Dec. 28, 1965 E. H. WIDELL ETAL 3,225,412

PLASTIC MASS-FORMING APPARATUS

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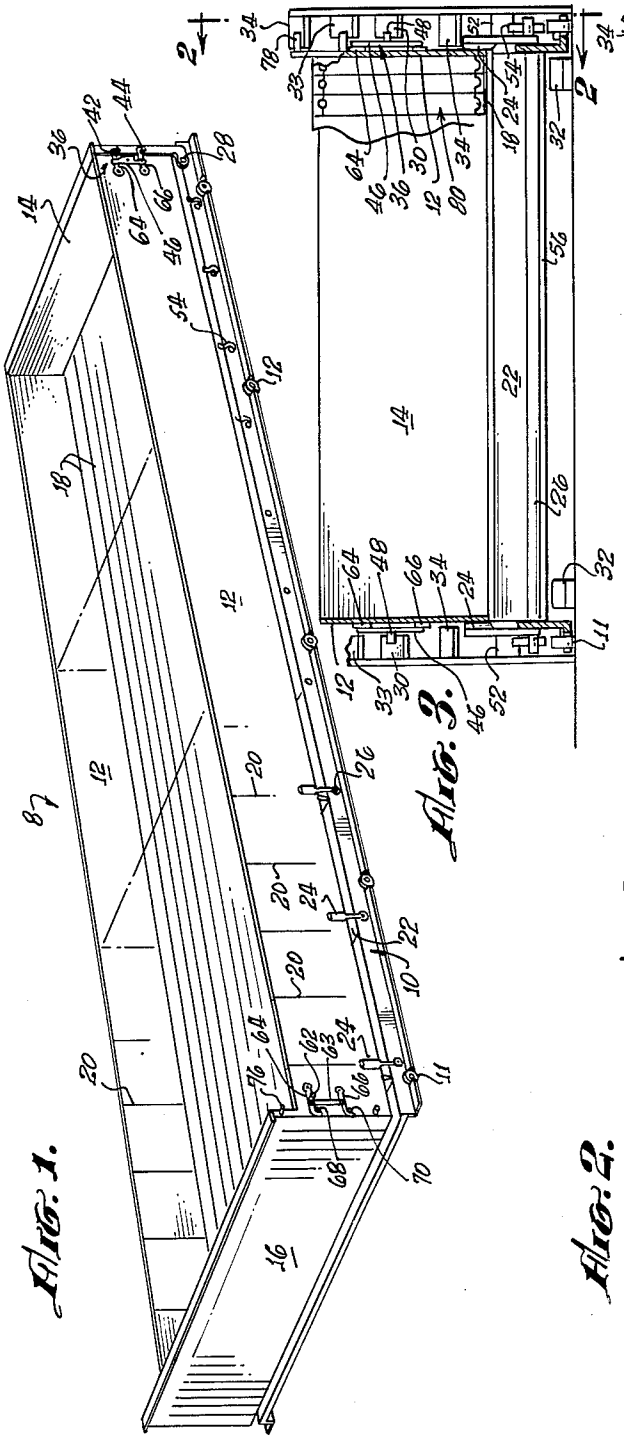


Fig. 1.

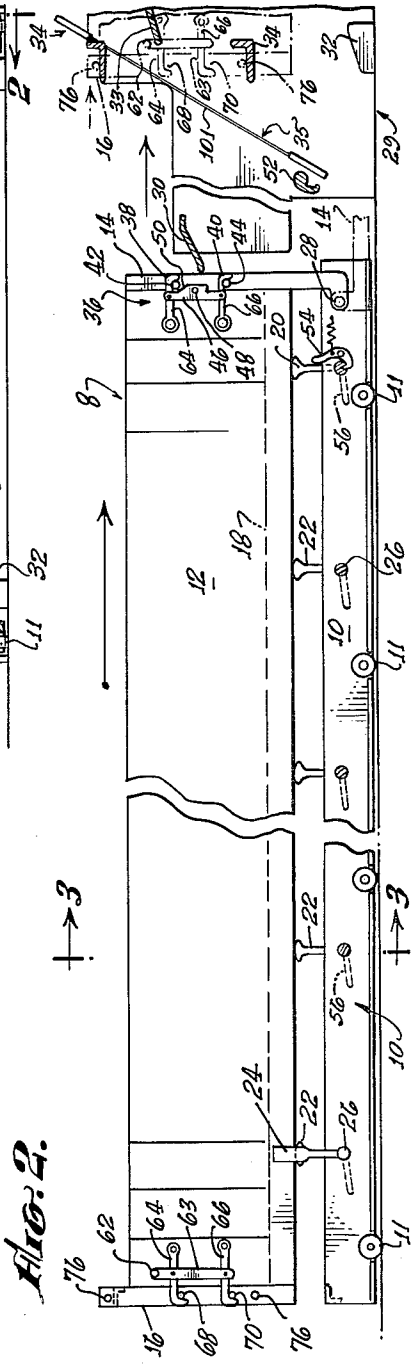


Fig. 2.

