Jan. 23, 1951

A. MAGNANI

METHOD AND APPARATUS FOR PRODUCTION OF FIBROUS CEMENT ARTICLES

2,538,972

Filed Dec. 31, 1947

3 Sheets-Sheet 1

Fig. 1

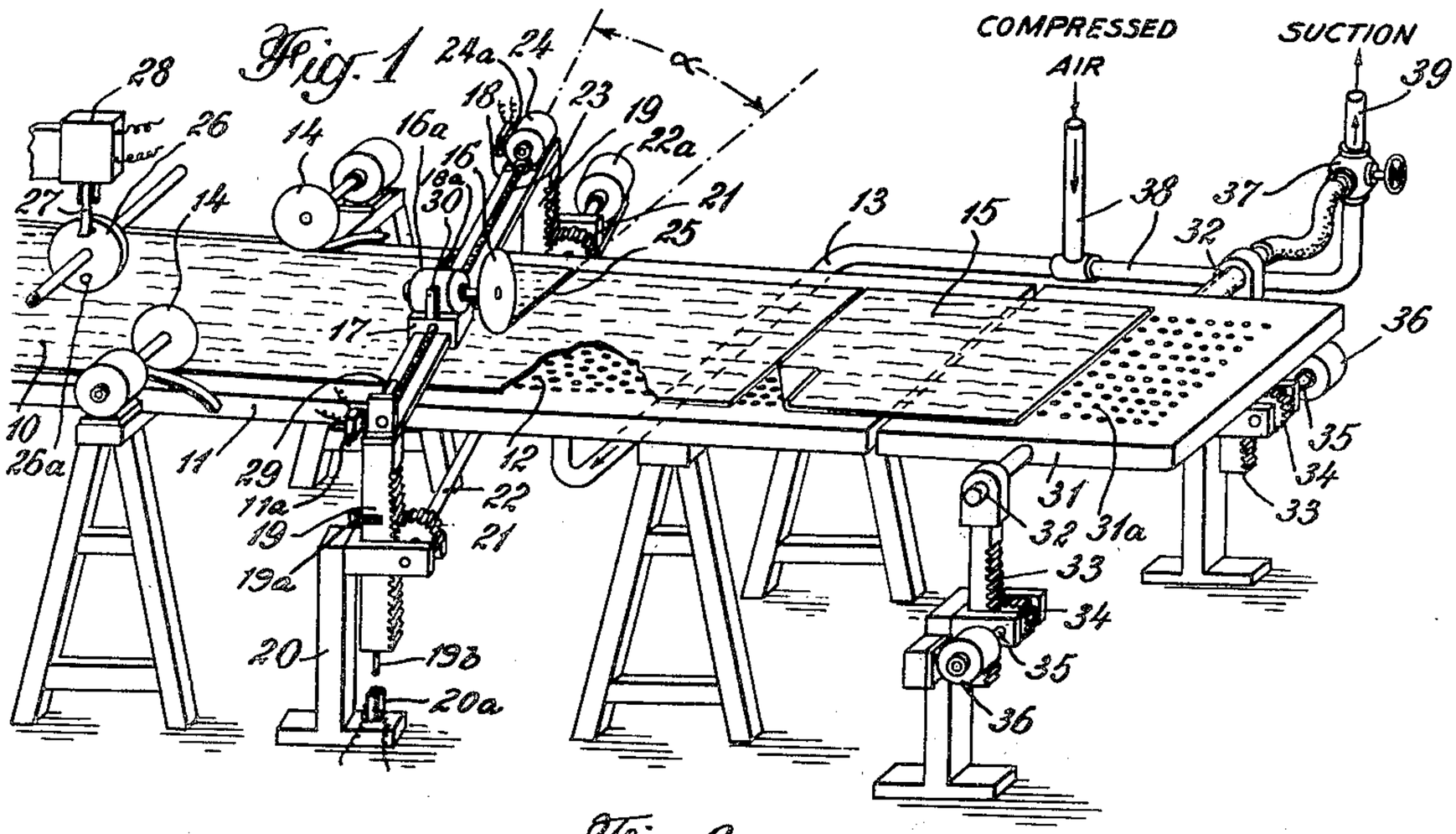


Fig. 2.

