June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

Filed Nov. 30, 1945 26 Sheets-Sheet 1

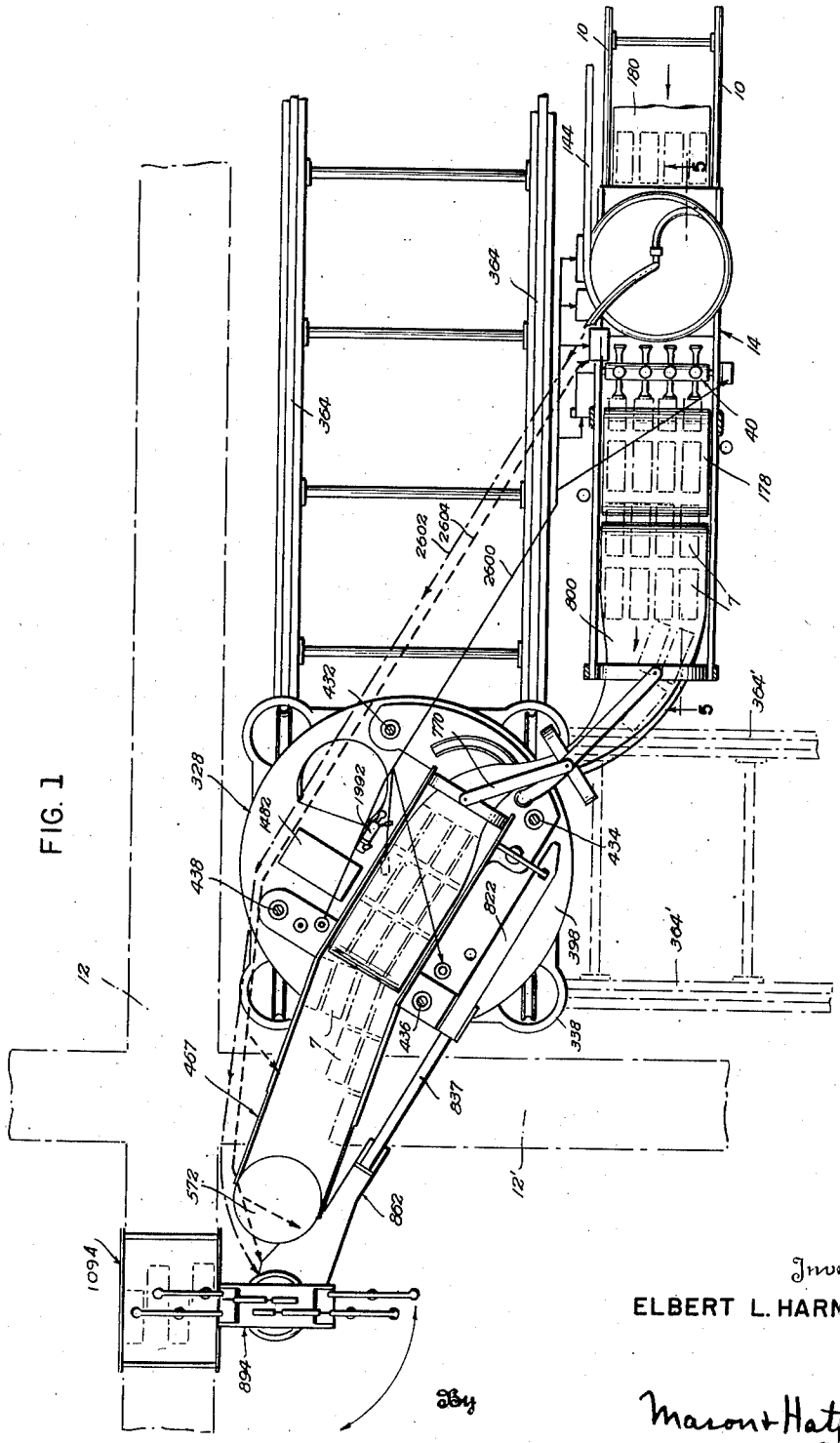


FIG. 1

Inventor
ELBERT L. HARNEY

By Mason + Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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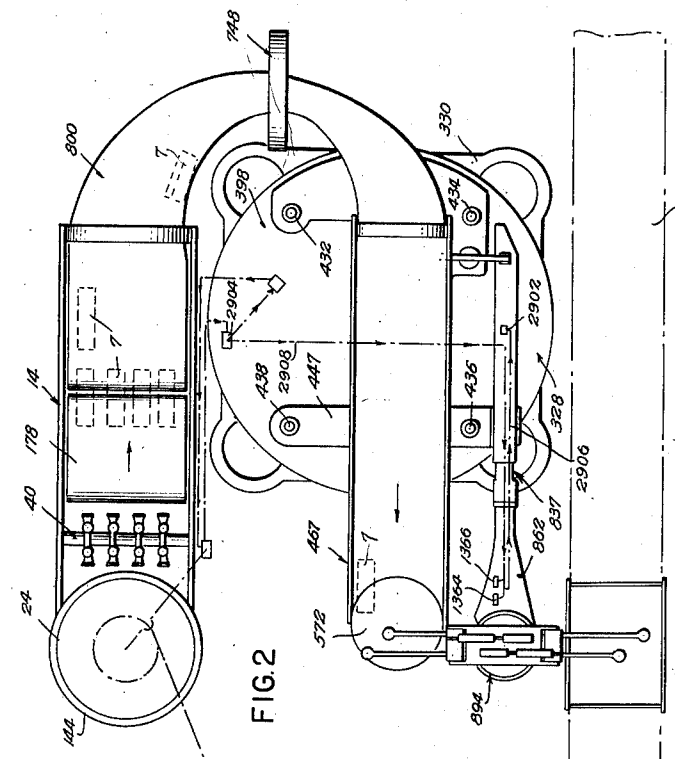


FIG. 2

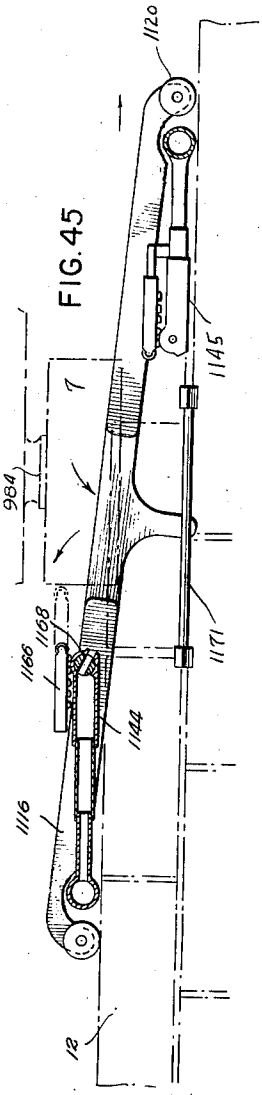


FIG. 45

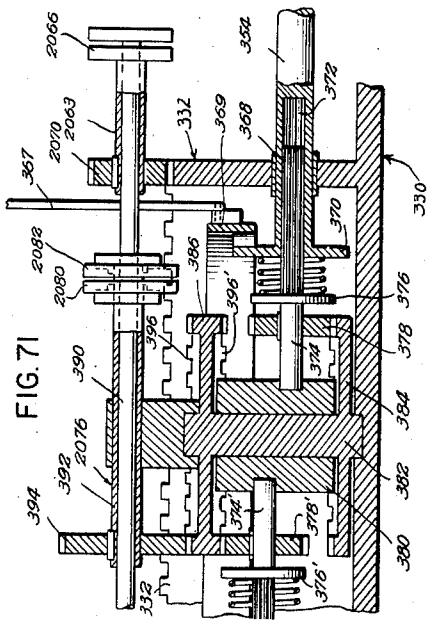


FIG. 71

Inventor
ELBERT L. HARNEY

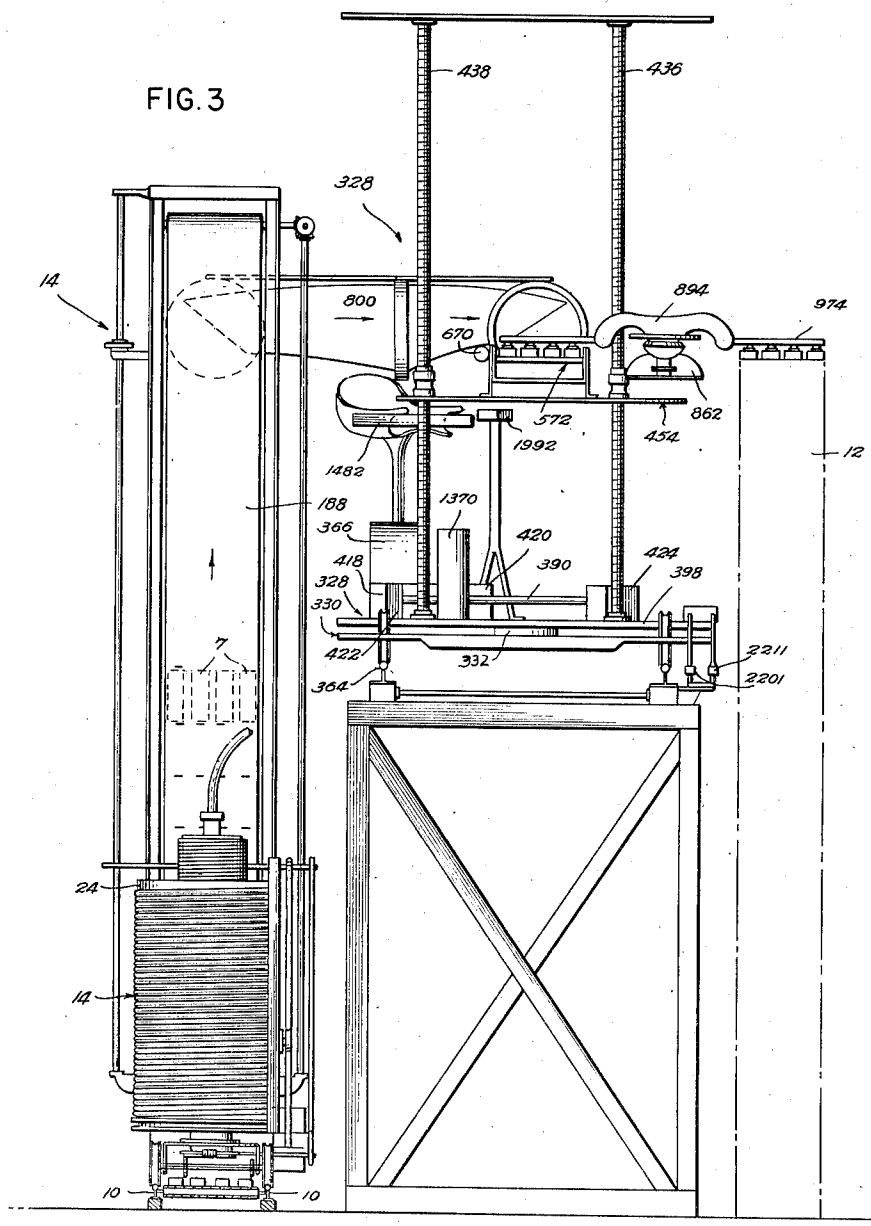
By Mason & Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

Filed Nov. 30, 1945 26 Sheets-Sheet 3

FIG. 3



Inventor

ELBERT L. HARNEY

By Mason & Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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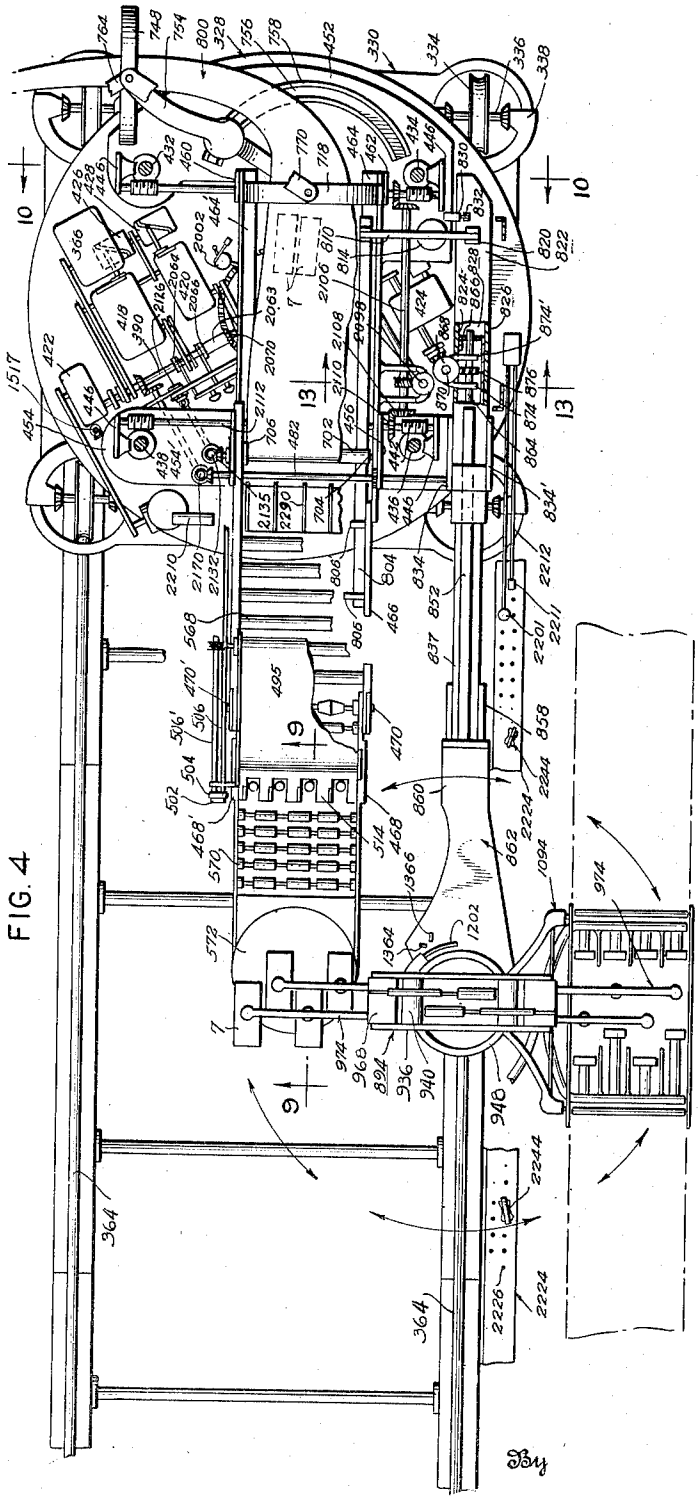


FIG. 4

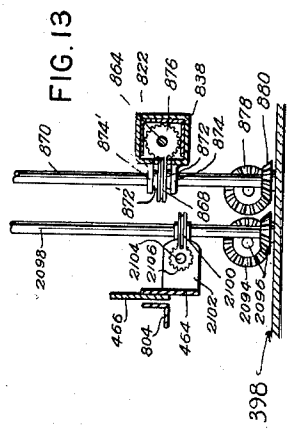


FIG. 13

Inventor
ELBERT L. HARNEY

By Mason & Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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FIG. 5

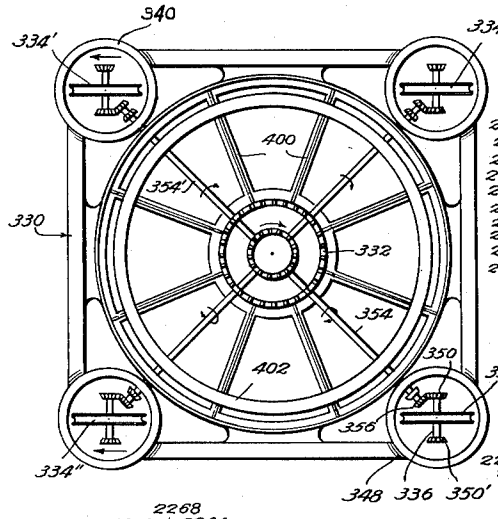


FIG. 6

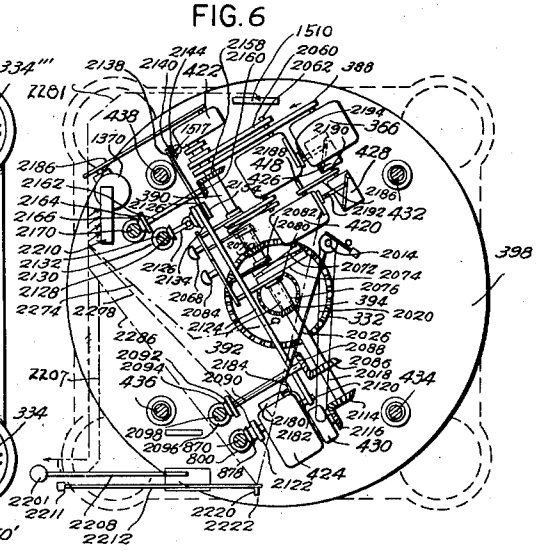


FIG. 70

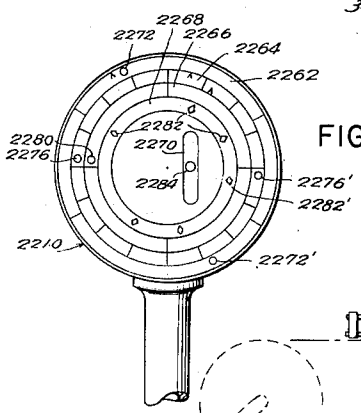
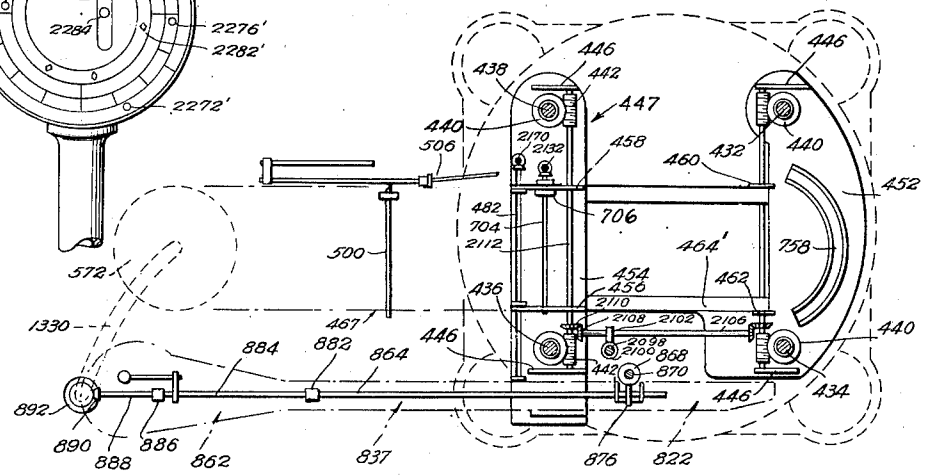


FIG. 7



Inventor

ELBERT L. HARNEY

By Marson & Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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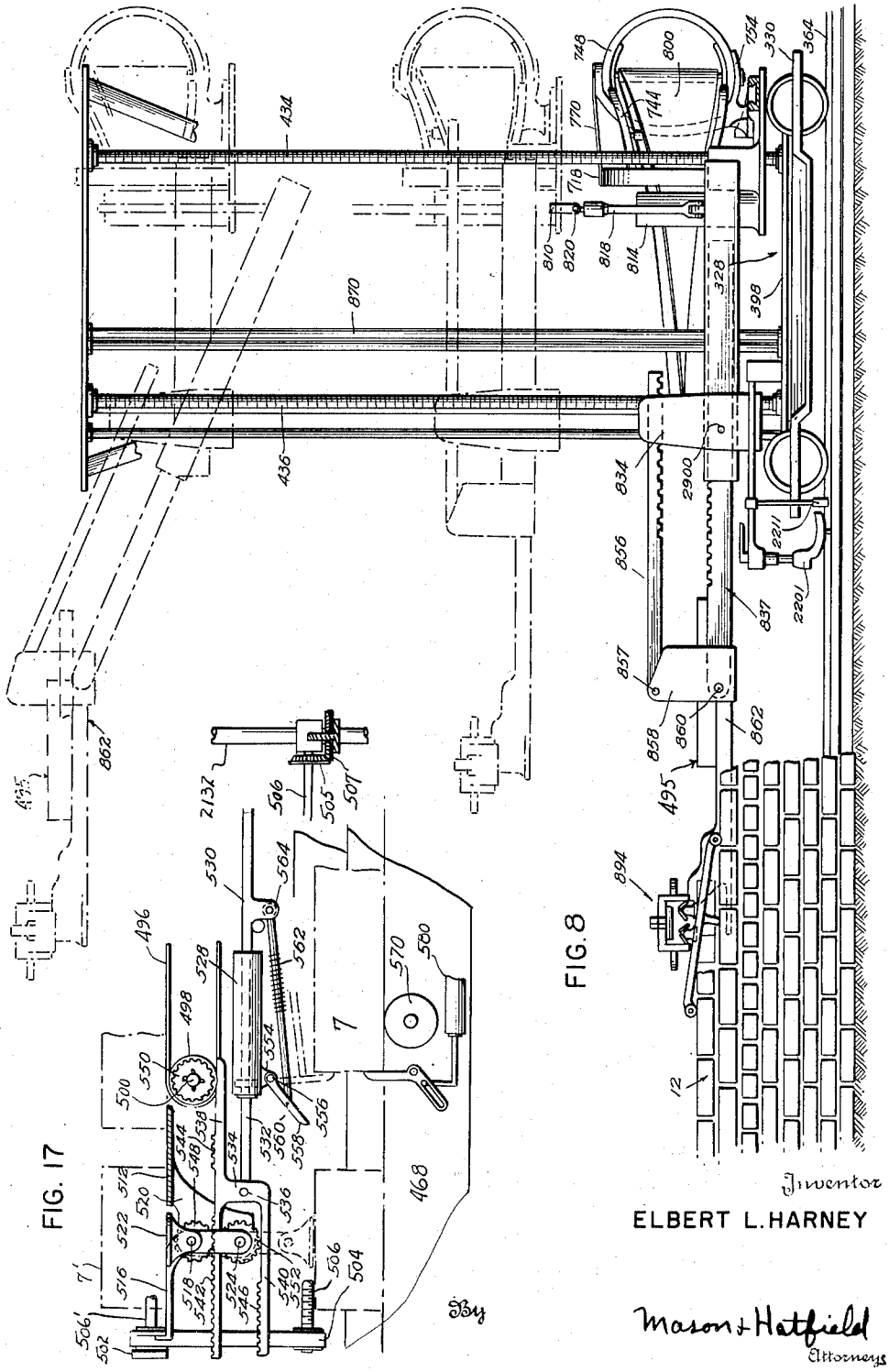


FIG. 17

FIG. 8

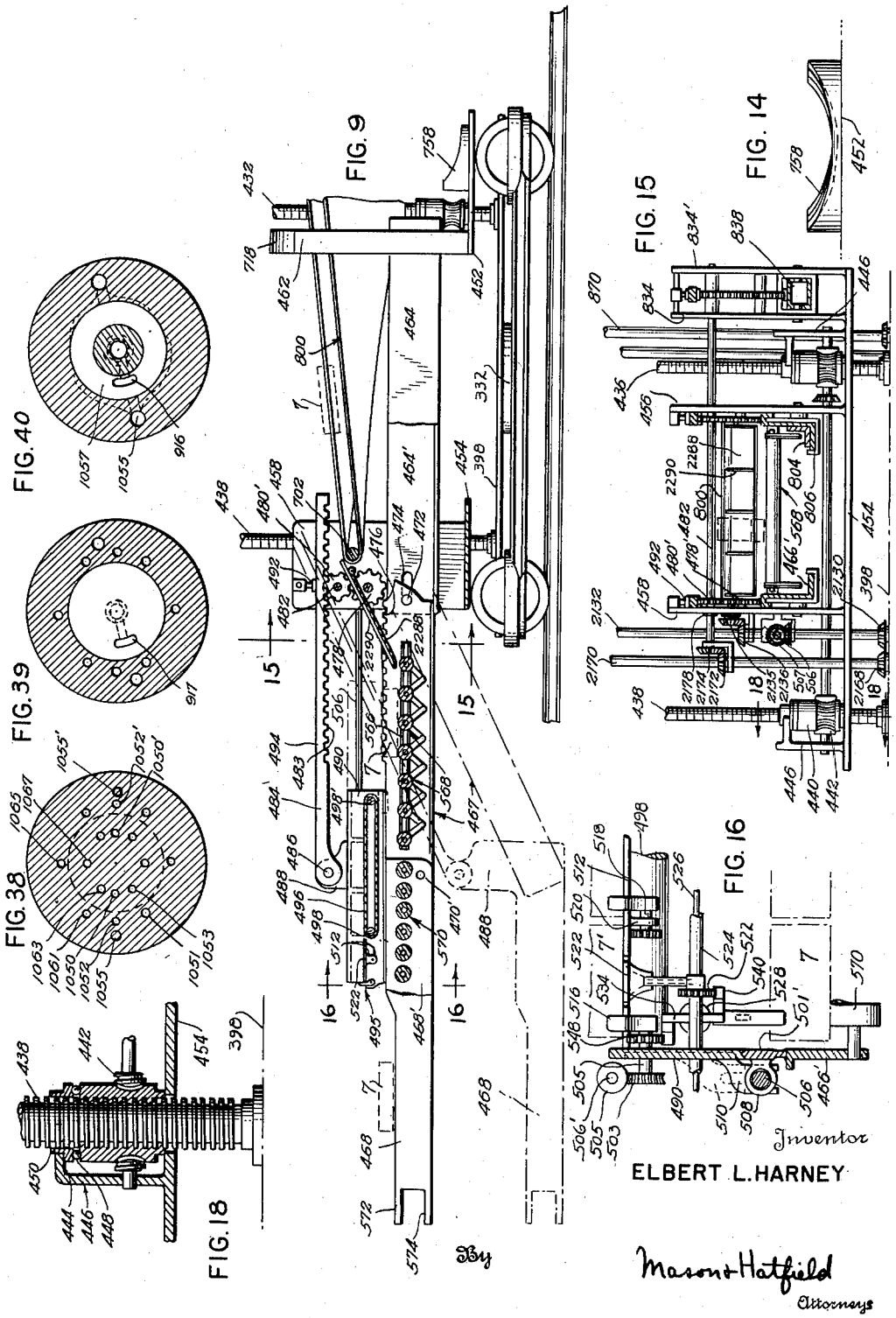
Inventor
ELBERT L. HARNEY

By Mason & Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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FIG. 10

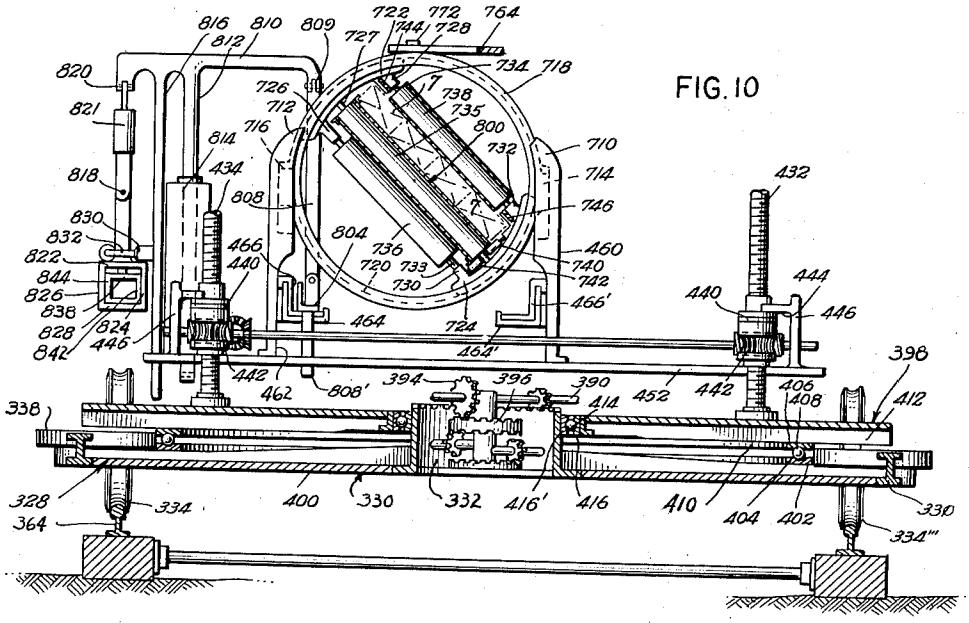


FIG. 12

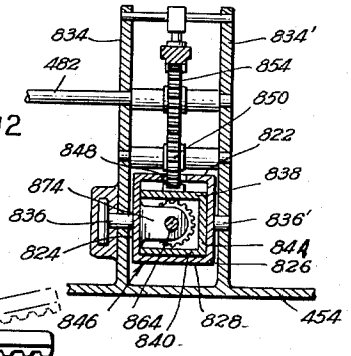
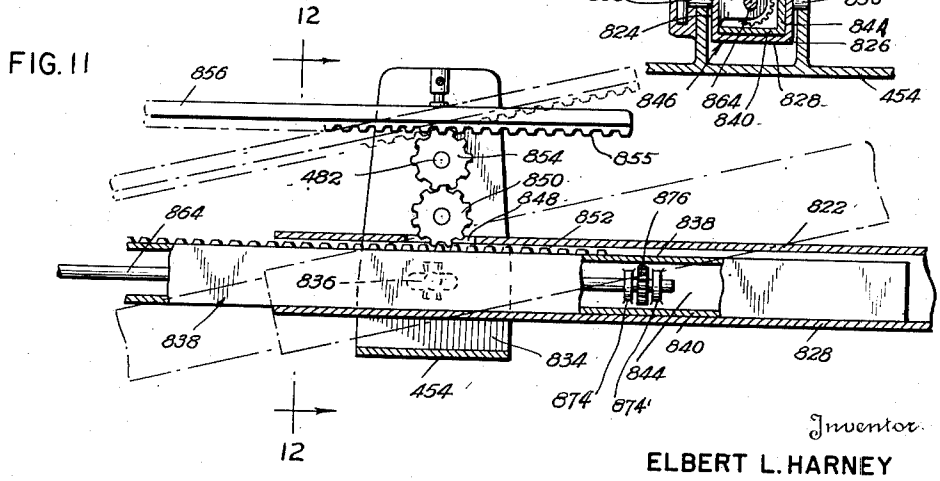


FIG. 11



Inventor
ELBERT L. HARNEY

By Marcus & Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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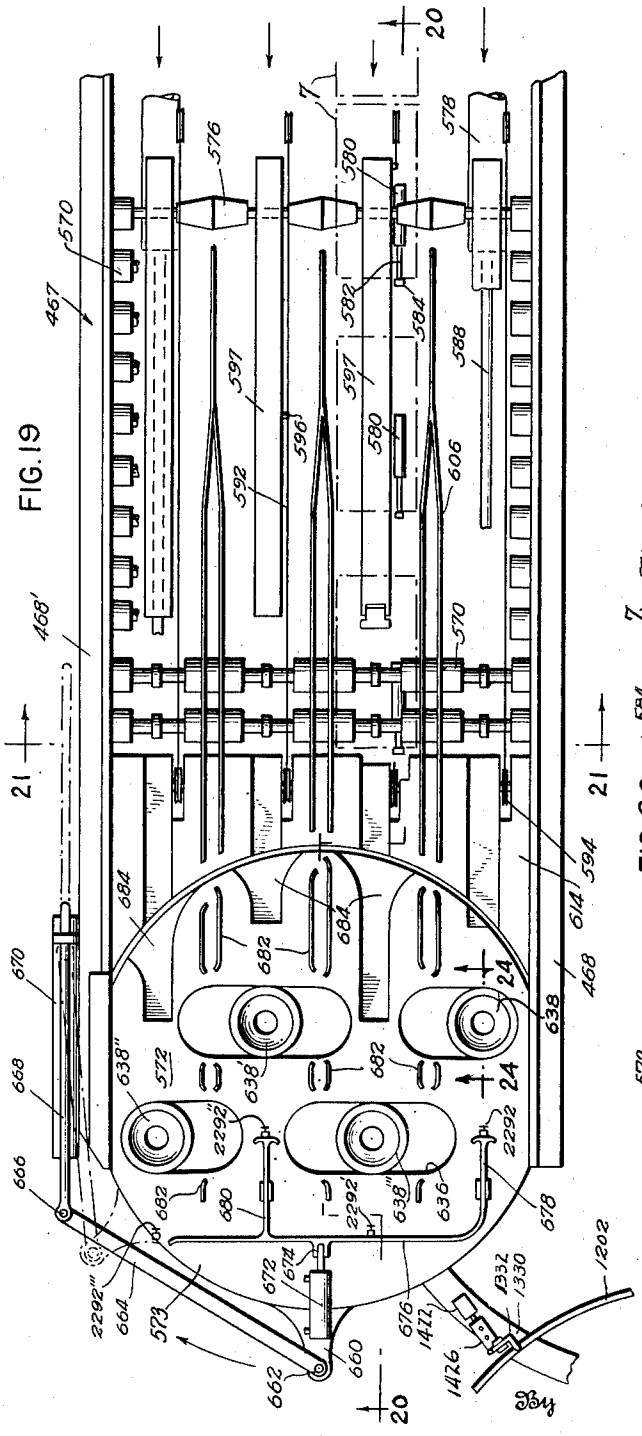


