Sept. 25, 1962 F. LOBATO 3,055,146

CONCRETE STAIRWAY

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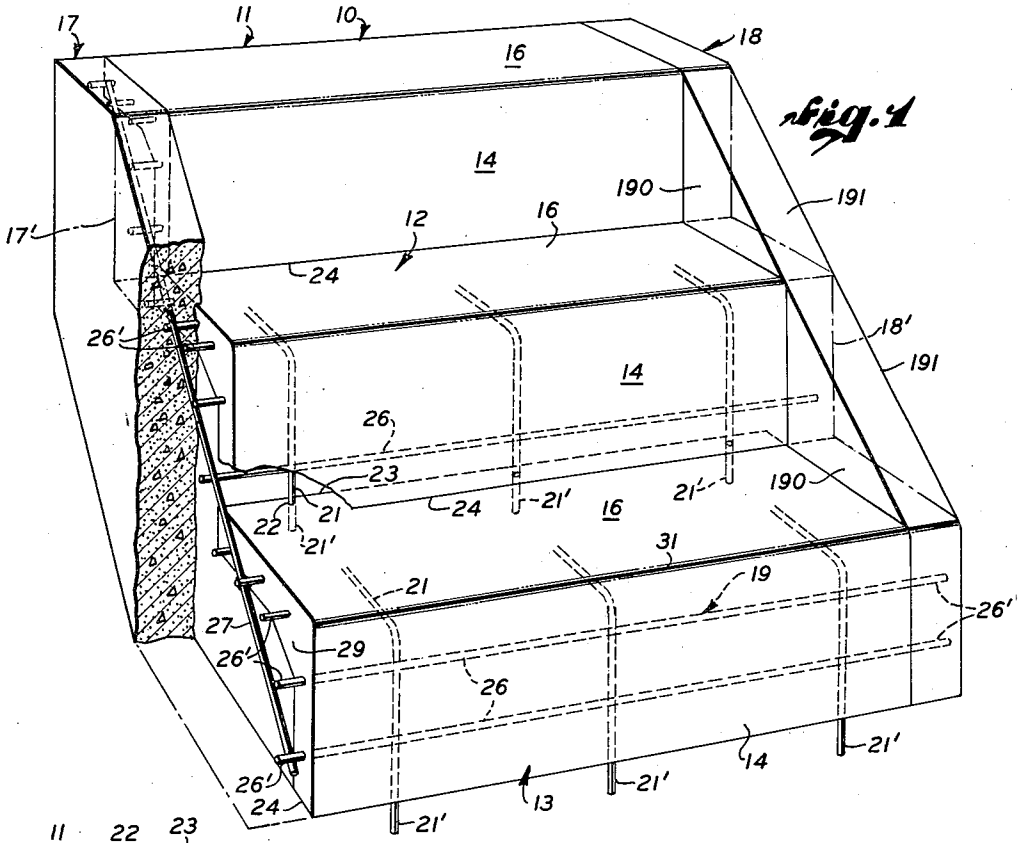


Fig. 1

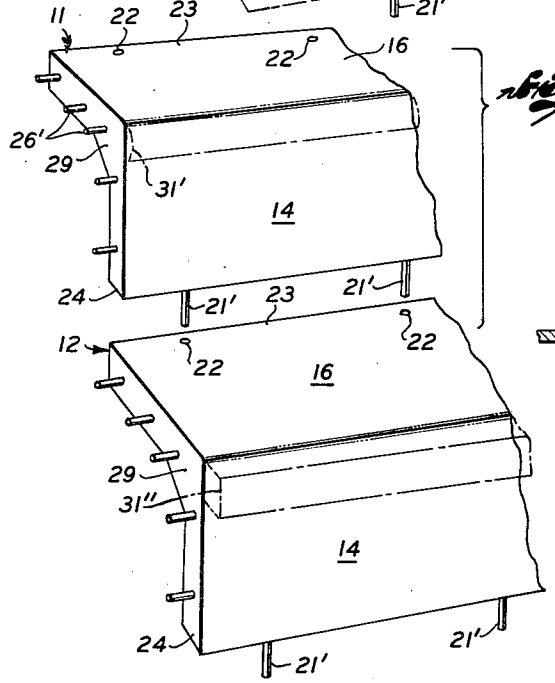
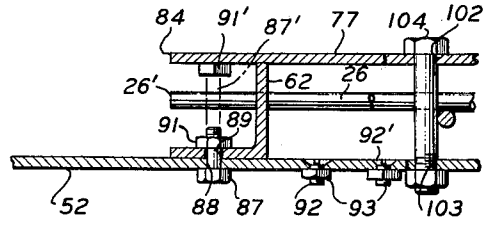