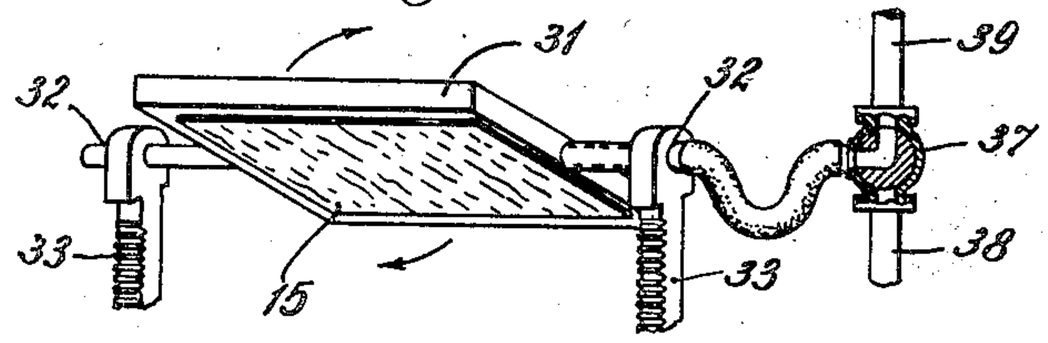
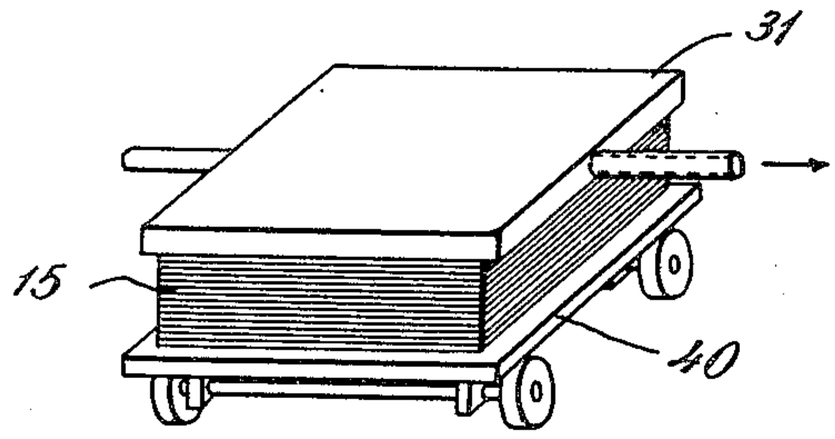


Fig. 3.



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3 Sheets-Sheet 2

Fig. 4.