FIG. 19

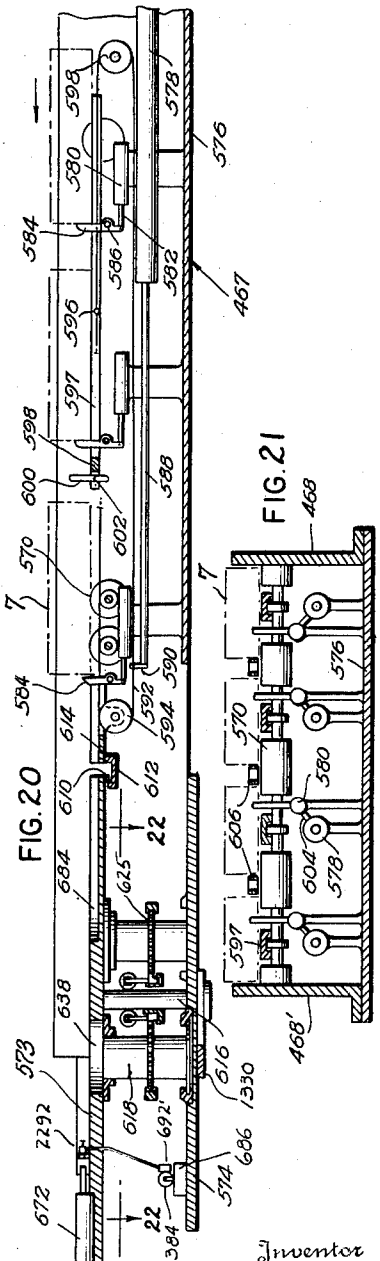


FIG. 20

FIG. 21

Inventor
ELBERT L. HARNEY

Mason & Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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FIG. 22

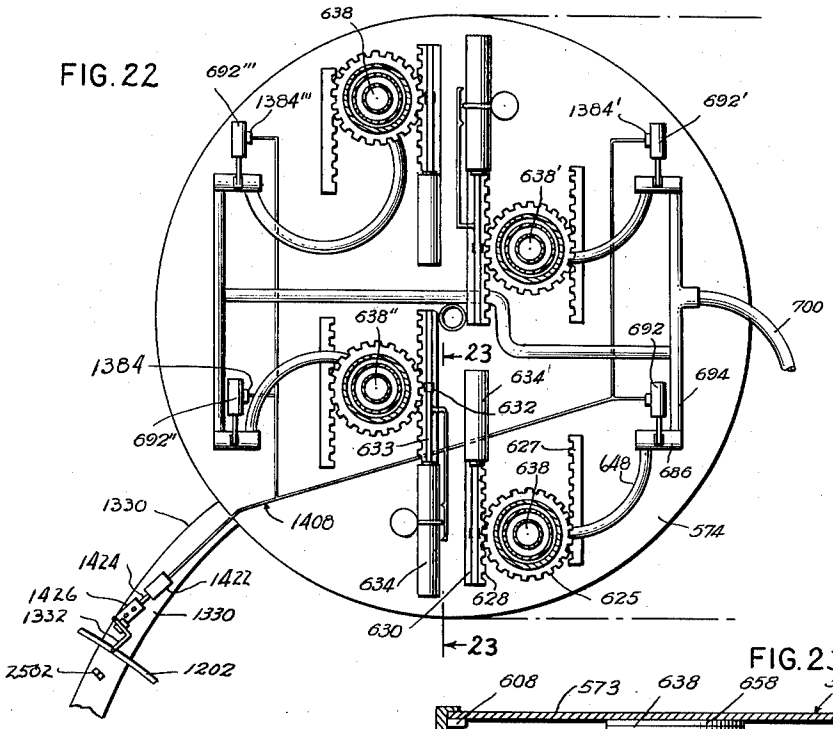


FIG. 23

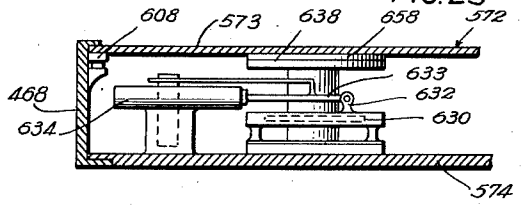


FIG. 46

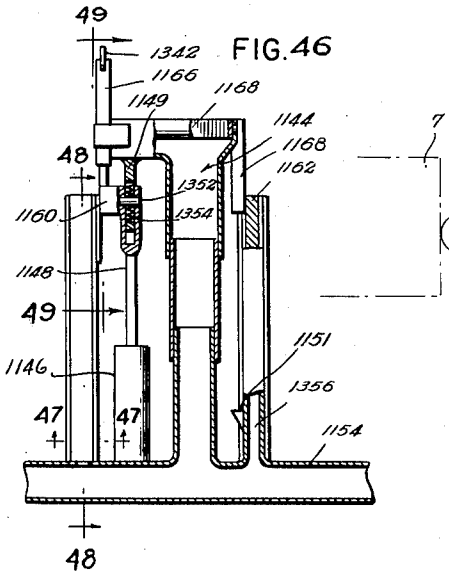
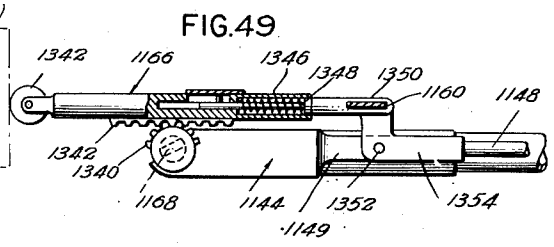


FIG. 49



Inventor

ELBERT L. HARNEY

By Mason + Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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FIG.72

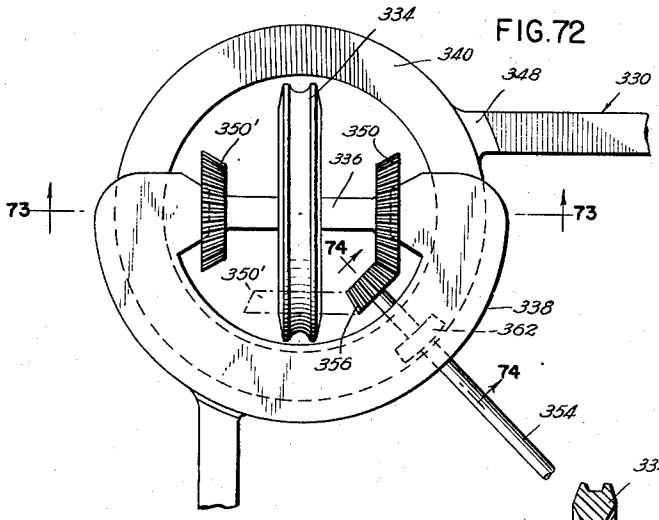


FIG.73

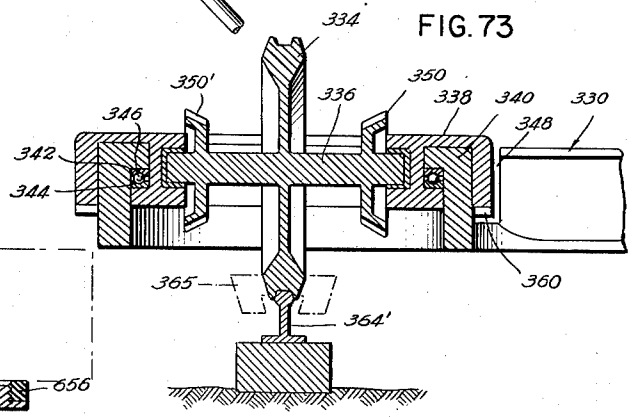


FIG.24

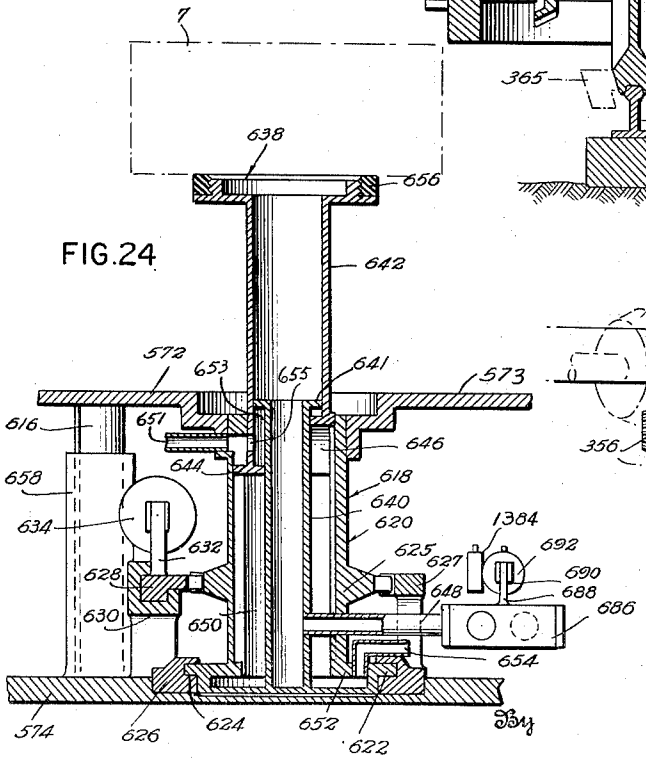
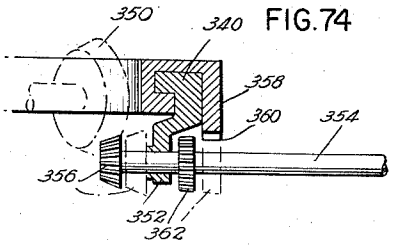


FIG.74



Inventor

ELBERT L. HARNEY

Mason & Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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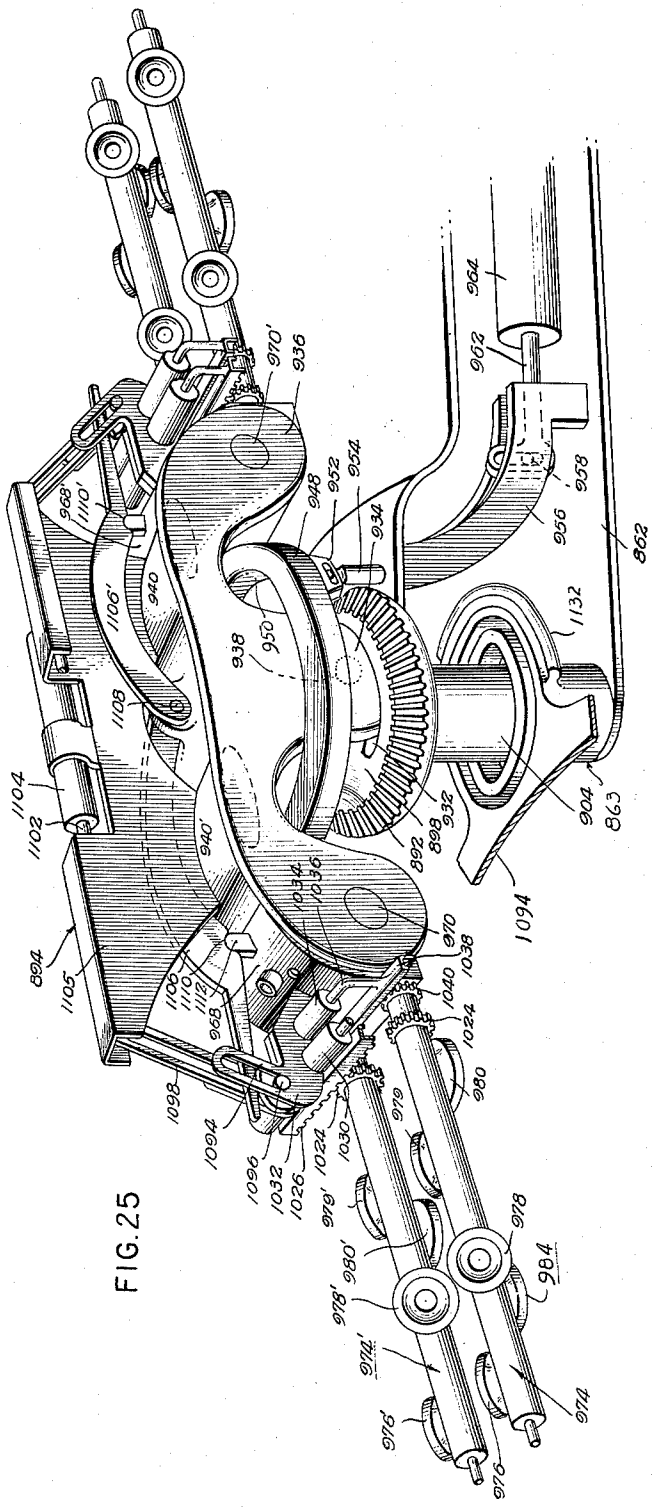


FIG. 25

Inventor.
ELBERT L. HARNEY

Mason & Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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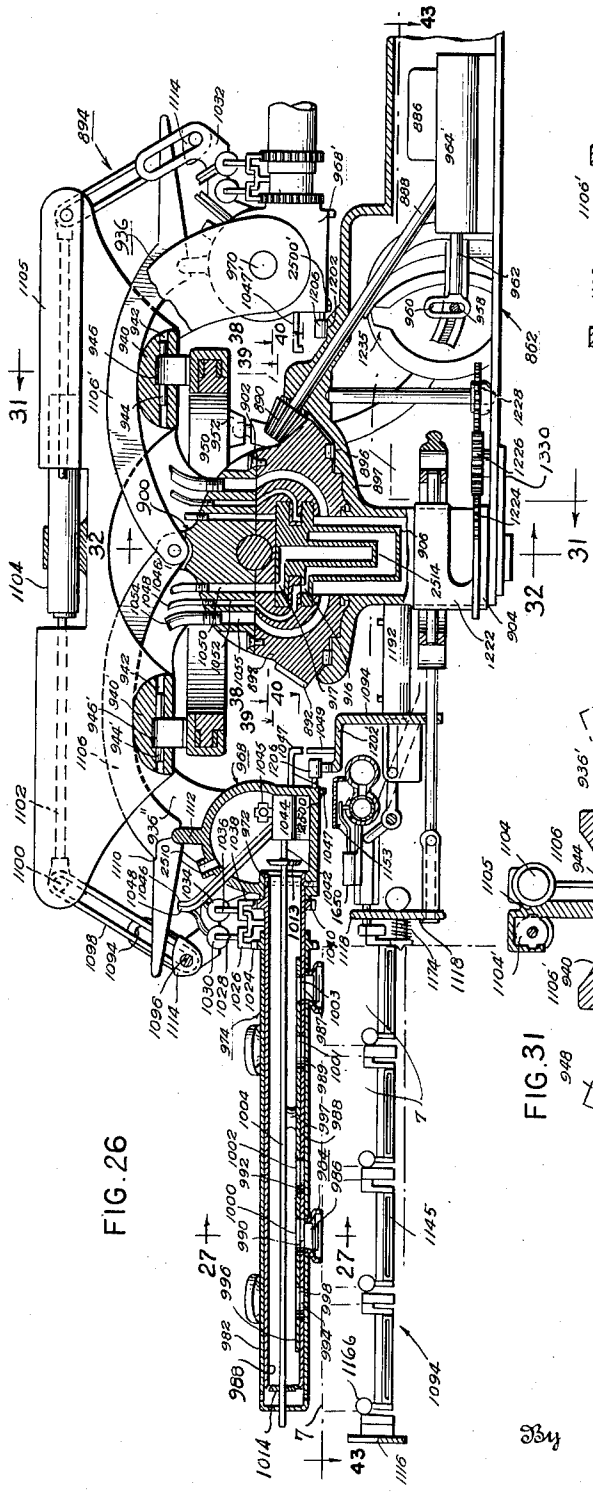


FIG. 26

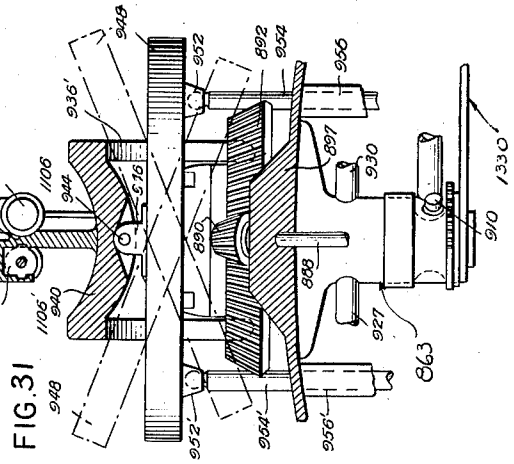


FIG. 31

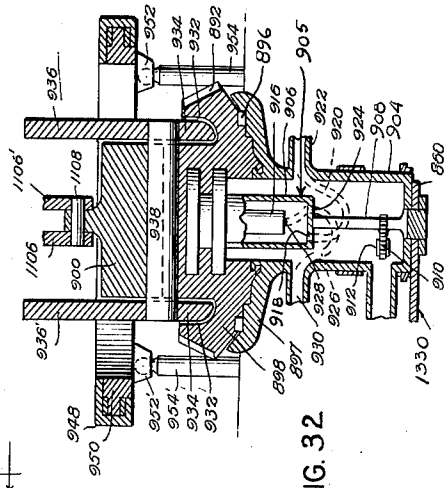


FIG. 32

Inventor

ELBERT L. HARNEY

By Mason & Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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FIG. 27

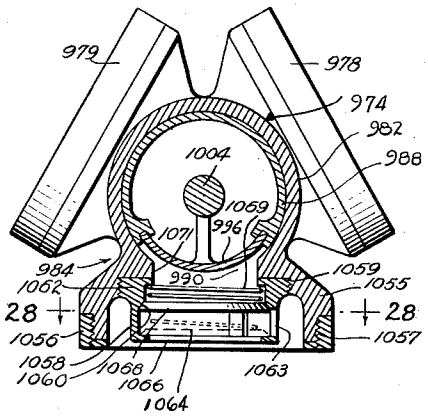
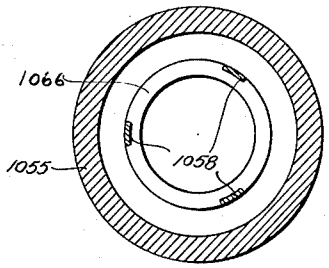


FIG. 28



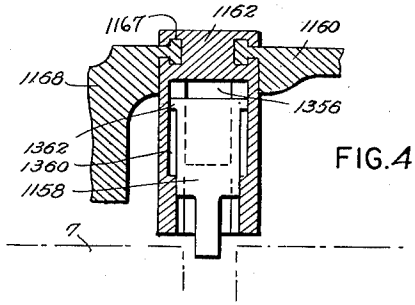


FIG. 47

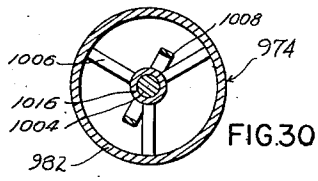


FIG. 30

FIG. 48

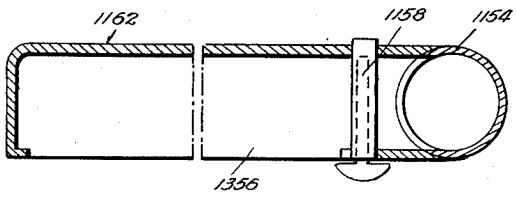
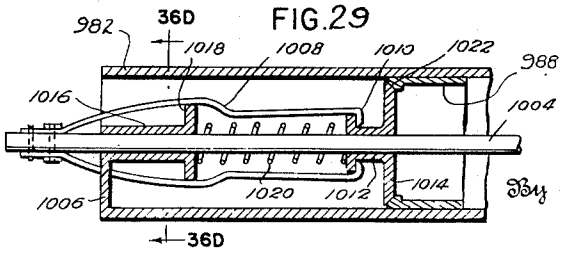


FIG. 29



Inventor

ELBERT L. HARNEY

By Mason & Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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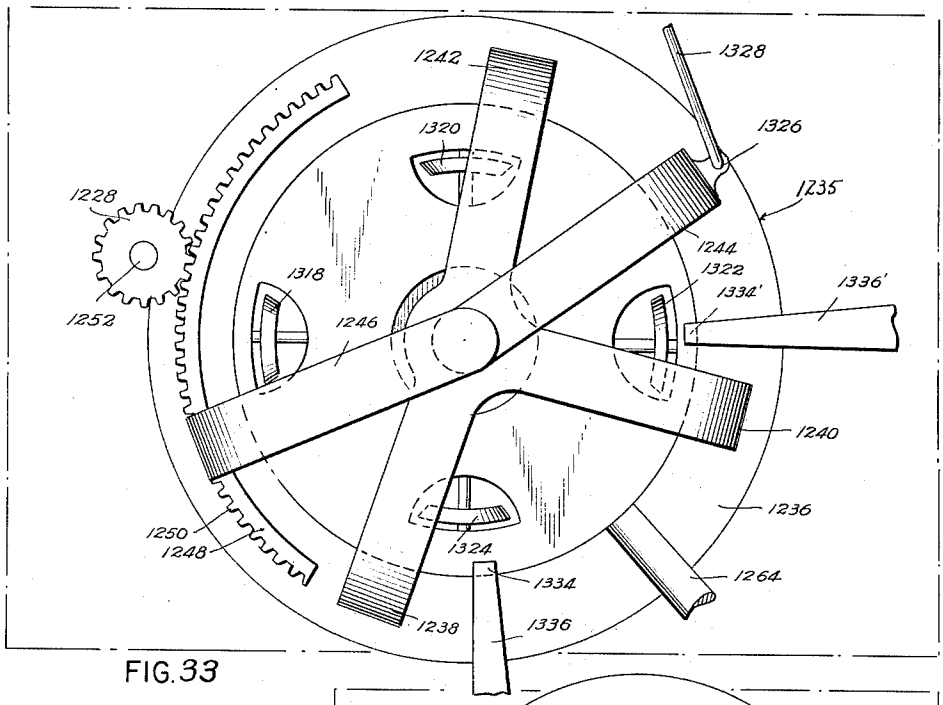


FIG. 33

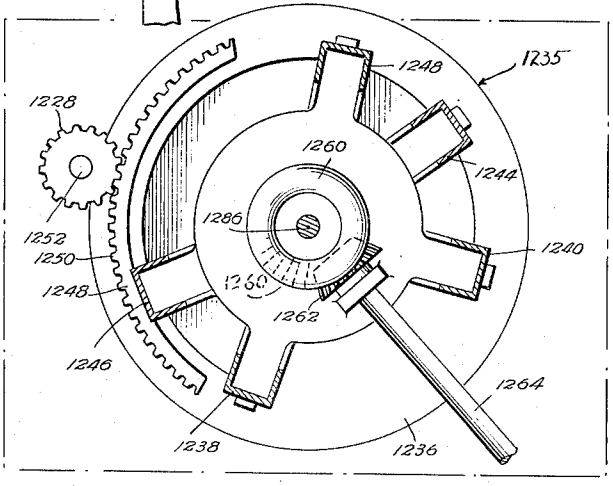
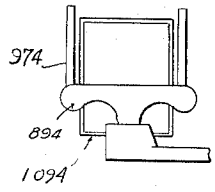


FIG. 34

FIG. 41



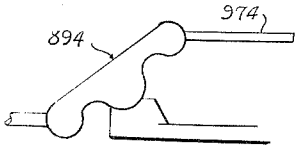
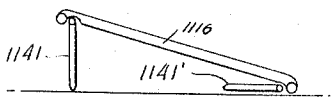


FIG. 42

FIG. 44



Inventor

ELBERT L. HARNEY

By

Mason & Hatfield

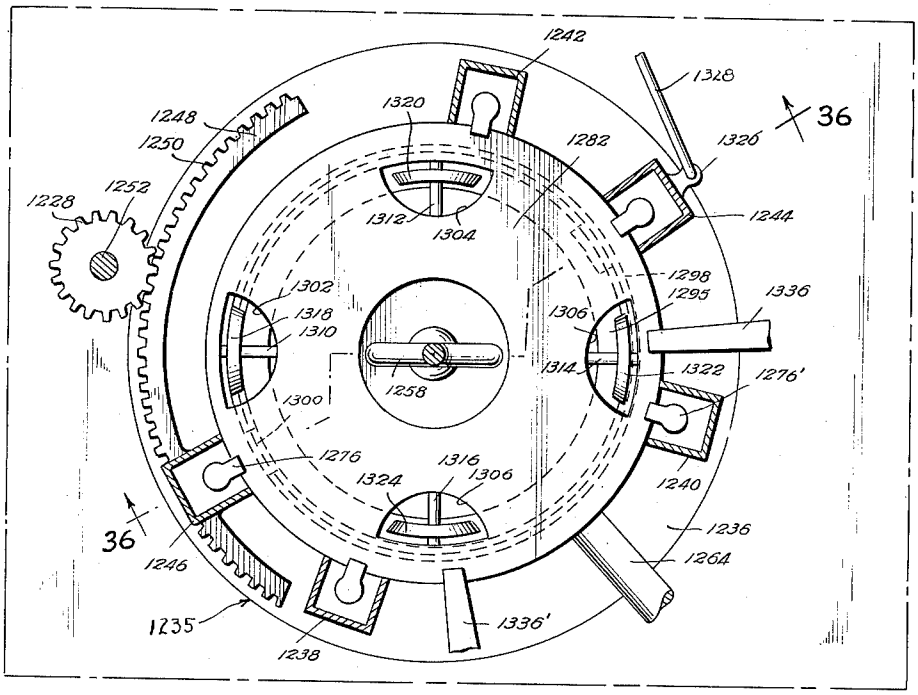
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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FIG. 35



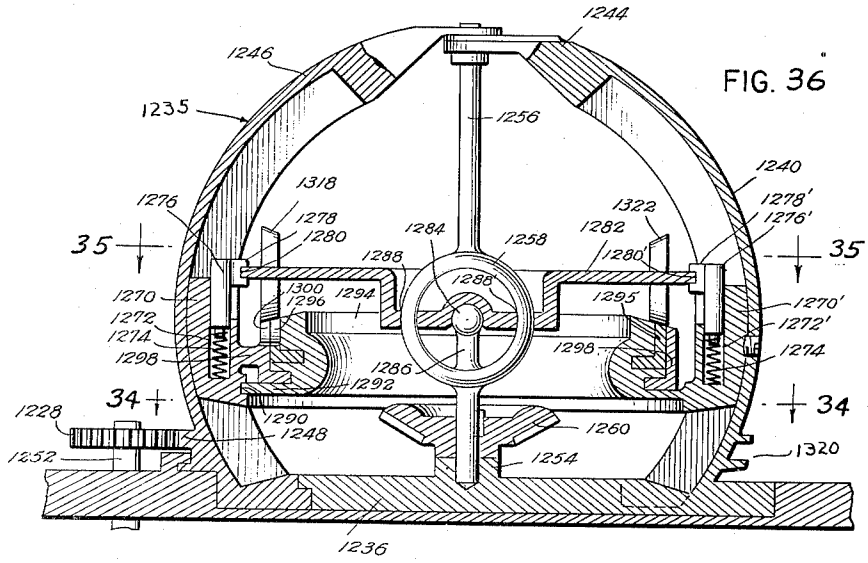


FIG. 36

Inventor

ELBERT L. HARNEY

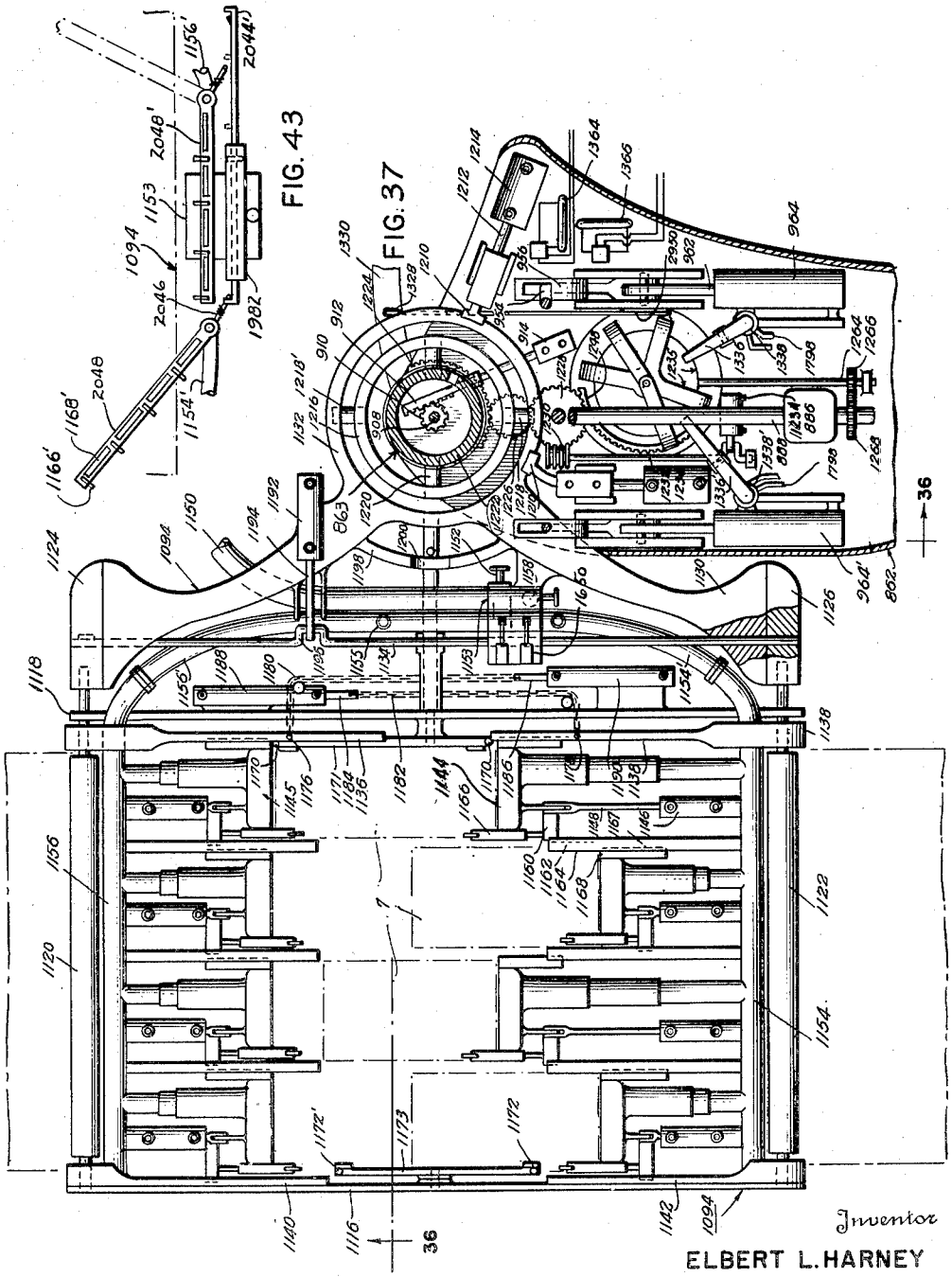
By Mason & Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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Inventor
ELBERT L. HARNEY