Fig. 2

Fig. 9



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CONCRETE STAIRWAY

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Fig. 3

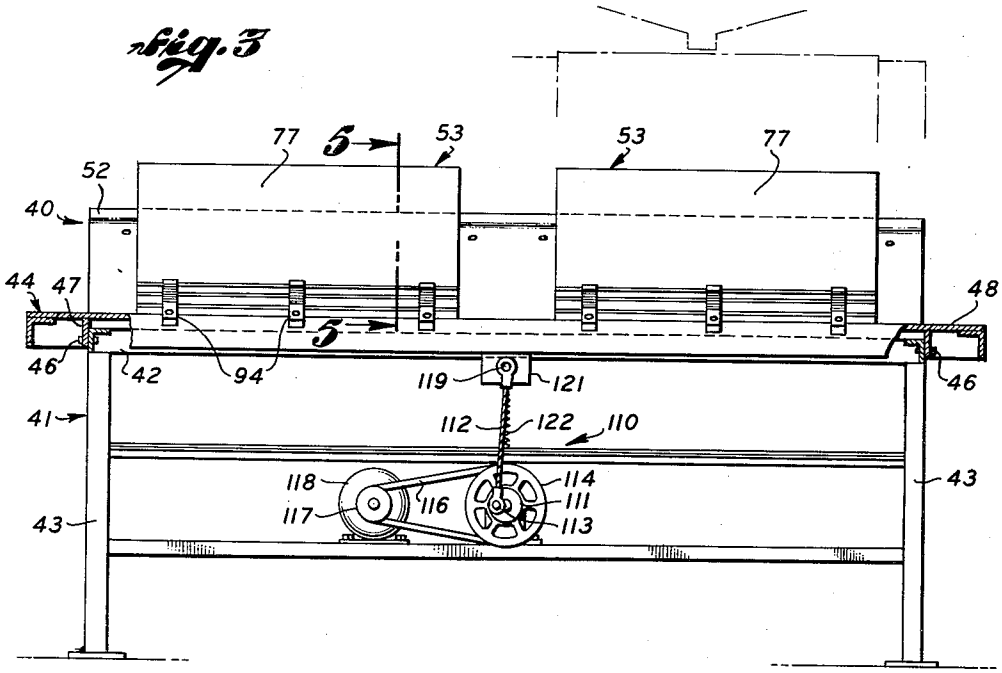


Fig. 4

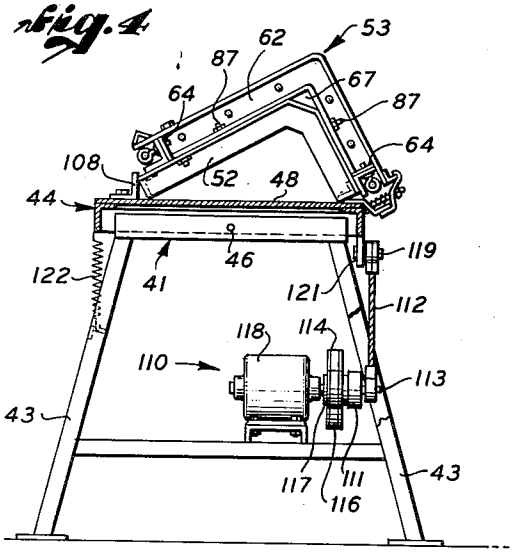


Fig. 5

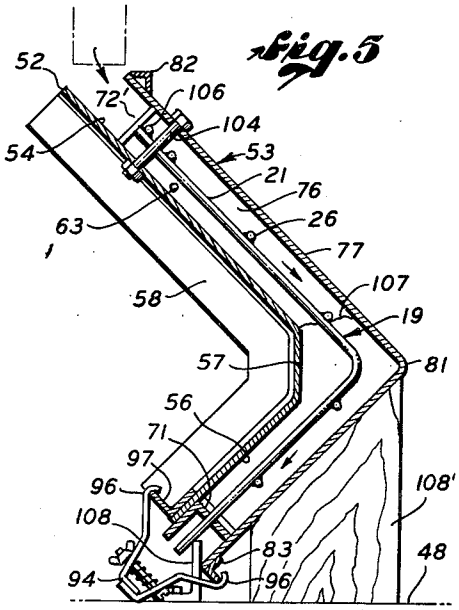
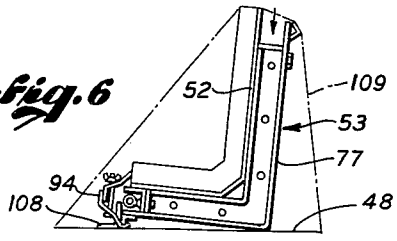


Fig. 6



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CONCRETE STAIRWAY

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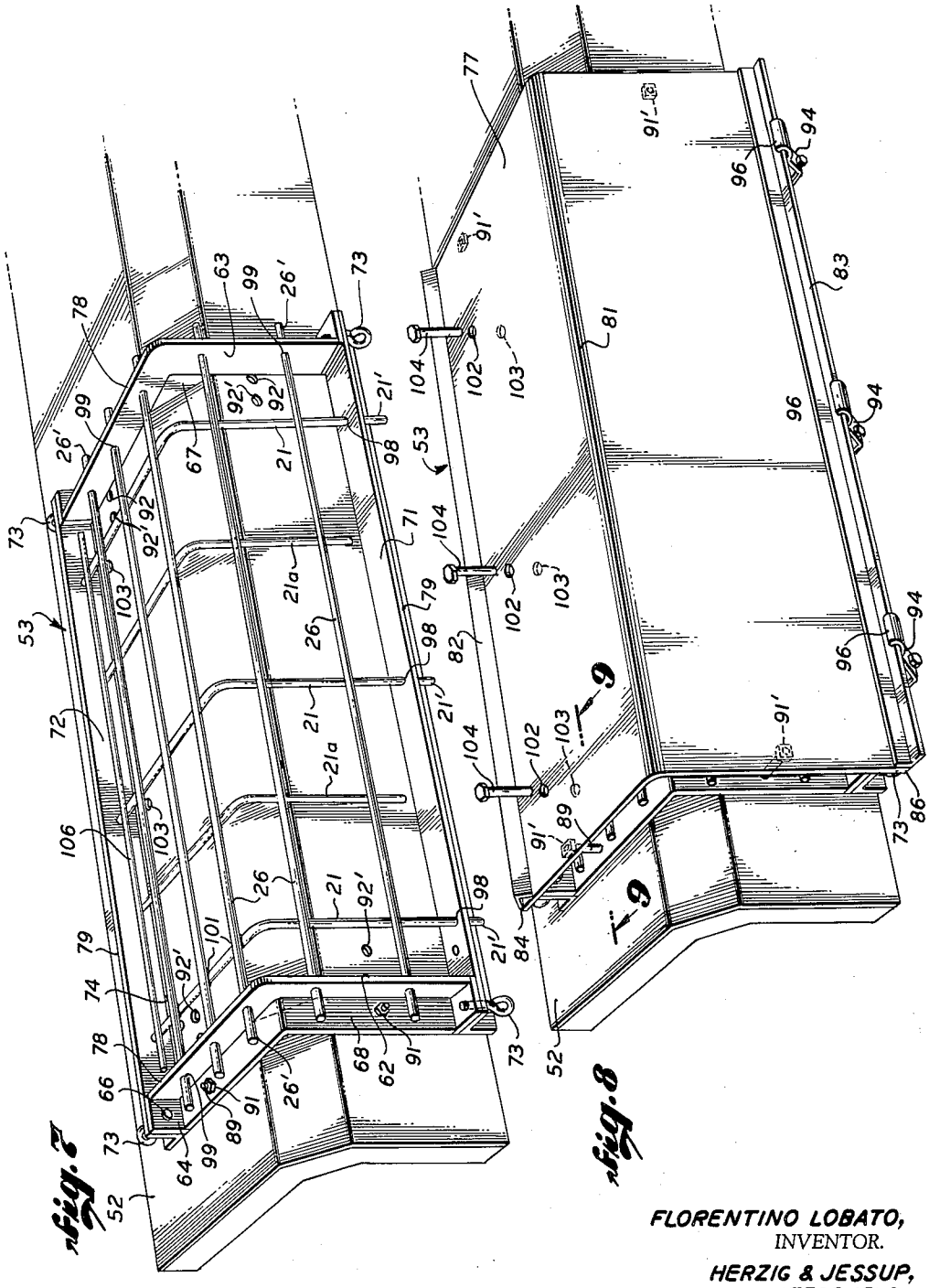

