

[54] METHOD AND MEANS FOR MAKING A WALL SECTION 3,688,965 9/1972 Kellner et al. .... 29/430

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[57] ABSTRACT

[52] U.S. Cl. .... 29/430; 29/200 R; 29/200 J

This invention is a method and apparatus for making a wall section. Wall studs and plates are placed in a support and secured together. Sheet material is placed on the studs and secured thereto. The wall section is removed from the support. The apparatus for making the wall section has a movable carriage for the studs and plates, movable through an assembly line to (1) place studs and plates, (2) to secure the studs and plates together, (3) to place sheeting on a portion of the secured plates and studs, (4) to secure the sheeting material to the plates and studs and (5) preferably to remove the produced wall section from the carriage.

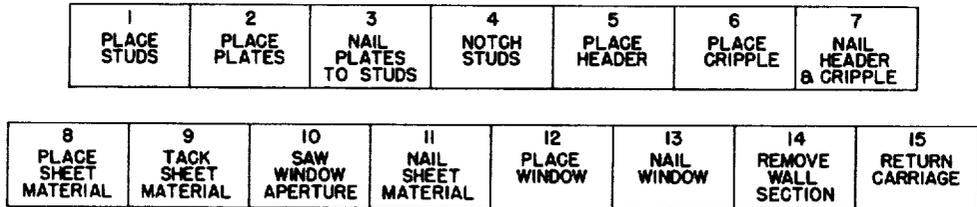
[51] Int. Cl. .... B23p 21/00

[58] Field of Search..... 29/429, 430, 200 R, 200 A, 29/200 J, 208 R

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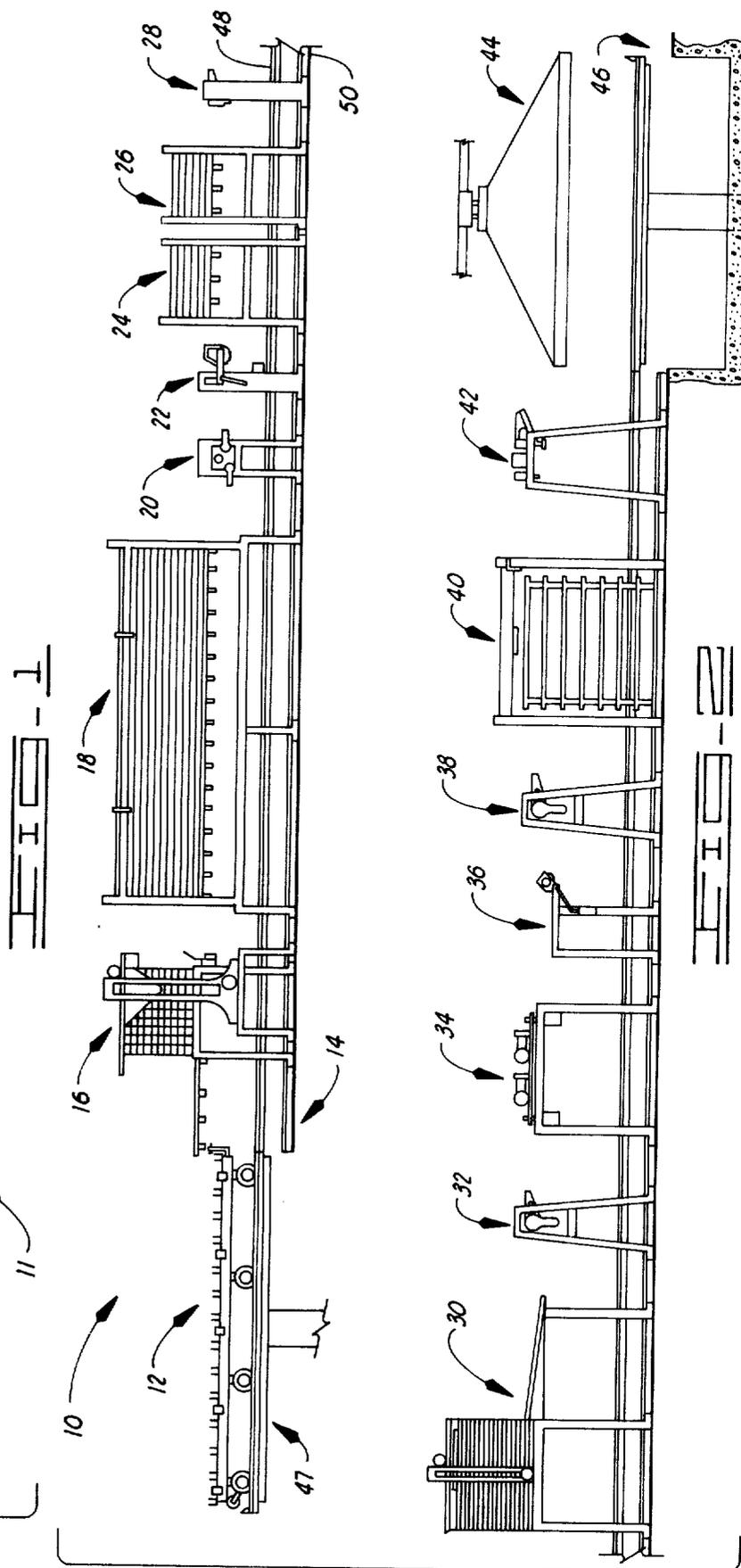
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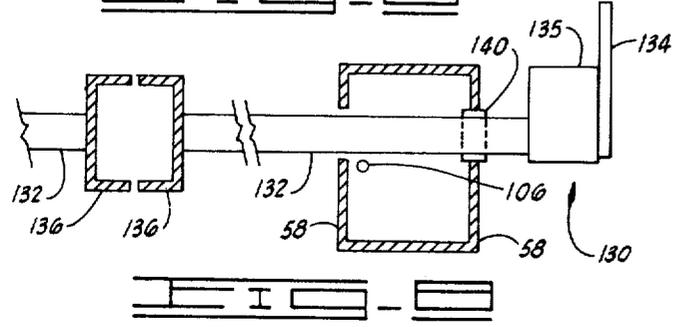
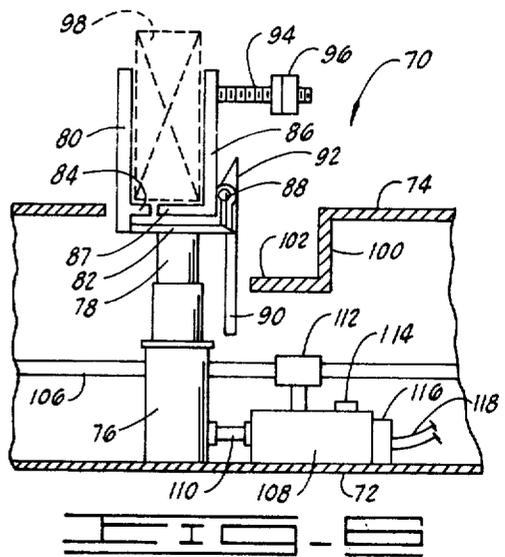
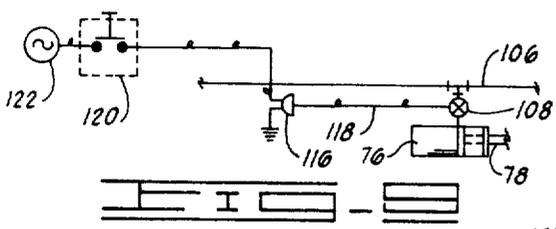
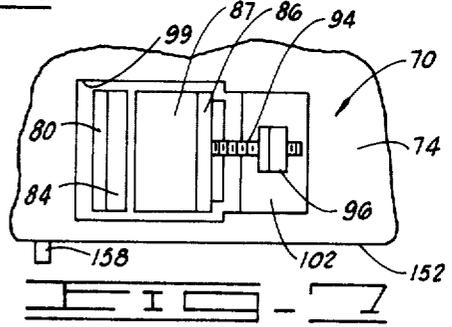
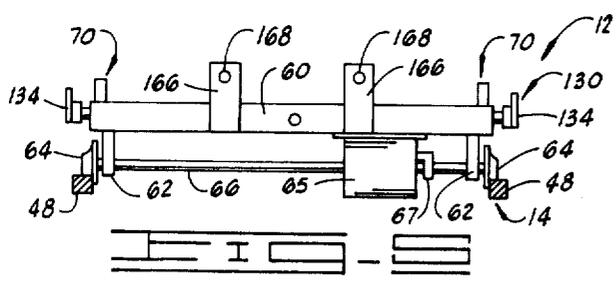
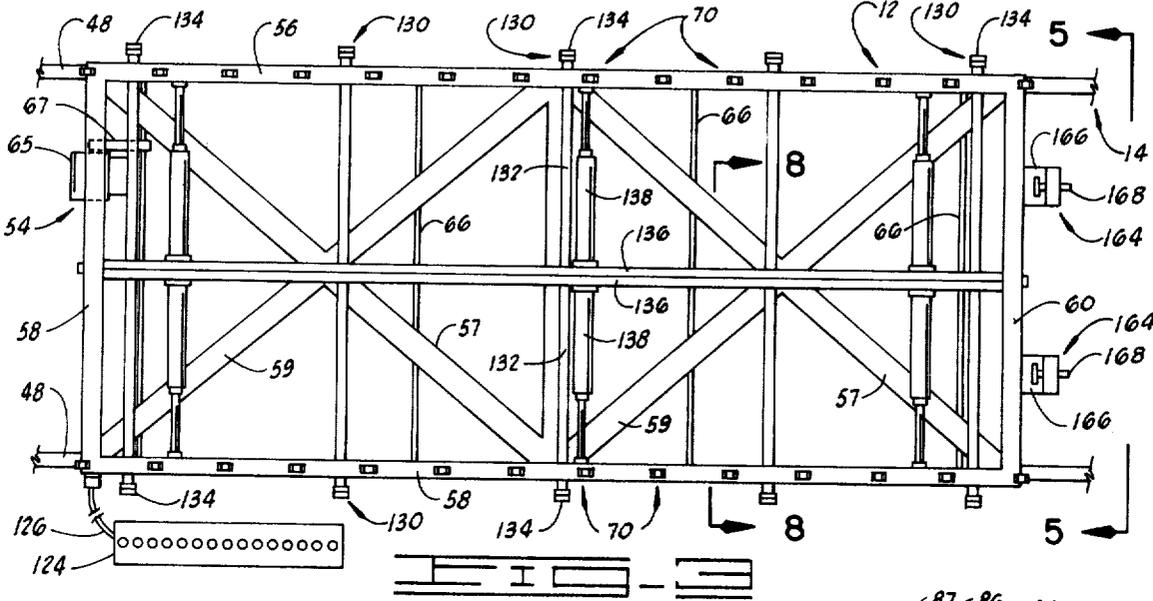
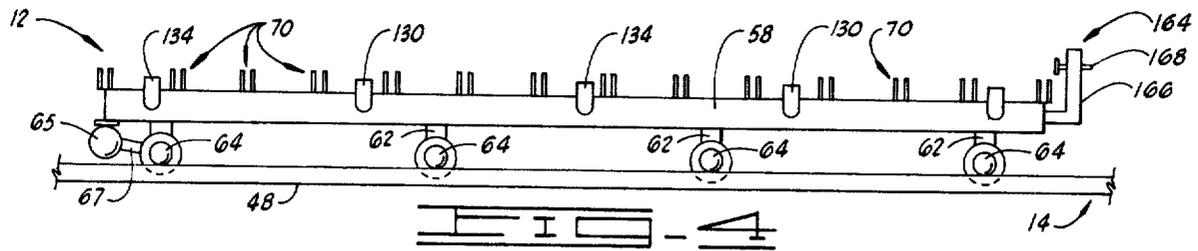
12 Claims, 43 Drawing Figures

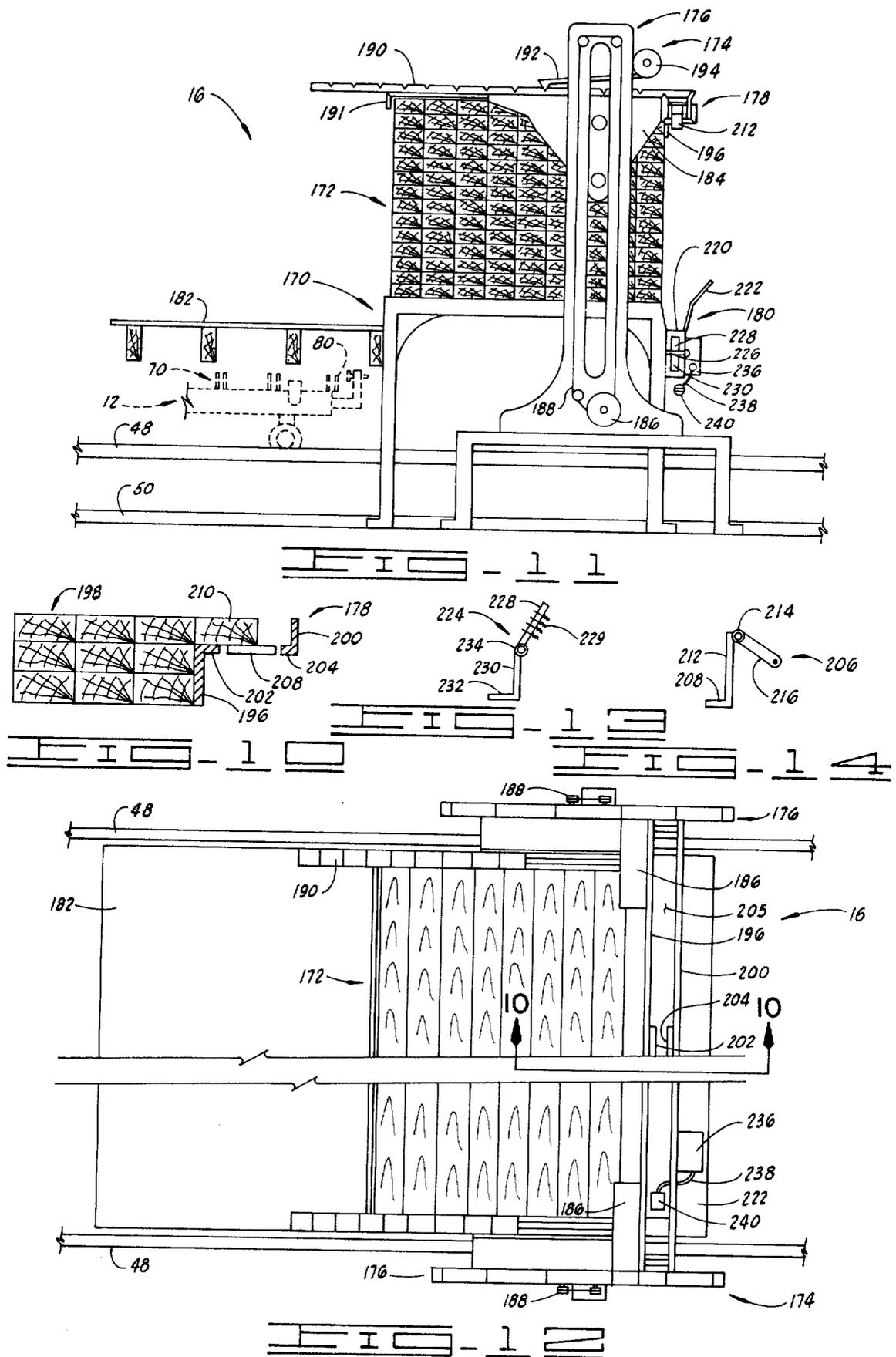


1	2	3	4	5	6	7
PLACE STUDS	PLACE PLATES	NAIL PLATES TO STUDS	NOTCH STUDS	PLACE HEADER	PLACE CRIPPLE	NAIL HEADER & CRIPPLE

8	9	10	11	12	13	14	15
PLACE SHEET MATERIAL	TACK SHEET MATERIAL	SAW WINDOW APERTURE	NAIL SHEET MATERIAL	PLACE WINDOW	NAIL WINDOW	REMOVE WALL SECTION	RETURN CARRIAGE







