Jan. 25, 1944. W. E. URSCHEL 2,339,892

MACHINE FOR BUILDING WALLS

Filed Oct. 20, 1941 4 Sheets-Sheet 1

Fig. 1.

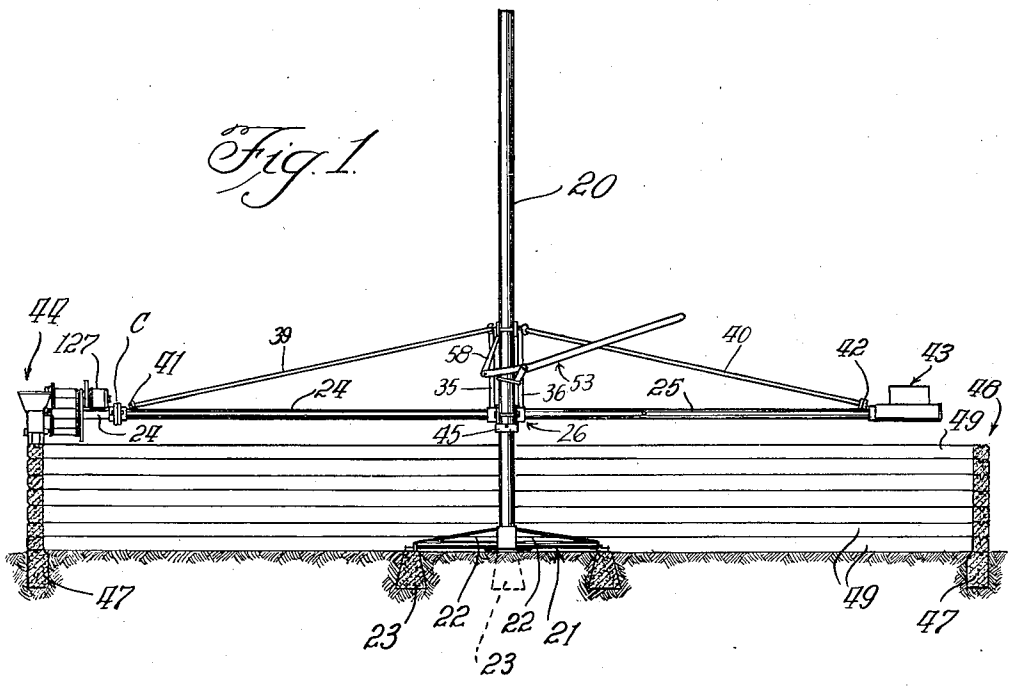
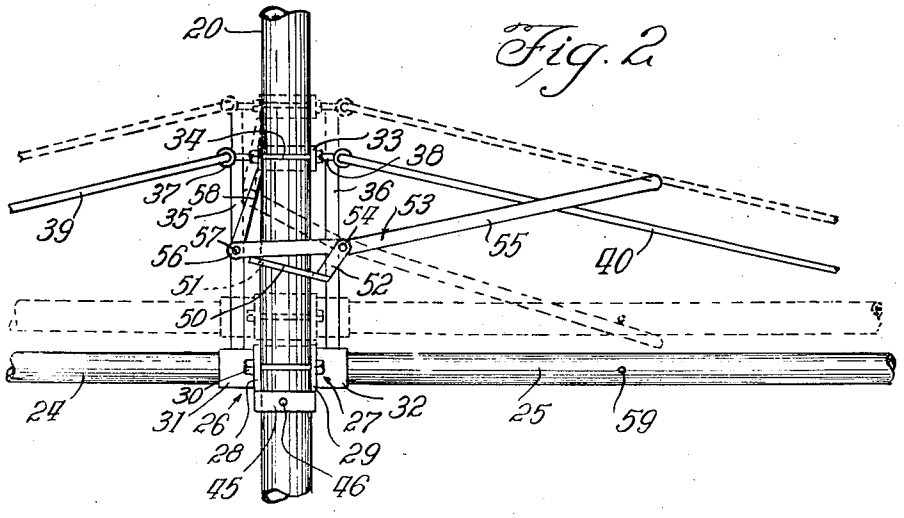


Fig. 2.



INVENTOR.

BY William E. Urschel

ATTORNEY.

Jan. 25, 1944. W. E. URSCHEL 2,339,892

MACHINE FOR BUILDING WALLS

Filed Oct. 20, 1941 4 Sheets-Sheet 2

Fig. 3.

