

[54] HONEYCOMB MAKING MACHINE

[75] Inventors: **Kenneth G. Clark**, Pennington;
Thomas J. Cook, Kendall Park; **Ernest T. DePass**, Bound Brook;
Abraham Manfredonia, Titusville,
all of N.J.

[73] Assignee: **Union Camp Corporation**, Wayne,
N.J.

[22] Filed: **Aug. 3, 1970**

[21] Appl. No.: **60,268**

[52] U.S. Cl. **156/548**, 156/197, 156/291,
156/572

[51] Int. Cl. **B32b 31/08**, B32b 31/18

[58] Field of Search.....156/197, 291, 512, 548, 549,
156/551

[56] References Cited

UNITED STATES PATENTS

3,518,151	6/1970	Ellinor.....	156/512
3,519,510	7/1970	Ardolino et al.	156/197
2,983,640	5/1961	Knoll et al.	156/197
3,551,257	12/1970	Rochla	156/510

Primary Examiner—Benjamin A. Borchelt

Assistant Examiner—James M. Hanley

Attorney—Kane, Dalsimer, Kane, Sullivan and Kurucz

[57]

ABSTRACT

A continuous honeycombed paper making machine is provided which transforms the output of four paper stock rolls into a continuous core of honeycombed material. The machine comprises four sections: a gluer; sheet stacker; pad slicer; and slice combiner. The gluer forms a continuous 4-ply web from the stock rolls by applying adhesive in staggered, longitudinal stripes to the top and bottom surfaces of the first or topmost and third plys. The sheet-stacker cuts and trims the 4-ply web and accumulates a quantity of sheets into a stack where adjacent sheets are bonded to one another by virtue of the adhesive on the top surface of the topmost ply and then compresses the stack to form a pad. The pad slicer slices each pad into slices extending transverse to the adhesive stripes. The slice combiner applies adhesive to each slice and then positions them in a vertical column where the slices are bonded to one another to form the desired continuous core.

11 Claims, 26 Drawing Figures

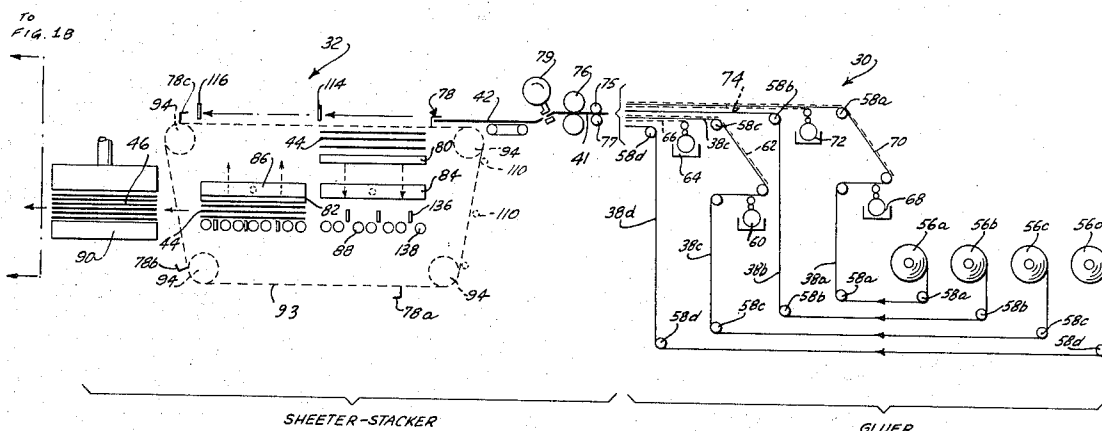
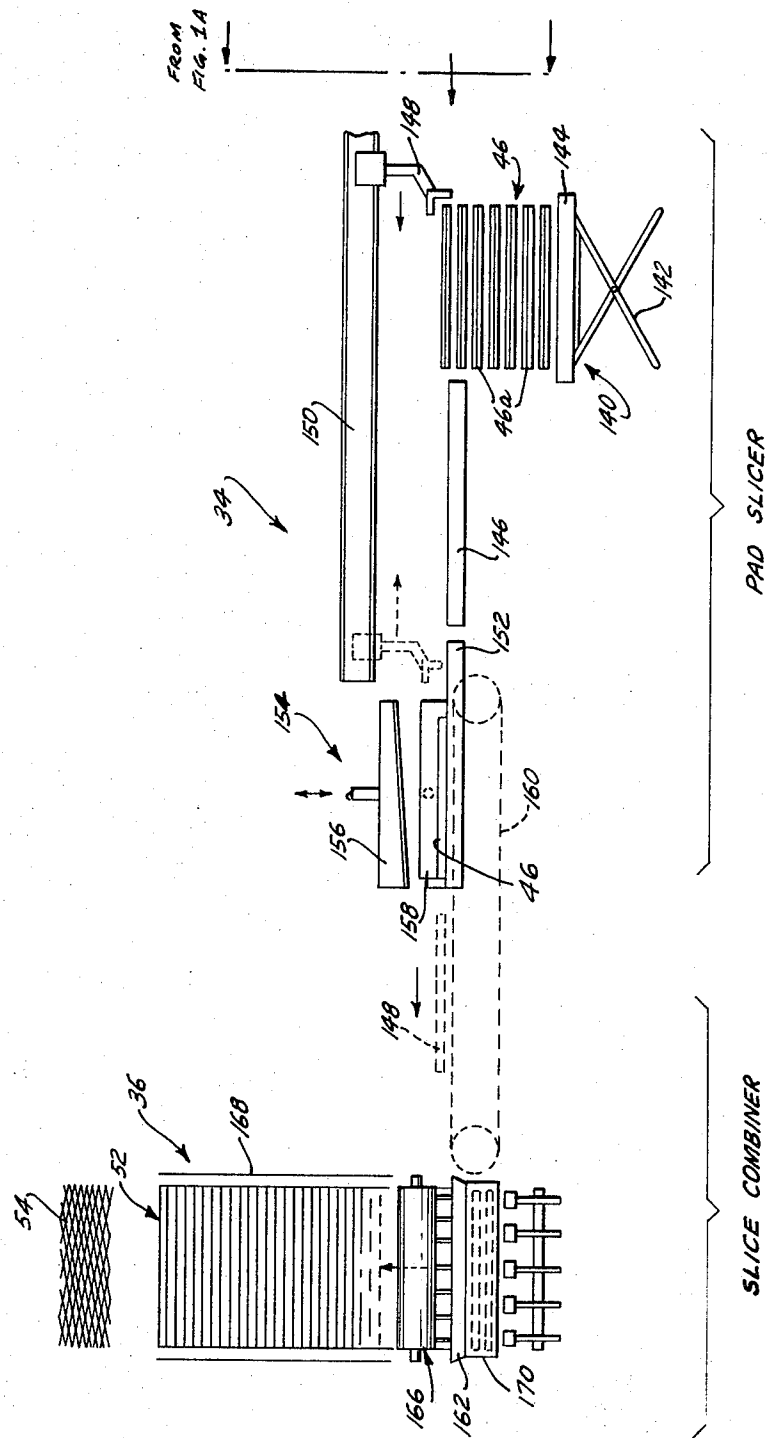


FIG. 1B



INVENTORS
 KENNETH G. CLARK
 THOMAS J. COOK
 ERNEST T. DEPASS
 ABRAHAM MANFREDONIA
 BY
 Kane, Schinner, Kane, Sullivan & Kuncy
 ATTORNEYS

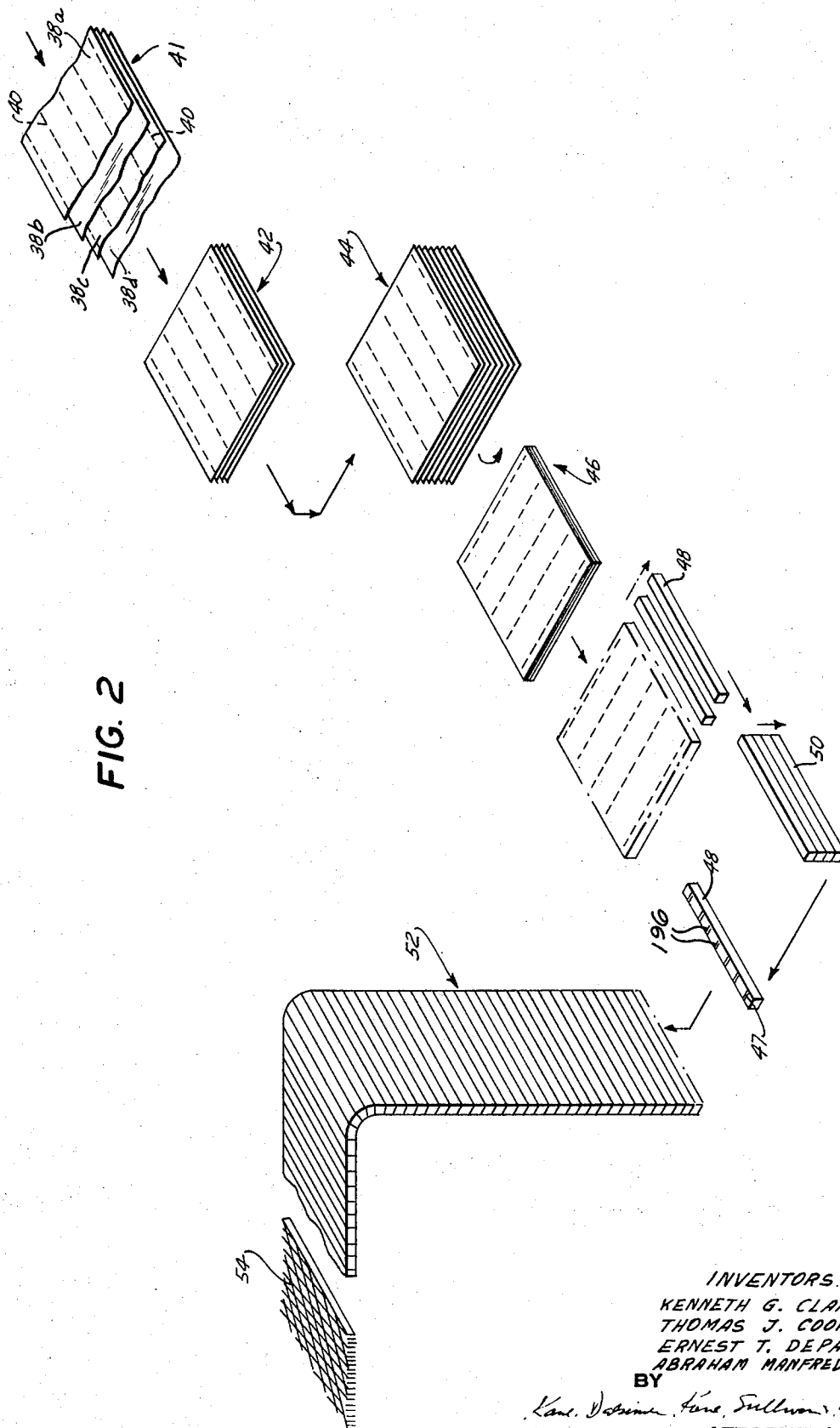
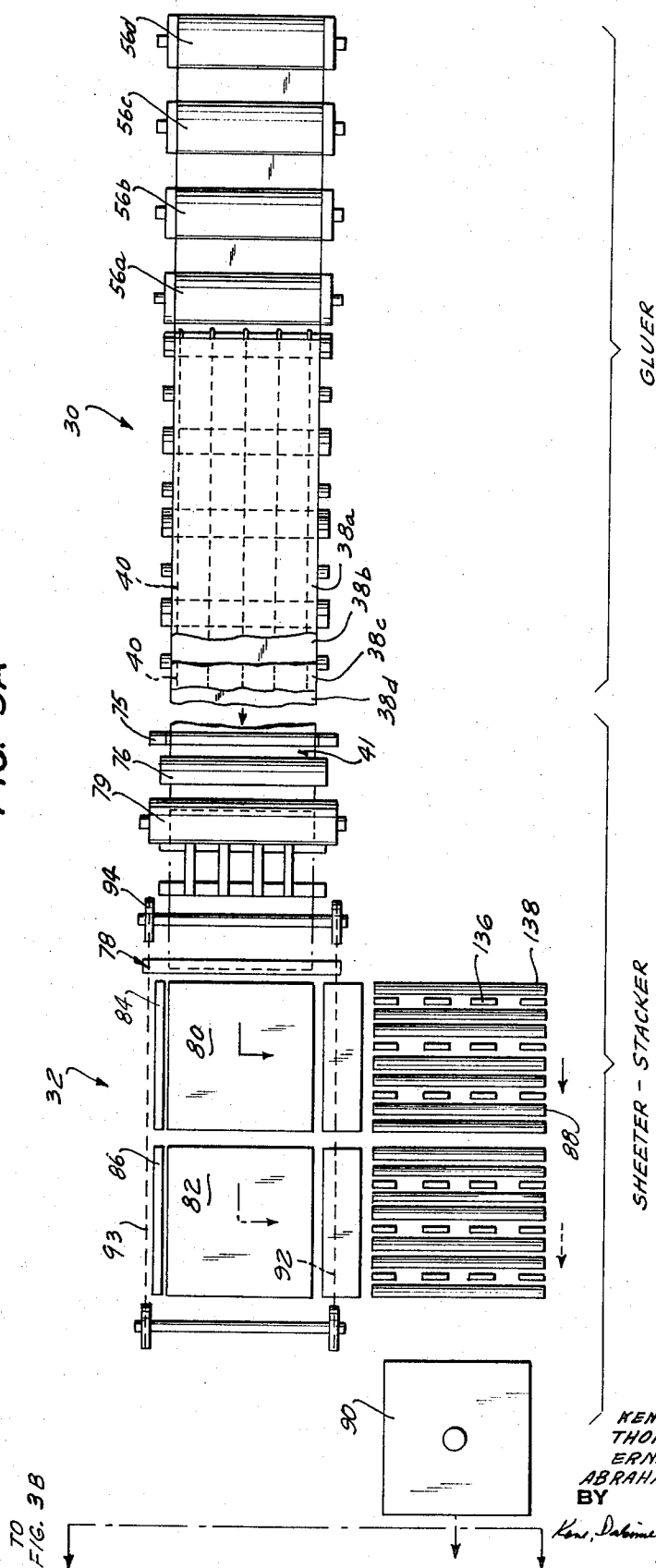
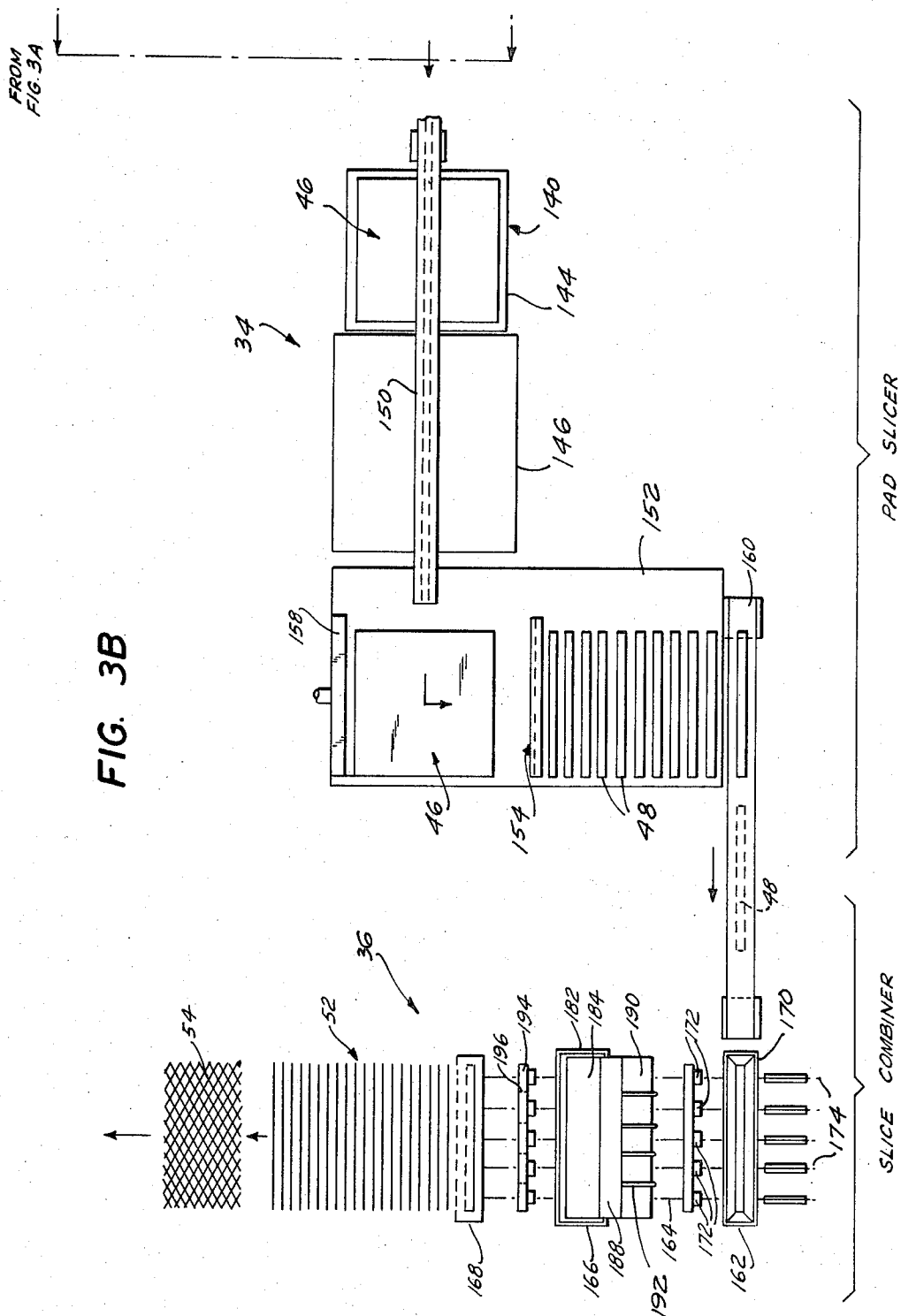