By Mason & Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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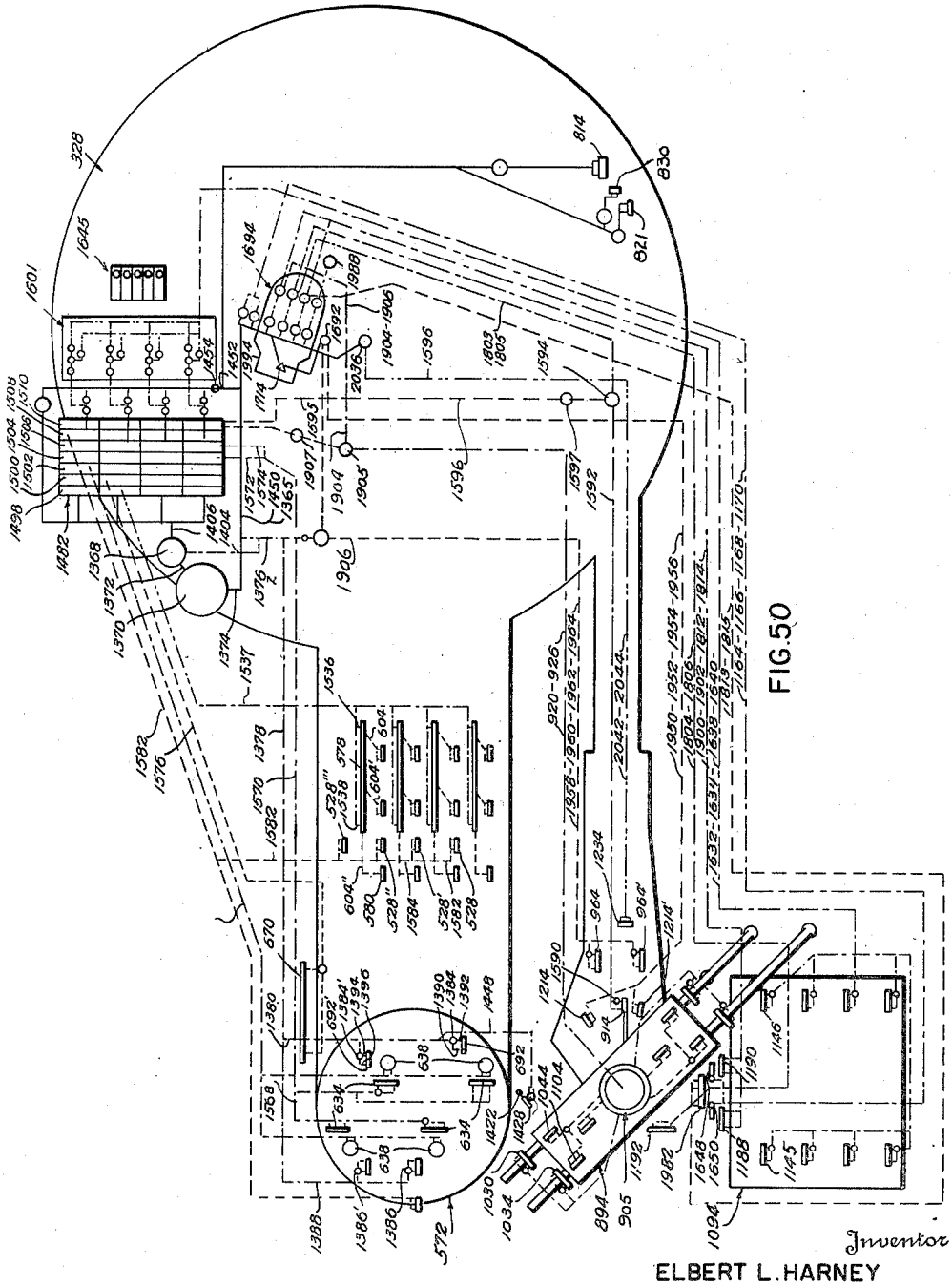


FIG.50

Inventor
ELBERT L. HARNEY

By Mason & Hatfield
Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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FIG.51

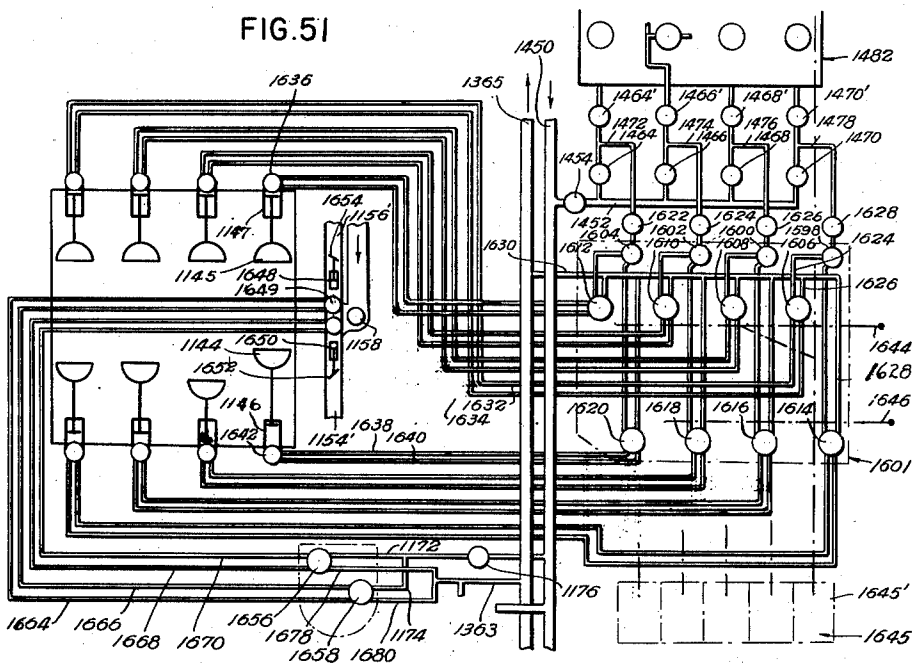
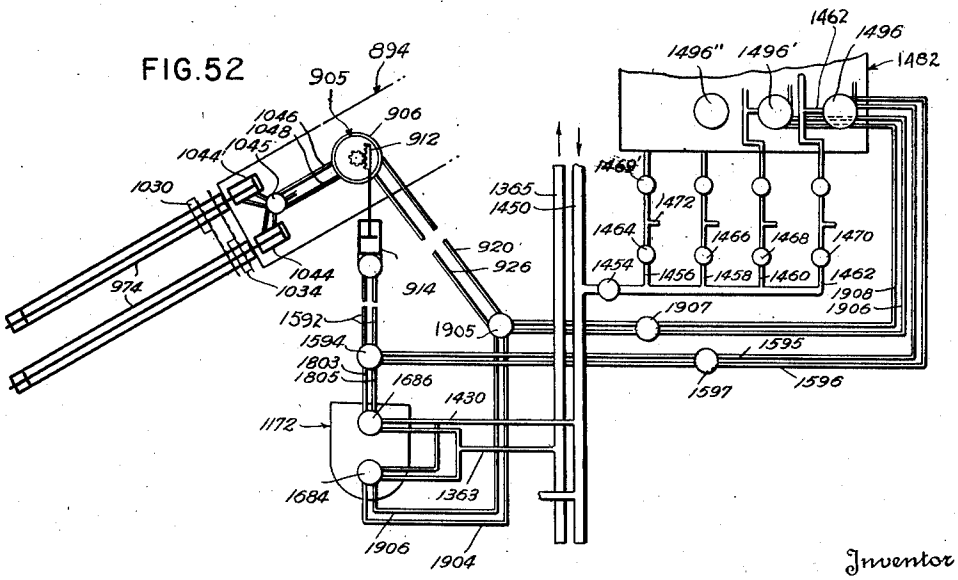


FIG.52



Inventor

ELBERT L. HARNEY

By Mason & Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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FIG. 54

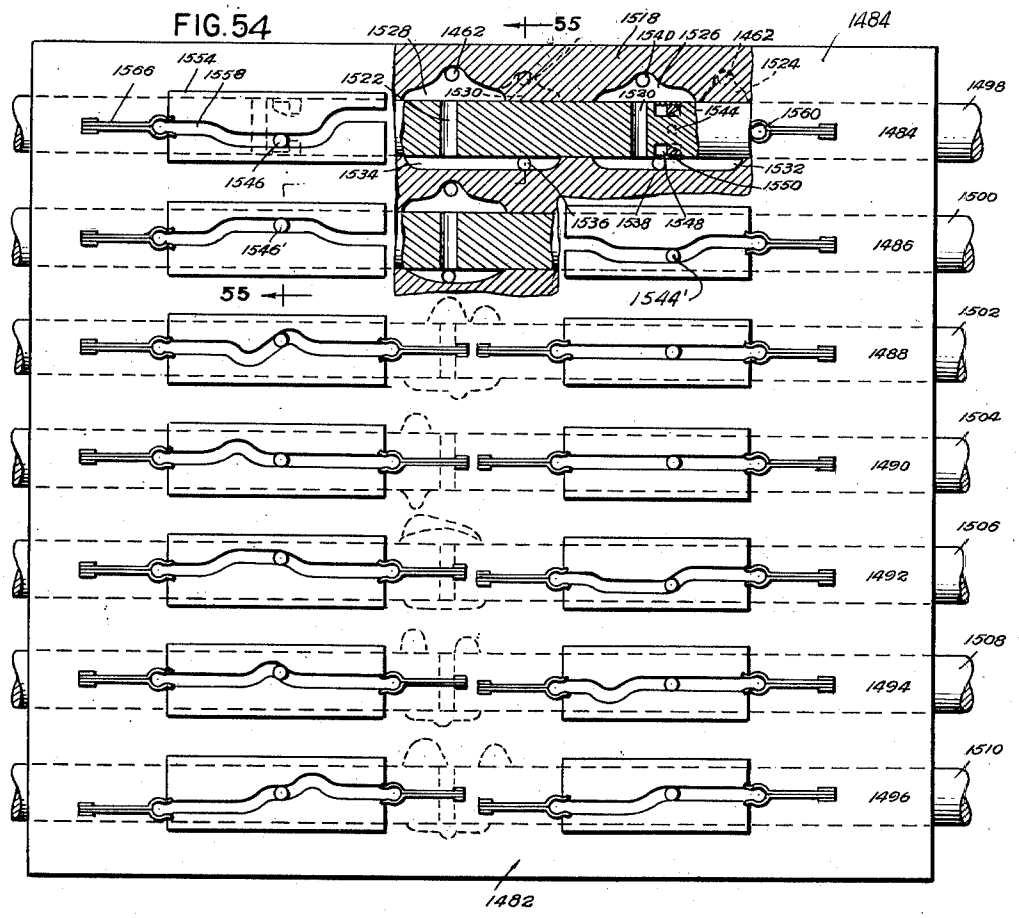
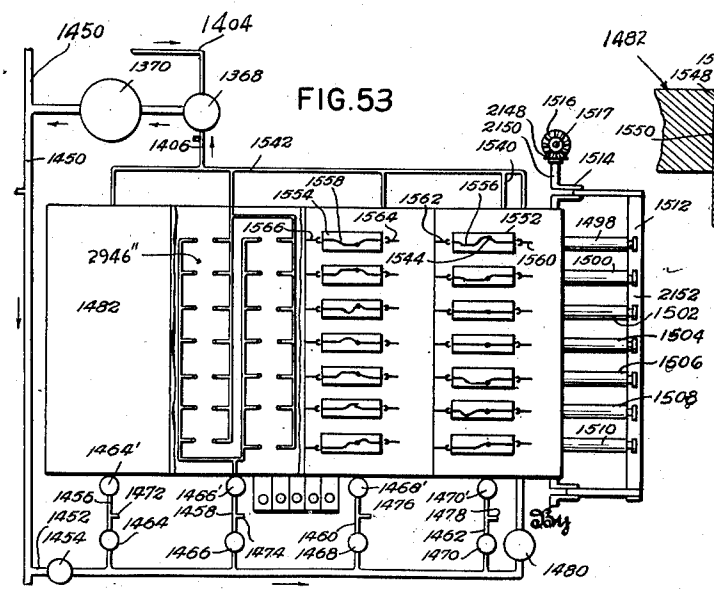


FIG. 53



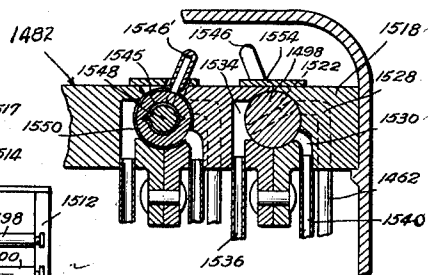


FIG. 55

Inventor

ELBERT L. HARNEY

Mason & Hatfield

Attorneys

June 10, 1952 E. L. HARNEY 2,599,552

BRICKLAYING MACHINE

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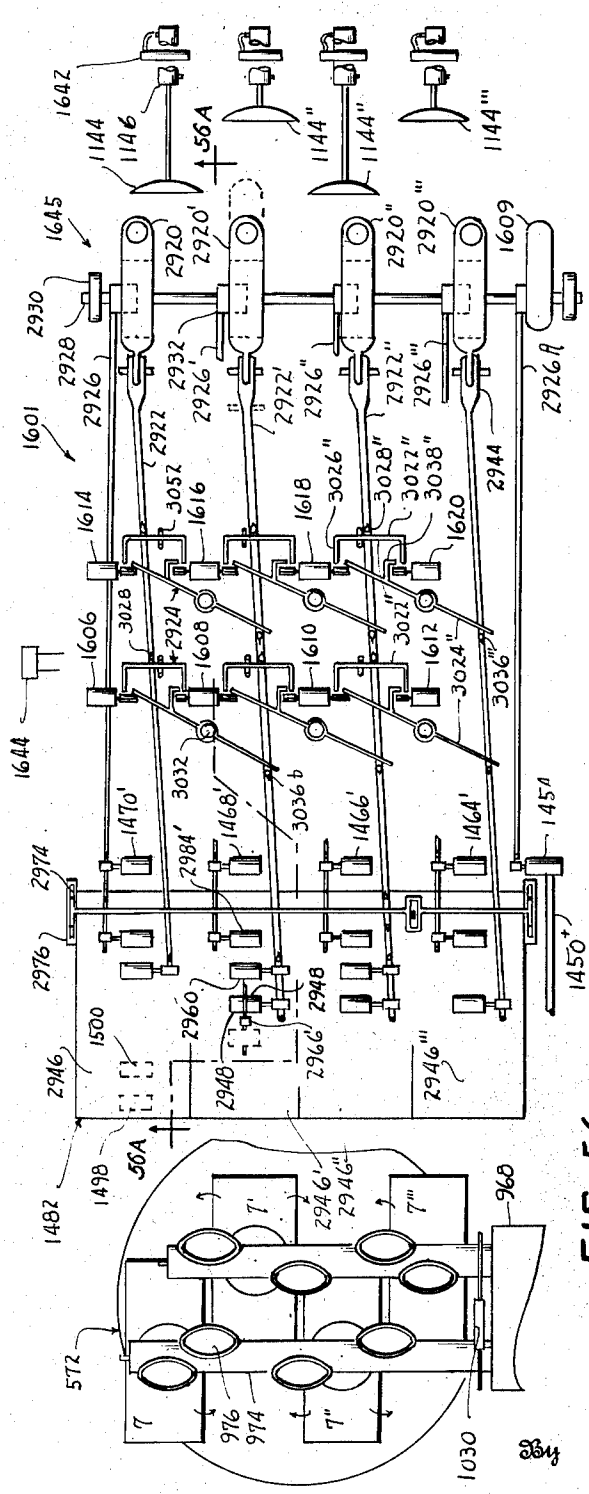


FIG. 56

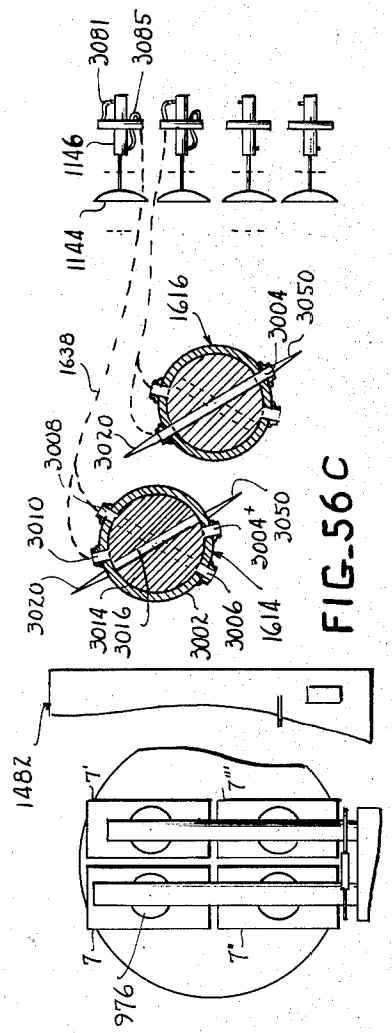


FIG. 56C

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BRICKLAYING MACHINE

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FIG-56A

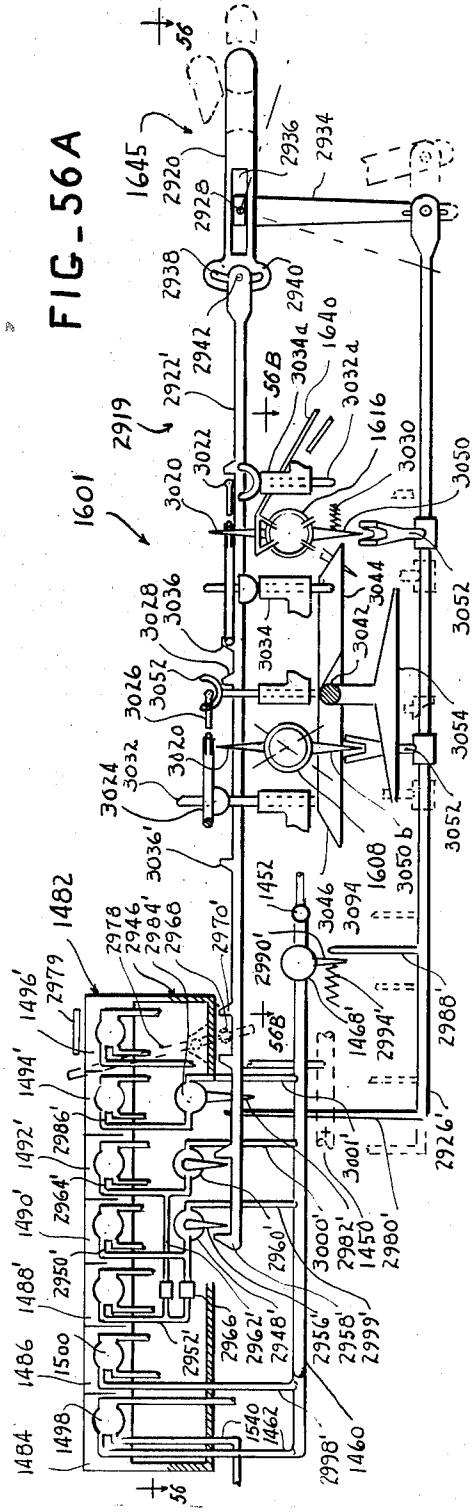


FIG-56D

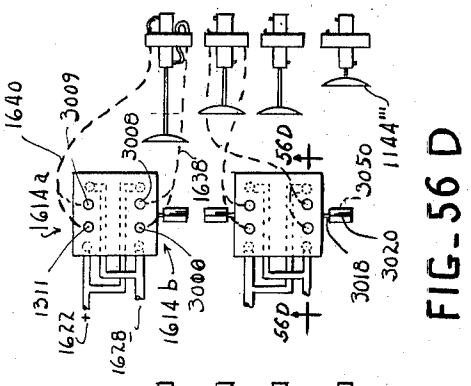
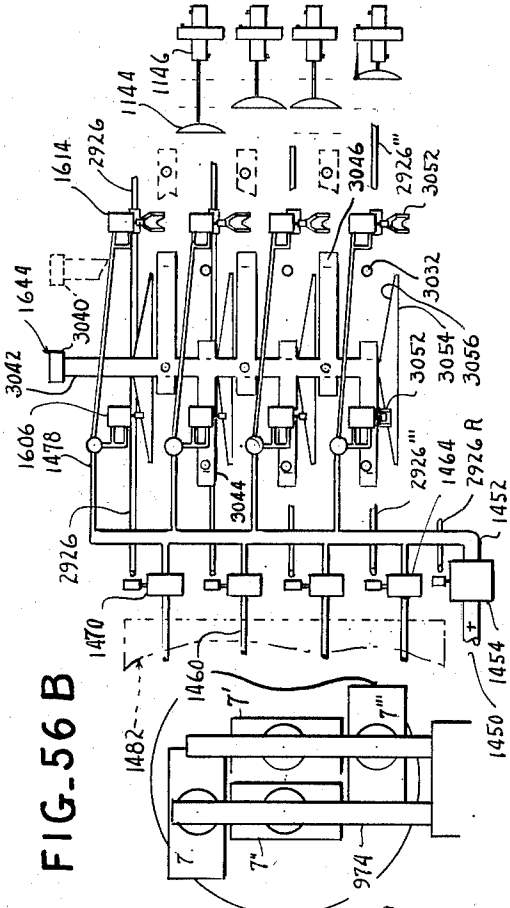


FIG-56B



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FIG. 60

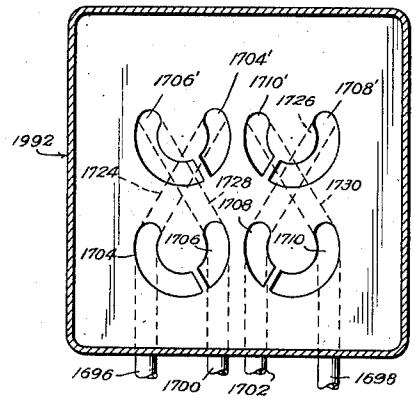


FIG. 61

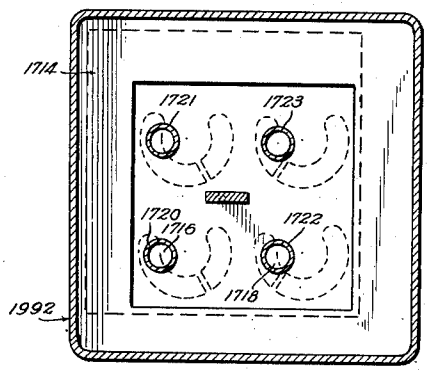


FIG. 58

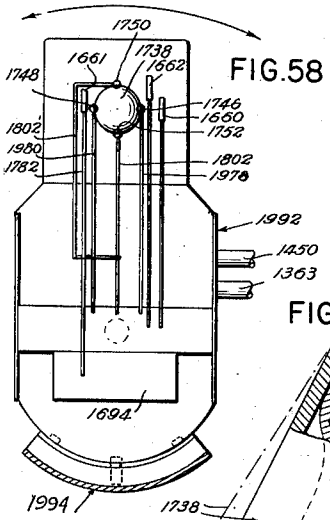


FIG. 57

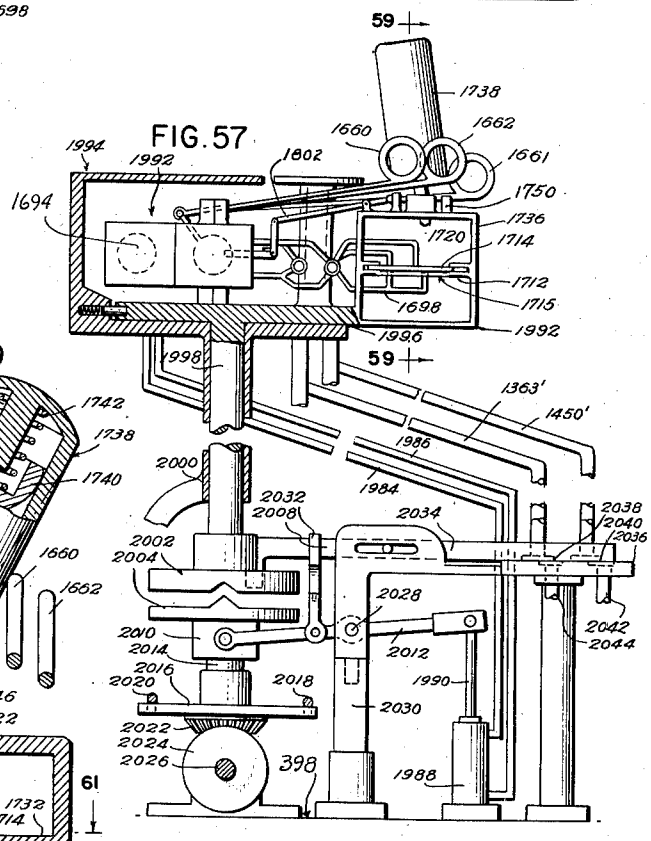
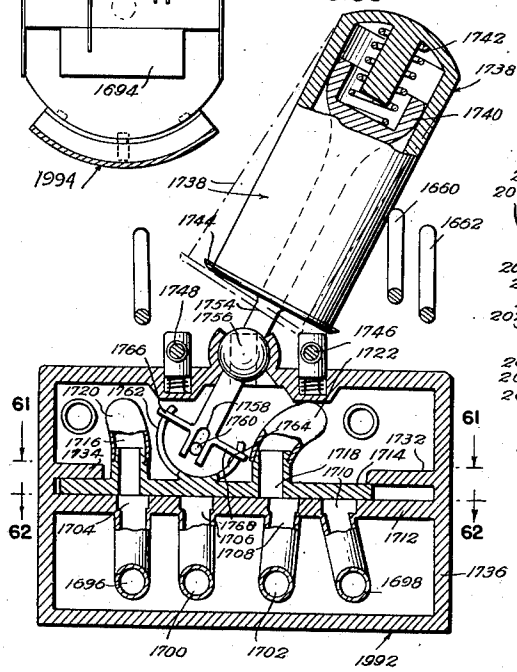


FIG. 59



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FIG. 62

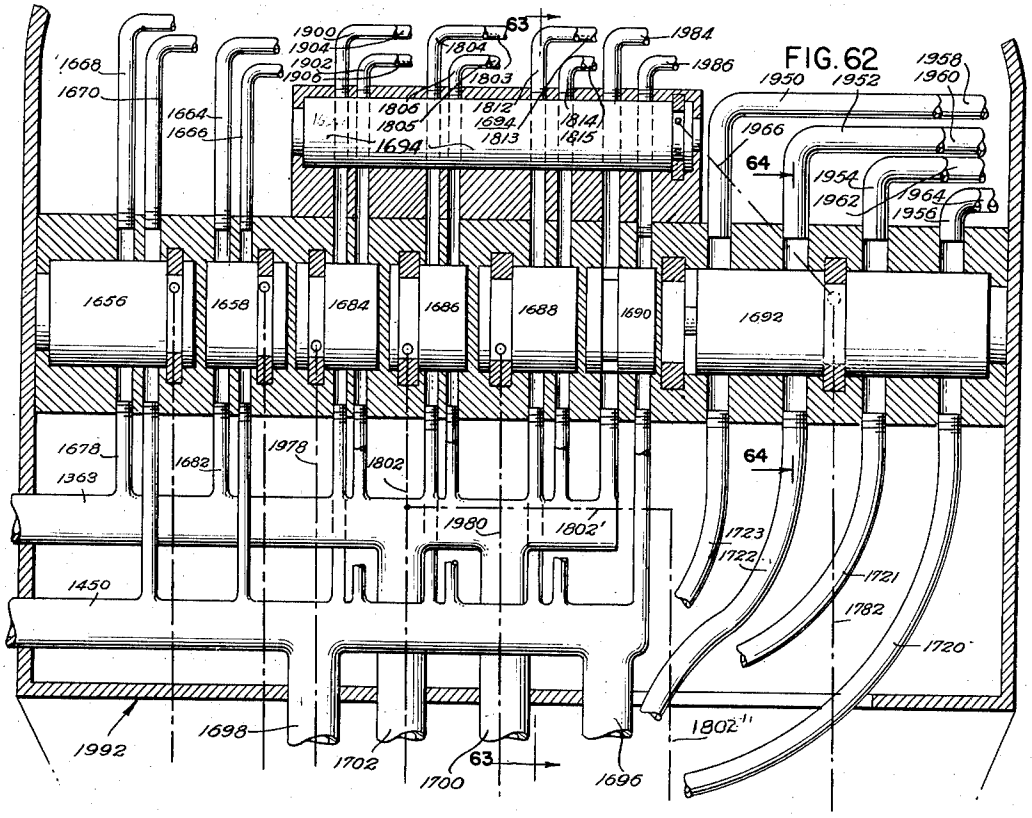


FIG. 63

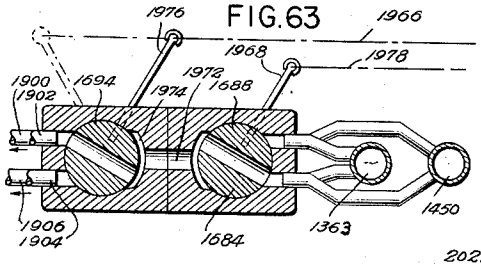


FIG. 65

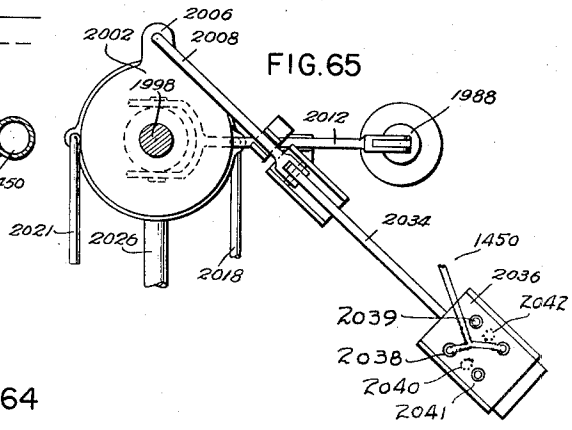
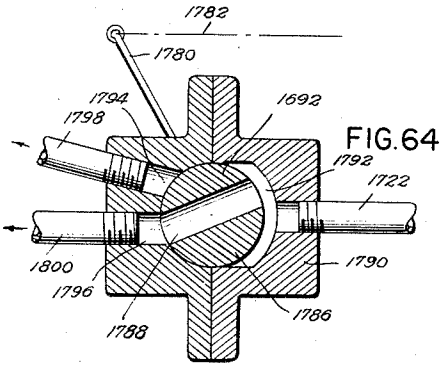


FIG. 64



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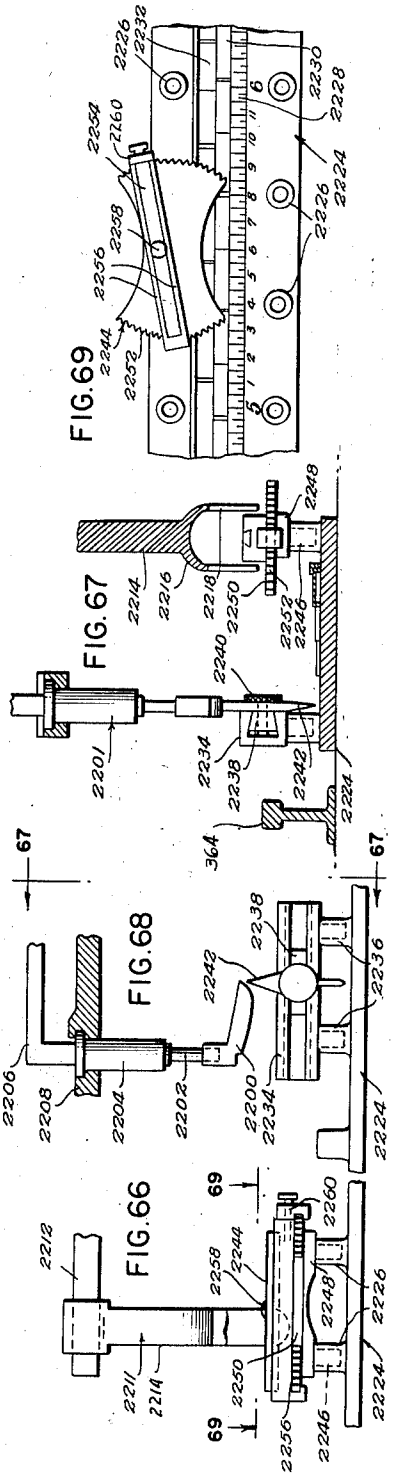
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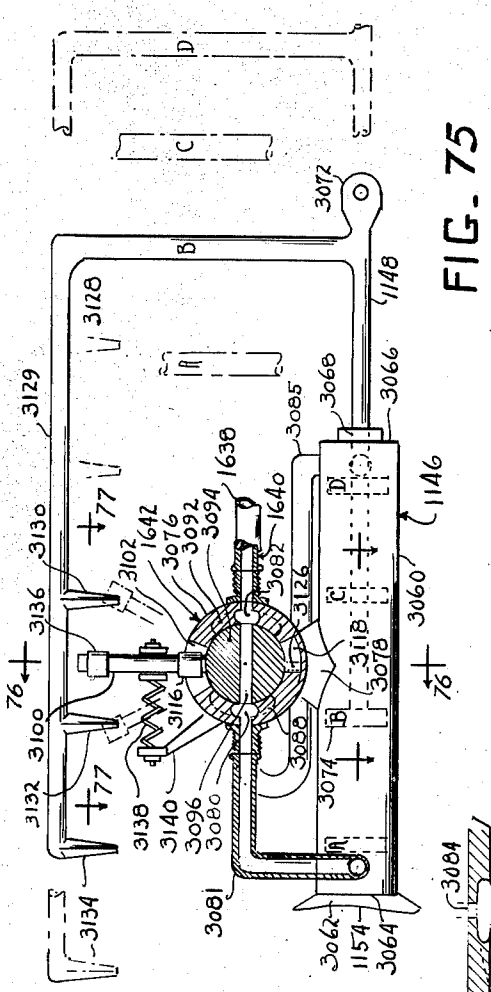


FIG. 75

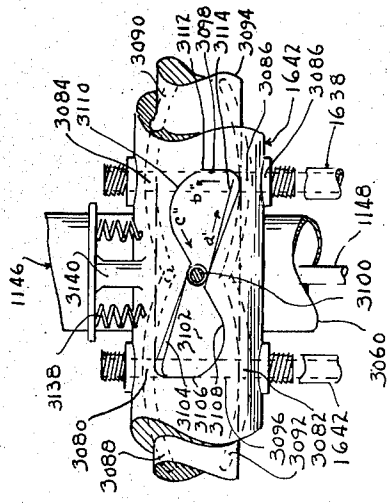


FIG. 77

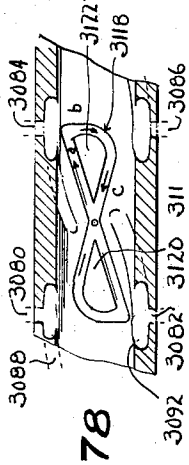


FIG. 78

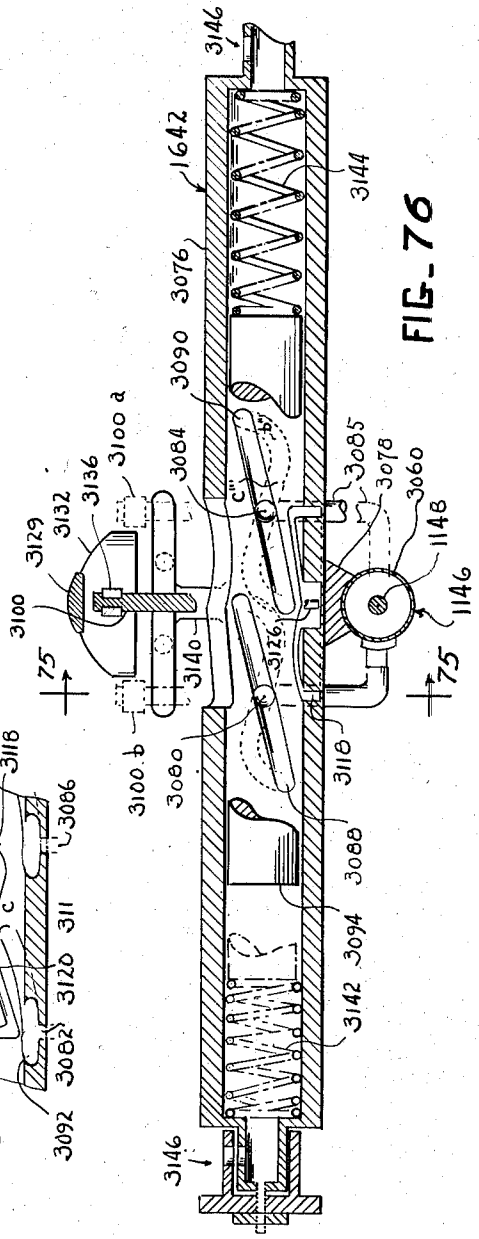


FIG. 76

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Patented June 10, 1952

2,599,552

UNITED STATES PATENT OFFICE

2,599,552

BRICKLAYING MACHINE

Elbert L. Harney, Chicago, Ill.