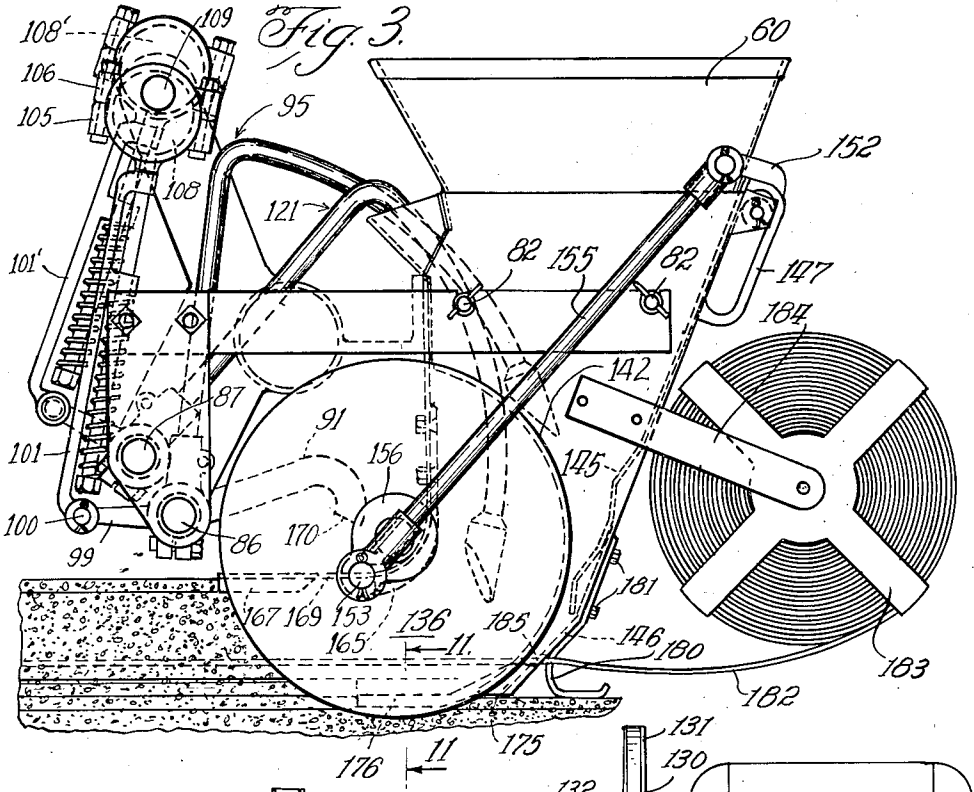
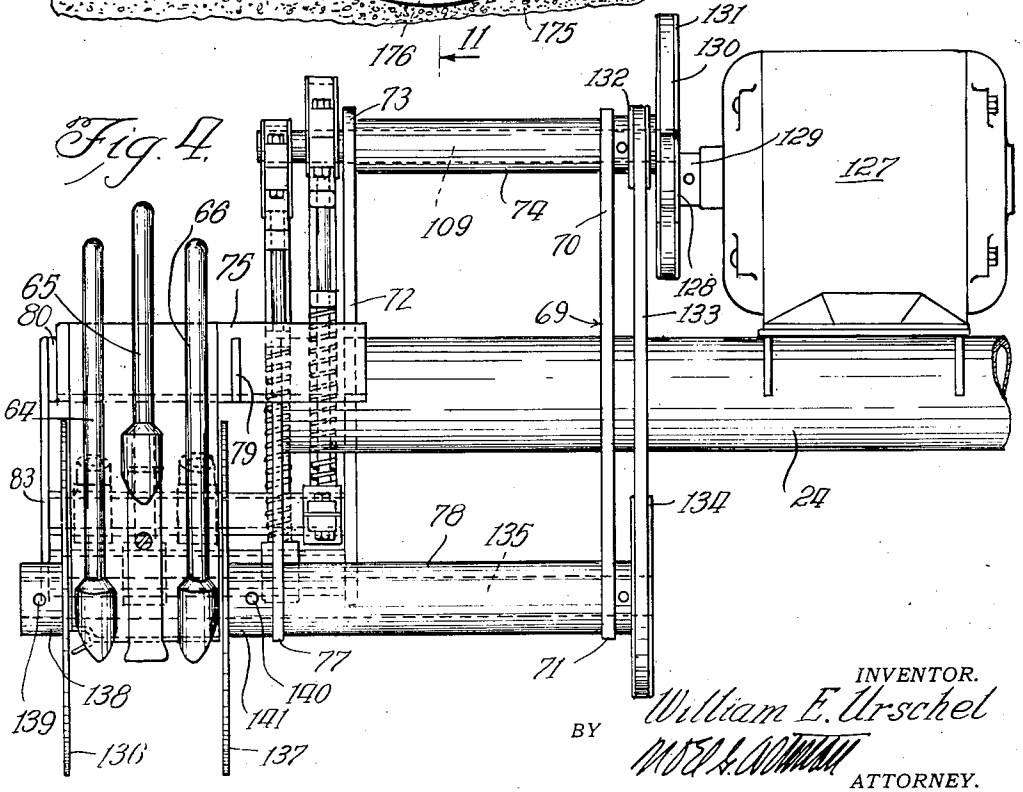


Fig. 4.



INVENTOR.
William E. Urschel
BY
ATTORNEY.