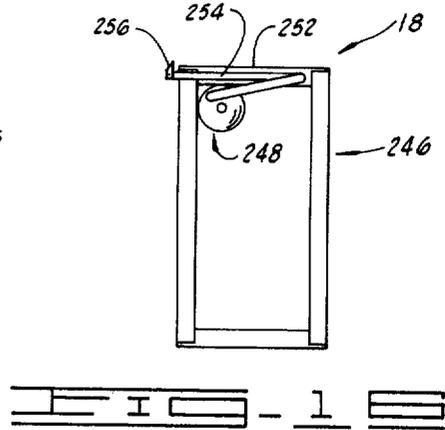
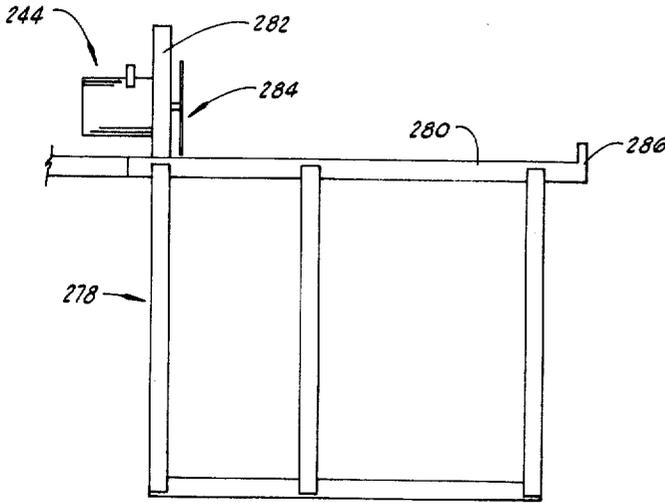
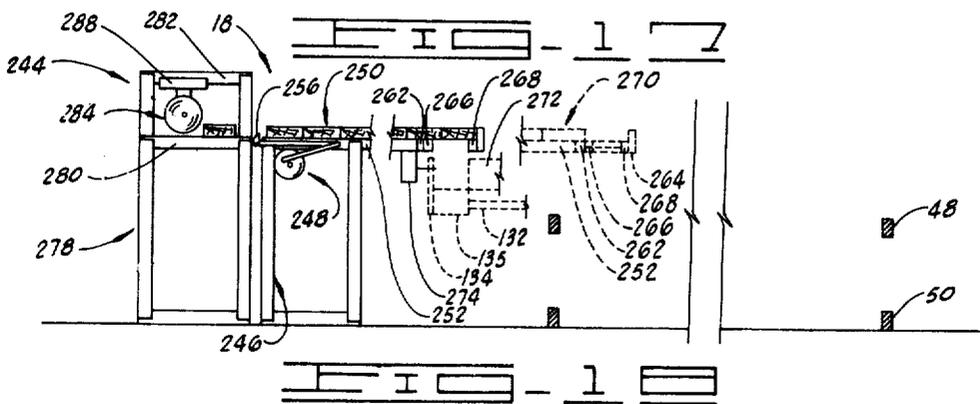
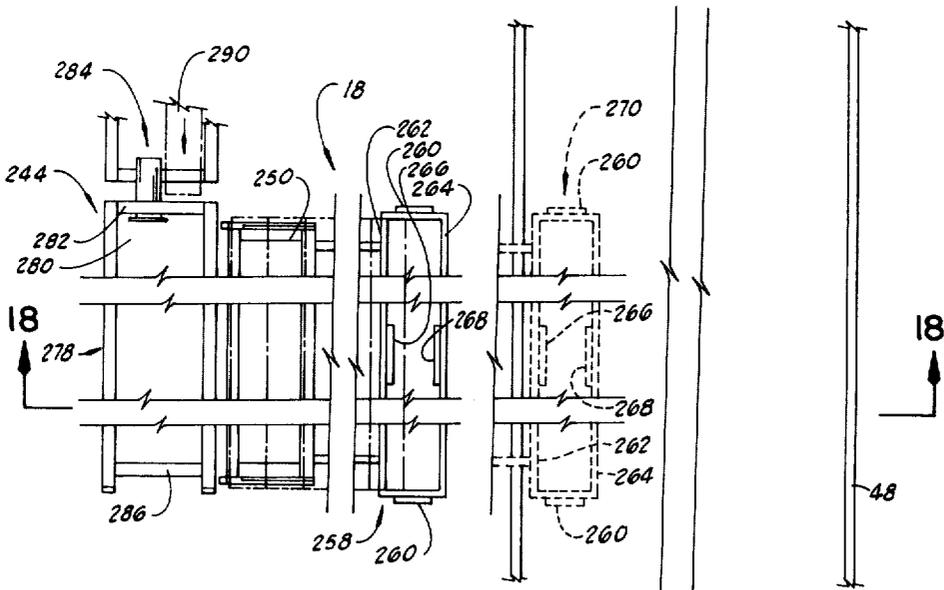
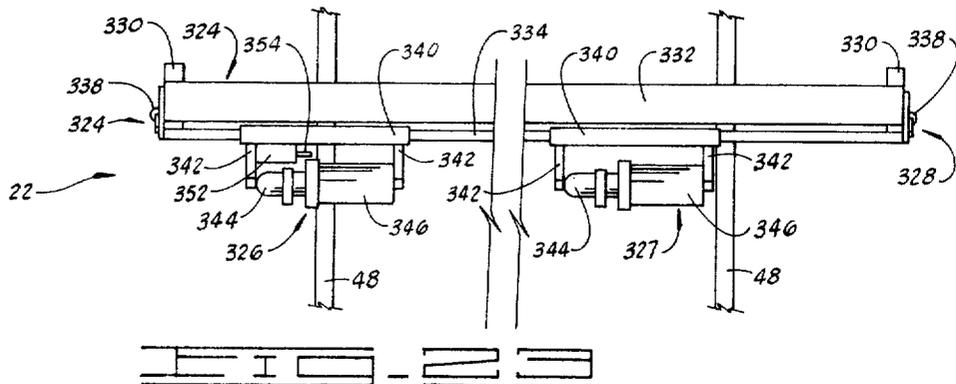
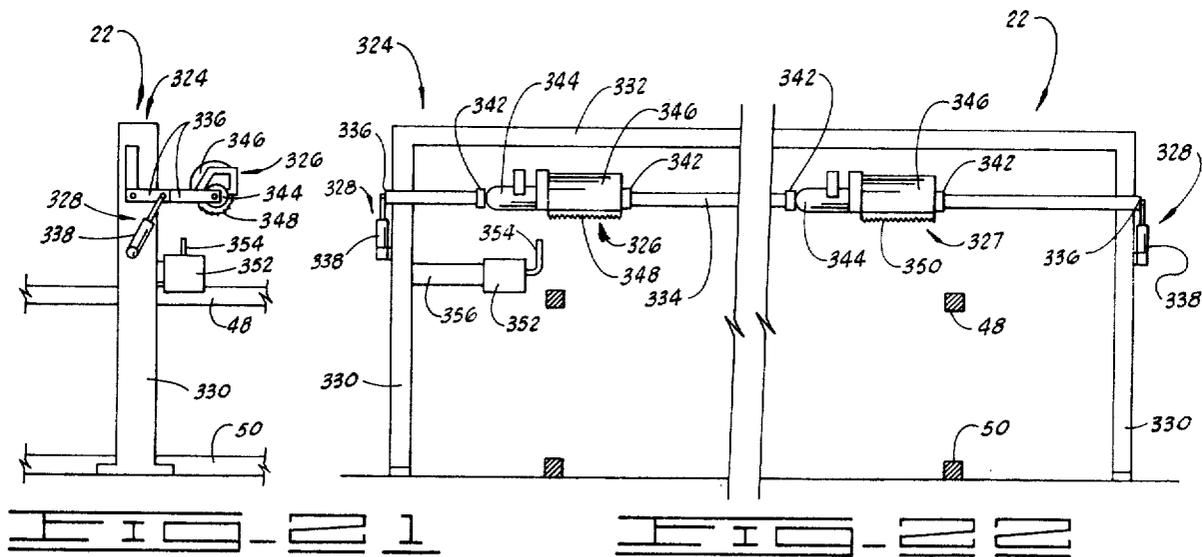
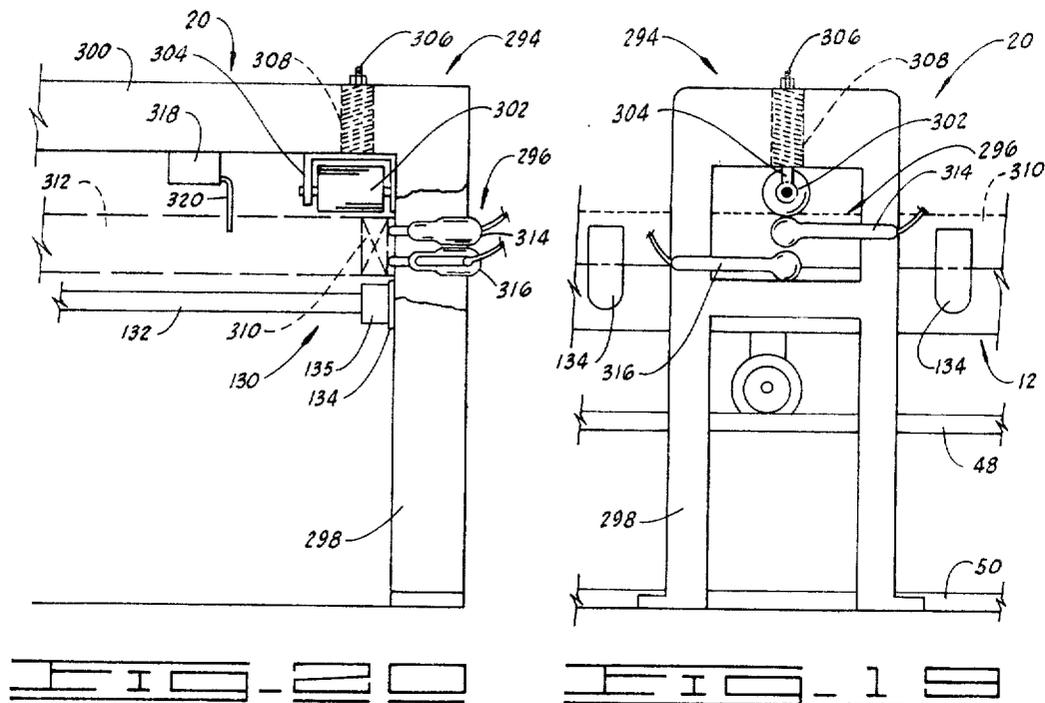
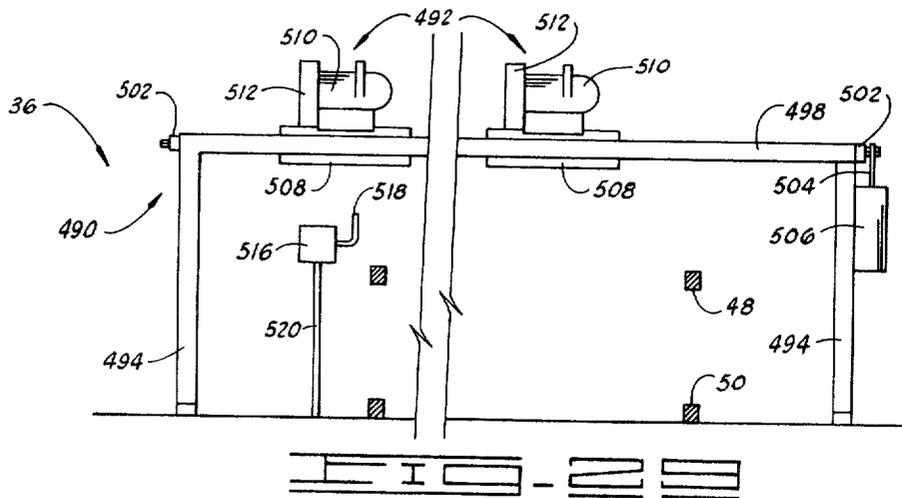
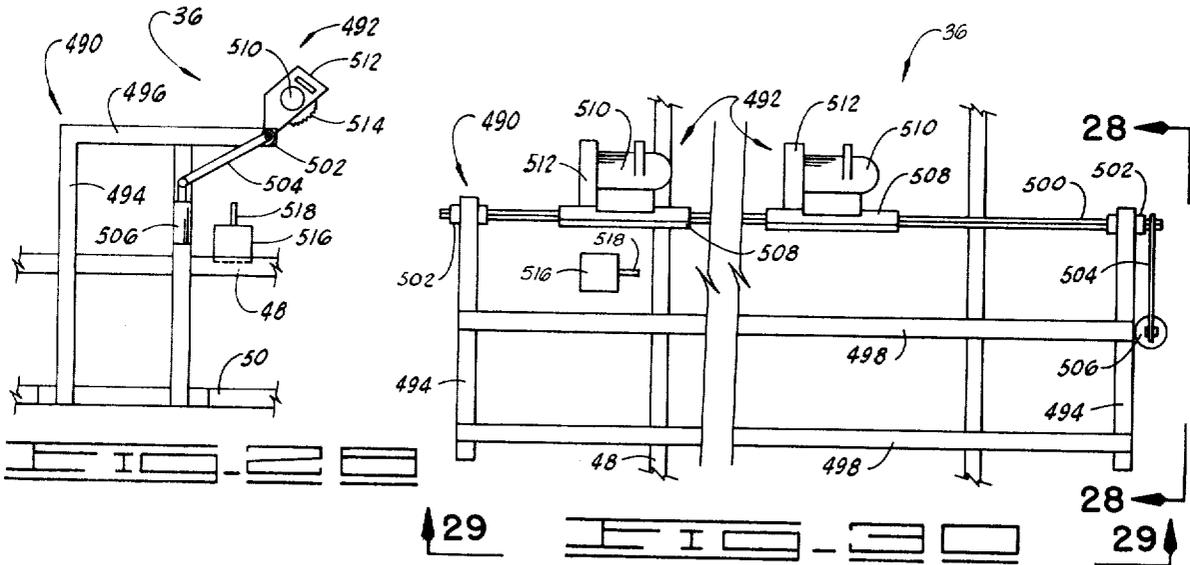
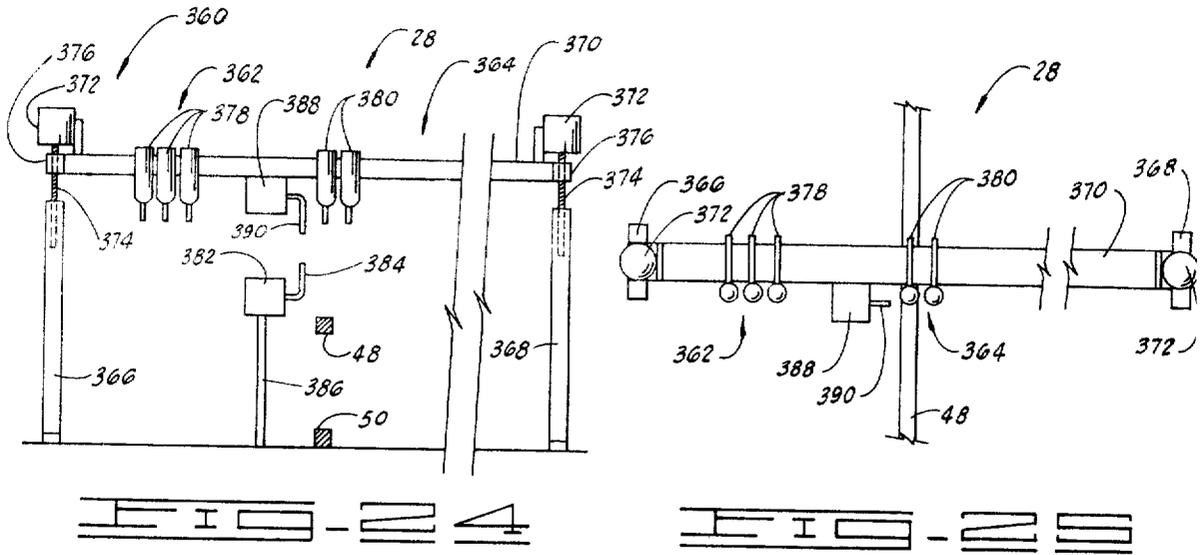