Application November 30, 1945, Serial No. 631,858

47 Claims. (Cl. 72—129)

1

This invention relates to brick handling apparatus and, more particularly, to a machine for receiving, lifting, conveying, spacing, arranging, laying, and mortaring a plurality of bricks, in successive groups and bonds.

The primary object of the invention is to provide apparatus for handling bricks singly or in groups throughout a sequence of steps from the time when the bricks are first delivered to the machine until they are finally laid, automatically, to form walls of various thicknesses and types of bonds, having doorways and windows, and the corners, piers, pilasters and partitions common to brick structures. In keeping with this broad objective, it is intended to provide apparatus controlled by a single operator, serviced by relatively few laborers, which when set for a given piece of work, will automatically reproduce, mechanically, with great speed and precision, the skill and toil of many artisans with untiring precision.

This is an accomplishment utterly unattainable in bricklaying machines heretofore known in the art. It is also intended to provide a machine for laying bricks in any one of a plurality of bonds in a wall of several wythes (bricks) in width and to provide for the changing of bonds at any given time. Further, the invention contemplates the provision of an individual control for the laying of a brick or group of bricks by the operator through the manual operation of his controls. While in normal operation the machine may be set to lay a stretch of wall, it is also operable to lay the bricks right up to a window or door frame and to lay the bricks in small piers, as between a window frame and a closely adjacent column and as well, to underpin beam bottoms. Likewise, it is proposed to provide apparatus for injecting bats at intervals where needed for the bond selected. Also among the broad objectives is the provision of means for spacing the bricks as laid so that, for a given stretch of wall, the bricks will work out properly at the end.

Recognizing that, in the laying of a wall for a building, it is necessary for the machine to lay bricks at many heights, it is proposed herein to provide apparatus for setting the bricks at a low level relative to the starting position, for laying the succeeding courses at higher levels, until the uppermost limit is reached, as at the top of the first story, and then to provide scaffolding or other support means for the apparatus from which to lay the second story. More particularly, at the beginning of brick construction, templets and trackways are provided alongside the walls-

2

to-be, consisting of main trackways running along a sidewall foundation and trackways set at an angle to the main tracks at the corners. The apparatus being self-propelled, proceeds down the main trackway, laying a course of four bricks more or less to the full thickness of the wall as it moves, until the corner is reached, whereupon it builds up the corner and returns back and forth along that wall until it is a story high.

Next, a scaffold may be set up for the trackways, and a second story raised as was the first.

It is a still further object of this invention to provide chute means to receive the bricks delivered to the rear end of the layer, the slide being adjustable in planes extending transversely to a vertical axis; manually adjustable vanes are provided on the slide to divert the bricks passing thereover into certain desired channels. The bricks, as they move forwardly on the slide, are in turn delivered to a series of rollers provided with means for varying the distance between their respective longitudinal axes, the rollers being mounted in a suitable support formed on the brick spotter boom.

As will be set forth in detail below, the carriage for the layer proper comprises, principally, a wheeled chassis having mounted thereon, a revolving body, the framework of which carries an elevatable frame on which is mounted the above mentioned slide and spotter boom. The framework also supports a layer boom.

It is a further object of this invention to provide means associated with the spotter and layer booms whereby the same may be extended and contracted with respect to the supporting framework.

A still further object of the invention is to provide means for rotating the layer and the spotter booms in planes disposed generally substantially horizontal with respect to a vertical axis, and also to provide means for moving the layer and spotter booms in planes at an angle to the horizontal.

It is further contemplated to associate, in connection with the spotter boom, a bat belt or conveyor, the bat belt being adapted to deliver bats or brick of special color, form, size, etc. at desired intervals to the conveying means leading to the spotter proper.

As will be seen, a plurality of vacuum cups are rotatably mounted transversely of the longitudinal axis of the spotter boom and parallel to the path of travel of the bricks toward the spotter plate. The vacuum cups are adapted to receive bats from the bat belt and deliver the same to

the rollers described below, means being provided for retarding the normal delivery of the standard brick to the rollers in order to provide space for the bat.

A second series of spaced rollers is positioned transversely of the forward path of travel of bricks and are fixedly mounted in the movable portion of the spotter boom. Hydraulic means are provided in the spaces intermediate these rollers for restraining the forward movement of the bricks to the spotter plate and a second hydraulic device is also disposed therein for ramming the brick onto the spotter plate at certain predetermined intervals.

Flexible, longitudinally extending steel guide vanes are provided for guiding the brick over the second series of rollers as they move toward the spotter plate.

The most vital object of the invention is the provision of the mechanisms and controls for accomplishing mechanically every necessary activity of a bricklayer from the time he grasps a brick which has been delivered near him to the time the brick has been shoved into its place in the growing wall. These activities include, in part, the prearranging of the brick in a position or pattern corresponding to the bond in which the brick are to be laid; also the transportation of the brick by mechanically actuated arms having individual brick engaging elements thereon corresponding, in effect, to the arms and hands of many bricklayers combined in an imaginary single being for simultaneous gang operation, this transportation being from the spotter or arranging mechanism to a transient laying station at the wall. Simultaneous with the deposit of the brick at the laying station, it is proposed to provide for their mortaring both as to bed mortar and as to the mortaring of the head joints. In all these functions speed and precision are the essence.

A more specific object in regard to the spotter mechanism is the provision of a surface upon which brick are rammed from the output end of the feeder belt, the brick being rammed in uniform position in each instance on to individual spotting elements, each element being capable of turning the brick thereon. By the selective turning of the individual brick, it is an object to provide for the prearrangement of the brick to form a pattern corresponding to the bond in which the brick are to be laid simultaneously as a group. When the machine is to be operated for laying brick individually, the direction of the length of the individually spotted brick, of course, will predetermine the direction in which the length of that brick will extend when deposited by the laying mechanism. It is proposed also to provide for the centering of brick or brick bats on the individual spotter cups so that the brick or bats will be uniformly engaged by the brick engaging elements on the layer arms.

A basic object of the invention is the provision of a laying head for transporting the brick from the arranging station. In accordance with this intention, it is proposed to provide an element rotatably mounted on an adjustable boom between the arranging station and the laying station, the element having a plurality of radially extending arms with suction cups spaced along the arms and arranged to sweep from the arranging station, or spotter, to the laying station. As the arms sweep to the spotter, it is proposed to provide for dipping the arms downwardly so as to bring the individual vacuum cups into engagement respectively with the individual prearranged brick. By means of a pneumatic system, and synchronized control therefor, air is to be exhausted from the vacuum cups so that the brick will effectively be engaged thereby and lifted from the arranging mechanism as the layer arms are raised and swing towards the laying station.

If the brick are to be laid as rowlocks or soldiers, the arms may be rotated at 90 degrees in transit, otherwise, the brick will be maintained at all times with their flat faces disposed horizontally.

Since the brick may be arranged in patterns corresponding to any one of a plurality of bonds, it is proposed to provide arrangements of vacuum cups variously along the length of the layer arms, and controls for selecting the cup arrangement required for the particular bond being formed.

A further object of the invention is the provision of the rotatable layer head having radially projecting arms, with brick engaging element thereon for transporting brick from an arranging station to a laying station, angularly spaced along the path of rotation of the arms, the head being continuously rotatable and the arms capable of being dipped for picking the brick from the spotter or arranging mechanism on the fly, so to speak, and similarly dipping and releasing the brick upon sweeping past the laying station with much the same motion that a brick layer would use.

In addition to the overall accomplishments in laying the brick, it is intended to provide, as a result of the sweeping motion of the layer arms, for the shoving of the brick into position as they are laid so as to form shoved joints.

Another of the more important objects of the invention is the provision of a mortar spreader extending laterally from the end of the boom where on the laying head is supported and being moveable about an axis common with the axes of rotation of the laying head so as at all times to lie along the paths of the movement of the brick being transported from the arranging station or spotter. It is additionally intended so to couple the mortar spreader and the controls for the laying head that the brick being transported by the laying head will be deposited upon reaching the mortar spreader. In the mortar spreader which, in effect, defines the transient laying station as it is moved over the portion of the wall being laid, it is proposed to provide two sets of nozzles having functions interchangeable in dependence upon the direction in which the machine as a whole moves.

More particularly it is an object to provide a pair of parallel arms to project transversely of the wall, each arm carrying a set of nozzles projecting inwardly in the space between the arms. The nozzles projecting backwardly from the leading arm are for spreading bed mortar, the leading arm and the nozzles attached thereto being disposed at a level so that the brick being transported by the laying head will pass closely thereover immediately prior to being deposited.

Control valves for the nozzles are provided so that, while functioning to spread bed mortar the nozzles extrude cement constantly and at a fixed rate so as to lay a uniform bed, immediately ahead of the bricks being laid.

Another object is to provide for the telescopic extension and retraction of the individual nozzles so that those spreading bed mortar may be uniformly retracted and so that the nozzles project-

ing forwardly from the trailing arm may be staggered in accordance with the staggering of the brick being laid in bond.

It is also proposed to provide valves for the individual nozzles and valve triggers respectively engaged by the brick as they are slid home so that the nozzles forming the head joints, while ordinarily closed will have their valves triggered open to inject doses of mortar immediately in front of the bricks just prior to the time they are slid into place.

In further consideration of the mortar spreader, it is intended to provide for tilting the spreader as a whole so as to dispose one arm above the other and in this manner to allow for laying a brick and spreading the mortar in close places, as between two frames. In fact, it is a basic theme of the entire apparatus that it may be operated for laying brick within the limits of confined spaces as well as along expanses.

In order to govern the many correlated activities of the various elements, it is proposed to provide both automatic and manual controls so that ultimately the variable functions of many different elements may be put through different routines by manipulation of no more control elements than may simultaneously be operated by one individual. Furthermore, it is intended that the controls be arranged so that, once set, the machine will operate automatically for straight work, as for laying up a stretch of solid wall. For other than routine laying, it is intended that the manual controls may either supersede or merely vary the automatic controls so that, for instance. the laying head may be caused to oscillate between the arranging station and the laying station in contrast to its normal full rotation, this being an example of a case where the manual controls supersede the automatic. In the case where keys are pressed to cause the machine to lay bats instead of full brick, the operator merely varies the automatic operation of the machine.

While the object of machine as a whole is the laying of brick, it is intended to provide various elements of more general application; i. e., article handling, it being readily apparent that several of the elements and combinations of the elements would be useful in conveying, arranging or placing articles.

These and other objects will be apparent in the following specification and drawing in which:

Figure 1 is a plan view of the brick layer unit and the accompanying brick feeder unit in one of the working positions, including the tracks over which both units are capable of movement.

Figure 2 is a simplified top plan view of the brick layer unit and the brick delivery unit when disposed in their substantially normal working position, the figure also disclosing, diagrammatically, certain electrical circuits.

Figure 3 is a front end elevation of the feeder and layer units, the units being shown as having certain elements in one of their elevated working positions.

Figure 4 is an enlarged top plan view of the layer carriage, the power drives therefor, and its associated elements.

Figure 5 is a top plan view of the layer unit's chassis frame.

Figure 6 illustrates in plan, and diagrammatically, the operator's platform on which is supported the operating means for the layer unit and the variable speed gearing therefor; together with their cooperating control means.

Figure 7 illustrates the supporting, elevatable framework for the spotter and layer booms and beams.

Figure 8 is a side elevational view of the layer unit and also illustrates the relative position of the compensating mechanism.

Figure 9 is a cross-sectional view taken substantially on lines 9—9 of Figure 4, showing the general make up of the spotter boom assembly.

Figure 10 is a cross-sectional view taken on the lines 10—10 of Figure 4, looking in the direction of the arrows, and shows certain layer unit features from the rear.

Figure 11 is a longitudinal cross-section of the layer boom, showing certain of the details of the driving and tilting mechanism for the layer beam and boom.

Figure 12 is a cross-section taken on the lines 12—12 of Figure 11 showing layer boom details.

Figure 13 is a cross-sectional view of the driving pinion arrangement for elevating the layer and spotter booms, the view being taken on the lines 13—13 of Figure 4.

Figure 14 is a view of the track for one of the supports of the feeder belt, showing its contour, from the rear.

Figure 15 is a cross-section taken on the lines 15—15 of Figure 9, showing the front girder assembly.

Figure 16 is a cross-section taken on the lines 16—16 of Figure 9, showing details of the bat belt.

Figure 17 is a diagrammatic showing of the mechanism for delivering bats from the bat belt to the rollers.

Figure 18 is a cross-sectional view taken on lines 18—18 of Figure 15, looking in the direction of the arrows.

Figure 19 is a top plan view of the spotter boom and plate assembly.

Figure 20 is a cross-section of the spotter boom and plate taken on the lines 20—20 of Figure 19.

Figure 21 is a cross-section taken on the lines 21—21 of Figure 19.

Figure 22 is a cross-section of the spotter plate taken on the lines 22—22 of Figure 20.

Figure 23 is a detailed cross-sectional view taken on the lines 23—23 of Figure 22.

Figure 24 is a detailed cross-sectional view taken on the lines 24—24 of Figure 19.

Figure 25 is an isometric view, partly broken away, showing the structure of the layer head.

Figure 26 is a cross-section, partly in elevation, of the layer head shown in Figure 25.

Figure 27 is a section through the layer arm and suction cup taken on lines 27—27 of Figure 26.

Figure 28 is a plan in section of the above suction cup taken on lines 28—28 of Figure 27.

Figure 29 is a section in elevation of the outer end of one of the layer arms.

Figure 30 is a longitudinal section through the end of the layer arm.

Figure 31 is a cross-section of the layer head taken on the lines 31—31 of Figure 26.

Figure 32 is a cross-section of the layer head taken on the lines 32—32 of Figure 26.

Figure 33 is a top plan view of the mechanism adapted to control the dip and pick of the layer arms.

Figure 34 is a cross-section through the base of the mechanism shown in Fig. 33 taken on the lines 34—34 of Figure 36, illustrating the drive shaft connection which is synchronized with the layer drive shaft.

Figure 35 is a horizontal section on the line 35—35 of Figure 36 showing the layer control cams.

Figure 36 is a cross-section of the layer control cams taken on the lines 36—36 of Figure 35.

Figure 37 is a top plan view of the spreader assembly with the layer head removed showing the control mechanisms for the layer head which are disposed beneath the layer head proper.

Figure 38 is a cross-section taken on the lines 38—38 of Figure 26 showing the disposition of the hydraulic and vacuum passages within the layer head.

Figure 39 is a cross-section taken on the lines 39—39 of Figure 26, also showing the disposition of the hydraulic and vacuum passages.

Figure 40 is a cross-section taken on the lines 40—40 of Figure 26 showing the disposition of the hydraulic vacuum passages.

Figure 41 is a diagrammatic side elevation of the layer head and mortar spreader with the layer arms and mortar spreader in a lifted position.

Figure 42 is a further diagrammatic view of the layer head, the head being shown in its tilted position.

Figure 43 is a diagrammatic illustration of the auxiliary spreader in one of its working positions.

Figure 44 is a diagrammatic representation of the spreader showing a section of nozzles in a lowered position.

Figure 45 is a side elevation of the spreader in one of its regular working positions.

Figure 46 is a detailed cross-section of one of the mortar nozzles.

Figure 47 is a section through a grouter-nozzle guide taken on lines 47—47 of Figure 46.

Figure 48 is a section through a grouter-nozzle guide taken on lines 48—48 of Figure 46.

Figure 49 is a side elevation, partly in section, taken on the lines 49—49 of Figure 46 and looking in the direction of the arrows.

Figure 50 is a diagrammatic illustration of the hydraulic systems employed in the layer unit.

Figure 51 is a plan of that portion of the hydraulic system which deals with the operation of the mortar spreading nozzles and reads in general on Figure 50.

Figure 52 is a plan of that portion of the hydraulic system which deals with the operation of the hydraulic gland in the layer head and shows in addition the connection thereto of the jacks which handle the vacuum in the layer arms.

Figure 53 is a top plan view of the automatic valve control plate.

Figure 54 is an enlarged view of a portion of the automatic valve control plate shown in Figure 53.

Figure 55 is a cross-section of the automatic control plate taken on the lines 55—55 of Figure 54.

Figure 56 is a schematic plan of the top layer of linkage controlled by the keys at one of the operator's hands, also showing the associated spotter arrangements of brick in a normal bond all the layer arms cups in normal position and the normal working position of that set of spreader nozzles engaged in putting head joints on brick being laid.

Figure 56A is a section in elevation taken on lines 56A—56A of Figure 56.

Figure 56B is a low level schematic plan taken on line 56B—56B of Figure 56A showing certain valve linkage and, as well, showing the arrangement of layer arms cups and heading nozzles for the binder header which has been set up on the spotter.

Figure 56C is a low level schematic plan taken on lines 56C—56C of Figure 56A showing certain valve linkage and as well, showing the arrangement of layer arms cups and heading nozzles for the full header which has been set up on the spotter.

Fig. 56D is a schematic plan view of certain valves and spreader nozzles further illustrating the reactions of the elements shown in Fig. 56C.

Figure 57 is a side elevation, partly in section, of the control stand proper.

Figure 58 is a top plan view of the control stand shown in Figure 57.

Figure 59 is a cross-sectional view taken on lines 59—59 of Figure 57 of one of the valve controls.

Figure 60 is a cross-sectional view taken on lines 60—60 of Figure 59 of the incoming lines to the masking plate.

Figure 61 is a cross-sectional view taken on the lines 61—61 of Figure 59.

Figure 62 is a plan view, partly in section, of the valves and lines to the layer and spreader.

Figure 63 is a cross-sectional view taken on the lines 63—63 of Figure 62.

Figure 64 is a cross-sectional view taken on the lines 64—64 of Figure 62.

Figure 65 is a bottom plan view of a portion of the control stand.

Figure 66 is a side elevation of the compensating mechanism.

Figure 67 is a cross-section taken on the lines 67—67 of Figure 68.

Figure 68 is a side elevation of the plumbing mechanism.

Figure 69 is a plan of the bonding scale, and compensating gage.

Figure 70 is a plan view of the compensating dial.

Figure 71 is a cross-sectional view of a portion of the layer carriage showing the carriage driving mechanism.

Figure 72 is a top plan view of a portion of the layer chassis showing one of the driving wheels.

Figure 73 is a cross-section taken on the lines 73—73 of Figure 72.

Figure 74 is a cross-section taken on the lines 74—74 of Figure 72.

Figure 75 is a sectional view of impulse valve.

Figure 76 is a longitudinal section taken on lines 76—76 of Figure 75.

Figure 77 is a top plan view of the central portion of the impulse valve.

Figure 78 is a cut away portion of the casing of the valve and is taken on line 78—78 of Fig. 75.

Referring now particularly to Figs. 1 to 3, the feeder unit 14 will be briefly described only insofar as is necessary to understand the operation of the bricklaying apparatus 328.

Reference numeral 10 denotes one of a pair of rails laid either parallel or at right angles to a wall 12 or 12' to be erected. Feeder unit 14, which rides on rails 10, include a wheeled chassis supporting a mortar tank 24 rotatable on bearings about a vertical axis so as to constitute a reel for a mortar supply conduit 2602 which runs to the mortar spreader hereinafter described. A suitable pressure system forces the mortar through conduit 2602 to the spreader drawing a vacuum.

Also on feeder unit 14 is a pneumatic system (not shown) for drawing a vacuum through line

2604, the controls on the feeder unit and the bricklaying apparatus 328 being coordinated via a hydraulic system 2600.

Brick 7 are supplied to feeder unit 14 by a conveyor belt 180 running between the rails of track 10. A pneumatic lifter 40 on unit 14 picks the brick off belt 180 and passes them to a vertical adjustable elevating belt 178 which raises the brick to the level at which the bricklaying apparatus is working. From elevating belt 178, brick 7 pass to a feeder belt 800, the output of which forms the input of the bricklaying apparatus. Coupling means, not detailed herein, are provided for maintaining the upper end of elevating belt 178 at working level of apparatus 328, and feeder belt 800 flexibly compensates for whatever angle may exist between the working position of the bricklaying apparatus and feeder unit 14.

The layer carriage proper

The layer unit carriage indicated generally by the reference numeral 328 comprises a chassis 330 having an upwardly projecting, annular gear box housing 332. The chassis 330 is substantially rectangular in shape and has supported thereon a plurality of wheels 334 mounted, fixedly, on axles 336. The axles 336 are journalled in suitable bearings in a rotatable shoe 338 (Figures 71, 72, 73, and 74). Referring to Figures 4, 5, and 6, it will be noted the shoe 338 is rotatably supported on a track 340 and may, if desired, include the roller races 342, 344, and the roller bearings 346. As is seen in Figures 72 and 73 the chassis frame 330 is grooved at 348 to permit the rotation of the member 338.

Positioned adjacent the opposite ends of the axle 336 are keyed, the beveled gears 350, 350'. The track 340 is apertured at 352 (Figure 74) to rotatably and slidably receive a drive shaft 354. A pinion 356 is rigidly secured to the outer end of the shaft 354 and is adapted to mesh with either gear 350 (as shown in full lines in Figure 72) or gear 350' (as shown in broken lines in Figure 72). A depending flange portion 358 formed on the rotatable shoe 338 is provided with gear teeth 360 (Figures 73 and 74) adapted to mesh, under certain conditions, with a pinion 362 fixedly mounted on the shaft 354.

The wheels 334 are adapted to ride on tracks 364 and 364', the latter being disposed at an angle to the former. The driving movement for the layer carriage 328 is derived from a prime mover 366 (see Figure 4) through the shaft 354, the pinion 356, the gear 350, (or 350') connected with the wheels 334 through the axle 336.

The inner end of the shaft 354 extends through an aperture 368 (see Figure 71) and is slidably and rotatably mounted therein. The extreme inner end is provided with a flange 370 and is internally splined at 372. A splined shaft 374 is mounted in the hollow splined end of the shaft 354 and has a collar or flange plate 376 fixedly mounted intermediate its ends. Adjacent the innermost end of the shaft 374 a gear 378 is keyed thereon, while the terminal point of the inner end of the shaft 374 is rotatably journalled in a collar 380. The collar 380 is, in turn, rotatably mounted on the shaft 382 carrying the ring gears 384 and 386. The ring gear 384 is adapted to mesh with gear 378 and thereby drive the wheels 334 through the shafts 374 and 354, power from the prime mover 366 (see Figure 6) being supplied through belt 388 connected by a pulley (not shown) to the drive shaft 390 which serves as a bearing surface for the sleeve 392 keyed to a gear 394. The gear 394 engages gear teeth 396 of the gear 366 thereby rotating shaft 382.

In alignment with shaft 374 but positioned slightly thereabove is a shaft 374' having a gear 378' which is driven from gear teeth 396' on the under side of gear 386. This gear drives the wheel 334' diagonally across (or spaced 180°) from wheel 334, see Figure 5. The other two wheels, 334'' and 334''' are driven in a similar manner.

When the laying unit arrives at a corner or junction of the tracks 364, 364', the wheels 334 are brought to rest on a suitable turntable section 365 at the meeting of tracks 364 and 364' shown diagrammatically in Figure 73. To effect a turning of the wheels the lever 367 is operated (see Figure 71) to diminish the diameter of the substantially annular band 369 whereby the splined shaft 354 is caused to telescope with shaft 374. This movement retracts gear 356 from engagement with gear 350 and causes gear 362 to mesh with gear rack 360. The shaft 354 is then driven and the wheel 334 will rotate with the shoe 338.

Reference is made to Figures 5 and 10 wherein it is seen that the chassis 330 is provided with a plurality of radially, inwardly extending, inverted and T-shaped supporting arms 400 welded thereto and to the gear box 332, on which is fixedly mounted an annular support 402 having a bearing race 404. Ball bearings 406 ride in the race 404 and the race 408 formed in a complementary annular member 410 which is rigidly secured to the lower edge of T-shaped supporting arms 412 adapted to support the operator's platform 398. As is clearly shown in Figure 10, the platform 398 and its supporting framework are rotatably mounted on the gear box 332 through the bearings 414 and bearing races 416, 416'.

The platform 398 has mounted thereon the above referred to prime mover 366 (see Figures 4 and 6) having associated therewith the variable speed transmission devices 418, 420, 422, and 424, the barrel cams 426 and 428, and planetary gear device 430, together with certain drive shafts, clutching mechanisms and controls which will be described in detail below.

As is seen in Figures 1, 2, 4, 6, 7 and 21, the platform 398 has mounted thereon four upright screw threaded, spaced members 432, 434, 436 and 438, respectively. These screw threaded members are adapted to cooperate with internally screw threaded collars 440 (see Figure 28), which are externally threaded at 442. The collars 440 are adapted to engage the under surface 444 of one end of an L-shaped bracket member 446 while the other end thereof is rigidly secured to the elevatable framework indicated generally by the reference numeral 447 (see Figure 7). To reduce the friction between the collars 440 and the brackets 446, a bearing race is formed in the upper end portion of the collars 440 adapted to receive the bearings 448 cooperating with the race 450 carried by the bracket 446 (see Figure 18).

The elevatable framework mentioned above comprises a cross member 452 at the rear of the layer unit, the member 452 being supported on the uprights 432 and 434, by the brackets 446, see Figure 21. In a similar manner, a second cross member 454 at the front of the layer unit is supported on uprights 436, 438 by brackets 446, see Figures 4 and 15. Referring now to Fig. 18, each of the cross members 452, 454, respectively,

is provided with a pair of spaced, oppositely disposed, upwardly extending brackets 456, 458, 460, and 462. To brackets 456 and 462 is secured a longitudinal member 464, while to brackets 458 and 460 is rigidly affixed the longitudinal member 464'. The members 464 and 464' will be hereinafter referred to as the "spotter beams." As is seen in Figures 4, 9 and 15, the spotter beams comprise substantially L-shaped angle elements on which is telescopically mounted extension arms 466, 466', and 468, 468', hereinafter referred to generally as the spotter boom 467.

As is seen from Figures 4 and 9, the extension arms 466, 468 and 466' and 468', respectively, are pivoted at 470, 470' to permit the laying of brick at the floor level. To accomplish this operation, the arms 466, 466' are also pivoted near the end of the spotter beams 464, 464', the members being held in their respective positions by means of a pivot pin 472 mounted on the boom 466 adapted to engage in slot 474 formed in the spotter beam when the elements 466, 466' approach the outer ends thereof. Means are provided (not shown) for withdrawing the pin 472 from the slot 474 when it is desired to retract the spotter boom.

Referring now to Fig. 9, the spotter boom arms 466, 466' are extended and retracted from the spotter beam by means of the gear rack 476, 476' adapted to mesh with the idler gears 478, 478' rotatably mounted on the brackets 456, 458, respectively. The idler gears are driven by the gears 480, 480', mounted on shaft 482 (see Figure 15).

The gear 480 is also adapted to engage a second gear rack 483 formed on the underside of the arm 484 (one of a pair of arms 484 and 484') pivoted at 486 to a lug 488 rigidly secured to the boom 468' (see Figure 9). Engagement of the gear rack 483 with the gear 480' is insured by means of the resiliently and pivotally mounted piston 492 secured to the bracket 458, the piston 492 being constantly urged downwardly against the upper surface 494 of the arm 484'.

The bat belt

The bat belt assembly 495 has a frame 490 which carries a bat belt 496 mounted on rollers 498, 498', of which the roller 498' is mounted on and driven through the shaft 500 rigidly secured thereto, the gear 503, the gear 505, shaft 506', the clutch 502, pulley 503, and the belt 504 which is driven by the pulley 503' keyed to the longitudinal extending and screw threaded drive shaft 506 rotatably mounted in brackets 508 (see Fig. 16) carried by the boom track 501. Track 501 is affixed to the boom member 466' and has slidably mounted upon it the bat belt frame 490 which carries a bifurcated side extension element 510 vertically adjustable with respect to the frame 490 (see Fig. 7) and shaft 506 carries a universal joint 509, is driven by gear 505, and 507, gear 507 being keyed to the shaft 2132.

The bat belt frame 490 which carries a bifurcated side extension element 510 vertically adjustable with respect to the frame and adapted to engage, when in its downward position (as shown in full lines in Figure 16) the screw threaded shaft 506. It is at once obvious that the rotation of shaft 506 causes the frame 490 to move in one direction or the other on the spotter boom arms, depending on the direction of the rotation of the shaft.

Thus it will be understood that the bat assembly 495 can be retracted on boom members 501 and 501' for loading.

Also mounted on the bat belt frame 490 and extending transversely thereof is support member 512 (Figure 4) having laterally extending spaced extension arms 514. Adjacent the free ends of arms 514 the side edges are notched to provide space for the rotatable dogs 516 mounted for rotation on shaft 518 (Figures 16 and 17). Suitable brackets 520 are provided to depend from the support member 512 as intermediate bearing supports for shafts 518 and 524.

