chute to sense the absence of a brick therein when the last brick of a stack is in position for release onto the wall. Closure of this switch engages a clutch **69** connected to the drive motor **16** as indicated by the dotted line **71** and also connected to the drive spools **53** for the two belts to drive them until the next stack of brick is disposed in the discharge column to de-activate the switch **68**.

During operation of the apparatus, while laying bricks that are eight inches long, a brick must be released from the discharge chute once for about every eight and three-eighth inches of travel of the apparatus, considering a three-eighth inch butt joint between successive bricks in a course. For this purpose brick latches are provided, one at each end of the brick at the bottom of the discharge chute. A description of one will suffice for both, as they are identical.

The brick latch **72** includes a lower plate **73** having an inner edge **74** disposed under the end of brick **76**. Another plate **77** is affixed to plate **73** at **78** and a pin **79** extends lengthwise of the junction **78** and is received in slots **81** in the outwardly projecting downwardly extending arms **82** at the drop chute. The angular relationship between the plates **73** and **77** remains virtually constant and a cam follower lug **83** may be provided on the upper surface of plate **73** but located so it will not interfere with bricks engaging the edge **74**. The aperture in this lug receives a cam **84** mounted on the drive shaft **86** which is driven by a suitable chain drive **26** from the motor **16**.

As the chain **26** drives the shaft **86** in rotation, the cam moves the plates **73** and **77** from the position shown in FIG. 7 to the position shown in FIG. 8 whereupon the brick **76** can fall onto the mortar atop the immediately lower course of bricks, and a brick **87** moves down to replace brick **76**. Brick **87** is prevented from falling out of the chute by engagement of plate **77** with the end **87A** of the brick. Engagement of this retainer plate **77** for this brick latch and the corresponding retainer plate for the other brick latch serves to prevent brick **87** from dropping out on top of brick **76**. As the shaft **86** continues to rotate, it moves the plates back to the initial position whereupon the brick **87** comes to rest on the edge **74** of the lower plate **73**. It is then ready for deposit on the mortar next to brick **76**.

The downwardly projecting arms **88** and **89** of carriage **33** support a frame **91**. The joint closer **34** is disposed between the brick hopper and the front end of frame **91** and includes a mounting bracket **92** which is affixed to the front end of the carriage frame **91**. A pulling arm assembly **93** is mounted to the bracket by means of a rear arm portion **94** hinged to the bracket at **96**, the front arm portion **97** being telescopically received on the rear arm portion at **98**. The front arm portion includes a downwardly projecting end-engaging lug **99**, and a forwardly projection portion **101** having a drive pin receiver slot **102** therein.

An oscillator wheel **103** driven by motor **16** is provided with a pin **104** (FIG. 11) thereon receivable in the notch **102**. As the oscillator wheel rotated in the direction of arrow **106**, pin **104** moved upward into the slot **102** to lift the front end of the closer arm assembly **93** and move it forward over brick **37** which had just been deposited so that the lug **99** moved down in front of the front end of that brick as the oscillator wheel completed a half revolution. Then the pin disengages from the slot **102** permitting the return spring **107** to pull the front end portion **97** back along the rear end portion **94** toward the hinge **96**. In so doing, the brick **37** was moved back approximately one and five eighths inches to provide the desired three eighths inch butt joint gap between brick **37** and brick **13**. As this occurred, the oscillator wheel completed the other half revolution to the position shown in FIG. 11, and another brick **76** dropped from the chute. Again, approximately a two inch end gap existed as at **108** between brick **76** as dropped, and brick **37** as properly positioned in the wall. The pin **104** engages the slot **102** and the cycle is repeated for brick **76**. As each brick is dropped from the chute onto the wall, the end of the brick is "shot" with mortar by the pump discharge pipe **19**.

In some building construction, windows and doors will

be framed in before the brick is laid. In that event it may be necessary for the machine of the present invention to move outwardly and inwardly with respect to the wall line as a window or door opening is passed. For that purpose suitable provisions are made on the carriages as will now be described.

