PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : B26D 1/16 — A1

(11) International Publication Number: WO 93/25357

(43) International Publication Date: 23 December 1993 (23.12.93)

(21) International Application Number: PCT/US93/00414

(22) International Filing Date: 21 January 1993 (21.01.93)

(30) Priority data:
898,151 15 June 1992 (15.06.92) US

(71) Applicant: ALPINE ENGINEERED PRODUCTS, INC. [US/US]; P.O. Box 2225, Pompano Beach, FL 33061 (US).

(72) Inventor: HARNDEN, Charles, W. ; P.O. Box 2225, Pompano Beach, FL 33061 (US).

(74) Agent: OLTMAN, John, H.; Oltman and Flynn, 915 Middle River Drive, Suite 415, Fort Lauderdale, FL 33304 (US).

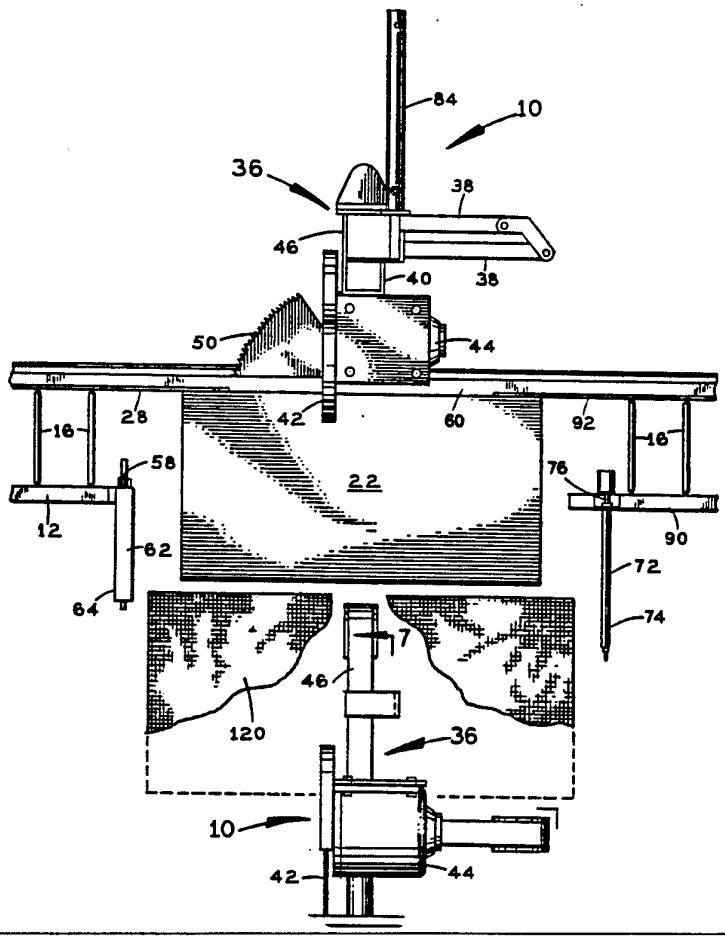
(81) Designated States: CA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: AUTOMATIC SAW MACHINE AND METHOD

(57) Abstract

A saw apparatus (10) for automatically sawing pieces (20) of material at various predetermined lengths and angles includes a power saw mechanism (42 and 44), powered anchoring mechanisms (62 and 72) for anchoring the pieces (20) of material during sawing, a mechanism (104) for longitudinally positioning the pieces (20) of material relative to the power saw mechanism (42 and 44) for cutting at desired lengths, a computer (130) and program for the computer (130) for operating switches so that at least one piece (20) of material is longitudinally positioned by the mechanism (104) for longitudinally positioning the pieces (20), is automatically anchored by the powered anchoring mechanism (62 and 72), and the power saw mechanism (42 and 44) is automatically moved to cut the piece (20).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**FR**	France	**MR**	Mauritania
AU	Australia	**GA**	Gabon	**MW**	Malawi
BB	Barbados	**GB**	United Kingdom	**NL**	Netherlands
BE	Belgium	**GN**	Guinea	**NO**	Norway
BF	Burkina Faso	**GR**	Greece	**NZ**	New Zealand
BG	Bulgaria	**HU**	Hungary	**PL**	Poland
BJ	Benin	**IE**	Ireland	**PT**	Portugal
BR	Brazil	**IT**	Italy	**RO**	Romania
CA	Canada	**JP**	Japan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SK**	Slovak Republic
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SN**	Senegal
CM	Cameroon	**LI**	Liechtenstein	**SU**	Soviet Union
CS	Czechoslovakia	**LK**	Sri Lanka	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**MC**	Monaco	**UA**	Ukraine
DK	Denmark	**MG**	Madagascar	**US**	United States of America
ES	Spain	**ML**	Mali	**VN**	Viet Nam
FI	Finland	**MN**	Mongolia		

AUTOMATIC SAW MACHINE AND METHOD

FIELD OF THE INVENTION

The present invention relates generally to the field of radial arm saws, and more specifically to a computer-controlled radial arm saw and method, including a conveyor track having support rollers for delivering pieces of lumber or other material to a table, an arm member extending over the track for positioning the pieces to be cut at a desired length, two pneumatic clamping elements which drive and hold each piece against a stop wall at the rear of the table, a circular saw mounting structure including a saw supporting arm member movable horizontally over the table with a hydraulic cylinder, motor and gear means underneath and supporting the saw mounting structure for rotating the saw mounting structure to orient the saw for each cut, an ink jet printer device for marking the pieces after they are cut and a track exit segment, a safety mat in front of the table for retracting the saw when a person stands on the mat, and a control panel tied into a computer having a program which controls the operation of the arm, the pneumatic clamping elements, saw, a motor for rotating the saw support structure, and a motor for moving the stop gage to the proper cutting length, so that a series of pieces are delivered to the table, cut at predetermined length and angles, labeled, and carried to a collection point.

BACKGROUND AND PRIOR ART

There have long been automatic saws for reducing the manpower required to process lumber. While these saws have generally served their intended purposes, they have not

been designed to be computer controlled to automatically make a variety of differently oriented cuts on the same work piece.

An example of these prior automatic saws is that of Fuglie, U.S. Patent Number 2,664,926, issued on January 5, 1954. Fuglie discloses an automatic saw mill for sawing logs and heavy timbers into boards. The logs are mounted between two chucks and cut by two separate sets of parallel saw blades mounted on a movable saw carriage. After sawing, the cut boards are automatically dropped onto a conveyer belt located below the saw blades. A problem with Fuglie is that there is no provision for making angled cuts across boards, as may be needed to construct trusses. And even if the logs could be somehow rotated to permit angled cuts, the angle could not change automatically for cuts at different angles on the same board. Another problem with Fuglie is that the person operating the saw apparatus must move dangerously close to the saw to load the timbers.

Strauser, U.S. Patent Number 4,887,219, issued on December 12, 1989, teaches a manual board cut-off saw assembly for enabling a cut-off saw operator to cross-cut several elongated boards at desired locations along their length. Strauser further permits the removal of defective sections from the boards based upon the observation of the operator. The apparatus includes several cut-off saw lines with manually activated cut-off saws for cutting the boards across each line. Each cut-off saw line has an optical measuring system and a sorter for sorting wood pieces according to their measured length, and for delivering information concerning board and wood piece lengths to a computer for storage. The computer also displays the recovery rate and production information. A problem with Strauser is that no provision is made for cutting the boards at the varying angles necessary for such applications as truss construction. Another problem with Strauser is that an operator can get dangerously close to the saw blades while they are spinning.

Hagstrom, U.S. Patent Number 4,962,685, issued on

October 16, 1990, discloses a production table saw including a saw table and a storage cabinet below the saw table in which the saw is enclosed when not operating. A foot activated pedal is provided to lift the saw blade out of the cabinet to an operating position. At the same time the pedal action causes a safety guard to move into a protective position over the blade. A problem with Hagstrom is that no provision is made for automatically making a series of varying angled saw cuts, nor for automatically measuring the cutting length of wood pieces on the saw. Thus Hagstrom is costly in man-hours to use. Another problem is that Hagstrom does not provide a large table surface or deelivery means capable of handling long work pieces.

Richards, U.S. Patent Number 5,043,907, issued on August 27, 1991, illustrates a band saw apparatus and method regulated by a controller. A band saw is provided having a controller responsive to sensing signals as to operating parameters of the saw to generate a material distribution profile during a first cut of a piece of bar stock. During subsequent cuts, the controller operates control circuits for blade cutting force, blade feed rate, and blade speed to maintain a constant material cutting rate despite changes in material cross-section. A problem with Richards is that, once again, no provision is made for automatically making a series of varying angled saw cuts. Furthermore, no safety provision is apparently made for shutting off power to the saw when the operator is close to it.

Steiner, U.S. Patent Number 4,641,557, issued on February 10, 1987, teaches an electronically controlled power saw for making a number of different types of cuts on a work piece. A microcomputer is provided into which certain cut parameters are preset, such as saw elevation relative to the work piece. Yet for angled cuts, the arm on which the saw is mounted is swung into position manually for each cut. The microcomputer simply measures and displays the miter or bevel angle to aid in manually

positioning the saw. A problem with Steiner is that angled cuts cannot be preprogrammed, but must be manually set up, one at a time. Steiner is thus relatively time-consuming to operate, and no continuous work piece feed is provided. Another problem, once again, is that the operator can move dangerously close to the saw while it is activated.

It is thus an object of the present invention to provide an automatic saw apparatus which reduces labor costs with substantial computer control and operation.

It is another object of the present invention to provide such an apparatus which increases the accuracy of individual cuts and thereby reduces the number of re-cuts required, and eliminates undetected mis-cuts.

It is still another object of the present invention to provide such an apparatus which reduces set up time for a random mix of cuts and automatically schedules and tracks the pieces cut, to reduce inventory time.