Fig. 3.

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Fig. 4.

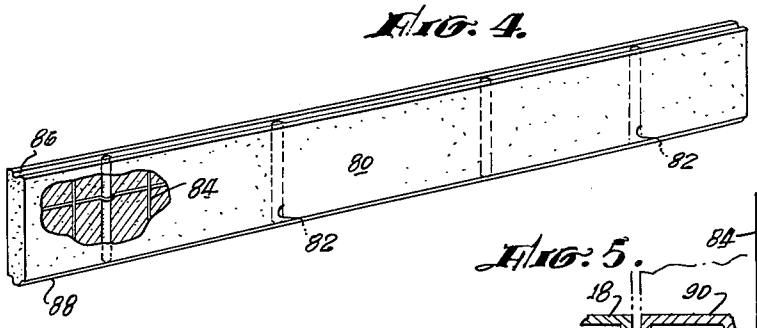


Fig. 5.

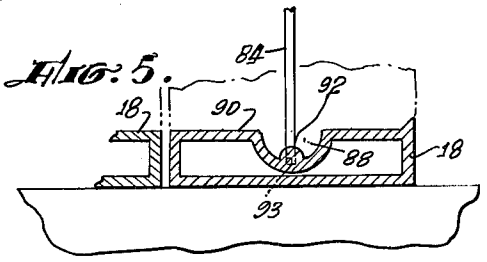


Fig. 6.

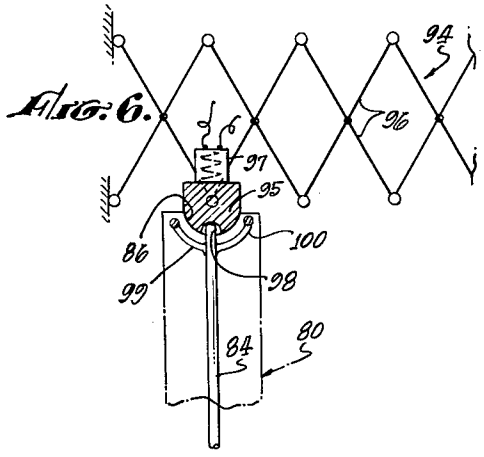


Fig. 8.

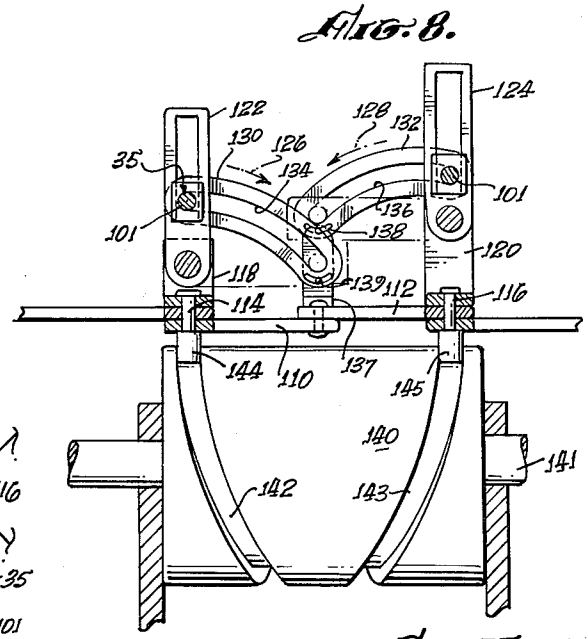
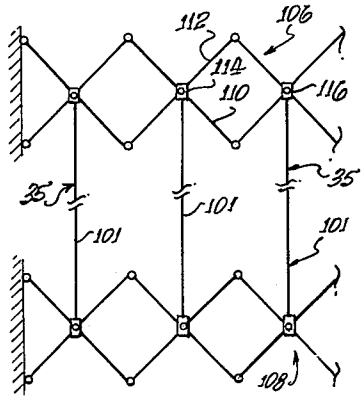


Fig. 7.



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FIG. 9.

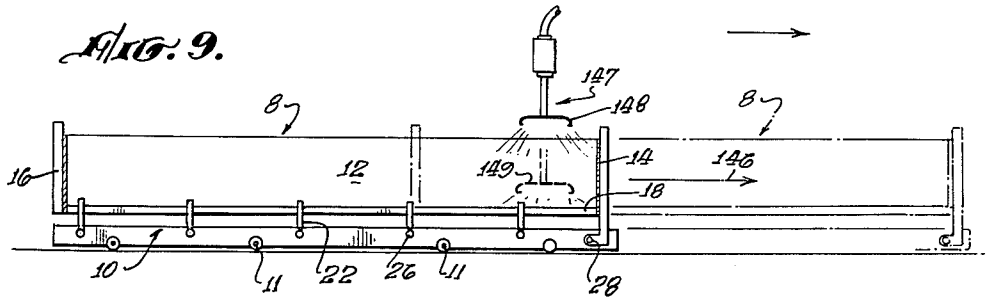


FIG. 10.