FIG. 3A



INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA
BY

Kear, Dahme, Koss, Sullivan & Koss
ATTORNEYS



INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA

BY

Kane, DeBenedictis, Kane, Sullivan & Curran
ATTORNEYS

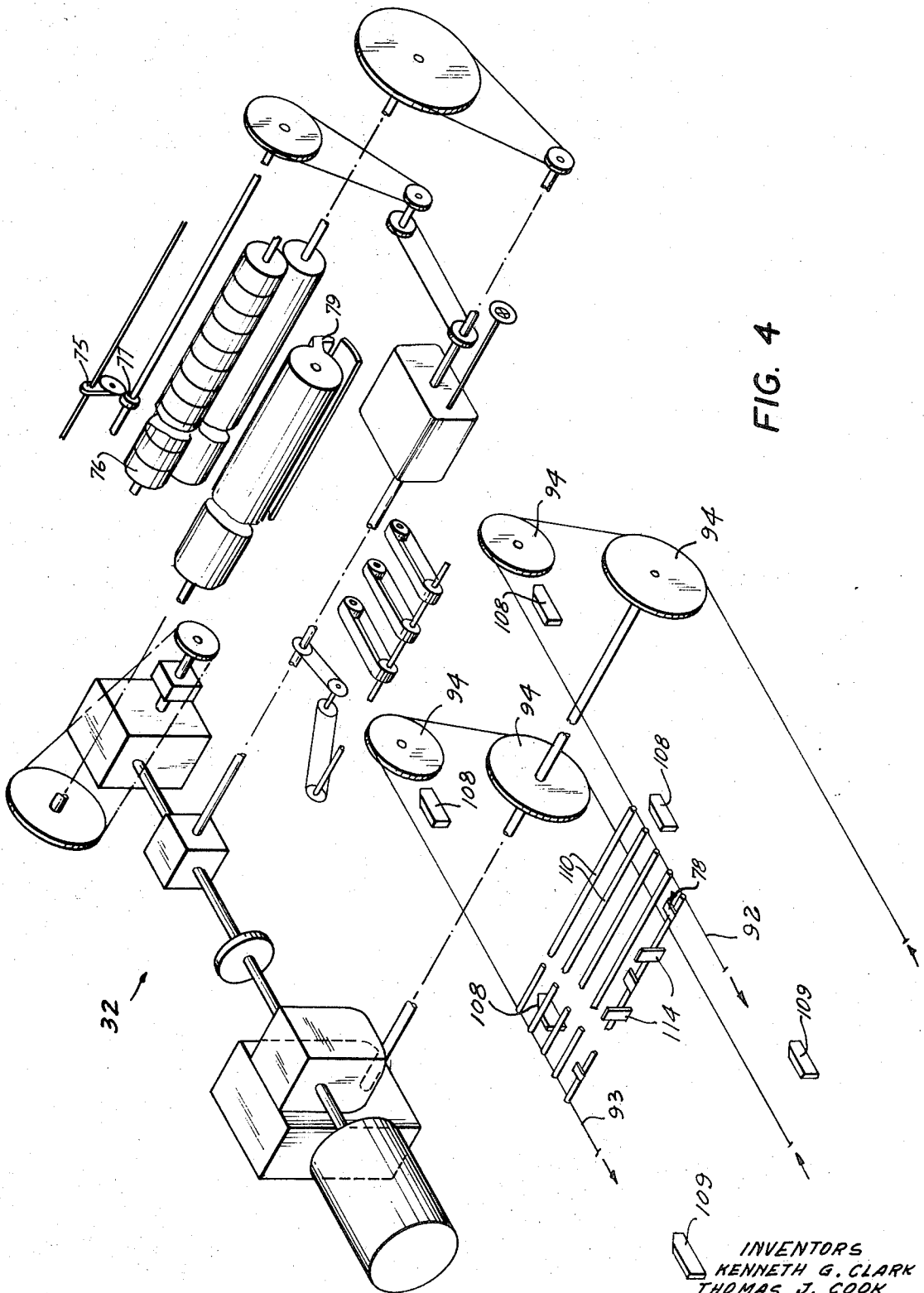


FIG. 4

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA
BY

Kane, Doherty, Kane, Sullivan & Kury
ATTORNEYS

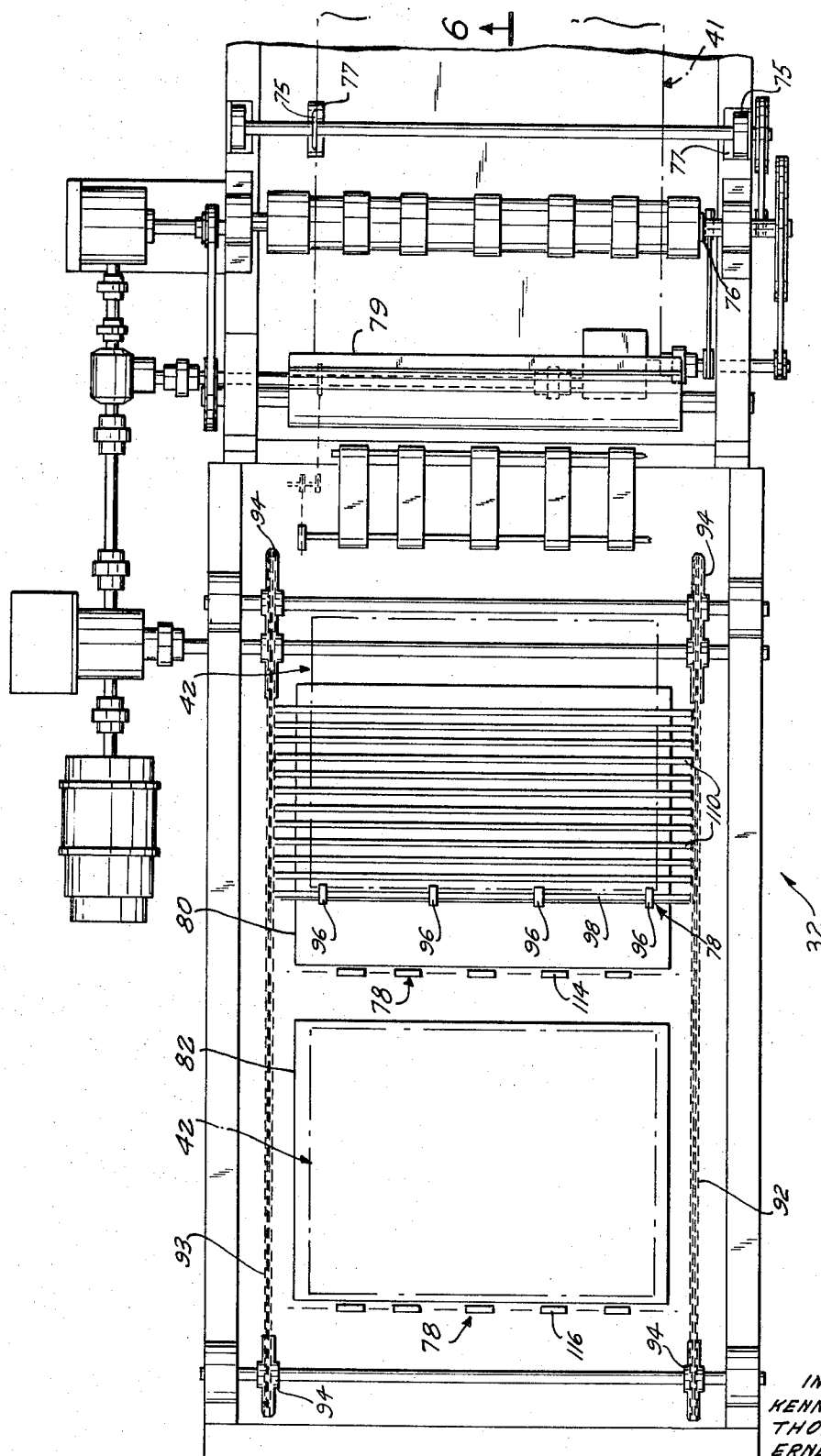


FIG. 5

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA

BY

Kane, Dabner, Kane, Sullivan & Kinnery,
ATTORNEYS

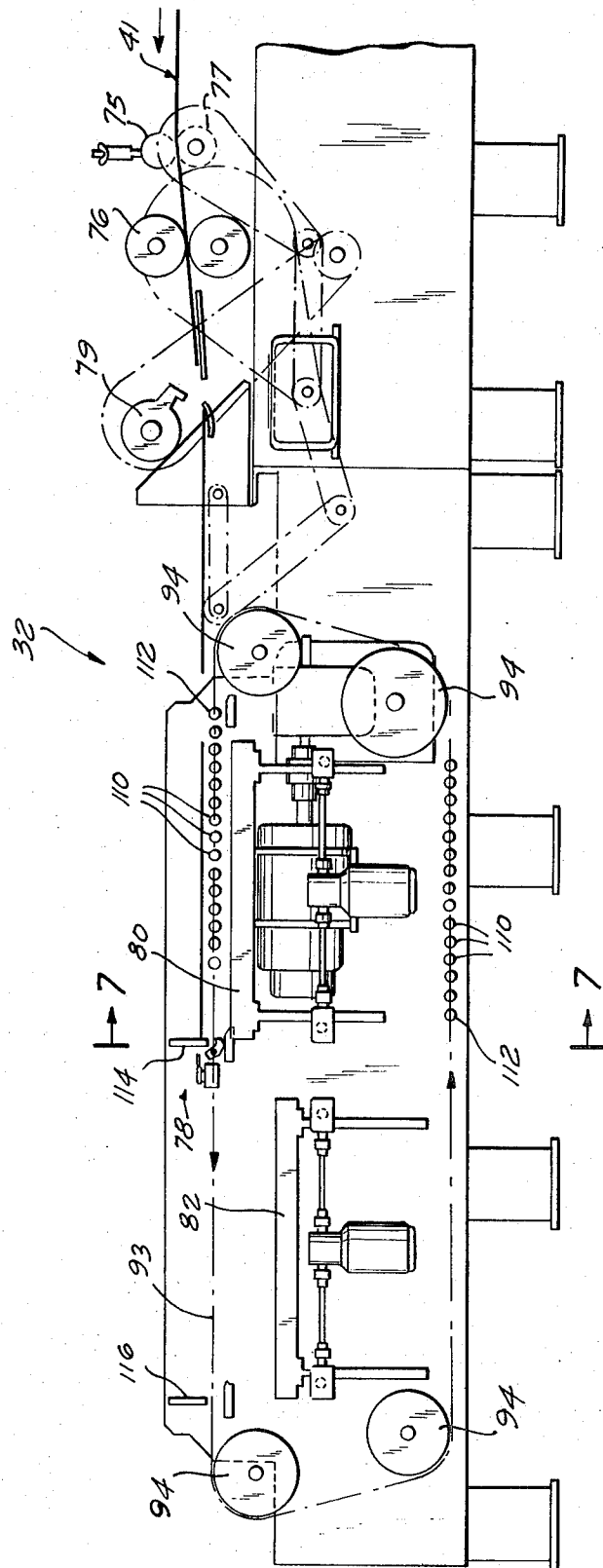


FIG. 6

INVENTORS
 KENNETH G. CLARK
 THOMAS J. COOK
 ERNEST T. DEPASS
 ABRAHAM MANFREDONIA
 BY
 Kone, DePrime, Kone, Sullivan, & Lunsay
 ATTORNEYS