It is finally an object of the present invention to provide such an apparatus which reduces the danger involved for the operator by permitting full operation several feet away from the saw table and automatically retracting the saw away from the operator when the operator moves too close to the saw table.

SUMMARY OF THE INVENTION

The present invention accomplishes the above-stated objects, as well as others, as may be determined by a fair reading and interpretation of the entire specification.

A saw apparatus is provided for automatically sawing pieces of material at various predetermined lengths and angles, including a power saw mechanism, a rotatable saw mechanism mounting structure, a motor for rotating the mounting structure, a translational power saw moving mechanism, powered anchoring mechanisms for anchoring the pieces of material during sawing, a mechanism for longitudinally positioning the pieces of material relative to the power saw mechanism for cutting at desired lengths, a power supply and power supply connecting mechanism for delivering power to the mechanism for longitudinally posi-

tioning the pieces, to the powered anchoring mechanism, to the power saw mechanism, to the motor for rotating the mounting structure, and to the translational power saw moving mechanism, switches for controlling the flow of power through the connecting mechanism, a computer and program for the computer for operating the switches so that at least one piece of material is longitudinally positioned by the mechanism for longitudinally positioning the pieces, is automatically anchored by the powered anchoring mechanism, and the power saw mechanism is automatically rotated to a predetermined angle relative to the piece by the motor rotating the mounting structure, and the power saw mechanism is automatically moved to cut the piece by the translational power saw moving mechanism. The apparatus preferably includes a table for supporting the pieces of material during sawing and a stop wall on the table against which the pieces of material are clamped. The anchoring mechanism preferably includes clamp members mounted on a shaft of a piston contained within a pneumatic cylinder, for advancing against and clamping a piece of material against the stop wall. The mechanism for longitudinally positioning the pieces of a material preferably includes a track on which the pieces of material are placed, a movable arm member extending over the track against which an end of each piece of material is placed, for longitudinally positioning the length of the pieces of material along the track relative to the power saw so that the piece of material is cut to a desired length. The arm member preferably includes a rack having an edge and having gear teeth along the edge, the edge being parallel to the track, a motor and a drive gear mounted on the motor for engaging the edge, and for moving the rack and thus moving the arm member along the track to a measuring position. A mat is also preferably provided beside the saw mechanism mounting structure, and a switch within the mat is activated by a person standing on the mat, for interrupting the flow of power through the connecting mechanism so that the translational power saw moving mechanism retracts the

power saw mechanism away from the mat. The anchoring mechanism may alternatively be rotated instead of the saw mounting structure.

A method is also provided for automatically sawing pieces of material at various pre-determined lengths and angles using a computer controlled saw apparatus having a piece delivery track, a saw blade, a saw table, a saw arm member for extending the saw blade over the saw table and cutting the pieces, clamps and a movable piece positioning arm member extending over the delivery track and a side rail for positioning the pieces along the delivery track, and a program for the computer, including the steps of logging onto the computer, signaling the computer through the program to move the saw arm member along the delivery track to a distance from the saw blade equivalent to the predetermined length, signaling the computer through the program to rotate the saw blade relative to the side rail to the predetermined angle, placing the piece on the delivery track, against the side rail with an end of the piece abutting the movable arm member, activating the saw arm member to advance the saw blade toward and cut the piece. The method may additionally include the steps of laterally or longitudinally flipping over the piece, signaling the computer through the program to rotate the saw blade relative to the side rail to a second predetermined angle, activating the saw arm member to advance the saw blade toward and cut the piece.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIGURE 1 is a top view of the saw table, saw, mounting structure and clamps of the inventive apparatus.

FIGURE 2 is a front view of FIGURE 1.

FIGURE 3 is a top view of the intake track segment, arm, rack and first clamping assembly.

FIGURE 4 is a front view of FIGURE 3, showing the

support frame under the intake track segment.

FIGURE 5 is a top view of the output track segment, printer, motor and gear assembly for the rack, and second clamping assembly.

FIGURE 6 is a front view of FIGURE 5.

FIGURE 7 is a side view of the saw, table, and mounting structure showing the saw and linkages in a retracted horizontal position, and in an extended position in broken lines.

FIGURE 8 is a top view of the saw, table, mounting structure and clamping assemblies.

FIGURE 9 is a top view as in FIGURE 8, except that the table is shown in broken lines and the gears and motor for rotating the mounting assembly are revealed beneath the table. The mounting assembly is shown in a rotational position to make right angle saw cuts, and twice again in broken lines to make angled saw cuts.

FIGURE 10 is a side view of the rack, the arm carriage and a rail of a track segment, showing the mounting wheels on which the carriage and rack ride.

FIGURE 11 is a close-up side view of the arm carriage on a track segment rail.

FIGURE 12 is a cross-sectional view of a track segment and the arm carriage.

FIGURE 13 is a top view of the arm member and carriage on a track segment.

FIGURE 14 is a side view of the first clamping assembly and disk clamping element in the retracted position.

FIGURE 15 is a side view as in FIGURE 14, but with the clamping assembly in the extended position.

FIGURE 16 is a side view of the second clamping assembly in the retracted position, and again in broken lines in the extended position.

FIGURE 17 is a top view of FIGURE 16.

FIGURE 18 is a close-up side view of the motor and gear assembly for moving the rack and cross-sectional view of the output track segment.

FIGURE 19 is a front view of the rack motor and gear assembly and a segment of the rack engaged by the assembly

FIGURE 20 is a top view of several boards cut by the inventive apparatus at angles suitable for use in truss construction. Cutting such truss elements is a key kntended purpose of the apparatus.

FIGURE 21 is a close-up top view of the speed encoder located below the output track segment, with the printer assembly removed.

FIGURE 22 is a side view of the speed encoder of FIGURE 21 and the printer assembly as well, and a printed work piece.

FIGURE 23 is a conceptual block diagram illustrating the interaction of the computer with the rest of the apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention which may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure.

Reference is now made to the drawings, wherein like characteristics and features of the present invention shown in the various FIGURES are designated by the same reference numerals.

First Preferred Embodiment

Referring to FIGURES 1-23, a computer-operated sawing apparatus 10 is disclosed for automatically measuring pieces of lumber or other material, clamping the pieces, rotating a saw mounting structure to make cuts at various predetermined angles, and delivering the pieces from the table to a discharge location.

Apparatus 10 includes an elongate intake track segment

12 mounted on a support frame 14 having a series of support rollers 16 for delivering the pieces 20 of material to the table 22, an arm member 26 mounted to a side rail 28 of track segment 12 for pushing pieces 20 along track segment 12 to table 22. See FIGURES 1-7. Table 22 is plywood sheet placed on top of supporting frame members 34. The saw mounting structure 36 includes several pivoting linkages 38 and a telescoping horizontal arm 40 extending over table 22 on which a circular saw 42 and a saw motor 44 are attached. See FIGURES 7, 8 and 9. Horizontal arm 40 is connected to a vertical arm segment 46. Vertical arm segment 46 attaches to an edge of a mounting structure positioning gear 50, and has an angled lower segment 52 extending at about a 45 degree angle downward and under table 22 to pivotally join to a fixed, central mounting shaft 54. Gear 50is driven by a motor and gear assembly 56 for rotating structure 36.

A stop wall 60 is provided on table 22 against which pieces 20 are clamped during sawing. See FIGURE 1. A first clamping assembly 62 includes a piston rod 58 extending from an air-driven pneumatic cylinder 64. See FIGURES 14 and 15. Assembly 62 is positioned adjacent and perpendicular to track segment 12 for clamping each piece 20 against stop wall 60. A rotatable disk clamping element 66, having a section cut out essentially along two radial lines and a tooth 68 on one radial edge, is rotatably mounted on rod 58 to grip side and top faces of piece 20. A second clamping assembly 72 is provided parallel to assembly 62 and includes a second air driven pneumatic cylinder 74 and piston rod 76, and operates in unison with assembly 62 to clamp each piece 20. See FIGURES 16 and 17. Clamping assemblies 62 and 72 are operated by a single air solenoid valve which forces air into the cylinders to push pistons to cause piston rods 58 and 76 to extend or withdraw as needed. The air solenoid valve is controlled by the computer. A hydraulic cylinder 84 is provided, and is attached to arm 40 for extending and retracting saw 42 along its horizontal path. See FIGURES 7,8 and 9. A track

segment 90 continues on the opposite side of table 22 from track 12 segment and either includes rollers 16 or a conveyor belt, and a guide rail 92 along which a second arm member 26 moves to position pieces 20 when flipped end over end. The rollers 16 or conveyor belt deliver each piece 20 to a collection point, where pieces 20 are removed from apparatus 10.

Each arm member 26 is attached to an arm carriage 94, which includes a rack member 96. See FIGURES 10-13. Each rack member 96 has an edge 98 with gear teeth directed downward and engaged by a motor and gear assembly 104, and rides adjacent and parallel to guide rails 28 and 92. Wheels 102 extend from arm carriage 94 to ride against guide rails 28 and 92 to minimize friction.

A printer assembly 110 is preferably provided adjacent to output track segment 90 for marking pieces 20 with information about the same cuts made on it. See FIGURES 21 and 22. Assembly 110 may also place the name of the manufacturer or any other information on pieces 20. A speed encoder 116 of conventional design is provided below the printer head. See FIGURE 21. Assembly 110 is of a type well known in the industry, and a CRS ink jet printer subsystem is preferred. An encoder wheel mounted on the drive roller 16 system feeds back information to printer assembly 110 regarding the speed of travel of pieces 20. The printer controller senses the leading edge of the advancing piece 20 and sprays printed characters onto piece 20 as it travels under the print head. The printer controller communicates with the computer to obtain print information and to report the status of the printing.

A safety mat 120 is preferably provided in front of table 22 and contains a sensor and switch for causing hydraulic cylinder 84 to retract arm 40 away from mat 120 when a person stands on mat 120. See FIGURE 1.