Fig. 7

Fig. 8

Fig. 9

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CONCRETE STAIRWAY

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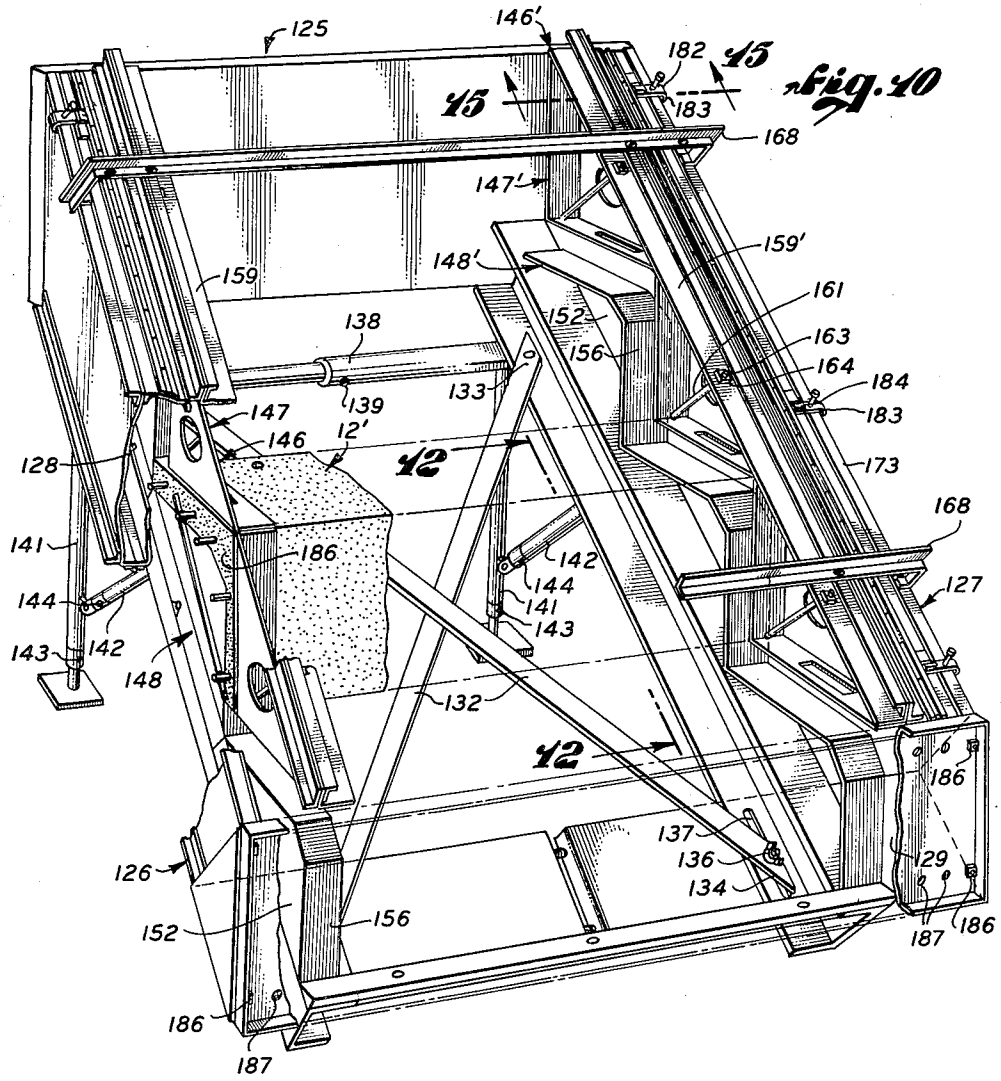