Jan. 25, 1944. W. E. URSCHEL 2,339,892

MACHINE FOR BUILDING WALLS

Filed Oct. 20, 1941 4 Sheets-Sheet 3

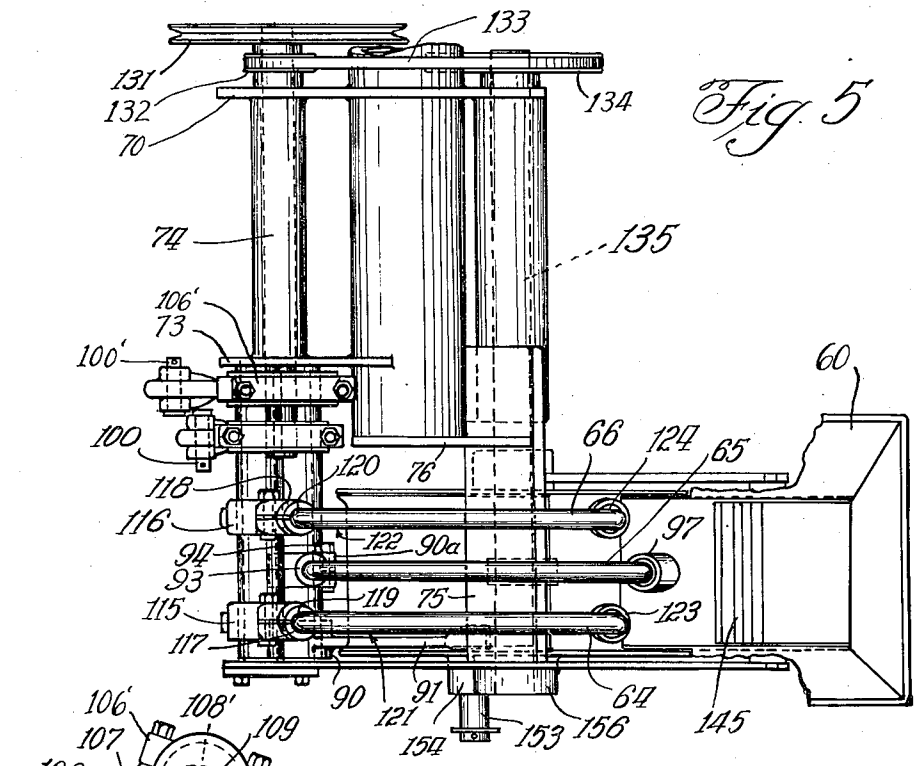


Fig. 5

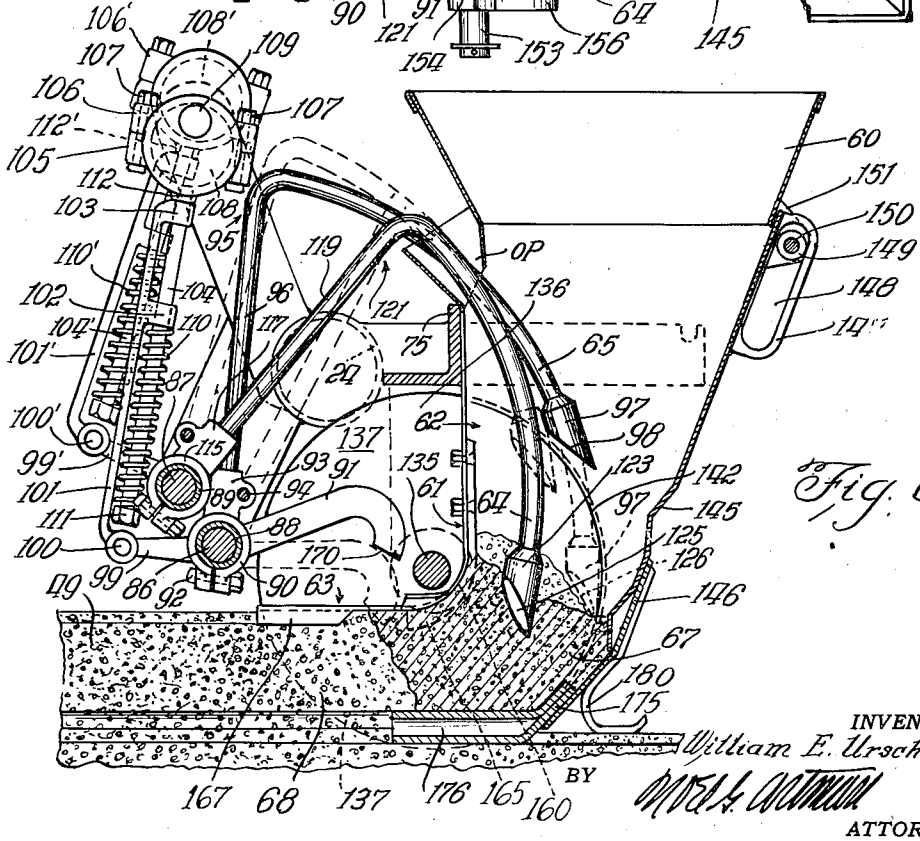


Fig. 6.

INVENTOR.
William E. Urschel
BY
ATTORNEY.

Jan. 25, 1944. W. E. URSCHEL 2,339,892

MACHINE FOR BUILDING WALLS

Filed Oct. 20, 1941 4 Sheets-Sheet 4

Fig. 7.

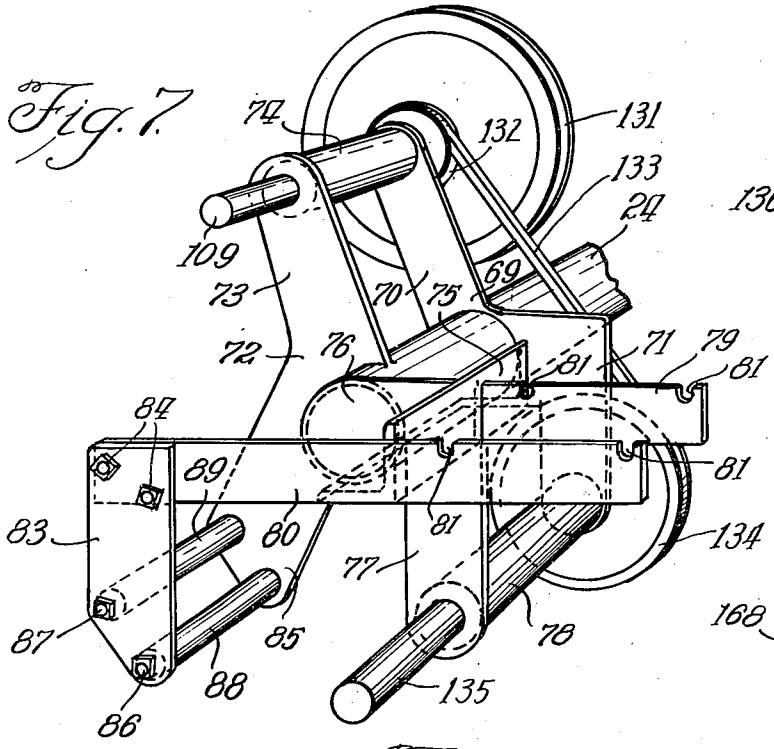


Fig. 11.

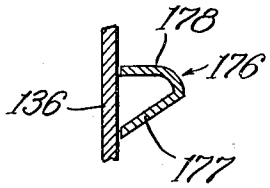


Fig. 8.

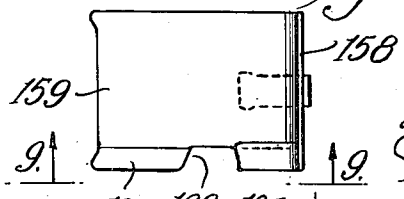


Fig. 10.

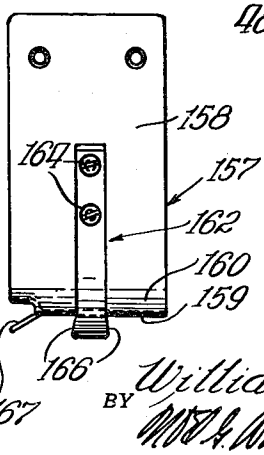


Fig. 9.

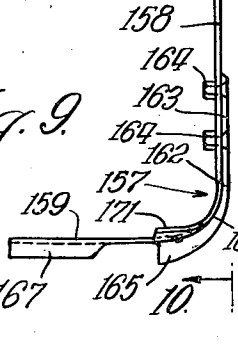
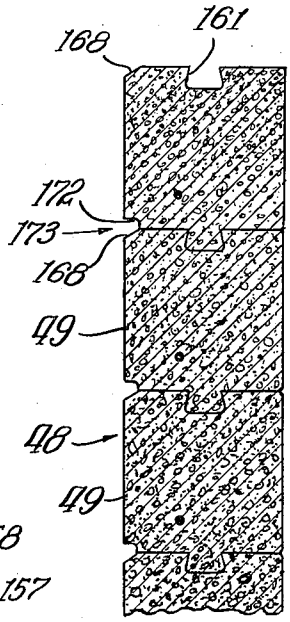


Fig. 12.



INVENTOR.

BY William E. Urschel

ATTORNEY.

Patented Jan. 25, 1944 2,339,892

UNITED STATES PATENT OFFICE

2,339,892

MACHINE FOR BUILDING WALLS

William E. Urschel, Valparaiso, Ind.

Application October 20, 1941, Serial No. 415,687

15 Claims. (Cl. 25—1)

This invention has to do with molding machines and relates more particularly to such a machine operable to mold a solidifiable material into the form of a strip and deposit the same as a course or layer in the formation of a wall. The invention also contemplates and encompasses the novel method of strip forming adapted to be performed by the machine.

This invention is an improvement upon that disclosed in United States Patent No. 2,314,468, for Molding and depositing machine for solidifiable plastic materials, and has as an important general object the provision of an improved mechanism operable to form and lay a well packed strip of moldable material.

Additional objects of the invention include the provision of:

An improver strip molding and laying apparatus having a molding passage through which the strip is passed and having a new molding means associated with the passage for imparting to the strip a contour possessing mechanical usefulness as well as a pleasing appearance.

A novel arrangement of tamping members operable to tamp moldable wall-forming material into said passage.

An additional tamping means operable independently of said tamping members, to feed the strip material along part of the molding means associated with the passage.

A new vibratory feeder device disposed in a side wall of a hopper holding the moldable material preparatory to its being fed into the passage, and operable to expedite the feeding of such material into the passage.

Means associated with the molding and laying apparatus for holding a supply of reinforcing strip and causing such strip to be laid simultaneously and in predetermined relation with a molded wall course.