FIG. 1

FIG. 1







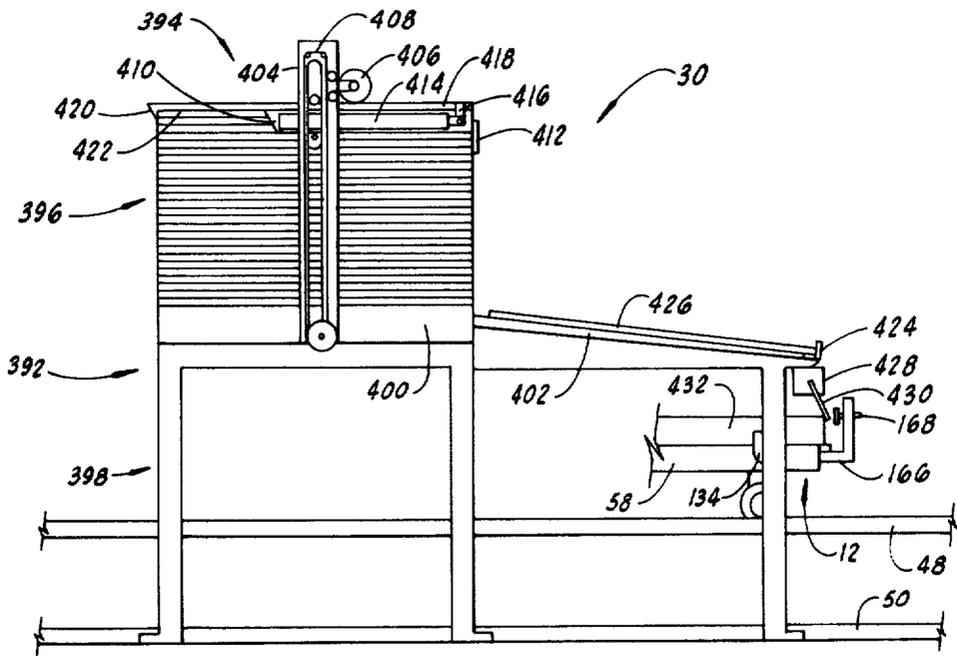
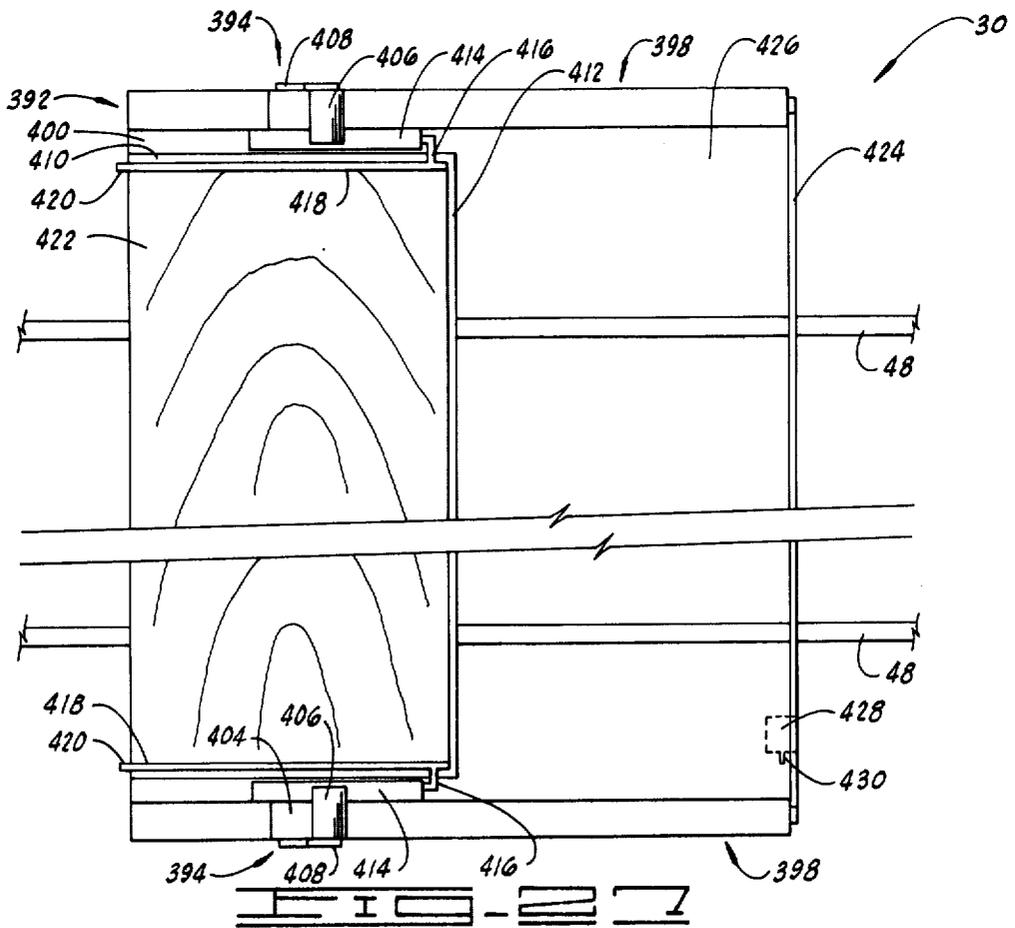
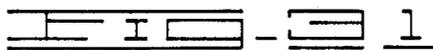
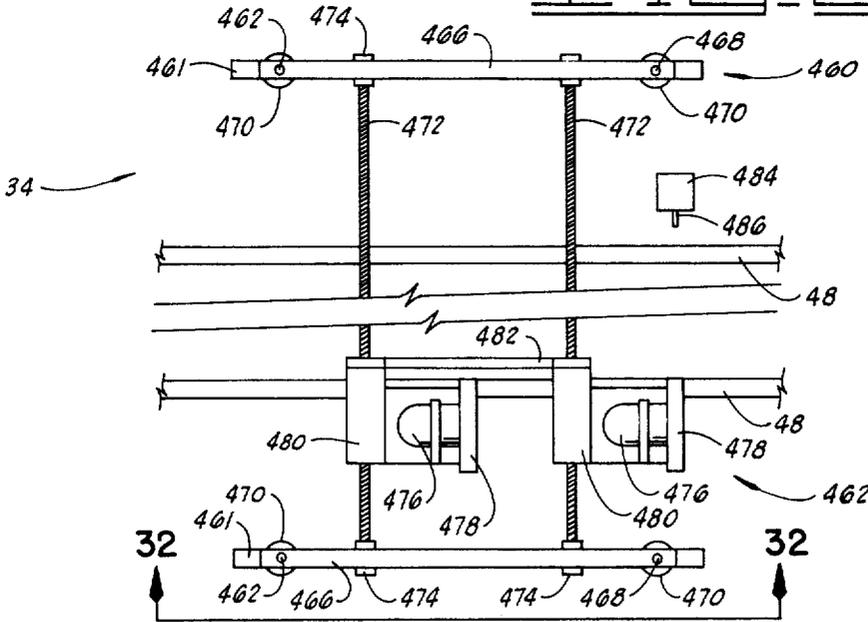
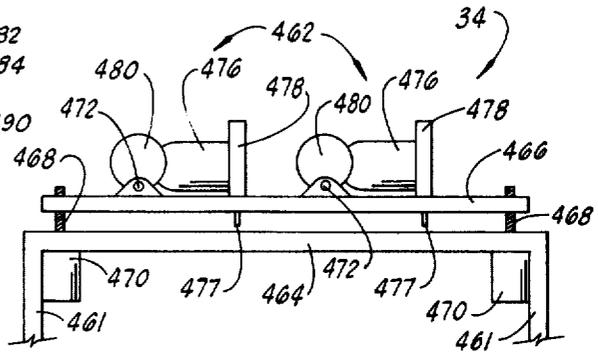
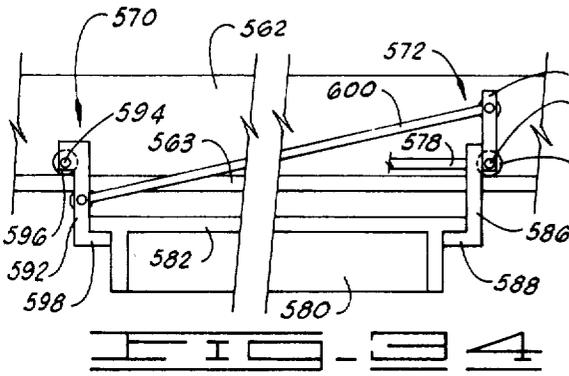
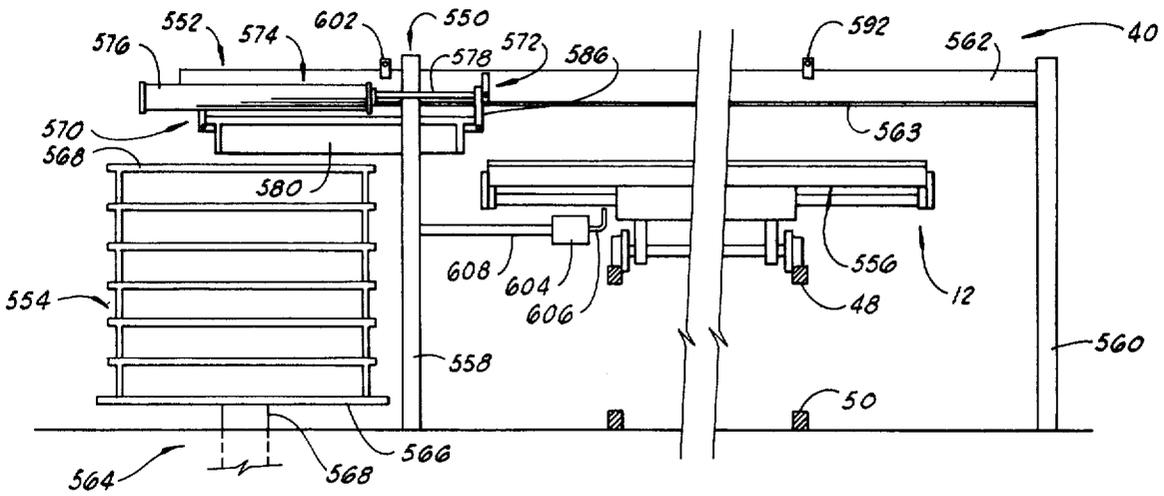
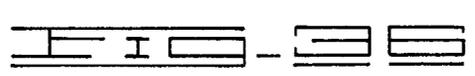
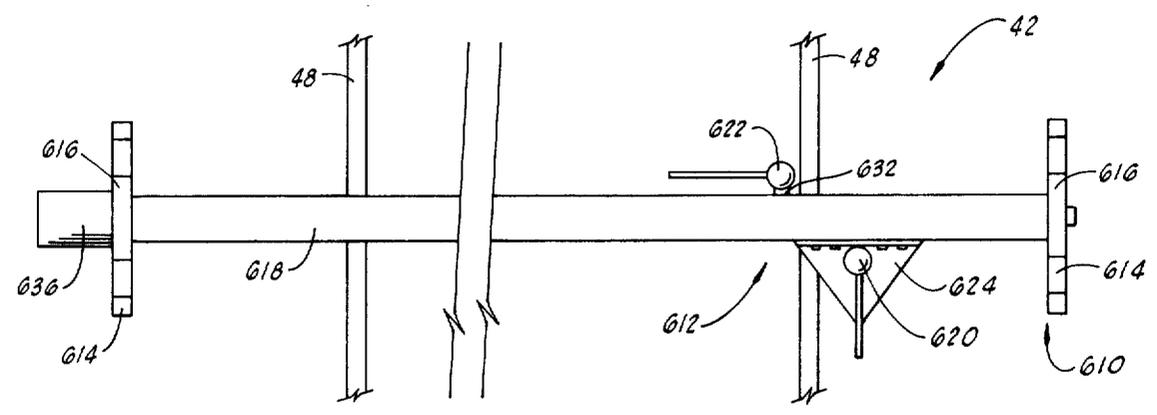
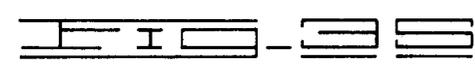
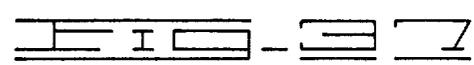
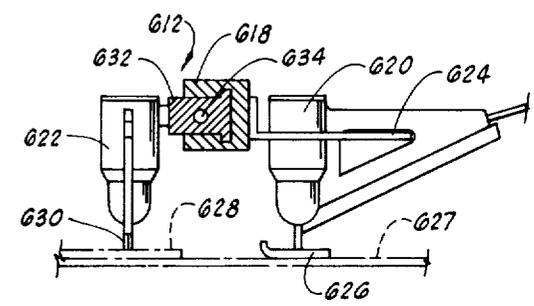
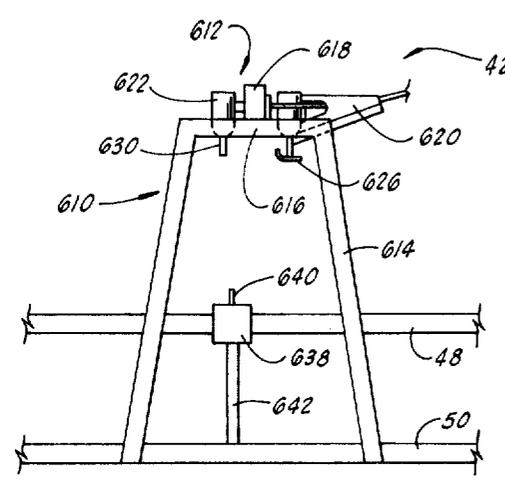
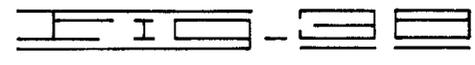
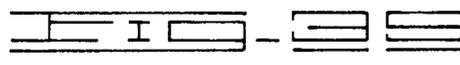
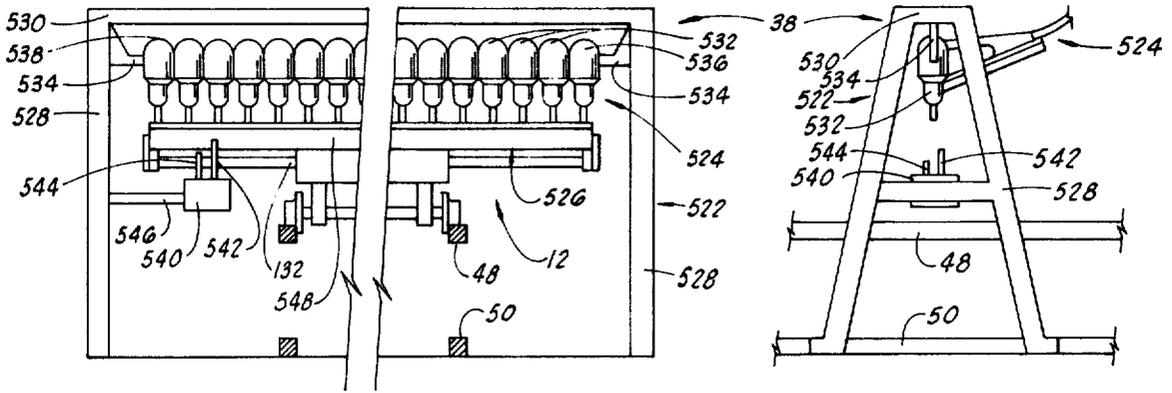
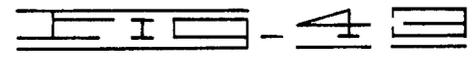
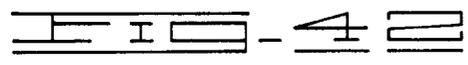
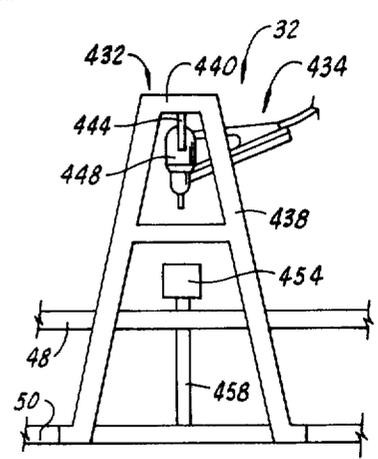
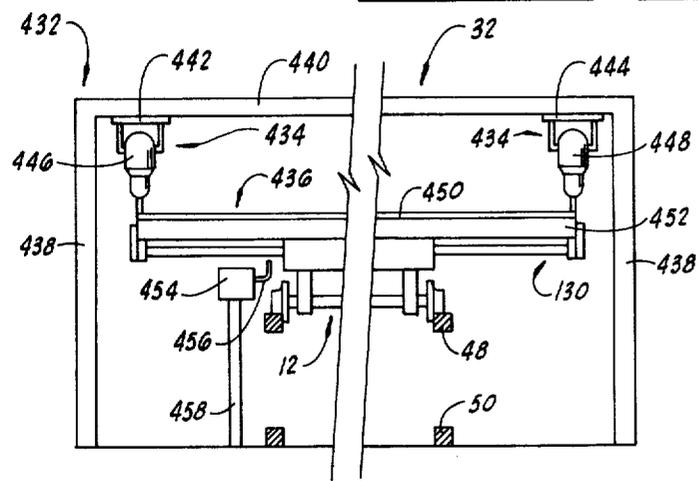
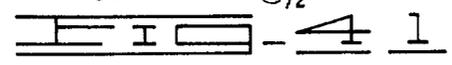
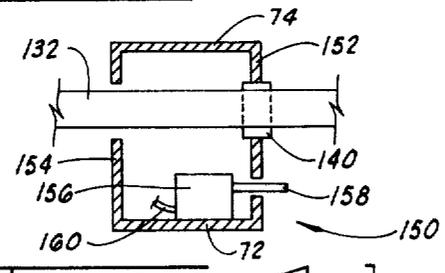
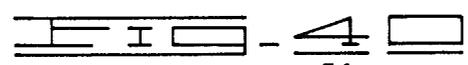
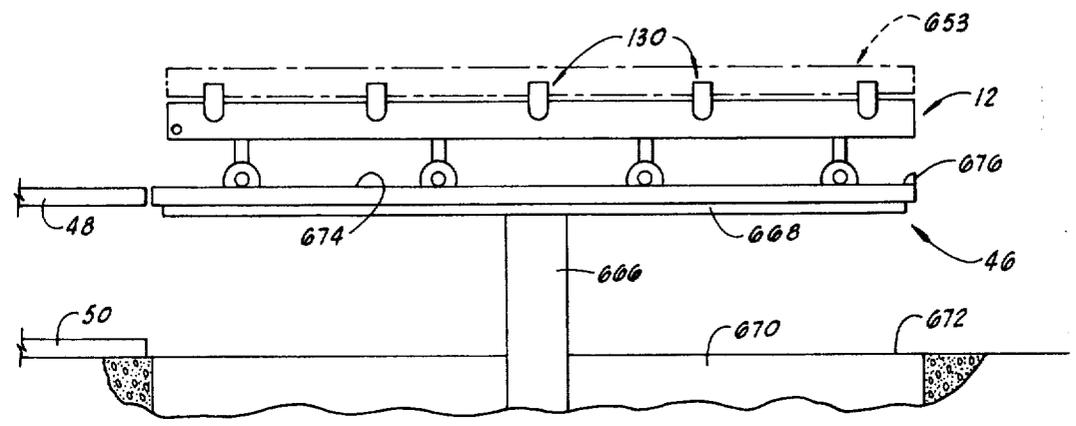
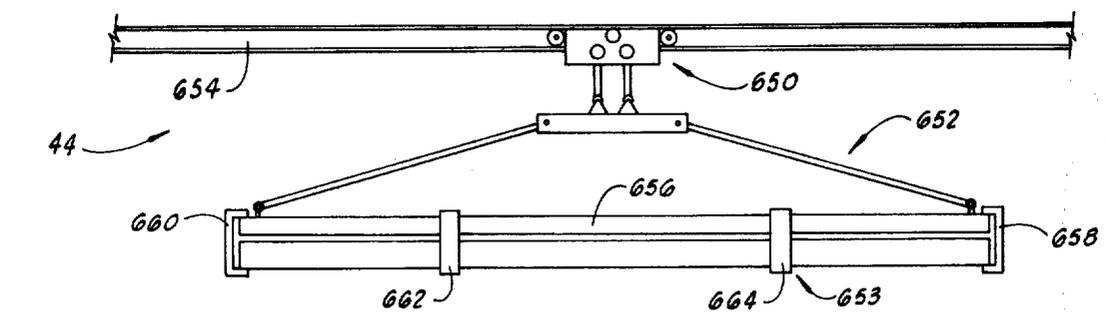


FIG. 25









## METHOD AND MEANS FOR MAKING A WALL SECTION

Numerous types of construction devices are known in the prior art for use in making wooded structures such as wall sections, roof, trusses and other portions of wooded building structures. Generally, the prior art devices consist of a table with a plurality of board fastening fixtures thereon to support the board members and sheets for the structures. This type of prior art device is essentially a construction jig wherein the boards of the structure are placed in the jig in a secured position then the structure is nailed or glued together. In a manufacturing operation utilizing this type of device the individual sections are removed from the jigs then wall surfaces or coverings are added to complete the unit before it is assembled to form an entire structure. Another type of table structure known in the art and used for fabricating walls and the like is an elongated table having a conveyor apparatus to support and move the wall section in a jig relation past stations where work is done on the wall section by hand. Jig apparatus' are known in the prior art which have a carriage movable under a plurality of automatic nailers to make wooded structures. This type of prior art device is specifically adapted for the construction of wooded pallet structures. Generally all the known prior art devices for construction pre-fabricated wooden structures must have the individual members thereof placed in the jig assemblies by hand and in some cases cut and sized by hand in place before the fixtures of the jig are tightened so the individual members nailed together. Also, these prior art devices utilize a great deal of hand work in nailing the several members of the structure together which is time consuming and tedious as well as involving a high labor cost since a great number of people are necessary to operate such a device at a substantially productive and profitable rate.

In one preferred specific embodiment, a method and means for making a wall section is provided including an assembly line type operation with a carriage having a jig apparatus thereon movable through a plurality of machines for inserting members in the jig apparatus, securing the members together, placing sheeting material on the members, securing it to them and another machine for placing windows in the wall section. The apparatus includes provisions for removal of completed wall sections from the carriage and returning the carriage to the start of the assembly line for returning therethrough. The apparatus for making a wall section is substantially all automatic with the members placed in the carriage by machines; the individual members secured together by automatic nailers; the sheeting material placed on the joined members by a machine and secured thereto by an automatic nailer; the window hole or holes cut by saw machines; windows placed in the wall section by a machine; and the windows secured by an automatic nailer. The carriage has provisions for selectively changing the individual positions of members thereon remotely to provide for constructing different designs of structures. The method of making a wall section accompanies the apparatus therefor and involves the steps of automatically placing the individual wall members, securing them together, placing sheeting material on the secured members and securing same and placing a window in the wall section if desired and removal of the completed wall section from the apparatus. The method of making a wall section is sub-

stantially carried out by the apparatus with hand operations involved only in supplying the apparatus with a stock of precut members.

One object of this invention is to provide a method and means for making a wall section overcoming the aforementioned disadvantages of the prior art devices and methods therefor.

One other object of this invention is to provide an apparatus for making a wall section of the prefabricated type with the apparatus having a carriage movable through a plurality of machines to place individual members of the wall section on the carriage, secure the members together and remove the completed wall section from the carriage.

Another object of this invention is to provide an apparatus for making a wall section of the prefabricated type having a carriage which receives and supports stud members and plate members of the wall section, the carriage having a plurality of clamp devices closable when the stud member is placed therein for securing the stud members, and the carriage having a clamp apparatus to hold in a secured position the plate members transversely at the end of the stud members.

Another object of this invention is to provide an apparatus for making a wall section of the prefabricated type, the apparatus having a carriage with a plurality of remotely controllable clamp devices to be selectively positioned for the construction of wall sections and variously spaced and placed stud members.

Another object of this invention is to provide an apparatus for making a wall section of the prefabricated type, the apparatus having machines for placing stud members and plate members on the carriage; automatic nailers for securing the stud members and plate members together forming a frame; saws for cutting notches in the stud members for header members and cripple members for windows; machines to place header members and cripple members in the slotted stud, machines to place sheeting material on the secured plate and stud members; automatic nailers to secure sheeting to the frame of the stud and plate members; saws to cut apertures in the sheeting for windows; a machine to place prefabricated windows in the wall section; automatic nailers to secure windows to the wall section; and a lifting apparatus to remove the finished wall section from the carriage so the carriage can be returned to the start of the assembly line.