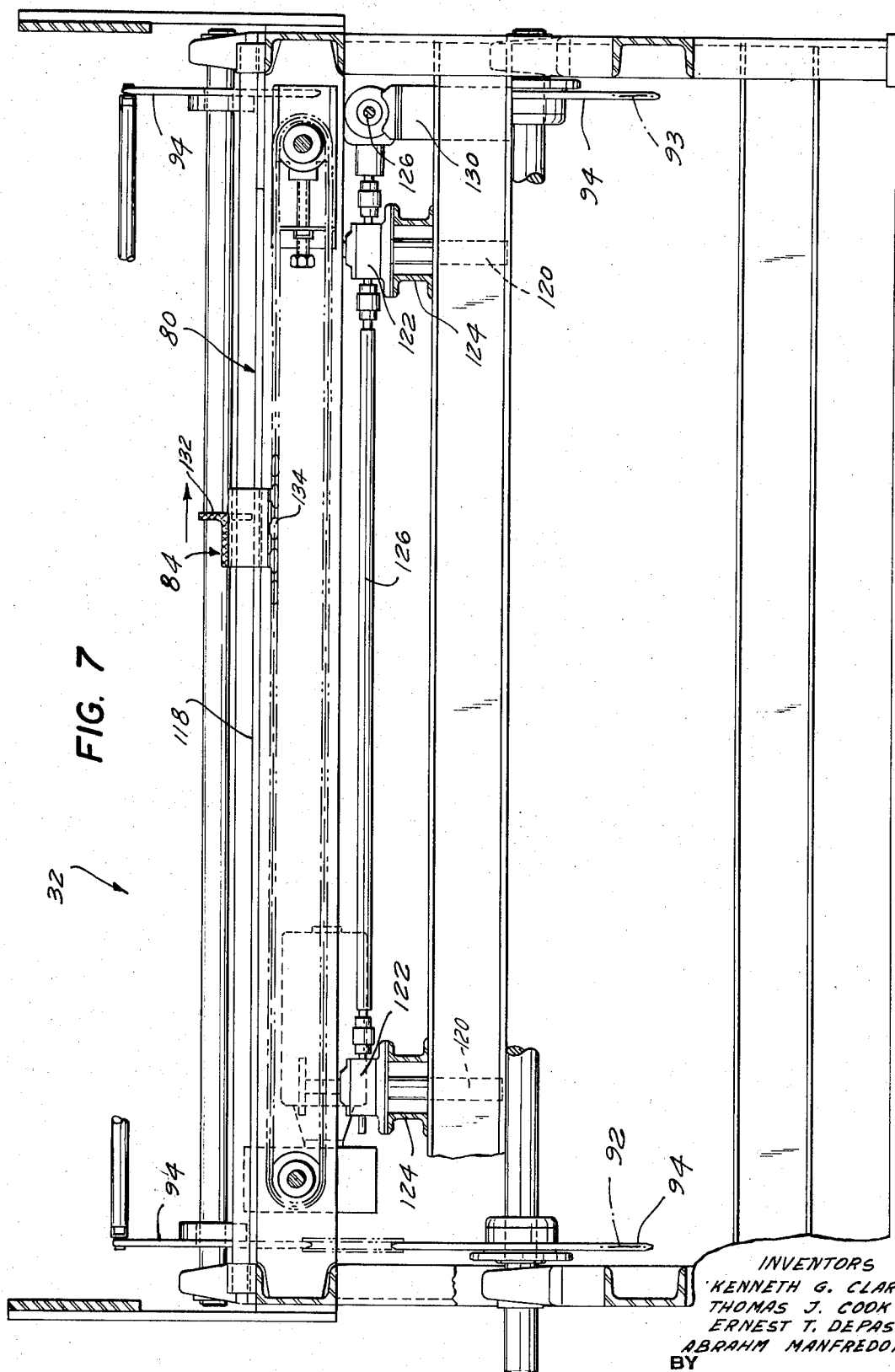


FIG. 7

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA

BY

Law, Prosser, Law, Sullivan & Young
ATTORNEYS

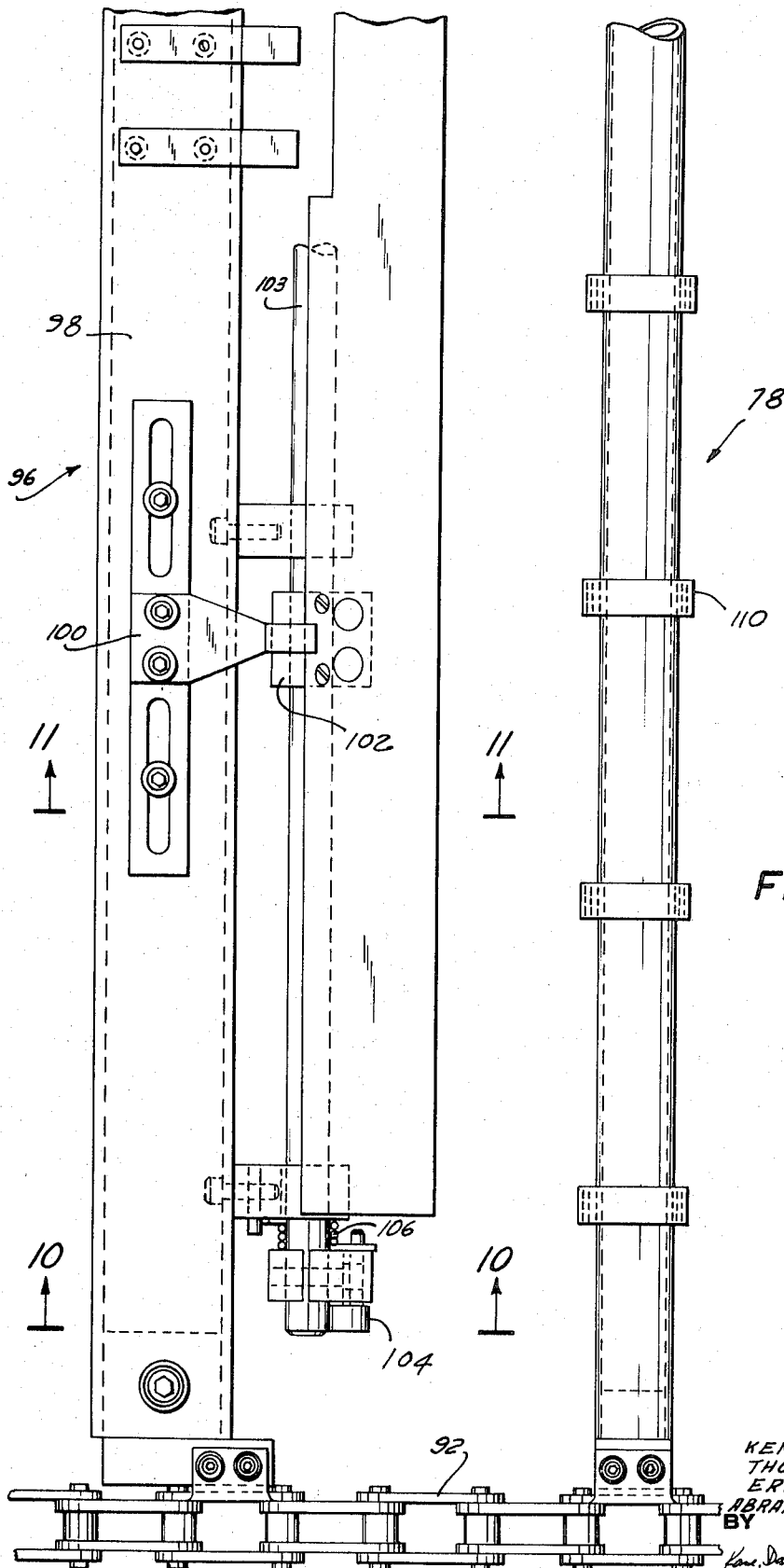
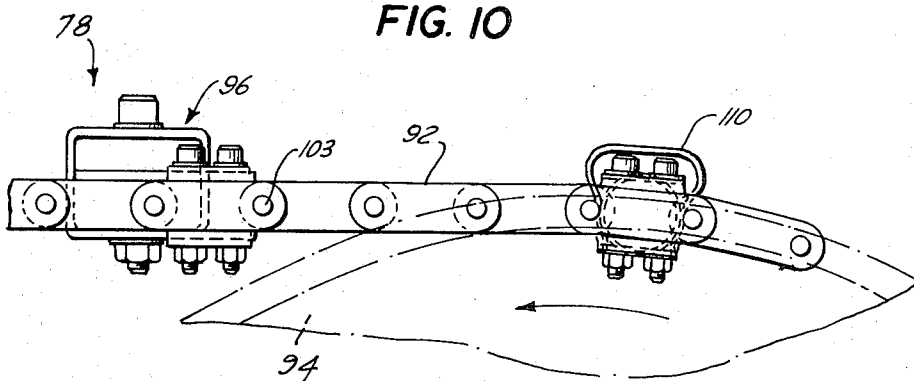
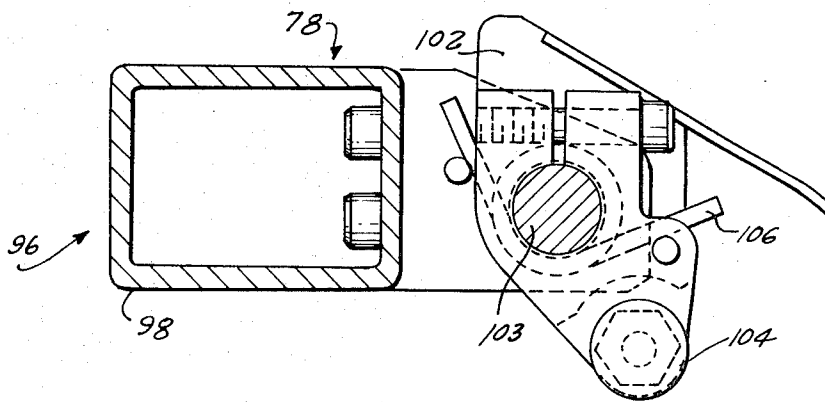
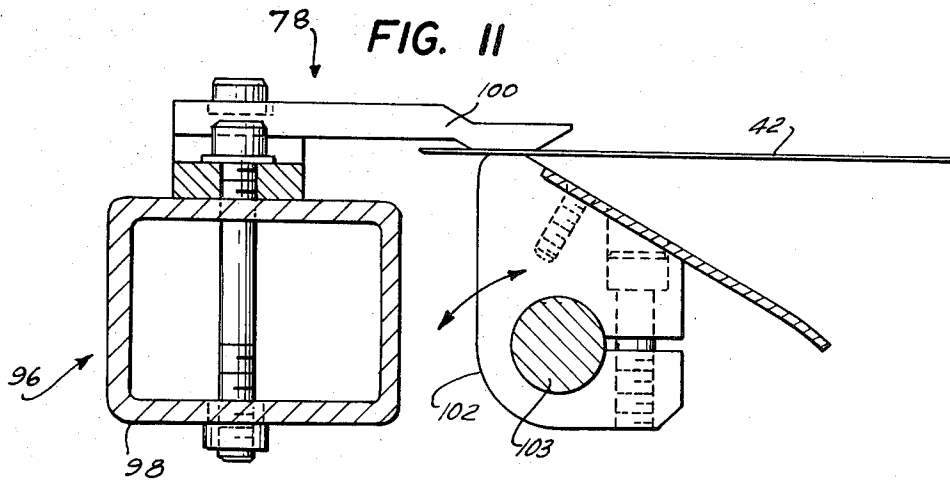


FIG. 8

INVENTORS
 KENNETH G. CLARK
 THOMAS J. COOK
 ERNEST T. DEPASS
 ABRAHAM MANFREDONIA
 BY
 Kenneth G. Clark, Kenneth J. Cook, Ernest T. DePass, Abraham Manfredonia
 ATTORNEYS



INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA
BY

Kane, Osborne, Kane, Sullivan & Lurvey
ATTORNEYS

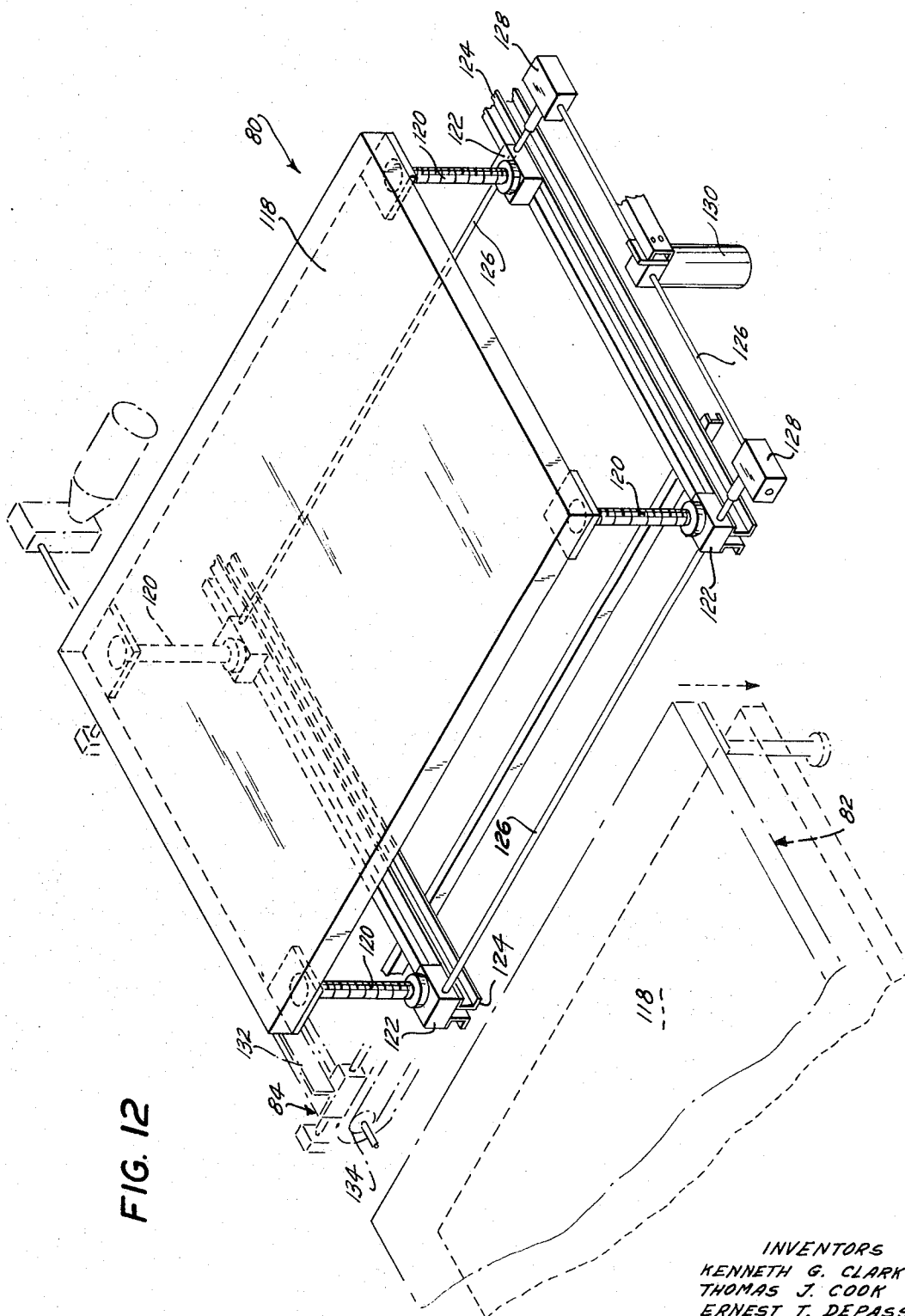


FIG. 12

INVENTORS
 KENNETH G. CLARK
 THOMAS J. COOK
 ERNEST T. DEPASS
 ABRAHAM MANFREDONIA

BY

Law, Robinson, Kane, Sullivan & Koenig
 ATTORNEYS

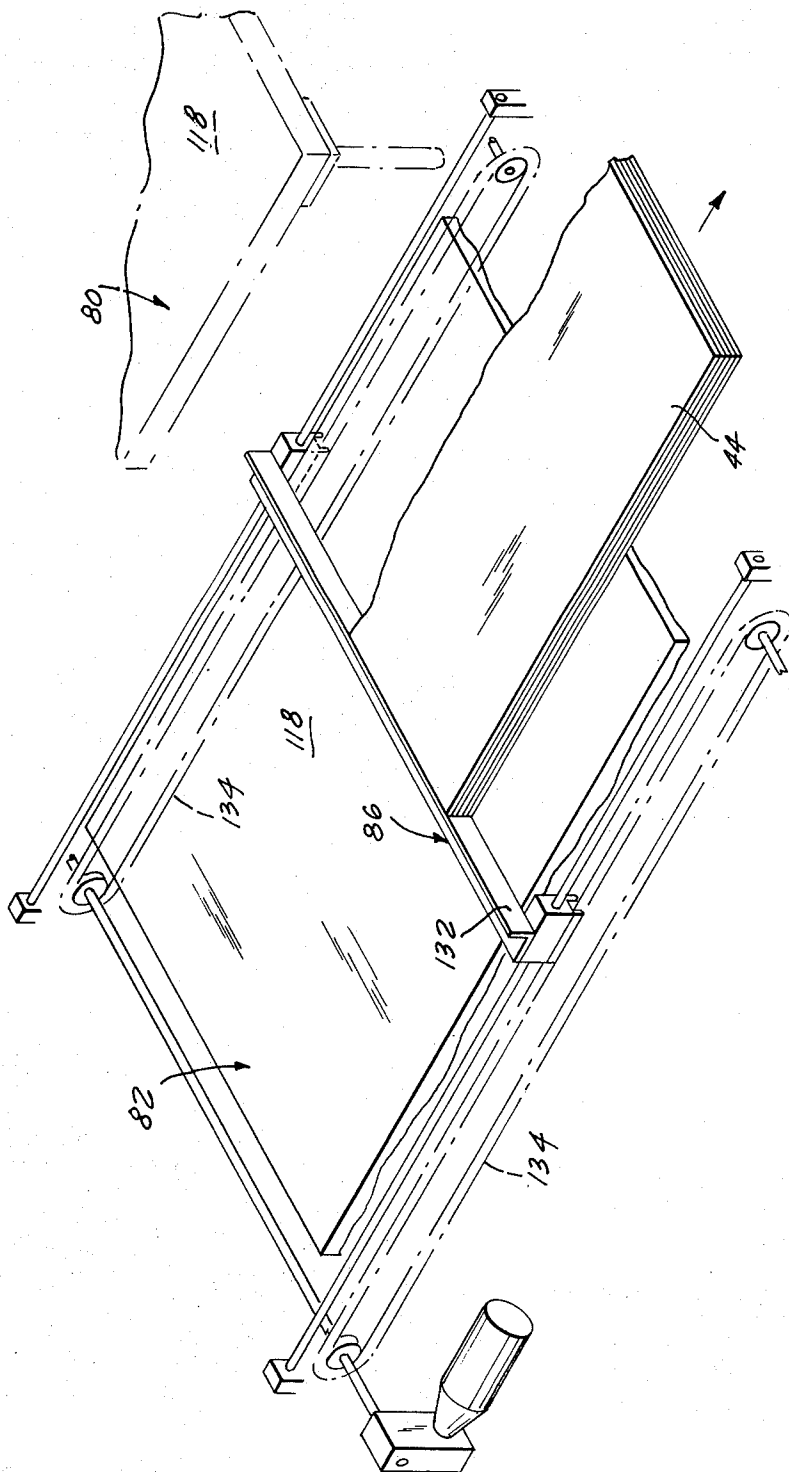
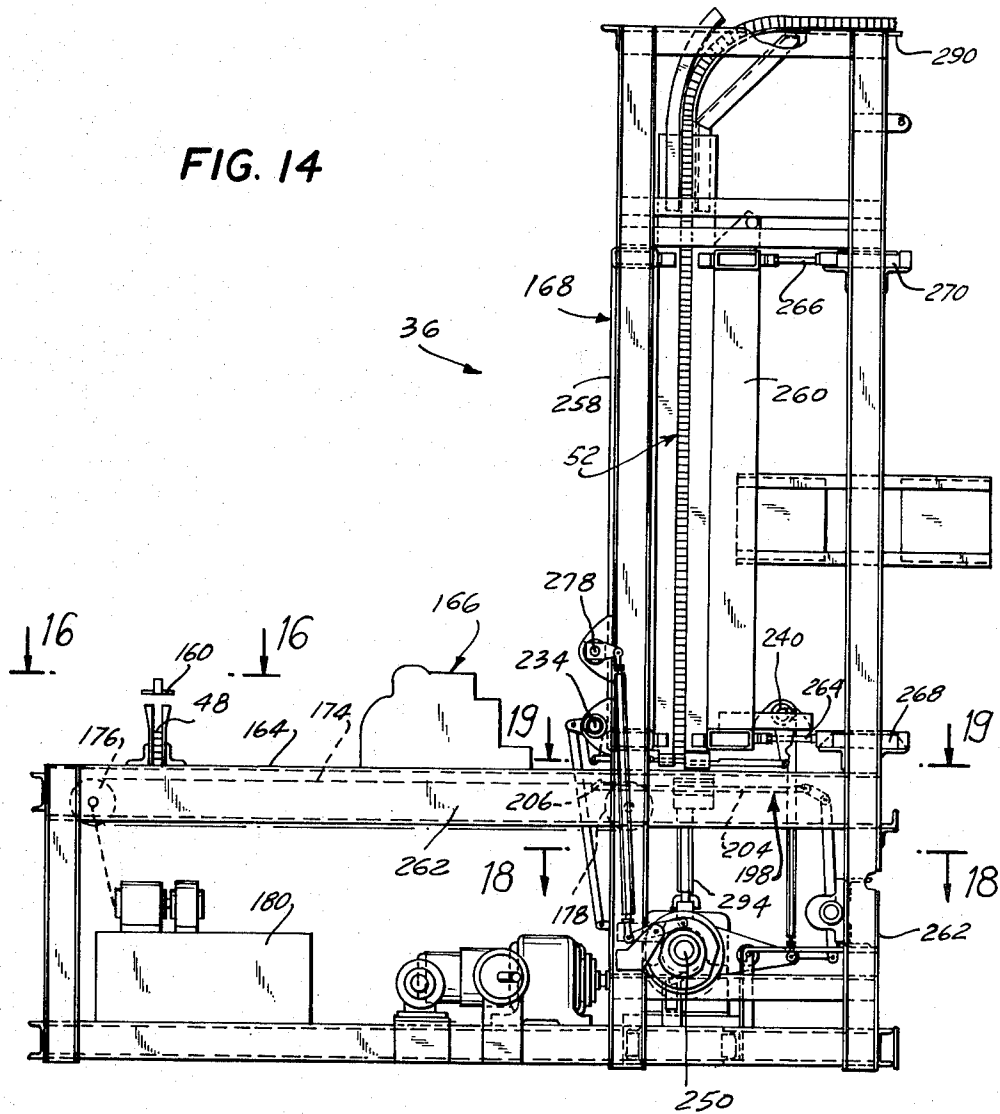