Fig. 10

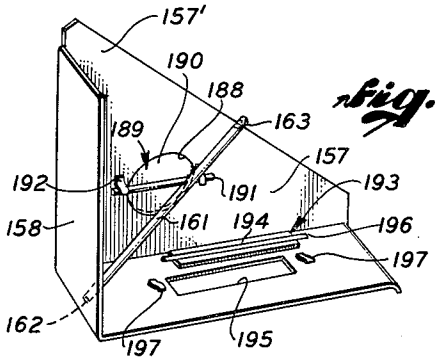

Fig. 11

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Fig. 12

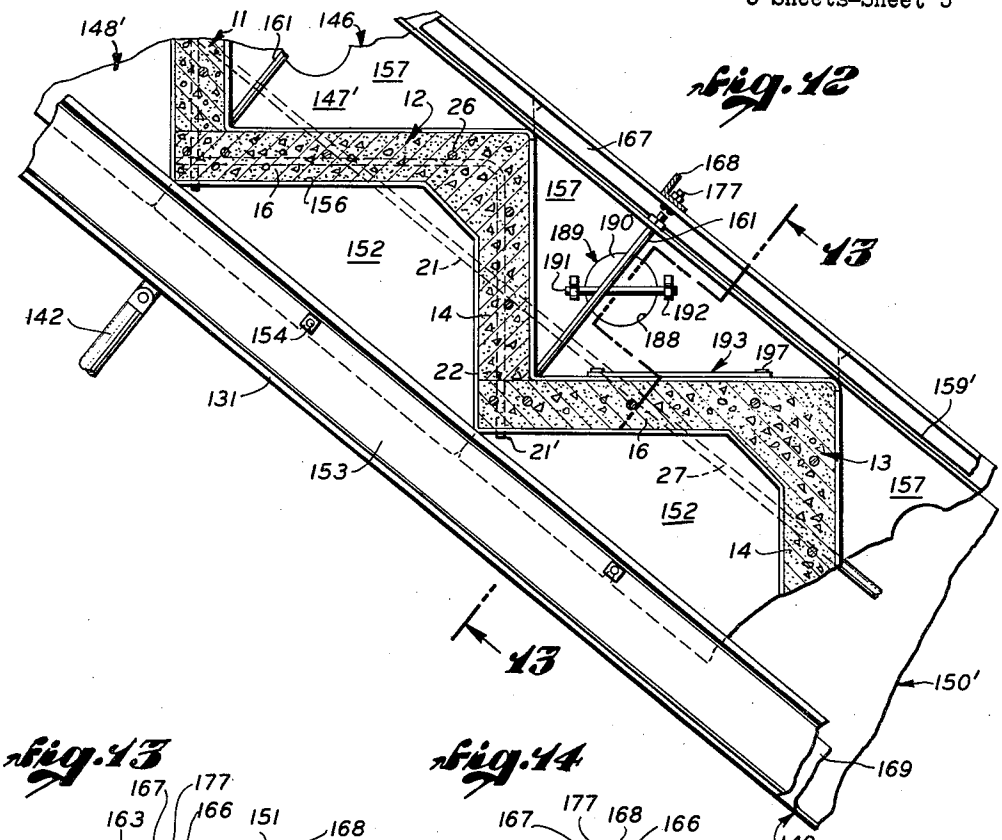


Fig. 13

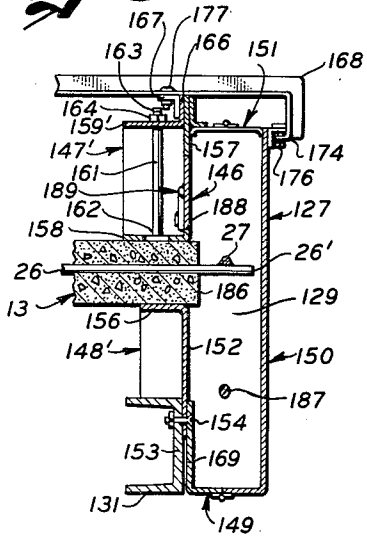


Fig. 14

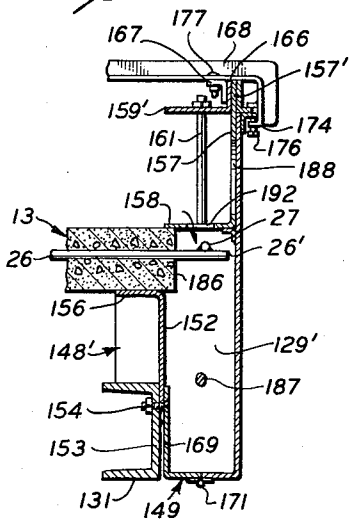
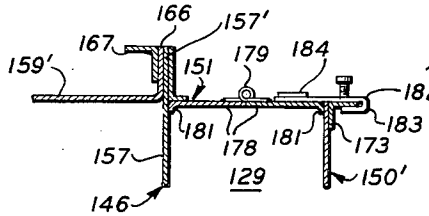


Fig. 15



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United States Patent Office

3,055,146
Patented Sept. 25, 1962

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3,055,146

CONCRETE STAIRWAY

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Filed Oct. 17, 1958, Ser. No. 767,973
2 Claims. (Cl. 50—109)

This invention relates to a concrete stairway, and more particularly to new and useful improvements for a means and method for forming a concrete stairway which comprises a plurality of step units having horizontal tread portions and integral vertical riser portions in each unit, whereby the units may be assembled to form a continuous stairway of any desired height, and having stringers enclosing ends thereof.

An object of this invention is to prefabricate a stairway having discrete step units secured in step formation to stringers prior to installation at place of use, each step unit having a horizontal tread portion and an integral vertical portion which can be easily handled without the use of large machinery to assemble the units into a stairway of any desired height having any desired number of steps.

A further object of this invention is to provide a means and method of assembling the step units to construct a stairway which is relatively strong, capable of supporting great weights, and which resists settling and cracking normally associated with concrete steps which are poured into conventional wooden or other molds fabricated at the location of use of the steps.

Another object of this invention is to prefabricate a concrete step unit of the character described which provides means for interlocking one step unit with another and interlocking the assembled steps with stringers molded on location or remotely therefrom after assembly of the steps to provide a concrete stairway of greater strength, neater appearance and lighter weight for facilitating transporting of the assembled stairway or parts thereof to the place of use.

An additional object of this invention is to provide new and improved mold means for prefabricating a concrete step of the character described, which is easily erected, serves as a jig for arranging reinforcing rods in a preselected pattern for envelopment within the concrete step unit, and which is easily disassembled for removal of the concrete step when hardened.

A further object of this invention is to provide new and improved means for providing a smooth stone-free outer surface on the completed concrete step which does not require any further treatment after hardening to provide smooth external surfaces.

Another of the objects of this invention is to provide for adjustment of the mold means whereby concrete step units of varying length may be pre-fabricated.

Yet another object of this invention is to provide a new and improved mold means for forming stringers for the stairway which is capable of supporting a plurality of step units in interlocking relationship for enclosure of end portions thereof within stringers cast within the mold for locking the step units in a permanently assembled relationship, the mold being adjustable to correspond to step units of varying lengths, easily dismantleable after solidification of the stringers for removal thereof and for repeated use of the mold, and capable of producing either full or half stringers, as desired.

These and other objects of this invention will be more apparent from the following drawings, detailed description, and appended claims.

In the drawings:

FIG. 1 is a perspective view, in elevation, of a concrete stairway designed and constructed in accordance with this invention, with parts broken away for greater clarity;

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FIG. 2 is a fragmentary, exploded perspective view, illustrating the interlocking features of the individual step units therein;

FIG. 3 is a side view, in elevation, of a step mold means, in accordance with this invention, for forming discrete concrete step units;

FIG. 4 is an end view thereof, as viewed from the left side of FIG. 3;

FIG. 5 is an enlarged cross-sectional view as taken on a line 5—5 of FIG. 3, with a portion thereof in another position;

FIG. 6 is an end view, similar to FIG. 4, illustrating yet another position thereof;

FIG. 7 is an enlarged perspective view, in elevation, illustrating the step mold means in greater detail;

FIG. 8 is an enlarged perspective view, similar to FIG. 7 illustrating the mold means of FIG. 7 more completely assembled;

FIG. 9 is an enlarged fragmentary cross-sectional view as taken substantially on a line 9—9 of FIG. 8;

FIG. 10 is a perspective view, in elevation, of a stringer mold means in accordance with this invention, with parts broken away for greater clarity;

FIG. 11 is a perspective view, in elevation, illustrating a portion thereof in greater detail;

FIG. 12 is an enlarged cross-sectional view taken substantially along a line 12—12 of FIG. 10;

FIG. 13 is a cross-sectional view as taken substantially along a line 13—13 of FIG. 12;

FIG. 14 is a cross-sectional view similar to FIG. 13 illustrating a portion thereof in another position; and

FIG. 15 is an enlarged cross-sectional view taken substantially along a line 15—15 of FIG. 10.