Yet, another object of this invention is to provide a method of making a wall section of the prefabricated type with the method generally including the steps of passing a carriage through a plurality of devices which place members of the wall section on the carriage securing them together and then removing the finished wall section and returning the carriage to the start of the assembly line for a repeat operation. Yet, a further object of this invention is to provide a method of making a wall section of the prefabricated type which is compatible with the above described apparatus for making a wall section; the method comprising the placing stud members and plate members together and securing them together, placing sheet material on an upper surface of the secured frame of the stud members and plate members, securing the sheet material to the stud and plate members, removing the wall section from the carriage, cutting an aperture in the sheet material and placing therein a window if desired, and removing the wall section from the support.

Various other objects, advantages, and features of the invention will become apparent to those skilled in the art from the following discussion taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a strip diagram numbered 1 to 15 outlining the steps of the method associated with the apparatus of this invention;

FIG. 2 is a side elevation view of the complete assembly line apparatus in two segments showing the carriage at the start of the assembly line and showing in dashed lines at the end of the assembly line a frame raising apparatus;

FIG. 3 is a top plan view of the carriage on a supporting track;

FIG. 4 is a side elevation view of the carriage on a supporting track;

FIG. 5 is an end elevation view of the carriage on the supporting track;

FIG. 6 is a side elevation view of a stud holding clamp in the carriage side member with the carriage side member shown in cross-section;

FIG. 7 is a top plan view of the stud holding clamp in the raised and closed position;

FIG. 8 is a transverse sectional view of the carriage taken on line 8—8 showing the plate holding clamp;

FIG. 9 is a schematic diagram of the electrical fluid apparatus used to control the holding clamps shown in FIG. 6 and FIG. 8;

FIG. 10 is an enlarged cross-sectional view of the stud dispenser machine stud dropping passageway and adjacent portions of the machine;

FIG. 11 is a side elevation view of the stud dispensing machine and a portion of the tracks;

FIG. 12 is a shortened top plan view of the stud dispensing machine shown in FIG. 11;

FIG. 13 is a side elevation view of the stud end piercing clamp member of the lower stud clamp portion of the stud dispensing machine;

FIG. 14 is a side elevation view of the stud release clamp member of the upper stud clamp portion of the stud dispensing machine;

FIG. 15 is a side elevation view of the saw machine used for cutting the header members from lumber stock;

FIG. 16 is an end elevation view of the ejector machine used for ejecting the plate members and header members for placing the members on the carriage;

FIG. 17 is a top plan view of the saw structure and ejector machines shown in FIGS. 15 and 16 over a narrowed portion of the track;

FIG. 18 is a side elevation view of the saw and ejector machines alongside a narrowed portion of the track, the ejector shown loaded with boards for ejection from the apparatus onto the carriage;

FIG. 19 is an end elevation view of the nailer machine used to nail the plate members to the stud members with a portion of the carriage adjacent thereto and shown in dashed lines;

FIG. 20 is a carriage side elevation view of an end portion of the nailer machine shown in FIG. 19;

FIG. 21 is an end elevation view of the saw machine used to cut notches in stud members for header and cripple members, the machine shown over a portion of the tracks;

FIG. 22 is a narrowed carriage side elevation view of the saw machine shown in FIG. 21;

FIG. 23 is a narrowed top plan view of the saw machine shown in FIGS. 21 and 22;

FIG. 24 is a narrowed carriage side elevation view of the nailer machine used to nail header members and cripple members to stud members, the machine shown over a portion of the tracks;

FIG. 25 is a narrowed top plan view of the nailer machine shown in FIG. 24;

FIG. 26 is a side elevation view of the sheeting material placer machine shown over a section of the track and showing a portion of the carriage;

FIG. 27 is a narrowed top plan view of the sheeting material placer machine over a section of the track;

FIG. 28 is an end elevation view of the saw machine used to make longitudinal cuts in the sheeting material for windows, the machine shown over a portion of the tracks;

FIG. 29 is a narrowed carriage side elevation view of the saw machine shown in FIG. 28;

FIG. 30 is a narrowed top plan view of the saw machine shown in FIGS. 28 and 29;

FIG. 31 is a narrowed top plan view of the saw machine used to make transverse cuts in the sheeting, for windows, the machine shown over a portion of the tracks;

FIG. 32 is a side elevation view of the upper portion of the saw machine shown in FIG. 31, showing the saws and saw moving portions of the machine;

FIG. 33 is a narrowed carriage end elevation view of the window placer machine shown over the carriage and its supporting tracks;

FIG. 34 is a side elevation view of the traveling window support clamp portion of the window placer machine shown in FIG. 33;

FIG. 35 is an end elevation view of the window nailer machine shown over a portion of the tracks;

FIG. 36 is a narrowed top plan view of the window nailer machine shown in FIG. 35;

FIG. 37 is an enlarged side elevation view of the nailers and supporting structure portion of the window nailer machine shown in FIGS. 35 and 36 showing the upper portion of a window in dashed lines in contact with the nailer shoes;

FIG. 38 is a side elevation view of the sheeting nailer machine shown over a segment of the track;

FIG. 39 is a narrowed carriage end view of the sheeting nailer machine shown in FIG. 38 and shown over the carriage with the nailer shoes contacting a wall section structure on the carriage;

FIG. 40 is an enlarged side elevation view of the assembly line end portion showing the carriage on the track end section with the end section in a raised position, a wall section raised above the carriage by the hoist, and in dashed lines the wall section on the carriage and the track end section in a lowered return position;

FIG. 41 is a sectional elevation view of a side of the carriage frame showing a trigger pin assembly and a portion of a plate clamp;

FIG. 42 is a narrowed end elevation view of the sheeting material tacker machine with the carriage having a wall section shown therein;

FIG. 43 is an end elevation view of the sheeting material tacker machine shown in FIG. 42.

The following is a discussion and description of preferred specific embodiments of the method and apparatus for making a wall section of this invention, such

being made with reference to the drawings, whereupon the same reference numerals are used to indicate the same or similar parts and/or structure. It is to be understood that such discussion and description is not to unduly limit the scope of the invention.

In referring to the drawings and in particular to Sheet 1 thereof, such shows in FIG. 1 a diagram generally indicated at 11, enumerating and identifying the several steps of the process of making a wall section of this invention which is carried out by the apparatus shown in FIG. 2. FIG. 2 shows a side elevation view of the assembly line like apparatus generally indicated at 10 of this invention. The apparatus 10 includes a carriage 12 movable on tracks 14 through a plurality of separate machines which place wooden members on the carriage, nail them together forming a frame, place sheet material on the frames, cut holes in sheeting material for windows and place windows therein nailing same in place. The plurality of machines in the apparatus includes a stud placer machine 16 adapted to place stud members transversely in holding clamps on the carriage 12; a plate placer machine 18 adapted to place plate member at the ends of a stud members in holding clamps on the carriage 12; a nailer machine 20 adapted to nail through the plate members into the ends of the stud members; the saw machine 22 to cut notches in the stud members for placement of header members and cripple members at a window location; a header placer machine 24 adapted to place header members in notched portions of the stud members; and cripple placer machine 26 adapted to place cripple members in notch portions of the stud members; a nailer machine 28 adapted to nail through the header members and cripple members into the studs for securing the header members and cripple members to the studs; a sheet material placing machine 30 to place sheets of wall covering material on the upper surface of the frame formed by the plate members and stud members; a sheet material tacker machine 32 adapted to nail through the sheet material at the corners thereof securing same to the plate members; window saw machines 34 and 36 adapted to make transverse and longitudinal cuts respectively through the sheet material to form an aperture therein to receive a prefabricated window assembly; a nailer machine 38 to nail through the sheeting material into the plate and stud members to secure the sheet material thereto; a window placer machine 40 adapted to place prefabricated window assemblies in the aperture cut through the sheeting material a nailer machine 42 to nail through the window frames and sheeting material to secure the prefabricated windows to the stud and header members hoist 44 to remove the finished wall section from the carriage 12; and lifts 46 and 47 at the finished end and at the start end of the assembly line 10 to raise and lower the end segment of the tracks 14 for transfer of the carriage 12 between the sets of rails 48 and 50 from the finished end of the assembly line to the beginning of the assembly line 10.

The assembly line apparatus 10 is preferably arranged in an elongated line with the plurality of machines positioned in an end-to-end relationship. The tracks 14 consist of two sets of tracks, one directly above the other. The upper set of tracks has a pair of rails 48 and provides support for the carriage 12 as it moves through the machines where operations are performed in making the wall sections. The lower portion of tracks is preferably positioned directly beneath the

upper set of tracks and has a pair of rails indicated at 50. The second set of tracks or the lower tracks are used for a carriage return from the end of the assembly line to the start of the assembly line. The rails 48 of the upper tracks are supported by the structure of the several machines and can be supported by a plurality of support posts or uprights along the length thereof. The rails 50 of the lower track can be attached to the floor on which the plurality of machines set or they can be supported from the machine structures in a spaced relation to the upper track. The starting end segment of the track and the finished end of the track are preferably alternately connectable between the upper track and lower track for moving the carriage between tracks at the beginning and end of the operation. The specific structure of the track end segment and lifts will be discussed hereinafter in conjunction with the finished end portion of the assembly line apparatus 10.

A carriage 12 is shown in detail in FIGS. 4 through 9 on Sheet 2 of the drawings. The carriage 12 has a rectangular frame structure indicated at 54 which is formed of a plurality of hollow members. The carriage frame 54 has end members 58 and 60, side members 56 and 58, and end members 58 and 60 connected therewith the end member 60 is at the normally forward end of the carriage 12. Two pairs of cross-bracing members with the members thereof indicated at 57 and 59 join in the portions of the carriage frame 54 to the center portion thereof to provide a substantially rigid frame structure; however these braces can be eliminated if the carriage can be constructed sufficiently rigid without them. Preferably, the carriage 12 is constructed in the form shown in FIG. 3 with the longitudinal axis thereof substantially elongated relative to the transverse axis thereof. Wheel support members 62 extend downward from the carriage frame side members 56 and 58 to support the wheels 64 on an axle 66 for movement of the carriage 12 on the tracks 14. Preferably the wheels 64 are flanged wheels as shown in FIG. 5 with the flange thereof on the inner side thereof to extend over the inner portion of the rails 48. The wheels 64 are preferably rigidly secured to the axle 66 to insure an even motion of the carriage 12 as it moves on the rails 48 of the tracks. An electric motor 65 is mounted with the carriage frame 54 and connected with an axle by a drive apparatus 67 for propelling the carriage 12 on the tracks 14. The motor 65 is preferably reversible so it will move the carriage in a forward or reverse direction.

The carriage frame side members 56 and 58 are preferably rectangular hollow members as shown in FIGS. 6 and 8 in order to provide a cavity therein to accommodate the stud clamp apparatus. The carriage frame end members 58 and 60 are preferably channel-like members to receive and support movable portions of the plate clamp apparatus. FIGS. 6, 7 and 8 show in detail a typical stud member clamp, indicated generally at 70 of the stud clamp apparatus. The stud clamp apparatus has stud member clamps positioned at regularly spaced intervals along the carriage frame and side members 56 and 58. These regularly spaced clamps 70 are adapted to support opposite ends of stud members preferably, the stud clamp members are positioned every 5.333 inches along the carriage frame side member 56 and 58 so that a stud member can be supported by stud clamps with its elongated axis being transverse to the elongated axis of the carriage 12. The stud clamps 70 are con-

structured so they will open when raised in order that a stud member can be dropped vertically into the clamp and the clamp will close to the position shown in FIG. 6 with the jaws thereof pressing on the sides of a stud member securing same in the clamp. The stud clamps are mounted in the hollow side members to be extendable when needed. As shown in FIG. 6 the side members have a bottom member 72 and the top member 74. The stud clamp 70 has a piston and cylinder lifting member with the cylinder indicated at 76 and the piston indicated at 78. The clamp 70 has a fixed side member 80 attached to a base 72 on the upper end of the piston 78 with a lower inwardly extending ledge portion 84 and a movable or pivotable side member 86 mounted with the base 72 at a pivot joint 88. On the pivot side of the clamp a guide member 90 extends below the pivot joint 88 and a stop member 92 extends above the pivot joint 88 to limit pivotable movement of the pivotal clamp side member 86. On the upper end portion of the pivotable clamp side member 86 a threaded rod member 94 extending therefrom and has a weight 96 thereon. When the clamp 70 is extended and no stud member is in the jaws thereof it will open with the pivotally mounted side 86 resting on the stop member 92, (such position is not shown in the drawings). In the closed position, shown in FIG. 6, a stud member indicated by the dashed lines and the numeral 98 is placed in the jaw of the clamp 70 with the jaw members 80 and 86 in contact with them. As the stud member 90 is dropped into the clamp, the pivotable side member 86 rotates about the pivot point 88 to close the clamp into the position shown in FIG. 6. FIG. 7 shows a top view of the stud clamp 70 in the closed position without a stud member and the jaw thereof. In the open position without a stud in the jaw of the clamp it will move by itself to assume the described open position. The upper carriage side member 74 has an opening 99 and a recessed portion with a recessed portion formed by a vertical portion 100 and a horizontal portion 102 as shown in FIG. 6 to enclose the clamp and counter weight 96 when the stud clamp 70 is in the retracted position. When the clamp 70 is in the open position the guide 90 and fixed clamp side member 80 can contact sides of the opening 99 to prevent rotation of the clamp and the pistons 78 relative to the cylinder 76 and the carriage frame 54 thereby maintaining the clamps 70 in a proper position to receive a stud when the clamp is raised.

Raising and lowering the stud supporting clamps 70 is accomplished by an air operated actuator control system within the hollow side members 56 and 58. A high pressure air supply line 106 connected with the source of air pressure and used to operate piston and cylinder actuator devices mounted with the clamps 70. Preferably the air line of 106 is connected with the source of air of a relatively high pressure by a flexible conduit such as a hose that can be joined with and pulled by the carriage 12 as it moves in the assembly line. A solenoid operated two position valve 108 is connected with the cylinder 76 by a conduit 110. A T-fitting 112 joins the air line 106 to the unit of the solenoid operated valve 108. The valve 108 has an exhaust port 114 used to discharge air for retraction of the piston 78. An electrical solenoid 116 with wires 118 connected thereto operates the valve. The valve 108 opens when the solenoid 116 is energized to pass air from the air line 106 into the cylinder 76 for raising the clamp

70. Preferably de-energizing the solenoid 116 opens the valve's discharge port 114 and allows air in the cylinder 76 to be discharged into the atmosphere thereby lowering the clamp 70. FIG. 9 shows a schematic diagram of a portion of the air-electrical control system with the valve 108, solenoid 116 and air line indicated by the respective numerals and including a switch 120 connected between a power source 122 and the solenoid. The plurality of the stud supporting clamps and other electrically controlled devices of this invention will be described hereinafter are preferably controllable from a single control point. FIG. 3 shows in the lower left hand portion thereof a control panel 124 having a plurality of switches which is connected by a cable 126 to the frame of the carriage. Preferably the control apparatus has switches to individually activate each of the plurality of solenoid actuated devices on the carriage and the control panel can be moved with the carriage and carried therewith through the assembly line or it can be remotely mounted and connected by a cable which is pulled with a carriage 12 through the assembly. The control panel 124 shown in FIG. 3 is intended to illustrate the connection of a control apparatus with the carriage 12 and does not necessarily represent the specific control apparatus necessary to control all the plurality of solenoid activated devices on the specific carriage 12.

The carriage 12 has a plate member clamping apparatus generally indicated at 130 adapted to support plate members and the ends of the stud members and pull same into contact therewith for retaining same in a rigid position during the assembly line operation. The plate member clamping apparatus 130 includes clamping bar members 132 mounted transversely with the carriage frame 54 having clamp end members 134 and spacer members 135 on the exposed outer ends thereof, clamping bar member supports 136 extending longitudinally through the frame supporting the inner ends of the clamping bar members 132 and a plurality of piston and cylinder devices 138 connected between the clamping bar support members 136 and the inner side of the carriage frame 54. The clamping bar members 132 are moved inward and outward relative to the center of the carriage frame 54 to move the clamp end members 134 inward and outward to contact the plate members when placed on the carriage 12. The clamping bars support members 136 extend the length of the carriage 12 and are supported at their ends in channel-like frame end members 58 and 60. Each of the clamping bar members 132 is rigidly secured on its inner end to the clamping bar support member 136 and slidably supported in a bearing 140 at the side members. FIG. 8 shows in detail the side members 58 and a plate clamp. Movement of the clamping bar support members 136 is accomplished by the pistons and cylinder devices 138. The pistons and cylinder devices 138 are shown in FIG. 3 with the cylinder portion secured to the support members 136 and the piston end portion secured to the inner side of the frame 54. The outer end portion of the clamping bar is preferably constructed as shown in detail in FIG. 8 with the spacer member 135 connected between the end of the bar 132 and the upright clamp member 134. The spacer members 135 are used in operation to support the plate members at the same vertical level as the stud members. As shown in FIG. 8 the upper surface of the side member 58 and the upper surface of the spacer member 135 are in the

same plane. When the carriage 12 is in use and moving through the assembly line, the plate clamp apparatus has a clamping bar 132 extended substantially from the carriage frame 54 with the clamp end plate members 134 pulled into contact with the outer side of the plates and kept in position by the piston and cylinder devices 138. Preferably, the plate clamping devices are constructed to extend approximately four feet from the edge of the carriage thereby enabling the carriage end assembly line apparatus to produce a wall section of approximately 14 feet in width or height. Control of the piston and cylinder devices 138 of the plate clamp apparatus 130 is accomplished by an electrically actuated air control system having a control valve connected with the air line in the frame side members 56 and 58. The specific solenoid actuated control valve for the plate clamp apparatus 130 is not shown in the drawings; however, such requires only a single control valve similar to the one shown in FIG. 6 and described in conjunction therewith as the plurality of piston and cylinder devices 138 must move together in a uniform operation. When the carriage is in use and the plate clamp apparatus 130 is in contact with plate members and a constant pressure must be maintained in the operating cylinders so the clamp apparatus 130 will remain in a fixed position.