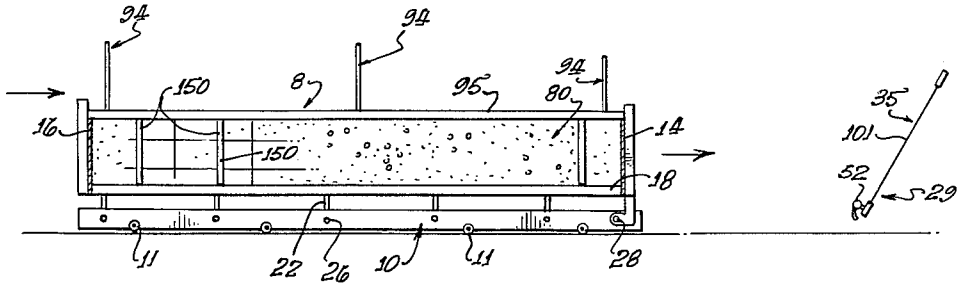


FIG. 11.

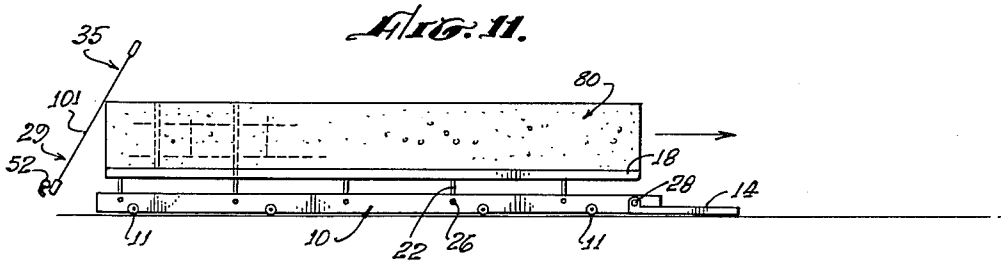
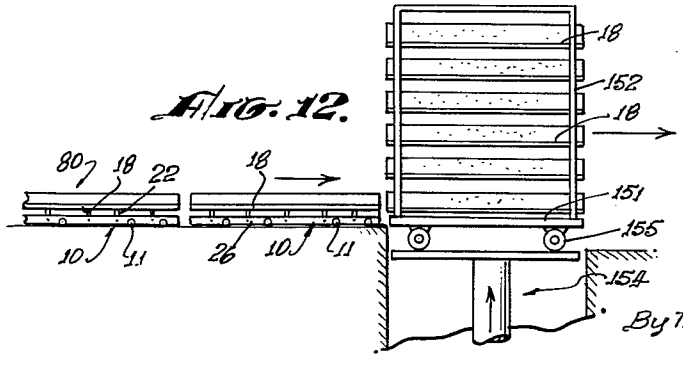


FIG. 12.



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FIG. 13.