A control panel 130 (See FIGURE 3) is tied into a computer having a program which controls the movement of arm member 26, the flow of air into and out of pneumatic cylinders 54 and 64 to operate clamping elements 52 and 62,

saw motor 44 and motor 56 for rotating saw mounting structure 36. See FIGURE 23 for a conceptual block diagram. As a result of this computer control, a series of pieces 20 are delivered to table 22, cut at predetermined angles, labeled, and carried on track segment 90 to a collection point. It is alternatively contemplated that table 22 rotate, rather than saw mounting structure 36.

Method

In practicing the invention, the following method may be used. The operator turns on the computer, which is equipped with a conventional keyboard 136. The computer automatically boots up the program and displays the truss-calculation main menu on the screen. The main menu includes option numbers 1 and 2. With option No. 1, the operator can load cutting files from a floppy disk to the hard disk in the computer. With option number 2, the operator can turn on the apparatus 10 truss options menu. Using the arrow keys, the operator moves the highlighted bar down to "HOME" and presses the Enter key. The saw blade 42 then automatically positions itself. The operator next selects the truss to be cut. Again using the arrow keys, the operator moves the highlighted bar to either "CHORDS", "WEBS", OR "TRUSS" for items to be cut and presses the Enter key. Next the operator moves the highlighted bar to "PICK TRUSS", and presses the Enter key. The trusses loaded into the computer appear on the screen. The operator uses the arrow keys to move the highlighted bar up or down to select the truss to be cut, then presses the Enter key. The computer clears the list of trusses from the screen and moves the highlighted bar to "LOAD PIECES". The operator places a piece 20 on track 12 and presses the Enter key. Saw blade 42 is automatically positioned at the necessary angle and arm member 26 is automatically positioned at a distance to give the necessary length for the piece 20 to be cut. A picture of the piece 20 to be cut appears on the screen, with the angle to be cut highlighted. After the operator has positioned piece 20, he must use both hands to press the two pairs of buttons to

extend saw arm 40. One pair of buttons will extend saw arm 40 more rapidly and will work better on single piece 20 cutting. Another pair of buttons will extend saw arm 40 more slowly, such as when two pieces 20 are being cut at one time or when extra long single cuts are being made.

Upon completion of the cut, the operator simply reads the screen and the computer displays what the next operation will be. When there is only a single cut to be made on piece 20, the display will call for a new piece. If this is the case, the operator slides the cut piece 20 under and through printer assembly 110 to label the piece 20 and then presses the Enter key to position saw blade 42 for a new piece 20. If there is more than one angle to be cut on the same end of the piece 20, the program causes saw blade 42 to automatically move to the next desired angle and arm member 26 to the next desired length. When piece 20 has two long angles to cut on the same end, the screen tells the operator to roll piece 20 over, following the first cut. Piece 20 is rolled over so the angle just cut is directed away from side rail 28. Then the operator presses the Enter key to signal to the computer that piece 20 has been rolled over. The screen then shows piece 20 in the rolled over position, and saw blade 42 is positioned at the necessary angle and arm member 26 is positioned at the necessary length to make the next cut. The next step is to cut piece 20. If piece 20 is to be cut on both ends, the screen instructs the operator to flip piece 20, if it is eight feet long or shorter, or to slide piece 20 to the right arm member 26, if it is over eight feet in length.

Where piece 20 is flipped, it is done end over end and pushed tight against the left arm member 26. As with rolling piece 20 over, the operator must press the Enter key to tell the computer that piece 20 has been flipped. Again, the screen shows piece 20 in the flipped position, and saw blade 42 and arm member 26 automatically adjust to the new angle and length respectively. The operator presses the buttons to complete the cut on the second end and then pushes the piece 20 through printer assembly 110.

On the other hand, sliding the pieces 20 avoids the need to flip long pieces 20. When the sliding procedure is used, the second end is positioned using the right arm member 26. The operator pulls the right arm member 26 button to lower the right stop, and then presses the Enter key and apparatus 10 adjusts for the new angle and length. Then the operator slides piece 20 to the right side under the printer assembly 110 head tight to the right arm member 26 and side rail 28, and makes the cut. When finished, the operator pushes the right stop button to raise the stop and slide piece 20 down conveyor output track segment 90. The screen now shows "NEW PIECE". The operator then presses the Enter key to display the next piece 20. When all pieces 20 of a truss are cut, the screen becomes largely blank and "LOAD PIECES" is highlighted on the right side of the screen. The operator moves the highlighted bar to "PICK TRUSS" and executes the above steps once again.

While the invention has been described, disclosed, illustrated and shown in various terms or certain embodiments or modifications which it has assumed in practice, the scope of the invention is not intended to be, nor should it be deemed to be, limited thereby and such other modifications or embodiments as may be suggested by the teachings herein are particularly reserved especially as they fall within the breadth and scope of the claims here appended.

I claim as my invention:

1. A saw apparatus for automatically sawing pieces of material at various predetermined lengths and angles, comprising:

power saw means,

a rotatable saw means mounting structure,

a motor for rotating said mounting structure,

translational power saw moving means,

powered anchoring means for anchoring said pieces of material during sawing,

means for longitudinally positioning said pieces of material relative to said power saw means for cutting at desired lengths,

a power supply and power supply connecting means for delivering power to said means for longitudinally positioning said pieces, to said powered anchoring means, to said power saw means, to said motor for rotating said mounting structure, and to said translational power saw moving means,

switches for controlling the flow of power through said connecting means,

a computer and program for said computer for operating said switches so that at least one said piece of material is longitudinally positioned by said means for longitudinally positioning said pieces, is automatically anchored by said powered anchoring means, and said power saw means is automatically rotated to a predetermined angle relative to said piece by said motor rotating said mounting structure, and said power saw means is automatically moved to cut said piece by said translational power saw moving means.

2. An apparatus according to claim 1, additionally comprising a table for supporting said pieces of material during sawing.

3. An apparatus according to claim 2, additionally comprising:

a stop wall on said table against which said pieces of material are clamped.

4. An apparatus according to claim 3, wherein said anchoring means additionally comprises:

clamp members mounted on a shaft of a piston contained within a pneumatic cylinder, for advancing against and clamping one said piece of material against said stop wall.

5. An apparatus according to claim 1, wherein said means for longitudinally positioning said pieces of material comprises:

a track on which said pieces of material are placed,

a movable arm member extending over said track against which an end of each said piece of material is placed, for longitudinally positioning each said piece of material along said track relative to said power saw so that each said piece of material is cut to a desired length.

6. An apparatus according to claim 5, wherein said arm member comprises:

a rack having an edge and having gear teeth along said edge, said edge being parallel to said track,

a motor and a drive gear mounted on said motor for engaging said edge, and for moving said rack and thus moving said arm member along said track to a measuring position.

7. An apparatus according to claim 1, additionally comprising:

a mat located beside said saw means mounting structure,

a switch within said mat which is activated by a person standing on said mat, for interrupting the flow of power through said connecting means so that said translational power saw moving means retracts said power saw means away from said mat.

8. A saw apparatus for automatically sawing pieces of material at various predetermined lengths and angles, comprising:

power saw means,

a saw means mounting structure,

translational power saw moving means,

rotatable powered anchoring means for anchoring said

pieces of material during sawing,

a motor for rotating said anchoring means,

means for longitudinally positioning said pieces of material relative to said power saw means for cutting at desired lengths,

a power supply and power supply connecting means for delivering power to said means for longitudinally positioning said pieces, to said powered anchoring means, to said power saw means, to said motor for rotating said anchoring means, and to said translational power saw moving means,

switches for controlling the flow of power through said connecting means,

a computer and program for said computer for operating said switches so that at least one said piece of material is automatically longitudinally positioned by said means for longitudinally positioning said pieces, is automatically anchored by said powered anchoring means, and said anchoring means is automatically rotated to a predetermined angle relative to said mounting structure by said motor, and said power saw means is automatically moved to cut said piece by said translational power saw moving means.

9. A method for automatically sawing pieces of material at various predetermined lengths and angles using a computer controlled saw apparatus having a piece delivery track, a saw blade, a saw table, a saw arm member for extending said saw blade over said saw table and cutting said pieces, clamps and a movable piece positioning arm member extending over said delivery track and a side rail for positioning said pieces along said delivery track, and a program for said computer, comprising the steps of:

logging onto said computer,

signaling said computer through said program to move said saw arm member along said delivery track to a distance from said saw blade equivalent to said predetermined length.

signaling said computer through said program to rotate said saw blade relative to said side rail to said

predetermined angle,

placing said piece on said delivery track, against said side rail with an end of said piece abutting said movable arm member,

activating said saw arm member to advance said saw blade toward and cut said piece.

10. A method according to claim 9, additionally comprising the steps of:

laterally flipping over said piece,

signaling said computer through said program to rotate said saw blade relative to said side rail to a second predetermined angle,

activating said saw arm member to advance said saw blade toward and cut said piece.

11. A method according to claim 9, additionally comprising the steps of:

longitudinally flipping over said piece,

signaling said computer through said program to rotate saw blade relative to said side rail to a second predetermined angle,

activating said saw arm member to advance toward and cut said piece.