These and other desirable objects and advantages inherent in and encompassed by the invention will later appear, reference now being made to the annexed drawings disclosing a preferred embodiment, and wherein:

Fig. 1 is an elevational view of the entire machine, illustrating it in association with a cylindrical wall in process of being built by the machine;

Fig. 2 is an enlarged fragmentary view showing means for supporting the boom structure of the machine upon a standard and for changing the elevation of the boom structure upon said standard;

Fig. 3 is a side elevational view of a molding and depositing head or apparatus carried upon an end of the boom structure of Figs. 1 and 2;

Fig. 4 is a front elevational view of the apparatus shown in Fig. 3, the hopper of such apparatus being removed to expose moving parts of the apparatus;

Fig. 5 is a plan view of the apparatus shown in Fig. 3;

Fig. 6 is a side elevational view similar to Fig. 3 but having parts broken away for exposing other parts of the apparatus;

Fig. 7 is a perspective view of a framework and bearings therein for supporting the hopper and moving parts of the molding apparatus;

Fig. 8 is a plan view of a drag trowel member which forms part of the side walls of a passage in the molding apparatus through which a moldable material is passed during operation of the machine;

Fig. 9 is a side elevational view of the drag trowel member, taken on the line 9—9 of Fig. 8;

Fig. 10 is a side elevational view of said drag trowel member, taken on the line 10—10 of Fig. 9;

Fig. 11 is a sectional view taken on the line 11—11 in Fig. 3 through a molding member disposed within a lower corner of the molding passage; and

Fig. 12 is a fragmentary sectional view taken through a wall of the type constructed by the present apparatus.

The present machine includes a vertical standard 20 shown in Figs. 1 and 2, supported at its lower end in a base 21 consisting of a plurality of arms 22 radiated from the standard 20 and supported at their ends upon supporting members as 23 which may consist of concrete blocks imbedded within the earth. A boom structure is mounted upon the standard 20, this structure including a pair of oppositely directed arms 24 and 25 secured at their inner ends to a hub structure 26 which in the present instant consists of a U-shaped member 27 of which the legs 28 and 29 are upon opposite sides of the standard. A bolt 30 is adapted to hold the legs 28 and 29 in close association with said standard. Sockets 31 and 32 secured to the legs 28 and 29 as by welding receive the aforesaid inner ends of the boom arms 24 and 25.

A second U-shaped member, 33, is disposed about the standard 20 in the same manner as the member 27, a bolt 34 holding the legs of this U-shaped member in close association with the standard in the same manner as explained above with respect to the bolt 30. A pair of

upright iron bars 35 and 36 interconnect the members 27 and 33 for maintaining them in fixed spaced relation. Eyebolts 37 and 38 connected with the U-shaped member 33 serve as respective anchorages for stays 39 and 40 which are connected at their outer ends with suitable anchorage members generally designated 41 and 42 upon outer end portions of the boom arms 24 and 25 as illustrated in Fig. 1. Thus the boom arms are supported in the desired horizontal position. The boom arm 25 is provided with a counterweight 43 for balancing a molding head or apparatus 44 upon the outer end of the boom arm 24. The latter is articulated at coupling C.

The boom structure and hence the molding apparatus 44 is maintained at a desired elevation upon the standard 20 by a collar 45 releasably fixed upon the standard by a setscrew 46. During operation of the machine the boom structure is rotated about the standard while the hub 26 bears against the upper end of the collar 45. Prior to starting the operation of the machine a circular foundation 47, Fig. 1, will be laid coaxially with the vertical axis of the standard 20. This base 47 is for supporting the wall 48 comprising a plurality of superposed layers or wall courses 49. During the laying of each of these wall courses 49 the boom structure will be maintained at a fixed elevation by the collar 45 while the molding head 44 is advanced along the foundation 47 or the upper supporting surface of the next previously laid wall course 49 while depositing on said surface a molded strip of solidifiable material for effecting an additional wall course. Subsequent to completing each of the wall courses 49 the boom structure will need to be raised for placing the molding head 44 at the proper elevation for laying the material in position for forming the succeeding wall course. Apparatus for lifting the boom structure comprises a fulcrum plate 50 shown canted upon and with respect to the standard 20 in Fig. 2 as permitted by an oversize opening 51 in the plate. An apertured ear 52 at one edge of the plate 50 supports a lever 53 upon a pivot pin 54. The longer arm 55 of the lever 53 is for manual engagement and operation whereas the shorter arm 56 of this lever carries at its outer end a pin 57 for pivotally supporting the lower end of a link 58 which is pivotally connected by means (not shown) with the U-shaped member 33. Normally the lever 53 will be in the position illustrated in Fig. 2 while the hub 26 bears against the collar 45. When, however, it is desired to lift the boom structure to some position as illustrated in dotted outline in Fig. 2 preparatory to laying a succeeding wall course, the right end of the lever will be pressed downwardly manually incident to lifting the left end of this lever and hence the thrust link 58, and the U-shaped member 33. Since the bars 35 and 36 are connected between the U-shaped member 33 and the hub 26, the entire boom structure will be pushed upwardly with the thrust link 58. After the right end of the lever 53 is forced downwardly in this manner it may be hooked beneath a pin 59 upon the boom arm 25 for maintaining the boom structure in the elevated position. It will be noted that since the pivot pin 54 is supported upon an edge of the fulcrum plate 50, the right and left edges of the opening 51 as viewed in Fig. 2 will be caused to bite into opposite sides of the standard 20 and thus prevent the fulcrum plate from sliding downwardly axially of this standard when the force for lifting the boom structure is applied to the lever 53. After lifting the boom structure and placing the right end of the lever 53 under the pin 59 the setscrew 46 may be loosened preparatory to lifting the collar 45 into engagement with the lower end of the hub 26 and then retightening the setscrew, whereupon the lever 53 may be disengaged from the pin 59 to permit the boom structure to rest upon the collar 45 again in a manner permitting the boom structure to be pivoted about the standard.