Referring to the drawings, and particularly to FIGURES 1 and 2, there is shown, by way of illustration but not of limitation, a stairway, generally designated by the numeral 10, of concrete construction, which is designed and constructed in accordance with this invention. The stairway 10 comprises a plurality of step units 11, 12 and 13, each having a vertical riser portion 14 and a horizontal tread portion 16, the step units being retained in the assembled condition by a pair of post-formed side stringer members 17 and 18.

Each concrete step unit 11–13 is, in accordance with this invention, prefabricated in a mold means to be hereinafter described, whereby the tread portion 16 and riser portion 14 thereof, are integrally formed to enclose a core or basket 19 comprising a plurality of reinforcing rods whose selective ends extend outwardly of the step for the purpose of interlocking one step unit to the other and each step unit 11–13 to the stringers 17 and 18.

The cores 19 include a plurality, three in number shown in the drawings, of L-shaped reinforcing rods 21 which are spaced within a step unit and whose lower ends 21' depend downwardly from the vertical riser portions 14 of the unit.

A plurality of vertical openings 22, corresponding in number to the L-shaped rods 21, are provided in each horizontal tread portion 16, extending therethrough and spaced in accordance with the spacing of the L-shaped rods 21, adjacent an outer longitudinal edge 23 of the tread portions 16 and spaced inwardly therefrom. The step units 11, 12, 13 are arranged in superimposed relationship whereby a lower edge surface 24 of a riser portion 14 rests on the upper outer surface of the tread portion 16 and adjacent the edge 23 thereof, with the outwardly extending ends 21' of each rod 21 residing within the openings 22 to interlock one step unit with the other, the ends 21' of the lowermost unit, 13 in FIG. 1, being enveloped within a foundation (not shown) if desired, or optionally cut off.

The cores 19 further include spaced elongated longitudinal reinforcing rods 26 having ends 26' extending outwardly of the step unit. Selective ends 26' are preferably tied together as by elongated tie rods 27, as by welding or the like, after which the stringers 17 and 18 are molded within a stringer mold 20 (FIGURES 10–14) to enclose the ends 26' and tie rods 27, thereby locking the steps units 11–13 to the stringers 17 and 18 at each end thereof.

The step units 11–13 are supported within the mold means 20 until the stringers 17 and 18 are molded and hardened, to form the complete stairway 10, as will be hereinafter described. To further strengthen each step unit 11–13, the risers 14 and treads 16 are preferably provided with thickened portions of fillets 29 at the intersection of the inner surfaces thereof.

It is to be understood that although a substantially flat riser portion 14 and tread portion 16 is herein described and having merely a slightly rounded outer corner 31, steps of any desired configuration may be formed such as having a rounded bead or leading ledge indicated in dotted lines 31' of step unit 11 in FIG. 2, or a squared overhang, indicated in dotted lines 31'' of step unit 12, in the same figure, if desired.

An important feature of this invention is the provision of improved apparatus or mold means for precisely, accurately and quickly prefabricating step units like units 11–13 which can be readily assembled in interlocking relationship and permanently secured in such relationship by stringers molded thereto, the entire assembly being readily transportable for installation at the location of use. The step units may be optionally assembled at the place of use, if desired, and the stringers molded thereto.

Referring to FIGURES 3–9, improved means for forming step units, generally referred to by the numeral 40, is illustrated, the means 40 being illustrated as adapted for use in forming two step units, like units 11–13, at a time. It is to be understood, however, that any number of units may be prefabricated by merely modifying the means 40 in its length alone. The means 40 includes a support means 41 which may conveniently comprise a bench or table 42 supported as by legs 43, to pivotally support a frame 44 as by stub shafts or pins 46 thereof rotatably disposed in bearings 47 mounted on the frame 44.

The frame 44 includes a horizontal bed 48 for supporting elongate base plate 52 common to a plurality of mold means 53, two of them being illustrated in FIG. 3.

The base plate 52 is preferably L-shaped in configuration, having a relatively flat longitudinal portion 54, on which the tread portion 16 is formed, substantially perpendicular to a second relatively flat longitudinal portion 56, on which the riser 14 is formed, the portions 54 and 56 meeting at an intermediate portion 57 which is angularly disposed relatively to both portions 54 and 56. The portion 54 serves to form the inner surface of the horizontal tread portion 16 of a step unit, the portion 56 serves to form the inner surface of the vertical riser portion 14 of the step unit, while the intermediate portion 57 serves to form the inner surface of the fillet 29 of the step unit. The base plate 52 is preferably formed of sheet metal or the like and reinforced as by L-shaped angle pieces 58, corresponding in configuration to the portions 54, 56 and 57.

As best seen in FIGS. 4 and 6, a pair of side wall members 62 and 63 are removably disposed on the base plate 52. Each side wall 62, 63 is preferably of angular cross-section and L-shaped in configuration to conform substantially to the configuration of the base plate 52, having secured at each end thereof, as by welding or the like, end plates 64 having threaded apertures 66 therethrough. A gusset 67 is provided on each side wall 62, 63 to conform to the beveled or angular surface 57 of the base plate 52 whereby the lower surfaces 68 of each side wall 62, 63 together with the outer edge surface 69 of each gusset 67, conforms to the configuration of the base plate 52.

Removably secured to the end plates 64 of the side walls 62, 63 and spanning the walls 62 and 63 is a pair of end walls 71 and 72. The end walls 71 and 72 may be conveniently formed of angular cross-section, the upstanding leg of each being substantially equal in width to the upstanding legs of the sidewalls 62 and 63. The end walls 71 and 72 are provided with apertures therethrough whereby fastening members 73 may extend therethrough and threadedly engage the threaded apertures 66 of the end plates 64 for removably securing the walls 71 and 72 to the side walls 62 and 63, lower edges 74 thereof being in contact with the base plate 52. To complete the mold means 53, thereby forming a cavity 76, a cover member or outer wall 77 is removably secured to the base plate 52. The cover member 77 may be formed of sheet metal or the like, in L-shaped configuration, conforming to the outer edges 78 of the walls 62 and 63 and the outer edges 79 of the end walls 71 and 72. The cover member 77 may be rounded at its corner 81 and provided with reinforcing members 82 and 83, welded or otherwise secured to the outer longitudinal edges 84 and 86, respectively, thereof.