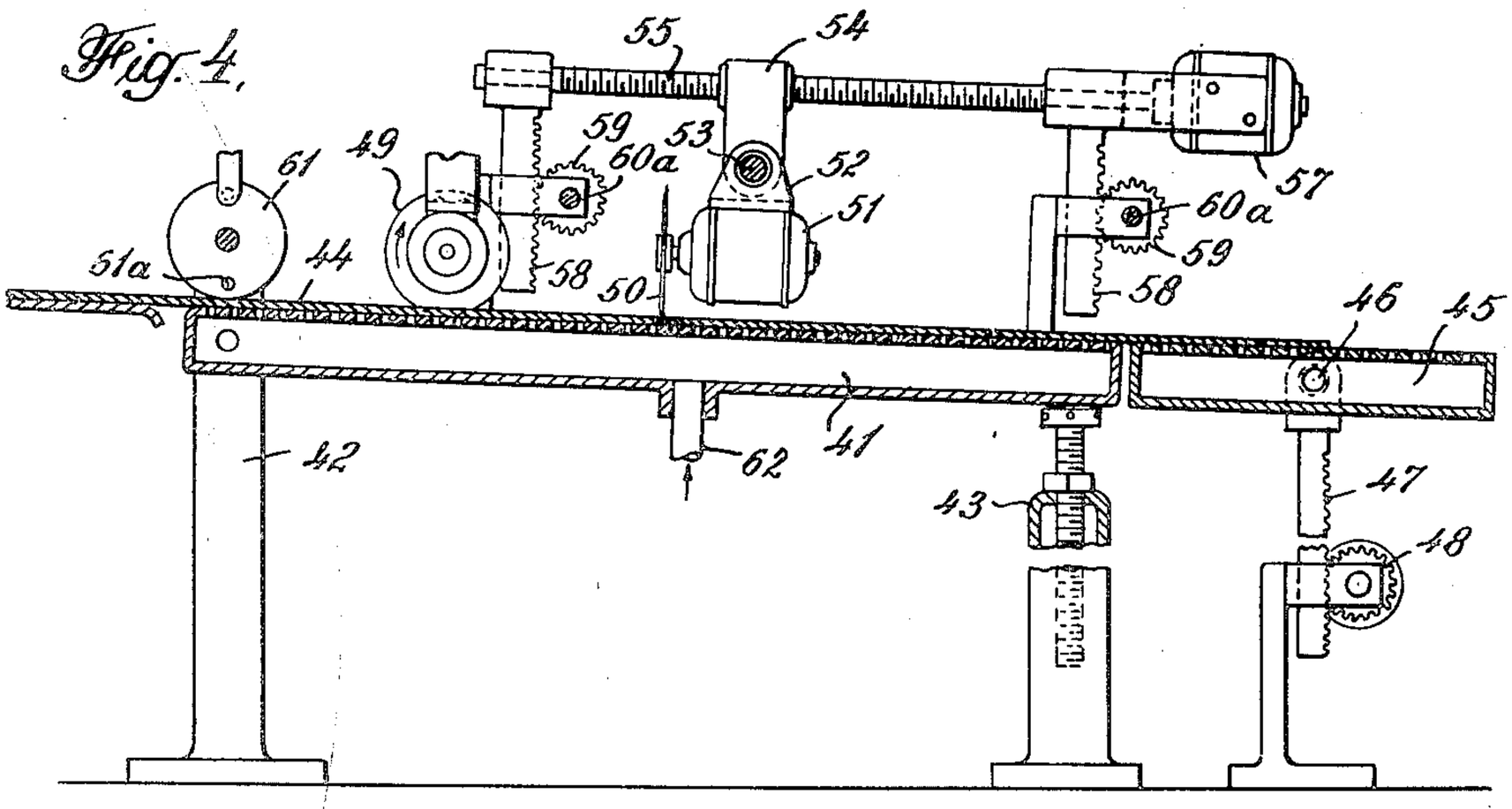
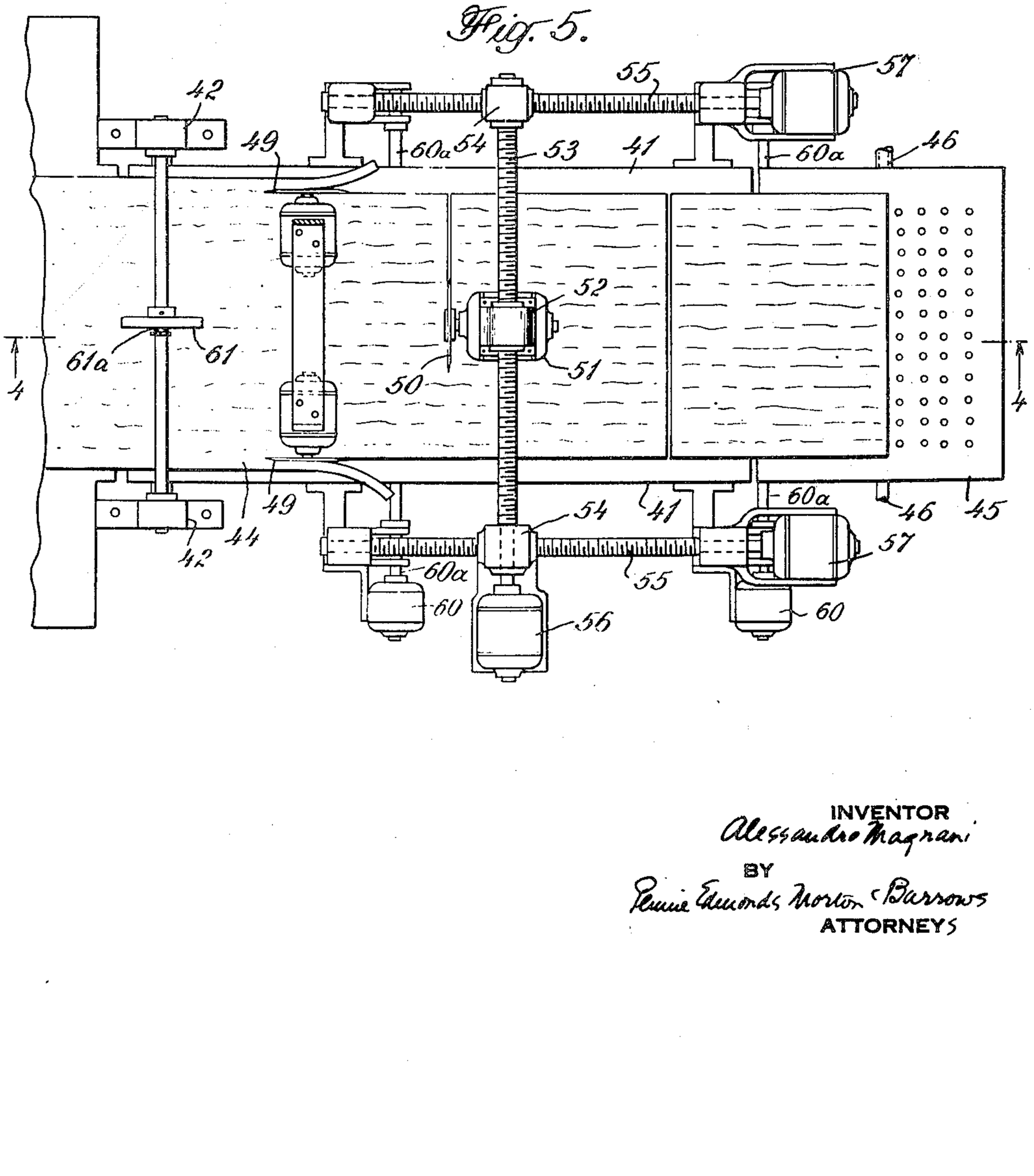


Fig. 5.