FIG. 13

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA

BY
Kane, Dabner, Kane, Sullivan & Kury
ATTORNEYS

FIG. 14



INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA
BY

Law, Victoria, and Sullivan & Lewis
ATTORNEYS

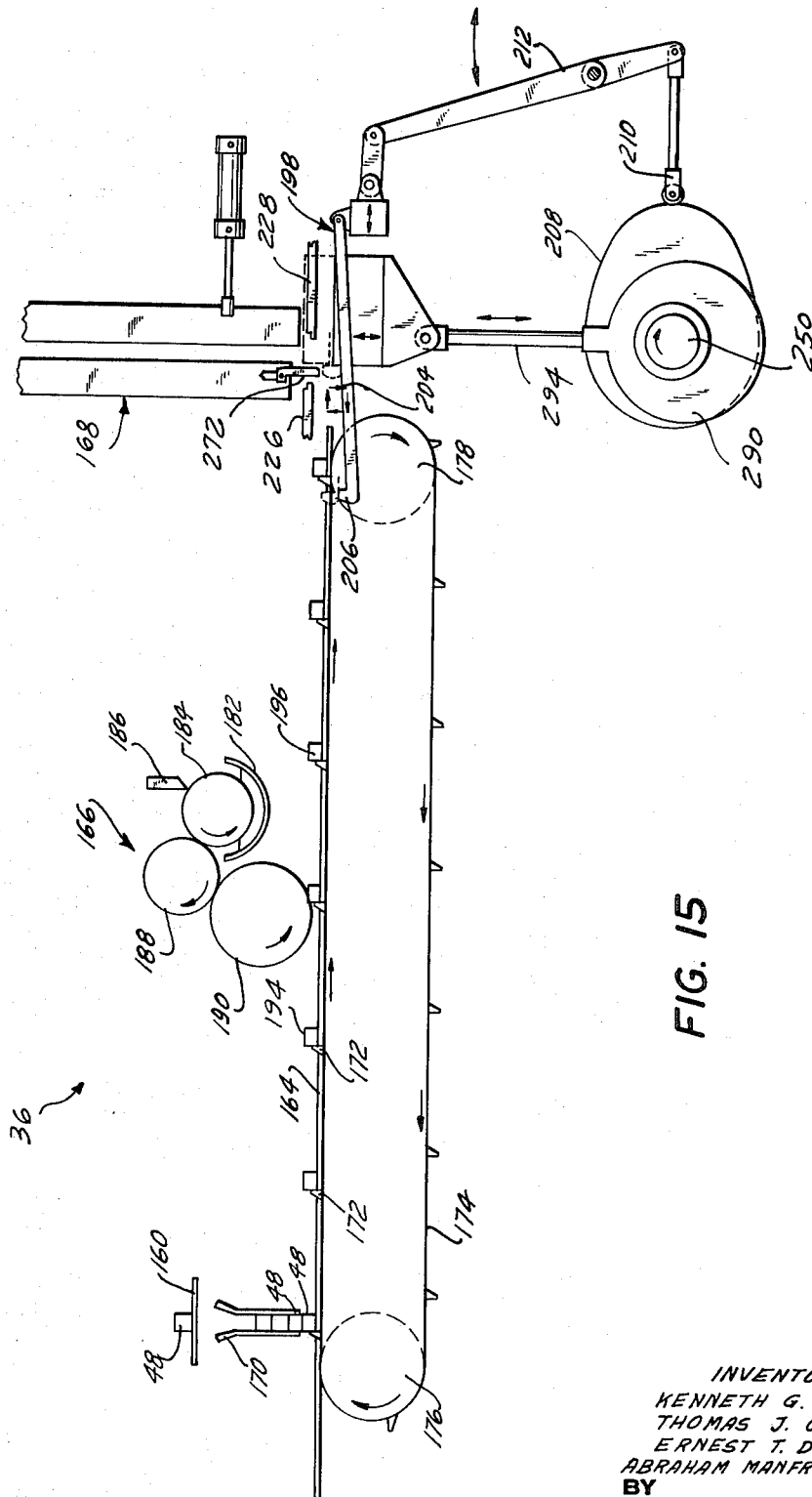


FIG. 15

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA

BY

Kane, Delmar, Kane, Sullivan & Kinnery
ATTORNEYS

FIG. 16

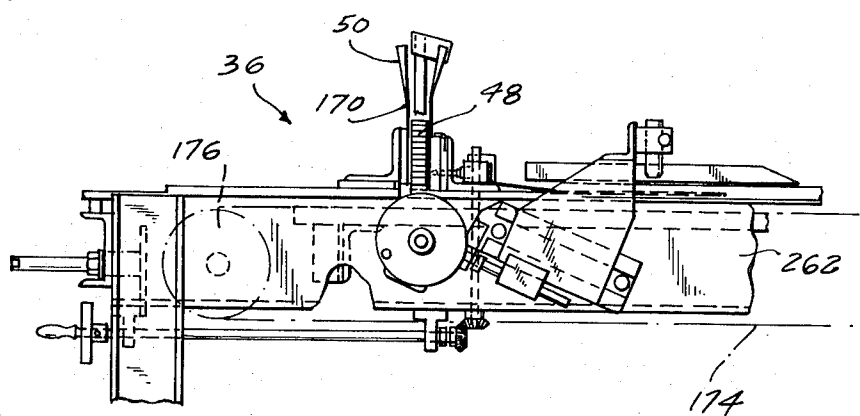
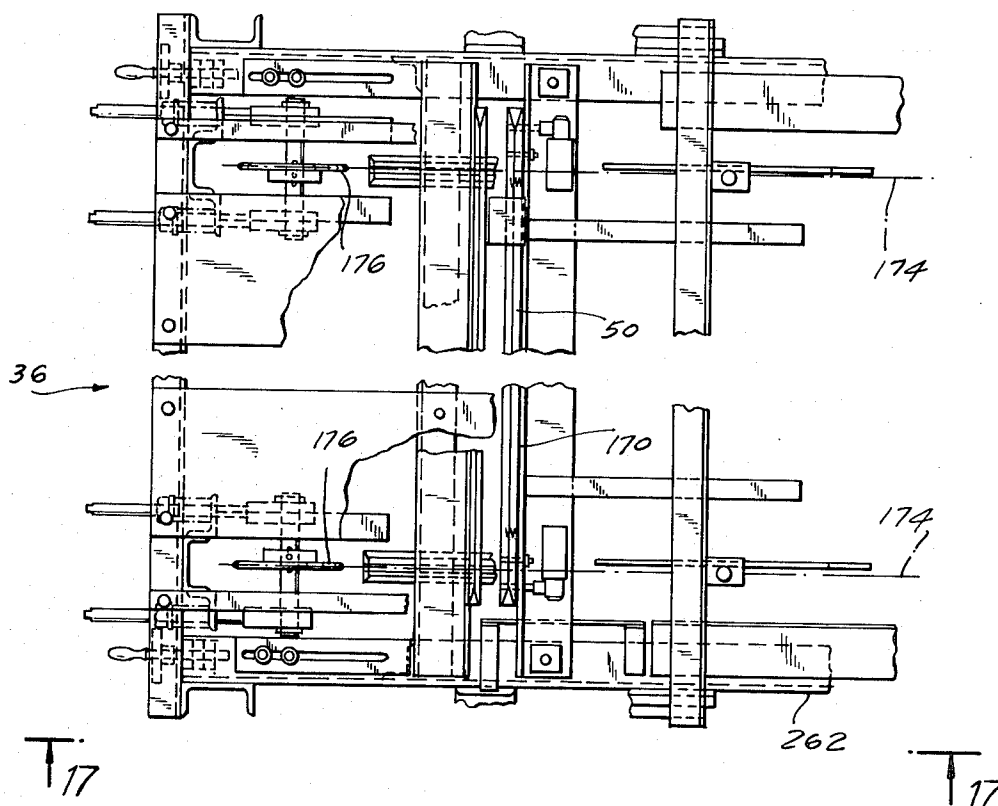