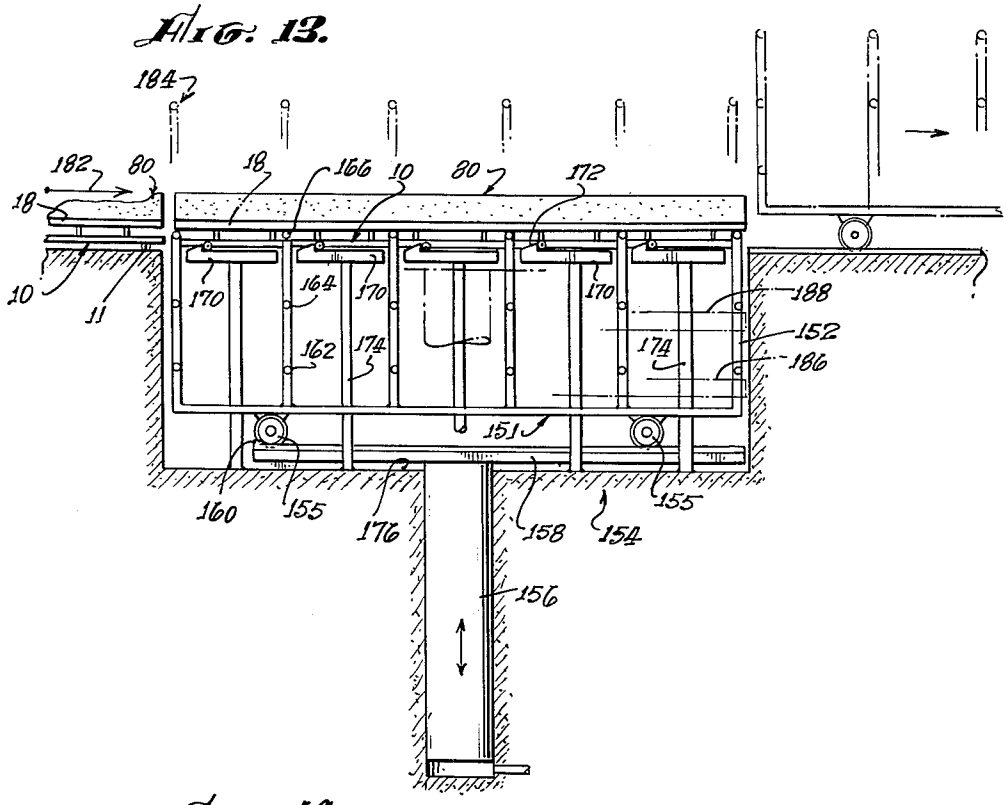
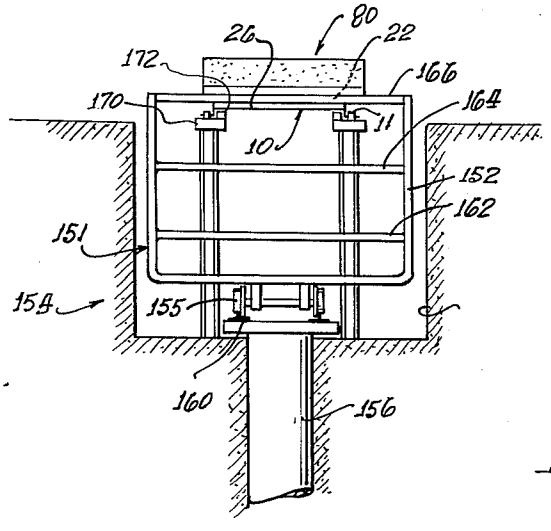


FIG. 14.



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United States Patent Office 3,225,412 Patented Dec. 28, 1965

3,225,412

PLASTIC MASS-FORMING APPARATUS

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Filed Sept. 6, 1963, Ser. No. 307,239
1 Claim. (Cl. 25—108)

This invention relates to apparatus for use in the making of light-weight structural units, and more particularly to a new and improved method and apparatus for molding and slicing cellular concrete in its semiplastic state into a plurality of separate structural slabs and for loading them onto a framework for curing.

Cellular or "gas" concrete is a relatively light-weight concrete building material having a high strength-to-weight ratio and is used where its great strength is desired, but where the usual heavy weight of conventional concrete is not desired. Roof decking, interior partition walls, and exterior walls are examples of such uses.

Cellular or gas concrete bodies are commercially manufactured from a slurry of cement, lime, and silica to which a foaming agent has been added. This mix is poured into a multiple mold which is preferably of a unit length and width dimensions and of a multiple slab thickness. After the mix has precured in the mold, it hardens into a semiplastic state so as to be self-supporting yet capable of being cut with wires into a plurality of slabs or "planks" of the desired size. After the concrete is cut, the resultant slabs are placed in an autoclave and are steam cured or hardened for ultimate use. The finished product has a density of from 30 to 50 pounds per cubic foot and provides satisfactory test results when compared with conventional concrete slabs having a density of approximately 150 pounds per cubic foot.

The gas concrete material, in its prehardened state, is extremely fragile and weak in tension so that great care must be taken in order to avoid stressing the material during the handling of the slabs prior to the time they are steam hardened in the autoclave. Apparatus heretofore used for handling these slabs has been heavy, cumbersome, and costly. Intricate mechanical apparatus has been necessary for supporting the molded body during the cutting in order to avoid breaking or cracking of the molded body. In addition, considerable manual labor was necessary with this apparatus.

Automatic and semiautomatic production techniques and apparatus in accordance with the present invention overcome the disadvantages of the prior art production of light-weight cellular or gas concrete slabs.

It is therefore an object of the present invention to provide an improved means for casting, cutting, and handling prehardened cellular concrete and similar materials in a structurally weak condition.

Another object is to provide apparatus for wire slicing a prehardened semiplastic material into a plurality of slabs with each slab being individually supported throughout its length and capable of being moved to an autoclave for final curing.

The specific nature of this invention, as well as other objects and advantages thereof, will become more apparent to those skilled in the art from the following detailed description, taken in conjunction with the annexed sheets of drawings on which, by way of example only, the preferred embodiment of this invention is illustrated.