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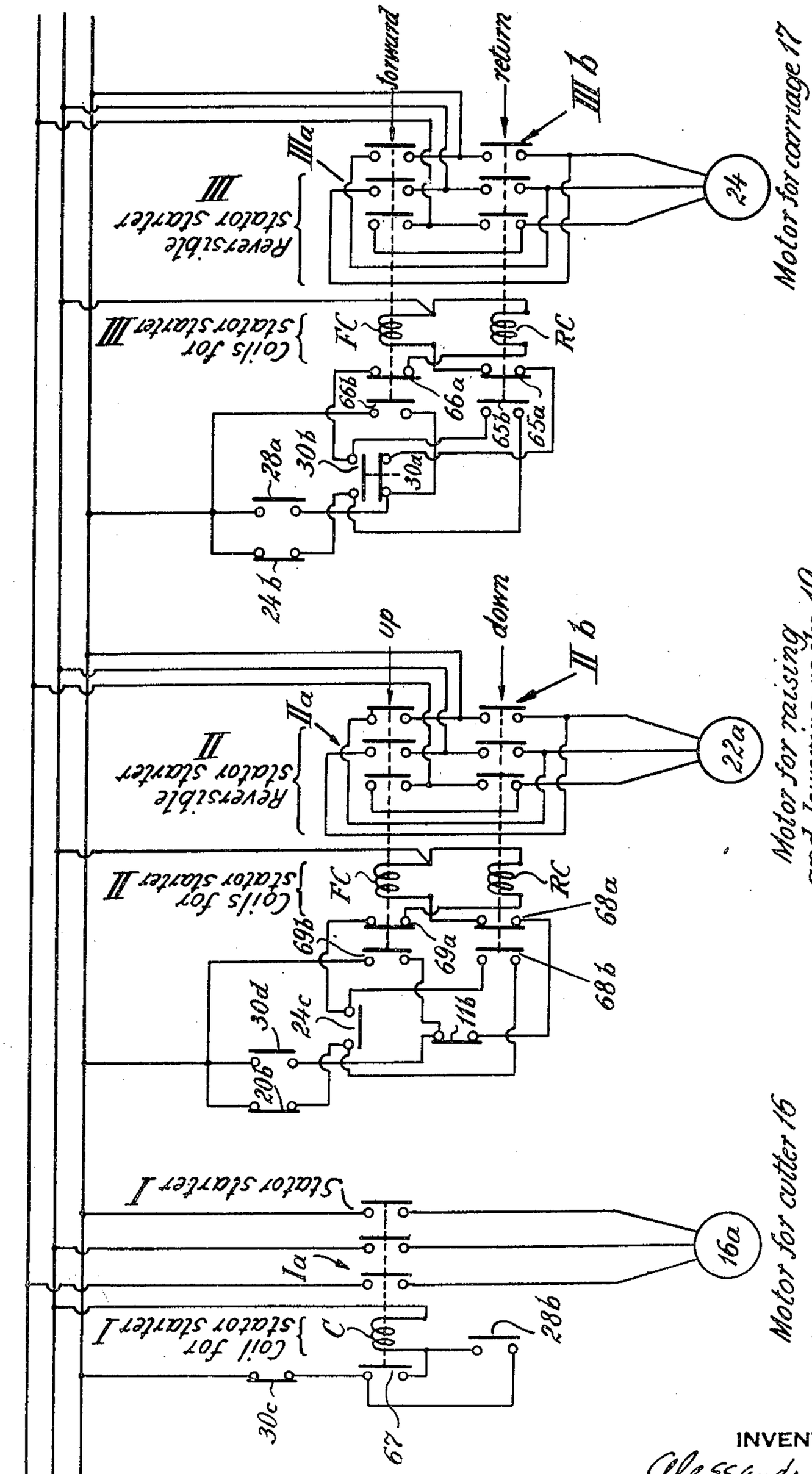

Fig. 6.

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METHOD AND APPARATUS FOR PRODUCTION OF FIBROUS CEMENT ARTICLES

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This invention relates to the production of fibrous cement sheets and is concerned more particularly with a novel method of cutting a continuously moving fibrous cement web into sheets and stacking the sheets, and with an apparatus, by which the method may be advantageously practiced.

Fibrous cement webs of indefinite length can be made by apparatus of various kinds and the webs so formed are cut into sheets, which are allowed to set and harden. The sheets cut from the freshly made web are difficult to handle because of their size, and they are readily damaged because of their softness, particularly when they are relatively thin. Heretofore, the sheets have been handled manually and the operations are slow and laborious and involve a considerable loss of material as a result of damage thereto.

The present invention is directed to the provision of a method, by which a fibrous cement web being continuously advanced from the apparatus in which it is produced, can be cut into sheets and the sheets stacked or piled on a truck or conveyor without manual handling of the finished sheets. In the practice of the new method by the apparatus of the invention, the indefinitely long web is advanced continuously over a support and is cut into sheets by a cutter, which travels across the support and back at such an angle less than 90° to the direction of movement of the web, that the sheets are rectangular in shape. Beyond the support, the sheets advance upon the top of a discharge table, which is capable of being tilted on an axis parallel to its top and also raised and lowered. The top surfaces of the support and table are pervious and air under pressure may be passed through the pervious surfaces from beneath to facilitate the movement of the sheets over the surfaces. When a sheet has moved from the support wholly upon the table, the air supply to the surface of the table is cut off and suction is applied to the under side of the sheet through the table top, these operations being performed manually. The table is then rotated on its axis with the sheet held tightly in place thereon by the suction and, when the table is upside down, it is lowered to place the sheet upon a truck or conveyor. The suction is then cut off to release the sheet and the table raised and rotated to its original position to receive the next sheet. The movement of the web and sheets over the support and table may be facilitated by so mounting the support and table, that their tops are inclined downwardly in the direction of travel of the web and sheets.