The side walls 62 and 63 are secured to the base plate 52 by a plurality of bolts 87 (see FIG. 8) extending through an aperture 88 of the base plate 52, and aligned apertures 89 of the side wall members 62 and 63 and threadedly secured by nuts 91.

To adapt the base plate 52 for greater versatility, additional apertures, like 88 and indicated at 92 and 92', are provided in the base plate 52 whereby the side walls 62 and 63 may be shifted longitudinally, relative to the base plate 52, to space them closer together or farther apart, as desired, to form step units of varying lengths. The apertures 88, 92 and 92' are preferably countersunk, as illustrated in FIG. 8, whereby an aperture, such as 92', extending within the cavity 76 of the mold means 53 when a step of a length lesser than maximum is being formed, can be covered as by a countersunk head of a bolt 93 to avoid leakage of cementitious material when poured into the cavity 76. In the event that the apertures 92 or 92' are used to make a form of a different longitudinal dimension, end members 71 and 72 and cover 77, of appropriate dimension, may be substituted for the ones illustrated to compensate for the differing dimensions, or optionally, a cover and end members of maximum length may be provided each having a plurality of longitudinally spaced apertures suitably plugged when not used. A nut 91' is preferably secured as by welding or the like to the undersurface of the cover means 77 and an elongated bolt 87' indicated in broken lines substituted for the bolt 87 to secure the cover 77 to the base plate 52 when a maximum length is used.

The mold means 53 is secured in covered position by providing clamps 94 having outer ends 96 engaging the reinforcing strip 83 of the cover member 77 and a reinforcing strip 97 secured to the undersurface of the base plate 52 to grip the strips and insure a non-leaking engagement between the cover member 77, side walls 62, 63, end wall 71 and base plate 52. The mold means 53 is additionally secured by bolts or pins 104 extending therethrough as will be hereinafter described.

In order to accurately and precisely space and support the reinforcing rods 21 and 26 of the basket 19 previously described, a plurality of spaced apertures 98 are provided in the end wall 71 extending therethrough. The L-shaped rods 21 are automatically and accurately spaced by the apertures 98 and supported in the spaced relationship. Similar apertures 99 are provided in the sidewalls 62 and 63, extending therethrough, for spacing and supporting the longitudinal elongated reinforcing rods 26, the bars 21 and 26 having their ends 21' and 26' respectively extending outwardly of the cavity 76. The rods 21 and 26 are loosely supported as by means of the

apertures 98 and 99, and secured together as by welding or the like at points at which they intersect, as indicated at 101. Additional L-shaped rods 21a are preferably provided equally spaced between the rods 21 and welded or otherwise secured to the rods 26 to provide further reinforcement, but having their outer ends terminating within the cavity 76.

In order to form the vertical openings 22 extending through the tread portions 16 of the step units 11–13, aligned apertures 102 and 103 are provided in the top member 77 and base plate 52 respectively, through which bolts or pins 104 are inserted, after the cover 77 has been positioned over the side and end walls. The shank of each pin 104 extends through the cavity 76 to form the openings 22 in the tread portion 16 of the step unit when the cementitious material is poured into the cavity 76. An additional longitudinal reinforcing rod 106 is preferably secured, by welding or the like, to the L-shaped reinforcing rods 21 to provide additional reinforcement between the opening 22 and the outer edge 23 of the tread members 16. The rod 106 does not necessarily extend through the side walls 62 and 63 and may terminate adjacent thereto.

For convenience, the base plate 52 rests on the bed plate 48 in a position convenient for installation of the side and end walls and the rods 21 and 26, such as shown in FIG. 4, after which the cover member 77 is secured in place, as previously described, after which the end wall member 72 is removed by removing the fastening means 73 therefrom.

The base plate 52 is then rotated into a tilted position, illustrated in FIG. 5, wherein cementitious material may be poured, as through the opening 72' formed at what is now the upper end of the mold means 53 to fill the now lower portion of the cavity 76 to a level approximated by the line 107, after which the mold is rotated to the position illustrated in FIG. 6 to fill the upper portion of the cavity 76 to a level flush with the outer surfaces of the upper end plates 64 of the side walls 62, 63. Stops 108, of angular form, are preferably secured adjacent a rear edge of the bed plate 48 against which the base plate 52 may abut while being supported at a tilted angle by a removable wedge 108' for the pouring position of FIG. 5. Cables 109, or other ties, indicated in broken lines, in FIG. 6, may be provided to assist in supporting the mold 53 in various positions.

The end member 72 may then be replaced and locked in place by the fastening means 73 to prevent outflow of the cementitious material.

The base plate 52 is preferably vibrated or oscillated during pouring in the positions of FIGS. 5 and 6 in a manner to be hereinafter described to cause the aggregate within the cementitious material to redistribute and thereby cause the finer material thereof to rise against the plate 77, providing smooth and stone-free outer surfaces which do not require further finishing after hardening. Vibration or oscillation also provides a means for removing air bubbles that normally form during pouring of the material. Such air bubbles are eliminated while the mold means and base plate 52 are vibrated during pouring. After the cavity 76 is completely filled the end wall 72 is replaced as previously described and the mold means 53 is stored in the position indicated in FIG. 6 to dry and harden. After the step unit has hardened for approximately 40 hours the cover 77 may be removed; the side walls 62 and 63 and end walls 71, 72 may be removed from the base plate 52 to free the step unit after it has completely dried.

The base plate 52 is preferably lifted and removed from the bedplate 48 for drying in order that the bedplate may be continually used to form additional step units by placing another base plate 52 and component parts of molds like 53 thereon.

Vibrating means, indicated generally by the numeral 110 (see FIGS. 3 and 4), may be one of various types. The vibrating means 110 as herein illustrated, comprises an eccentric collar 111 secured as by a flexible cable 112 to the bed plate 48 of the frame 44. The collar 111 is rotated as by a shaft 113 secured to a pulley 114 driven by a pulley belt 116 and a motor-driven pulley 117, driven by a motor 118 mounted on the support means 41. The flexible cable 112 is attached as at 119 to a depending extension 121 of the bed plate 48 which, after being pulled downwardly at one edge thereof by the eccentric bushing 111, is returned by a spring 122 secured as to the opposite edge thereof. It is to be understood, however, that various vibrating means may be employed to provide an oscillatory motion to the base plate 52, thereby causing a vibration of the mold means 53 and the cementitious material therein to rearrange the particles of aggregation within the cementitious material to bring the finer particles thereof to the surface, that is, against the cover member 77 to provide stone-free, bubble-free exterior surfaces on the finished step unit.