Intermediate each pair of dogs a vacuum brick handling device 522 of the type described above is rotatably mounted on a hollow shaft 524 coaxially and rotatably mounted on a hollow vacuum line pipe 526.

Four hydraulic jacks 528, only one of which is shown in Figure 17, are suitably mounted on the frame 490, the piston thereof having forwardly and rearwardly extending rods 530, 532. The free end of rod 532 is connected to a stem member 534 at 536, the ends of the stem connecting with a pair of spaced parallel bars 538, 540. The upper surface of bar 538 is provided with two spaced sets of gear teeth 542 and 544 while the lower bar 540 carries the gear rack 546.

The gear rack 542 is adapted to mesh with gear 548, while gear rack 544 engages, during a portion of the rearward movement of bar 538, ratchet sprocket 550 drives the bat belt roller 498. In a similar manner the gear rack 546 engages, during a portion of the movement of arm 540, the gear 552 affixed to the shaft 524. This causing timed movements of the bat belt 496 holding dog 516 vacuum cup 522.

The jack 528 carries on its under side a bracket 554 to which is pivoted a link or dog 558 connected intermediate its end at 560 to a lost motion lever shown diagrammatically at 562, the other end of which is pivotally connected at 564 to the rod 530.

The spotter assembly

The spotter boom members 466, 466' (see Figure 9) are slotted longitudinally at 566 and slidable, interconnected rollers 568 are mounted therein. The spotter boom members 468, 468' are provided with transversely extending fixed rollers 570 and 577. The extreme outer end of the spotter boom members 468, 468' carry the spotter plate assembly 572.

The spotter boom side members 468, 468' carry a floor 576 secured to their under or lower edges (see Figures 19, 20, 21 and 50). On the floor 576 are mounted a plurality of alternately spaced parallel hydraulic jacks 578 and 580. The jacks 580 are provided with a piston rod 582 to which is pivotally connected one end of a dog 584 suitably pivoted intermediate its ends at 586. The piston rod 588 carries a lug 590 on its free end, the lug having secured thereto one end of a line 592 which runs over pulley 594 to a pin 596 mounted on a rammer rod 597 at which point it is anchored, and then continues over pulley 598 and returns to lug 590. The rammer rod is recessed at 598 to receive a counterbalanced dog 600 pivoted on the rammer rod 597 at 602 and adapted to pivot into recess 598.

The hydraulic jacks 580 are interconnected with the hydraulic jacks 578 by conduits 604 (Figure 21).

Suitably mounted on the spotter boom are a plurality of bifurcated resilient elements 606

adapted to guide brick over the rollers 570 toward the spotter plate 572.

The spotter assembly 572 includes a base plate 574 and spotter "plate" 573 rotatably supported in the side members 468, 468' of the spotter boom (see Figure 23) on bearings 608. The inner end of the spotter plate 573 is provided with a depending flange 610 (Figure 20) adapted to slide in a groove 612 formed in a support plate 614 extending transversely of the spotter boom arms 468, 468', to prevent the spotter assembly from slipping from the spotter boom arms.

The spotter base plate 474 is interconnected with the spotter plate 473 by a king pin 616. The base plate 474 also supports hydraulic spotter cup assembly 618 (Figures 20 and 24).

The spotter cup assembly 618 comprise a substantially cylindrical housing 620 flanged near its base at 622, the flange 622 adapted to rotate in a track 624 formed in an auxiliary base 626 fixedly mounted on the base 574. The housing 620 is flanged intermediate its ends and gear teeth 625 (Figure 22) are formed thereon adapted to mesh with the gear rack 627 rigidly mounted on the base 574, and to mesh with a second gear rack 628 slidably mounted in a track 630 (Figure 24). The gear rack 628 is rigidly secured to one end of an arm 632 while the other end is affixed to the piston rod 633 of a hydraulic jack 634. The spotter plate 573 is slotted at 636 (Figure 19) to permit the spotter cup assembly 618 and the spotter cups 638 to rotate and move laterally simultaneously in their respective slots and track 624 when the jack 634 is operated.

The housing 620 is provided with an inner, coaxial upright cylinder 640 open and flanged at 641 near its upper end and spaced from the inner surface of the housing. Disposed between the cylinder 640 and the housing 620 and in surface contact therewith is the stem or plunger portion 642 of the cup 638. The inner end of the stem 642 is provided with an inturned arcuately shaped flange 644 having a portion thereof cut away to form a slot 646 adapted to clear a pipe 648 which extends through the housing 620 and communicates at one of its ends with the interior of the cylinder 640. The top of the housing 620 is apertured to receive pipe 651. As is seen in Figure 24, the pipe 651 has operative connection with chamber 653, chamber 653 formed by the flange 644 and flange 641 via slot 650 and port 655.

The housing is also apertured at 652 to receive one end of a conduit 654, the function of which is to be described.

The vacuum cup 638 is provided with an annular internally threaded sealing ring 656 adapted to be releasably mounted upon its free end.

As is seen in Figure 24, the king pin 616 is slidably but not rotatably mounted in the collar 658 fixedly mounted on the base plate 574.

Referring now to Figure 19, it is seen that the spotter plate 573 is provided with a radially extending lug 660 on which is pivotally mounted at 662 one end of a link 664, the other end of the link being pivotally connected at 666 to the piston rod 668 of a spotter plate aligning jack 670 secured to the member 468'.

The brick are laid generally when the layer arms are at 90° to the line of the boom and track. As brick cannot be picked up and laid at the same time by the 180° arms of the layer head, it is necessary to locate the pick position at other than 180° from the lay position. This

requires turning of the spotter plate and the longitudinal axis of the brick thereon to a position at 90° from a line connecting the axes of the spotter and layer. This turning is accomplished by jack 670 and link 664 through timed operation of valve 1500.

Mounted on the upper surface of the spotter plate 573 is a variable brick stop jack 672, the piston rod of which is connected at 674 to a cross arm 676 having two extension arms 678 and 680. The plate 573 also carries a plurality of spaced, resilient brick guide members 692 and is grooved at 694 (Figures 19 and 20) to receive the free ends of the rammer rods 597 when in their extended positions.

The layer boom

As seen in Figures 4, 10, and 15, a tilt bar 804 is slidably mounted in brackets 806, 806', which are secured to the spotter boom arm 466. The rear end of the tilt bar is pivotally secured to an arm 808 at 809 depending from a cross arm 810 which is connected intermediate its ends to a piston rod 812 of a jack 814, the base of which is secured to the elevatable member 452. The arm 808 is provided with an extension 808' projecting below the tilt bar 804, which is slidably received in a slot (not shown) formed in the member 452.

A second arm 816 also depends from the cross arm 810 and is slidably received in a slot formed in the base 452; and on the outer end of the cross arm 810 an arm 818 is pivotally mounted thereon at 820 through a jack 821. The other end of the arm 820 is rigidly secured to the top member 822 of the layer beam having side members 824 and 826, and the bottom element 828. A jack 830 has the outer end of its piston rod 832 pivotally connected to the arm 818 intermediate the jack 821 and the layer beam member 822.

As seen in Figures 4, 11 and 12 the layer beam is pivotally supported in spaced brackets 834, 834' which project upwardly from the base 454 on pivot pins 836, 836'. The rectangular layer boom 837 has a portion which is substantially U-shaped and is constructed of the top member 838, a bottom member 840 and interconnecting side members 842 and 844. As seen in Figures 4, 11 and 12, the side member 824 is slotted at 846 for a portion of its length. The side 824 of the layer beam is slotted at 848 (Figure 12) to permit the insertion of a gear wheel 850 which is pivoted in bracket 834, 834' to mesh with a gear rack 852 rigidly secured to the top 838 of the layer boom 837, the gear 850 being driven by a gear 854 mounted on the drive shaft 482. The gear 854 also meshes with a gear rack 855 formed on a parallel arm 856. The parallel arm has one of its ends pivotally connected at 857 (see Figure 8) with a pair of plates 838 (only one of which is shown), the plates being pivotally connected, in turn, at 860 with the side members 842, 844, of the layer boom.

Referring to Figures 4 and 8, an extension member 862, of the boom 837 substantially hollow, has one of its ends rigidly secured to the plates 858, the other end of which supports the layer head and its associated elements to be described.

A drive shaft 864 for the layer head is mounted in a bearing 866 in one end of the layer boom while the other end is provided near its outer end (Figure 7) with a universal joint 882, in turn connected with the extension 884, the universal joint 886, the shaft 888 terminating in

the bevelled gear 890 (Figures 26 and 7) which is adapted to mesh with gear teeth 892 formed on the lower end of a rotatable layer head indicated generally by the reference numeral 894.

The inner end of the layer head drive shaft 864 is driven through a gear 868 keyed to a slotted shaft 870 on which it is adapted to move upwardly or downwardly in the manner described above. The collars 872, 872' are adapted to bear against the oppositely disposed adjacent faces of brackets 874, 874' having extensions adjacent a gear 876 keyed on drive shaft 864, gear 876 meshing with and being driven by gear 868. Hence it is seen that (Figure 13) power transmitted to gear 878 which meshes with gear wheel 880 keyed to shaft 870 will drive shaft 864.

The layer head proper

The layer head 894 is rotatably supported on the end post 863 of the extension 862 of the layer boom 837 on rollers 896 as shown in Figures 26 and 32, the extension, at its terminal end being recessed to form a substantially hollow cup-like member 897 in which the layer head rides.

The layer head 894 comprises a base member 898 and a top member 900 fixedly mounted thereon as by bolts 902. Disposed coaxially within the base 898 and depending within the sleeve 904 is a cylindrical gland 905 having an outer shell 906 which has an extension arm 908 rotatably supported on the base of the sleeve 904. Intermediate the ends of the arm 908 a radially extending lug 910 is provided having its free end pivotally connected with one end of a piston rod 912 of the hydraulic jack 914 (see Figure 37). A second gland 916 somewhat smaller in diameter also housed within the base 898, extends into the cylindrical gland 906.

The base of the gland 906 is provided with a port 918 to which is connected a flexible conduit 920 connected with a boss 922 which is in turn connected to a hydraulic source.

The base of the gland 906 is formed with a second port 924 through which extends a flexible conduit 926 in a fluid tight seal, the conduit 926 being connected at one of its ends with a port 928 of the gland 916 while its other end connects with the boss 930 which connects in turn with a hydraulic outlet source.

As seen in Figures 25 and 32, the bottom bearing 898 is provided with a pair of spaced parallel grooves 932, 932' adapted to receive the central depending flange portions 934, 934' of a pair of spaced parallel side members 936, 936' pivotally mounted on the layer head 894 by the transversely extending shaft 938. The members 936, 936' are joined by a pair of laterally extending spaced support elements 940, 940', slotted at 942 to receive a pin 944. The pin 944, 944' connects a pair of depending brackets 946, 946' with an annular ring 948 channel-shaped in cross-section. The ring 948 slidably supports a second ring 950 provided with two depending spaced bosses 952, 952' in which are swiveled one of the ends of the arms 954, 954'. The two arms 954, 954' are slidably received in an arcuate guideway 956, 956' and are provided with pins 958 which are slidably mounted in a slot 960 formed in the enlarged end of the piston rod 962 of the hydraulic jack 964.

The side members 936 are arched at 966, 966' between their respective ends and the depending portion 934 (Figure 25) and each end supports a laterally extending casing 968, 968' connected thereto by bearings 970, 970'.

Each of the casings 968, 968' is provided with two apertures 972, 972' in which are rotatably received in an airtight connection a pair of spaced parallel cylindrical layer arms 974, 974' each of which are provided with a plurality of spaced radially extending vacuum cups, 976, 976', 978, 978' and 979, 980, 980', 980'', respectively. As seen in Fig. 25, cups 976, 978 and 980 are spaced around the longitudinal axis of the layer arm 974 at a distance of 120°.

As seen in Figures 25 and 26, the layer arm comprises an exterior casing 982 provided at spaced intervals with a plurality of circular flanges as described above concentrically mounted thereon. An inner sleeve 988 has the casing 982, rotatably mounted on it. Sleeve 988 is provided with a plurality of apertures 990, 992 and 994, 987 and 989. A masking plate 996 is slidably mounted within the sleeve 988 and is concentric therewith. The sleeve 996 is also provided with apertures, 998, 1000, 1002, 1001 and 1003.

A rod 1004 extends the length of the layer arm, is coaxially disposed with respect thereto, and is secured at spaced intervals to the slidable member 996 by the flanges 997. The arm 974 has mounted on its outer end a spider 1006 (see Figs. 29 and 30) in which rod 1004 is slidably mounted. Adjacent the outer end of the rod a plurality of resilient members 1008 are mounted, these members extending inwardly toward the layer head. The inner ends of the resilient members are bent inwardly to provide a hook 1010 adapted to cooperate with a flange portion 1012 formed on a valve 1014 slidably mounted on the shaft 1004. The spider 1006 is provided with an inwardly extending portion 1016 having an enlarged terminal portion 1018 adapted to cooperate with the resilient members 1008 to release the valve 1014 from the hook 1010. A spring 1020 is disposed between the spider 1018 and the outer end of the flange 1012 and tends to constantly urge valve 1014 toward its valve seat 1022.

The inner end of the layer arms have a similar valve and control therefor.

The casing 982 is provided near its inner end with a ring gear 1024 adapted to cooperate with a gear rack 1026 affixed to the piston rod 1028 of a hydraulic jack 1030 mounted on a bracket 1032 rigidly mounted on the member 968. A second jack 1034 is also mounted on the bracket 1032 and is provided with piston rod 1036 affixed to a gear rack 1038 which meshes with a gear 1040 rigidly secured to sleeve 988.

The inner end of the rod 1004 is secured to the piston rod 1042 of a jack 1044 mounted within the casing 968. The hydraulic jack 1044 is provided with a cut-off valve 1045 operated by means of a trip arm 1047 which engages against a fixed abutment 1049 mounted on the spreader frame 1094.

The hydraulic jacks 1030, 1034, are each provided with reversible inlet and outlet conduits 1046, 1048, respectively, the systems for each jack being independent of the other. These lines are in turn connected to the conduits 1050, 1052 in the layer bearing 900. The jack 1044 is provided with a similar connection with the layer head, not shown.

The casing 968 is in turn connected by the conduit 1054 with the vacuum system of the device through the layer bearing 900.

The vacuum cup 984 (see Fig. 27) is threaded externally at 1057 to receive a replaceable wearing surface 1056. The cup 984 is also threaded internally at 1059 to receive member 1062 having

three depending legs 1058, which carry a rim 1066. The member 1062 has a circular valve seat at 1060 against which the butterfly valve 1068 is held by vacuum when the cup 984 is not engaged against a brick, thus sealing the arm against leak from a disengaged cup. Also engaged within the internal member 1062 and mounted concentric with and between the valve 1065 and shoulder 1062 is a spring 1069.

The layer arms 974 are adapted to be raised and lowered with respect to the horizontal by means of the bracket 1032 which is slotted at 1094 to slidably receive a lost motion linkage mechanism comprising a pin 1096 fixedly mounted in the end of a link 1098 pivotally connected at 1100 with a piston rod 1102 of a jack 1104 mounted on the lateral ties 940 and 940' and shielded by the flanged plate 1105. It is readily seen that the extension or retraction of the piston rod 1102 will cause the arms 974 to change their angle of inclination to the horizontal.

A pair of locking arms 1106, 1106' are pivotally mounted at 1108 on the top bearing 900 of the layer head 894. These arms are notched at 1110 to receive a tongue 1112, 1112' affixed to the casing 968, 968'. Each of the locking arms are spaced from (when in locked position) the adjacent surface of a cam 1114.

While in Figure 25 only six conduits are shown in the layer head, eighteen are actually contemplated. Reference is now made to Figures 38 to 40, inclusive, which disclose the arrangement of these conduits.

Figure 38 is taken on lines 38—38 of Figure 25 and discloses a vacuum line conduit 1055 spaced from the reversible hydraulic lines or conduits 1050, 1052. On the diametrical opposite are disposed in order the reversible hydraulic conduits 1050' and 1052' and the vacumm line 1055'. For the purpose of simplicity the lines affecting the operation of one arm only will be described, it being understood that the same functions occur in the other layer arms under the same given conditions.

The conduits 1050 and 1052 are connected on opposite sides of the piston of the hydraulic jack 1030 whereby the reduction or increase in pressure in either line will produce a movement of the piston rod 1028. The vacuum line 1055 connects with the casing 968 through the conduit 1054 as described. The jack 1034 is similarly connected through the reversible pressure conduits 1051 and 1053. The hydraulic jack 1044 is connected in an identical manner with the conduits 1061 and 1063, and the lifting jack 1104 is hydraulically connected to the layer head through the conduits 1065, 1067.

Figure 39 is a view similar to Figure 38 but taken on the lines 39—39 and showing port 917 from the central gland 916 which is operatively connected with conduits 1050, 1053, 1063, 1067, 1050', 1053', 1063', and 1067'.

In Figure 40 it is seen that the vacuum line 1055 connects with an arcuately shaped chamber 1057 formed in the layer bearing 898 which connects with the hollow interior of the base 904.

The mortar spreader

The spreader device 1094 comprises a frame. An outer side member 1116 may be used. An inner side member 1118 has ends which are journaled to rotatably receive the interconnecting, laterally extending front and rear rods 1120 and 1122, respectively. These rods are covered with a roller suitably mounted to rotate thereon. The inner ends of the rods 1120, 1122 are supported in members 1124, 1126 which are in turn rotatably supported on the arms 1128, 1130, of a framework formed integrally with the substantially annular ring 1132, all on the rotatable shaft 1134.

Reference is now made to Figs. 37, 41, 42, 43, 45, 46, 47, 48, and 49. Pivotally mounted on the shafts 1120, 1122 are a pair of oppositely disposed arms 1136, 1138 and a corresponding pair of arms 1140, 1142. Disposed between the arms 1136, 1140 and 1138, 1142 are a plurality of telescoping mortar spreader nozzles 1144 (see Figure 37 and Figure 43), and grouped in two sections having the general reference numbers 1141 and 1141'. Each mortar spreader nozzle 1144 is provided with a jack 1146 having a piston rod 1148 connected with the outer end of the mortar spreader nozzle whereby the nozzle may be extended or retracted at will. Each mortar nozzle connects with the flexible mortar conduit 1150 through the valve 1152, flexible leads 1155 and 1157 and the valve assembly 1153, which will be described below, and the branches 1154, 1156. A pressure control valve 1158 is also provided in the mortar supply line. The jacks 1146 are supported at one of their ends on either of the conduits 1156 or 1154 and are supported at their other ends by the laterally extending arms 1160 connected at one of its ends with the piston rod 1148, while its other end is slidably received in a groove 1162 formed in the side of a longitudinally extending support 1164, having one of its ends rigidly secured to either of the conduits 1156 or 1154.

The support 1150 also carries a mortar nozzle valve control or trigger 1166, adapted to reciprocate and in so acting, alternately open and close the valve 1168 in nozzle 1144 (see Figures 45 and 49).

The other side of the member 1164 is grooved at 1167 to slidably receive the nozzle support 1168.

The arrangement and mounting of all the mortar nozzles and their controls is similar to that described.

The side members 1116 and 1118 also carry the horizontal and vertical jointers 1170 and 1172, 1170', 1172' respectively. These jointers are adapted to reciprocate in horizontal planes and are constantly urged inwards by the spring 1174 which abuts against one end of the jointer, see Figure 26, the other end of the spring engaging the frame members 1116 and 1118, respectively.

The nozzle supports 1136 and 1138 are connected at 1176 and 1178 with chains 1180, 1182, respectively, which in turn are connected with one end of piston rods 1184, 1186, of hydraulic jacks 1188, 1190. These jacks control the angle of displacement of the nozzles sections 1141 and 1141' with respect to the plane of the spreader frame.

A third jack 1192 is provided with a piston rod 1194 which is secured to a crank lever 1196 formed integral with the shaft 1134 thereby providing means for rotating the spreader frame into planes disposed at an angle to the horizontal. An arcuately shaped track 1198 having a depression 1200 is connected at its opposite ends with the arms 1128 and 1130. A track 1202 (see Figs. 4 and 26) similar in configuration is displaced from track 1198 at 180° and is formed on the head of the layer support casing 862. These tracks and their respective depressions are adapted to carry rollers 1204, 1206 mounted on the tiltable layer arm members 968, 968'.

The ring shaped portion 1132 of the spreader frame is provided over a segment of its periphery

with a slotted gripping edge 1208 which is engaged at spaced intervals by ratchets 1210, 1210', mounted on piston rods 1212, 1212' of the hydraulic jacks 1214, 1214' mounted on the layer boom.

The ring shaped portion 1132 is pivoted on an annular member 1216 by the interconnecting rods 1218, 1218'. A second set of rods 1220, 1220', spaced 90° from rods 1218, 1218' interconnect the ring 1216 with a collar 1222 (see Figures 26, 31, and 37) rotatably mounted on the stem 904 of the layer head support, the collar having gear teeth 1224 disposed around its periphery adjacent the lower end thereof. The gear teeth 1224 are adapted to mesh with the idler gear 1226 driven through gear 1228 which in turn meshes with a worm gear 1230 mounted on shaft 1232 which is driven by the reciprocating motor 1234.

Cams

A plurality of cams, indicated generally by the numeral 1235, are employed to influence the dipping of the layer arms in their laying and picking position. These cams are mounted within the layer boom member 862 and comprise (see Figs. 26, 33, 34, 35, and 36, 37) a fixed base 1236 having secured thereto three upwardly projecting arcuately shaped channel members 1238, 1240, 1242. Two other arcuately shaped channel members 1244, 1246, are slidably mounted with respect to the fixed base 1236 and the floor of the layer boom. The arcuate member 1246 is provided with a flanged segment 1248 provided with gear teeth 1250 adapted to be engaged by gear 1228 mounted on shaft 1252 mounted on the layer boom.

A boss 1254 projects upwardly from the base 1236 and is journaled to receive a shaft 1256 having an intermediate ring shaped portion 1258. A gear 1260 is keyed to the lower end of the shaft 1256, the gear being adapted to mesh with gear 1262 mounted on the shaft 1264 which is provided with a second gear 1266. Gear 1266 is driven through the gear 1268 keyed on the drive shaft 888, thus synchronizing the revolutions of the cams 1235 with the layer head 89A.

Each of the arcuately shaped members described above carry a chuck 1270, 1270' (only two being shown) slidably mounted therein. Each chuck is provided with a pocket 1272, 1272' in which is mounted a spring element 1274, 1274' adapted to engage the lower end of a piston 1276, 1276' provided with an inwardly extending shoulder portion 1278, 1278' grooved at 1280, 1280' to slidably receive a plate 1282. The plate 1282 is swivally mounted on the enlarged head 1284 of a shaft 1286 rigidly mounted on ring 1258 and coaxial with shaft 1256. The plate is apertured at 1288, 1288' to permit rotation in an inclined plane with respect to the ring 1258.

Each chuck is provided adjacent its lower end with a groove 1290 adapted to slidably receive a flange 1292 of an annular member 1294. The member 1294 is provided with a track 1295 having two recessed portions 1296 (only one being shown) disposed 180° apart.

The chuck 1270 is provided with an inwardly disposed annular track 1298 having diametrically opposite recesses 1300.

As seen in Figure 35, the plate 1282 is provided with cutaway portions 1302, 1304, 1306, 1308, in which are mounted shaft 1310, 1312, 1314, and 1316, respectively, to which are keyed the wheels 1318, 1320, 1322 and 1324 adapted to ride on tracks 1295 and 1298.

The arcuate member 1244 is pivotally connected at 1326 with a rod 1328 which has its free end connected with the radius rod 1330. The radius rod 1330 has one of its ends connected to the spotter boom while its other end is connected with the layer head. The radius rod 1330 carries a tripping element 1332 adapted to contact trigger arm 1047 when the layer arms are rotated into the pick position over the spotter boom.

The plate 1282 engages cam shaped grooves 1334, 1334' formed in the free end of trigger levers 1336, 1336' which have their other ends connected with an automatic valve 1338, 1338' controlling the fluid supply to the hydraulic jacks 964, 964'. This valve is also provided with an overriding control adapted to cut out the automatic function and to permit the fluid to enter the jacks by manual control means.

Referring now more particularly to the mortar nozzles 1144 of the spreader device, the details of their construction will be readily seen in Figs. 26, 45, 46, 47, 48, and 49. The mortar nozzle 1144 is formed in any number of telescoping sections and is connected at one of its ends with the mortar supply pipe 1154. The free end of the nozzle 1144 is provided with a rotatable valve 1168 having a gear 1340 affixed thereto. The valve actuating mechanism comprises a bumper roller 1342 mounted on frame 1166, the frame carrying a gear rack 1342 on its underside and adapted to engage the gear 1340 to rotate the valve into its open or closed position. The inner end of the trigger frame 1166 is substantially hollow and has mounted therein a resilient member 1346 which acts against an abutment 1348 on the rod 1350 mounted on the flange or lug 1160.

The support 1162 is provided with a passage 1356 through which grouting is fed. A weighted gate valve 1158 of any desired type is slidably mounted in the support in channels 1360. Inwardly turned shoulders 1362 prevent the valve from displacement when in its downward or open position.

A pair of mercury switches 1364, 1366, are mounted at right angles to each other on the spotter boom, the function of which will be described below.

While numerous hydraulic jacks have been described no attempt has been made to show their operative connections and controls. Such a system is set forth in detail below.

A fluid reservoir 1368 (see Figs. 50 and 53) is connected with a pump 1370 through a conduit 1372. The pump 1370 is provided with an outlet conduit 1374 having a branch 1376 which carries a pipe into conduit 1378 which is in turn connected with a pipe 1380 which connects with the intake ports of four valves 1384, 1384', 1384'' and 1348''' adapted to control the vacuum supply to the vacuum cups 638, 638'. A conduit 1388 connects with the intake ports of a pair of valves 1386, 1386'.

The valves 1384, 1384' are each provided with ports wihch are connected by means of the pipes 1390, 1392, 1394 and 1396 with the interior of the hydraulic jacks 692, 692' on opposite sides of the piston (not shown) thereof.

A fluid return line from the valve to the reservoir 1368 is carried in the conduit 1378 and the interconnecting conduit 1404.

The valves 1384 are operated in such a manner as to alternately throw fluid under pressure from one side of the piston to the other and to permit the exhaust of the fluid from the low pressure side to the reservoir. The valves 1384 are hydraulically operated to cut off the vacuum in

the jacks 638 and 638'. This done through the closed system 1408, which includes the conduits system 1410 and the servo-motor 1422.

The servo-motor 1422 is actuated by a piston rod 1424 connected with the piston of the hydraulic jack 1426 connected to a valve 1428 having an operating trigger 1332 adapted to be struck by links 1047 and 2500 mounted on the layer head.

The valve 1428 is a spring return type adapted to move the piston of the jack 1426 by use of the high pressure and return lines in conduits 1448 and 1380.

Vacuum cups 638, 638', 638'', 638''' when an oncoming brick is seated against any of the plungers 2292, 2292', 2292'', 2292''', each plunger reacting against the fluid in its closed pipe 1440, 1440', 1440'', 1440''', only one of which 1440''' is shown, see Fig. 21. The pressure on the fluid in turn throwing the control valve 1384''' of the jacks 692'''.

Reference is now made to Figs. 19, 20, 21, 50, 53, 54, and 55. Let it be assumed that brick have been delivered to the dogs of the jacks 580 and are in position to be rammed onto the spotter plate.

Hydraulic fluid has passed from the pump 1370 through the conduit 1450, the pipe 1452, the main cut-off valve 1454. Intermediate the ends of the pipe 1452 four branch pipes 1456, 1458, 1460 and 1462 are connected thereto, each of the last named pipes being provided with a pair of spaced cut-off valves 1464, 1464', 1466, 1466', 1468, 1468' and 1470, 1470'. Positioned intermediate each of the spaced valves is a branch conduit 1472, 1474, 1476 and 1478.

A pressure relief valve 1480 is also connected with conduit 1452.

Each of the pipes 1456, 1458, 1460 and 1462 are connected to a valve device indicated generally by the reference numeral 1482. This valve device contains seven banks of valves, 1484, 1486, 1488, 1490, 1492, 1494 and 1496. Each of the banks of valves is provided with a reciprocating plunger, 1498, 1500, 1502, 1504, 1506, 1508, and 1510. The plungers are secured at one of their ends to the cross arm 1512 which is secured to a crank shaft 1514 having one end provided with a gear 2148 which meshes with pinion 1516 keyed to a vertical shaft 1517.

Since each bank of valves is similar in construction only one will be described in detail, namely, 1484.

The plunger 1498 reciprocates in a valve casing 1518 (see Figs. 54 and 55) and is provided with eight transversely extending, spaced, parallel passages (only two of which are shown) 1520, 1522.

The valve casing in which the plunger reciprocates is provided with four groups of inlet and outlet passages only two groups being shown, namely, inlet and outlet passages 1524 and 1526, respectively, and 1528, 1530, respectively. As seen from an inspection of Fig. 54, these inlet and outlet passages are of varying configuration. The valve casing also carries four pair of passages, one pair only being shown.

While four reamer jacks 578 are shown only the operation of one will be described, it being understood that the remaining three are also connected with the valve 1484.

One side of the piston of jack 578 is connected through pipe 1536 and conduit 1537 with passage 1534 while the other side of the piston is connected through pipe 1538 and conduit 1537 with passage 1532.

The incoming high pressure fluid in pipe 1462 is connected with the passage 1528 while passage 1526 is connected through conduit 1540 with the reservoir 1368 through pipes 1542 and 1406. The high pressure fluid is also connected through pipe 1462 with passage 1528 and the passage 1530 connects with the reservoir 1368 through pipes 1540', 1542, and 1406.

Each plunger is provided with two projecting pins 1544 and 1546 adapted to be slidably and rotatably mounted on a reduced portion 1548 of the plunger. As seen in Fig. 54, the pins 1544, 1546 are rigidly secured to an internally splined annular member 1545. Each reduced portion 1548 is splined at opposite ends in order to receive the splined annular member 1545 during a portion of the plunger travel. A collar 1550 is superimposed over the reduced portion to prevent leakage.

Cam elements 1552, 1554, are mounted on each valve bank, the cam elements having transversely extending passages 1556, 1558 adapted to receive the pins 1544 and 1546, respectively. The contour of the cams is such that so long as the cams maintain the pins in vertical position no fluid passes through the valves. However, whenever the pin is forced to rotate to either side of the vertical, the valve operates to permit the entrance or exhaust of the fluid from one end of the jack it is designed to control. The other side of the jack's piston receiving an opposite flow of fluid.

Adjacent each end of the cam plates 1552 and 1554 are disposed a plurality of spring clamps 1560, 1562, 1564, and 1566 at each end of their path of travel. The clamps are designed to engage the splined reduced portion of the plunger with the splined annular member affixed to the pin. Cam passage 1556 controlling the rotation of the valve plunger 1498 on its travel to the left, while cam passage 1556 will control the plunger 1498 on its travel to the right.

The remaining six banks of valves are constructed in a similar manner.

It will be understood that each of the four reamer jacks 578 are connected with a pair of passages formed in the valve body 1518 as described, and each passage is controlled by a transverse passage extending through the plunger.

The dog jacks 580 comprise servo-motors each side thereof being connected with opposite sides of the reamer jacks 578 through the conduits 604.

The jacks 634, 634', 634'', and 634''' (see Figs. 22 and 50) which control the rotation and lateral movement of the spotter cups 638, 638', 638'' and 638''' are connected in a similar manner with valve bank 1504 and 1506 and are connected therewith through the conduits diametrically indicated by the reference numerals 1568, 1570, 1572, or 1574.

The jack 670, effecting the turning of the spotter plate 572 is connected with valve bank 1500 through the conduit 1576.

The batjacks 528 are connected with the valve bank 1508 through their pressure and return conduits 1582, as shown diagrammatically in Fig. 50.

The gland control jack 914 is connected with valve bank 1510 through the valve 1590, the conduit 1592, valve 1594, and conduit 1596.

The mortar nozzle jacks as seen in Fig. 57, 1147 and 1146 are provided with group 1601, bank and individual control valves 1606, 1608, 1610, 1612, and 1614, 1616, 1618, and 1620. As seen in Fig. 51, pressure reducing valves 1622, 1624, 1626 and

1628 are inserted in the high pressure lines 1472, 1474, 1476, and 1478, respectively. The valves 1598, 1600, 1602 and 1604 are three way valves and a description of the function of one will be typical of the nature and function of the others.