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For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Fig. 1 is a view in perspective of one form of apparatus for practicing the new method;

Fig. 2 is a perspective view of the discharge table, showing the latter reversed in the discharging operation;

Fig. 3 is a perspective view showing the deposit of a sheet on a truck;

Fig. 4 is a vertical view in longitudinal section of a modified form of the apparatus;

Fig. 5 is a plan view of the apparatus in Fig. 4, with parts broken away; and

Fig. 6 is a wiring diagram.

In the practice of the method by the apparatus shown in Fig. 1, the fibrous cement web 10 advances endwise from the apparatus, in which it is formed, over a support table 11, which is hollow and has a top 12 formed with a plurality of perforations. Air under pressure may be supplied through a line 13 to the interior of the support table and the air issues through the perforation and strikes the under surface of the web, forming an air cushion on which the web floats over the support table.

As the web advances over the support table, it first passes a pair of motor-driven rotary cutters 14 mounted on opposite sides of the support table and trimming the web to uniform width. Beyond the trimming cutters, the advancing web is cut transversely into sheets 15 and this cutting operation is performed by a motor-driven cutter 16 mounted on a carriage 17 movable along a track 18 extending across the support table and above it. The track is mounted on the upper ends of racks 19, which are movable vertically in standards 20 by pinions 21 on a driven shaft 22. The carriage is moved along the track by means of a screw 23 driven by a motor 24 at one end of the track. The track extends at such an angle to the direction of movement of the web that, as the carriage and cutter move along the track from motor 24, the carriage and cutter also move in the direction of movement of the web and at the same speed, so that the cut 25 is transverse to the longitudinal axis of the web.

The operation of the motor 16*a* driving the cutter 16 and of the motor 24, which advances the carriage and cutter along the track, may be controlled by a contact disc 26, which bears against the surface of the web to be rotated thereby. The disc is provided with one or more contacts 26*a*, which engage an arm 27 and cause it to close a pair of switches in a switch box 28.

Upon closing of the switches, motors 16*a* and 24 are started, so that cutter 16 is rotated and carriage 17 is moved along the track in a direction away from motor 24. During such movement of the carriage, the track is in a lower position so that cutter 16 severs the web. When the carriage reaches the end of the track, an end stop 29 at the end of the track operates switches in a switch box 30 on the carriage and, as a result, motor 16*a* is stopped, motor 22*a* is started in a direction to raise the track, and motor 24 is stopped and then started in the reverse direction to cause the carriage to return along the track. One of the racks 19 carries an arm 19*a*, which operates a switch in a switch box 11*a* mounted on the support table 11, when the rack reaches the upper limit of its travel, and the operation of the switch causes motor 22*a* to be stopped. A switch box 24*a* containing a pair of switches is mounted on track 18 adjacent motor 24 and these switches are operated by an element 18*a* on carriage 17, when the carriage reaches its initial position on the track. The operation of the switches in box 24*a* causes motor 24 to be stopped, and motor 22*a* started in a direction to lower racks 19. A switch box 20*a* is mounted on one of the standards 20 and contains a switch, which is operated by an arm 19*b* on the rack 19 movable in the standard, when the rack reaches the lower limit of its travel. Operation of the switch in box 20*a* stops motor 22*a*.

The severed sheet 15 may be advanced along the support table by a gentle push, until it passes off the end of the support table and upon the top of a discharge table 31. The discharge table is mounted on pivots 32 in the upper ends of racks 33 engaged by pinions 34 on shafts 35 driven by motors 36. The discharge table is hollow and its top 31*a* is made pervious by being formed with a plurality of perforations. One of the pivots 32 is hollow and is connected through a three-way valve 37 to a compressed air line 38 and a suction line 39.

As the sheet 15 is moving over the top of the discharge table, valve 37 is adjusted to cause air under pressure to be supplied to the interior of the table, the air issuing through the perforations to form a cushion for the sheet. When the sheet is fully in place on the table, the valve is turned manually to cut off the supply of air and connect the interior of the table to the suction line, the suction holding the sheet tightly in place on the table. The discharge table is then turned upside down by hand, as indicated in Fig. 2, and motors 36 are operated to drive the pinions 34 to lower racks 33 and the table. In order to transport the sheets to storage, a truck 40 is placed beneath the discharge table at the beginning of operations and, when the table with the sheet held thereto by suction has been lowered close to the top of the truck, valve 37 is operated to cut off the suction, whereupon the sheet is released and deposited upon the top of the truck. The discharge table is then raised by motors 36 to its initial position, being reversed during the raising movement. As the discharge table comes up into registry with the top of support table 11, motors 36 are stopped and valve 37 is operated to supply air to the discharge table.