FIG. 17

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA

BY

Koe, Dabner, Koe, Sullivan & Koenig
ATTORNEYS

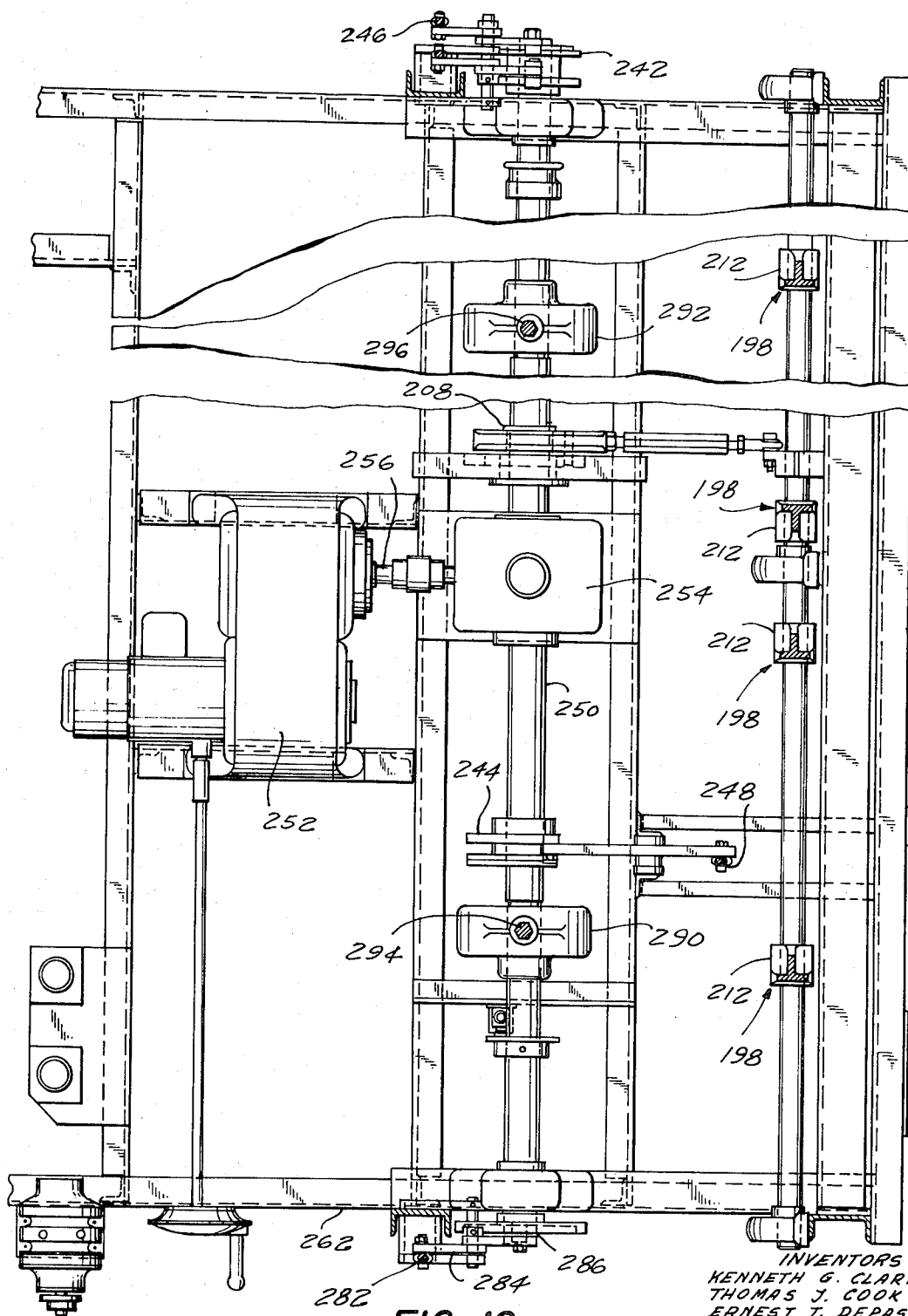


FIG. 18

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA

BY
Kane, DeBorja, Kane, Sullivan & Hickey
ATTORNEYS

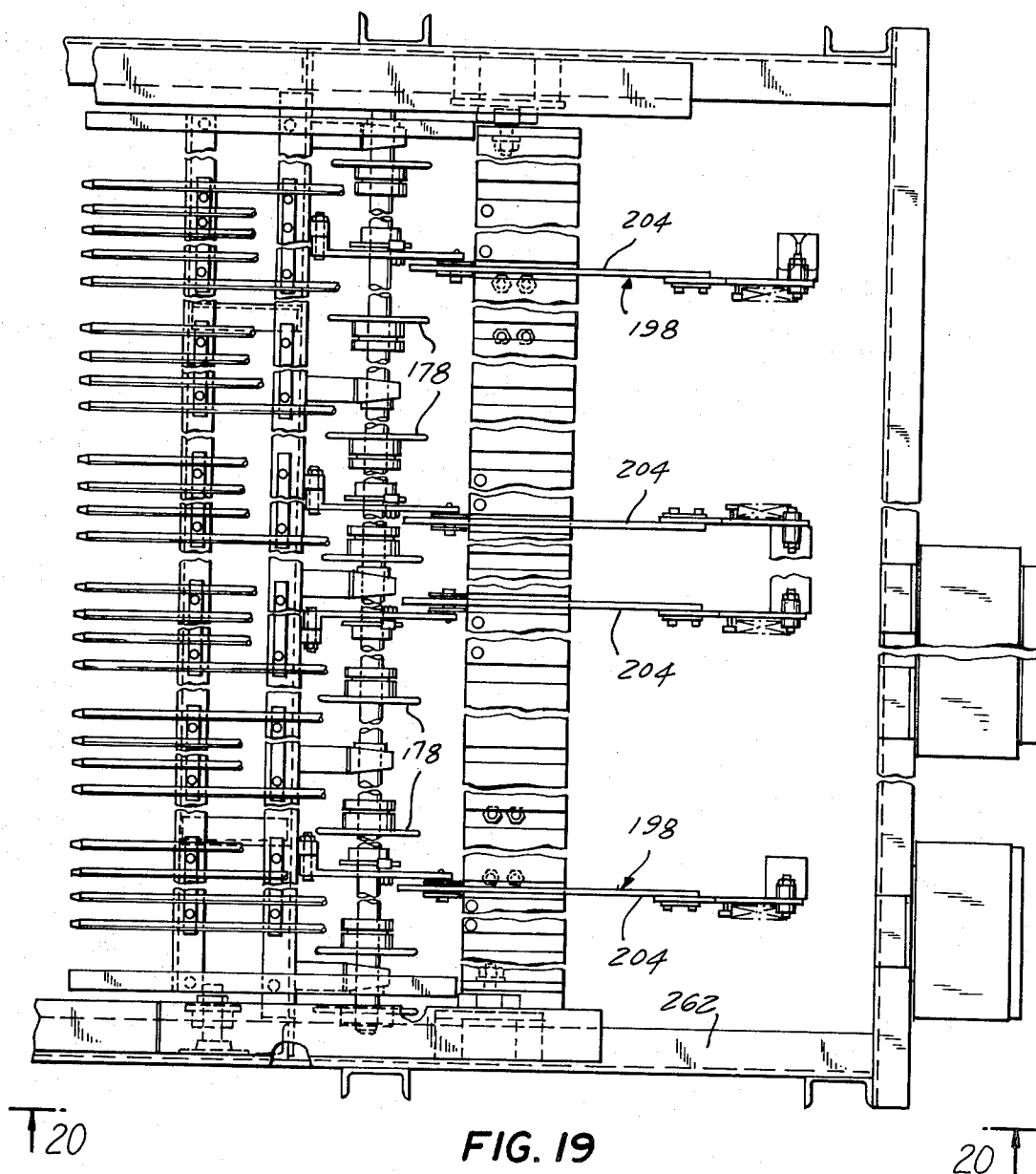


FIG. 19

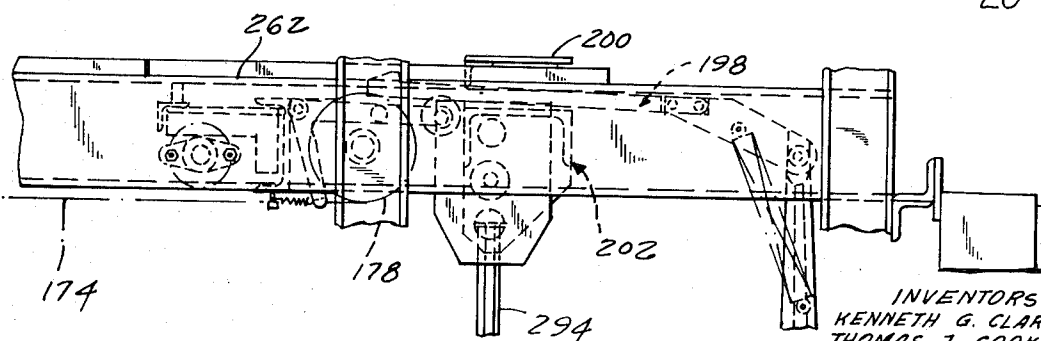


FIG. 20

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA
BY

Kane, Dobner, Kane, Sullivan & Hursey
ATTORNEYS

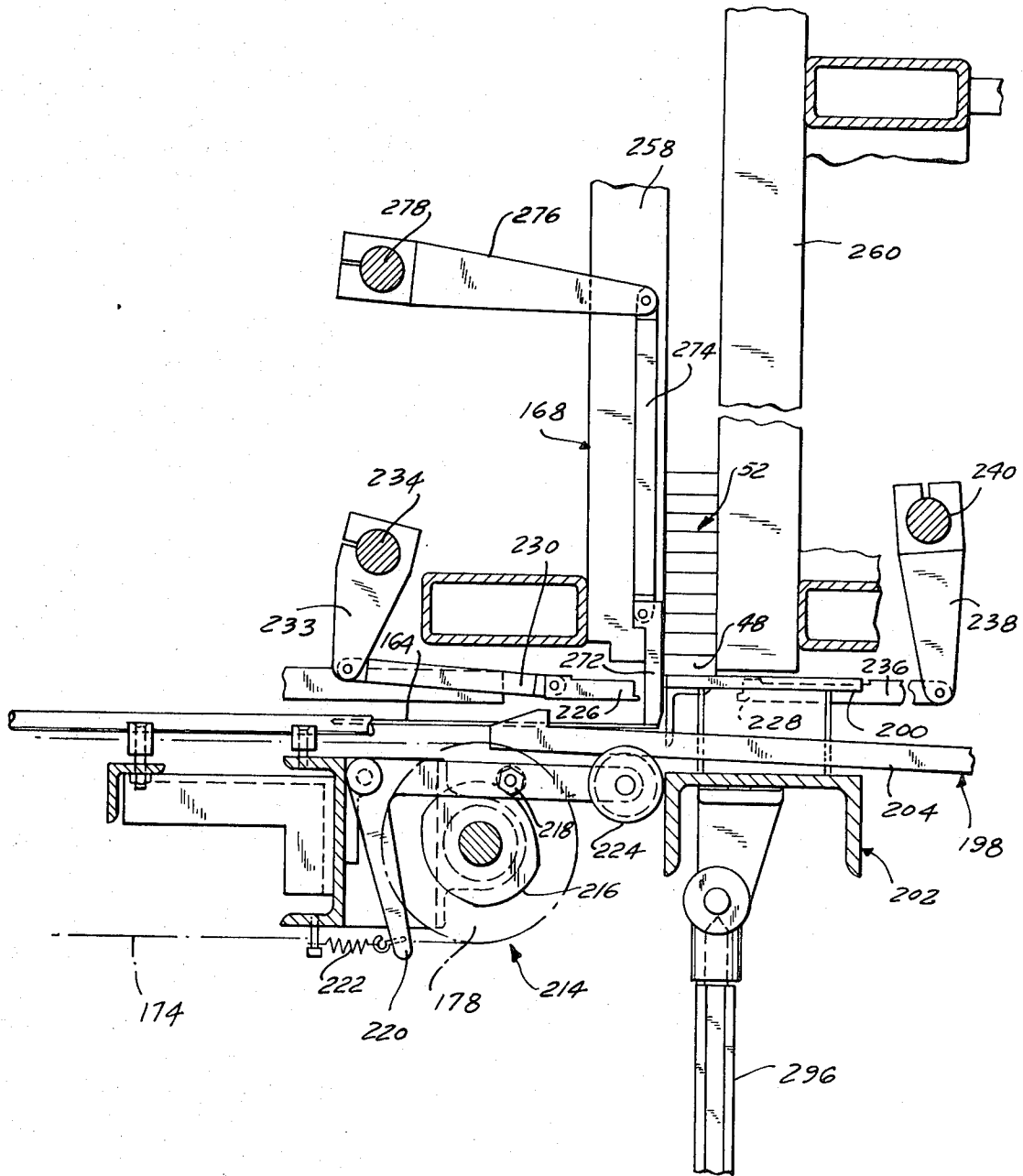


FIG. 21

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA

BY

Law, Machine, & Engineering
ATTORNEYS

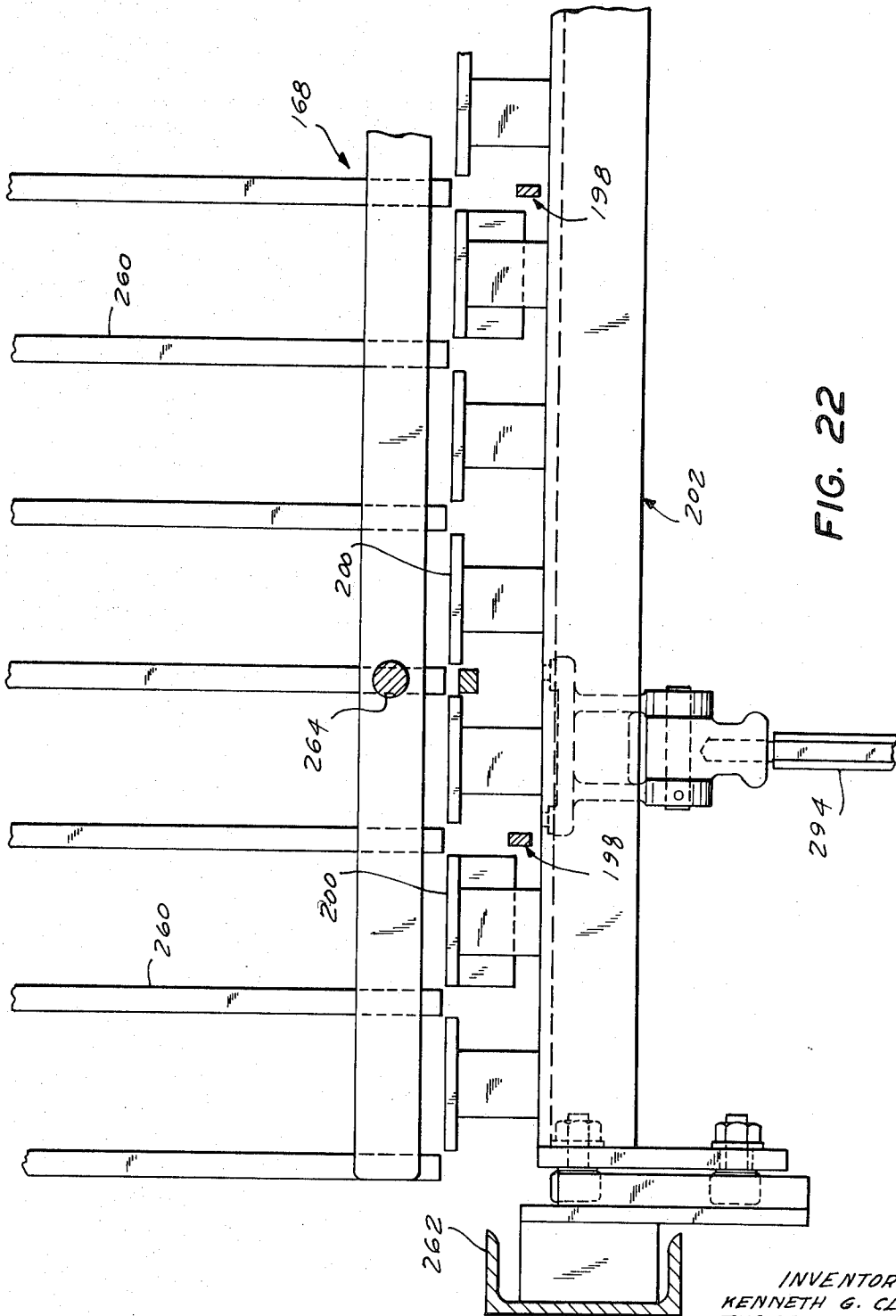


FIG. 22

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA
BY

Kane, Dabner, Kane, Sullivan & Kury
ATTORNEYS

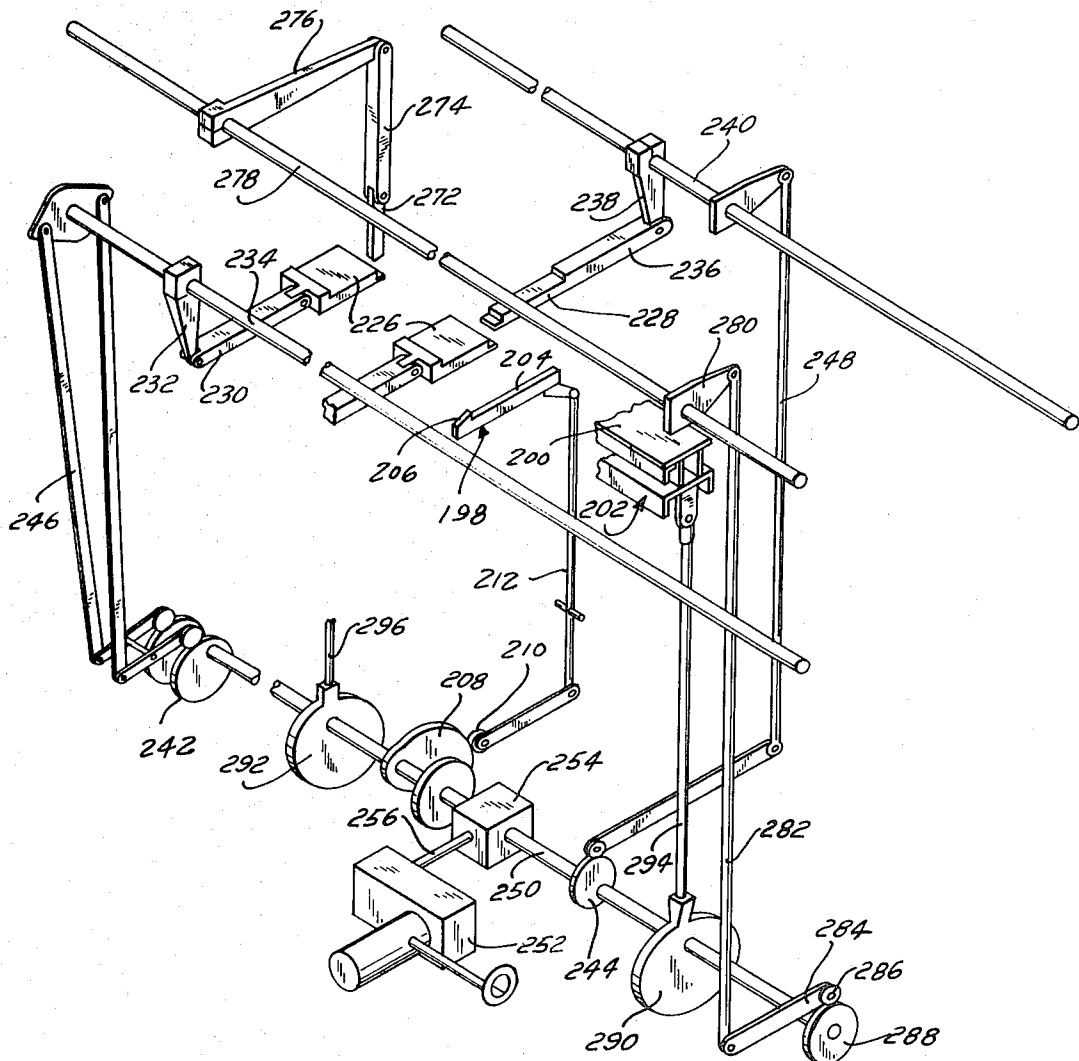


FIG. 23

INVENTORS
KENNETH G. CLARK
THOMAS J. COOK
ERNEST T. DEPASS
ABRAHAM MANFREDONIA
BY

Kane, Dalziel, Kane, Sullivan & Kuncz
ATTORNEYS

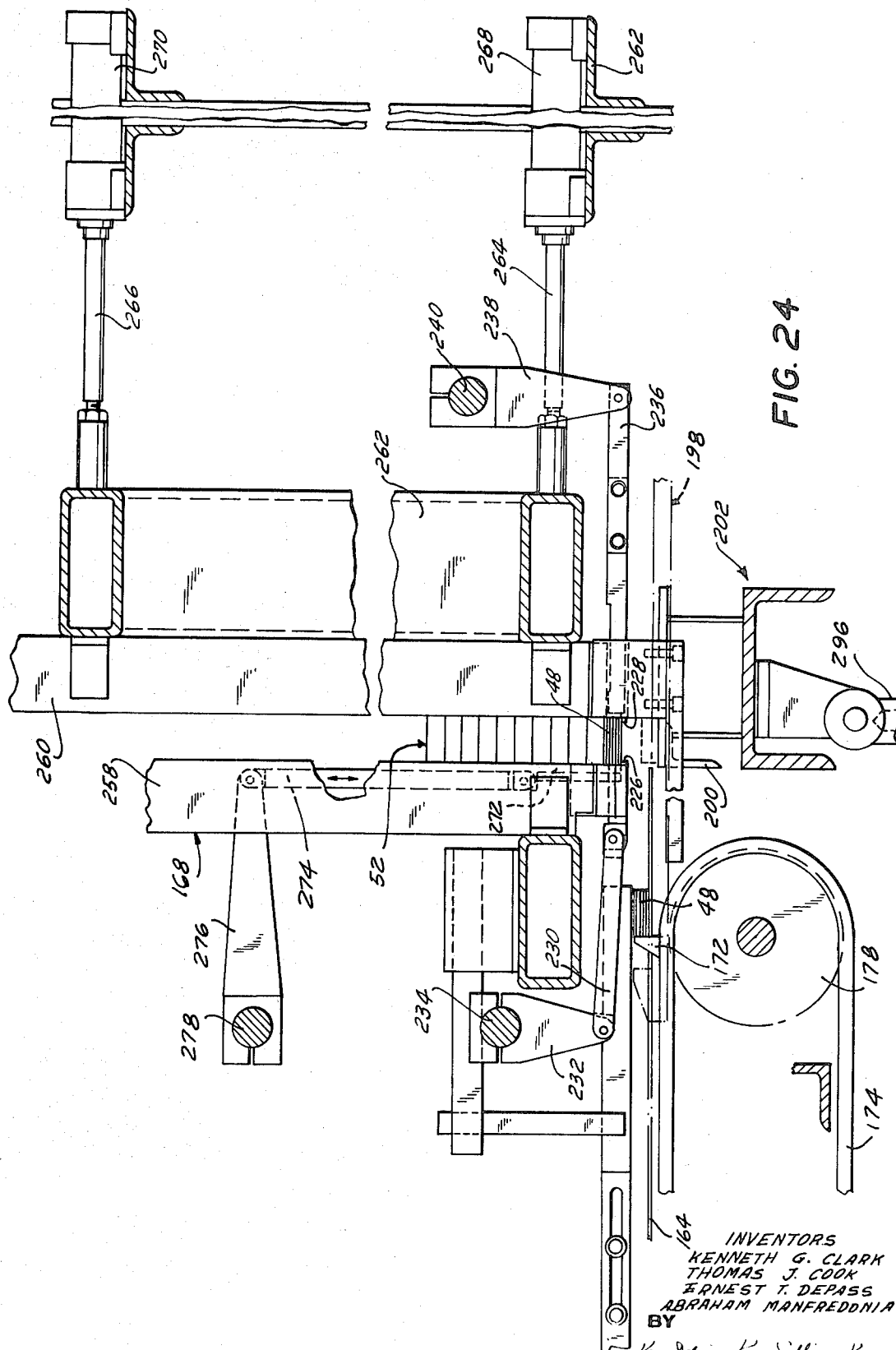


FIG. 24

INVENTORS
 KENNETH G. CLARK
 THOMAS J. COOK
 ERNEST T. DEPASS
 ABRAHAM MANFREDONIA
 BY
 Kne, Schmitt, Kne, Sullivan & Kne
 ATTORNEYS

HONEYCOMB MAKING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to an improved machine for the automated manufacture of unexpanded honeycombed material. The principal object of the present invention is to provide a machine capable of producing a continuous core of unexpanded paper honeycomb at a speed heretofore not attainable.