Valve 1598 connects by pipe line with valve 1614 and through a 2nd pipeline with valve 1606. The structure of the valve is such that one may, selectively, cause fluid to pass to either one of the valves or to both, as desired.

The valves 1606 and 1614 are provided with fluid return pipes 1626 and 1628 which are connected to the reservoir 1368 through conduit 1630. The valve 1606 is connected through conduits 1632, 1634, with a valve 1636. The valve 1636 is in turn connected to the opposite sides of the jacks 1147 through conduuits not shown.

The valve 1614 is connected through conduits 1638 and 1640 with a similar, oppositely disposed valve 1642 connected with jack 1146.

Kinematic means illustrated diagrammatically by the broken line 1644 is provided for manually controlling as a group the valve bank 1606, 1608, 1610, 1612, and the valve bank 1614, 1616, 1618, and 1620.

The mortar lines 1154 and 1156 are provided with jacks 1648, 1650 adapted to selectively operate the gate valves 1652 and 1654 respectively, through the valves 1656, 1658, operated by handle members 1660 and 1662. The jack 1648 is connected with valve 1658 through the conduits 1664 and 1666, and the jack valve 1649 while jack 1650 is connected with valve 1656 through conduits 1668 and 1670. The valves, in turn, are connected with a fluid pressure source through conduits 1172, 1174, and 1450. A pressure reducing valve 1176 is inserted between the line 1450 and valves 1656 and 1658 to reduce the line pressure before the fluid reaches valves 1656, 1658. The valves 1656, 1658 are provided with fluid return conduits 1678, 1680 which connect with pipes 1363 and 1365 which returns the fluid to the reservoir 1368.

The valves 1656, 1658 mentioned above comprise but two of a series of manually operated valves. These valves are incorporated with valves 1684, 1686, 1688, 1690, 1692 and 1694 (see Figs. 57 and 62) in a valve bank referred to generally by the numeral 1992.

Fluid under pressure is connected with conduits 1696, 1698 (Figs. 59, 60, and 62) and exhaust conduits 1700, 1702, are connected with the reservoir 1368. The conduits 1696, 1698, 1700, 1702 are provided with ports 1704, 1706, 1708, and 1710, respectively, formed in the base plate 1712 over which is super-imposed a masking plate 1714 provided with ports 1716 and 1718 to which are connected flexible conduits 1720 and 1722, respectively.

As seen in Fig. 60, the ports 1704, 1706, 1708, 1710 are arcuately shaped, and that branch conduits 1724, 1726, 1728, and 1730 connect a second set of arcuately shaped ports 1704', 1710', 1706' and 1708', respectively, with the inlet and outlet conduits 1696, 1698, 1700, 1702.

The masking plate 1714 is adapted for movement over plate 1712 and beneath the guide shoulders 1732, 1734, formed integrally with the housing 1736.

A manually operated handle 1738, having a substantially hollow interior is slidably mounted upon a piston 1740. Between the upper end of the handle 1738 and the piston 1740 is disposed a spring member 1742 tending to constantly urge the handle away from the piston.

The base of the handle 1738 is provided with a flange 1744 adapted to contact the top of linkage operating pins 1746, 1748, 1750 and 1752.

The piston 1740 is provided with a shank 1754 which is swiveled at 1756 on the housing 1736. The free end of the shank 1754 is slotted at 1758 in order to receive a pin 1760 which extends transversely of a semi-spherically shaped element 1762 which is slotted at 1764, 1764' to receive arms 1766, 1768. Hence it is seen that as the masking plate 1714 is moved laterally from the left to the right, the direction of the fluid in the pair of flexible pipes 1720 and 1721 will be reversed. The flexible pipes 1720, 1721, 1722 and 1723 (see Fig. 62) connect with the valve 1692. The outlet from the valve 1692 comprises a plurality of pairs of pipes 1950, 1952, and 1954, 1956 and 1958, 1960 and 1962, 1964. The pair of pipes 1950, 1952 connect with the jack 1214 while the pair of conduits 1954, 1956 connect with the jack 1214'. The bottom pairs of lines 1958, 1960 connect with the jack 964 and the pair of conduits 1962, 1964 connect with the jack 964'.

Kinematic means 1782 connecting with the lever 1661 are provided in order to operate the valve 1692. These kinematic means, 1782, are operated simultaneously with secondary kinematic means 1966 whereby the valve control 1694 is operated simultaneously with the valve 1692.

The valve 1694 is superseded by the control valves 1684, 1686 and 1688, each of which is connected to the supply and return conduit 1363 and 1450. As shown in Fig. 63, the valves 1684, 1686, and 1688 are adapted to determine the direction of the flow of the fluid through the conduits leading from the outlet side of the valve bank 1694. As shown in Fig. 63, operation of the pin 1968 through kinematic means 1978 will reverse the direction of the flow of the fluid through the conduit 1972 and to the chamber 1974. The operation of the pin 1976 will determine whether or not the fluid is to be directed to the upper series of pipes such as the conduits 1900, 1902, or the lower series of pipes 1904, 1906.

Referring once again to Fig. 62 of the drawings, the valves 1684 and 1686 permit fluid to pass into the conduits 1900 and 1902 when the valve pin 1976 is in the position shown in Fig. 63. The valve 1684 is operated through the kinematic means 1978 which in turn is operated through the nib 1746 and by the handle member 1738. If the pin 1976 be moved to its left hand position as shown in dotted lines, the fluid will be directed to the lower pair of pipes, 1906, 1904, and the direction of the flow of the fluid therethrough will be again determined by the position of the valve 1684.

The valve 1686 is controlled by the nibs 1750 and 1752 which are connected through linkage mechanism 1802 and 1802'. The outlet side of the valve 1686 connects with the inlet of the valve 1694 where the fluid is permitted to pass through the upper conduits 1804, 1806, or optionally, through the lower set of pipes 1803 and 1805.

The valve 1688 is controlled by the kinematic means 1980 which connects with the nib 1748. The conduits from the outlet ports of the valve 1688, are connected, again, with the valve 1694 which may be operated through the above-described means to permit the flow of fluid through the upper pair of conduits 1812 and 1814 or through the lower pair of conduits 1813 and 1815.

With the arrangement just described, the upper series or pairs of pipes all connect to jacks

mounted, to the spreader while the lower pairs of conduits are connected with jacks, mounted in general upon the layer device. More specially, the upper pair of conduits 1900, 1902 are connected with the jack 1188, the conduits 1804 and 1806 are connected with the jack 1192, and in a similar manner the conduits 1812 and 1814 are connected with the jack 1190. The lower series of pairs of pipes 1904, 1906 connect with the 6-way valve 1905 from which the fluid is directed to the glands 905 through the conduits 920, 926. The pair of conduits 1803, 1805 are connected with the gland jack 914 (see Fig. 52). And finally, the lower pair of conduits 1813 and 1815 connect with a jack 1982 for operating an auxiliary mortar blade to be described.

The valve 1694' is also controlled by the kinematic mechanism 1782 and controls the direction of the flow of the fluid through the conduits 1984, 1986. These conduits (see Fig. 57) connect with the hydraulic jack or servo-motor 1988 which is provided with the piston rod 1990.

The entire valve bank and controls therefor referred to generally by the reference character 1992 is mounted on a casing or stand 1994. As shown in Figs. 57 and 65 the base plate 1996 of the control mechanism 1992 has rigidly secured thereto a depending shaft 1998. The casing 1994 is rigidly secured to the supporting legs 2000. Thus, it is seen that the shaft 1998 and the base plate 1996 together with its associated mechanism may be rotated independently of the housing or casing 1994.

To the base of the shaft 1998 is secured one member of a disclutch 2002 and 2004. The plate 2002 of the disclutch is provided with a laterally projecting apertured portion 2006 which is adapted to receive the toe of the L-shaped member 2008. The other member, 2004, of the clutch is provided with a depending collar 2010 to which is pivotally mounted a laterally extending arm 2012. A shaft 2014 connects the collar 2010 with the plate 2016 on which are pivotally secured the two laterally extending rods 2018 and 2020. The bevel gear 2022 is fixedly secured to the base of the plate 2016 and is in coaxial alignment with the shafts 2014 and 1998. A second bevel gear 2024 meshes with the gear 2022, the former being rigidly mounted on drive shaft 2026.

As was mentioned above, the arm 2012 has one of its ends pivotally connected with the collar 2016. The other end of the arm 2012 is pivotally connected with the free end of the piston rod 1990. Intermediate the ends of the arm 2012 is provided a pivot point 2028 whereby the arm may be supported and pivoted on the support 2030. Intermediate that end of the arm 2012 which is connected with the collar 2010 and the pivot point 2028 is also pivoted a link member 2032 which is adapted to engage the arm 2008 whereby operation of the servo-motor 1988 will raise and lower the toe of the arm member 2008 in order to engage and disengage the same from the apertured boss 2006. The function of this particular piece of apparatus will be described more in detail below.

As will be seen from an inspection of Figs. 57 and 65 of the drawings, as the plate 2002 is rotated around its center point, the arm 2008 and its connecting arm 2034 will be moved longitudinally. The arm 2034 has secured to its free end a plate 2036 in which are mounted the ends of the flexible couplings 1450' and 1363'. The ends of the conduits 1450' and 1363' are adapted, upon lateral movement to the right, as shown in Fig. 57, to shift into alignment with ports 2038 and 2040 which in turn are connected with the conduits 2042, 2044 which connect with opposite sides of the motor 1234 (see Fig. 37). It should be noted that the hydraulic leads 1450' and 1363' are divided as they approach the plate; lead 1450' connecting with ports 2038 and 2040 and lead 1363' dividing to ports 2039 and 2041. Thus movement of the top plate of the valve to the right will cause motor 1234 to drive its shaft 1262 (see Fig. 37) in one direction while movement to the left will cause a reversal of the shaft 1262.

As was mentioned before, the conduits 1913, 1915 control the jack 1982. The jack 1982 (see Figs. 26 and 37) is mounted on a plate 1153' forming a part of the assembly 1153. As shown in these figures, the jack 1982 is provided with piston rods which extend laterally from each end thereof, the free ends of the piston rods being provided with hook members 2044 and 2044', the hook portions being adapted to engage upon lateral movement of the piston rod the projecting arms 2046 and 2046' respectively. The projecting arms 2046 and 2046' are formed integrally with the blades 2048 and 2048' which are pivotally mounted on the conduits 1154 and 1156. Each of these arms, as is seen in the drawings, is connected with a mortar supply through apertures 1155 and 1155' formed in the pivotal mount.

The driving means for carrying out the function of this machine will be now described.

Reference is made to Figs. 4 and 6 in which general plan views of the driving mechanism are shown. The prime mover comprises a motor 366 which is preferably of the electric type, the motor driving the shaft 390 by means of the belt connection 388. The shaft 390 is connected, in turn, by means of the belt 2060 with the shaft 2062 in order to drive the variable speed gearings 418 and 420. The variable speed gear device 418 is connected with shafting 2063 (see Figs. 71 and 4) superimposed over the drive shaft 390 which includes the clutches 2064 and 2066 operable by the foot lever 2068 for driving the pinion 2070 in one direction or the other. The driving of the pinion 2070 which meshes with the circular gear 332 causes a rotation of the carriage body about its vertical axis.

The variable speed gearing 420 is connected by means of the belts 2072 and 2074 with shafting 392 for transmitting motion through the pinion 394 to the wheels of the brick laying device 334, 334', 344'', and 334'''. Associated with the shaft 392 are suitable clutches 2080, 2082 operable by the foot lever 2084 (see Figs. 6 and 71).

An extension of the drive shaft 390 has rigidly secured thereto a pinion 2086 which meshes with the pinion 2088 rigidly secured to one end of the shaft 2090, the other end of the shaft being provided with a suitable clutch 2092 for connecting or disconnecting the pinion 2094 with the gear 2096 which is rigidly secured on the shaft 2098. The shaft 2098 is slotted in the manner similar to the shaft 870 (see Fig. 13) and rotation thereof will produce an elevation of the member 464 (see Fig. 4). The elevation of this member is derived from the fact that the pinion 2100 mounted on the bracket 2102 meshes with the screw gear 2104 which is in turn rigidly mounted on the shaft 2106 which has secured to one of its ends the bevel gear 2108 (see Fig. 4). The bevel gear 2108 in turn meshes with the bevel gear 2110 which is rigidly mounted on the shaft 2112, the opposite ends of which are provided with worm gearing 442 (see Fig. 18).

A still further extension of the main drive shaft 390 is provided on its terminal end with the bevel gear 2114 which is meshed with the complementary bevel gear 2116 rigidly secured to the input shaft 2118 of planetary gearing 430 and the variable speed gearing 424. The output end of the variable speed gearing 424 is provided with a drive shaft 2120 on one end of which is mounted a clutch 2122 for connecting and disconnecting therewith the bevel gear 878 that is in continuous engagement with the cooperating bevel gear 800 as shown in Figs. 13 and 6.

The other end of the drive shaft 2120 of the variable speed device 424 is connected by means of belt 2124 with the shaft 2126. The shaft 2126' has, rigidly secured thereto, the bevel gear 2128 which meshes with the horizontally disposed bevel gear 2130 keyed to the shaft 2132 (see Fig. 15). A suitable clutch 2134 is interposed between the shaft 2126 and the shaft 2126' whereby the latter may be driven at the will of the operator. The shaft 2132 carries the gear 2136 which is adapted to mesh with the gear 2135 (see Figs. 4 and 15) mounted on the cross shaft 702 (see Fig. 9) for driving the belt 800.

The drive shaft 2126 carries a second drive belt 2138 which is connected with a shaft 2140 on which is mounted a gear 2142 meshing with the gear 2144 which is keyed to the vertical shaft 1517 which carries with it a second gear 1516 (see Figs. 53 and 54) adapted to mesh with bevel gear 2148 rigidly secured to the crank 2150. The crank 2150 operates to cause a reciprocation of the U-shaped member 1512 (see Fig. 53) to which is secured the ends of the valve rods 1498, 1500, 1502, 1504, 1506, 1508, and 1510 (see Figs. 53 and 54). Suitable clutching means 2154 is provided for clutching and declutching the shaft 2126 with the belt 2138.

The control of the planetary gearing 430 is derived through the laterally extending links or arms 2018 and 2020 (see Figs. 6 and 57), the variation in the effective lengths of said arms being accomplished by turning the shaft 2014.

The other terminal end of the drive shaft 390 is connected, directly, with the variable speed gearing 422 the output of which is connected through the belt 2156 with the pump 1370.

Intermediate the ends of the shaft 390 is provided a bevel gear 2158 which is rigidly secured thereto and meshes with a cooperating gear 2160 rigidly secured to the cross shaft 2162. The cross shaft 2162 is in turn provided with a clutch 2164 for controlling the rotation of the pinion 2166 adapted to mesh with the horizontal pinion 2168 (see Fig. 15), the pinion 2168 being keyed to the shaft 2170 and driving in its turn the pinion 2172 adapted to mesh with the gear 2174 which is secured, fixedly, to the cross shaft 482 to provide extension of the spotter booms 467 through the gearing 480 and 478 and the gear racks 476 and 483 (see Fig. 9). A clutch 2178 is provided intermediate the gear between the gear 2174 and the drive shaft 482 for selectively engaging and disengaging the latter from the driving means.

The control for the variable speed gearing 424 is derived primarily through the hydraulic mechanism 2180 which is connected by means of the pinion 2182 (see Fig. 6) with cooperating pinion 2184 connected to one end of the shaft 2026 (see Fig. 57).

The variable speed gearing devices 418, 420 are interconnected by means of cross shaft 2188, the shaft 2188 driving the belt 2186 which is adapted to drive the cross shaft 2190 interconnecting two barrel cams 426, 428. Linkage mecnanism 2192 and 2194 is provided for synchronizing the relative speeds of two variable gear devices 418, 420.

It is a well known fact that brick from the same car load lot will vary some in length. Yet, it is desirable and necessary that the vertical joints in the wall be kept plumb up to the face of the wall. It is also a well known fact that very often a section of wall between, let us say, two window joints will have a measurement which does not work out even brick lengths. Yet, it is desirable and necessary to tighten up or loosen up the head (vertical) joints in order to cause these brick to work out even. Hence it is often necessary to "compensate" (tighten or loosen the head joints) for this difference in brick lengths and lengths of walls.

The present invention has for one of its objects the provision of such means. It also becomes necessary in the laying of a brick wall to establish plumbing points. It is a further object of the present invention to provide such plumb means which will be referred to generally as the plumbing shoe and will have the general numeral 2201.

Referring now to Figs. 4, 6, 8, 66, 67, 68, 69, and 70, it is seen that the chassis of the laying device 398 has secured thereto an arm 2208 which projects forwardly of the machine parallel with the line of travel thereof. The arm 2208 has rigidly secured thereto and depending therefrom a servomotor 2204 which is provided with a piston rod 2202, the lower end of which carries a shoe 2200 having a cam shaped toe surface. The upper end of the cylinder or servo-motor 2204 is connected by means of a conduit 2206 with an indicating device generally indicated by the reference numeral 2210. The nature and function of the indicating device will be described below.

The compensating mechanism referred to generally by the numeral 2211 comprises an arm 2212 which is also mounted on the base of the brick laying device 398, the arm 2212 also projecting forwardly of the machine and parallel with the line of travel thereof. The outer end of the arm 2212 is provided with a depending arm 2214 which is bifurcated at its lower end forming the arms 2216 and 2218. Adjacent the rear end of the arm 2212 is disposed a servomotor 2220. The extreme rear end of the arm 2212 is mounted for rotation in a bracket 2222. The bracket 2222 is provided with a frictional bearing (not shown) which is of such type as to permit the arm 2212 to be retained in any position in which it may be rotated therein.

Reference is made at this point to Figs. 4, 6, 8, 66, 67, 68, and 69 in which is shown the operating means for the devices just described. In Fig. 67 it is seen that a gage strip, generally indicated by the reference numeral 2224 is provided, the same extending parallel to one of the rail members, 364. The gage strip 2224 carries a plurality of spaced upwardly projecting substantially hollow bosses 2226 and a plurality of scales. As seen in Fig. 69, the first scale 2228 is divided into linear feet. The second scale 2230 is a fixed scale indicating brick bond. The third scale 2232 is a sliding brick bond scale.

Associated with one side of the gage strip 2224 is provided a substantially U-shaped channel member 2234 which is provided with a pair of arms 2236 which extend laterally from one of the arms of the U-shaped member 2234 and are so spaced as to permit insertion at predetermined intervals in the hollow bosses 2226. As is seen

in Fig. 67, the sides of the member 2234 taper inwardly and provide a wedge-shaped surface which is adapted to cooperate with the outer surfaces of the wedge member 2238. The wedge 2238 is internally threaded in order to receive a set screw 2240. A cam member 2242 is provided, the cam being apertured to permit the entry therethrough of the set screw 2240 and projects at its upper end to a point above the plane of the lowest point on the cam surface of the toe 2200.

Associated with the other side of the gage strip, and at certain predetermined points is provided a device for cooperation with the compensating mechanism referred to above. The compensating mechanism described above is adapted to cooperate with a "compensator set lever" indicated generally by the reference numeral 2244. This mechanism comprises a base 2248 from which depend a plurality of lugs 2246 adapted to be inserted in the upwardly projecting bosses 2226 at a certain predetermined point on the gage strip. The base 2248 carries with it a horizontally extending strip member 2250 which is provided on each end thereof with an arcuately shaped surface 2252, the latter being serrated at regular intervals representing degrees. A lever indicated generally by the reference numeral 2254 is provided with a pair of upstanding parallel shoulders 2256. Intermediate the ends of the lever 2254, the same is provided with a pivot pin 2258 which is engaged at its lower end by the plate 2250 to which it is fixedly secured. A set ratchet pin 2260 is spring mounted in one end of the arm 2254, the ratchet being adapted to cooperate with the serrated ends 2252 at any desired point thereon.

From the above discussion, the operation of the compensating and plumbing devices is believed to be apparent. As the brick laying chassis moves forwardly or reverse and the toe 2200 is brought into engagement with the upper end portion of the cam 2242, the toe 2200 together with piston rod 2202 are elevated thereby causing a flow of fluid through the conduit 2206 which is reflected in the indicating device 2210 in the manner yet to be described. Similarly, the "compensating set lever" 2244 having been set at a predetermined point along the gage strip and the angle of the arm 2254 having been also pre-set, one of the two arms 2216 or 2218 will engage one of the side surfaces 2256 of the member 2254 thereby producing a rotation of the shaft 2212 which in turn operates the servomotor 2220 to cause an indication on the meter 2210.

Reference is now made to Fig. 70 which discloses the above referred to indicating device 2210. As is seen from the drawing, the indicating device is provided with four concentrically spaced scales 2262, 2264, 2266, and 2268, respectively. A fifth scale 2270 extends vertically across the face of the dial. Cooperating with the dial face 2262 is a double-ended indicating arrow 2272, 2272'. Mechanical means of any desirable type, indicated generally by the reference numeral 2274 (see Fig. 6) are employed for connecting the indicating arms 2272 in such a manner as to indicate the distance travelled forwardly or rearwardly by the layer carriage. Dial face 2264 is provided with cooperating double-ended dial hand 2276, 2276'. This dial hand is connected through appropriate mechanical linkages 2278 shown diagrammatically in Fig. 6, with the layer head 894 and is adapted to disclose to the operator the exact arcuate position of the layer head. The third scale, 2266, is provided with indicating arrow 2280 which is operated by a take off 2281' from the hydraulic line running between the valve plunger 1510 and the gland jack 914. The arrow 2280 indicates the arcuate position of the outlet port of the gland. The inner scale 2268 is provided with an indicator 2282 having a plurality of arms, each arm being spaced from its adjacent arm. The arms 2282 are connected through appropriate servo-motors and conduits 2207 with the conduit 2206 which is in turn connected with the servomotor 2204. The operation of the servo-motors is such that when the plumb shoe 2200 is elevated, the servo-motors cause a declutching of the dial hands 2282 (which normally rotate with the dial hands 2272 and 2276) to indicate to the operator that a plumb point has been reached. The vertically extending scald 2270 is provided with a vertically movable cooperating indicating arm 2284. The position of this arm 2284 is substantially, when in normal position, intermediate the two ends of the face of the scale 2270. However, through suitable hydraulic means, the arm 2284 is varied from its normal position to points above or below the normal position upon rotary movement of the shaft 2212 caused by the engagement of the bifurcated arms 2216, and 2216 with the sides 2256 of the element 2254. The hydraulic connections between the servo-motor 2220 and the indicating device 2210 is indicated diagrammatically at 2286 in Fig. 6.

The compensating and plumbing mechanisms which have been described above in considerable detail were designed in order to afford the operator means for determining what actions or sequence of actions must be brought about in order to effect a proper laying of brick. While these devices have been described as being subject to manual control and reliance by the operator upon that which is indicated by the dials for performing certain given functions, still it will be understood that automatic means can be substituted for these means of the plumbing and compensating means obviating the necessity for continuous manual operating means.

Having described this invention in considerable detail, the operation of the mechanisms will be described.

The brick feeder belt 800 rides at one of its ends over the idler pulley 326 while the motivating power therefor is taken from the shaft 2132 (see Figs. 20, 25) and the gear 2136 which is connected to the main prime mover of the brick laying device 366.

The brick after passing out from beneath the helper belt 798 move forwardly to the left, as seen in Fig. 9, where they are deposited on the inclined slide 2288 which is provided with a plurality of longitudinally extending vanes 2290 which are mounted thereon for controlling adjustable transverse movement of brick across the upper face of the slide 2288. Brick deposited upon the slide 2288 are conveyed downwardly under the force of gravity toward the rollers 568 and move laterally toward the left over these rollers. The foremost brick is then brought into contact with the rollers 570 and are fed between the flexible guide strips 606 (see Figs. 19 and 21). The brick, having now come to rest on the rollers 570 are also superimposed over the dog jacks 580. The dog jacks 580 and their associated rammer jacks 578 are operated, hydraulically, through the valve 1498 (see Fig. 54). At the moment of the operation of these two

jacks, the dog of the jack 589 is rotated to a position below the under surface of the brick and, simultaneously therewith, the rammer jack 578 forces piston rod 583 and its abutting element 599 laterally toward the right as seen in Fig. 20 whereby the pulleys 594 and 598 are rotated in a counterclockwise direction to produce a lateral movement to the left of the rammer 597 which carries the abutment element 600. The abutting element 600 engages the rear end surface of the brick positioned immediately in front thereof and, forces that brick laterally to the left upon the "spotter plate" 572 and over one of the spotter cups 638. Each brick is positioned at its mid-point over one of the spotter cups 638, the position thereof being governed and determined by means of stops 2292, 2292', 2292'', and 2292''' rigidly secured to the cross arm 676 and arms 678 and 680. The stops 2292 serve a dual purpose in that while their jackets are rigidly secured to the arms 676, 678 and 680, the pistons thereof are slidably mounted therein by the inward movement thereof with respect to the arms 676, 678, and 680 will each and individually produce hydraulic operation of the valves 1384, 1384', 1384'' and 1384''' shown diagrammatically in Fig. 22 (see also Fig. 20) to cause a vacuum condition to exist between each brick individually and its respective vacuum cup 638, 638', 638'' or 638'''.

Referring to Figs. 9, 16, and 17 of the drawings, mechanism for inserting bats has been disclosed. In accordance with certain well established practices in brick laying, it frequently becomes necessary to insert a bat at a given point. A bat belt 496 is mounted on rollers 493, 498' rigidly secured to a frame member 490 slidably mounted on the track elements 501 and 501' attached to the side elements 468 and 468' of the spotter boom 467. The frame 490, in order to load brick on the bat belt, is retracted by engaging the bifurcated member 510 with the shaft 506 (see Fig. 16) until the frame 490 is moved to a position adjacent the free end of the pivoted slide 2288. The slide in this instance has been elevated by means not shown, whereby brick which are fed from the conveyor belt 800 to the slide are permitted to move from the slide 2288 to a position on the bat belt 396. After the bat belt has been loaded, it is moved outwardly to its proper position and the slide 2288 is lowered to its normal operating position. Adjacent the outer end of the bat belt is disposed a plurality of rotatable suction cups 522 (see Figs. 16 and 17) each of which are adapted to receive one of the bats 7' loaded on the bat belt 496. At the desired interval, the shaft 524 carrying the bat 7' secured to the vacuum cup 522 is rotated thereby depositing bat 7' to the position 7'' as shown in Figs. 16 and 17 in the lowermost position on the rollers 570 and in position above the dog jacks 589. Rotary movement is imparted to the vacuum cup 522 through the system shown in Fig. 17. Hydraulic motor 528 is operated through the valve 1503 (Fig. 54).

In the discussion immediately preceding, it will be understood that the operator of this brick laying device has first energized the electric motor 366 from any desirable source of electric current. It is also assumed that it is understood that upon the energization of the electric motor 366 the drive shaft 390 has been caused to rotate and through its associated clutches and interconnecting shafts the crank 2150 has been caused to rotate causing the reciprocation of the valve plungers 1498, 1500, 1502, 1504, 1506, 1508, and 1510 (see Fig. 53). It will also be understood that in all instances where vacuum is required the vacuum means are connected to the common source of vacuum 32.

As described above, the brick have now been brought into position above the spotter cups and are ready to be picked therefrom by the layer head arms.

Reference is made to Figs. 26 and 4 of the drawings which disclose the structure of the layer head in considerable detail.

The shaft 888 is geared to the electric motor 366, a manually operated clutch 2122 being provided for effecting a coupling between the shaft and the motor. Engagement of the clutch causing a rotation of the shaft 883 will produce a rotary movement of the layer head 894. One of the arms 974, consequently, approaches a position directly above the brick which have been brought to the spotter plate 572. As the layer arm approaches this position the segment jack 964 is automatically operated to withdraw the shaft 954 thereby producing a downward movement of that portion of the annular track 959 immediately adjacent the outer end of the arcuately shaped shaft 954. As the arm 974 approaches the pick position, the member 1206 rides downwardly in the track 1202 thereby permitting the arm 974 to be lowered while still maintaining a horizontal position. Simultaneously with this action, the jack 964' has been operated in such a manner as to extend its piston rod thereby causing an elevation of the ring track 950 on the side opposite to the spotter. This, of course, will result in an elevation of the oppositely disposed arm 974. In elevating and depressing the two arms, it will be seen that the laying and picking arms are maintained, constantly, in substantially parallel planes.

As was described above, as the picking arm approaches its pick position, a trigger member 1047' is brought into engagement with a trip member 2502 causing an operation of the servomotor 1044 whereby the vacuum cups on the pick arm are connected directly with the source of vacuum. Simultaneously, with the creation of the vacuum condition in the cups 984, a trip 2500' engages a trigger 1332 mounted on the member 1330 (see Fig. 19) which operates the hydraulic linkage connected with the valve 1428 to cut off the vacuum from the vacuum cups 638. As the pick arm continues its rotation, the element 1206 rides upwardly in the track 1202 while still maintaining a substantially horizontal position. The rotation continues until the brick are brought to a point approaching the lay position.

At this point, the member 1206 again rides downwardly in the track 1202' and as the arm reaches its actual lay position, the trigger 1047' is tripped by means of the abutment 1049 thereby destroying the vacuum condition which originally maintained and permits the brick to be properly positioned on the wall being built. It will be recognized, of course, that as the arm 974 approaches its lay position, the corresponding oppositely disposed arm will again be brought into its pick position. The cycle is continued so long as the shaft 888 remains clutched to the main drive shaft 390.

Referring now more particularly to the operation of the laying arm and as was noted above, the trigger 1047' actuates jack 1044 to cause the rod 1004 to close valve 1013 to the vacuum in chamber 968 and to open the valve 1014 to atmospheric pressure which further aids in releasing

the brick from the hold of the vacuum cup. If the cup 984 has reached the lay station without being engaged in carrying a brick from the supply station, the valve 1068 will have been held in its valve seat 1060; however, the inrush of air upon the closing of valve 1013 and the opening of valve 1014 will knock valve 1068 to its open position at 1068'. The masking plate 996 has by now closed the port 990, the spring 1008 (see Fig. 29) has released stem 1012 and spring 1020 has forced valve 1014 to its closed position at 1022. A cooperating and somewhat similar spider at valve 1013 has opened valve 1013 permitting vacuum to build up in arm 974. As cup 984 approaches its pick position, valve 1068 remains held down by spring 1069. At this instant of "pick," jack 1044 is actuated as described above, causing rod 1004 to return to the right as seen in Fig. 26. Thus opening port 990 without, however, affecting the position of either valve 1013 or 1014. If a brick has been set up on the cup 638 the pick action of the arm 974 causes a seal between the brick and rim 1056. At this instant the port 990 is opened as described above and vacuum condition inside the arm and atmospheric pressure outside the cup gives control of the brick to the arm 974. The vacuum condition extends through port 990 and openings 1064 to the upper face of the brick, and as well to the under side of the valve 1068, thus neutralizing the upward pull of the vacuum condition within the arm 974 on the valve 1068. This upward pull is further neutralized by the continuing moderate pressure downward from the spring 1069.

It will be readily seen from a reference to Fig. 15 that the actual picking and lay positions are displaced from each other to an extent greater or lesser than a straight line angle. The lay position is normally maintained at 90° from the line of the boom while the center point of the spotter plate is displaced approximately 80°.

In order to lift the arms 994 as during the temporary discontinuance of one set of arms, it is necessary to observe that the jacks 1104 are operated in one case to retract the piston rod while in the other case the piston rod is extended. The operation of the servo motors 1104, 1104' is derived from the valves 1686 and 1684 which is operated by means of the handle member 1738 in its action against either the nib 1750 or 1752 (see Figs. 50, 57 and 58). As is seen in Fig. 26, the retraction of the piston rod 1102 will cause, after a short movement thereof, an engagement of the member 1114 with the free end of the arm 1106 and in the course of such engagement will remove the recess portion 1110 from the upstanding projection 1112 formed integrally with the member 968. The disengagement of these two members frees the arm 974 for rotary movement around its pivot point 970 (see Fig. 25).

During the time that the head 894 has been rotated various gland (referred to generally as by the numeral 905) positions have been effected. During the course of the rotation of the head, the housing 968 is always provided with a pressure less than atmospheric pressure. This affords a constant source of vacuum available to the layer arm 974 in any position the arm may achieve through its rotation of 360°. To effect such a condition the conduit 1054 is connected directly to the apertured boss 2510 formed on the housing 968 as shown in Fig. 26.