FIG.1

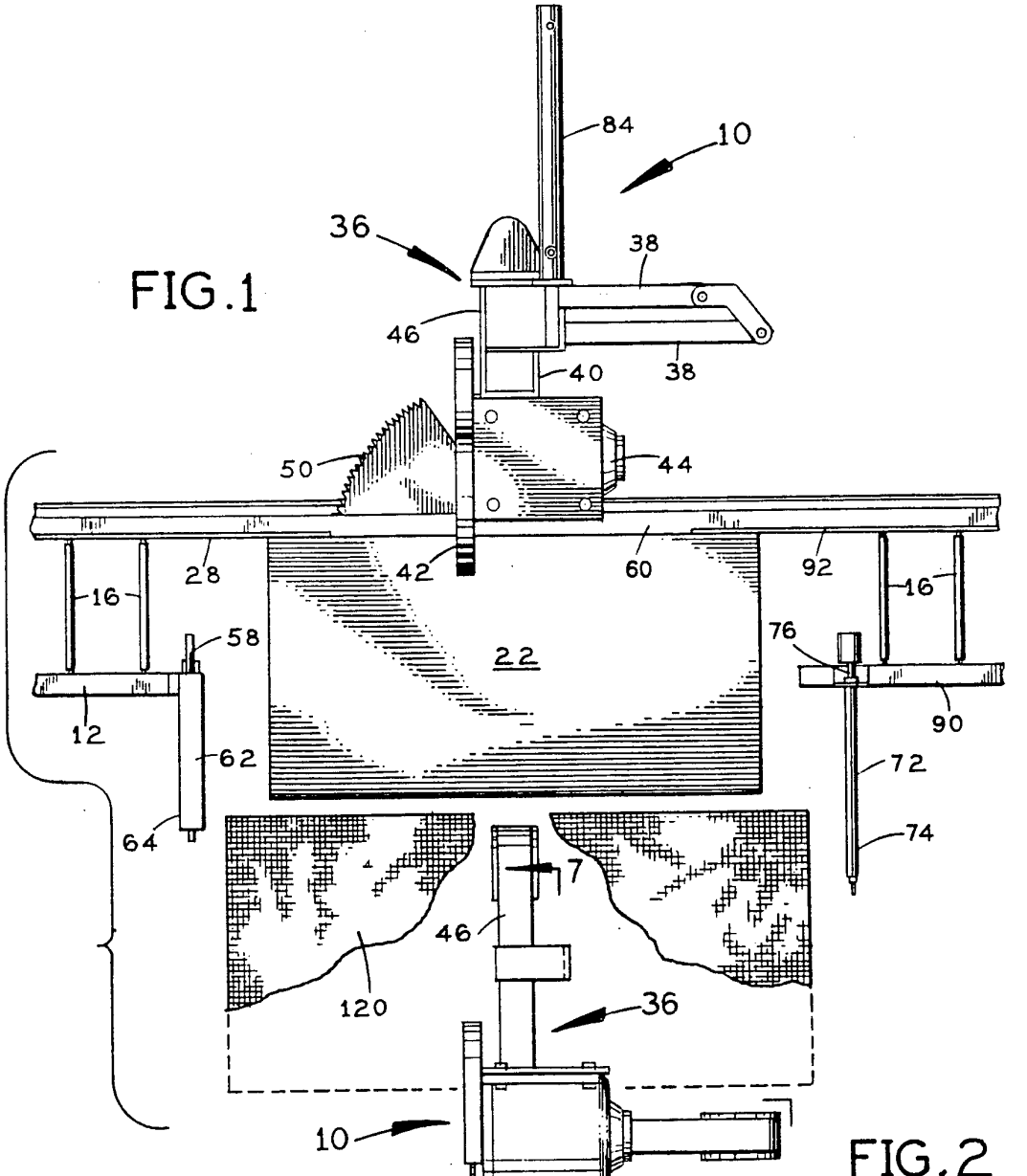

84
10
36
38
46
40
38
50
44
28
42
60
92
16
16
58
22
76
12
90
62
72
64
74
7
46
120
36
10
42
44
92
16
66
22
74
16
9
9
62
64
56
50
72
90
14
34
52
34
14
120
7