An additionally control apparatus which is a part of the carriage 12 is a plurality of solenoid operated trigger pins which are extendable from the outer side of the carriage frame side members 56 and 58 and are used for controlling operation of the plurality of machines in the assembly line. FIG. 41 on Sheet 10 of the drawings shows in section a side member of the carriage frame 54 and a solenoid actuated trigger pin apparatus, generally indicated at 150. The solenoid actuator trigger pin apparatus 150 is preferably mounted in the hollow confines of the frame side members in a lower portion thereof as shown and is attached to the bottom 72 frame side member. The frame side members have a bottom 72, a top member 74, an outer side 52 and an inner side 154. The solenoid actuator trigger pin apparatus 150 has an electrically actuated solenoid 156 with a trigger pin 158 extendable thereby through an aperture in the outer frame side 152. The solenoid 156 is connected by wires 160 to the control apparatus previously described in conjunction with the stud holding clamps 70. The solenoid actuated trigger apparatuses 150 are preferably individually and selectively controllable to extend or retract the pin members as desired. Preferably the solenoid actuator triggers 150 are positioned adjacent to the stud holding clamps 70 and are in the same relative position for each set of clamps so the trigger pin member 158 of each such trigger apparatus will be in the same position relative to the fixed side portion of the jaws of the clamps 70 and such is necessary for proper and precise operation of the assembly line apparatus 10 of this invention. The solenoid 156 has an induction coil therein adapted to produce an electromagnetic field to influence a magnetic element on the trigger pin 158 which will cause it to be extended or retracted depending upon the direction of the flux flow of the magnetic field. FIG. 41 shows the trigger pin member 158 in the extended position; in the retracted position the outer end of the pin member is preferably flush with the frame side 152. The pin member 158 in the extended position extends substantially from the frame side member 152 so during use in the

assembly line control switch actuator levers on several of the plurality of machines in the assembly line can contact the pin to activate the switches and in turn control the machines. The specific machines controlled by the trigger pin apparatus is indicated with the discussion of the particular machines. The relative spacing of the solenoid actuated trigger pin device 150 and the stud member holding clamp 70 is shown in FIG. 7 wherein the trigger pin 158 is extended from the side member 152 in a position substantially spaced from the fixed jaw side of the clamp 70 so in normal forward motion of the carriage 12 the trigger pin 158 will precede the clamp apparatus 70.

On the normally forward end portion of the carriage 12, a sheet material stop apparatus 164 is attached. The stop apparatus 164 has an arm member 166 extending forwardly and upwardly from the forward carriage end member 60 as shown in FIGS. 3, 4 and 5. An adjustably positionable stop member 168 is mounted through the upper end portion of the arm 166. The stop member 68 is mounted in a generally horizontal position extending through the arm 166 and has a head or enlarged portion of the side thereof as shown in FIGS. 3 and 4. The stop is adjustable in its position and relative spacing from the arm 166. The stop 168 is spaced above the stud holding clamps 70 to catch and stop the forward edge of sheeting material placed on the stud and plate frame work as sheeting material is added to the structure of the assembly line operation. The stop 168 is adjustable to allow for sheeting material to be aligned exactly with the edge of the end stud or to overhand the edge of the end stud as desired by the user. Adjustment of the sheeting materials stop and is done before a wall section started. Two of the stops 168 are provided to provide for catching to substantially spread portions of a sheet of material, this is desirable as a single sheet of material is normally sized to span the entire height of a wall section and is approximately 4 feet in width. The succeeding segments of sheeting material placed on the plate and stud frame work weld about the trailing edge of the first sheet placed on the carriage 12.

The stud placing machine 16 is shown on Sheet 3 of the drawings in FIGS. 10 and 14. The stud placing machine 16 is the first machine in the assembly line 10 and is constructed to, in operation, place stud members in the stud holding clamps 70 on the carriage 12 as the carriage 12 moves through the machine. The stud placing machine includes a frame 170 upon which a quantity of studs, indicated at 172, are placed for removal by the removal apparatus 174 that is mounted with a vertical frame 176, an upper stud clamp and stud turning device 178 and a lower dispensing clamp 180. The frame structure 170 upon which the studs 172 are placed is transverse to the assembly line and is constructed to receive a bundle of precut stud members thereon with a bundle in a rectangular form as shown. A platform 182 on the forward side of a frame provides access to the frame 170 for placing bundles of studs thereon. The removal apparatus 174 moves up and down on the vertical frame 176 and is supported on both sides of the machine. The removal apparatus 174 is constructed with similar side members 174 on the sides thereof with the side members 184 being mounted with the frame 176 and movable up and down in a track thereon. The side members 184 are raised and lowered by a cable apparatus 188 powered by a motor 186. On the side members 184 is mounted the stud removing

portion of the apparatus which is similar on both sides of the machine. The removal device includes an elongated puller bar member 190 having a notched upper portion and a catch on the bottom thereof as shown in FIG. 11, a ratchet member 192 operated by a motor and drive apparatus 194. The catch 91 hooks over the edge of the end most stud of the top row so that row of studs can be pulled by the bar 190. A top of the bar 190 is notched to receive the pointed portion of the ratchet member 192 with the notches in a spaced relation to the width of the stud members. The ratchet drive apparatus 194 has a motor and appropriate gearing so as to extend the ratchet member and retract the ratchet member upon command from the control system of the machine to move the bar member 190 in order to move or pull the studs one at a time into the upper clamp 178. In continuous operation of the stud dispensing machine 16 the bar 190 is moved across the bundle of studs 172 until the last stud in the roll had been dispensed, then the arm is extended in the same manner in which it is retracted, and then the removal apparatus 174 is lowered to the next row of studs whereupon the removal operation is continued.

FIG. 10 shows in detail a portion of the upper clamp apparatus taken on FIG. 12 showing a quantity of studs in the opening through which the studs pass. FIG. 14 shows the holding and release member of the upper clamp 178. The upper clamp apparatus 178 has an upright member 196 on the side thereof adjacent to the bundle of studs 172 with the upright member terminating at the bottom of the top row of studs indicated at 198; this upright member holds the rows of studs below the top row 198 in place as the top row is pulled over the second row. Another upright member 200, in the center portion of the upright members 196 and 200 a pair of protrusions 202 and 204 extend inward from the inner sides thereof respectively as shown in the combination of FIGS. 10 and 12. The space between the upright members 196 and 200 provides an opening, indicated generally at 205 for the studs to pass. At the end of the opening 205 and the ends of the removal apparatus a stud catch is provided to catch the end of the stud members when they are pulled into position to pass through the opening 205. FIG. 14 shows in side elevation the stud end catch arm indicated at 206. The stud catch arm 206 has an inwardly extending portion 208 aligned with the top of the upright member 196 to receive the end of a stud such as the stud indicated at 210 in FIG. 10, to hold same until the proper time for its release. The stud catch arm 206 has a support arm 212 with the extended portion 208 on its lower end, a pivot attachment 214 on the upper end of the support arm 212 and a second arm portion 216 used for rotation for the support arm 212 about the pivotal attachment 214. Preferably the stud catch arm 206 is pivoted by an electrical solenoid (not shown in the drawings). In operation the catch arm 206 supports the ends of the stud 210 when it is moved to the opening 205. As the stud member to be dropped it is moved by the removal apparatus 174 into the area of opening where the ends of the stud are supported on the extended catch portions 208. As the stud is dropped the center portion of the stud will strike either of the protrusions 202 or 204 which will in turn rotate the stud about its elongated axis so it will fall with the crown portion thereof up and move downward into the lower clamp apparatus 180 on the bottom portion of the stud placing machine 16. As

a stud is passed through an opening 205 the removal apparatus 174 has the ratchet drive motor 194 actuated by the control system of the machine to pull the top row of studs 198 so as to place another stud on the stud end catch as described. The lower clamp apparatus 180 has a chute 220 supported on the frame 170 to receive therein two stud members in a vertical position one above the other for releasing the same into the stud supporting clamps 70 on the carriage 12. A guide 222 extends upward and outward from the chute 220 to guide the studs in downward motion from upward clamp apparatus 178 so they will pass properly into the opening of the chute 220. The stud end catch for the lower clamp apparatus 180 as shown in FIG. 13 and generally indicated at 224. The stud end clamp 224 is supported at a pivot 226 from the walls of the chute 220. The stud end clamp 224 has an upper portion 228 with a plurality of spike members 229 extending therethrough and it has a lower L-shaped portion 230 to support the lower stud member with the extended portion thereof 232 being below the end of the stud member. Preferably, the stud end clamp 224 is shaped as shown in FIG. 13 and pivotable about its center portion 234. In use the stud end clamp 224 is in a position shown in FIG. 13 with the ends of one stud resting on the extended portion of the L-shaped portion 232 of its lower portion and the second stud rests on top of the first stud. As needed, the end clamp 234 is rotated about its pivotal mount 236 to release the lower stud and grasp the upper stud with the spikes 229. After the lower stud is dropped away, the clamp is rotated back to the position shown in FIG. 13 whereupon the upper stud drops to the lower portion of the clamp and is retained by the extended portion 232 and another stud is dropped from the upper clamp assembly 178 to rest on top of the stud now in place at the lower clamp assembly 180. Rotation of the stud end clamp 224 is preferably accomplished by a solenoid actuator, (not shown in the drawings).

The control system for the stud placing machine 16 is electrical and is initiated in operation as the carriage 12 moves under or through the machine 16; it is specifically constructed to be actuated by the stud holding clamps 70 on the carriage 12. The control apparatus includes control switch 236 mounted with the chute 220 on the lower clamp apparatus 180. The control switch has an arm 238 with an end member, such as a roller 240 on the end thereof. The control switch arm 238 is positioned so that it will strike the forward jaw member 80 of the stud holding clamps 70 when they are in the extended position as shown in FIG. 11. The control switch 236 and arm 238 can be adjusted in position so studs will be dropped at the proper time to pass correctly into jaws of the stud holding clamps 70. The switch 236 is actuated only when a stud holding clamp is in the raised position. Therefore, no studs will be dropped unless the clamps are raised to receive them. Sequencing of the other electrical controls for this machine 16 associated with the stud removal apparatus can be connected with the control switch 236 as it controls the time at which the studs are dropped from the machine.

FIGS. 16, 17 and 18 show in detail the structure of the plate placer machine 18 which is the second machine in the assembly line 10. The plate placer machine 18 is the machine which places plate members in the plate holding clamps 130 on the carriage 12. The plate

placing machine 18 is shown in FIGS. 17 and 18 on one side of the assembly line to illustrate the features of the machine. The assembly line 10 should have two such machines, one on each side of the line positioned to be on opposed sides of the carriage 12 in an opposed relation for placing plate members on both sides of the carriage 12 simultaneously. Along with the plate placer machine 18 is a saw machine 244 positioned adjacent to the plate placer machine and used to cut a stock of material for the plate placer machine. FIG. 15 shows the saw machine 244 inside view.

The plate placer machine 18 includes a frame 246 in the form of a table like structure having an ejector device 248 to move a quantity of plate members 250 for dispensing. The frame 246 has a planar top surface 252 on which the quantity of plate members 250 are laid in a flat position as shown in FIG. 18. The ejector device has a motor drive eccentric moving an arm 254 and ratchet 256 mechanism which is operable to slide the plate members over the top 252 one at a time to the dropping passageway, indicated generally at 258. The dropping passageway 258 is an opening with a catch device at opposite ends thereof to receive a plate member to the drop and hold same until the proper time for its dispensing of same. The passageway to 258 has side members 262 and 264 with interior protrusions 266 and 268 respectively which are adapted to contact the crown side or curve side of the plate member so the plate member will drop with the crown portion thereof up. The catch in 260 are similar to those shown in FIG. 14 and generally indicated at 206 as described in conjunction with the stud dispensing machine 16. The catch device 260 grasp the ends of the plate member to be dropped holding same in position until actuated to release the plate member. Preferably, the catch devices 260 are solenoid actuated by electrical controls and operated to release the plate member through the passageway 258. As shown in FIGS. 17 and 18 the top 252 of the frame 246 is extended from the upright portion of the frame; this is necessary so the point from which the plate members are dropped is aligned properly with the position on the carriage on which it could be dropped. Preferably, the frame top 252 is adjustable laterally from the upright portion of the frame 246 so the drop point can be adjusted accordingly. Shown in dashed lines on the right hand portion of FIGS. 17 and 18 is the passageway portion of the frame top, such being indicated generally at 270. Preferably, the frame tops extended end portion 270 can be adjusted over a wide range so as to be extendable over the center portion of the carriage 12. When in use, the opening 258 is positioned relative to the carriage as shown in FIG. 18 wherein a portion of the carriage is shown in dashed lines. The plate member to be drawn passes through the opening to the end portion 258 and drops into the plate member holding clamp apparatus adjacent and adjacent to the end of a stud 272 already partially supported by the block member 135 of the plate member holding clamp. Actuation of the plate placer machine 18 is accomplished by the use of a control switch 274 mounted below the frame top 252 and spaced as shown in FIG. 18 to contact the upright end member 134 of the plate member holding clamp. The control switch 274 is preferably positioned at the end of the plate placer machine 18 so the carriage 12 will move into position under the extended portion of the machine and then contact the control switch 274 which actuates the

machine 18. During operation of the plate placer machine 18 the carriage 12 is necessarily stopped and remains stationary until the plate members are dispensed to the carriage.

The saw machine 224 is usable with in conjunction with the plate placer machine 18 and is used to supply precut lengths of material to the plate placer machine 18. FIG. 15 shows the saw machine 224 in a side view and FIGS. 17 and 18 show it in position adjacent to the plate placer machine 18. The saw machine 224 includes a frame structure 278, a top 280 with a saw supporting structure 282 on one end thereof mounting a circular saw 284, and having a measuring stop 286 on the other end thereof. The measuring stop 286 is clearly adjustable to allow quantities of plate members to be cut at different lengths. The saw 284 is supported from the saw supporting structure 282 by a slidable mount 288 so it can be drawn transversely across the top 280 for cutting the board. In use the saw machine 244 is operated by hand wherein a person moves an elongated board 290 over the top 280 moving it against the stop member 286 so the person can move the saw on the slidable mount 288 and cut the board whereupon it can be placed on the adjacent plate placer machine 18 for use. The saw machine 224 is adapted to provide a means of readily supplying the plate ejector machine 18 with a stock of material. An advantage of having the saw 224 next to the plate placer machine 18 is that wall sections of different lengths can be readily constructed since different lengths of plate members easily movable to the adjacent plate placer machine; this saves time, effort and confusion in cutting the proper size and quantity of plate members needed if different lengths of wall sections are to be produced in an assembly fashion.

FIGS. 19 and 20 on Sheet 5 of the drawings shows the nailer machine 20 which is operable to nail through the plate members into the ends of the stud members to secure same together. The nailer machine 20 follows the plate placer machine 18 in the assembly line 10. The nailer machine 20 spans the assembly line transversely extending over the carriage and will operate as the carriage 12 moves slowly therethrough, to nail the plate members to the stud members securing the frame work of the wall section being constructed. The nailer machine 20 includes a frame 294 which supports a pair of nailers 296 on the ends thereof to nail through the plate members into the stud members. The frame 294 has upright ends 298 secured with an upper frame portion 300 that spans the assembly line. A hold down roller assembly is mounted with the outer end portion of the upper frame portion 300 and functions to exert downward measure on the frame formed by the plate members and the stud members to align same properly during the nailing operation. The hold down roller assembly has a roller 302 supported in a yoke 304 that is mounted on a shaft 306 extending vertically through the upper frame portion 300. The shaft 306 supporting the yoke 304 has a spring thereon indicated at 308 to exert downward pressure on the yoke 304 and turn on the roller 302 to press downward on the plate and stud framework to properly align same. The hold down roller assembly insures that the plate and stud framework is in the proper position when nailed as such may be necessary depending upon the amount of warpage if any that is present in the members. FIG. 20 shows a plate member 310 and a stud member 312 in the

proper position for nailing below the roller 302 and supported on the plate member clamp apparatus 130. The nailers 296 are individually indicated at 314 and 316 and are preferably adjustably mounted with the frame structure 294 by a mount (now shown in the drawings) so they may be positioned at the desired position relative to the carriage 12 and relative to the plate and stud framework. The nailers 314 and 316 are preferably mounted in the general position shown to place two nails through the plate member 310 into the end of the stud member 312.

The nailers 296 are preferably pneumatic and are triggered for operation by a control switch 318 mounted with the frame structure 294. The control switch 318 has an actuator lever 320 which contacts the stud members 312 as the carriage moves through the machine 20. As the actuator lever 320 is moved the nailers 296 are actuated accordingly to place the nails. The nailers 296 are not actuated unless a stud member contacts the lever 320 of the control switch 318. Preferably, the control switch and the nailers 296 are sequenced such that the carriage 12 may move slowly through the nailer machine 20 without stopping while the nails are placed in the plate and stud framework. Additionally, it is to be noted that the nailers 296 must be provided with shoes or the like so the nail outlets thereof will pass over the end members 124 of the plate member holding clamp apparatus 130 as the carriage 12 moves through the machine. In the event that it is desirable for the carriage 12 to stop as the nailers 296 are actuated such can be done by connecting the control switch 318 with the nailers 296 and with the propelling motor 65 on the carriage 12 to affect this pause in the operation. As the carriage 12 moves through the nailer machine 20, the nailer on opposite sides of the machine will nail simultaneously to secure opposite ends of the stud members to the plate members.

The nailers 314 and 316 and other nailers shown and described hereinafter are preferably a pneumatic type of nail driving devices well known and widely used in the art of prefabricated construction. The nailing devices generally are constructed to receive a quantity of nails in a strip like form with the shank portions of the nails being parallel and operable to drive the nails as required. The nailing devices can be actuated as the nailer device is pushed against an object such as a board or the device can be actuated by a trigger or the like. In operation of such nailer devices is quite rapid therefore requiring only a minimal pause in motion for the device to be actuated.

FIGS. 21, 22 and 23 on Sheet 5 show in detail the saw machine 22 used to cut notches and the stud members for placement of header members and cripple members at the window locations. The saw machine 22 follows the nailer machine 20 in the assembly line. The saw machine 22 includes a frame structure, indicated generally at 324 which spans the assembly line transversely and has mounted thereon a pair of saws 326 and 327 supported on a saw lifting apparatus 328. The saw lifting apparatus 328 is adapted to raise and lower the saws 326 and 327 for making the appropriate cuts in the stud members of the wall section frame on the carriage 12 as it passes through the saw machine 22. The frame structure 324 includes upright end members 330 on opposite sides of the assembly line connected by a top member 332 to form a rigid support for the saw lifting apparatus. The saw lifting apparatus 328 includes an

elongated saw support member 324 spanning the assembly line and supported on the end by an arm 336 pivotally mounted with the frame end 330. A pair of hydraulic piston and cylinder devices 338 are secured to the frame ends 330 and secured to the arm 336 to pivot same for raising and lowering the saws. The saws 336 and 337 are similarly mounted on the support member 324; they have a motor connected to an elongated arbor which has mounted thereon a plurality of circular saw blades in a side-by-side fashion. The saws 326 and 327 are preferably structurally the same including their mounting with the support member 324 and for description purposes they bear the same numerals. FIG. 23 shows in detail the saw mount, which includes a collar 340 slidably mounted on a supporting member 334, a pair of saw end support members 342 extending from the ends of the collar 340 and secured to the structure of the saw motor and/or blade shield structure. The saws have a motor 334 and an attached elongated blade shield structure 346. The saw motors 324 are provided with an elongated arbor on which a plurality of saw blades or the like can be mounted. For safety reasons the saw blades are partly enclosed in the blade shield structure 346. The saw indicated at 326 has a plurality of blades indicated at 348 and the saw indicated at 327 has a plurality of blades indicated at 350. The width of the cut made by the separate saws 326 and 327 can be changed by varying the blades 348 and 350 mounted therein respectively in order to achieve the desired width of cut in the stud members for placing the header members and cripple members of the wall section frame structure. FIGS. 21 and 22 show the saws 326 and 327 in a lowered position or the position which they assume when making cuts through the stud members. In the raised position (not shown in the drawings) the saws would be raised to a position substantially above the carriage and the wall sections frame thereon.