In its preferred form, a mold is provided with a mold bottom comprising longitudinal elements arranged in parallel relation and narrowly spaced apart. Sides and ends are provided for containing the molding material until it has prehardened into a semiplastic state. The crevices between the narrowly spaced elements are sprayed with a filler material to prevent escape of the slurry through these spaces. The mold, with the body of molded material therein, is then moved to a cutting station where wire cutters are positioned. Wires spaced a preselected distance apart determine the thickness of the plurality of slabs to be cut. As the mold enters the cutting station, a cam-actuating mechanism causes the front wall to drop down out of the way of the wire cutters. Provision is made for the bottom horizontal frame portion of the cutting members to pass without hindrance beneath the light-weight concrete body while it is reliably supported during the cutting operation. The rear gate remains to serve as the backup against the trailing edge of the body to prevent cracking of the material as the wires leave the body. Thereafter the rear gate is removed, together with the side walls, and the concrete slabs on their individual supports are stacked in a suitable conveyor for final curing in an autoclave.

Referring now to the drawings:

FIGURE 1 is a perspective view of one of the concrete block forms;

FIGURE 2 is a side elevational view, with parts broken away;

FIGURE 3 is a sectional view, taken along the lines 3—3 of FIGURE 2;

FIGURE 4 is a perspective view of the completed slab or plank, with parts broken away;

FIGURE 5 is a sectional view of the bottom member showing the position of the reinforcing wire;

FIGURE 6 is a diagrammatic illustration of apparatus for adjustably positioning the reinforcing wire and contour forcing apparatus;

FIGURE 7 is a diagrammatic representation illustrating how the wire cutters may be adjustably spaced for cutting slabs of predetermined thicknesses;

FIGURE 8 is a plan view showing a refinement in the "lazy-scissors" wire cutting arrangement;

FIGURES 9, 10, 11 and 12 are schematic sequence illustrations as the concrete mold passes through various stations; and,

FIGURES 13 and 14 illustrate apparatus and methods for loading concrete slabs onto a truck for movement to a station for final curing of the concrete.

Reference is now made to FIGURES 1, 2, and 3 for a more complete description of the preferred form of mold used in practicing the present invention. Here there is shown a mold **8** consisting of a lower framework **10**, side walls **12**, front wall **14**, rear gate **16**, and bottom members **18**. While the lower framework **10** is shown with wheels or rollers **11**, it is to be understood that other means may be provided for moving this framework to the various stations as work is performed on the concrete slabs or planks. The side walls **12** are spaced approximately 4 feet apart and are about 16 inches high. The front wall **14** and rear gate **16** are approximately 20 feet apart. Slots **20** are provided in the side walls **12** so that transverse partitions (not shown) may be placed to make planks less than 20 feet long, if desired. The bottom members **18** preferably are 3, 4, or 5 inches wide, or some multiple thereof, and are closely spaced so that the cutting wires may pass between these members in the cutting operation. The bottom members **18** are supported on a series of spaced, tranversely extending bridging members or paddles **22** which are mounted for pivotal movement between a vertically extending supporting position and a horizontally extending cutting position, as will be more fully explained hereinafter.

Side locks **24** are also mounted on the pivotal shafts **26** and prevent the weight of the slurry within the mold from bowing the side walls **12** outwardly. These side locks also must pivot to a horizontally extending cutting position at the cutting station, as will be later explained. The front wall **14** is pivotally mounted at pivot **28** to

the lower framework 10 so that the front wall may be dropped down to a horizontal position below the cutters and not interfere with the cutting operation.

A cutting station 29 provides stationary cams 30, 32, and 33 and liftoff hooks 34 which are placed at selected positions from the cutters 35 along the path of movement of the concrete retaining mold 8 to actuate gate levers, gates, and support paddles at proper times. Wire cutters 35 are in fixed position and the mold or form 8 moves past these cutters. The stationary cam 30 lifts the front wall latch 36 for swinging movement of the front wall 14 downwardly in a clockwise direction to the horizontal position shown in phantom lines. This latch 36 consists of a pair of hooks 38, 40 with an interconnecting bar 46. These hooks are pivotally mounted on the side walls 12 and engage pins 42, 44 on the front wall 14. The interconnecting bar 46 has a pin engageable with cam 30 which causes it and the hooks 38, 40 to move upwardly as the form moves to the right relative to the stationary cam 30. As interconnecting bar 46 moves upwardly, pin 42 engages slope 50 of bar 46 to push the front wall forwardly, starting its clockwise movement. Pivot 28 is rearward of the wall 14 and gravity causes this front wall to continue its falling movement to the horizontal position out of the way of the cutters 35. When the front wall 14 has dropped, the form 8 continues past the cutting station.