FIG.2

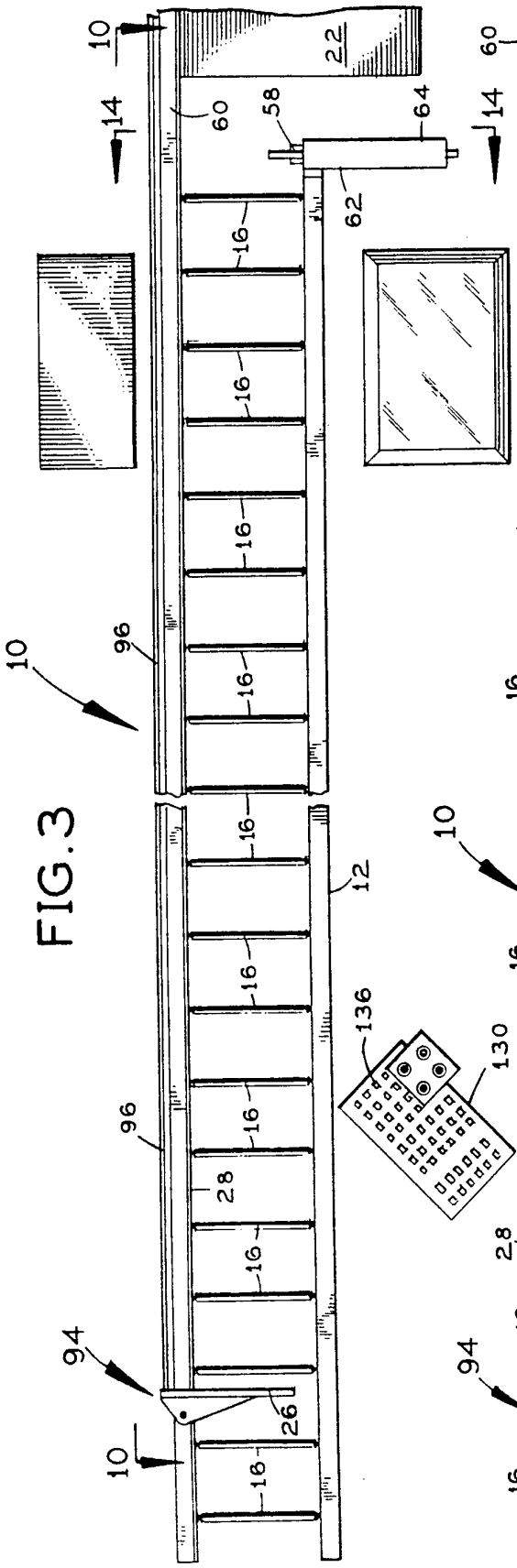

10
22
14
60
58
64
62
16
96
12
28
26
94
18

FIG.3

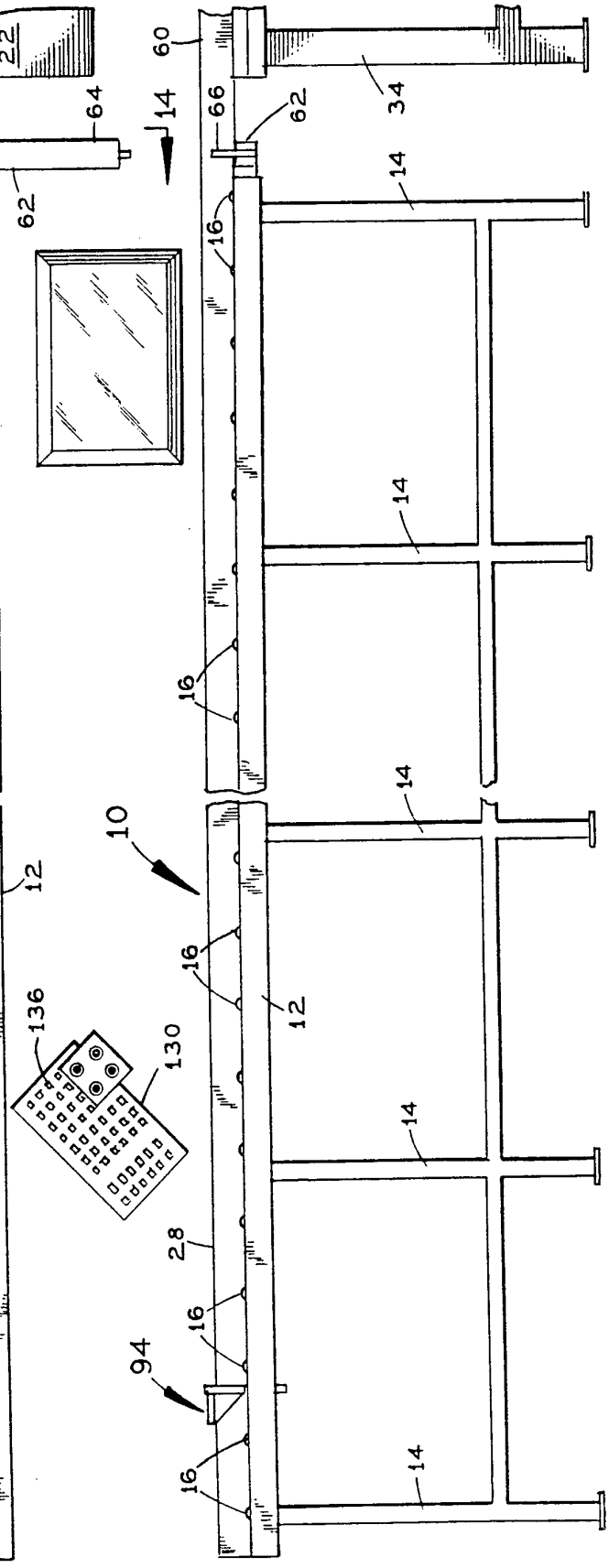

60
66
62
34
14
16
10
12
136
130
28
94

FIG.4

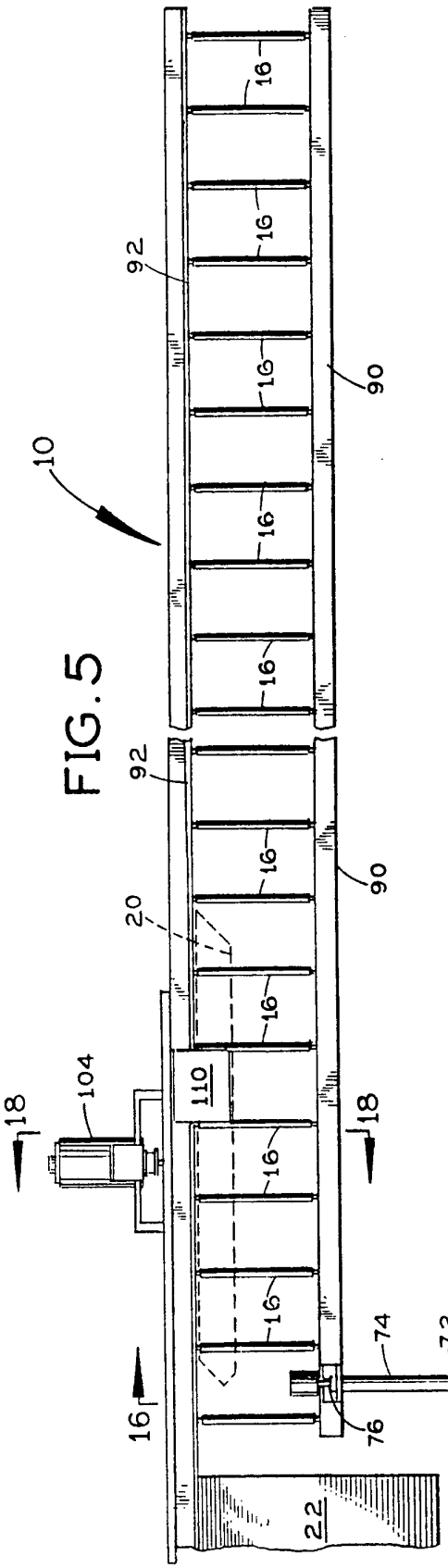


FIG.5

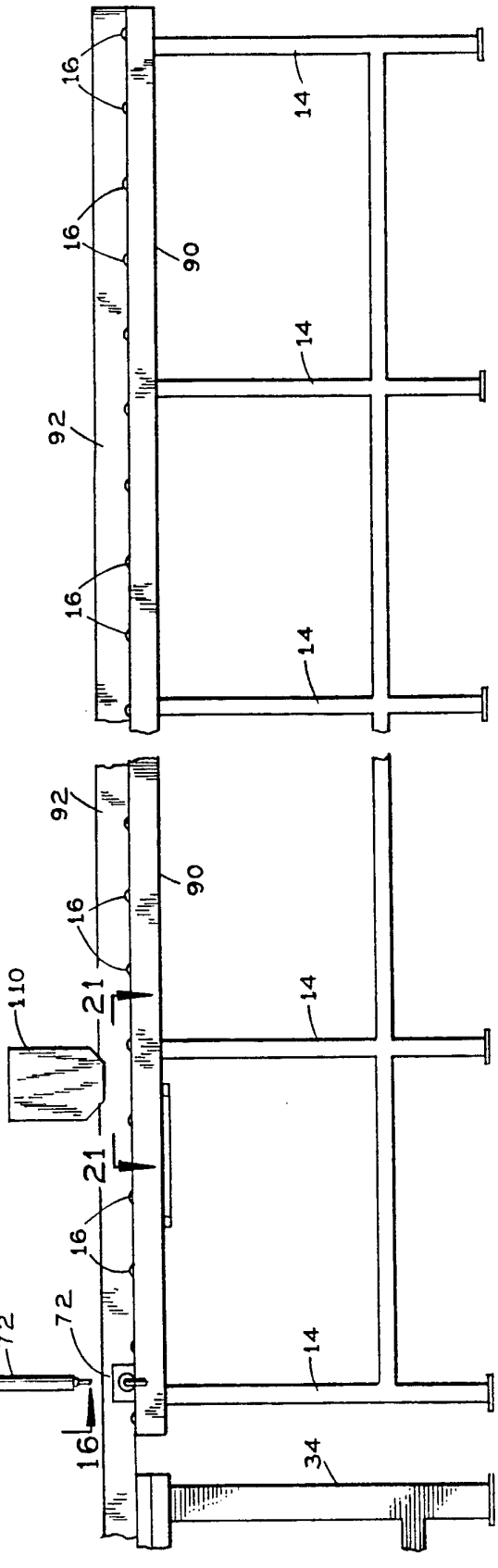


FIG.6

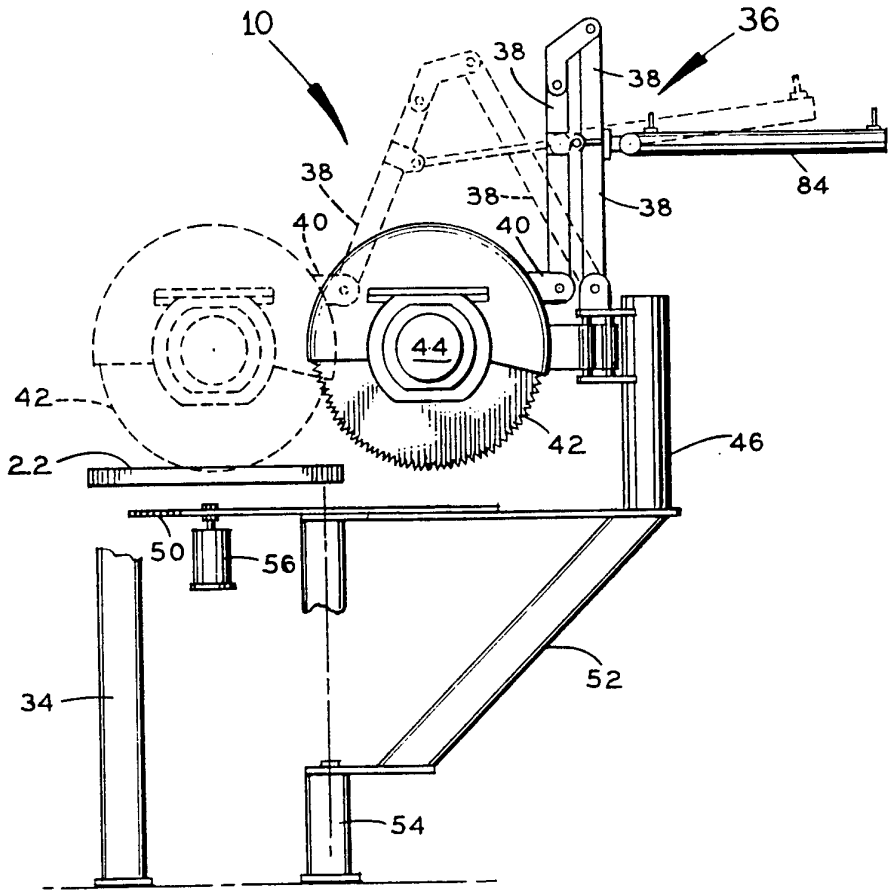


FIG. 7

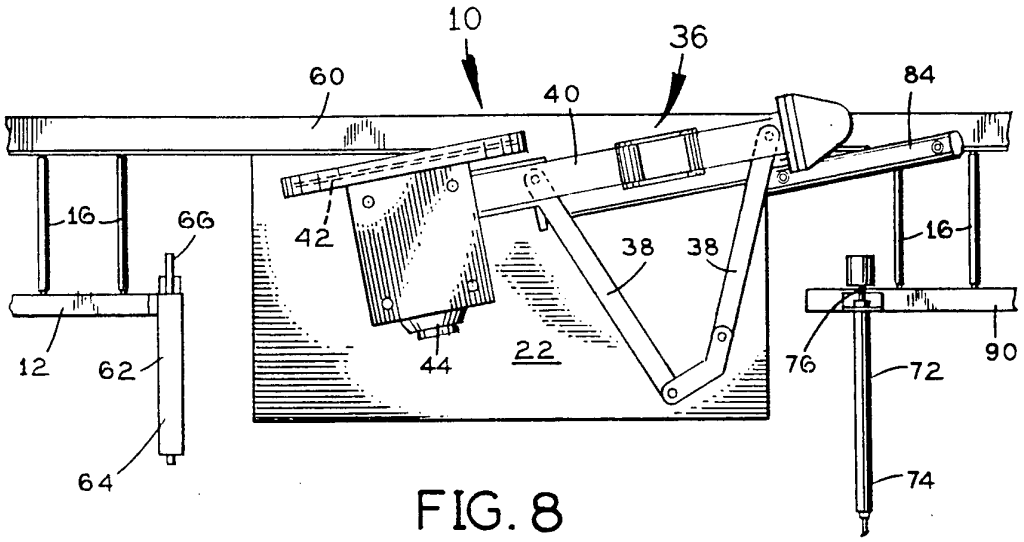

10
36
60
40
84
16
66
42
38
38
16
12
62
44
22
76
72
90
64
74

FIG. 8

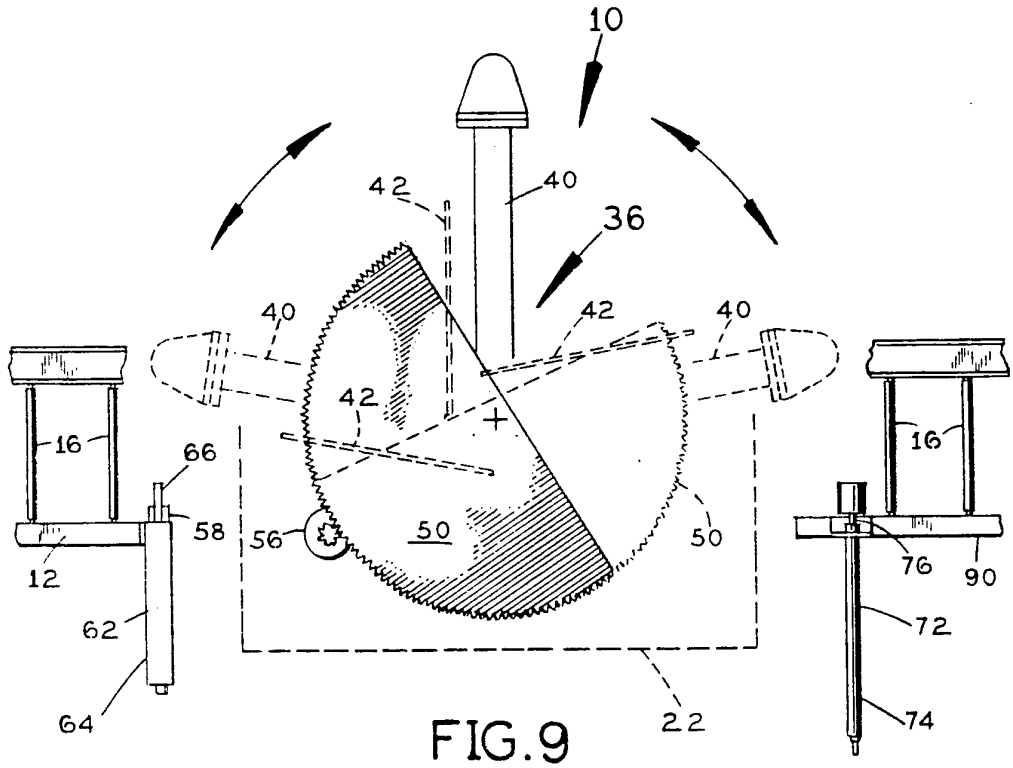

10
42
40
36
40
42
40
42
16
66
16
58
56
50
50
12
76
90
62
72
64
22
74

FIG. 9

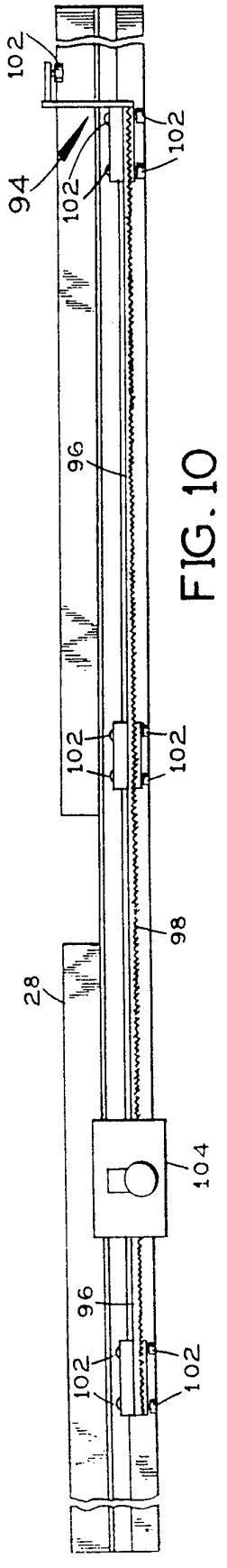


FIG.10

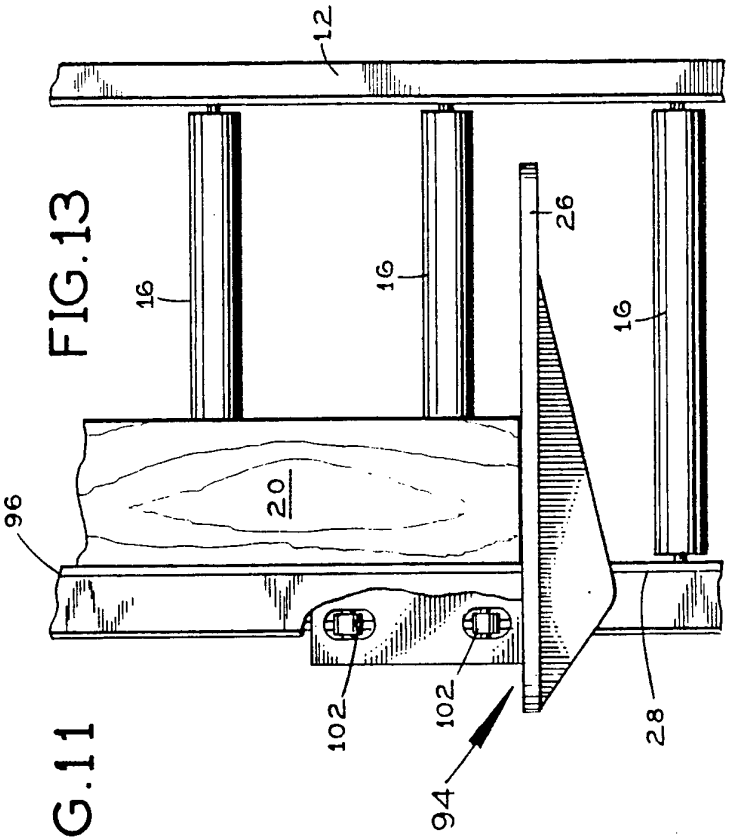


FIG.13

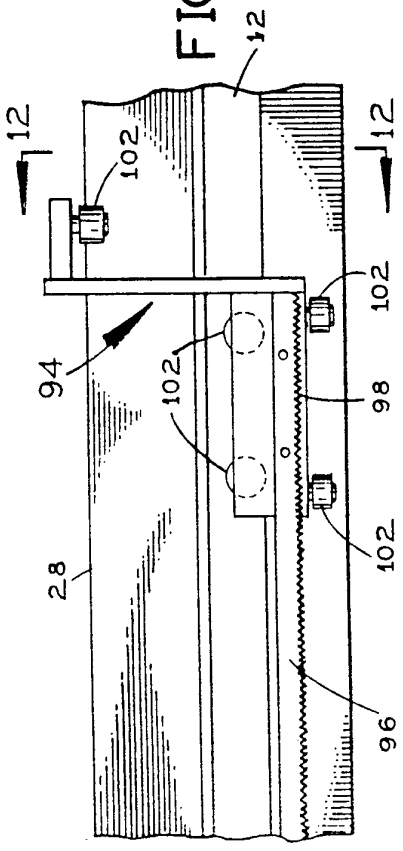


FIG.11

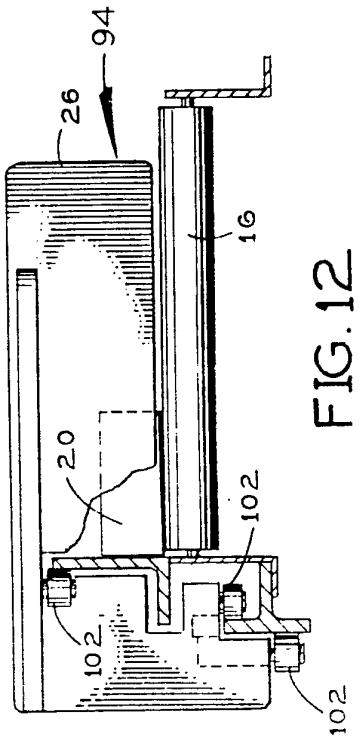


FIG.12

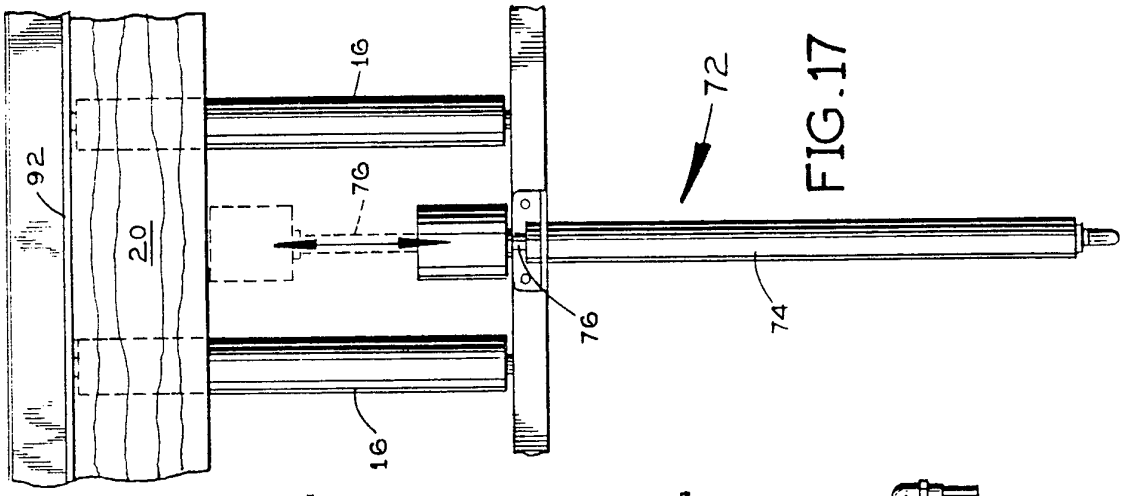


FIG.17

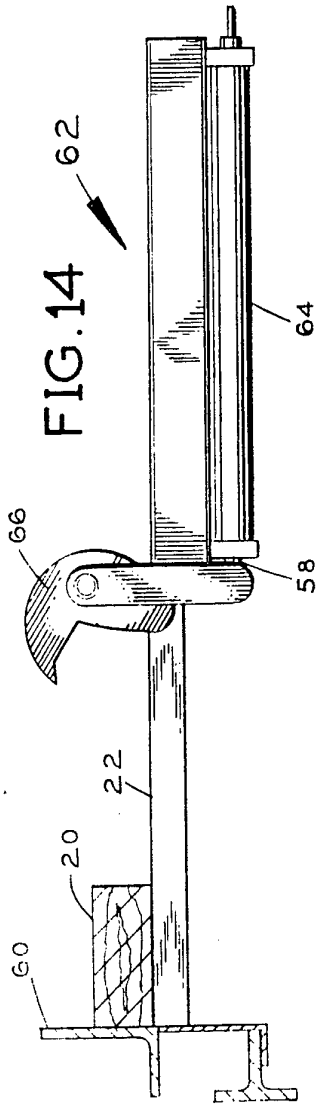


FIG.14

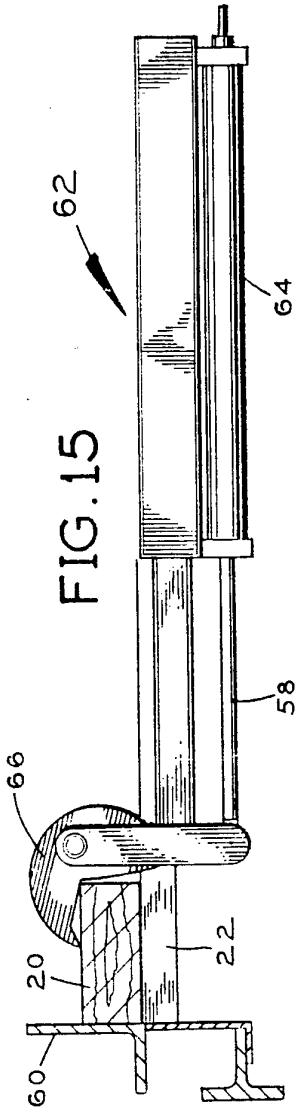