The saw machine 22 is provided with a control system that will lower the saws into position as required to cut notches in the stud members of the wall section frame as required. The control system for the saw machine 22 has a control switch 352 with an actuator arm 354 that is contacted by the pin members 158 of the solenoid actuated trigger pin apparatus 150 on the carriage 12. The control switch 352 is mounted by a support arm 356 with a frame end member 330 in the position shown in FIGS. 21, 22 and 23. The control system is constructed and sequenced in operation so the saws will be lowered to the operating position slightly ahead of the stud members in order that a uniform cut is made through the stud members as the carriage passes. In operating the control system of the saw machine 22, it is necessary to have a trigger pin in the extended position to initiate the sequence of lowering of the saws and starting of the saw motors 344 and it is necessary to have another trigger pin in the extended position which will contact the actuator arm 354 and cause the saws 326 and 327 to be raised at the end of the cut. During the sawing operation, it will not be necessary for the carriage 12 to stop as it moves through the saw machine 322.

FIG. 1 on Sheet 1 shows a header placer machine 44 immediately following the saw machine 22 and a cripple placer machine 26 immediately following the header placer machine 24. The header placer machine 24 and the cripple placer machine 26 are constructed

and adapted to place the header members and cripple members in the slot formed in the stud members of the wall section frame of the carriage. The header placer machine 24 and the cripple placer machine 26 are constructed substantially the same as the plate placer machine 18 shown in FIGS. 16, 17 and 18 of the drawings and for this reason are not duplicated in the drawings. The header placer machine 24 and plate placer machine 26 are substantially the same as the plate placer machine 18 with the exception that they are substantially shorter longitudinally and the machines top 252 is extended so the header members and cripple members are placed in appropriate portions on the wall section frame. The header placing machine 24 has the machine top extended past the outer edge portion of the carriage, inward relative to the center of the carriage, so as to place the header members in the appropriate notch cut in the stud members particularly at what will be the top portion of the window. The cripple placer machine 26 is constructed with the top portion of the machine extended past the outer edge of the carriage, inward relative to the center of the carriage so as to place the cripple member in the appropriate slot which in the stud members, particularly at the bottom portion of the window.

The control system used with the header placer machine 24 and cripple placer machine 26 uses a control switch similar to that for the saw machine 22 and positioned to contact the trigger pins on the carriage 12 which are used by the saw machine 22 in cutting the notches for the header and cripple members. During operation of the header placer machine 24 and the cripple placer machine 26 motion of the carriage 12 must necessarily be stopped so the header member and cripple members can be properly placed. First, the carriage must stop at the header placer machine 24 so the header member can be properly placed; then the carriage must advance to the cripple placer machine and again stop so the cripple member can be properly placed; and then the carriage can proceed. It is to be noted that a saw machine such as the saw machine 244 shown in FIGS. 15, 17 and 18 can be used with the header placer machine 24 and cripple placer machine 26. The saw 244 or a similar saw machine or machines can be placed adjacent to the header and cripple placer machine 24 and 26 respectively as desired by the user.

FIGS. 24 and 25 on Sheet 6 of the drawings shows a nailer machine 28 which nails through the header members and cripple members into the studs for securing the header members and cripple members to the studs. The nailer machine 28 follows the cripple placer machine 26 in a position with the assembly line 10. The nailer 28 includes a frame structure which spans the assembly line transversely and has mounted thereon two sets of nailers indicated at 362 and 364 respectively. The set of nailers 362 in use secure the header members to the stud members and the other set of nailers 364 secures the cripple members to stud members. Normally in home construction the cripple member is not substantially secured to the stud members; however, in the assembly line production operation of this invention is believed that vibration will cause the cripple members to be displaced from their proper position if not secured. The frame structure 360 includes upright side members 366 and 368 on opposite sides of the assembly line which are connected by a movably mounted upper member 370. The movable mounted

upper member 370 is secured to the upper ends of the frame uprights 366 and 368 by an elevator device which will raise and lower the upper member 370 and the sets of nailers 362 and 364. The elevator devices connecting the upper members 370 and the frame uprights 366 and 368 are similar and are preferably motor driven screw type jacks. The elevator devices include motors 372 mounted above the upper frame member 370 having threaded members 374 that extend through end portions 376 of the upper member 370 and are rotatably mounted in the frame uprights 366 and 368. Rotation of the threaded members 374 by the motors 372 will rotate the threaded members in the upper frame members ends 376 and thereby cause the upper member 370 to be raised or lowered relative to the frame uprights 366 and 368 and relative to the ground. The motors 372 are necessarily reversible in direction of rotation to provide for raising and lowering and selective vertical adjustment of the upper frame member 370.

The elevator devices include motors 372 mounted above the upper frame member 370 connected with threaded members 374 that extend through end portions 376 of the upper frame member 370 and are rotatably mounted in the frame uprights 366 and 368. Rotation of the threaded members 374 by the motors 372 will rotate the threaded members 374 in the upper frame member ends 376 and thereby cause the upper member 370 to be raised or lowered relative to the frame uprights 366 and 368 and relative to the ground. The motors 372 are necessarily reversible in direction of rotation to provide for selective vertical adjustment of the upper frame member 370.

The two sets of nailers 362 and 264 are preferably mounted as shown on the upper frame member 370. The set of nailers indicated at 362 is provided with three nailing devices, indicated at 378 and the other set of nailers indicated at 364 are provided with two nailing devices indicated at 380. The control system for the sets of nailers 362 and 364 is designed so the nailers function only when the header and cripple members are beneath the nailers. In order to accomplish the required control of the nailers a pair of control switches are provided to initiate operation of the nailers as the leading edge portion of the window portion of the wall section moves beneath the nailers so they will function to drive nails through the header and cripple members into the studs along the length of the window portion of the wall section. A first control switch 382 is positioned below the wall section and has an actuator arm 384 positioned to contact the same trigger pins used by the saw machine 22, the header placing machine 24 and cripple placing machine 26. The control switch 382 is supported by a mount 386. Another control switch 388 is positioned above the wall section and depends from the upper frame member 370; it has an actuator arm 390 which will contact the stud members of the wall section as it moves through the machine 28. The second control switch 388 is positioned so the actuator arm 390 thereof will contact and be moved by all of the stud members of the wall section. The control switches 382 and 388 are connected in a series relation so the nailers 378 and 380 will not be actuated until the studs supporting the header and cripple members are beneath same. As the carriage moves into position under the nailers the lower control switch 382 will be actuated by the trigger pin located at the leading edge

portion of the wall sections window portion whereupon the upper control switch 388 will control functioning of the nailers 362 and 364 to pass nails through the header and cripple members into the stud members into each of the studs which are beneath the header and cripple members. As the carriage moves forward and the trailing edge portion of the wall sections window portion passes the lower control switch 382 to the trigger pin at that point will contact the actuator arm 384 causing the control switch 382 to break the circuit thereby forestalling operation of the nailers. In the use of the nailer machine 28 it may be necessary to move the carriage at a slow rate of speed or provide a minimal pause in its forward motion for the nailers 362 and 364 to operate properly in driving the nails. The elevator devices used to raise and lower the upper frame member 370 must necessarily be positioned in the proper vertical relation to the wall section frame structure on the carriage 12 before the carriage moves through the nailer machine 28.

FIGS. 26 and 27 on Sheet 7 of the drawings show in detail the sheet material placing machine 30. The sheet material placer machine 30 is constructed and adapted to in operation place sheets of wall covering material on the upper surface of the wall section frame as it moves therethrough. The sheet placer machine 30 is adapted to place sheets of material which are sized to span the width of the wall section, from the top thereof to the bottom thereof, with the sheets of wall covering material in an edge-to-edge relationship on the upper surface of the wall section.

The sheeting placer machine 30 includes a frame structure which spans the assembly line transversely and has a sheet removal device 394 thereon adapted to remove sheets of wall covering material one at a time from a stack of sheets, indicated at 396, supported on the frame structure 392. The frame structure 392 has frame side portions in an opposed relation on opposite sides of the assembly line indicated generally at 398 which are connected by a joining top portion 400 on which the stack of sheets 396 is placed. The frame side members 398 support the removal device 394. On the outlet portion of the machine 30 the frame structure 392 has an inclined portion 402 on which sheets removed from the stack 396 rest until they are dispensed onto the wall section frame on the carriage. The removal device 394 has a vertical frame structure 404 supporting an elevator like device. A motor 406 and cable apparatus 408 are provided for raising and lowering the elevator type device on the upright frame 404. The elevator type device has a frame structure 410 with a sheet holding member 412 positioned transversely on the rear side of the stack of sheets 396 or the side of the stack of sheets 396 to which the sheets are removed from the stack, a piston and cylinder device 414 connected by a linkage 416 to a sheet puller member 418.

The sheet puller member 418 has a catch 420 on the end thereof to catch the edge of the topmost sheet of the stack for pulling. The sheet puller member 418 is moved by the piston shown in the device 414 as the piston thereof extends. FIGS. 26 and 27 show the piston and cylinder 414 in the retracted position. The sheet puller member 412 is positioned so the upper edge thereof is below the lower edge of the topmost sheet 422 on the stack so when the puller member 418 is moved only the topmost sheet 422 will be slid from the stack. In operation as top sheet is moved the motor of the elevator

type device is actuated to lower the elevator including the sheet puller member 418 so the then topmost sheet of the stack can be removed. Preferably, extension and retraction of the piston and cylinder device 414 is very rapid so the frictional resistance of the top sheet moving against the lower sheet is a minimum. Preferably, the sheeting placer machine 30 has the elevator type devices and sheet pulling members on both end frame portions thereof as shown in FIG. 27 which operate simultaneously in a corresponding relation to remove the sheets from the stack. On the inclined portion of the frame structure, the inclined ramp thereof 402 is adjacent to the frame top 400 which supports the stack of sheets. A sheet catch 424 is provided at the lower end of the incline ramp 402 to catch the sheets removed from the stack and hold them until the proper time for dispensing. The catch 424 is preferably a solenoid actuated mechanism or a suitable equivalent which will lower the catch or rotate same to a position which will allow a sheet, such as the sheet on the incline ramp indicated at 426, to move from the ramp as required. The solenoid actuator for the catch 424 is not visible in the drawings.

The sheet placer machine 30 is provided with a control system to control the operation thereof. The control system includes a start-stop sequence switch 428 mounted with the frame structure 392 at the discharged end portion of the machine. The control switch 428 is connected to control the piston and cylinder device 414 and the catch 424; it has an actuator arm 430 positioned to contact a plate member on its forward edge as the carriage 12 moves under the sheet placer machine 30. The control switch 428 when initially actuated by movement of the arm 430 starts operation of the machine 30 and as the carriage moves through allows the machine 30 to continue to operate; then when the carriage 12 has passed and the arm 430 moves off of the trailing edge portion of the plate member, operation of the machine 30 is stopped. In FIG. 26 is shown the leading edge portion of the carriage 12 positioned under the discharge portion of the sheet placer machine 30 with the switch arm 430 in contact with the leading portion of the plate member indicated at 432. As the carriage 12 moves forward from the position shown in FIG. 26 the catch 424 is lowered and the sheet 426 slides from the inclined portion 402 onto the wall section frame as described.

In the operation of the sheet material placer machine 30 it is initially in the position shown in FIG. 26 and FIG. 27. The control system of the sheet material placer machine 30 when actuated causes the sheet 426 on the incline portion 402 to be released by the catch 424 whereupon it slides into position on the wall section frame of the carriage 12. As the sheet on the incline portion is removed therefrom the sheet puller member 418 is moved to pull the topmost sheet 422 from the stack of sheets 396. As the sheet puller member 418 is moved by the extending piston of the piston and cylinder device 414 the sheet moves over the sheet holder 412 and falls by gravity force onto the incline portion 402. In the assembly line operation the sheets are placed on the wall section frame one after the other in a rapid fashion, and it is not necessary for the catch 424 to stop each sheet and then release same. Preferably, in the placing of the sheets on the wall section frame the first sheet will contact the stop members 168 on the forward portion of the carriage 12 as the car-

riage moves past the discharge portion of the sheeting placer machine 30. The weight of the first sheet placed along its forward sliding motion leaving the frame structure 392 will push the carriage forward thereby making it unnecessary to move the carriage under the power of its motor 65. The succeeding sheets discharged from the sheet placer machine 30 reach the wall section frame and have their leading edge portion contact the trailing edge portion of the last placed sheet and push the carriage 12 forward accordingly. Operation of the sheet placer machine is terminated by the control switch 428 as the actuator arm 430 moves from the trailing edge of the plate member. Upon termination of the sheet placing operation the catch 424 is raised to prevent further sheets from sliding from the inclined portion 402.

FIG. 42 and FIG. 43 on Sheet 10 of the drawings show the sheeting material tacker machine 32. The sheeting material tacker machine 32 follows the sheet material placer machine 30 in the assembly line 10 and is constructed and adapted to in operation nail the corners of the sheets of material placed on the wall section frame to the plate members of the frame at the corners of the sheet. The sheeting material tacker machine 32 includes a frame structure 432 which spans transversely the assembly line 10 and has supported thereon a pair of nailer devices 434. The frame structure 432 supports the nailer device at 434 in position over the edges of the wall section 436 as the carriage 12 moves through the machine. The frame structure 432 has upright end members 438 connected by an upper frame member 440. The nailers 434 are mounted in a depending relation from the upper frame member 440 by individual mounts 442 and 444 with the individual nailers indicated at 446 and 448, respectively. The nailer support mounts 442 and 444 are preferably adjustably mounted with the upper frame member 440 so the nailer can be positioned to drive nails through the edge portion of the sheeting material, indicated at 450, into the wall section of the frame, indicated at 452.

Operation of the nailer machine 32 is controlled so that the nailers 434 are actuated to drive nails through the sheeting material and into the wall section frame at the corners of the sheet sections of the sheeting material. One manner in which the control of the nailers 434 can be accomplished is by using the trigger pin apparatus 150 on a carriage 12. In this manner a control switch 454 having an actuator arm 456 is supported by a mount 458 alongside the carriage so the control switch arm 456 will contact trigger pins on the carriage 12 when they are extended. The trigger pin apparatus 150 on the carriage must have the individual trigger pins extended at points approximately at the position of the corner of the individual sheets so the nailers 434 will be actuated to drive nails at or approximately at the corners of the individual sheets. Preferably, the control switch 454 is positioned below the nailers 434 or in an appropriate position relative to the nailers so that movement of the switch arm 456 will cause the nailers 434 to be actuated. Another manner in which the nailer machine 32 can be controlled is by placing a control switch on the discharge side of the inclined portion 402 of the sheeting placer machine 30 to sense the movement of a sheet from that machine will correspondingly actuate the nailers 434 at the appropriate time to place the nails at or approximately at the corner portions of the individual sheets on the wall section carried by car-

riage 12. During operation of the nailing machine 32 it may or may not be necessary to stop the forward motion of the carriage as the nailers 434 are actuated, depending upon the speed of the carriage and the accuracy needed in placing the nails. Once the carriage 12 has passed through the nailer machine 32 the corners of the sheets of material comprising a sheeting 450 on the wall section 436 are tacked to the wall section frame which will hold the sheets in position as the window hole is sawed in the wall section in the succeeding operations.

A window saw machine 34 is shown in FIGS. 31 and 32 on Sheet 8 of the drawings. The window saw machine 34 follows the sheeting tacker machine 32 in the assembly line 10 and is designed to make transverse cuts in the wall section on the carriage 12 for the window. The saw machine 34 includes a frame structure which spans the assembly line 10 transversely and has upright frames 461 on its opposite ends in an opposed relation which supports a pair of saws 462 mounted to move transversely across the assembly line and over the carriage 12. Each of the frame uprights 461 has an elevator type apparatus thereon that is designed to raise and lower the saws 264 relative to the carriage 12 as it moves through the machine and during operation of the saw machine 34. Each of the frame uprights 461 has spaced legs supporting an upper frame member 464. The saws 462 are supported from a raisable and lowerable support member 466 from the frame upper member 464 by threaded turnable members 468 that are connected with and supported by motors 470. The motors 470 rotate turnable members 468 thereby raising and lowering the support members 466 which in turn raises and lowers the pair of saws 462. Each of the pair of saws 462 is supported by a saw advancing device on a rotatable threaded member 472 which extends transversely across the assembly line. The rotatable threaded members 472 are supported in bearing mounts 474 on the saw support member 466. The pair of saws 462 is comprised of two circular saws each having a motor 476 to rotate a blade 477 which is enclosed in a shield 478. Structural support for the saws 462 is a mount with the saw advancing device 480 supporting same on the rotatable threaded members 472. The saw advancing device 480 provides the means of rotating the rotatable member 472 for moving the saws 462 in the translating motion across the assembly line. The individual saw structures of the pair of saws 462 are connected by a link 482 which will allow the saw advancing devices 480 to rotate the rotatable members 472 and to remain in a stationary position when operating. Rotation of the rotatable members 472 must be done simultaneously so the saws 462 will move together in the transverse motion. Other apparatus can be substituted for the apparatus shown to move the saws transversely across the assembly; if the apparatus is suitable, it will move the saws 462 in unison in the path that is required to make the transverse cuts for the windows.

Operation of the saw machine 34 is controlled automatically to make the saw machine function when the carriage 12 is in the proper position under the machine. The control system of the saw machine 34 includes a control switch 484 mounted alongside the tracks 48 and having an actuator arm 486 to be contacted by the trigger pin apparatus on the carriage 12 as it moves through the machine. The control switch 484 is positioned such that it can be contacted by the trigger pins

which are extended and used previously in conjunction with the saw machine 22, the header placer machine 24, the cripple placer machine 26, and the nailer machine 28. In operation of the saw machine 34, the carriage moves through the machine until the trigger pin contacts the control switch arm 486 at which time the carriage is stopped in position and the saws 462 begin to function. In a cutting operation the saw motors 478 are started and the blades 477 are lowered into the wall section cutting through the sheeting material and then the saws 462 are moved by the saw advancing devices 480 on the rotatable members 472 transverse to the assembly line to make the cuts. Motion of the saws 462 across the carriage 12 is controlled by suitable means to limit the range of motion of the saws. One such apparatus for limiting motion of the saws 462 is to attach limit switches as to the sides of one of the saw units which contacts stop members attached to the rotatable support members 472 with the switches being connected to stop and start the saw advancing devices 480. Once the cuts are made through the sheeting of the wall section, the saws 462 are raised by the motors 470 and stopped and the carriage 12 moves on through the machine or to the next position where a window is to be placed.