Referring to Figs. 26, 58, 62, 38, 39, 40, 52, to effect a manual operation of the jacks 1030, 1034 to set up the arrangement of vacuum cups on the layer arm that will correspond with the pattern of brick to be picked up from the spotter plate, the operator moves the handle 1738 into contact with the nib 1750 or 1752 which aligns the gland ports 916 and 917 with the ports 1051 and 1053. The alignment of these ports is derived through the operation of the servo motor 914 which causes a reciprocation of the gear rack 912 which is, as described above, in engagement with the gear 910 formed on the base of the shell 906 (see Fig. 32).

When the ports 916 and 917 have been brought into alignment with their cooperating ports 1051 and 1053, the valve 1684 is operated through movement of the handle 1738 into engagement with the nib 1746. The operation of this handle member causes fluid to be passed through the conduits 1904, 1906.

In all the movements of the handle member 1738 as described above, it will be understood that the position of the masking plate 1714 has remained unchanged. The reciprocating action of the telescoping parts 1740, 1738, together with the swivel action and lost motion connection of the shaft 1754 with respect to masking plate 1714 permit the handle 1738 to effect lateral movements independently of any movement of the masking plate 1714.

It is seen from a study of the action of the gear rack 912 and its associated shell member 910 that the operation of the servo motor 914 will permit the glands referred to above to be brought into alignment at any desired point whereby the operator may effect the action of any of the servo motors mounted on the head 894.

The above discussion has set forth a method for operating this device manually. The same operation may be accomplished automatically through the operation of the crank member 2150 (Fig. 55) and its associated valve 1496 (see Fig. 53). The details of the operation of this automatic valve structure are shown more clearly in Fig. 52 wherein valve 1496 has been shown diagrammatically as comprising three valves, 1496, 1496' and 1496''. As the plunger 1510 is reciprocated in synchronization with the other pistons connected with the crank 2150, fluid under pressure is admitted alternately to line 1596 and 1595 to the control valve 1594 and thence to the opposite sides of the piston mounted in the servo motor 914. The control valve 1594 being manually operated, may supersede the operation of the automatic control.

The piston 1510 also controls, automatically, the introduction of fluid to the gland 905 (Fig. 27) by means of the operation of the valve 1496'. The fluid is transmitted therefrom through the conduits 1906, 1908 to the gland 905. It will be seen from Fig. 52 that the manually controlled valve 1905 is also provided for superseding the action of the automatic control of the admission of fluid to the gland 905.

It will be noted that pressure reduction valves 1907, and 1597 have been inserted in the supply lines 1906 and 1908 and 1595 and 1596 respectively.

The vacuum control on the arm 974 is derived through the action of the servo motors 1044, 1044', both of which are activated through the valve 1045 (see Figs. 26 and 53a). The valve 1045 is, as was described above, operated by the tripping of the arm 1047. Hydraulic fluid for operating the jacks 1044 and 1044' is derived through conduits 1046, 1048 which are connected

with the ports 1061 and 1063 in the layer head 894.

Further details of the brick laying operation will now be discussed.

As the brick has been rotated from the pick position to the laying position, the mortar spreading device will have spread a layer of mortar on the wall. This is accomplished by operating the kinematic mechanisms indicated by the reference numerals 1644 (see Fig. 52) and 1645 which operate the valves 1606, 1608, 1610, and 1612, in such a manner as to cause a retraction of the telescopic mortar spreading nozzles 1144. As was described above, reference being made to Figs. 46 and 49, the connection between the piston 1148 operates through the spring tension member 1354 to permit a slight play between the piston 1148 and the nozzle connecting lug 1149. The travel of the nozzle proper 1144 being limited, by the supporting bracket 1168, to the distance between the end of the grouter arm 1162 and the stop lug 1151 adjacent to the base of the grouter arm. Hence, it will be seen that after the setting of the nozzle in the desired position, the lost motion virtue of spring 1354 enables piston 1148 by further retraction and through pin 1352 to exert influence on the valve 1168 to open it for spreading operations, or, by limiting the action of piston 1148 to nozzle set only, to permit the valve to remain closed, but subject to opening by the trigger 1166, for head joint purposes, as will be described below.

As was described above, the mortar nozzles are connected with a suitable source of mortar supply under pressure.

The mortar nozzles, having been thus opened and mortar admitted to them, thru valves, 1652 and 1654, spread a layer of mortar on the top surface of the brick already in position on the wall.

The brick, having been brought into laying position, engages against the rotatable member or bearing 1342 of the mortar nozzle trigger mechanism. By engaging against the terminal of the trigger 1166, the rack 1342 causes gear 1340 to rotate and thus a spurt of (reference is now made to Fig. 45), mortar under pressure is extruded through the valve 1168 between the brick laid during a previous brick laying operation and the brick now being laid. At the instant the brick is brought into its proper position upon the wall the vacuum in the arms 974 is cut off through the trigger mechanism described above and the brick laying arm is then ready to be rotated into its pick position. The operations thus far described are periodically repeated with each ½ rotation or reciprocation of the brick laying head.

As illustrated in Fig. 51 and Fig. 37, the mortar nozzles are arranged in banks. It will be understood that the operation of the kinematic means 1644 applies to one bank of nozzles when the machine is travelling in a given direction, whereas, a similar operation will be given to the mortar spreading nozzles in the oppositely disposed bank, when a reversal of direction of travel occurs.

It will be understood that Fig. 37 illustrates the normal operating position of the various mortar nozzles when carriage is traveling to the right. However, the relative arrangement of each of the nozzles may be varied in accordance with the type of work to be performed.

These variations in the arrangement and disposition of the mortar nozzles 1144 and their respective and synchronized mechanisms are accomplished through the operation of keys 1645. Key 2920 for example will, when extended, cause (*a*) valve 1490′ to move spotter cup 638′ to the left, (*b*) valves 1616 and 1618 to arrange mortar nozzles 1144′ and 1144″ in their intermediate position to receive the header brick, (*c*) jack 1030 to rotate the layer arms 974 cups some 120° in their respective position for picking this particular header arrangement. However, when key 2920 for example, is retracted (as will be described in greater detail below) the following movements occur: (*d*) valve 1490′ causes spotter cup 6381 to move to the right, (*e*) valves 1616 and 1614 align nozzles 1144 and 1144′ respectively in their intermediate or header position and (*f*) layer arm cups to reverse rotation to accommodate a pick up of the new header arrangement.

By virtue of the operation of the hydraulic system illustrated diagrammatically in Fig. 52, the servo-motor 1034 may be operated to cause a rotation of the sleeve 982 about its longitudinal axis in order to achieve the bonds known as "rowlocks" or "soldiers."

As was stated above, it is one of the objects of this invention to provide means for compensating for the discrepancies in the lengths of the brick with respect to the length of a wall to be laid. Such discrepancies are overcome in part through the insertion of more or lesser volumes of mortar between the brick which has been laid and the brick to be laid, and in particular, by, in the case of long bricks, decreasing the rotation of the layer head (and all its associated and synchronized mechanisms) with respect to the timed travel of the layer carriage along the wall.

By reference to the compensating dial 2210 (see Figs. 70 and 59) the operator may, at will, through the operation of the control 1660, and 1662 cause valves 1652, and 1654 to vary the amount of mortar to be supplied to the head joint, and/or to vary the amount of mortar being spread on the wall.

From the above description it becomes apparent that the mortar spreading device may be operated either en bank or the nozzles of each bank may be broken down into the operation of pairs of nozzles. It is also deemed apparent that each pair of oppositely disposed mortar nozzles may be operated independent of the remaining nozzle elements. This last-named operation is achieved through the operation of valves 1468′ and 1608 and is illustrated in Figs. 51 and 52.

It will also be observed that through the operation of the element 1992 and more specifically the handle member 1738 into contact with the nib 1746, the valve 1684 is operated to cause fluid to flow through the pipes 1900, 1902 into the corresponding servo-motors 1188 whereby one of the banks of valves may be pivoted downwardly out of the plane of the arms of the mortar spreading device proper. This operation is particularly useful in the building of piers and jams. Similarly nib 1748 operates valve 1688 to cause jack 1190 to move its associate bank of nozzles.

The laterally projecting arms 1120 and 1122 together with the associated mortar nozzle banks may be elevated into a plane substantially perpendicular to the normal working plane through the operation of the crank lever 1134 by means of the servo-motor 1192. The servo-motor 1192 is controlled through the valve 1686 which is in turn operated by the handle member 1738 which is

brought into contact with the nib 1750 and/or 1752.

While the sequence of operations described immediately above continue throughout the laying of a single course of brick along a wall or piece of wall, it will be understood that the direction of travel of the apparatus described can be reversed and the brick laying mechanism and the brick delivery unit may be elevated in the manner described whereby a second course of bricks may be superimposed over the course just laid and if desired the direction of the machine reversed in carrying out these functions.

In the foregoing, reference has been made in the manner in which bats are fed to the spotter plate. In laying a bat, one of the keys 1645 is operated in such a manner as to cause a flow of fluid through the valve 1494. The operation of this valve in turn produces the ejection of the bat into its proper place for movement to the spotter plate.

Reference is now made to Fig. 1 for corner construction. An optional operation of the device is as follows. The movement of the brick laying carriage along the track may be subjected to the control of barrel cam 428 of the variable speed transmission gearing 420. The barrel cam is synchronized with the barrel cam 426 which controls through suitable clutching the rotation of the layer body 328. The layer boom 837 and the spotter boom 467 are adapted to be moved to their extended position and maintained therein through the sequence of operations to be described. In this position the device is operated normally for two and three courses of brick laid on the wall 12. At the termination of this operation, the wall 12' will be built by causing the barrel cams 426 and 428 to control the machine in synchronization whereby the spotter and layer booms are caused to rotate about the vertical axis of the layer device 328. At the same time, the device is caused to reciprocate on the tracks.

The direction of movement of the brick laying carriage may be changed whereby the device may be made to travel over tracks 364'. This is brought about by operating the handle member 367, (see Fig. 71) whereby the gear 362 is moved into engagement with the gear teeth 360 (see Fig. 74) causing the shoe 338 to rotate the wheels 334, 334', 334'', 334''' 90° to their new position.

The motor 36 of the brick delivery unit is synchronized with the electric motor 366 of the brick laying device through the electrical circuit illustrated diagrammatically by the reference numeral 2904 (see Fig. 2).

Synchronization is also maintained between the feeder system of the brick delivery unit and the laying head. This synchronization is accomplished by a closed hydraulic system shown diagrammatically in Fig. 1 by the reference numerals 2600. The movement of the handle member 1738 which governs the speed of the laying head through the shaft 2026 at the variable gear control 2180 operates in such a manner as to synchronize the associated variable speed mechanisms of the brick laying unit.

The spreader device is connected with the source of mortar supply through the conduit 2602 and the vacuum for the layer system is derived through the conduit 2604 (see Fig. 1).

The individual wythes or longitudinal rows in a single course of brick are respectively controlled by a series of keys denoted generally at 1645 and more specifically by #2920, 2920', 2920'', 2920'''; these keys each are capable of several different movements for correspondingly varying the brick in wythes.

In the first instance any of the keys may be depressed to cut out the wythe associated therewith so that from 1–4 wythes of brick may be layed. Ordinarily when the machine is at rest all four keys are depressed then as the machine is brought into operation the keys are raised from depressed to horizontal positions. To revert momentarily, when a key is depressed to cut out a wythe, the rammer for that wythe is deprived of its operating fluid so that the cutting out of a wythe is accomplished, by damming the source of brick to the particular spotter cup associated with that wythe.

A second function of keys 1645 is to vary the bond by setting the machine so that certain brick will be laid as headers instead of stretchers.

Figs. 4 and 56 illustrate a standard stretcher bond, such as that used for the first four courses, of the wall as shown in Fig. 8. Fig. 56C shows brick arranged to form a full header bond as used in the sixth course in Fig. 8. In a typical four wythe wall as illustrated in Fig. 8, the fifth and seventh courses are formed by the bond illustrated in Fig. 56B.

Where the outer wythes are stretchers and tying headers form the inside of the wall. Headers in respective wythes are set up by sliding the keys forwardly and rearwardly, so as to rotate the spotter cups and simultaneously to bring into operation the appropriate series of vacuum cups in laying arm.

In order to arrange the mortar heading nozzles in positions corresponding to the particular bond set up by the keys, the linkage between the keys and the hydraulic system controlling the position of the head joint forming mortar nozzles and designated generally by the #2920 is also provided. A cross linkage indicated generally at 2924 is provided, so that when ever a key is pushed or pulled to set up the laying of a header, not only is the head joint nozzle primarily associated with that key telescoped or extended to its proper position for mortaring the head joint, but likewise the necessary adjacent and associated nozzle is telescoped or extended to the same position since two nozzles are required in mortaring the head joints for headers.

Keys 1645 are also movable from there normal horizontal operating positions to an upper position to inject bats into the wythe corresponding to the key which has been tipped to its upper position. By tipping a key up, the flow of whole brick to a rammer is dammed and bats are fed from the bat reservoir to the rammer instead of whole brick.

The linkage operated by tipping key 2920 from a horizontal position to its upper position is indicated generally at 2926.

In describing the structure illustrated in Figs. 56–56C inclusive the elements controlling one wythe are designated by whole numbers and similar elements controlling the other wythes are designated by similar prime numbers, except in certain instances where whole numbers are used, to facilitate explanation of the cross linkage.

Referring particularly to Figs. 56–56A, the key board 1645 includes four keys, 2920, 2920', 2920'', 2920''' and a thumb key, 1609, which is a master off-on key mounted on a cross shaft 2928 which, in turn, is affixed at its ends by a suitable support 2930. The keys 2920, etc. are each mounted

for independent rotation on shaft 2928 by means of a horizontally extending lug 2932 on the upper end of a vertical lever 2934. Lug 2932 is provided with a bore extending horizontally from end to end, so as to fit rotatably on the shaft 2928. It should be noted particularly that key 2920 is slotted at 2936, lug 2932 slotably fitting in the slot so that the key may be slid forwardly and rearwardly without swinging lever 2934 but that when the key is depressed or raised, lever 2934 is rocked with it about shaft 2928, and this without extending or retracting the key, if so desired.

An arcuate slot 2938 is formed in the enlarged end 2940 of key 2920 for slidably receiving the pin 2942 of a clevis 2944 on the adjacent end of bar link 2922 so that when the key is depressed or raised to rock lever 2934 about shaft 2928 the bar link is not affected while on the other hand when the key is moved inwardly or outwardly to drive the bar link 2922, the bottom linkage 2926 may be left unaffected at the option of the operator. The various valves which govern the header or stretcher set up for the wythes and which control the head joint nozzles of the mortar spreader are controlled by the inward or outward movement of bar link 2922, these valves being conveniently divisible into two groups, namely the group 2946 seen at the left hand portion of Fig. 56B and those 1601 seen at the central portion of Fig. 56B and at the right hand portion of Fig. 53. The valves in group 2946 are on-off valves disposed in the lower level of multiple valve bank 1482, as shown also in Fig. 54, for controlling the flow of fluid to certain of the switch valves in the upper level of the valve bank 1482.

In referring to the valves which control the header-stretcher set-up mechanism for the wythes, the intermediate groups 2946' will be detailed since only the intermediate bricks 7' or 7'' may be turned from stretcher to header position by both clockwise or counter-clockwise rotation, as seen in Figs. 56, 56B, and 56C.

Referring to group 2946', valve 2948', controls the flow of fluid to valve 1490' in multi valve bank 1482 so that when valve 2948' is opened by a retraction of bar link 2922' fluid is admitted through pipe 2950' to valve 1490' which in turn rotates spotter cup 638' by applying fluid under pressure to jack 634'. Since it is necessary to raise each spotter cup when it is rotated to avoid interference by brick supported thereon with adjacent brick, a pipe 2952' is branched from 2950 to admit fluid to valve 1488', so as to enable valve 1488' to admit fluid under the hydraulic piston portion of spotter cup 638', thus to drive cylinder 642' upwardly. Valves 1488' and 1490' which govern the rotation and the raising of spotter cup 638' are, of course, synchronized by cam action as previously described.

Spotter cup 638' is retracted to its lower position by fluid controlled by valve 1488' and admitted by pipe 644', this latter action being another of the synchronized motions of multi valve bank 1482. Valve 2948' is operated by lever 2956' biased by a spring (not shown) against a lug 2958', on bar link 2922'. A stop (not shown) is provided for preventing lever 2956' from rotating clockwise beyond its 600 position so that valve 2948' is opened only by retraction of lever 2922', to the right and is not affected by extension to the left as seen in Figs. 56, 56A.

An arrangement similar to that described immediately above is provided for valves 2960' and 1492', with the exception that valve 2960' is opened by movement to the left of bar link 2922' as seen in Figs. 56, and 56A. Valve 2960' being unaffected by movement to the right (retraction) of bar link 2922'. Admission of fluid to valve 1492' enables this latter valve to cause rotation of spotter cup 638' clockwise as it is shifted by jack 634' to the left so as to turn brick 7' from its 56 position to the position shown in Fig. 56C. In order to raise the spotter cup 638' to avoid brick interference as previously described, a pipe 2962' is connected to the input of valve 1488' from the pipe 2964', which leads from valve 2960' to valve 1492'. In order to avoid cross talk between pipes 2950' and 2964' which have common branches 2952' and 2962' to valve 1488' check valves 2966 are inserted in the branches.

Transverse push rod 2968 constitutes a delayed action follower for all the bar links 2922, 2922', 2922'', 2922'''. Each bar link carries a pair of spaced dogs, such as lugs 2970, 2972' as shown in Fig. 56A. The spacing between the dogs and push rod is such that as push rod 2922' for instance is retracted, dog 2972' moves bar 2968 to the right but does not transmit motion to any of the other of the bar links. Likewise extension of bar link 2922' moves dog 2970' to the left against push rod 2968 so as likewise to move this push rod to the left without affecting any other bar link. Push rod 2968 is provided at each end with T head 2974 fitting in guide way 2976 which maintains the rod in a true transverse position across each bar link at all times. A lever 2978 is engaged by cross rod 2968 so as to move to the left and the right, therewith, the trigger being mechanically coupled to a movable cam plate 2979 on the multivalve bank 1482 so as to throw valve 1496' closed at a certain phase in the cycle of operation of the valve. This phase is timed to stop the flow of fluid from valve 1496 to jack 914 (Fig. 52), thus stopping the regular oscillation of gland 905 intermediate the pick and lay positions of the gland. By stopping the gland at the intermediate position slightly in the lead of ports 1050, 1052, motive fluid may thus be transmitted to jack 1030 so as to rotate the outer casing of arms 974 and 974' from the position shown in Fig. 56A to either of the positions shown in Fig. 56B or Fig. 56C, depending upon whether a bar link such as 2922' has been retracted or extended. Lever 2978 is connected to a second movable cam plate which changes the timing of valve 1496 so as to inject motive fluid through ports 916 and 917 as pipes 1050 and 1052 pass over them, the ports 916 and 917 having been brought to the proper position and at the proper time by the cam plate 2979 having caused valve 1496'' to admit fluid under pressure to gland jack 914.

Valve group 1601 is for shifting mortar nozzles to various positions in accordance with the bond set up by operation of keys 1645. Valves 1601 are arranged in two banks, the first bank comprising individual valves 1606, 1608, 1610, 1612 being individually connected to the respective jacks 1147 which control the positions of mortar nozzles 1145 on one side of the mortar spreader 1094 while valve 1614, 1616, 1618, 1620 are connected to jacks 1146 which control the positions of nozzles 1144 on the opposite side of the mortar spreader 1094.

Since, in moving along a wall, the leading nozzles are always retracted so as to exude mortar continuously, and since only the trailing nozzles are positioned to eject mortar upon engagement by a brick for forming head joints, valves 1601

are arranged so that only the bank controlling the jacks which position the trailing nozzles are operated along with the other elements which control the bond set up. In the setting illustrated in Figs. 51 and 56, 56A, 56B, 56C inclusive valves 1614, 1616, 1618, and 1620 operate to control jack 1146 which position trailing nozzles 1144, while valves 1606, 1608, 1610, 1612 are temporarily disengaged from the control of bars 2922 and are operated to cause jacks 1147 to retract nozzles 1145 to their constant spread positions as will be described later.

Upon raising a key such as 2920' the lower end of lever 2934 is rocked rearwardly as described above so as to pull bar 2926 to the right as seen in Figs. 56 and 56A, so also to pull its vertical end 2980' against operating lever 2982' to open valve 2984'. When open (valve 2984' which, like its adjacent similar valves is provided with a fluid inlet) fluid under pressure is fed to pipe 2986' to valve 1494' which later valve being synchronously operated, brings into play the bat injecting mechanism for that wythe as previously described. Vertical end 2980' and operating 2982' are laterally set off so as not interfere mechanically with the adjacent element. Operating lever 2982' is normally biased clockwise to the 6 o'clock position by a spring and against a stop not shown.

A given wythe is cut off by depressing the key therefor. When a key, such as 2920' is depressed, lever 2934' is rocked to the left as seen in broken lines in Fig. 56B, thereby moving vertical post 2988' against operating lever 2990' of normally open valve 1468' thereby closing the valve. Operating lever 2990' is normally biased counterclockwise, against a stop 2992' by a spring 2994' in which position the valve is open. Upon movement of post 2988' against operating lever 2990' the lever is rotated clockwise to close the valve, it being understood that spring 2994' is sufficiently strong so as to return operating lever 2990' to a position at rest against stop 2992' when key 2920' is leveled but that spring 2994' is not strong enough to move key 2920' and the linkage therebetween unless the key is manually and deliberately leveled. This arrangement applies likewise to the biasing of the other valves described above.

Fluid under pressure is fed by a master inlet pipe 1450 through a normally open master cut off valve 1454 and thence through the normally open individually wythe cut off valves 1464', 1466', 1468', 1470'. From an individual wythe cut off valve such as 1468' the fluid under pressure is fed through a manifold 1460 and through branch pipe 2998' directly to associated valves in the multiple valve bank 1482 or through branch pipes 2999', 3000', 3001' to control valves 2948', 2960', 2984', respectively.

A master cut off key 1609 is connected by linkage 2926A similar to lever 2934, bar 2926 and post 2988 so that, when key 1609 is depressed master cut off valve 1454 is closed, thereby stopping the flow of fluid to the Multiple Valve Bank and also to nozzle control valves 1601.

At the same time that the spotter cups and the layer arm cups are operated to lay a brick such as brick 7' in header position as shown in Fig. 56B instead of stretcher position as in Fig. 56, the spotter mortar nozzles which mortar the head joints must be accordingly shifted. As shown in Fig. 56, bricks 7' and 7'' are in stretcher position and staggered; nozzles 1644' and 1644''' are likewise staggered, nozzle 1644'' being fully advanced for engagement by brick 7'' and nozzle 1644' being set back for brick 7'.

When brick 7'' is laid as a header as in Fig. 56B, nozzle 1644'' must be pulled back and nozzle 1644' must be advanced, since it requires two adjacent nozzles to mortar the head joints for a brick laid in header. Valve group 1601 and the operating linkage therefor control the positioning of the nozzles mortaring the head joints.

Valves 1606, 1608, 1610 and 1612 control the nozzles 1145 through operation of jacks 1147 whereas valves 1614, 1616, 1618, and 1620 control the positioning of nozzles 1144 by operation of jacks 1146. As shown in Figs. 56, 56A and 56B, and particularly in Figs. 56C and 56D, these valves each include a cylindrical casing 3002 having a port 3004 leading eventually to fluid line 1450 which supplies fluid under pressure and an adjacent port 3006 which leads to the return line of the inlet side of the fluid pump. Additional ports 3008 and 3010 respectively and diametrically opposite ports 3006 and 3004 are both connected to a pipe which leads to one end of one of the impulse jacks for positioning a nozzle. In the case of valve 1614, ports 3008 and 3010 are both connected to the nozzle end of jack 1146 by pipe 1638. A rotor 3014 having a diametric channel 3016 is provided for selectively connecting either of ports 3004 or 3006 to pipe 1638 via either ports 3008 or 3010 so as to drive the piston in impulse jack 1146 to the right or left as seen in Fig. 56C.

It should be noted that rotor 3014 is rotatable between three positions so as to dispose channel 3016 between ports 3006 and 3008 in first position, ports 3004 and 3010 in second position and in the third postion the rotor has passed beyond the point of communication with any ports. Suitable stops (not shown) are provided for preventing turning of the rotor beyond the desired extremes.

Each of valves 1606, 1608, 1610, 1612, 1614, 1616, 1618, and 1620 consists of two identical halves utilizing a common cylindrical case 3002 and rotor 3014. Referring particularly to Figs. 56C and 56D valve 1614 for example has an upper portion 1614A and a lower portion 1614B as seen in plan view. The outlet ports of portion 1614(*a*) are connected by a common line 1640 to the rear end of jack 1164 whereas the outlet ports of portion 1614(*b*) are connected by a common line 1638 to the front end of jack 1164 so that when fluid under pressure passed through portion 1614(*a*) to the rear end of the jack, portion 1614(*b*) connects the front end of the jack to the return side of the fluid pressure system and ultimately to the intake side of the fluid pump. The reverse arrangement, of course, occurs when the valve is turned so that portion 1614(*b*) switches fluid under pressure through line 1638 to the front end of jack 1164. In order to accomplish this, the fluid pressure line 1622 is connected to port 3004 in portion 1614(*b*) whereas in portion 1614(*a*) the fluid pressure line 1622 is connected to the port corresponding to port 3006. Fluid return line 1628 is, of course, connected to port 3006, portion 1614(*b*), and to the port in portion 1614(*a*) which corresponds in angular position to port 3004.

The rotors in all of the valves in group 1601 are turned by a shaft 3018 which extends outwardly from each end of the valves 3018 with the exception whereas valves 1606, 1612, 1614, and 1620 are driven by shafts which extend axially from one end only. Shafts 3018 carry at their ends upstanding arms 3020 for engagement by

bracket arms 3022 and lever 3024 described below. In Figs. 56A and 56D, it will be apparent that the ports 3008, 3010 on the upper portions of certain of the valves are connected to the front ends of the jacks controlled thereby as in the case of valves 1614, 1618, 1606, 1610, whereas the corresponding ports in the other valves are connected to the rear ends of the associated jacks. A final destination between certain of the valves is that valves 1614, 1618, 1606, and 1610 have stops arranged to prevent further rotation of the rotors 3014 after passage 3016 has been turned counter-clockwise just beyond and out of communication with port 3010, whereas for valves 1616, 1620, 1604, 1612 the stops are arranged so that the rotors can be turned clockwise just beyond and out of communication with ports 3008 (see Fig. 56F). These differentiations in the fluid connections to the valves and the arrangement of their stops are in accordance with the most frequently used position for the nozzles controlled thereby, which is for stretcher bond.

Cross linkage 2924 includes U shaped bracket 3022 and levers 3024, brackets 3022 being slidably supported in suitable guideways (not shown) for movement to the left and right as seen in Figs. 56A and 56B. The ends of the arms 3026 on brackets 3022 engage against the arms 3020 which drive the respective valves associated therewith the brackets 3022 being engaged, when in operating position by lugs 3028 on bar links 2922 and 2922', etc. so that when the bar links are extended to the left, lugs 3028 push brackets 3022 to the left so that arms 3026 engaging arms 3020 on the valves rock the valve rotors counter-clockwise. Valve arms 3020 are each biased by a spring 3030 for clockwise rotation so that when a key such as key 2920'' is retracted to normal so as to pull connected bar link 2922'' to the right valve arm 3020 returns in a clockwise direction and maintains the associated bracket engaged against its associated lug 3028.

It should be noted that the drive of the valves through brackets 3022 is a one way drive in that it is only by extension of keys 2920, 2920' to the left that brackets 3022 move the valves. It should further be noted that with the exception of key 2920''', extension of any given key, such as key 2920 operates the valve 1606 or 1614 which ever is then controlling the nozzle operating as a head joint nozzle in the 2920 key wythe and in addition operates the valve 1608 or 1616 which controls the nozzle operating as a head joint nozzle in the wythe directly controlled by the adjacent key 2920'. This results in the positioning of the required two adjacent nozzles to form a head joint for a brick in header position.

In order to complete the linkage accomplishing the results set forth above, levers 3024 which rotate about a vertical pivots 3032 supported in sleeves 3034 are engaged by lugs 3036 on bar links 2922, 2922', etc. Levers, 3024 extend from one bar link to a valve directly associated with an adjacent bar link so that when key 2920''' is retracted, one of the levers 3024 is rotated counter-clockwise as seen in Fig. 56 so as to rotate the rotor of valve 1610 or 1618, as the case may be, counter-clockwise. Levers 3024 each carry hook 3038 which engage a valve arm 3020 as shown in Fig. 56 so that when key 2920''', for instance, is retracted, valve 1618 and 1620 both operate.

The necessary operations of valve 1606, 1608, 1610, 1612, 1614, 1616, 1618, 1620 are such that bracket arms are not needed on bar link 2922'''.

In the operation of the mortar spreading nozzles, the nozzles, such as nozzles 1144 in one bank, are variously positioned to spread mortar to form head joints, the nozzles in the opposite bank being then fully retracted to bed mortar. When the direction of travel of the brick laying carriage is reversed, the functions of the two banks of nozzles 1144 and 1545 are also reversed.

As shown in Fig. 51, nozzles 1144 are fully retracted and are not affected by extension or retraction of keys 1645. The apparatus described immediately below accomplishes this function.

The linkage indicated generally at 1644 includes a handle 3040 for sliding the spine 3042 to the left and right, as seem particularly in Figs. 56, 56A and 56B. The spine 3042 carries a series of latterly projecting prongs 3044 which have upwardly facing cam surfaces at their ends 3046. As heretofore described levers 3024 are supported on pivot pins 3032 which rotate in sleeves 3034, the sleeves being suitably affixed to a supporting frame. Pivot pins 3032 are also vertically slidable in sleeves 3034 so that when a prong is slid therebeneath, the cam surface 3044 on the prong cams pivot pin 3032 upwardly, thus disengaging the lever arm 3024 from lug 3036.

A somewhat similar mechanism is provided for disengaging bracket arms 3022 from lugs 3028. There being pins 3032*a* vertically slidable in sleeves 3034*a*, the pins 3032*a* carrying forks 3052 on their upper ends for lifting brackets 3022 when the pins are cammed upwardly by cams 3044. As shown best in Fig. 56A, the levers 3024 and brackets 3022 which drive valves 1606, 1608, 1610, and 1612 are lifted out of engagement with the lugs on the bar links 2922, 2922', etc. When spine 3042 is moved to its dotted line position of Fig. 56, the levers 3024 and brackets 3022 which control valves 1606, 1608, 1610, and 1612, will be dropped in to driving engagement with the lugs 3036*b* and 3028, whereas the levers and brackets which control valves 1614, 1616, 1618 and 1620 will be lifted out of engagement with their lugs.

In order that the valves 1606, 1608, 1610, 1612, which, in the Figs. 56, 56A, and 56B, for example, may be controlled to position nozzles 1144 (Fig. 51) so as to spread bed mortar, a depending arm 3050 rigid with arm 3020 is provided on each of the valves. Forks 3052 hinged on bar 2926 are engageable with arms 3050 when raised for rocking arms 3050 and there respectively associated valve rotors.

Normally forks 3052 rest in a fallen-over position as in the case of the right hand fork 3052 shown in Fig. 56A so as to be out of engagement with the depending arm 3050 on the valve thereabove. A lower set of prongs 3054 is provided on spine 3042, prongs 3054 having cam surfaces 3056 on the sides for camming forks 3052 upwardly. As shown best in Figs. 56A and B, prongs 3054 are positioned by spine 3042 to cam up the forks 3052 so as to drive arms 3050*b* on valves 1606, 1608, 1610, 1612. When linkage 1644 is in the position as shown, keys 1645 may be depressed and the rods 2926, forks 3052*b* and arms 3050*b*, control valves 1606, 1608, 1610, 1612, so as, in turn, to extend nozzles 1145 slightly and thus prevent the spreading of the bed mortar for the wythe of the key which is depressed.

In the positioning of certain elements through the operating of hydraulic jacks, it is desirable that the jacks be operable to move the elements to any one of a number of critical positions. An example of a jack and a control valve therefor is illustrated in Figs. 75 and 78 inclusive, where-

in is illustrated one of jacks 1146 and its control valve 1642.