In order to complete the stairway 10 by enclosing step units such as 11–13 within the stringers 17 and 18, the stringer mold means 20 is provided wherein the step units 11–13 are pre-assembled, i.e., are arranged in stepped formation with the depending rod end portions 21' of one step unit engaging and residing within openings 22 of an adjacent step unit within the stringer mold means 20 after which stringers 17, 18 are cast adjacent the sides of the steps to enclose the ends of the step units and outwardly extending ends 26' of the reinforcing members 26 and the diagonal tie rods 27 therein.

Referring more particularly to FIGS. 10–15, an apparatus for forming stringers to complete the stairway is illustrated wherein the stringer mold means 20 comprises a frame, generally designated by the numeral 125, on which a pair of stringer molds 126 and 127 are removably secured forming a pair of spaced cavities 128 and 129, respectively, for forming the stringers 17 and 18, respectively.

The frame 125 comprises a pair of spaced channel members 131 having their open sides facing each other and being adjustably secured to each other as by a pair of cross-braces 132 pivotally secured at their upper ends 133 to a lower wall of each channel member 131 and adjustably secured at their lower ends 134 as by fastening means 136 extending through apertures of the lower ends 134 and elongated slots 137 of the lower wall of the channel members. The members 131 are additionally secured by a transverse telescoping brace 138. The brace 138 preferably includes a set screw 139 to lock the channel members 131 in a predetermined spaced position. The frame 125 is supported in an inclined position by a pair of telescoping leg members 141 pivotally secured to the undersurface of each channel member 131 adjacent their elevated ends and braced as by telescoping brace members 142 having ends pivotally secured to the legs 141 and the channel members 131, whereby a desired angle of inclination of the frame 125 may be achieved by adjusting the overall length of the legs 141 and braces 142 after which the legs 141 and braces 142 may be locked as by set screws 143 and 144, respectively, to retain such angular position.

Each stringer mold 126 and 127, of the stringer mold means 20, comprises an inner wall 146, formed of discrete upper and lower inner wall members 147 and 148, respectively, a lower wall 149, an outer wall 150, an upper wall 151, and end walls 152 and 153. The inner wall 146, the lower wall 149, and the outer wall 150 of each stringer mold 126, 127, are identical with the exception that the walls of one stringer mold are mirror images of the walls of the other stringer mold and are therefore designated by like numbers with the exception of primed numbers being used to designate corresponding parts in the mold 127. The end walls 152 and 153 are common to both molds 126, 127, while the upper walls 151 are interchangeable.

Each of the lower inner wall members 148, 148' comprises a plurality of substantially triangular vertical walls 152 removably secured to the outer walls 153 of the channel members 131 as by a bolt or screw fastener 154. Each vertical wall 152 is provided with an integrally formed inwardly extending flange 156, each flange including a horizontal portion, a vertical portion and an intermediate angular portion complementary to the undersurface of the step units like 11–13 to support these step units in assembled stacked relationship, one being indicated in FIG. 10 and three step units 11, 12 and 13 illustrated in FIG. 12. The triangular walls 152 and their integral flanges 156 thereby form a stepped configuration when attached to the channel members 131 complementary to the stepped configuration of the undersurface of the step units 11–13 when assembled.

The upper inner walls 146, 146', are adapted to conform to the upper surface of the stepped configuration of the step units when assembled and include vertical walls 157 of substantially triangular configuration, each wall 157 having an inwardly extending integral flange 158 complementary to the outer surface of the riser and the tread portions of the step units 11–13. The members 157 are secured in step configuration to a longitudinal member 159, 159', of the molds 126, 127, respectively, as by sandwiching an upper edge 157' thereof between angular elements of the members 159, 159' and secured against inner movement by a fastening member 161 comprising an elongated rod having one end 162 abutting the flange 158. The rod 161 is threaded at its outer end 163 which extends through an aperture of the longitudinal members 159, 159', and is in engagement with a nut 164 thereon. The longitudinal members 159, 159', are each preferably provided with an upturned flange 166 to which an elongated angular piece 167 is secured for securement to a transverse clamp 168, to be hereinafter described, whereby the longitudinal members 159, 159', and thereby the discrete members 157, are securely held in place, with the flanges 158 in abutment with the assembled step units 11–13.

Each of the bottom walls 149 includes an upwardly extending flange 169 for removably securing the wall to its adjacent channel member 131 as by the fasteners 154. The wall 149 is preferably centrally split and joined as by a longitudinal hinge 171 to facilitate parting of the mold from the stringer when the stringer has hardened. In practice, it has been found advantageous to form a portion of the lower wall 149 as by an inturned flange 172 integral with an outer wall 150, 150' and secured as by welding or the like to the hinges 171, whereby an outer wall 150, 150' and its integral flange 172 may be pivoted outwardly at the hinge 171 to part the walls 150—172, 150'—172, away from its stringer when hardened.

The outer walls 150, 150' are provided at their upper edges with an elongated angular member 173, or with optionally formed outwardly facing integral flanges, to engage hooked ends 174 of the transverse clamp members 168, there being a hooked member 174 at each end of the clamps 168 to engage each angular member 173 of both outer walls 150, 150', as best seen in FIGS. 10 and 13. The clamps 168 may be secured to the wall members 150, 150' as by set screws 176. The clamps 168, spanning the entire width of the mold means 20, provide convenient securement for the upper inner walls 146, 146' as by fasteners, in the form of bolts and nuts 177.

Each upper wall 151 is preferably formed of a pair of elongated sheet metal members 178 abutting at adjacent edges and secured together as by a hinge 179. Each elongated member 178 is preferably curved downwardly at its edges 181 to provide a curved edge on the finished stringers 17, 18. The upper wall 151 may be removably secured as by a hooked clamp 182 engaging the angular strip 173 of the outer walls 150, 150', at one end 183 thereof and to the upper wall 151 at the other end thereof as by clips 184 whereby the wall 151 may be easily and quickly removed from the upper edge of the stringer when the stringer has hardened, the hinge 171 facilitating disengagement of the curved edges 181 from the stringer.

The end walls 152 and 153 are preferably of sufficient length to span the entire width of the mold means 20, in its maximum expanded condition, and are secured at each end thereof to the outer walls 150, 150' by suitable fasteners such as nuts and bolts 186 indicated in FIG. 10. Additional longitudinally spaced apertures 187 are preferably provided in the end walls 152 and 153 for the securement of the end walls 152, 153 to the outer walls 150, 150' in various adjusted positions, the apertures 187 being plugged temporarily when not used by countersunk screws like 93 described in relation to the step mold means of FIG. 9.