In the event that a wall section is being produced which is to have a door therein, the saw machine 34 can be used to make the necessary transverse cuts in the wall section. The saw machine 34 is preferably actuated by the trigger pin apparatuses 150 on the carriage 12 to make appropriate cuts for the door aperture. Motion of the saws 462 across the wall section would necessarily be controlled to start the cuts at the top of the door aperture and terminate same at or before the edge of the wall section which is to be the bottom of the wall. It may be necessary to not cut the plate member at the normally bottom edge of the door so the wall section is not reduced in strength by a large aperture while on the carriage 12.

Another saw machine 36 is shown in FIGS. 28, 29 and 30 on Sheet 6 of the drawings. The saw machine 36 follows the other saw machine 34 in the assembly line 10 and is adapted to make longitudinal cuts through the wall section on the carriage 12 to join the transverse cuts in the wall section for removal of a portion thereof to provide an opening for the window. The saw machine 36 has a frame structure 490 on which a pair of saws 492 are pivotally mounted. The saws 492 are mounted so they can be raised above the wall section on the carriage and lowered into cutting position to make cuts through the sheeting material and stud members of the wall section joining the previously formed transverse cut so the portion of the wall section wherein the window will be inserted is cut out.

The saw machine 36 is provided with the frame 490 which has upright end frame portions 494 on opposite sides of the assembly line in an opposed relation. The frame uprights 494 have top members 496 which are connected by transverse frame members 498 as shown. The transverse members 498 span the assembly line and provide a rigid frame structure. The saws 492 are attached to a non-round rotatable member 500 which is rotatably supported by mounts 502 on an end of the frame upper members 496. The non-round support member 500 is connected by a pivotal linkage 504 to a piston and cylinder device 506 which functions to rotate the rotatable member 500. The rotatable member

500 is rotated or pivoted about its elongated axis as the piston and cylinder device extends and retracts. Mounting of the saws 492 includes a slidable member 508 slidably engaged on the non-round support member 500 with the slidable member 508 being connected with the structure of the saw's motor 510 and blade shield 512. Each of the saws of the pair of saws 492 has a slidable member 508 which is adjustably positionable along the length of the non-round support member 500. The slidable members 508 are constructed with a locking device (not shown) for securing same with the non-round support member 500. Selective adjustment and placement of the saws 492 is accomplished by securing the slidable members 508 with the support member 500. Each of the saws 492 has the blade thereof 514 enclosed within a blade shield 512 for safety reasons. The saw blades 514 are preferably sized to cut through the sheeting material and the stud members so the portion of the wall section forming the window aperture can be completely removed from the wall section once the cutting operation is complete.

Control of the saw machine 36 is accomplished via a control system which functions to lower the saws 492 into cutting position when the carriage is properly positioned therebelow and raise the saws 492 at the end of the cut. The control system of the saw machine 36 has a control switch 516 which is connected to the saw motors 510 and connected to control the fluid circuit of the piston and cylinder device 506. The control switch 516 has an actuator arm 518 and is supported by a mount 520 positioned to be below the carriage so the control arm 516 will contact the trigger pin apparatus on the carriage 12 as it moves through the saw machine 36. As the carriage 12 moves through the saw machine 36 the trigger pin apparatus previously extended and used with the other machines involved in making the window aperture structure are contacted by the actuator arm 518 of the control switch 516. When the carriage 12 moves into the machine and the control switch 516 is actuated, the saw motors 510 are started and are lowered so the saw blades 514 contact and cut through the sheeting material and the stud members as the carriage continues in forward motion. The cuts made by the saws 492 extend between the previously made transverse cuts. As the carriage moves to a point where the cuts made by the saws 492 and the previously made cuts join, the saws 492 are rapidly raised from the wall section and the motors 510 turned off so the carriage 12 can proceed without the necessity of being stopped. Rapid insertion and removal of the saw blades into and from the wall section allows the carriage 12 to move through the saw machine 36 without stopping. Positioning of the control switch 516 relative to the saws and the carriage depends upon the speed of the carriage when moving through the saw machine 36. Once the cutting operation of the saw machine 36 is complete the saws 492 will remain in the raised position until the next time they are needed. Additionally, once the cuts are completed the portion of the wall section in the window aperture will no longer be supported by the wall section structure and will drop therefrom onto the carriage or through the carriage to be removed at a later time once the carriage has passed.

In the event that a wall section is being produced which is to have a door therein, the saw machine 36 can be used to make the necessary longitudinal cuts. The saws 492 can be spaced so one cuts the top of the door

aperture and the other makes a cut at the bottom of the door aperture. It is desirable to make the door bottom cut above the plate member which will be at the bottom of the wall so that plate member will remain intact in the wall section thus not decreasing the strength of the wall section overall. The portion of the plate member can be cut away after the wall section is removed from the carriage 12.

The sheet material nailer machine 38 is shown in FIGS. 38 and 39 on Sheet 9 of the drawings. The sheet material nailer machine 38 follows the saw machine 36 in the assembly line 10 and is adapted to nail the sheet material to the wall section along the stud members to secure same prior to insertion of a window. The nailer machine 38 includes a frame structure 522 which spans the assembly line transversely and has mounted thereon a plurality of nailers 524 supported in a depending relation and positioned to be above the wall section 526, indicated hereat, when the carriage 12 moves through the nailing machine 38. The frame structure 522 has upright end members 528 placed on opposite sides of the assembly line in an opposed relation and connected on their upper portion by a frame upper member 530. The individual nailers of the plurality of nailers 524 are indicated individually at 532. The individual nailers 532 are secured to an adjustable mount structure 534 which is attached to the frame 522 and provides an adjustable and positionable amount for the nailers. Spacing of the individual nailers 532 is such that the nails therefrom are discharged at approximately 4 inch intervals across the span of the wall section 526. The end nailers of the plurality of nailers 524 are individually indicated at 536 and 538. Preferably, the end nailers 536 and 538 are positioned relative to the wall section 526 so nails will be passed from the nailers through the sheeting material into the plate members of the wall section. The nail outlets from the plurality of nailers 524 are arranged in a straight line transverse to the assembly line and transverse to the wall section 526 on the carriage 12 so the nails therefrom will be discharged in a straight line as is required for them to pass into the stud member.

The nailer machine 38 is controlled by a control system to actuate the plurality of nailers 524 so nails will be driven into the stud members of the wall section 526. The control system includes a control box 540 having a pair of control switches mounted therein and having actuator arms 542 and 544. The control box 540 is secured to the frame structure 522 by a mount 546. The control switches are connected in series and connected to the plurality of nailers 524 to control the function of same. As shown in FIG. 39 the control actuator arms 542 and 544 are different lengths with the control arm 542 being the longer. The arm 542 will contact the stud members of the wall section 526 as the carriage 12 moves through the machine. The shorter arm 544 will contact the clamp bar members 132 as the carriage 12 moves through the nailer machine 38. The circuit of the control system is such that the control switches are connected in a series relation with the control switch having the longer arm being normally open and the control switch having the shorter arm 544 being normally closed. As the carriage 12 with a wall section 526 thereon moves through the nailer machine the long control arm 542 will contact the stud members of the wall section 526 and cause the nailers 524 to be actuated to drive nails into the stud members which the

control arm 542 contacts. Along the carriage the plate clamp bar members 132 will be contacted by the shorter control arm 544 and the longer control arm 542. As the shorter control arm 544 is moved, the circuit controlling the nailers will be opened, thus nullifying any motion of the longer control arm 542 which will override or prevent the nailers 524 from being actuated. Once the plate clamp has passed the control box 540 the shorter control arm 544 is released and likewise the longer control arm 542 is released thereby allowing the nailing operation to continue with the control switch connected to the longer control arm 542 controlling. It is to be noted the nailers at the window aperture will not operate as the aperture passes because the nailers can be adjusted to not operate unless the nail outlet shoe contacts a surface. During operation of the nailer machine 38 it may or may not be necessary to stop the carriage 12 as the nailers 524 are actuated. If the carriage must necessarily be stopped such can be connected with the circuit of a control system for the nailer machine to accomplish such stopping. As the carriage moves from the nailer machine 38, the sheet material is secured to the plate and stud frame of the wall section 526. Once the trailing edge stud member of the wall section is nailed to the sheet material the operation of nailing the sheet material is completed.

The window placer machine 40 is shown on Sheet 8 of the drawings in FIGS. 33 and 34. The window placer machine 40 follows the sheet material nailer machine 38 in the assembly line 10 and is designed to place a prefabricated window assembly in a window aperture of the wall section. The window placing machine 40 includes a frame structure 550 transversely spanning the assembly line and having a window dispensing device, indicated at 552, to remove windows from a stack of windows 554 and place same in window apertures in the wall section, indicated here at 556, as the carriage 12 moves through the window placing machine 40. The frame structure 550 has uprights 558 and 560 on opposite sides of the assembly line in an opposed relation which are connected by a transverse member 562. The transverse frame member 562 extends to the side of one side of the assembly line where the windows and window dispensing device 552 are positioned. The transverse frame member 562 is a beam with a flange 563 which forms a rail on which a portion of the window dispensing device 552 uses to move the windows to the proper position for placement. The stack of windows 554 is raised by a hydraulic lift apparatus indicated at 564 to feed windows to the window dispensing device 552. The lift 564 has a platform 566 which is mounted atop a hydraulic piston 568. Windows are dispensed from the stack of windows 554 one at a time from the top of the stack and the stack is raised accordingly by the lift apparatus 564. Once a stack of windows has been removed, the lift apparatus 564 has the platform 566 lowered so more windows can be placed thereon. The window dispensing device 552 is adapted to pick up the topmost window, indicated at 568, from the stack of windows 554 and move same to a position over the wall section 556 to the previously cut window aperture at which time the window is released and drops into position in the window aperture. The window dispensing device 552 has a pair of clamps 570 and 572 to grasp opposite edges of the brick molding of the window structure; and further includes a piston and cylinder apparatus 574 to move the window and the

clamps 570 and 572 on the transverse frame member 562 over the carriage 12. The piston and cylinder apparatus has the cylinder thereof 576 secured with the frame structure 550 and the piston thereof 578 secured with a frame structure (not visible in the drawings) mounting the clamps 570 and 572. Extension of the piston 578 from the cylinder 576 causes the window clamps 570 and 572 to move on the transverse frame member 562 in the direction of the carriage; likewise, the traction of the piston 578 causes an opposite motion. FIG. 33 shows a window indicated at 580 supported by the window clamps 570 and 572 in the position which it is supported as it is moved over the wall section 556.

FIG. 34 shows in detail the structure of the window brick molding clamps 570 and 572 on a portion of the transverse frame member 562. The window assembly 580 is prefabricated type wooden window assembly which has a brick mold portion on opposite edges thereof which is used by the clamps 570 and 572 to grasp the window assembly for moving. The clamp 572 has an upwardly disposed portion 582 extending upward from a center portion which mounts an axle 584, and a downwardly extending portion 586 extending downwardly from the center portion and having a paw 558 extending therefrom to catch the window brick mold. A roller 590 mounted with the axle 584 rests on the transverse frame member flange 563 for movement of the clamps 570 and 572. The clamps are in position shown in FIG. 34 when it is carrying a window. The clamp 572 will rotate about the axle 584 to catch and release the window. The piston 587 is connected with the axle 584 of the clamp 572. The clamp 570 has a downwardly disposed portion 592 extending from a center portion which is mounted on an axle 594. A roller 596 mounted on the axle 594 supports the clamp 570 on the flange 563. A paw portion 598 extends from the lower end of the downwardly disposed portion 592 and is used to catch the window under the brick molding thereof. A linkage rod 600 is pivotally connected between the upwardly disposed portion 582 of the clamp 572 and the downwardly disposed portion 592 of the clamp 570. The linkage rod 600 is connected so that pivotal movement of the clamp 572 will also pivot the clamp 570 for catching and releasing the window 580. When the clamps 570 and 572 are moved along the transverse beam 562 the upper end of the upwardly disposed portion 582 contacts the stop 592 whereupon the clamp arm is rotated about the axle 584 and similarly the clamp arm of the clamp 570 is rotated about the axle 594 to move the paws 588 and 598 from beneath the window brick molding 582 and release the window 580. The clamp stop 592 is necessarily adjustably mountable with the transverse beam 562 so the point at which a window is dropped may be varied depending upon its placement in the wall section 566. After a window has been released from the window dispensing device 552 the piston 578 is retracted and the clamps 570 and 572 returned to their original position over the stack of windows so the topmost window 568 can be grasped. As the clamps 570 and 572 move to their position over the stack of windows and the paws 588 and 598 move under the brick mold of the topmost window the piston 578 can be further retracted so the upper end of the upwardly disposed portion 582 of clamp 572 will contact a second stop member 602 to rotate the clamping arms to properly position the paws

thereof. When the topmost window 568 is grasped properly by the clamps 570 and 572, the window placing machine 40 is ready to place another window.

The window placing machine 40 has a control system which controls the operation thereof in the placing operation. The control system includes a control switch indicated at 604 having an actuator arm 606 to contact the trigger pin apparatus 150 on the carriage 12 as it moves through the window placing machine 40. The control switch 604 is positioned generally as shown in FIG. 33 and supported by a mount 608 attached to the frame structure 550. The control switch 604 uses the same trigger pin apparatuses which are extended and used in the previously described machines associated with the construction of the window apertures in the wall section 556. In operation as the carriage 12 moves through the window placing machine 40 the control switch 604 is actuated as the arm 606 which contacts the forwardmost trigger pin at a window location and at such time the forward motion of the carriage 12 is stopped and the window assembly to be placed is moved by the dispensing device 552 over the wall section 556 to the proper point at which time the clamps 570 and 572 are released as described dropping the window assembly into the window aperture. After the window assembly is placed, the dispensing device 552 retracts as described to grasp another window assembly from the top of the stack of windows 556. Before the dispensing device 552 moves the window assembly from the stack 554 it may be necessary to lower the stack by the lift apparatus 564 so the window of the stack below the topmost window will not interfere with the topmost window as it begins its translating motion. Once the window dispensing device 552 is retracted the lift apparatus 564 is actuated to raise the stack of windows 554 so the topmost window assembly 568 can be grasped by the clamps for removal from the stack for placement. When a window assembly has been placed in the wall section 556 the carriage 12 may proceed forward to the next window location as the window dispensing device 552 retracts and grasps the next window to be dispensed. It is to be noted that clamp portions of the window assembly dispensing device 552 can be changed without departing from the scope of the invention to grasp and release window assemblies by other means and to handle other types of windows such as storm windows and the like.

The window nailer machine 42 is shown in FIGS. 35, 36, and 37 on Sheet 9 of the drawings. The window nailer machine 42 follows the window placer machine 40 in the assembly line 10 and is designed to nail the window assemblies placed in the wall section to the wall section by nailing across the top and along each side of the window assemblies. The window nailer machine 42 includes a frame structure 610 transversely spanning the assembly line and having supported thereon a pair of nailers and the appropriate control system to operate the nailer machine at a window location on a wall section. The frame structure 610 includes end uprights 614; a frame top end member 616 joining the legs of the upright 616; and a transverse channel-like member 618 spans the assembly line and has the nailers 612 mounted thereon. The nailers 612 consist of two nailers individually indicated at 620 and 622. The nailer 620 is positioned as shown in FIGS. 36 and 37 and is designed to nail across the top portion of the window assembly as the carriage 12 moves through the

window nailer machine 42. A mount 624 supports the nailer 620 from the transverse channel-like member 618. The mount 624 is shown in the drawings as bolted to the transverse member 618. This is done because the top portion of windows in a wall section of a building such as a house are generally the same distance below the top of the wall section; thus this nailer would generally not be moved. The nailer mount 624 can be made adjustable on the transverse member 618 if desired. A shoe 626 is mounted on the discharge end of the nailer 620 and is constructed to ride over the sheet material indicated here in dashed lines at 527 as the wall section moves through the nailer machine 42 and to be raised by the window's exterior portion, indicated here in dashed lines at 528, to actuate the nailer 620. When the shoe 626 is raised by the raised window portion 628 the nailer 620 will be actuated to drive nails at specified and predetermined intervals and will continue to do so until the shoe 626 returns to the surface of the sheet material 627. A mount is provided for the nailer 622 which will support it and move it along the channel-like transverse member 618 over the sides of the window's raised portion 628 during the nailing operation. The nailer 622 is provided with a shoe 630 similar to the shoe 626 on the nailer 620 which allows its nail outlet to slide along the surface of the sheet material and of the window structure. The movable nailer mount has a slidable support portion 632 mounted in the interior of the channel member 618 as shown in FIG. 37. The slidable member 632 preferably has mounted through a center portion thereof a threaded member 634 which when rotated will cause the slidable member 632 to move within the channel member 618 and in turn move the nailer 622. The threaded member 634 preferably rotated by a reversible motor 636 mounted with the end of the frame structure 610 as shown in FIG. 36. During operation of the nailer machine 42 the motor 636 rotates the threaded member 634 thereby moving the mount 632 and the nailer 622 to advance it over the window's raised portion 628. As the shoe 630 is moved onto the window's raised portion 628 the nailer 622 is actuated and begins to drive nails preferably at predetermined and specified intervals as it is moved along the window's raised side portion 628.

The window nailer machine 42 is provided with a control system to control the operation thereof. The control system includes a control switch 638 connected with the motor 636 and the motor 65 on the carriage 12. The control switch 638 has an actuator arm 640 and the switch 638 is supported by a mount 642 positioned generally below the nailers 622. The control switch 638 is actuated by the trigger pin apparatus on the carriage 12, preferably the same trigger pin apparatuses which are used previously in construction of the window aperture. During operation of the window nailer machine 42 the shoe 626 of the nailer 620 slides along the upper surface of the sheet material 628 and when it is raised by the window assemblies raised portion 628 the nailer 620 begins to operate as described and continues to operate until the shoe 626 slides from the trailing edge side of the window's raised portion 628. Control of the nailer 620 can be independent of the control switch 638 because raising of the shoe 626 actuates the nailer 620. As the window portion of the wall section approaches the nailer machine 42, the control switch actuator arm 640 contacts an extended pin of the trigger pin apparatus on the carriage 12 which

stops the motion of the carriage at a point where the nailer 622 can discharge nails into the edge portion of the window's raised portion 628, then the motor 636 is operated to move the nailer 622 along the side portion of the window assembly. When the leading edge side of the window assembly has been nailed, the motor 636 is stopped, the carriage 12 is advanced until the window apertures trailing edge trigger pin contacts the control actuator arm 640, then the motor 636 is again operated to move the nailer 622 across the trailing edge portion of the window raised portion 628 for nailing. When the trailing edge portion of the window is nailed, the carriage 12 proceeds forward. It is preferable that the nailer 620 is connected with the control switch 638 so the action thereof is stopped when motion of the carriage 12 is stopped during the times when the leading edge portion and the trailing edge portion of the window assembly is being nailed. When the nailing operation of the window nailer machine 42 is completed, the carriage moves on in the assembly line to the next window location or from the window nailer machine 42 as the case may be.