In the form of apparatus illustrated in Fig. 4, the hollow support table 41 is pivotally mounted at one end on standards 42 and its other end is supported from beneath on a standard 43, which is adjustable in height, so that the top of the support table may be inclined downwardly in the direction of travel of the web 44 over its top. Beyond the lower end of the support table is a hollow discharge table 45 mounted for rotary movement on pivots 46 in the upper end of racks 47 operable by pinions 48. The edges of the web 44 advancing over the support table are trimmed by motor-driven cutters 49 and the web is cut transversely into sheets by a rotary cutter 50 on the shaft of a motor 51. The motor is mounted on a carriage 52 movable along a screw 53 supported at its ends in carriages 54 on screws 55 extending lengthwise of the support table. Screw 53 is driven by a motor 56 attached to one of the carriages 54 and screws 55 are driven by motors 57. Screws 55 are mounted in bearings at the upper ends of racks 58, which are engaged by pinions 59 on motors 60 driving shafts 60*a*.

A contact disc 61 engaging the top of the advancing web is provided with one or more contact terminals 61*a*, which operate switches (not shown) controlling the operation of motors 51, 56, and 57, and, when one of the contact terminals 61*a* becomes effective, motors 51, 56, and 57 start operating. At this time, the screws 55 are in a lower position and, as cutter 50 begins to move across the web to sever the latter, screw 53 is advanced lengthwise of the web on screws 55 at the same speed as the web by motors 57. When carriage 52 reaches the end of its outward travel, an end stop operates switches (not shown) to shut off motor 51, to reverse motors 56 and 57, and to start the motors 60 driving shafts 60*a*, by which racks 58 are raised. When the carriage 52 reaches its initial position on screw 53, an end stop operates a switch (not shown) to shut off motor 56, and another end stop operates a switch to shut off motors 57, when screw 53 has reached its initial position on screws 55. When racks 58 have reached a selected upper position, end stop switches thereon cause a reversal of the motors driving shafts 60*a*. The racks are then lowered to their initial positions with cutter 50 in cutting relation to the web, and motors 60 are stopped by an end stop switch.

The support table 41 and the discharge table 45 are hollow and the tops thereof are perforated. The interior of support table 41 is connected by a line 62 to a source of compressed air and one of the pivots 46 of discharge table 45 is hollow and connected through a suitable valve to a source of compressed air and a source of suction.

In the operation of the apparatus shown in Figs. 4 and 5, the advancing web moves along the support table on an air cushion formed by air issuing through the perforations in the top of the support table and the edges of the web are trimmed and it is severed transversely into sheets, which are successively moved upon the top of discharge table 45. The inclination of the tops of the support table and discharge table are such that the severed sheets travel by gravity down the support table and upon the discharge table. Whenever such a sheet is in position on the top of the discharge table, the compressed air supplied to the table is cut off and replaced by suction, which serves to hold the sheet tightly in place on the table. The discharge table is then reversed and lowered, until the sheet lies close to the top of a truck similar to truck 40 or to the top of a pile of sheets thereon. The suction is then cut off and the sheet in contact with the discharge table is released therefrom and deposited on the truck.

The circuits employed in the apparatus of Fig. 1 are illustrated in the wiring diagram, Fig. 6, which shows motors 16*a*, 22*a*, and 24 as of the three phase A. C. type. Motor 16*a* is provided with a stator starter I and motors 22*a* and 24 are provided with reversible stator starters II and III, respectively. Switches 28*a* and 28*b* are those in box 28 and both are closed momentarily, whenever a contact 26*a* on disc 26 engages the arm 27. Switch box 30 contains 30*a*, 30*b*, 30*c*, and 30*d* and, when the switches are operated by end stop 29, switch 30*a* is opened, switch 30*b* is closed, switch 30*c* is opened, and switch 30*d* is closed. Switch box 11*a* contains switch 11*b* and switch box 24*a* contains two switches 24*b* and 24*c*. Switch box 20*a* contains a single switch 20*b*. With the switches in the condition shown, the operation of the apparatus is as follows:

Upon the closing of switch 28*a*, current flows from supply line B through switch 28*a*, closed switch 30*a*, closed switch 65*a*, and the forward coil FC of starter III to supply line Y. Energization of coil FC closes contacts III*a* and motor 24 starts to operate in the forward direction to advance carriage 17 along track 18. On energization of coil FC, switch 66*a* is opened and switch 66*b* is closed. Closing of switch 66*b* establishes a shunt circuit around switch 28*a*, so that coil FC continues to be energized after switch 28*a* has opened.