In Figs. 3, 5 and 6 the molding head or strip molding and laying apparatus will be seen to comprise a hopper 60 from which a supply of solidifiable moldable material, such as Portland cement, may be fed downwardly through an L-shaped passage 61 having an upright leg 62 and a horizontal leg 63. Both ends of this passage are open whereby a plurality of tamping members 64, 65 and 66 are operable for tamping and thus advancing the material 67 downwardly through the vertical passage leg and backwardly of and outwardly through the back end of the horizontal passage leg in the form of a strip 68 shaped to effect one of the wall courses 49. The molding head is built about a framework shown in perspective in Fig. 7. This framework is assembled about the outer end of the boom arm 24. One part of the framework consists of a bracket 69 attached to the boom arm as by welding and having an upwardly and backwardly directed arm 70 and a downwardly depending arm 71. A second bracket 72 is also connected with the boom arm 24 as by welding. A leg 73 of the bracket 72 extends upwardly in spaced parallelism with the arm 70 to enable these arms to support a bearing sleeve 74 therebetween. A piece of angle iron 75 is welded to the boom arm 24 in the position shown in Figs. 4, 5, 6 and 7 with the outer end thereof projecting beyond the outer end of said boom arm. The anchorage of the angle iron piece 75 with the boom arm is strengthened by a plate 76, Figs. 5 and 7, suitably fixed upon the end of the boom arm and having lower edge and front edge sections welded respectively to the horizontal and upright flanges of said angle iron piece. From the lower or horizontal flange of the angle piece 75 there depends an arm 77 in spaced parallelism with the arm 71 for mutually supporting a sleeve bearing 78 therewith. A pair of spaced-apart bars 79 and 80 are for receiving a part of the hopper 60 therebetween, the bar 79 being welded at its back end to the vertical flange of the angle piece 75 and the bar 80 being welded to the outer end of said angle piece. Notches 81 are provided in the upper edge of the bars 79 and 80 for receiving the shanks of thumbscrews 82 which are connected with the hopper and thus detachably mount it upon the bars 79 and 80.

At the back end of the bar 80 a frame member 83 is connected as by bolts 84 in spaced relation with a downwardly depending arm 85 of the bracket 72 and for cooperating with the latter in supporting a pair of bearing cylindrical members 86 and 87, Figs. 6 and 7, upon which bearing sleeves 88 and 89 are journaled for the support of the tamping members 64, 65 and 66.

The bearing sleeves 88 and 89 are oscillatable about their bearing members 86 and 87. The sleeve 88 has fixed thereon an axially split hub 90 of a tamping member 91 of which the purpose will be fully explained hereinafter. A bolt 92 is

used for tightening the split hub 90 upon the bearing sleeve 88 in the conventional manner. An axially split socket 93 is formed integrally with a split hub 90a, Fig. 5, also fixed upon the sleeve 88, and a bolt 94 is employed in the conventional manner for tightening this socket onto the shank of the quadrant shaped member 95 that is disposed within said socket. This quadrant shaped member comprises an arm 96 extending radially from the hub 90a and the arcuate tamping member 65 having a center of curvature substantially coincident with the axis of said hub. An enlarged head 97 upon the tamping member 65 has an inclined tamping face 98 for prodding the material 67 during operation of the apparatus. Each of the curved tamping members 64, 65 and 66 extends into the vertical passage leg through an opening OP in the front wall of such passage leg.

Means for oscillating the hub 90a for effecting vibratory movement of the tamping member 65 between oscillative limits shown respectively in full in dotted outline in Fig. 6 includes an arm 99 non-rotatively fixed upon the sleeve 88 and extending backwardly and pivotally connected by a pin 100 with an upwardly extending bar 101 having a pair of loops 102 and 103 near its upper end. These loops 102 and 103 slidably embrace an eccentric rod 104 which is connected at its upper end with the lower most of the eccentric strips 105 and 106 held by bolts 107 onto an eccentric cam 108 carried non-rotatively upon a shaft 109 carried rotatively in the bearing sleeve 74; see Figs. 5, 6 and 7. The lower loop, 102, upon the bar 101 serves as a stop for the upper end of a helical spring 110 whereas a nut 111 upon the lower end of the eccentric rod 104 serves as a stop for the lower end of said spring. It will be seen, therefore, that upon rotation of the shaft 109 the eccentric cam 108 will cause the eccentric rod 104 to reciprocate. On the upward stroke of the rod 104 the nut 111 will pull the spring 110 endwise upwardly causing the upper end of this spring to force the bar 101 upwardly by bearing against the loop 102. The spring 110 constantly exerts force between the nut 111 and the loop 102 for normally maintaining the loop 103 in contact with a shoulder 112 at the upper end of the rod 104, and upon the return or down stroke of said rod this shoulder while bearing against the loop 103 forces the bar 101 downwardly. Such reciprocation of the bar 101 imparts oscillative movement to the arm 99, the hub 90a and the arm 96 of the quadrant shaped member 95 for vibrating the tamping member 65 in the aforesaid manner.

The bearing sleeve 89 has a pair of split hub members 115 and 116, constructed similarly to the hub member 90, fastened thereon for oscillation therewith about the bearing rod 87. Split sockets 117 and 118 integral with these split hub members receive the shanks of arms 119 and 120 comprising parts of quadrant shaped members 121 and 122 which are constructed similarly to the quadrant member 95. The arcuate tamping members 64 and 66 depend from the outer ends of the arms 119 and 120. These arcuate tamping members 64 and 65 have a center of curvature substantially coincident with the axis about which the hub members 115 and 116 are oscillatable. Tamping heads 123 and 124 similar to the tamping head 97 are carried respectively upon the free ends of the arcuate tamping members 64 and 66, and these tamping heads 123 and 124 have tamping faces 125 and 126 that face somewhat laterally or sidewise toward their respective side walls of the molding head passage as well as being inclined from the vertical.

Oscillation of the sleeve 89 for oscillating the hub members 115 and 116 is accomplished by parts like those described for oscillating the sleeve 88, and these parts which respectively correspond to those for oscillating the sleeve 88 are identified by the same respective reference characters, with a prime added. Thus an arm 99' corresponding to the arm 99 is fixed non-rotatively upon the sleeve 89. A pin 100' pivotally connects a bar 101' with the arm 99'. An eccentric 108' fixed upon the shaft 109 operates an eccentric rod 104' which is effective through a spring 110' and a shoulder 112' for reciprocating the bar 101' in the manner explained above whereby the hubs 115 and 116 are caused to oscillate together with the quadrant shaped members 121 and 122 connected therewith. It will be noted that the shoulders 112 and 112' abut directly against the upper ends of the bars 101 and 101' for pushing these bars downwardly and thus positively lift the tamping members 64, 65 and 66 to their upper limits whereas the downward movement of these tamping members is effected in an impositive manner by force exerted upwardly by the eccentric rods 104 and 104' upon the lower ends of the springs 110 and 110'. Should the tamping members encounter an extremely hard or immovable object in the holding head passage the eccentric rods 104 or 104' could continue their upward movement while compressing the springs 110 and 110' without causing injury to the apparatus.

Power for driving the shaft 109 upon which the eccentrics 108 and 108' are non-rotatively fixed is received from an electric motor 127, Figs. 1 and 4. This motor is mounted upon the boom arm 24 adjacently to the strip molding and laying apparatus and has a pulley 128 upon its drive shaft 129 drivingly connected through a V-belt 130 with a pulley 131 fixed upon an end of said shaft 109.