The hoist 44 and lift 46 are shown in FIG. 40 on Sheet 10 of the drawings. The hoist 44 and lift 46 are positioned at the finish end of the assembly 10 following the window nailer machine 42 and are used for removal of the finished wall section and to return the carriage 12.

The hoist apparatus 44 has a winch 650 supporting a wall section attaching structure 652 that is used to attach the wall section which is indicated here at 653. The winch 650 is shown mounted on a support beam 654 to illustrate a suitable support for the winch apparatus. The attaching structure 652 has a frame 656 with clamps 658 and 660 on ends thereof and clamps 662 and 664 on the sides thereof which are used to grasp the wall section 653 and support same. The frame 656 has the clamp 658 and 660 preferably pivotally attached on the opposite ends thereof to reach under the wall section 653 at the end portions thereof so it can be removed vertically from the carriage 12 and carried in a horizontal position. The clamps 658 and 660 can be manually operated or automatically remotely operated as desired. The use of clamps to grasp the ends of the wall section is preferable since the wall section 563 may be constructed in a narrow height and thus may not extend past the width of the carriage 12. Clamps 662 and 664 are positioned on the sides of the frame 656 for securing the sides of the wall section to the carriage 12 if desired. The clamps 662 and 664 must necessarily be positioned in a spaced relation to the structure of the carriage 12 so they will not interfere with the plate clamps 130. Before the wall section 653 is raised from the carriage 12 the plate clamps 130 must be extended from the sides of the wall section 653 so it can be raised. As the wall section 653 is raised from the carriage 12, the stud holding clamps 70 release themselves automatically from the stud members of the wall section 653.

The lift apparatus 46 is shown in the lower portion of FIG. 40 with the carriage 12 and a wall section shown in dashed lines, the wall section indicated here at 653. The finish end lift 46 is similar to the start end lift 47 at the starting end of the assembly line 10. The structure of the lift 47 will not be described in detail herein as it is same as the lift 46. The lift 46 includes a hydraulically raisable and lowerable piston 666 having

mounted on the upper end thereof a tracked platform 668 to receive the carriage 12. The track platform 668 is lowerable into a pit 670 or to a portion below the ground line 672 on which the lower track 50 is supported. The platform 668 has a set of tracks 674 mounted thereon spaced to align with the tracks 48 and 50 so the carriage can move onto and off of the platform easily. A stop 676 is provided on the end of the tracks 674 to limit the carriage 12 movement. The lift 46 is in the position shown in FIG. 40 when the carriage 12 reaches the end of the assembly line and the wall section 653 is removed. After the wall section is removed the piston 666 is retracted lowering the platform 668 and aligning the rail 674 with the other track rails 50 so the carriage 12 can be returned to the beginning end of the assembly line. At the beginning end of the assembly line 10 the start end lift 47 is positioned to receive the carriage 12 on the rails 50 and raises it to the other rails 48. The hoist 44 and lift 46 can be provided with a control system that is sequenced so that in an automatic operation when the wall section 653 is removed the lift 46 will lower the carriage 12 for return to the beginning of the assembly line.

The method or process of making a wall section of this invention is outlined generally in FIG. 1 on Sheet 1 of the drawings. Details of the method of making a wall section of this invention is described along with the description of the apparatus portion of the invention along with the description of the function of each of the several machines of the assembly line apparatus 10. It is to be understood that the method of making a wall section of this invention can be accomplished with machines or means other than that shown and accomplish the same end product. The method comprises 15 separate steps as illustrated and outlined in FIG. 1 wherein the steps are indicated by a descriptive title and are numbered in the sequence in which they are performed. The following is a numbered step-by-step description of the several steps of the method including reference to the machine or machines of the assembly line 10 which is provided accomplish the particular step:

1. Place the studs in the appropriate stud holding clamps 70 on the carriage 12. This is accomplished by the stud placer machine 16.
2. Place the plates in the appropriate plate holding clamps 130 on the carriage 12. This is accomplished by the plate placer machine 18.
3. Nail the plates to the studs. This is accomplished by the nailer machine 20.
4. Notch the studs at window locations for the headers and cripples. This is accomplished by the saw machine 22.
5. Place headers in the appropriate notches at the window locations. This is accomplished by the header placer machine 24.
6. Place the cripples in the appropriate notches at the window locations. This is accomplished by the cripple placer machine 26.
7. Nail the headers and the cripples to the studs at the window locations. This is accomplished by the nailer machine 28.
8. Place sheet material on the plate and stud frame. This is accomplished by the sheet material placing machine 30.

9. Tack the sheet material to the plate and stud frame. This is accomplished by the sheet material tacker machine 32.

10. Saw an aperture at the window or door location. This is accomplished by the saw machines 34 and 36 with the saw machine 34 making transverse cuts and the saw machine 36 making longitudinal cuts.

11. Nail the sheet material securely to the plate and stud frame. This is accomplished by the nailer machine 38.

12. Place the window in the window aperture. This is accomplished by the window placer machine 40.

13. Nail the window to the wall section. This is accomplished by the nailing machine 42.

14. Remove the wall section from the carriage 12. This is accomplished by the hoist apparatus 44.

15. Return the carriage to the beginning of the assembly line. This is accomplished by the lifts 46 and 47 and the tracks 14.

At the end of the process a wall section having wall covering sheet material on one side thereof and a window therein is produced and the carriage 12 of the assembly line apparatus 10 is returned to the start of the assembly line to produce another such wall section.

In the event that a wall section is to be produced which does not have a window therein, the process is slightly different in that the steps necessary to form a window aperture in the wall section structure and place and secure the window therein are not necessary. In such a case Steps 4, 5, 6, 7, 10, 12, and 13 are omitted from the process. In regard to the assembly line apparatus at a time when a wall section is produced without windows, the machines 22, 24, 26, 28, 34, 36, 40, and 42 would necessarily be turned off so they would not operate.

In the event that a wall section is to be produced which has a door therein, the process is the same as that first described above. In Step 10 the aperture formed therein is sized as required to accommodate a door and is preferably cut as the carriage 12 passes through the saw machines 34 and 36 as other apertures are cut for windows.

In the manufacture of the building means structure or the assembly line and its several machines of this invention, it is obvious that the assembly line is constructed for the specific purpose of manufacturing in a rapid fashion wall sections such as for a frame building. The assembly line structure including its numerous machines are designed for the rapid substantially automatic functioning to achieve the end product. Each of the several machines of the assembly line is individually controlled to perform an operation on the wall section. In the construction of the several machines of the assembly line each of the machines can be constructed with simple frame structures. The several machines of the assembly line 10 require only relatively simple control systems for the operation thereof. A source of air is used to operate the several nailers of the different machines. The carriage 12 supports the wall section and is used to control placement of studs and window locations.

In the practicing of the method of this invention, it is obvious that the method is efficiently comprised of several steps to achieve the end product. The method of producing a wall section of this invention can be accomplished by the mechanical apparatus of the assembly line 10 as shown and described in the foregoing and

it can be accomplished by apparatuses other than those shown. The method of producing a wall section of this invention embodies moving the wall section in its various stages of completion past points at which parts are added or operations are performed in an orderly sequence to produce as an end result a wall section having sheet material on one side thereof and having a window therein or a door therein if desired. The method of making a wall section can be practiced to form a wall section without windows and doors if desired.

In the use and operation of the means of making a wall section or the assembly line apparatus 10 of this invention, it is seen that same provides an apparatus to accomplish the method of making a wall section of this invention. The assembly line apparatus 10 is operable to substantially automatically produce a wall section by moving the carriage through a plurality of machines which add parts to the wall section and perform operations on it. In the use of the method of making a wall section of this invention, it is seen that same provides a process of making a wall section which is designed for use in an assembly line type operation and can be accomplished by an assembly line apparatus.

As will become apparent from the foregoing description of the applicant's method and means for making a wall section, relatively simple means have been provided to accomplish the method disclosed herein for making a wall section. The means of making the wall section is an assembly line structure having a plurality of machines which is substantially automatic in operation and can be adjusted or reset to produce wall sections of varying heights and lengths and wall sections with or without windows and doors. The method of making a wall section is relatively simple and is concerned with moving parts of the wall section past several points where parts are added or operations are performed to achieve the end product.

While the invention has been described in conjunction with preferred specific embodiments thereof, it will be understood that this description is intended to illustrate and not to limit the scope of the invention, which is defined by the following claims.

I claim:

1. An assembly line means for making a wall section, comprising:

- a. means for supporting and moving in horizontal position a wall section and having means to temporarily receive and hold stud members, and means to temporarily receive and hold plate members,
- b. means to place stud members in said means to temporarily receive and hold stud members,
- c. means to place plate members in said means to temporarily receive and hold plate members,
- d. means to secure said plate members to said stud members while with said means for supporting a wall section,
- e. means to place sheet material on an upper surface of said stud members and said plate members while with said means for supporting a wall section,
- f. means to secure said sheet material to said stud members and said plate members while in said means for supporting a wall section,
- g. means to cut an aperture in said wall section through said sheet material while said wall section is with said means for supporting a wall section,

- h. means to place a window assembly in an aperture in said wall section while said wall section is with said means for supporting a wall section, and
- i. means to secure said window assembly to said sheet material while said wall section is with said means for supporting a wall section.
2. The means of claim 1 wherein there is means to remove a wall section from said means for supporting a wall section.
3. The assembly line means for making a wall section of claim 2, wherein same has:
  - a. means to notch said stud members to receive a header member, while said stud members are with said means for supporting a wall section,
  - b. means to place a header member in a notch in said stud members while said stud members are with said means for supporting a wall section.
  - c. means to notch said stud members to receive a cripple member while said stud members are with said means for supporting a wall section, and
  - d. means to place a cripple member in a notch in said stud members while said stud members are with said means for supporting a wall section.
4. The assembly line means of claim 3, wherein:
  - a. said means for supporting and moving a wall section is a carriage means,
  - b. said means to temporarily receive and hold stud members has a stud clamp means constructed to receive and hold said stud members in an upright position,
  - c. said means to temporarily receive and hold plate members has a plate clamp means constructed to receive and hold said plate members transverse to said stud members, in an upright position and in contact with ends of said stud members, and
  - d. a track means extends through said assembly line means for making a wall section to support and guide said carriage means.
5. The assembly line means of claim 4, wherein:
  - a. said means to place stud members has means to remove said stud members from a stack of pre-cut stud members, said stack having a plurality of rows and columns and being positioned transverse to said carriage means, and drop said stud members through an aperture into said stud clamp means as said carriage means moves through said means to place wall stud members,
  - b. said means to place plate members has means to remove a plate member from a platform having a plurality of plate members lying thereon and positioned parallel to said carriage means and drop said plate members through an aperture into said plate clamp means in position perpendicular to and abutting said stud members with said carriage means temporarily stopped,
  - c. said means to secure said plate members to said stud members has an automatic nailing means to drive nails through said plate members into the end portions of said stud members as said carriage means moves through said means to secure plate members to said members,
  - d. said means to notch said stud members to receive a header member has an automatic saw means to form a notch in said stud members at a window location as said carriage means moves through said means to notch said stud members,

- e. said means to place a header member has means to remove a header member from a platform having a plurality of header members lying thereon and positioned parallel to said carriage means and drop said header members through an aperture into said notch in said stud members with said carriage means temporarily stopped, 5
- f. said means to notch said stud members to receive a cripple member has an automatic saw means to form a notch in said stud members at a window location as said carriage means moves through said means to notch stud members, 10
- g. said means to place a cripple member has means to remove a cripple member from a platform having a plurality of cripple members lying thereon positioned parallel to said carriage means and drop said cripple members through an aperture into said notch in said stud members with said carriage means temporarily stopped, 15
- h. said means to place sheet material has means to remove a sheet of wall covering material from the top of a stack of horizontally stacked sheets of same said wall covering material and dispense same wall covering material in sliding motion one at a time onto said upper surface of said stud members and said plate members as said carriage means moves through said means to place sheet material, 20
- i. said means to secure said sheet material has means to tack said sheets of wall covering material to said plate members with an automatic nailer means operable to nail at corner portions of said sheets of wall covering material as said carriage moves through said means to tack said sheets of wall covering material, 25
- j. said means to cut an aperture in a wall section has a first saw means having a pair of saws operable to make a pair of cuts through said wall section transverse to said carriage means with said carriage means temporarily stopped and a second saw means having a pair of saws to make a pair of cuts through said wall section and said stud members longitudinally relative said carriage means as said carriage means moves through said second saw means, 30
- k. said means to secure said sheet material has an automatic nailer means to nail through said sheet material into said stud members and said plate members along and in line with said stud members as said carriage means moves through said means to secure said sheet material, 35
- l. said means to place a window assembly has means to remove a window assembly from the top of an upright stack of window assemblies and means to drop a window assembly into an aperture in said wall section with said carriage means temporarily stopped, 40
- m. said means to secure said window assembly has an automatic nailer means to nail through said window assembly into said sheet material as said carriage means passes through said means to secure said window assembly, 45
- n. said means to remove a wall section has a hoist means and a frame means temporarily attachable to said wall section for raising same said wall section from said carriage means. 50
6. The assembly line means of claim 5, wherein: 55

- a. said carriage means has an elongated frame and a means to move said frame on said track means, 5
- b. said stud clamp means has a plurality of pairs of stud clamps positioned in a spaced relation on opposite sides of said frame, said clamps each having a fixed jaw portion and a pivotable jaw portion pivotable to a closed position when a stud member is placed in same said clamp and pivotable to a normally open position when same said stud member is removed, and 10
- c. said plate clamp means has a plurality of clamping bar members transversely mounted with said carriage frame extendable to the sides thereof to engage with said plate members, a clamping bar support member attached said plurality of clamping bar members centrally longitudinally disposed and movably mounted with said carriage frame, and a piston and cylinder means having opposite ends thereof secured to said carriage frame and to said clamping bar support member operable to move said support member and said clamping bar members transversely relative said carriage frame. 15
7. A method of making a wooden frame wall section having a covering on one side thereof, comprising: 20
- a. conveying a wall section support means in a horizontal position, 25
- b. placing stud members with said wall sections support means,
- c. placing plate members with said wall sections support means, 30
- d. securing said plate members to said stud members,
- e. placing window assembly support members with said stud members and securing said window assembly support members to said stud members, 35
- f. placing sheet material on an upper surface of said stud members and said plate members,
- g. securing said sheet material to said stud members and said plate members, 40
- h. cutting an aperture in said sheet material at a window location,
- i. inserting a window assembly into said aperture, and 45
- j. securing a window assembly to said wall section.
8. The method of claim 7 wherein said wall section is removed from said wall section support means. 50
9. The method of claim 8, wherein:
- a. said placing stud members having placing means operable to place stud members with a portion thereof extending upward, 55
- b. said placing plate members having a dispensing means to place said plate members perpendicular to said stud members at ends thereof,
- c. said securing said plate members to said stud members having a nailing means operable to nail through said plate members into end portions of said stud members, 60
- d. said placing sheet material placing a plurality of sheets of wall section covering material, and
- e. said securing said sheet material having a nailing means operable to nail through said sheet material into said plate members and said stud members. 65
10. The method of making a wooden frame wall section of claim 9 wherein:
- a. said stud members are notched at a window location to receive a header member and a cripple member, 70
- b. placing a header member in resulting notches in notched stud members, 75

- c. placing a cripple member in resulting notches in notched stud members,
  - d. securing said header member and said cripple member to said stud members,
  - e. tacking said sheet material in place on said stud members and said plate members, and
  - f. cutting an aperture through said wall section between said header member and said cripple member.
11. The method of claim 10 wherein:
- a. a window assembly is placed in said aperture,
  - b. securing said window assembly to said wall section, and
  - c. removing said wall section from said wall section support means.
12. The method of claim 11, wherein:
- a. said notching said stud members having a saw means to saw said notches in a line parallel to said plate members,
  - b. placing a header member has a dispensing means operable to place a header member in said notches in said stud members,
  - c. placing a cripple member has a dispensing means operable to place a cripple member in said notches

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- in said stud members,
- d. said securing said header member and said cripple member has a nailing means to nail through said header member into said stud members and to nail through said cripple member into said stud members,
- e. said tacking said sheet material has a nailing means to nail through said plurality of sheets at corner portions thereof into said plate members,
- f. said cutting an aperture has a first saw means to form two parallel cuts in said wall section transverse to said wall section and a second saw means to form two parallel cuts in said wall section longitudinally connecting said two transverse cuts,
- g. said placing a window assembly has a window assembly dispensing means to drop a window assembly in said aperture, and
- h. said securing said window assembly has a nailing means to nail through said window assembly along sides thereof and along the top thereof into said stud members and into said header member respectively.

\* \* \* \* \*

**UNITED STATES PATENT OFFICE**  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 3,897,620

DATED : August 5, 1975

INVENTOR(S) : Richard C. Wright

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 27, delete "construction" and insert therefor ---constructing---

Column 2, line 28, delete "and" and insert therefor ---with---

Column 10, line 23, delete "of" and insert therefor ---on---

Column 10, line 43, delete "and" and insert therefor ---through---

Column 11, line 4, delete "swhon" and insert therefor ---shown---

Column 11, line 6, delete "91" and insert therefor ---191---

Column 11, line 67, delete "maching" and insert therefor ---machine---

Column 12, line 28, delete "he" and insert therefor ---the---

Column 13, line 18, delete "drive" and insert therefor ---driven---

Column 17, line 52, delete "postion" and insert therefor ---position---

Column 17, line 67, delete "movable" and insert therefor ---movably---

Column 18, line 34, delete "264" and insert therefor ---364---

Column 18, line 67, after "the" (first occurrence) insert ---extended---

Column 19, line 63 and 64, delete "therof" and insert therefor ---thereof---

Column 20, line 49, delete "intially" and insert therefor ---initially---

UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

PATENT NO. : 3,897,620  
DATED : August 5, 1975  
INVENTOR(S) : Richard C. Wright

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 25, line 15, delete "machien" and insert therefor ---machine---

Column 26, line 39 and 40, delete "oposite" and insert therefor ---opposite-

Column 29, line 57, delete "628" and insert therefor ---627---

Column 31, line 19, delete "Th" and insert therefor ---The---

Claim 9, line 47, after "a" and before "portion" insert ---crown---

**Signed and Sealed this**

*fourteenth Day of October 1975*

[SEAL]

*Attest:*

**RUTH C. MASON**  
*Attesting Officer*

**C. MARSHALL DANN**  
*Commissioner of Patents and Trademarks*