Closing of switch 28*b* causes current to flow from supply line B through closed switch 30*c*, switch 28*b*, and coil C of starter I to supply line Y, so that the contacts I*a* are closed and cutter motor 16*a* begins to operate. Energization of coil C causes closing of switch 67, which establishes a shunt circuit around switch 28*b*, so that coil C continues to be energized after switch 28*b* has opened.

When the carriage 17 reaches the end of track 18 and switches in box 30 are operated by end stop 29, switch 30*a* is opened and this cuts off the flow of current to forward coil FC of starter III. As a result, motor 24 is stopped, the carriage 17 comes to rest, switch 66*a* is closed, and switch 66*b* is opened.

Switch 30*b* is closed by end stop 29 shortly after the opening of switch 30*a* and, when switch 30*b* is closed, current flows from power line B through closed switch 24*b*, switch 30*b*, closed switch 66*a*, and reverse coil RC of starter III to line Y. Energization of coil RC causes closing of contacts III*b*, so that motor 24 starts to operate in the reverse direction. Energization of coil RC also causes opening of switch 65*a* and closing of switch 65*b*. Closing of switch 65*b* establishes a shunt around switch 30*b*, so that coil RC continues to receive current after switch 30*b* is opened.

Opening of switch 30*c* by end stop 29 cuts off current to coil C of starter I, so contacts I*a* open and motor 16*a* comes to rest.

Closing of switch 30*d* causes current to flow through switch 30*d*, closed switch 11*b*, closed switch 68*a*, and forward coil FC of starter II to power line Y. Energization of coil FC causes contacts II*a* to be closed and switch 69*a* to be opened and switch 69*b* to be closed. Closing of contacts II*a* causes motor 22*a* to be operated to raise racks 19 and closing of switch 69*b* establishes a shunt around switch 30*d*, so that coil FC of II continues to be energized after switch 30*d* has opened.

When the racks have been raised to the desired extent, arm 19*a* opens switch 11*b* in box 11*a* and the current supplied to coil FC of starter II is cut off. Contacts II*a* thereupon open, switch 69*a* is closed, and switch 69*b* is opened. Opening of contacts II*a* shuts off motor 22*a*.

When the carriage has returned to its starting point on track 18, an arm 18*a* on the carriage opens switch 24*b* and closes switch 24*c* in switch box 24*a* mounted on the track adjacent motor 24. Opening of switch 24*b* cuts off the current to coil RC of starter III, whereupon contacts III*b* are opened, motor 24 comes to rest, switch 65*a* is closed, and switch 65*b* is opened. The closing of switch 24*c* causes current to flow from supply line B through closed switch 20*b*, switch 24*c*, closed switch 69*a*, and reverse coil RC of starter II to line Y. Energization of coil RC of starter II causes contacts II*b* to close and switch 68*a* to open and switch 68*b* to close. Closing of contacts II*b* causes motor 22*a* to operate in a direction to lower racks 19. When the racks reach the lower limit of their travel, an arm 19*b* on one of the racks opens a switch 20*b* in switch box 20*a* on one of the standards 20. Opening of switch 20*b* cuts off the current to coil RC of starter II, and contacts II*b* then open and switch 68*a* closes and switch 68*b* opens. Opening of contacts II*b* stops motor 22*a*. The system is now in condition for the beginning of another cut.

In the practice of the method by the apparatus described, no manual lifting and transporting of the newly formed soft web and sheets are required. The web and sheets move freely over the support and discharge tables on the air cushions and the sheets are transferred from the discharge table to a truck or conveyor without being handled manually. The soft sheets are, accordingly, fully protected against injury, and laborious handling operations are avoided.

In the constructions illustrated, the support and discharge tables have flat tops, because a flat web is being handled, but if the web is provided with longitudinal corrugations, the surface of the support and discharge tables will be correspondingly formed.

I claim:

1. An apparatus for cutting a fibrous cement web into sheets and stacking the sheets, which comprises a support table having a substantially flat oblong top, on which the web may travel lengthwise of the top, a discharge table having a substantially flat top, the tops of the support and discharge tables being pervious, means for continuously passing air through the top of the support table from beneath during the operation of the apparatus to form an air cushion above said support table, a carriage movable across the support and back at an acute angle to the longitudinal axis of the support table during the travel of the web, a motor-driven cutter on the carriage, means for moving the carriage across the support and for raising and lowering the carriage relative to the support, and means actuated by a web traveling over the support for controlling the operation of the cutter and said means.

2. In an apparatus for stacking soft fibrous cement sheets, the combination of a support table having a substantially flat oblong top, on which the web may travel lengthwise of the top, a discharge table having a substantially flat top and mounted at one end of the support table for swinging movement on an axis parallel to its top, the tops of the support and discharge tables being pervious, means for passing air through the top

of the support table from beneath, and means for selectively passing air through the top of the discharge table from beneath and applying suction to the top of the discharge table from beneath.