The shaft 109, as seen in Fig. 4, carries a small pulley 132 for driving, by means of a V-belt 133, a pulley 134 fixed upon a shaft 135 journaled in the bearing 78. That part of the shaft 135 projecting to the left of the bearing 78, as viewed in Fig. 4, carries a pair of disk trowel members 136 and 137 in opposed axially spaced relation. A hub 138 of the trowel member 136 is secured non-rotatively to the shaft 135 by setscrew 139 and a similar connection of the disk 137 is had by means of a setscrew 140 within the hub 141 of such disk. In Figs. 3 and 6 it can be seen that the disks 136 and 137 form respective portions of the lateral side walls of the molding and discharge passage of the molding head. Those parts of the fixed lateral side walls of the passage to the rear of a curved edge 142 are cut away as illustrated in Fig. 6 so that the disks 136 and 137 can fit into the plane of these side walls and form a part thereof. During operation of the apparatus the disks 136 and 137 are rotated clockwise as viewed in Fig. 6 wherefore the parts of these disks forwardly of the shaft 135 are moved downwardly of the vertical leg of the passage, and the parts of these disks below said shaft are moved rearwardly along the horizontal leg of the passage. This downward and rearward movement of the disk parts respectively in the vertical and horizontal passage legs augments the flow of the material through the passage. The speed at which the disks are rotated, however, is such that the curvilinear movement of those parts of the disks

engaging the material within the passage exceeds the speed at which the material is moved wherefore said disks are operable to effect a troweling action upon the material.

Movement of the material 67 downwardly in the vertical leg of the passage into effective range of the tamping members is further facilitated by a feeding device comprising a transversely corrugated feeding member 145 sloping downwardly and rearwardly within and forming a part of the front wall 146 of the vertical passage. The feeding member 145 has a bearing bracket 147 attached to its upper end and having an elongated opening 148 therein for receiving a roller 149 which is journaled upon a stem 150 anchored in an ear 151 which is fixed upon the front wall of the hopper 60. The roller 149 together with the opening 148 facilitates vertical reciprocation of the feeding member 145 while retaining it within the plane of the front wall of the hopper and vertical leg of the passage. An arm 152, Fig. 3, is connected with the bracket 147 and the outer end of this arm is connected with a crank pin 153, Figs. 3 and 5, upon a crank 154 by means of a connecting rod 155. The hub 156 of the crank 154 is fixed upon the outer end of the shaft 135 which drives the trowel members 136 and 137. Thus during operation of the apparatus the connecting rod 155 will be operated for reciprocating the feeding plate 145.

The upper wall of the horizontal passage leg and the back wall of the vertical passage leg are formed by a unitary L-shaped drag trowel member 157 shown isolated in Figs. 8, 9 and 10. The vertical part 158 of the drag trowel member 157 forms the back wall of the vertical passage leg whereas the horizontal part 159 thereof forms the upper wall of the horizontal passage leg. An intermediate curved portion 160 of this trowel member facilitates the feeding of the material 67 from the lower part of the vertical passage leg into the front part of the horizontal passage leg while at the same time retarding the forward advancement of the molding head by bearing against a portion of the material 67 compacted immediately in front thereof by the tamping members 64, 65 and 66. During advancement of the molding head, however, this curved portion of the drag trowel deflects or mashes downwardly this compacted part of the material being molded, but in doing so retards the movement of the apparatus wherefore the term "drag" is incorporated into the name of this trowel.

A groove indicated at 161 in Fig. 12 is formed in the upper face of the strip molded in the molding passage, this groove being formed by an L-shaped molding member 162 having an upright portion 163 connected to the inner face of the upright trowel leg 158 by plow bolts 164. The curvature of the molding member 162 corresponds to that in the curved section 160 of the drag trowel member. The horizontal part 165 of said molding member projects below the horizontal leg 159 of said travel member and such horizontal part 165 is formed with upwardly converging side faces 166 for imparting an undercut contour shown in Fig. 11.

A second molding member is provided upon the drag trowel 157 by a downwardly turned edge portion 167 adjacently to the back end of said trowel and upon its outer edge. This molding member effects the shoulder 168 upon the wall course; see Fig. 12. This molding member 167 is immediately to the rear of a notch 169 in the outer edge of the drag trowel, which notch provides an opening in the upper wall of the horizontal passage leg and into which the downwardly turned end of the tamping member 91, Figs. 5 and 6, is adapted to project in the fashion illustrated in Fig. 6 in dotted outline. It will be recalled that the tamping member 91 is integral with the hub 90 fixed upon the sleeve bearing 88 wherefore the tamping member 91 is caused to oscillate with the quadrant shaped member 95. The tamping end, 170, of the tamping member 91 is arranged angularly so that as it is moved downwardly into the dotted line position this end will deflect that part of the moldable material 67 engaged thereby backwardly along the underface of the molding member 167. To assure a sufficient quantity of the moldable material for the tamping member 91 to operate upon for insuring that such material will be well packed in the shoulder portion formed beneath the molding member 167, I provide an upwardly turned lip or scoop 171 integrally with the drag trowel. This upwardly turned lip, as the apparatus advances, scoops an extra quantity of the moldable material for delivery in registry with the opening provided by the notch 169 and this material is tamped backwardly with respect to the drag trowel member and beneath the molding member 167 by the tamping member 91 which oscillates rapidly.

A second shoulder shown at 172 in Fig. 12 is desired at the lower outer corner of the wall course for cooperating with the shoulder 168 upon the upper outer corner of the previously laid course in forming a groove 173 extending lengthwise of the wall 48 at the juncture of each of the courses 49. Said shoulder 172 is formed by a molding member 176 shown in dotted outline in Fig. 3 and having a base portion 175 secured in any suitable manner to the front wall 146 of the vertical passage leg. That part of the molding member 176 extending alongside of the disk trowel 136 has an under oblique portion 177 conforming to and for moving along the shoulder 168 of the previously laid course, and a curved portion 178 for molding the shoulder 172 within the lower outer corner of the wall course being formed.

During the operation of the machine the moldable material is placed in the hopper 60 from which it feeds downwardly through the vertical leg 62 of the passage 61 and onto the upper supporting surface of the previously laid wall course 49. The motor 127 is then started for causing operation of the tamping members 64, 65 and 66 and of the disk trowels 136 and 137. Disposition of the eccentrics 108 and 108' upon their drive shaft 109 is such as to cause the tamping members 64 and 66, which move in unison, to operate substantially 180° out of phase with the tamping member 65. Thus while the tamping members 64 and 66 are moved endwise downwardly for tamping the moldable material the tamping member 65 will be moving upwardly preparatory to engaging and tamping fresh material into the passage. This tamping action of the tamping members advances the moldable material downwardly and into the horizontal passage leg while molding the material into this passage leg by packing it firmly therein thus causing the molded material to have a cross section conforming to that of the horizontal passage leg. It will be observed that the horizontal passage leg is formed by parts, namely, the horizontal part 159 of the drag trowel and lower portions of the disk trowels 136 and 137, effect-

ing a bottomless chamber, this passage leg having its bottom formed by the upper face or supporting surface of the previously laid wall course 49.