FIG.15

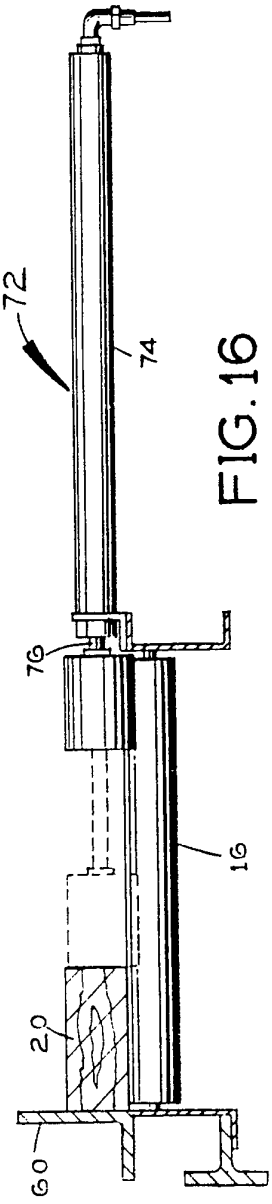


FIG.16

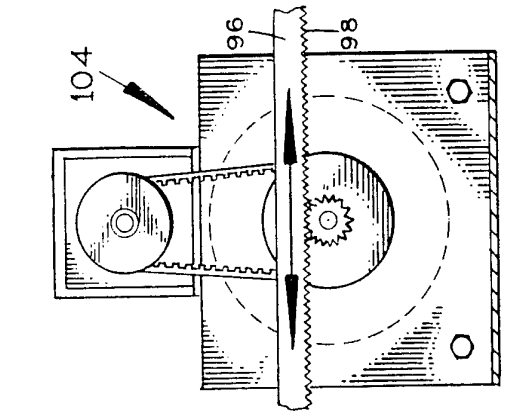


FIG. 19

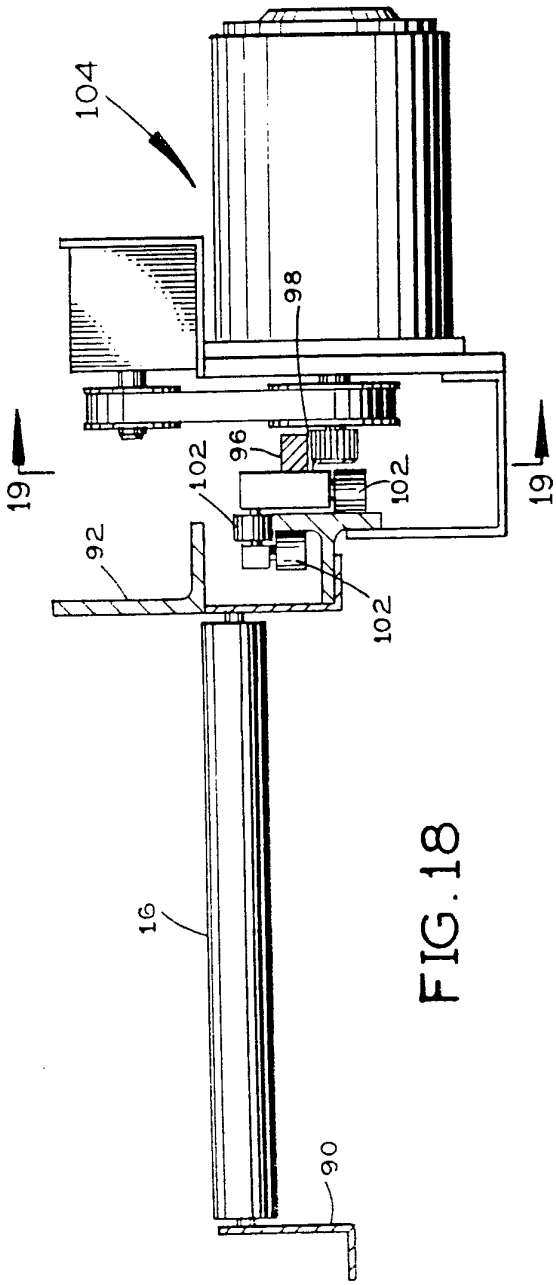


FIG. 18

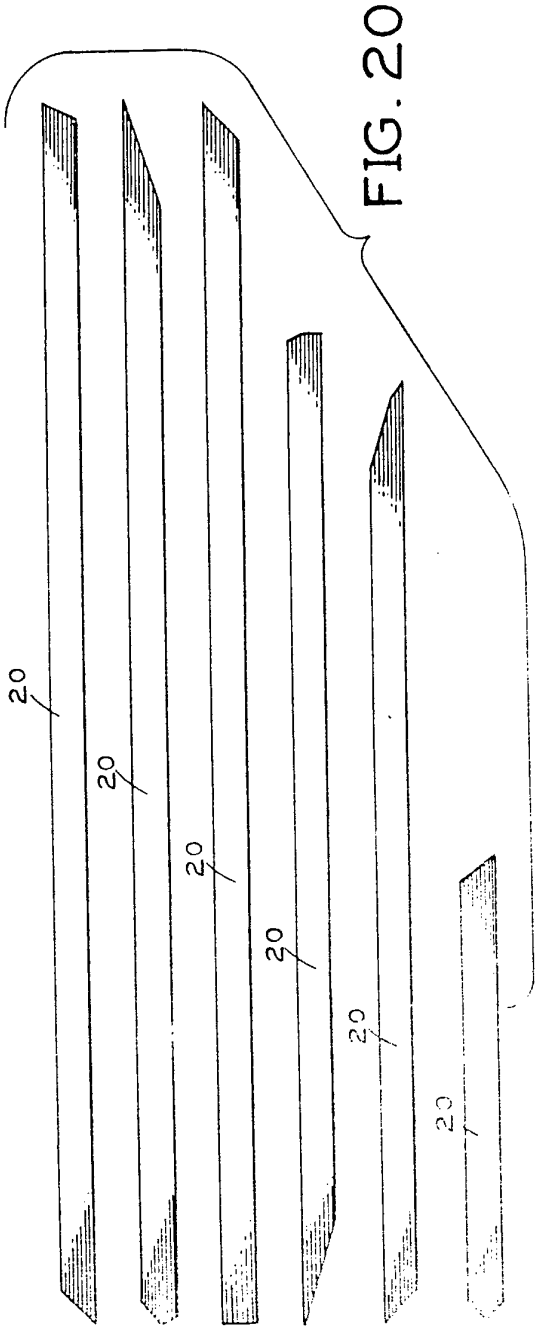


FIG. 20

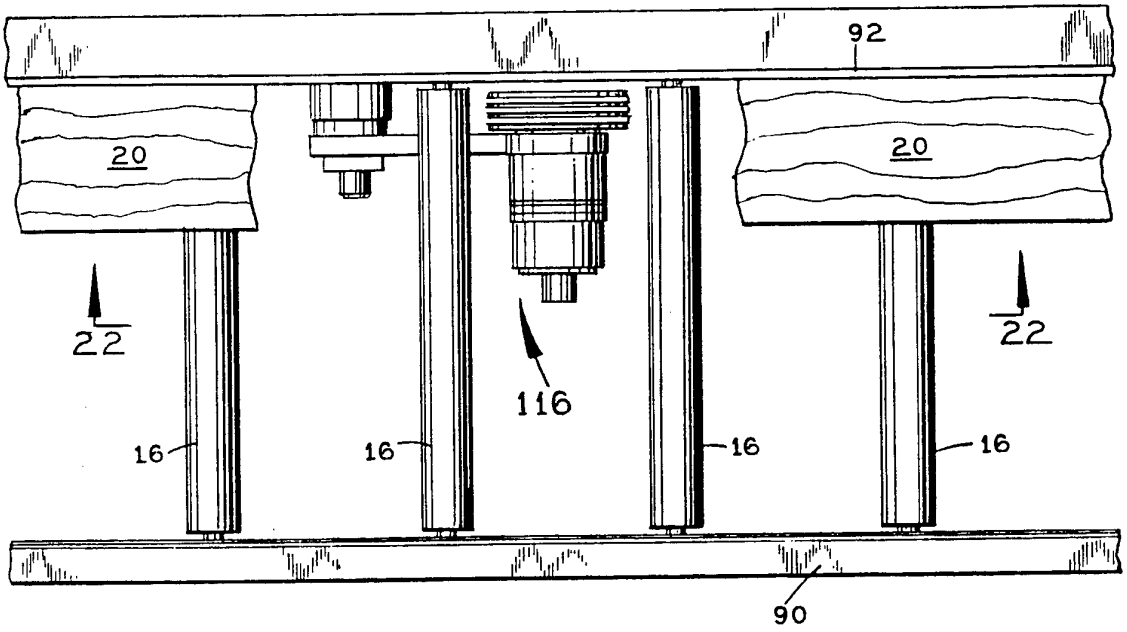

92
20
20
22
22
116
16
16
16
16
90

FIG. 21

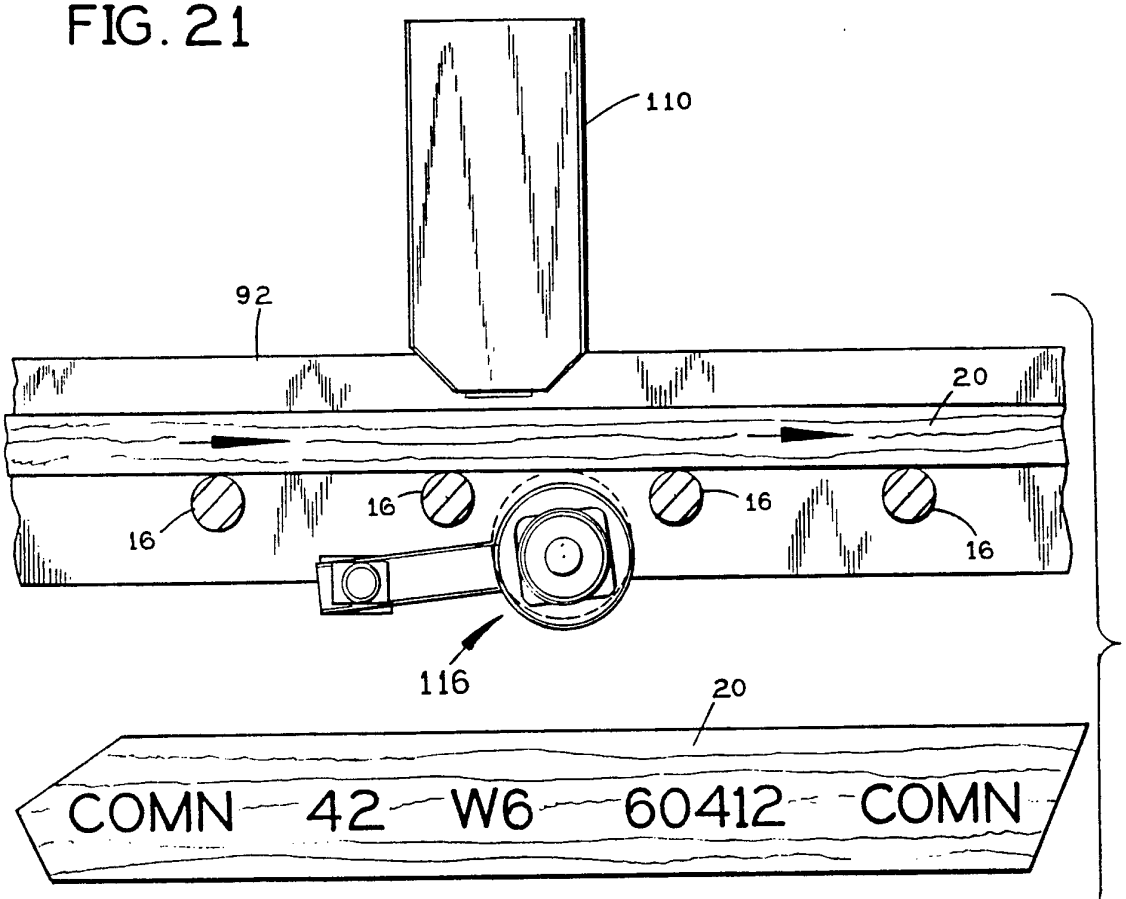

110
92
20
16
16
16
16
116
20
COMN 42 W6 60412 COMN

FIG. 22

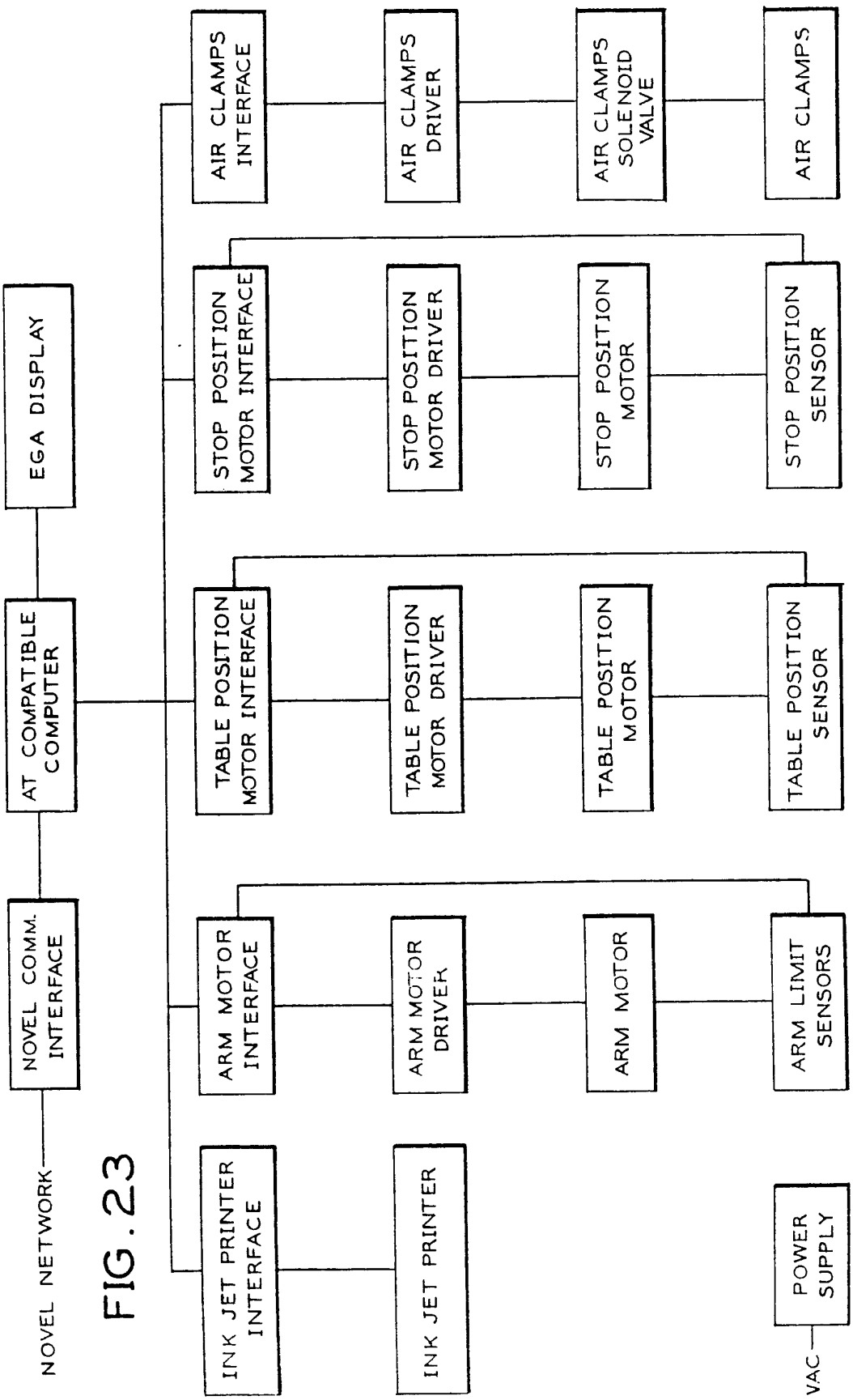

NOVEL NETWORK
NOVEL COMM. INTERFACE
AT COMPATIBLE COMPUTER
EGA DISPLAY
INK JET PRINTER INTERFACE
INK JET PRINTER
ARM MOTOR INTERFACE
ARM MOTOR DRIVER
ARM MOTOR
ARM LIMIT SENSORS
TABLE POSITION MOTOR INTERFACE
TABLE POSITION MOTOR DRIVER
TABLE POSITION MOTOR
TABLE POSITION SENSOR
STOP POSITION MOTOR INTERFACE
STOP POSITION MOTOR DRIVER
STOP POSITION MOTOR
STOP POSITION SENSOR
AIR CLAMPS INTERFACE
AIR CLAMPS DRIVER
AIR CLAMPS SOLENOID VALVE
AIR CLAMPS