Referring particularly to FIG. 9, some upper details of carriage **33** are shown by way of example. The inner and outer support arms **88** and **89** are connected by the bridge **109** and hang on the hangers **111** and **112** whose horizontal space is determined and fixed by the struts **113** and the hangers being mounted to the rail **11** by the rollers **44**. The bridge is supported on the hangers by rollers **114** beneath the bridge portion **109**, with rollers **116** or otherwise suitable means being provided on top for stability. The mounts for rollers **114** project downwardly through the longitudinal slots **117** provided in the bridge and the bridge has a solenoid **118** affixed to the central portion thereof, with armature extension rods **119** extending therefrom to the hangers **111** and **112**. By pushing an appropriate button **121**, for example, the solenoid **118** is energized to shift the bridge **109** and depending arms **88** and **89** therewith outwardly in the direction of the arrow **122** an amount sufficient to clear any framing which might be provided in the wall for doors, windows, or other features of construction. An example would be a two inch shift, and for this purpose a solenoid having a two inch stroke would be used. Other means might also be provided such as a motor, gear and rack assembly for effecting the side shift of the carriage. Once the obstruction has been passed, a return spring **123** connected between one of the hangers and the bridge member or solenoid frame will return the unit to its original condition. An alternative would be to employ a double acting solenoid with appropriate control buttons. Other alternatives might also be devised.

The rail support stands can be connected to scaffolding or any other structure for stabilization, if desired. They can also be provided with appropriate leg leveling means including extendable feet **124** adjustable by suitable cranks **126**. Built-in bubble levels **127**, **128** can be employed to aid in achieving plumb conditions.

In the foregoing description, it is mentioned that a sprocket **23** on an auger shaft is driven by chain **24**. This auger shaft **131** is disposed partially inside and partially outside the mortar hopper, the portion inside having any suitable blades **132** thereon for encouraging an uninterrupted flow of mortar from the hopper onto the course of brick as the unit is moved along.

If desired to do so, in locations remote from a source of electric power, the mortar carriage can be used to mount an engine-generator set of sufficient capacity to drive the motor **16**.

As shown in FIG. 1, the lower end of the mortar hopper **17** has a mortar shaper **133** thereon in order to provide a bed of mortar of a proper configuration for reception of a brick from the brick chute. FIG. 10 shows an end view of the mortar shaper with a brick **134** being down schematically to illustrate the nature of cross section of the mortar deposited and shaped by the mortar shaper **133** at **136**. This includes chamfered upper edges at **137** and a flat top **138**. A plate **139** can be provided in the bottom of the mortar hopper at the top of the mortar shaper, for sliding in and out in the direction of the arrows **141**, **142** (FIG. 1) to reduce or increase the hopper outlet size and thereby adjust the rate of discharge of mortar from the hopper.

Referring now to FIG. 2, the rail **11** has a loop formed therein at **147** to enable the bricklaying machine to move around the loop in the direction of the arrow **148** and move down the rail **149** perpendicular to rail **11**. To facilitate passage of the carriages through the intersection into and out of the loop, a switch **143** is provided at the intersection. As shown in FIG. 4, this switch is mounted on a central pivot shaft **144** secured on a bridge **146** between the rail **11** and the loop **147**. The switch has a rib **151** on the lower edge thereof and on which the gear rack **20** is continued. The sides of the rib are aligned with the track grooves **152** therein. As long as this rib is parallel to the section of rail in which the carriages are moving, they will move past the intersection properly. In order to assure that this is the case, a cam **153** is provided at the forwardmost end of the front carriage. In the event that the switch is 90° from the direction needed for passage of the carriages, this cam, which is just to the left of the center and under the rail, will engage the rib **151** and turn the switch to a condition parallel with the rail on which the carriages are moving, as the machine moves along. In order to maintain the proper orientation of the switch during passage of the machine thereover, suitable detent means are provided. An example is the two spring loaded pins **153** provided in the switch and received in appropriate detent notches in the ends of the rail sections facing the intersection.

While the invention has been disclosed and described in some detail in the drawings and foregoing description, they are to be considered as illustrative and not restrictive in character, as other modifications may readily suggest themselves to persons skilled in this art and within the broad scope of the invention, reference being made to the appended claims.

The invention claimed is:

1. A bricklaying machine comprising:
a generally horizontal rail;
ground engaging means supporting said rail;
carriages mounted on said rail and connected together for movement in unison along said rail;
drive means on one of said carriages and driving said carriages along said rail;
a mortar supply means on one of said carriages and having outlet means disposed to discharge mortar where a brick is to be deposited; and
a brick hopper in one of said carriages;
release means associated with said brick hopper for timely release of bricks therefrom for deposit on a wall as said carriages move along said rail;
said ground engaging means including a plurality of horizontally-spaced, ground-supported telescopic posts, with height adjustment means thereon including a story pole and hand crank on each of said posts to raise said rail for each successive course of bricks.