Wire cutter 35 has a lower transverse member 52 that must pass under bottom members 18 of the mold 8 as the wires pass between the closed spaced bottom members in cutting the concrete material into planks. When the front wall 14 has dropped out of the way, the concrete material moves through the wire cutters with the lower cutter bar 52 moving above the hinge pivot point 28 of the front wall 14 and above the shafts 26 on framework 10 on which the paddles 22 are mounted. When the paddles hit this lower wire cutter bar 52, they are sequentially bumped counterclockwise as the form continues moving to the right to permit their passage past the lower cutter bar 52. The paddles 22 are kept in their vertical support position by locks 54 pivotally mounted to the lower framework 10. One end of lock 54 is spring-urged into a detent in the shaft 26 so as to render it nonrotatable. The other end of the lock 54 is cammed so as to strike the lower cutter bar 52 as it passes by. This causes counterclockwise rotation of lock 54 to remove the opposite end of the lock from the detent in shaft 26 to render shaft 26 rotatable at the time paddle 22 strikes the lower bar 52. Each of these paddles has an ear 56 which extends downwardly when paddle 22 is in the horizontal, non-support position. This ear strikes stationary cam 32 which causes paddle 22 to rotate clockwise back again to its upper supporting position after it has passed by the lower cutter bar 52. In this manner only one support paddle is not in supporting position at any one time but is rotated out of the way when the wire cutter bar passes through. As previously stated, side locks 24 support the side walls 12 and are pivotally mounted on the paddle support shaft 26 to also pivot out of the way as the form passes through the wire cutter.

When the form 8 has passed from the left to right so that the tailgate 16 of the form (as shown in phantom lines 16A on the right) reaches wire cutters 35, a third stationary cam 33 strikes pin 62 upwardly to raise a pair of interconnecting arms 64, 66 to disengage their hooked portions from pins 68, 70 on rear gate 16. Stationary liftoff hooks 34 engage pins 76 on the rear gate 16 to prevent further horizontal movement of the gate to the right and to free the rear gate from the form as the form continues its forward movement. The rear gate 16 may then be removed from the liftoff hooks 34 and stored or used with another mold. As shown in FIGURE 1, the gate 16 has slots 79 extending up to, but not through, the top edge thereof. This permits the wire cutter 35 to pass through the concrete while the rear gate 16 is still supporting the trailing face of the concrete to prevent tearing or breaking away of portions of the concrete from the trailing face as the cutting wires emerge therefrom.

FIGURE 4 is a perspective view of the finished plank of gas concrete material, with parts broken away in order to show the finished panel with the groove-and-rib type of interlock and with reinforcing wire inside to illustrate one of many types of planks that can be made in accordance with the present invention. This plank 80 is preferably 20 feet long, 16 inches high, and 3, 4, 5, or 6 inches thick or multiples thereof. Core holes 82 are provided either with removable cores in the mold or with conduit pipe, as desired. Reinforcing wire 84 curves around the core at the core holes. Groove 86 along the top edge and tongue 88 along the bottom edge are formed in a manner to be described in connection with FIGURES 5 and 6.

Since the slurry introduced into the mold is readily flowable and is incapable of supporting vertically disposed wire reinforcing mesh, a means must be provided for holding it in place while the slurry is air curing and congealing to a plastic state. Because the thickness of the plank will vary according to the order of a customer, the apparatus involved must be readily adaptable to adjust for the selected thickness. Assuming a plank 5 inches in thickness is desired, a bottom member, such as bottom member 18 in FIGURE 5, of this thickness is assembled on the paddles 22 of the lower framework 10. These bottom members may be hollow, elongated, tubular members of aluminum, or other nonmagnetic material having the upper surface 90 of a configuration that will match that desired on one end of the plank. Here the surface is depressed in the center so as to form the tongue 88 of plank 80. Spaced along the length of the upper surface of the bottom member 18 are raised portions 92 through which holes 93 are provided for receiving the reinforcement wire 84. The holes 93 retain the bottom portion of the reinforcing wire 84 securely in position, yet when the concrete has been poured, cut, and cured, the reinforcement wire does not protrude beyond the tongue 88 so as to interfere with the mating of slabs in a building construction.

A scissors-type of apparatus 94 is shown schematically in FIGURE 6 to illustrate how the upper forms are retained at the top of the mold. This apparatus carries forms 95 for making the upper groove 86 and for positioning the top part of reinforcing wire 84. A longitudinal steel form 95, which will mate with the upper groove 86, extends from one of the intersecting points of crosspieces 96 of the lazy-scissors apparatus 94, at which point is placed an electromagnet 97. Other forms (not shown) extend from other intersecting crosspieces. Spaced along the bottom surface of this steel form are corresponding holes 98 which correspond vertically with the holes 93 in raised portions 92 in FIGURE 6. Into these holes extend the upper ends of the reinforcing wires 84 which are held in place by the electromagnet 97. Extending from the upper ends are further reinforcing wires, such as 99 and 100 for example, to strengthen the edges of groove 86 and prevent them from chipping in use. Before the slurry has been poured into the form, the electromagnet 97 is disengaged, at which time the reinforcing wire 97 is disengaged, at which time the reinforcing wire 84 drops slightly to engage the lower end into the hole 93 in the raised portion 92 of the bottom member 18. In this manner, the reinforcing wire is firmly positioned and does not apply stresses to the concrete while it is curing.