VAC
POWER SUPPLY

FIG. 23

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/00414

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B26D 1/16
US CL :83-34, 36, 76.1, 471.3, 487, 437, 452
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 83-34, 36, 76.1, 471.3, 487, 437, 452; 83-72, 35

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Searched APS
S 192/129R - 129A/CCLST and MAT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 3,910,142 (Jureit et al.) 07 October 1975	1-5, 8, 9, 11
Y	US, A, 5,033,347 (Hillistad et al.) 23 July 1991	6
Y	US, A, 4,392,176 (Kneip et al.) 05 July 1983	7
Y	US, A, 0,354,170 (Myers) 14 December 1886	10
A	US, A, 3,141,367 (Keener et al.) 21 July 1964	
A	US, A, 3,627,866 (Laws) 14 December 1971	

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:
"A"	document defining the general state of the art which is not considered to be part of particular relevance
"E"	earlier document published on or after the international filing date
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O"	document referring to an oral disclosure, use, exhibition or other means
"P"	document published prior to the international filing date but later than the priority date claimed
"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&"	document member of the same patent family

Date of the actual completion of the international search 08 MARCH 1993	Date of mailing of the international search report 19 APR 1993
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer Nguyen for KENNETH E. PETERSON Telephone No. (703) 308-1148

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/00414

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,574,670 (Johnson) 11 March 1986	
A	US, A, 4,907,337 (Krusi) 13 March 1990	
A,P	US, A, 5,176,060 (Thornton) 05 January 1993	