2. A bricklaying machine compirsing:
a generally horizontal rail;
ground engaging means supporting said rail;
carriages mounted on said rail and connected together for movement in unison along said rail;
drive means on one of said carriages and driving said carriages along said rail;
a mortar supply means on one of said carriages and having outlet means disposed to discharge mortar where a brick is to be deposited; and
a brick hopper in one of said carriages;
release means associated with said brick hopper for timely release of bricks therefrom for deposit on a wall as said carriages move along said rail;
said brick hopper including endless conveyor means disposed to move bricks in stacks toward the point of release, said conveyor means being periodically coupled to said drive means upon exhaustion of a stack of bricks, to move another stack into position for release.

3. The machine of claim **2** wherein:
said brick hopper includes a floor of anti-friction bearing means to facilitate movement of said brick stacks by said conveyor means toward a vertical discharge column above said point of release.

4. The machine of claim **3** and further comprising:
a joint closer on one of said carriages and following said release means, said closer including:
a lug driven by said drive means between positions behind and ahead of a brick deposited by said release

means, and engageable with said deposited brick for movement thereof back toward a previously deposited brick.

5. The machine of claim **4** and further comprising:

pump means having an inlet associated with said mortar hopper and an outlet disposed to discharge mortar onto a butt end of a deposited brick; and

a leveler and trowel behind said joint, and

a motar box associated with said trowel for receipt of mortar trimmed by said trowel.

6. A bricklaying machine comprising:

a generally horizontal rail;

ground engaging means supporting said rail;

carriages mounted on said rail and connected together for movement in unison along said rail;

drive means on one of said carriages and driving said carriages along said rail;

a mortar supply means on one of said carriages and having outlet means disposed to discharge mortar where a brick is to be deposited; and

a brick hopper in one of said carriages;

release means associated with said brick hopper for timely release of bricks therefrom for deposit on a wall as said carriages move along said rail;

said rail having a loop therein lying in a horizontal plane and enabling passage of said carriages around a corner.

7. The machine of claim **6** wherein:

the lineal distance around said loop exceeds the overall length of said carriages.

8. The machine of claim **6** and further comprising:

a switch at the intersection of portions of said loop, said switch being suspended from a bridge over said intersection and pivotally mounted thereto for rotation on a vertical axis for alignment of carriage roller receiving grooves therein with carriage roller receiving grooves in said rail, said switch having detent means therein to maintain alignment thereof with the rail during passage of carriages across said intersection.

9. A bricklaying machine comprising:

a generally horizontal rail;

ground engaging means supporting said rail;

carriages mounted on said rail and connected together for movement in unison along said rail;

drive means on one of said carriages and driving said carriages along said rail;

a mortar supply means on one of said carriages and having outlet means disposed to discharge mortar where a brick is to be deposited; and

a brick hopper in one of said carriages;

release means associated with said brick hopper for

timely release of bricks therefrom for deposit on a wall as said carriages move along said rail;

and carriage shift means disposed between said rail and one of said hoppers, said shift means including an actuator operable transverse to the direction of said rail, said actuator being operable, when energized, to shift said hopper outwardly with respect to the line of a wall, to traverse wall interruptions.

10. In a bricklaying machine the combination comprising:

brick hopper floor means for supporting a plurality of stacks of bricks,

endless belt means extending at the side of said floor means from an entrance toward an exit and having finger means thereon at spaced locations therealong between said entrance and said exit and engageable with bricks stacked on said floor means for movement thereof from said entrance toward said exit.

11. The combination of claim **10** and further comprising:

brick release means at said exit, said release means including a first member having an edge portion disposed below and supporting the lowermost brick in the stack at said exit, said release means including first oscillator means coupled to drive means and operable thereby to move the edge of said first member out from under said brick for release thereof;

and said release means including a second member operable by said drive means along with said first member to engage and hold the brick next above said lowermost brick as said lowermost brick is released.

12. The combination of claim **10** wherein:

said hopper lower means include low friction means facilitating lateral movement of stacks of bricks therealong from said entrance toward said exit.

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PRICE C. FAW, JR., Primary Examiner

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