As the material packs into the horizontal leg or molding portion of the passage, it is forced backwardly or to the left as viewed in Fig. 3 by the tamping members, but since backward displacement of this molded part of the strip or wall course is prevented from backward displacement relative to the wall by that part of the instant course just emerged from the horizontal passage leg, the tamping force exerted by the tamping members upon the molded material packed into the horizontal passage leg causes the molding head to advance. It will be seen, therefore, that the machine is capable of operating automatically. Moldable material is simply fed into the hopper 60, tamped into the molding passage by the tamping members, and as the material is molded into a wall course and deposited onto the previously laid course these tamping members cause the machine to advance pursuant to the laying of such wall course. In Fig. 6 it will be seen that the lower limit of the tamping members is about on a line with the upper wall of the horizontal passage leg whereby a portion of the material adjacently to and slightly above the rounded corner portion 160 of the drag trowel 157 is firmly packed and must be deformed and guided around and beneath this curved part of the drag trowel as the molding head advances. So long as material is being fed downwardly from the hopper 60 new material will be tamped onto this more firmly packed portion of the material in front of the rounded corner 160 to force such packed material downwardly and backwardly with respect to said rounded corner for causing the machine to advance. This packed material in front of the rounded corner 160 resists advancement of the molding head and is only overcome in allowing the machine to advance so long as there is a quantity of molding material in the hopper 60 or vertical passage leg 62 in excess of that shown in Fig. 6 and that can be operated upon by the tamping members for pressing the material therebeneath downwardly and backwardly with respect to the passage. When the material in the vertical passage becomes depleted to some such extent as that illustrated in Fig. 6 the material compacted in front of the rounded corner 160 will prevent the machine from advancing even though the tamping members continue operation as well as the trowel members 136 and 137. Consequently the machine in addition to being automatic or self-operating for advancing the molding head so long as molding material is supplied to the hopper 60, is also automatic in that it ceases to advance when the supply of material is exhausted. This operating feature of the machine is particularly advantageous since an operator of the machine need be concerned only with feeding material to the hopper and this can be done intermittently at his convenience.

While the molding head is advancing, the upturned lip portion 171 of the drag trowel receives a slight excess of the moldable material for being operated upon by the tamping member 91 which, as explained above, operates in unison with the tamping member 65. The inclined face 170 upon the tamping member 91 drives the material exposed through the opening formed by the notch 169 in the drag trowel member backwardly with respect to said trowel member, thereby preventing the horizontal portion 159 of this trowel from pulling the molded material thereunder away from the discharged part of the instant wall course adjacently to the trailing edge of said portion 159. The downwardly inclined molding member 167 upon the trowel drag plate is effective for molding the shoulder 168 into the wall course as it is formed. The molding member 162 is provided with an upright leg 163 for preforming the material as it is passed downwardly through the vertical passage leg, so that said material can be more easily forced about and beyond the backwardly turned portion 165 of this molding member in the horizontal passage leg. The molding member 162 forms a groove 161 in the upper face of the wall course. Since the bottom of the horizontal leg of the molding passage is formed by the upper face of the previously laid course, the tamping members are effective for driving the material into the groove 161 in said previously laid course and for causing intimate association of the contiguous particles in the adjacent courses, resulting in an intimate interlocked association of the courses as illustrated in Fig. 12.

Although the principal weight of the molding apparatus or head is carried by the boom arm 24, a small part of the weight is carried by a skid member 180, Figs. 3 and 6, secured as by bolts 181 to the front wall of the molding passage. Just enough of the weight of the molding head is supported by the skid member 180, which slides along the upper face of the supporting surface for the wall course being laid, to steady the molding head while thus maintaining it in the proper molding and discharge relation with respect to said supporting surface.

Reinforcing material as in the form of an unwindable package of iron wire, strip, or rod 182 may be fed from a reel 183 mounted between arms 184 (one being shown in Fig. 3) projecting forwardly from the side walls of the vertical passage leg and fed backwardly through an opening 185 in a lower part of said front wall and thence into the interior of the molded strip or wall course as it is formed. That part of the wall course in which an unwound portion of the reinforcing member 182 is imbedded offers sufficient resistance against being pulled forwardly with the molding head to cause the member 182 to be unwound from the reel 183 as the molding head advances.

While I have herein shown and described a preferred embodiment with the view of fully illustrating the invention, it should be understood that the invention extends to other forms, arrangements, structures and details falling within the scope and spirit thereof and not sacrificing all of its material advantages.

I claim:

1. In apparatus for building a wall transportable while discharging a strip of solidifiable plastic material in position to form a course in such wall, a passage having an upright portion terminating at its lower end in a rearwardly directed horizontal portion through which the material is advanced and discharged, and tamping means for advancing the material through said passage, comprising a member oscillatable about an axis positioned behind the upright portion and above the level of the horizontal portion of said passage, means for oscillating said member, an arm extending radially from said member for oscillating therewith, and a tamping member connected with a portion of the arm spaced from said axis and vibratable by said arm within said

passage through a limited arc extending downwardly and backwardly, and said tamping member having a surface portion facing in the axial direction the material is to be advanced in the passage and for engaging the material to prod the same in such direction while the tamping member moves in that direction pursuant to such vibration.

2. In apparatus for building a wall transportable while discharging a strip of solidifiable material in position to form a course in such wall, a passage having an upright portion terminating at its lower end in a rearwardly directed horizontal portion through which the material is advanced and discharged, and tamping means for advancing the material through said passage, comprising a member oscillatable about an axis positioned behind the upright portion and above the level of the horizontal portion of said passage, means for oscillating said member, an arm extending radially from said member for oscillating therewith, an elongated tamping member carried upon a portion of the arm spaced from said axis and to impart a downward and backward motion to said material within said passage wherefore it is alternately advanced and retracted endwise in the passage during oscillation of said arm, and means on said tamping member for prodding the material as an expedient for causing it to move therewith each time the tamping member is advanced in said passage.

3. In a machine of the class described, a transportable molding head having a molding passage having an upright portion terminating at its lower end in a rearwardly directed horizontal portion through which solidifiable plastic material is advanceable preparatory to being laid as a strip forming a wall course, and tamping means for advancing the material through said passage, comprising a member oscillatable about an axis positioned behind the upright portion and above the level of the horizontal portion of said passage, means for oscillating said member, an arm extending radially from said member for oscillating therewith, an elongated curved tamping member depending endwise from said arm at a portion spaced from said axis, said tamping member extending from said arm into said passage to impart a downward and backward motion to said material and the curvature of said tamping member being such as substantially has a center of curvature coincident with said axis wherefore oscillation of the arm causes endwise vibratory movement of the tamping member axially of the passage.