3. An apparatus for cutting a fibrous cement web into sheets and stacking the sheets, which comprises a support table having a substantially flat oblong top, on which the web may travel lengthwise of the top, a discharge table having a substantially flat top aligned with the top of the support table, the tops of the support and discharge tables being pervious, means for passing air through the tops of the tables from beneath to form an air cushion for supporting a web, a track extending across the support and above it, means for reciprocating the track lengthwise of the support, a carriage movable on the track across the support and back, a cutter mounted on the carriage, means for moving the carriage, means for raising and lowering the track, and means actuated by a web traveling over the support for controlling the operation of the cutter, and the reciprocating, moving, and raising and lowering means.

4. An apparatus for cutting a fibrous cement web into sheets and stacking the sheets, which comprises a support table having a substantially flat oblong top, which is downwardly inclined in the direction of its length, a discharge table mounted at the lower end of the support table, the discharge table having a substantially flat top downwardly inclined and aligned with the top of the support table, the tops of the support and discharge tables being pervious, means for passing air through the tops of the tables from beneath to form an air cushion on which a web can move lengthwise of the tables by gravity and means for cutting transversely a web moving along the support table on said air cushion.

5. An apparatus for cutting a fibrous cement web into sheets and stacking the sheets, which comprises a support table having a substantially flat oblong top, a discharge table having a substantially flat top aligned with the top of the support table, the tops of the support and discharge tables being pervious, a cutter rotatable in a plane normal to the top of the support table, means for moving the cutter across the support table and back at an angle to the longitudinal axis of the support table, means for passing air through the tops of the tables from beneath to form an air cushion on which a web can travel while being cut, and means operable by a web traveling on said air cushion to control the operation of the cutter.

6. A method of cutting a fibrous cement web into sheets and stacking the sheets, which comprises advancing the web lengthwise in its plane, while directing air under pressure against the under side of the web to support it, cutting the advancing web cross-wise into sheets, advancing the sheets in their planes, while directing air under pressure against the under side of each sheet to support it, cutting off the supply of air and applying suction to the bottom of the sheets successively to hold each sheet against movement in its plane, turning the sheet upside down while maintaining the suction, and cutting off the suction to release the sheet.

7. An apparatus for cutting a plastic fibrous cement web into sheets, which comprises a support table having a substantially flat top, a discharge table having a substantially flat top, the tops of the tables being aligned and pervious, a

cutter mounted above the support table, means for moving the cutter across the support table and back at an acute angle to the longitudinal axis of the support table, means for raising and lowering the cutter relatively to the support table, means for supplying air to the tops of the tables from beneath to form an air cushion on which a web may be supported and moved, and means operable by a web traveling on the air cushion on the support table for controlling the operation of the cutter and the means for moving and for raising and lowering the cutter.

8. An apparatus for cutting a fibrous cement web into sheets, which comprises a support table, a discharge table at the end of the support table, the tables having hollow tops with aligned flat pervious top surfaces, means for supplying air to the table tops to escape through the top surfaces thereof to provide a supporting air film over each table, means for cutting off the air supply to the top of the discharge table and connecting said table top to a source of suction, and means for cutting successive end sections from a web traveling over the support table while supported on said air film, the cutting means including a cutting element mounted to lie above the support table, means for moving the element along the support table with the traveling web and then returning the element to its initial position, and means for lowering the element prior to its advance with the web and raising the element prior to its return movement.

9. In a method of cutting a soft fibrous cement web into sheets and stacking the sheets, the steps of advancing the web lengthwise with its plane horizontal while supporting it from beneath on an air film, cutting successive end sections from the web, while its movement continues, to form sheets, advancing each sheet with its plane horizontal to a place remote from the end of the web, while supporting the sheet from beneath on an air film, and, when the sheet has reached said place, removing the supporting air film from beneath the sheet, applying suction to the surface of the sheet at a multiplicity of points, and transferring the sheet to a stacking station, while maintaining the suction thereon.

10. An apparatus for cutting a fibrous cement web into sheets, which comprises a support table, a discharge table at the end of the support table, the tables having hollow tops with aligned flat pervious top surfaces, means for supplying air to the table tops to provide a supporting air film over each table, and means for cutting successive end sections from a web traveling over the support table while supported on said air film, the cutting means including a cutting element mounted to lie above the support table, means for moving the element along the support table with the traveling web and then returning the element to its initial position, and means for lowering the element prior to its advance with the web and raising the element prior to its return movement.

11. In a method of cutting a soft fibrous cement web into sheets and stacking the sheets, the steps of advancing the web lengthwise with its plane substantially horizontal while supporting it from beneath on an air film, cutting successive end sections from the traveling web to form sheets, advancing each sheet edgewise with its plane substantially horizontal to a place remote from the end of the web, while supporting the sheet from beneath on an air film, and, when the sheet has

reached said place, applying suction to the surface of the sheet at a multiplicity of points to hold the sheet against edgewise movement, bodily transferring the sheet to a stack, while maintaining the suction thereon, and cutting off the suction to release the sheet, when it is upon the stack.

ALESSANDRO MAGNANI.

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