As shown in Figs. 75–78 inclusive, jack 1146 includes a cylindrical casing 3060 affixed by a support 3062 to the rigid part of mortar line 1154 of the mortar spreader 1094, the cylinder having a closed rear end 3064 and an apertured front end 3066. Apertured front end 3066 is suitably packed at 3068 to provide a sliding but leakproof passage for piston rod 1148, the free end 3072 of which is attached to element 1160 of the mortar nozzle 1144 (see Figs. 37 and 46). The inner end of piston rod 1148 carries a piston 3074, the object being to drive the piston, its rod and the nozzle assembly attached thereto, to any one of four positions designated A to D inclusive.

The positioning of piston 3074 is controlled through valve 1642 through which the motive fluid for the piston is passed and exhausted. Valve 1642 includes a cylindrical casing 3076 rigidly affixed by mounting 3078 on jack casing 3060 and extending transversely thereto, in the example shown. Casing 3076 is provided with two pairs of apposed fluid ports 3080 and 3082 on the one hand 3084 and 3086 on the other hand. For purposes of illustrating the operation of the jack in one direction, it will be assumed that fluid under pressure is to be admitted to port 3082 through pipe 1640 and fluid is to be exhausted through port 3086 through pipe 1638. Port 3080 is connected by pipe 3081 to the rear end of jack 1146 and port 3084 is connected by pipe 3085 to the front end of the jack 1146. As seen best in Fig. 76, valve casing 3076 is provided with elongated oblique grooves 3088 and 3090 on the inner surface thereof these grooves respectively registering with and passing across the inner ends of ports 3080 and 3084 as indicated in dotted lines; there is a similar oblique groove 3092 on the inside of casing 3076 and extending across the inner end of port 3082, and, of course, another such groove at the inner end of port 3086.

Each of these last mentioned grooves, such as groove 3092 extends in a direction opposite to its diametrically apposed groove 3088.

Valve 1642 has therein a solid cylindrical rotor 3094 rotatable and axially slidable in casing 3076, the rotor having a pair of longitudinal spaced, diametrically extending passages 3096 and 3098 extending therethrough. In the normal resting position of rotor 3094, passage 3096 connects ports 3080 and 3082 and passage 3098 connects ports 3084 and 3086.

Rotor 3094 is driven by a stem 3100 rigidly affixed thereto and extending upwardly through a slot 3102 in casing 3076. As seen best in Fig. 84 slot 3002 is shaped generally as a pair of opposed wedges and has edges 3104, 3106, 3108, which define the shape of one wedge 3110, 3112, 3114 defining the other wedge. A roller 3116 insures easy camming engagement of stem 3100 with the edges of slot 3102. The lower inside of casing 3076, as illustrated in Fig. 78, is provided with a set of guide grooves 3118, the outer edges of which are complementary with the edges of slot 3102 and there being in addition island like center pieces 3120 and 3122. Roller pin 3126 on rotor 3094 engages in guide grooves 3118.

Valve stem 3100 is driven by rod 1148 through an L-shaped arm 3129 which extends back over valve 1642 and which has depending therefrom spaced blades 3130, 3132, 3134, the blades being arranged to engage a roller 3136 on valve stem 3100. Normally valve stem 3100 is resiliently supported upright by means of a spring 3138 anchored by a bracket arm 3140 on valve casing 3076. Rotor 3094 is biased to a position intermediate the ends of casing 3076 by springs 3142 and 3144. Variable leak dash pots 3146 are provided at the ends of casing 3076 for damping the actions of springs 3142 and 3144.

Assuming that piston 3074 is in the "B" position and it is desired to drive it and the elements driven thereby to the "C" position, a valve, such as manually operated valve 1620 (see Fig. 56) is open to admit fluid under pressure to port 3082 through pipe 1640. The fluid passes in through port 3082, through passage 3096 and out through port 3080 and pipe 3081 to the rear end of the cylinder 3060 of jack 1144, thereby driving piston 3074 to the right as seen in Fig. 75. After piston 3074 has traveled part way to its "C" position, blade 3132 engages roller 3136 of stem 3100, thereby camming rotor 3094 to the right as seen in Fig. 76, by the cam action of the engagement of roller 3116 against edge 3114 of slot 3102.

As seen in Fig. 78, roller pin 3126 projecting from the lower side of rotor 3094 will travel along a portion of slots 3118 designated *"a"* as rotor 3094 moves to the right to compress spring 3144. Meanwhile, as rotor 3094 moves to the right, fluid connection between ports 3080 and 3082 is maintained via slots 3088 and 3092, with which passage 3096 continues to register. A similar action, of course, occurs with respect to the fluid exhausted from the front end of cylinder 3060 via the pipe 3085 port 3084 groove 3090 passage 3112, the opposite groove, port 3086 and pipe 1638.

Functions of impulse valve

When piston 3074 reaches its C position, stem 3100 will have then been cammed so far to the right that roller 3136 reaches the end of blade 3132, whereupon it slips off around the end of the blade and returns to its normal vertical position under the pull of spring 3138. As stem 3100 is pulled to its vertical position pin 3126 starts along the portion of slots 3118 designated *b* and while spring 3144, then compressed, biases piston 3094 towards its normal center position thereby engaging pin 3126 against the curved end of island 3122 (Fig. 78).

The action of pin 3126 against the curved end of island 3122 rotates rotor 3094 so as to swing stem 3100 slightly past its center position to the right as seen in Fig. 75 and finally roller pin 3126 travels along the portion of slots 3118 designated "c" as it is returned towards its normal longitudinal and angular positions by spring 3144, the return being restrained by dash pot 3146.

Of most importance is the fact that when roller 3136 passes around the end of blade 3132, piston 3094 is rotated so that passage 3096 no longer registers with slots 3088 and 3092 so that the fluid connection between ports 3080 and 3082 is cut off, similarly ports 3084 and 3086 are cut off from one another.

(See letters *"a," "b,"* and *"c"* which, with the accompanying arrows, indicate the travel of passage 3098 with respect to groove 3090; *b'''* and *c'''* being the cut off period.)

Without the driving force of the motive fluid, piston 3074 remains in its C position until spring 3144 drives piston 3094 to to its normal position shown in Figs. 76 and 77. The interval between the time when roller 3136 passes around the end of blade 3132 and the time when the piston 3094 returns to its center position allows the operator or automatic means to cut off the source of fluid under pressure for pipe 1640 so that, if desired,

the piston **3074** can be left exactly at its C position.

In the instances where the motive fluid is controlled by an automatically operating valve between the fluid pump and a pipe corresponding to pipe **1640**, as in the cases where the fluid is supplied through the glands **905** in layer head to similar valve and piston arrangements which rotate layer arms, the step by step piston control provides exact positioning of the piston driven elevent and the time lag in return of piston **3094** to its normal position renders less critical the dimensioning and timing of the automatic control valves in the fluid supply and exhaust lines. If the control of the fluid supplied to drive the piston be manual, as is the case of the fluid supplied thru pipe **1640** the operator can hold the control valve open, whereupon when piston **3094** returns to its normal longitudinal and angular positions, the cycle will be reinstituted so as to drive piston **3074** from its "C" position to position "D." If the operator wishes to drive piston **3074** to the left from, for instance, its "D" position to position "A," the fluid control supply and exhaust would be switched so as to supply fluid under pressure through line **1638** to the back end of cylinder **3060** and by holding the control valve open, piston **3074** would be driven successively to positions C, B, and A.

Thus an intermittent drive of piston is obtained even though the supply of motive fluid therefor be continuous.

Piston **3074** can be made to assume positions other than those designated A, B, C, and D by respacing blades **3130**, **3132**, **3134**. It is thus apparent that the arrangement is self-controlling and highly critical in its self positioning.

Vacuum clause

Throughout the specification reference is made conveniently to vacuum as a positive force in order to simplify the explanation. It is understood, of course, that the active forces are those resulting from the relative greater air pressures of element in accordance with well known pneumatic principles.

While one embodiment of the invention has been described in detail, the invention is not to be limited to the specific mechanism disclosed but is intended to cover all equivalents and modifications within the scope of the following claims.

I claim:

1. In combination, a carriage, boom means projecting laterally from said carriage, a bricklaying element on said boom means, said element including an arm, pivot means mounting said arm on said boom means, holding means on said arm for engaging and releasably holding a brick, means on said boom means for supplying brick to be laid by said element, said arm being adapted to swing so as to carry said holding means from adjacent said brick supply means to a position in which said holding means extend outwardly from the boom means to a bricklaying position, and means for controlling said element.

2. In a brick laying device, a support, a rotatable arm, brick engaging means on said arm, pivot means mounting said arm on said support for rotation between a brick supply station and a brick laying station laterally disposed with respect to one another, normally horizontal guide means movably mounted on said support for maintaining the rotation of said arm in a generally horizontal plane, and means for tipping said guide means from the horizontal whereby to tip the plane of rotation of said arm, said last named means including a fluid motor connected between said support and said guide means.

3. The combination claimed in claim 15 and a track, a carriage movable along said track forwardly and rearwardly, said support and boom means being mounted on said carriage for revolving action about a vertical axis, and cam means for dimensioning and timing said carriage movement and said boom action whereby to cause said selected laying station to vary arcuately along said arc.

4. In a bricklaying machine, including a support, a brick laying element, said element comprising a frame movably mounted on said support, an arm projecting from said frame and adapted to be moved thereby between a brick supply station and a brick laying station, means for moving said frame, a first series of vacuum cups adapted to engage and releasably hold brick, said cups being arranged along one longitudinal side of said arm, the cups forming said first series being spaced from one another in one pattern, a second series of vacuum cups arranged along another longitudinal side of said arm, the cups forming said second series being spaced from one another in another pattern, means for rotating said arm whereby either said series of vacuum cups may selectively be disposed in position for engaging bricks at said supply station and means for selectively activating and deactivating either of said series of vacuum cups.

5. In a device for laying brick in a wall wherein the layed brick have substantially horizontal and vertical surfaces, means for shoving a brick being laid so that a vertical surface thereof is moved toward a vertical surface of a layed brick and a support therefor, and means for supplying mortar to the space between said vertical surfaces prior to the completion of said shoving, whereby to compress the supplied mortar between said vertical surfaces, said last named means including a mortar conduit, a nozzle terminating said conduit, a nozzle support carried by the support by means for shoving a brick, a normally enclosed valve in said mortar conduit, and an operating member for controlling said valve, said operating member being disposed in the path of the brick being shoved.

6. In a device for laying brick in a wall wherein the layed brick have substantially horizontal and vertical surfaces, means for shoving a brick being laid along a generally horizontal path so that a vertical surface thereof is moved toward a vertical surface of a layed brick, mortar supply means for supplying mortar to at least one of said vertical surfaces, a valve for controlling the flow of mortar from said supply means, and a trigger interposed in the path of the brick being layed for momentarily opening said valve prior to the completion of said shoving.

7. In a device for laying brick in a wall wherein the layed brick have substantially horizontal and vertical surfaces, means for shoving a brick being laid so that a vertical surface thereof is moved towards a vertical surface of a laid brick, a support for the first named means including a chassis adapted to travel along a guideway independently of the wall being laid and a boom extending from said chassis, mortar supply means comprising a conduit having a nozzle on the end thereof disposed to feed mortar in the path of the brick being laid, said first named means and said mortar supply means both being supported adjacent the free end of the boom means for supplying mortar

under pressure to said conduit, normally closed valve means for closing said conduit, and means for opening said valve means.

8. In a device for laying brick in a wall wherein the laid brick have substantially horizontal and vertical surfaces, means for shoving a brick onto the exposed top of one layed brick and against an exposed side of another adjacent laid brick, first conduit means for feeding mortar on said exposed top, and second conduit means for feeding mortar between the brick being laid and said other brick, normally open valve means in said first conduit means, normally closed valve means in said second conduit means, means for feeding mortar under pressure to both said conduit means, and trigger means disposed in the path of the brick being shoved for opening said normally closed valve means.

9. In combination, a support, a bricklaying element on said support comprising an arm pivoted thereto for swinging about an axis between a brick supply station and a bricklaying station means for swinging said arm holding means on said arm for engaging and releasably holding a brick whereby to carry the same from said supply station along a path for deposit at said laying station means for activating and de-activating said holding means, and mortar supply means including means for spreading a bed of mortar at said laying station and dosage means including a valve for controlling the mortar supply means, and a trigger for controlling said valve, said trigger being interposed in said path for interposing a dose of mortar in said path.

10. In combination, a support, a bricklaying element on said support comprising an arm pivoted thereto for swinging about an axis between a brick supply station and a bricklaying station means for swinging said arm, holding means on said arm for engaging and releasably holding a brick whereby to carry the same along a path for deposit at said laying station means for activating and de-activating said holding means, mortar supply means on said support including a conduit having a nozzle for interposing mortar in the path of a brick being deposited at said laying station, a valve for controlling the flow of mortar from said nozzle, and control means for opening said valve momentarily upon approach of a brick towards said laying station, said nozzle being disposed with its discharged end closely adjacent to said path.

11. In a device for laying brick to form a wall, a boom, means for movably supporting said boom, and an element on said boom for laying brick, the improvement which comprises a mortar spreading device including an arm mounted on said boom and extending laterally therefrom to a position adjacent the wall being laid by said element, a nozzle supported on said arm and overlaying the portion of the wall being laid, means for supplying mortar to said nozzle, and means for controlling the mortar supplied.

12. In a device for laying brick to form a wall, a boom, means for movably supporting said boom, and an element on said boom for laying brick, the improvement which comprises a mortar spreading device including an arm mounted on said boom and extending adjacent the wall being laid by said element, a nozzle supported by said arm and overlying the portion of the wall being laid, means for supplying mortar to said nozzle, a valve for controlling the flow of mortar from said nozzle, trigger means adapted to be engaged by brick being laid by said element for opening said valve, and means remote from said valve for controlling the same.

13. In a bricklaying device including a boom and an element on said boom adapted to shove brick longitudinally at a transient laying station to form a wall, means for moving said boom along the line of the wall, a pair of spaced arms supported by and extending from said boom so as to overlay the wall, the arms being respectively on the leading and trailing sides of the laying station, a pair of nozzles respectively supported by said arms, said nozzles having open ends respectively extending towards one another, means for supplying mortar to said nozzles and means for raising the level of one nozzle relative to the other, whereby to provide a lower nozzle for spreading a bed of mortar and an upper nozzle for mortaring head joints.

14. In a bricklaying device, a support, including boom means, brick supply means on said boom means including means for supporting a brick in predetermined position at a supply station, an arm pivoted on said boom and adapted to swing to and from said supply station, holding means on said arm for engaging a brick at said supply station and releasably holding the same, means for swinging said arm from said supply station to a selected laying station, means for controlling said holding means for causing engagement thereof with a brick at said supply station and release of the same at the selected laying station, a mortar spreader supported on said boom adjacent said brick laying element, and means for moving said mortar spreader to said selected laying station.

15. In a bricklaying device, a support including boom means, brick supply means on said boom means including means for supporting a brick in predetermined position at a supply station, an arm pivoted on said boom means and adapted to swing about an axis to and from said supply station, holding means on said arm for engaging a brick at said supply station and releasably holding the same, means for swinging said arm about said axis so as to swing said holding means and a brick engaged thereby along an arc from said supply station to a selected laying station, a mortar spreader, and means pivotally mounting said mortar spreader on said boom means for swinging about said axis substantially along the arc of movement of said holding means.

16. In a bricklaying device, a support including boom means, brick supply means on said boom means including means for supporting a brick in predetermined position at a supply station, an arm pivoted on said boom means and adapted to swing about an axis to and from said supply station, holding means on said arm for engaging a brick at said supply station and releasably holding the same, means for swinging said arm about said axis so as to swing said holding means and a brick engaged thereby along an arc from said supply station to a selected laying station, a mortar spreader, means mounting said mortar spreader on said boom means for swinging about said axis and supporting said mortar spreader substantially along the arc of movement of said holding means, and means operated in accordance with the relative position of said arm with respect to said supply station and said mortar spreader whereby to actuate the holding means to engage a brick upon swinging of said holding means to said supply station and to release a brick upon swinging of said holding means to a position adjacent said spreader.

17. In a device for laying brick, including an element for laying brick at a bricklaying station to form a bond, the improvement which comprises a mortar spreader including a support, a plurality of extensible nozzles spaced from one another along said support and having open ends adjacent the bricklaying station, means for supplying mortar to said nozzles in discrete quantities, and means for individually extending and retracting said nozzles towards and away from said support, whereby to vary the position of the open ends of the nozzles in accordance with the position of said brick in the bond being layed.

18. In a bricklaying machine, including an element for laying brick at a transient brick laying station to form a wall and a support for said element, the improvement which comprises a bank of spaced substantially parallel nozzles for feeding mortar at said station, means for supplying mortar to said nozzles, means carried by said support and mounting said nozzles for pivotal movement about a horizontal axis lying substantially transversely of the wall being laid, and means for pivoting said nozzles about said axis.

19. In a bricklaying device, a mortar spreader, adapted to be disposed over a wall being laid, said mortar spreader comprising a pair of arms extending, when in one working position parallel to one another and transversely of the wall being laid and disposed on opposite sides, of a brick laying station, nozzle means on each of said arms, the nozzle means on each arm respectively having outlet ends directed toward the laying station, means for supplying mortar to said nozzle means, a boom, means movably mounting said arms on said boom for selective vertical movement relative thereto, and means for selectively raising each of said arms relative to the other, whereby to dispose the raised arm and the nozzle means thereon away from the aforesaid working position.

20. In bricklaying machine, including laying means for laying brick at a transient station to form a wall, and a support for said laying means, the improvement which comprises a nozzle having an outlet end adapted to be directed towards said bricklaying station, an arm mounting said nozzle for pivoting about a horizontal axis lying transversely of the wall being laid, means movably mounting said arm on said support for vertical movement relative thereto, means for pivoting said nozzle and means for raising and lowering said arm relative to said boom.

21. In a bricklaying machine, including a trackway extending along the line of a wall to be layed by said machine, a wheeled chassis movable along said trackway, rotatable driving means for moving said chassis along said trackway a predetermined distance with each rotation thereof, a brick arranging device supported by said chassis laterally of the line of the wall, a bricklaying member including an arm rotatably supported by said chassis for sweeping past both said arranging device and a bricklaying station on said line, releasable brick engaging means on said arm, and means for activating and deactivating said releasable brick engaging means for engaging a brick at said arranging device and for releasing the same at said laying station, whereby to lay a predetermined length of brick with each rotation thereof, the improvement which comprises a register having first and second rotatable indicators, gearing connecting said rotatable driving means and the first indicator the movement of said chassis along said track, and gearing connecting said head and said second indicator whereby to rotate the latter in accordance with the rotation of said arm.

22. A brick arranging mechanism having a plurality of arranging elements adapted to support brick in a close fitting flat pattern, means for selectively rotating said elements to form another close fitting flat pattern of said brick, and means for selectively moving said elements vertically when displacing brick from said patterns whereby to clear brick one from another during rotation.

23. A brick arranging mechanism comprising a plurality of individually rotatable brick supporting elements arranged on a generally flat support and adapted to hold brick so as to form one pattern of the brick held thereby, individual means for selectively rotating said elements to form another pattern of said brick, and means for selectively raising and lowering said brick-supporting elements with respect to said flat support whereby to clear said bricks with respect to one another during rotation thereof.

24. A brick arranging mechanism comprising a body having a plurality of arranging elements spaced laterally across a surface, thereof, means for centering brick on said elements to form one pattern thereof, means for selectively and individually rotating said elements whereby to rotate said brick from position occupied thereby in said pattern and for laterally moving said elements relative to one another, whereby to fit the rotated brick closely in another pattern.

25. In combination, a brick laying element having holding means thereon for releasably engaging a brick supported in any one of a plurality of positions at a supply station and to lay the same at a laying station in a position corresponding to that in which the brick was engaged, means for activating and de-activating said holding means, means for moving said element and the holding means thereon from said supply station to said laying station, movable support means at said supply station, means for feeding brick to said support means in one characteristic position, and means for selectively moving said support means, whereby to selectively predetermine the laying position of the brick.

26. In combination, a brick laying element having holding means thereon for releasably engaging a brick supported with its longitudinal axis horizontally disposed in any one of a plurality of directions at a supply station and to lay the same at a laying station in a position corresponding to that in which the brick was engaged, means for activating and de-activating said holding means, means for moving said element and the holding means thereon from said supply station to said laying station, brick support means at said supply station, means mounting said support means for rotation about a vertical axis, means for feeding brick to said support means with the axis thereof substantially horizontally disposed in one characteristic direction, and means for rotating said support for altering the direction of disposition of the longitudinal axis of a brick supported thereon.

27. In a bricklaying machine, a support, a bricklaying element, first pivot means movably mounting said elements on said support, a brick supply station spaced from said first pivot means, means for swinging said element about said first pivot means between said supply station and a brick laying station holding means on said ele-

ment for releasably engaging a portion of a brick supported with its longitudinal axis longitudinally disposed in any one of a plurality of directions at the supply station and for carrying the brick along a defined path for release at the laying station in a position corresponding to that in which the brick was engaged, means for activating and deactivating said holding means, movable support means at said supply station for supporting a brick adjacent the path of movement of said holding means for positioning brick on said support means in one characteristic position with respect to the support means and with its longitudinal axis horizontally disposed, means for rotating said support means about a vertical axis whereby selectively to predetermine the direction of the longitudinal axis ing said support means laterally of said pivot of the brick when engaged, and means for moving said support means laterally of said pivot means whereby to predetermine the lateral disposition of the brick when layed.

28. In a bricklaying machine, a mechanism for arranging brick in close fitting pattern comprising means forming a substantially flat topped working surface having openings arranged therein, a plurality of open topped vacuum cups, means movably mounting said cups in said openings for movement between a lower position in which the tops of said cups extend no higher than the adjacent working surface and an extended position in which the cup tops be substantially above said surface, means for feeding brick onto said surface, guide means on said mechanism for guiding individual brick respectively to resting positions over said cups, the spacing of said cups and guide means being such that said brick, when fed, rest in a close fitting pattern forming relationship, means for selectively rotating said cups for rearranging said brick, and means for extending at least some of said cups, whereby to clear adjacent brick one from another, during rearrangement.

29. In a bricklaying machine, a mechanism for arranging brick in a close fitting pattern, comprising means forming a substantially flat topped working surface having a plurality of staggered, substantially parallel guide ways therein, a plurality of open topped vacuum cups, means mounting said vacuum cups in said guide ways for vertical movement between a lower position in which the tops of said cups extend no higher than the adjacent working surface and an extended position in which the cup tops lie substantially above said surface, means for feeding brick on to said surface, guide means for guiding individual brick respectively, to resting positions over said cups, the spacing of said cups and guide means being such that said brick, when fed, rest in one close fitting relationship with their longitudinal axes extending transverse of said guide ways, means for selectively rotating said cups for selectively rearranging the axes of said brick, means for selectively extending said cups for clearing adjacent brick one from another during rearrangement, means for selectively moving said cups longitudinally of said guide ways, respectively, whereby to fit said brick into another close fitting pattern, and means for withdrawing air from said vacuum cups, whereby to engage said brick on said cups during rearrangement.

30. In a bricklaying machine, means forming a substantially flat-topped working surface having a recess therein, a brick supporting element in said recess normally lying no higher than said surface, means for shoving brick lengthwise across said surface and onto said element, a stop movably mounted above said surface and adjacent said element for stopping brick shoved onto said element, and means for moving said stop lengthwise of the direction of the shoving of said brick, whereby to center brick of variable length on said element.

31. In a brick laying machine, a support, a brick arranging mechanism including a base, first pivot means mounting said base rotation about a first vertical axis, a plurality of brick spotting elements arranged thereon for respectively supporting individual brick, a brick laying element for transporting brick from said spotting elements to a laying station and comprising an arm having a plurality of holding means spaced thereon for releasably engaging bricks, means for activating and deactivating said holding means, the spacing between said holding means being substantially similar to the spacing between said spotting elements, second pivot means pivotally mounting said arm for rotation about a second vertical axis spaced from the first axis, means for maintaining the spacing between said axes so that said holding means sweep adjacent the respective bricks on said spotting elements upon rotation of said arm about said second axis, and means for rotating said arm about said second axis.

32. In combination with a brick arranging mechanism having a plurality of spotter elements spaced thereon for spotting brick to be layed in wythes by a brick laying element, a plurality of brick loading devices for feeding brick respectively to said spotter elements, and means for selectively operating said loading devices, whereby to determine the wythe of the brick subsequently layed by said laying element.

33. In combination, a brick arranging mechanism comprising means forming a surface, a plurality of movable stops spaced across said surface for spotting brick to be layed by a brick laying element, means for adjustably moving said stops in one direction, a supply chute dimensioned for feeding a plurality of brick side by side to said surface in the direction of movement of said stop, and guide means forming channels on said chute, the channels formed by said guide means respectively registering with said stops.

34. In combination, a brick arranging mechanism comprising means forming a surface, a plurality of brick arranging elements spaced across said surface for individually arranging brick to be layed by a brick laying element, a supply chute dimensioned for feeding a plurality of brick side by side to said surface, guide means forming channels on said chute, the channels respectively registering with said brick arranging elements, and means for shoving the guided brick individually to said brick arranging elements.

35. In combination, a support, a brick laying element on said support, brick arranging means on said support adjacent said brick laying element, a guideway on said support for directing brick to said arranging means, said guideway terminating adjacent said arranging means, feeding means adjacent the terminus of said guideway for feeding said brick from said guideway to said arranging means, a brick bat reservoir carried by said support and disposed adjacent said guideway, and means for feeding brick bats from said reservoir to said feeding means.

36. In combination, a support, brick arranging means on said support, a brick laying element

on said support for periodically transporting brick from said arranging means to a laying station, brick supply means for feeding brick to said brick arranging means perodically in anticipation of the periodic demand for transportation thereof by said brick laying mechanism, a brick bat supply reservoir, means for withholding brick in said supply means contrary to the anticipated demand by said brick laying mechanism, and means for feeding a brick bat to said brick arranging mechanism instead of a withheld brick.

37. In combination, a support, brick arranging means on said support, a brick laying element on said support for periodically transporting brick from said arranging means to a laying station, a brick supply conduit terminating at said arranging mechanism, means for feeding a plurality of brick to said conduit, brick engaging means movable lengthwise of said conduit for engaging individual brick in said conduit and for moving the same individually to said arranging mechanism, and means for driving said brick engaging means.

38. In combination, a support, brick arranging means on said support, a brick laying element on said support for transporting brick from said arranging means to a laying station, a brick supply conduit having entrance and exit ends, the exit end terminating at said arranging means, means for feeding brick to the entrance end of said conduit, first releasable brick stop means at a first station adjacent the exit end of said conduit, second releasable brick stop means at a second station spaced back along said conduit from the first, means for driving a brick from said first station to said arranging means, and means for releasing said stop means, whereby to allow said brick to be so driven and for allowing a brick to move from said second station to the first.

39. In combination, a support, brick arranging means on said support, a brick laying element on said support for transporting brick from said arranging means to a laying station, a brick supply conduit having entrance and exit ends, the exit ends terminating at said arranging mechanism, means for feeding brick to the entrance end of said conduit, first releasable brick stop means at a first station adjacent the exit end of said conduit, a second station spaced back along said conduit from the first, driving means for driving a brick from said first station to said arranging means, means for releasing said first stop means upon operation of said driving means, a brick bat reservoir disposed adjacent said conduit brick bat feeding means for feeding brickbats individually from said reservoir to said first station, second releasable stop means at said second station, means for maintaining said second stop means in operation upon operation of said brickbat feeding means, and means for releasing said second means substantially upon operation of said driving means when said brickbat feeding means is in non-operation.

40. In combination, a brick laying element adapted to lay a plurality of wythes of brick at a transient laying station, a brick arranging mechanism having a plurality of spotters spaced thereon for arranging brick to be layed by said laying element, the arrangement of the brick on said mechanism corresponding to the bond thereof when layed by said element, a brick supply conduit terminating at said arranging mechanism, said conduit having a plurality of channels registering with said spotters, means for feeding brick to said channels, a plurality of driving means for driving brick individually from the channels to said spotters, a brickbat reservoir disposed adjacent said conduit, supply means operable for supplying brickbats from said reservoir to said driving means, and means for selectively operating said supply means for supplying the selected driving means with brickbats, whereby selectively to insert brickbats in the wythes subsequently layed by said laying mechanism.

41. In combination, a support, brick arranging means on said support, a brick laying element on said support for transporting brick from said arranging means to a laying station, an elongated brick guideway on said support and extending from said arranging means, said guideway, having entrance and exit ends, said exit end terminating at said arranging means, a conveyor having an outlet end terminating at said entrance end, whereby brick carried by said conveyor may be passed through said guideway to said arranging means, a brickbat reservoir disposed adjacent said guideway, means operable for conveying brickbats from said reservoir to said guideway, and means operable for bringing said conveyor into effective communication with said reservoir, whereby brickbats carried by said conveyor may be fed to said reservoir.

42. In combination, a support, a layer head comprising a bearing, means mounting said bearing on said support for rotation about a substantially vertical axis, an element extending laterally of said bearing, brick engaging means carried by said element, pivot means mounting said element on said bearing for rotation about a substantially horizontal axis, an arcuate guideway concentric with said vertical axis, a follower engaged with said guideway and restrained against vertical movement relative thereto, a pivot extending substantially radially of said vertical axis connecting said follower to said element, means mounting said guideway on said support for universal tilting movement about said vertical axis, first motor means for rotating said bearing, and second motor means for tilting said guideway.

43. In combination, a support, an element, brick engaging means on said element, means mounting said element on said support for rotation about a substantially vertical axis and for tilting movement with respect to a horizontal plane, means for rotating said element, guide means movably mounted on said support and operatively engaging said element for tilting the same, whereby to define the plane of rotation thereof when said element is rotated, a handle, a handle support, means mounting said handle on its support for tilting about an axis, motor means for moving said guide means, and a control connection between said handle and motor means, said element, guide means, motor means, connection and handle being so adapted and arranged as to tilt the plane of rotation of said element in accordance with the tilt of said handle.

44. In a device for laying brick in a wall, means for shoving a brick onto the top of one layed brick, and against an exposed side of another layed brick adjacent said one laid brick, first conduit means for feeding mortar on said exposed top, second conduit means for feeding mortar between the brick being laid and said other brick, normally open valve means in said first conduit means, normally closed valve means in second conduit means, trigger means disposed in the path of the brick being shoved for opening said normally closed valve means, supply means for

feeding mortar under pressure to both said conduit means, a first throttling valve in said first conduit means between said normally open valve means and said supply means, a second throttling valve in said second conduit means between said normally closed valve means and said supply means, and first and second manual operating elements for respectively controlling said first and second throttling valves.

45. In a bricklaying machine including a bricklaying element having a plurality of alternately operable sets of brick engaging elements, the elements forming one set being spaced from one another differently from the elements forming another set whereby respectively to engage brick arranged in correspondingly different patterns at an arranging station for transport to and deposit at a laying station, a brick arranging mechanism at said arranging station including a plurality of shiftable spotter elements adapted to receive individual brick uniformly supplied thereto in one characteristic position, means for shifting said spotter elements to arrange the same to other positions to form different patterns, a mortar spreading device at said laying station including a plurality of mortar ejecting nozzles adapted to spread mortar on the bricks being laid and adjustably disposed with respect to one another between different relative positions respectively corresponding to the positions of the bricks being laid, motor means for selectively operating said sets of brick engaging elements, motor means for shifting said spotter elements, motor means for adjusting said nozzles, and common control means for said motor means whereby correspondingly to operate the same to change from one brick pattern to another.

46. A bricklaying machine comprising a vehicular support, a longitudinal guideway for said support, a frame, bearing means mounting said frame on said support for rotation of said frame about a vertical axis, a boom extending outwardly from said frame, an arm, bearing means mounting said arm on said boom for rotation about an upstanding axis, means for rotating said arm, releasable brick engaging means on said arm, means for activating and de-activating said brick engaging means, and means for supplying brick to said brick-engaging means.

47. A bricklaying machine comprising, a support, a main frame, bearing means mounting said main frame on said support for rotation of said main frame about a vertical axis, means for rotating said main frame about said bearing means, a sub-frame, a vertical guideway supporting said sub-frame on said main frame for vertical movement of the former on the latter, means for moving said sub-frame vertically on said main frame, an outwardly extensible element mounted on said sub-frame, means for extending and retracting said extensible element, an arm, bearing means mounting said arm on said outwardly extensible element adjacent the outer end thereof for rotation about an upstanding axis, releasable brick engaging means on said arm, means for activating and de-activating said brick engaging means, and means on said extensible element for supplying brick to said brick engaging means.

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