4. In a machine of the class described, a transportable molding head having an L-shaped passage through which solidifiable plastic material is passed for discharge as a strip suitable for forming a wall course, the legs of said passage being respectively upright and horizontal and the horizontal leg projecting backwardly with respect to the direction the molding head is to be transported, and tamping means for urging the material downwardly through the vertical passage leg and backwardly with respect to the horizontal leg, said tamping means comprising a member oscillatable about an axis spaced rearwardly of the vertical passage leg and directed transversely thereof, an arm extending radially from said member for oscillating therewith, and an elongated tamping member depending endwise from said arm at a portion thereof spaced from said axis, and said tamping member extending from said arm axially downwardly in the vertical passage leg wherefore oscillation of the arm causes substantially endwise vibratory movement of the tamping member axially of said vertical passage leg.

5. In apparatus for building a wall transportable while discharging a strip of solidifiable plastic material in position to form a course in such wall, an L-shaped passage through which the material is passed for discharge in the form of such a strip, the legs of said passage being respectively upright and horizontal and the horizontal leg projecting backwardly with respect to the direction the apparatus is to be transported, and tamping means for urging the material downwardly through the vertical passage leg and backwardly with respect to the horizontal leg, said tamping means comprising an arm oscillatable about an axis spaced rearwardly of the vertical leg and directed transversely thereof a portion of said arm being disposed upwardly and forwardly from the axis, an elongated curved tamping member depending endwise downwardly from said arm portion and generally axially of and into said vertical passage leg, the curvature of said tamping member being such as substantially has a center of curvature coincident with said axis wherefore oscillation of the arm causes endwise vibratory movement of the tamping member axially of the vertical passage leg, prodding means upon said tamping member for prodding the material downwardly pursuant to downward strokes of the tamping member, and the prodding means being so positioned lengthwise of the tamping member that said prodding means occupies a position substantially at the juncture of said passage legs while the tamping member is at the lower limit of its vibratory field.

6. The combination set forth in claim 5 and wherein said prodding means is in the form of a face upon the lower end of said tamping member.

7. The combination set forth in claim 5 and wherein said prodding means is in the form of a face inclined upwardly and rearwardly upon the lower end of said tamping member whereby said face is operable to deflect the apparatus forwardly while reacting backwardly upon material crowded thereby into and backwardly with respect to the horizontal passage leg.

8. In a wall building machine comprising a transportable molding head having a passage from which solidifiable material is dischargeable in the form of a strip and laid thereby as a wall course upon a previously laid course as said head is transported along such previously laid course, and means for causing said molding head to move along a predetermined course, the provision of a support means operable to bear a substantial part of the weight of said head while it is so transported, and an auxiliary support means for said head and advanceable therewith along said previously laid course while bearing thereon to gauge the position of the head with respect to such course.

9. The combination set forth in claim 8, wherein said auxiliary support means is in the form of a skid member disposed upon said head in position to slide upon the previously laid course.

10. In a wall building machine comprising molding apparatus wherein there is a molding passage having inlet and discharge ends and through which solidifiable moldable material is passable incident to being molded into and conforming in cross section to said passage and for

forming a wall course, said passage comprising an upper side wall and opposed spaced-apart side walls intersecting the upper side wall and extending downwardly therefrom, together with means for moving the molding apparatus along a predetermined course, the provision of an opening in said upper side wall of the passage, and tamping means projectable into the passage through said opening against the material for prodding the same toward the discharge end of the passage.

11. In a wall building machine comprising molding apparatus wherein there is a molding passage having inlet and discharge ends and through which solidifiable moldable material is passable incident to being molded into a strip conforming in cross section to said passage and for forming a wall course, said passage comprising an upper side wall and opposed spaced-apart side walls intersecting the upper side wall and extending downwardly therefrom, and means for moving said molding apparatus along a predetermined course, the provision of a molding member disposed at the intersection of one of the opposed walls and the upper wall, said molding member having a face presented inwardly of the passage for molding a shoulder configuration within a corner of the strip, the provision of an opening in said upper wall aligned axially of the passage with said molding member and between said molding member and the inlet end of said passage, and the provision of tamping means projectable into the passage through said opening against the material for prodding the same toward the discharge end of the passage.

12. The combination set forth in claim 11, and wherein an end portion of the upper side wall, in alignment with said side wall opening, is displaced upwardly for admitting a greater quantity of the material into said passage to be acted upon by said tamping means.

13. In a wall building machine, molding apparatus, means for moving said molding apparatus along a predetermined course, a molding passage in said molding apparatus having inlet and discharge ends and through which solidifiable moldable material is passable incident to being molded into a strip confirming in cross section to said passage and for forming a wall course, said passage comprising an upper side wall and opposed spaced-apart side walls intersecting the upper side wall and extending downwardly therefrom, said upper side wall having at the inlet and forward end of one edge thereof an upwardly displaced portion to provide space for the admittance of a greater quantity of the material into the passage, a notch within said edge immediately to the rear of said upwardly turned portion for providing an opening through which tamping means may operate for prodding the material backwardly through the passage, and a downwardly turned section upon said edge between said notch and the discharge end of the passage and bounding an edge of said notch, said downwardly turned edge portion serving as a molding member for molding a shoulder upon a corner of said strip.

14. In a wall building machine, molding apparatus, means for moving said molding apparatus along a predetermined course, a molding passage in said molding apparatus having respectively forwardly and rearwardly disposed inlet and discharge ends and through which solidifiable moldable material is passable incident to being molded into a strip conforming in cross section to said passage and for forming a wall course, a rotatable disk trowel member disposed with a portion thereof forming a portion of a vertical side wall of said passage, and a molding member supported in said passage at a section forwardly of said trowel member and extending backwardly alongside of said trowel member within said passage and at the lower edge of said side wall for molding a shoulder-like configuration into a lower edge of said strip.

15. In a wall building apparatus wherein a molding head is transported while discharging a molded strip of solidifiable material in position to form a wall course, means for supporting said apparatus at predetermined selective elevations during the transportation thereof, comprising an upright standard, a boom having a base end supported upon said standard and an outer end for carrying said molding head, means for releasably maintaining the base end of the boom at a predetermined elevation upon the standard while said boom is pivoted about the standard pursuant to transportation of the molding head, and means for changing the elevation of the boom on said standard, comprising a fulcrum plate having an opening therein receiving said standard and over-size with respect thereto to adapt the plate to be turned diagonally to said standard incident to pressing portions thereof at opposite sides of the opening into engagement with said standard to preclude movement of the plate axially of said standard, a lever pivotally supported upon said plate for movement about a horizontal axis at an edge of said opening, and means connecting one end of the lever with the base of the boom wherefore a force exerted vertically upon the other end of the lever is effective for lifting said one end of the lever and the boom connected therewith while maintaining said plate in the diagonal position.

WILLIAM E. URSCHEL.