SUMMARY OF THE INVENTION

The above and other beneficial objects and advantages are attained in accordance with the present invention by providing a machine adapted to produce a continuous compressed paper honeycomb core. The machine includes a gluer for joining together a plurality of plies of paper stock into a multi-layer web. The plies are joined together along longitudinally extending, spaced apart, adhesive lines, the adhesive lines between adjacent layers being staggered by half the distance between adjacent stripes to form the desired honeycombed effect. The machine further includes transfer means to transfer the web from the gluer to a stacker where the web is cut into sheets and a plurality of the multi-layer sheets are accumulated into a stack. Adjacent sheets of the stack are glued to one another along adhesive lines which continue the pattern of the individual sheets. Means are also provided for transferring the stacks to a press adapted to compress the stacks into a compressed pad. The machine further includes a slicer for slicing the pad into slices extending transverse to the longitudinal stripes and means for accumulating the slices in vertical registry. The slices are then separated, individually glued and again accumulated in vertical registry to form a continuous compressed core of paper honeycomb.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 including subfigures 1a and 1b is a schematic, side elevational, sectional view of the honeycomb making machine of the present invention;

FIG. 2 is an isometric flow chart for the work piece of the honeycomb making machine;

FIG. 3 including subfigures 3a and 3b is a top plan view of the schematic representation of FIG. 1;

FIG. 4 is a simplified isometric drawing of the drive mechanisms for the gluer and sheeter-stacker sub-assemblies illustrated in FIGS. 1a and 3a;

FIG. 5 is a top plan view of the sheeter-stacker illustrated in FIGS. 1a and 3a;

FIG. 6 is a side elevational, sectional view taken along reference lines 6—6 of FIG. 5 in the direction indicated by the arrows;

FIG. 7 is an elevational view taken along reference lines 7—7 of FIG. 6 in the direction indicated by the arrows;

FIG. 8 is an enlarged fragmentary plan view of a gripper assembly utilized in the sheeter-stacker mechanism;

FIG. 9 is a fragmentary side elevational view of a gripper assembly and an associated carrier bar;

FIG. 10 is a sectional view taken along reference lines 10—10 of FIG. 8 in the direction indicated by the arrows;

FIG. 11 is a sectional view taken along reference lines 11—11 of FIG. 8 in the direction indicated by the arrows;

FIG. 12 is an enlarged fragmentary isometric view of the catch boxes of the sheeter-stacker sub-assembly;

FIG. 13 is a view similar to FIG. 12 illustrating the operation of the catch box pusher bar;

FIG. 14 is a side elevational, sectional view of the slice combiner sub-assembly;

FIG. 15 is a simplified, side elevational, schematic view of the slice combiner sub-assembly;

FIGS. 16—20 are detailed plan views of the slice combiner of FIG. 14;

FIG. 21 is an enlarged, fragmentary, side elevational, sectional view of the slice combiner depicting the slice elevator in an upward position;

FIG. 22 is an enlarged, fragmentary, side elevational, sectional view of the slice elevator through line 22—22 of FIG. 21.

FIG. 23 is a simplified drive schematic for the slice combiner sub-assembly; and

FIG. 24 is a view similar to FIG. 21 depicting the slice elevator in a downward position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

GENERAL DESCRIPTION

The present invention is illustrated in the accompanying drawings wherein similar components bear the same reference numeral throughout the several views. In FIGS. 1 and 3 (which have been divided respectively into subfigures 1a and 1b and subfigures 3a and 3b) the various sections of the present honeycomb making machine are schematically illustrated. The machine includes a gluer section 30 wherein adhesive is suitably applied to four continuous webs of paper and wherein these four piles are combined to form a continuous four ply web; a sheeter-stacker section 32 wherein the continuous four ply web is sliced into appropriately sized 4-ply sheets, a plurality of sheets is stacked in vertical registry, and the stacks are compressed to form pads; a pad slicing section 34 wherein the pads are sliced perpendicular to the longitudinal axis of the sheets; and a slice combiner section 36 which applies adhesive to the top portion of each slice and then positions the slices in a vertical column to assemble the desired continuous honeycomb material. Suitable conveyors connect each of the sections as will be described forthwith.

Reference is now made briefly to FIG. 2 wherein the flow of paper through the present machine is schematically illustrated. Accordingly, four continuous sheets of single ply paper stock 38a, 38b, 38c and 38d are first glued to one another by longitudinally running stripes of adhesive 40 on the top and bottom surfaces of the intermediate layer 38c and also the top and bottom surfaces of top layer 38a forming a continuous four ply web. The continuous four ply web is then trimmed and cut to form a 4-ply sheet 42 and a plurality of these sheets 42 is accumulated in a stack 44. In this connection the adhesive stripes on the top surface of each sheet 42 serve to secure adjacent sheets to one another to form the stack. The adhesive stripes on the top surface of intermediate layer 38c are aligned with the stripes on the top surface of top layer 38a and similarly

the stripes on both bottom surfaces of each sheet are aligned so that the stripe pattern throughout the stack is uniform. The stripes on the top and bottom surfaces, however, are out of phase with each other by one half the distance between adjacent stripes.

The stack 44 is then compressed to form pad 46 which is subsequently sliced perpendicular to the adhesive stripes forming pad slices 48. The slices are accumulated in a vertical magazine 50 and then fed to another gluer where additional glue 47 is applied to the top surface of each slice. The slices are then glued to one another to form the desired continuous core of honeycomb material. For illustrative purposes only, the leading edge 54 of core 52 is shown expanded and enlarged.

The various sections of the present honeycomb making machine will be individually discussed.

GLUER

The webs of material 38a, 38b, 38c and 38d are fed respectively from rolls 56a, 56b, 56c and 56d through suitable guide rolls 58 to the gluer section 30. Although four webs are shown and discussed in the present description, it should be apparent that any even number of webs may be utilized with suitable modifications. Accordingly, intermediate sheet 38c is first drawn past glue station 60 where stripes of glue (shown schematically as 62) are applied to the top surface. Sheet 38c is then drawn past glue station 64 where additional stripes of glue 66 are applied to the sheet bottom surface. Similarly, top sheet 38a is first drawn past glue station 68 where stripes of glue 70 are applied to its top surface and then drawn past glue station 72 where stripes of glue 74 are applied to its under surface. Equal spacing is maintained between all the glue stripes although the stripes on the top surfaces are out of phase with those on the bottom surfaces. The four individual webs then pass through draw rollers 76 where the four plies are joined together to form a 4-ply web 41. In this connection, the top draw roll is suitably ribbed to pass the wet glue stripes 70 on the top surface of the 4-ply web 41. As web 41 is drawn by rolls 76, it is trimmed between rotary slit 75 and an associated anvil 77 to insure its uniform width.

SHEETER-STACKER

The leading edge of 4-ply web 41 is driven through rotary knife 79 while said knife is open and is gripped by a gripper mechanism 78 (to be described forthwith) so that it is under the control of this gripper when the rotary knife comes around and severs sheet 42 from the 4-ply web. Gripper mechanism 78 then pulls the sheet 42 into position over one of two catch box tables 80 or 82 wherein a stock of sheets 44 is permitted to accumulate. The tables 80 and 82 are both vertically shiftable and suitably driven to move downwardly as the number of sheets contained therein increases. Each table has a pusher assembly associated therewith and when a predetermined number of sheets is contained on table 80 (or 82) the table drops to its lower limit and pusher assembly 84 (or 86) pushes the stack onto a conveyor 88 whereafter the individual stacks are conveyed into press 90 and compressed into pads 46.

As may be seen in FIG. 5, a plurality of gripper mechanisms 78 is driven by the spaced apart continu-

ous chains 92 and 93. The chains, in turn, are suitably supported and driven in timed relationship by sprockets 94 and cam drive mechanism such that the chains 92 and 93 and grippers 78 are at a standstill when sheets 44 are released to fall into catch box tables 80 or 82. Each gripper 78 includes a plurality of gripping elements 96 supported on a rod 98 extending between chains 92 and 93. Referring briefly to FIGS. 10 and 11, it is noted that each gripping element 96 includes a fixed finger 100 and a cam operable, movable anvil 102. The anvil is pivotally mounted about an axis 103 which is fixed with respect to finger 100 and is biased toward its associated finger by spring 106. At appropriate positions of the gripper mechanisms 78, cam follower 104 contacts a stationary cam causing anvil 102 to rotate about axis 103 thereby causing the anvil to separate from finger 100. At other positions of the gripper mechanisms, spring 106 forces the anvil toward its associated finger to cooperate in gripping a sheet 42 as shown in FIG. 11. The stationary cams are shown schematically at 108 and 109.

A plurality of carrier bars 110 are also provided extending between chains 92 and 93 rearwardly of each gripper assembly 78. It should be noted, however, that the carrier bars do not extend the entire distance between adjacent gripper mechanisms 78 and, in fact, the distance between the last carrier bar 112 associated with a particular gripper assembly and the next gripper assembly is greater than the length of sheet 42.

A series of spaced apart sets of stops 114 and 116 are provided aligned with the leading edges of tables 80 and 82 respectively. The spacing of each set of stops is such as to permit the gripping elements of gripper assemblies 78 to pass while preventing a sheet 42 from doing the same. Cams 108 are suitably positioned to open each gripper 78 simultaneously with the leading edge of sheet 42 being drawn against stops 114. As the stops hold back sheet 42, the carrier bars 110 which had previously been supporting sheet 42 pass under the sheet. As the carrier bars 112 pass the sheet, it falls into the catch box table 80 or 82. Stops 114 are designed to rotate upward out of the path of motion of the gripper assemblies to permit gripper 78 to advance to stops 116 when catch box 80 is filled and emptying as will be explained forthwith. Cam 108 is also suitably mounted so as to prevent its opening of gripper assembly 78 at stop 114 at appropriate times in the cycle (i.e. when the sheet is to be deposited in catch box 82). A suitable cam 109 is provided for opening the gripper assemblies at catch box 82 so that those sheets which pass stop 114 are released at stop 116 and collected in box 82.

Catch boxes 80 and 82 are illustrated in FIGS. 12 and 13. Since both catch boxes are identical, the following discussion will be limited to catch box 80 although it should be understood that the disclosure also applies to catch box table 82. Accordingly, catch box 80 includes a platform 118 supported at its corners by jack screws 120. The jack screws are supported within suitable gear boxes 122 which in turn rest on angle irons 124. A worm gear (not shown) is contained within each gear box and a series of shafts 126 and associated gears 128 cooperate in driving the jack screws simultaneously from motor 130.

Each catch box table has a pusher assembly 84 (or 86) associated therewith. Since the pusher assemblies

are identical, only pusher 84 associated with table 80 will be discussed. Accordingly, pusher 84 comprises a bar 132 mounted to chains 134 and adapted to move therewith across platform 118. As will be noted (in FIG. 7) the pusher bar is mounted sufficiently above the supports for jack screws 120 to enable the platform 118 to drop below the pusher bar thereby enabling the pusher to remove the stack of sheets 44 from the platform as illustrated in FIG. 13.

In operation, motor 130 is driven at a speed sufficient to enable the platform 118 to drop at a rate equal to that at which additional sheets are dropped thereon so that the top of the accumulating stack remains substantially at a constant height. Referring briefly to FIG. 3a again, it is noted that the pushers 84 and 86 serve to push the stacks accumulated on tables 80 and 82 onto conveyors 88 from which the stacks are conveyed into press 90 and compressed into pads 46. Conveyor 88 includes a first set of rollers 136 shown schematically in FIG. 1a arranged perpendicular to the path of movement of chain 92 and a second set of rollers 138 arranged parallel to the path of movement of conveyor 92. The transverse rollers 136 are vertically shiftable with respect to the longitudinal rollers 138. Thus, the transverse rollers 136 may be raised above the longitudinal rollers 138 to receive a stack of sheets pushed off platform 80 or 82 by pusher 84 or 86. After the pusher completes its transfer to the transverse rollers, the transverse rollers drop beneath the longitudinal rollers so as not to interfere with the longitudinal conveyance of the stack thus received to press 90.