Bottom members 18 are exchangeable with similar members but of greater and lesser width, depending upon the desire of the user. The lazy-scissors apparatus 94 accordingly may be used to position the steel form 95

in predetermined spacing with adjacent ones (not shown) as determined by the width of the bottom member **18**.

In order for the form in FIGURE 1 to be useful in cutting planks of varied sizes, the width of the bottom members **18** must vary. In practice, bottom members of various selected widths will be used, as desired, and the apparatus for positioning the reinforcement wires **84** for the planks are also adjustably spaced for the desired widths. The cutting wires of cutter **35** must also be adjustably spaced so that they may be passed between the bottom members **18** in the cutting operation. A lazy-scissors arrangement is schematically shown in FIGURE 7 for adjustably spacing cuter wires **101**. In order to keep the wires parallel, the top and bottom scissors apparatus **106** and **108** must be moved together. While the wires **101** are shown connected at the intersections of the crossbar links **110, 112** where the bars intersect at these midpoints, it is to be understood that this is a schematic illustration and that the connections preferably may be made at the ends thereof.

In cutting thinner planks, the cutter wires **101** in FIGURE 7 are moved more closely together and for thicker planks, the wires are moved farther apart. In cutting unusually thick planks, the scissors apparatus **106** and **108** will tend to become too long in adjustment for wider spacing of the cuter wires **101**. To illustrate, 15 cutter wires are necessary to cut 3-inch-thick planks from a 4-foot-wide concrete body. Only five are needed to cut 8-inch planks from the same body, and the other 10 wires simply extend out approximately 8 feet in space beyond the width of the form. However, it is possible to confine the width of the lazy-scissors apparatus for holding the cutter wires to the width of the form by effectively eliminating alternate wires. One example of this is to place adjacent wires in the same cutting path, such as shown in the enlarged detailed, cross-sectional, partial view of one of the scissors elements, as shown in FIGURE 8. Here scissors links **110** and **112** intersect at their midpoints at pivots **114, 116** which have suitable brackets **118, 120** mounted thereto. These brackets have wire-retaining guides **122, 124** through which wires **101** are positioned. Arcuate links **130, 132** have arcuate slots **134, 136** therein in which the wires **101** travel as the wire-retaining guides **122, 124** are turned inwardly in the direction of arrows **126** and **128**. A bracket **137** attached to links **110, 112** has pin-and-slot connections **138, 139** with the arcuate links **130, 132** to permit spacing adjustment between intersecting points of scissors links **110, 112**. The spacing adjustment is done with a camming drum **140** rotatable on a shaft **141** whose axis is parallel to the plane of the scissors links **110, 112**. This drum **140** has grooved guides **142, 143** of varied distances apart in the direction of the shaft axis. These grooved guides position extensions **144, 145** of the brackets **118, 120** therein so that their spacing may be adjusted by rotation of the drum **140**. In this manner, the wires **101** may be spaced apart 3, 4, 5, and 6 inches, respectively, and when bracket guides **122, 124** are turned inwardly, adjacent wires **101** are in alignment with the direction of the movement of the concrete forms relative to the wire cutters. Thus, both cutter wires travel the same grooved path through the concrete. In this manner, the previous sizes of 3, 4, 5, and 6 inch spacing between the wires will be doubled so that planks of 6, 8, 10, and 12 inches are now possible without unduly stretching the scissors apparatus.

FIGURES 9 through 12 symbolically illustrate a series of operations in making cellular concrete planks. In FIGURE 9, the empty mold **8**, consisting of side walls **12**, rear gate **16**, front wall **14**, and bottom members **18**, is shown mounted on its paddles **22** on its lowermost framework **10** which has rollers **11**. Arrow **14C** indicates the direction in which the mold is moved. A wax sprayer unit **147** which may, for example, be similar to the spraying machine described in United States Patent No. 2,151,100 which issued March 21, 1935 to W. E. Hadley, is adapted to move downwardly until the inverted spinning disk **148** is inside the mold near the front wall **14**, as shown in dotted line and indicated by reference numeral **149**. When the sprayer unit reaches the lower position, liquid wax is emitted from the center of the shafe where it is dispersed from the spinning inverted disk **148**. As the mold **8** moves forward, the waxer unit **147** sprays the mold **8** throughout, giving it a heavy coat of wax which seals the spaces between the bottom members **18**, as well as the slits **79** in the back gate **16** to prevent leakage when the wet concrete mixture is poured in. The sprayer unit **147** is raised to permit passage of the rear gate **16** and to be in position to spray the next mold reaching this station.