It will therefore be clearly understood from the foregoing description that upper and lower inner wall members 147 and 148, respectively, having sandwiched between their flanges 158 and 156, respectively, the outer ends of the step units 11–13, together with a lower wall 149, an outer wall 150, an upper wall 151, and the end walls 152, 153, common to both stringer molds 126 and 127, form discrete cavities 128, 129 for reception therein of cementitious material in plastic form whereby the outwardly extending ends 26' of the longitudinal reinforcing members 26 and a diagonal reinforcing member 27 secured thereto, extend into the cavities 128, 129 and are imbedded in the cementitious material of the stringer to securely join the step member 11–13 together when the stringer has hardened.

The channel members 131 are preferably so spaced, as by means previously described, to position the outer edges 186 of each step unit 11–13 inwardly of the cavities 128, 129 whereby the edges 186 are enclosed by the cementitious material poured therein to further strengthen the stairway 10. If desired, additional reinforcing rods such as indicated at 187 in FIGS. 13 and 14 may be spaced within the cavities 128, 129 to reinforce the stringers 17, 18, respectively.

To remove a finished stairway 10, the clamps 168 are disengaged and removed to unfasten the walls 150, 150' and longitudinal members 159, 159' whereby the longitudinal members and their attached upper inner walls 147, 147' may be easily removed therefrom. The top wall 151 may be easily removed because of its hinged construction, and the outer wall 150 and lower wall portion 172 broken away from the finished stringer by pivoting the walls at the hinge 171. The set screw 139 and fastening means 136 may then be loosened to draw the channel members 131 inwardly to break away the lower wall 149 and the lower inner walls 148, 148' from the inner surface of the stringer to free the step units and their now integral stringers from the mold 20, whereby the mold may be removed for subsequent use to form other stairways like 10.

To facilitate filling of the cavities 128, 129, an opening 188, of circular or other configuration, is formed in each of the vertical walls 157 of the upper inner walls 146, 146' thereby affording access to the cavity. The openings 188 may be closed as by a closure member 189 having a body 190 conforming to the configuration of the opening 188, secured by welding or the like to a transverse rod 191 engageable with clips 192 secured to the vertical wall 157 whereby the opening 188 may be closed after pouring cementitious material into the area of the cavities 128, 129 below the opening, after which material may be poured through an opening 188 of a vertical wall 157 thereabove.

It will be therefore clearly understood from the foregoing description that stringers, like 17, 18 may be formed on each side of the stairway to securely fasten step units thereof together in a manner in which triangular-shaped webs 190 are formed (see FIG. 1) having upper coextensive surfaces 191 to form a full stringer.

In some instances it is preferred to form what is known in the art as a half-stringer, that is, where the upper surface thereof conforms substantially to the stepped upper surfaces of the step units. For this purpose, as best seen in FIG. 14, an additional aperture may be provided in the clamp **168** whereby the longitudinal members **159**, **159'** may be shifted outwardly to a position shown in FIG. 14, wherein a vertical wall **157** is shifted outwardly to abut its outer wall **150**, **151'** in the position shown in this figure, whereby the integral flange **158** of each wall **157** overlies the cavity **129'** of reduced area to form the upper wall thereof, in which instance the upper wall **151** previously described is unnecessary. The upper inner walls **146**, **146'** are secured to the clamps **168** as by the fasteners **177** extending through the additionally provided apertures in the clamp **168** to secure the upper inner wall means **146**, **146'** in the abutting position described, the resultant half-stringer being indicated by a broken line **18'** in FIG. 1.

In order to provide access to the cavity **129'** that is formed, an opening **192**, of rectangular or other configuration, is provided in the horizontal portion of the flanges **158** and communicating with the cavity **129'** for pouring of cementitious material therethrough, the opening **192** being closable as by a closure means **193**, similar to the closure means **189** and comprising a body **194** conforming in configuration to the opening **192** and having a rod **196** secured thereto by welding or the like and engageable with clips **197** mounted on the horizontal portion of the flange **158**.

While I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and methods.

What I claim as new and desire to secure by Letters Patent is:

1. A concrete stairway comprising: a plurality of L-shaped step units juxtaposed in stepped relationship, each of said units having a horizontal tread portion and a vertical riser portion integral therewith having a plurality of spaced vertical openings therethrough adjacent an outer edge thereof; a plurality of L-shaped rod members extending through said tread and riser portions and having outer ends extending outwardly from said riser portion, said outer ends of the L-shaped members of one step unit residing in said openings of an adjacent step unit, said riser portion of one step unit resting on said tread portion of an adjacent step unit adjacent said outer edge; a plurality of spaced elongated longitudinal rod members extending through said tread and riser portions transversely of said L-shaped rod members and having outer ends extending outwardly of said step unit; a pair of stringer means of concretious material having flat surfaces juxtaposed flush against the ends of said step units, one on each side thereof, and having said outer ends of said longitudinal rod members embedded therein, a plurality of diagonal elongate rod members secured to selected ends of said longitudinal rod members of each step unit, and said diagonal members being spaced outwardly of said step units and being embedded in said stringer means.

2. A concrete stairway comprising: a plurality of L-shaped step units, each unit having a horizontal tread portion and an integral vertical riser portion, each of said tread and riser portions having an outer edge; a plurality of spaced L-shaped reinforcing rod members extending through said step units transversely of said edges and having ends, one of said ends of each member terminating in said tread portion and spaced inwardly of said edge thereof, the other of said ends extending outwardly of said riser portion edge; a plurality of spaced longitudinal reinforcing rod members extending through said tread and riser portions and having ends extending outwardly thereform; and a plurality of longitudinally spaced apertures corresponding in number to said L-shaped reinforcing rod members, spaced inwardly from said tread edge, the outwardly extending ends of the L-shaped reinforcing members of one of said step units residing in said apertures of an adjacent step unit and said outer riser edge of each of said units being in abutment with the tread portion and adjacent said edge thereof of an adjacent step unit; molded stringer means having flat surfaces adjacent the ends of said step units and having said ends of said longitudinal reinforcing rod members embedded therein to hold the step units and stringers in assembled relationship, said L-shaped reinforcing rod members being secured to said longitudinal reinforcing rod members, and diagonal reinforcing rod members secured to selected outwardly extending ends of said longitudinal reinforcing members, said diagonal reinforcing means being embedded in said stringer means.

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