PAD LOADER AND SLICE CUTTER

The pad slicing section 34 of the present device comprises equipment commercially available and thus will only be discussed briefly with reference being made to the schematic FIGS. 1, 2 and 3. As is indicated in FIG. 2, the stacks which enter press 90 are compressed to form pads 46. It should also be noted that the output of press 90 is rotated 90° with regard to its input. The compressed pads 46 are loaded on a pad-loader 140 which includes a vertically adjustable support 142 and a platform 144. The operation of support 142 is such as to insure the vertical alignment of the topmost pad 46a with the top of table 146. A transfer rake 148 supported from overhead rail 150 pushes the topmost pad 46a along table 146 onto cutting table 152 of slicer 154. Slicer 154 further includes a guillotine-type knife 156 aligned parallel to the path of movement of rake 148 and a pusher bar 158 arranged to move transverse to the path of movement of rake 148 and thereby push succeeding slices 48 of pad 46 onto a slice conveyor 160. The slice conveyor 160 which comprises a conventional moving belt is aligned transverse to the path of movement of pusher 158 and thus parallel to the path of movement of rake 148. The conveyor serves to convey the slices one at a time to the slice combiner 36 at which station the continuous honeycombed core is assembled.

SLICE COMBINER

The slice conveyor 160 transports the individual slices 48 to a slice magazine 162 which comprises the entrance to the slice combiner 36. The slices 48 are then transported from magazine 162 on a conveyor

table 164 (see FIG. 3b) past a glue applicator 166 where stripes of glue are applied to the top surface of each compressed slice. The glued slice is then further conveyed along table 164 to a slice accumulator 168 where the continuous core of honeycomb material 52 is formed by gluing each subsequent slice to the bottom of the core made of previous slices.

Reference will now be made in particular to FIGS. 14, 15, 21 and 24 as well as FIGS. 1b and 3b where the slice combiner 36 is illustrated in detail. Accordingly, as depicted most clearly in FIGS. 1b and 3b, the slice conveyor 160 is spaced above magazine 162 and terminates short of the hopper 170 of the magazine causing the slices on the conveyor to drop into the magazine. The magazine is positioned above a conveyor table (shown schematically in all views except FIG. 24) which is provided with a plurality of longitudinally extending slots. A series of spaced apart pusher dogs 172 extend upwardly through the table slots and are adapted to engage the bottom pad slice in the magazine. The pushers 172 are driven by chains 174 which in turn are driven through sprockets 176 and 178 by motor 180. The chains extend longitudinally along table 164 and the sprockets are so arranged as to cause the successive pushers 172 to come behind the bottom slice 48 in magazine 162 and push it along table 164. Pushers 172 push the pad slice past gluer 166 which includes a reservoir 182, a pickup roller 184, a doctor blade 186, in intermediate roller 188 and an applicator 190 as shown in FIG. 3b. Applicator 190 is provided with spaced ribs 192 which apply glue to each passing slice along stripe lines 196 on the top surface 194 of the slice. The ribs 192 are suitably spaced apart so as to allow the dogs of pusher 172 to pass therebetween without contact.

As a particular pusher 172 and its associated slice approach the down-stream sprocket 178, a rake mechanism 198 is activated to come up behind the slice and pull the slice onto platform 200 of an elevator 202. Actually, a plurality of identical, spaced apart rakes are provided to engage each slice. The elevator subsequently lifts the slice into an accumulator 168 where the previously lifted slices are held forming the honeycomb core. In the accumulator, the adhesive stripes 196 on the top surface of the slice will cause adhesion to the bottom surface of the last previous slice of the core thereby lengthening the core.

Referring to FIG. 15, rake mechanism 198 is shown to include an elongated arm 204, the front end of which 206 is turned upwardly. Arm 204 travels with a crank-like motion under the action of eccentric 208 through follower 210 and lever 212. The rotation of eccentric 208 is timed to coincide with the driving speed of pusher chain 174. The eccentric 208 is the longitudinal drive for rake 198.

As shown in FIG. 21, an additional drive 214 is provided for the vertical movement of the rake which enables it to pass under an approaching slice during a forward stroke (toward the magazine) and then lift to engage a slice on a reverse stroke. Drive 214 includes a cam 216 which drives its associated follower 218. Follower 218 is mounted on arm 220 which in turn is pivotally mounted to the frame of the machine. One end of arm 220 is biased by spring 222. A cam 224 is mounted to the non-pivoted end of arm 220. Rake arm

204 rests on cam 224 and rides up and down with arm 220 in response to the rotation of cam 216 which is timed to coincide with the rotation of eccentric 208.

Referring again to FIG. 24, it may be noted that when rake 198 completes its backward stroke (that is away from magazine 162) the platform 200 of elevator 202 is aligned with the conveyor table to receive a slice 48 as shown in phantom. As the rake moves forwardly, the elevator lifts to the position shown in FIG. 21 thereby bringing the slice 48 seated on the platform in contact with the slice already accumulated in core 52. The adhesive stripes on the top surface of the slice then serve to secure the top surface of slice 48 to the under surface of the last previous slice of the accumulated core to secure the slice to the core. In this connection, it should be noted that the spacing of the ribs 192 of glue applicator 190 are such as to continue the glue pattern already extending through the sections of the slice so as to provide a uniform glue pattern throughout the core and hence, prevent the detection of a seam at the juncture of two slices.

At the time the elevator is in the up position, illustrated in FIG. 21, the entire weight of the accumulated core 52 rests on the elevator platform. When the elevator is in the down position, illustrated in FIG. 24, front and rear hooks (226 and 228) support the accumulated core and thereby allow the platform to receive a new slice. Referring to FIG. 23, it may be seen that hook 226 is pivotally mounted to arm 230 which in turn is mounted to support 232 which rotates with shaft 234. Similarly, rear hook 228 is pivotally mounted to support 238 which rotates with shaft 240. Shafts 234 and 240 are driven through cams 242 and 244 through linkages 246 and 248 respectively. Cams 242 and 244, as well as the rake eccentric 208 are driven by main shaft 250 which in turn is driven by motor 252 through a suitable gear box 254 and shaft 256.

The accumulated core 52 is contained between two rows of spaced bars 258 and 260. The front bars 258 are fixed with respect to the frame 262 of the accumulator. The rear bars 260 are coupled to the pistons 264 and 266 of hydraulic cylinders 268 and 270 respectively. The pistons merely provide a constant load on the rear bars, clamping the core and forcing the entering slice to fall into line. The pistons are actuated only to open and close the accumulator during startup and shutdown.

Referring again to FIG. 21, it is noted that a vertically shiftable guide member 272 is provided aligned with the forward edge of elevator platform 200. Guide 272 is adapted to be shifted between the downward position illustrated in FIG. 21, wherein it guides the slice 48, resting on the elevator platform, into the space between the front and rear bars 258 and 260 and an upward position shown in phantom in FIG. 24 which allows the rake to move the rearmost slice onto the elevator platform without interference from guide member 272. Guide member 272 is pivotally connected to arm 274 which in turn is connected to support 276 which rotates about shaft 278. Shaft 278 in turn rotates with member 280 which is pivotally mounted to arm 282 which in turn is pivotally mounted to arm 284 which contains a follower 286 for cam 288 which rotates with the main shaft 250. The motion of elevator 202 is controlled by eccentrics 290 and 292 through support rods 294 and 296.

Referring again to FIG. 14, it is noted that the accumulated core 52 is fed through the guide bars 258 and 260 to the top of a table 290 from which any desired length may be removed.

Thus, in accordance with the above disclosure an improved device is disclosed for the production of a continuous core of honeycombed material from four single ply paper webs. The machine applies adhesive in discrete stripes simultaneously to the plies and overlies the plies which are then cut to form 4-ply sheets. A plurality of such sheets are then glued to one another continuing the glue pattern applied to the plies to form a stack. The stack is then compressed forming a pad which is subsequently sliced transverse to the adhesive stripes. The slices are then reoriented in vertical registry and continuously glued to one another to form the desired honeycombed material.

Although a preferred embodiment of the invention has been disclosed and described in detail herein, it should be understood that the invention is in no sense limited thereby and its scope is to be determined by that of the appended claims.

Having thus described the invention what is claimed is:

1. A machine for making a continuous, unexpanded paper honey-comb core comprising:

a gluer for joining together a plurality of plies of paper stock into a multi-layer web along longitudinally extending, spaced apart adhesive lines, the adhesive lines between adjacent layers being staggered;

cutting means;

a gripper-conveyor assembly;

a stacker;

first means for conveying said web from said gluer through said cutting means to said gripper-conveyor assembly, said cutting means cutting said web into sheets, said gripper-conveyor assembly being movable to transfer each said sheet from the cutting means to said stacker, said stacker accumulating said sheets into a stack;

said gripper-conveyor assembly including a pair of spaced apart chains, a plurality of spaced apart gripper assemblies extending between said chains, a plurality of support bars extending between said chains rearwardly of said gripper assemblies, the distance between the rearwardmost support bar of each assembly and the next assembly being greater than the length of the sheets;

means for transferring said stack to a press;

press means for compressing said stack into a pad;

means for slicing said compressed pad into slices extending transverse to said longitudinal stripes;

second means for conveying the said slices from the slicer to a slice accumulator; and,

means for accumulating said slices in registry and for joining together said slices to form a continuous compressed core of paper honeycomb.

2. The invention in accordance with claim 1 further comprising a cam follower associated with each of said gripper assemblies; and first stop means shiftable mounted to said machine and shiftable between a first position in the path of said first conveyor and a second position out of the path of said first conveyor whereby said stop means in said first position is adapted to allow passage of said gripper assembly and support rods but prevent the passage of the sheet associated therewith.

3. The invention in accordance with claim 2 wherein each of said gripper assemblies comprises a plurality of first members spaced apart along said bar; said stop means includes a spaced plurality of members extending transverse to the longitudinal axis of said chains said stop members being interdigitated between said gripper assembly first members and positioned above said bar and support rods so as not to interfere with the motion of said gripper assembly.

4. The invention in accordance with claim 3 further comprising a second catch box disposed in line with said first catch box beneath the path of said conveyor and positioned in front of said first catch box; second stop means in the path of said conveyor positioned over the rear edge of said second catch box, extending between said conveyor chains transverse to the longitudinal axis of said conveyor and adapted to allow the passage of said gripper assembly and support rods but prevent the passage of an associated sheet; and means for shifting said first stop means to said first stop means second position when said first catch box is full so as to allow said gripper assembly to draw an associated sheet up to said second stop means into position over said second catch box.

5. The invention in accordance with claim 4 wherein said stack transferring means includes a roller conveyor extending between said catch boxes and said press, said conveyor including a first set of rollers disposed transverse to the longitudinal axis of said conveyor and a second set of rollers disposed parallel to the longitudinal axis of said conveyor, said first set of rollers being shiftably mounted with respect to said second set of rollers whereby to allow said first set of rollers to rise above and drop beneath said second set of rollers; and pusher means shiftably mounted to each of said catch boxes and adapted to move across said catch boxes transverse to the longitudinal axis of said chain conveyor whereby to transfer the stack of sheets accumulating on said catch boxes to said roller conveyor.

6. The invention in accordance with claim 2 wherein said slice accumulating means includes a table having a first end and a second end; a hopper coupled to said table proximal said first end for receiving slices one at a time from said slicer and for aligning said slices transverse to the longitudinal axis of said table; means for transporting said slices longitudinally along said table toward said second end; a glue applicator fixed in the path of movement of said slices along said table and adapted to apply glue to each slice passing thereby; means for supporting a core of honeycomb material formed of said slices disposed at said second end; and means for removing a slice from said slice transporting means, for shifting said removed slice to said core supporting means, and for affixing said slice to the end of the core supported on said supporting means.

7. The invention in accordance with claim 6 wherein said table includes a plurality of slots extending longitudinally from said first end toward said second end and said transporting means includes a continuous chain driven pusher mechanism having a path of motion between said table ends and including a plurality of

spaced pusher dogs adapted to ride in said longitudinal slots during the portions of each cycle when said mechanism moves from said first end toward said second end and to fall below said slots when said mechanism moves from said second end toward said first end.

8. The invention in accordance with claim 6 wherein said core supporting means includes a pair of vertical guide members disposed at said table second end, said guide members being spaced apart a distance substantially equal to that of the width of an associated slice; an elevator disposed at said table second end aligned between said guide members; hook means spaced above said table and shiftable from a first position extending outside said guide members to a second position extending into the spacing between said guide members; said elevator being vertically shiftable between a first position aligned with said table to a second position aligned with said hook means; means for removing a slice from said table and transferring said removed slice to said elevator; and drive means adapted to drive said elevator and said hook means whereby when said elevator is in said second position, said hook means are in said hook means first position and when said elevator is in said elevator first position, said hook means is in said hook means second position.

9. The invention in accordance with claim 8 wherein said slice removing means comprises a longitudinally shiftable rake commonly driven with said elevator and hook means and adapted to draw a slice from said table onto said elevator when said elevator is in said elevator first position.

10. The invention in accordance with claim 8 wherein one of said vertical guide members is horizontally shiftable with respect to the other of said members.

11. The method of forming a continuous core of paper honeycomb from paper stock rolls comprising the steps of:

- a. applying adhesive in staggered longitudinal stripes to the webs of said paper stock rolls and overlying said webs to form a multi-ply web;
- b. transversely cutting said multi-ply web into a plurality of sheets;
- c. joining a plurality of sheets along longitudinal adhesive stripes to form a stack of sheets;
- d. compressing said stack to form a pad;
- e. slicing said pad transverse to said stripes; and,
- f. applying additional stripes of adhesive to the top surface of each said slice with the stripes positioned midway between the stripes on the underside of the top ply of the slice whereby the glue pattern will be uniform throughout the finished core;
- g. feeding each slice beneath the preceding slice with said slices in registry; and
- h. pressing said slices upwardly into a vertical stack and holding said slices in registration and compression until the adhesive sets whereby a continuous core of honeycomb material is formed.

* * * * *