Referring now to FIGURE 10, the reinforcing wire and top form are next supplied. Here a lazy-scissors-type of supports **94**, similar to that shown in FIGURE 6, are positioned over the form **8** to position a plurality of upper groove forms **95** across the top of the form. Projecting cores **150** and reinforcing wire **84** extend down to the bottom members **18** in a manner described in connection with FIGURE 5. When the concrete is poured, the reinforcing wire frame and core are already formed into it in proper position to reinforce each plank cut therefrom and to provide cored openings as desired. After the slurry is poured and cured to a semiplastic state, it is ready for cutting into planks at the cutter station exemplified by cutters **35** in FIGURE 10. Before the form reaches the cutter station **29**, the core and upper mold forms are removed and the front gate **14** is dropped. When ready for cutting, the gas concrete has sufficiently congealed so that it can be cut before final curing of the resultant planks in the autoclave.

FIGURE 11 shows the form after it has passed the cutters **35**. The tailgate **16** is removed, as well as the sides **12**. The bottom members **18** with planks **80** thereon are now ready to be loaded as a stack of finally formed units for curing.

FIGURE 12 shows a loading station for loading the base supports **18** with the concrete planks **80** onto a truck **151**. This truck has a framework **152** for stacking a plurality of layers of base supports and slabs thereon for curing. The truck **151** is positioned over an elevator **154** and dropped down so that the loading is done from the top and as one row of planks is loaded, the elevator raises to position the framework of the truck for the next row. The lower frameworks **10** are not loaded. When the truck is full, the wheels **155** are level with the floor and the truck is wheeled into the autoclave (not shown) for final curing under heat and pressure in the conventional manner.

FIGURE 13 is an elevational view of the autoclave truck loading station **154** in FIGURE 14, and FIGURE 14 is an end view thereof. Elevator **154** is adapted for vertical movement by means of a hydraulic ram **156**. On the ram **156** is a platform **158** having a truck stop member **160**. The truck **151** has a frame **152** having a plurality of vertically spaced positions for receiving planks **80**. These vertical positions consist of horizontal, transverse combination roller-tie rods **162, 164,** and **166** spaced along the length of frame **152** at intervals different from the spacing of support paddles **22** on lower framework **10**. These roller-tie rods rotate paddles **22** on the framework **10** in a counterclockwise direction in the same manner that the lower member **52** of the cutters **35** in FIGURE 2. With different spacing between the roller-tie rods **162, 164,** or **166**, depending upon the elevator loading position, only one paddle at a time will be in the horizontal position to permit a roller-tie rod to pass, while the other paddles are in the vertical support position. Sections **170** are stationary, nonelevating trackway members over which the rollers **11** of lower framework **10** pass as the framework is moved onto the frame of the truck. On these sections are mounted reset cam plates **172** that perform in a manner similar to cams **32**

in FIGURE 2 for returning the paddles **22** to vertical position. While sections **170** are shown mounted on supports **174** extending from the bottom of the elevator well **176**, if desired they may be mounted on frame **152**. As shown in FIGURE 14 wheels **155** of truck **151** must be spaced inwardly from the track sections **170** in order to move the truck onto and off the elevator platform **158**.

In loading the base sections **18** with planks **80** thereon onto the truck **151**, the lower framework **10** is moved in the direction of arrow **182** onto the track sections **170** after the platform **158** has been moved to its lowermost position, as shown. For the initial loading, the concrete planks are positioned over the top roller-tie rods **166**. The lower framework **10** travels under the roller-tie rods **166** by alternately having the rotating support paddles **22** displaced from their vertical position on contact with the combination roller-tie rod units **166**, and then reset to their vertical or load-supporting positions by the cam plates **172** attached to each track section **170**. When the load is fully positioned, the hydraulic lift **154** is raised two or three inches so that the rollers **166** will completely support the mass of planks, and the lower framework **10** is then removed entirely from the truck transfer rack **152**. The elevator platform **158** is then raised to the next position, shown in phantom at **186**, at which position frame **152** can receive another load of planks on rollers **164**. The hydraulic lift is in position **186** when the tie rods **164** are loaded, after which the lift is raised to the next position **188** and the same operation is repeated. The lower frame **10**, when it is removed from the rack **152**, is returned to the makeup department for reuse.

Having thus described the preferred form of the present invention, it is to be understood that various forms and modifications will occur to those skilled in the art, and it is also to be understood that these deviations from the preferred embodiment are intended to form part of this invention as now defined in the appended claim.

What is claimed is:

Wire cutter apparatus comprising:

a plurality of wires adjustably spaced in parallel relationship for passing through and cutting a body of gas concrete in a semiplastic state into a plurality of gas concrete planks;

a first lazy-scissors apparatus to receive and support the top ends of said wires;

a second lazy-scissors apparatus to receive and support the bottom ends of said wires;

said wires being adjustably spaced by movement of said lazy-scissors apparatus;

brackets mounted on each of said lazy-scissors apparatus; and

wire-retaining guides pivotally mounted on said brackets;

said wires being movable into alignment without further movement of said lazy-scissors apparatus whereby one of said wires is positioned behind another of said wires to travel the same grooved path through the concrete as the concrete body is pushed therethrough.

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