US 20090031870A1

(19) **United States**

(12) **Patent Application Publication**

O'Connor

(10) **Pub. No.: US 2009/0031870 A1**

(43) **Pub. Date: Feb. 5, 2009**

(54) **SYSTEM AND METHOD FOR CUTTING A WEB TO PROVIDE A COVERING**

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(21) Appl. No.: **12/181,498**

(22) Filed: **Jul. 29, 2008**

Related U.S. Application Data

(60) Provisional application No. 60/953,519, filed on Aug. 2, 2007.

Publication Classification

(51) **Int. Cl.**

B26D 1/00	(2006.01)
B25B 11/00	(2006.01)
B26D 7/01	(2006.01)
B26D 5/08	(2006.01)
B23K 26/38	(2006.01)

(52) **U.S. Cl.** **83/13**; 269/21; 83/451; 83/581; 219/121.67

(57) **ABSTRACT**

A covering is provided for exterior or interior application on solid surfaces such as garage floors, patios, and walkways. The covering is formed as tiles formed of a top layer of fibrous material, such as carpet, and a bottom layer of adhesive applied in spaced bands, lines, strips or rows that allow the tile to be removed from the surface after installation if desired. A release sheet, preferably formed of plural pieces, is secured over the adhesive for removal during installation. A portion of the release sheet can function as a positioning strip to assist in accurately placing the tiles. The covering is manufactured by coating the bottom surface of a strip of material in beads of adhesive, smoothing the beads into bands, lines, strips or rows, and then cutting the strip into tiles using a non-mechanical cutter such as a laser.

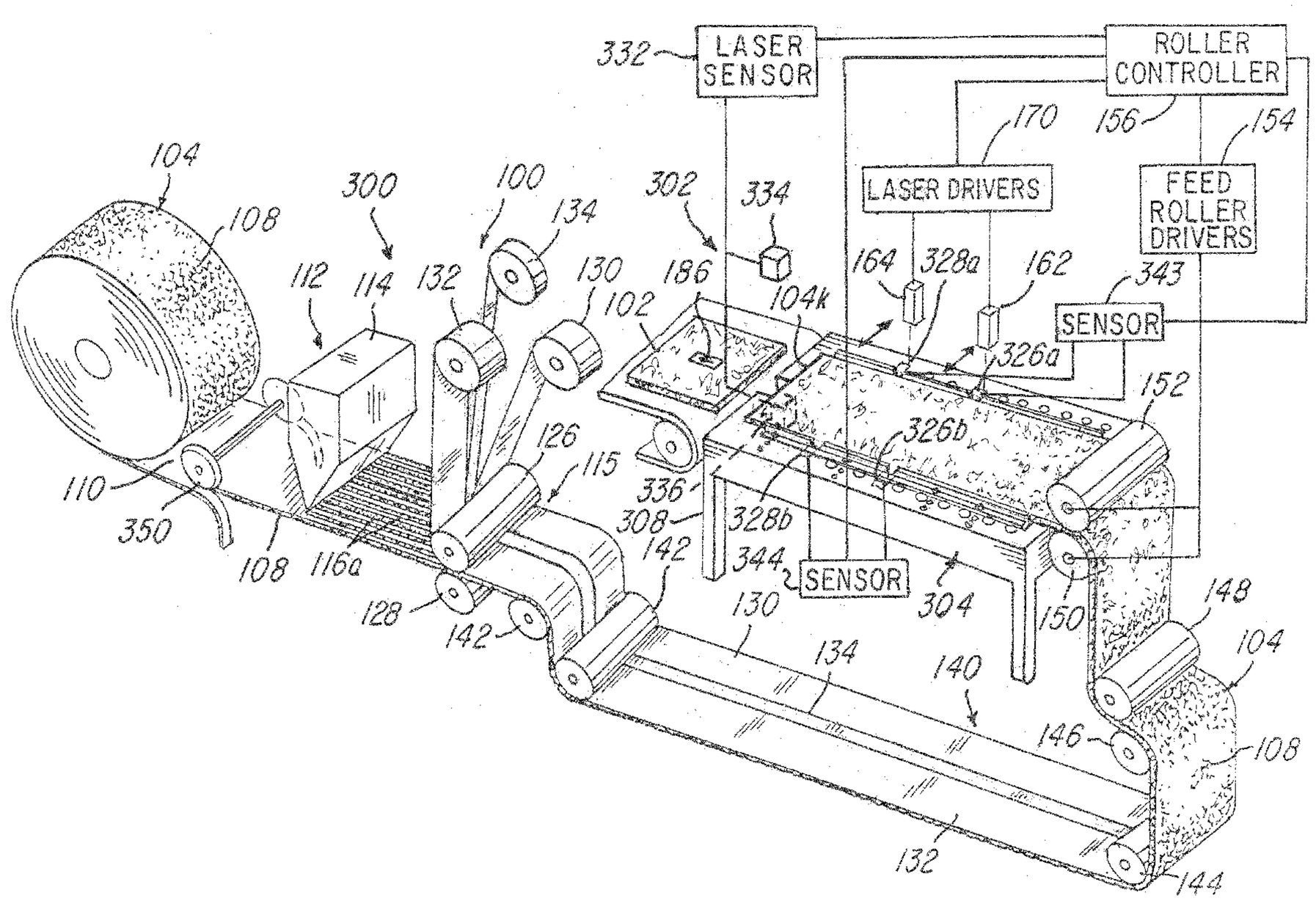


FIG-1

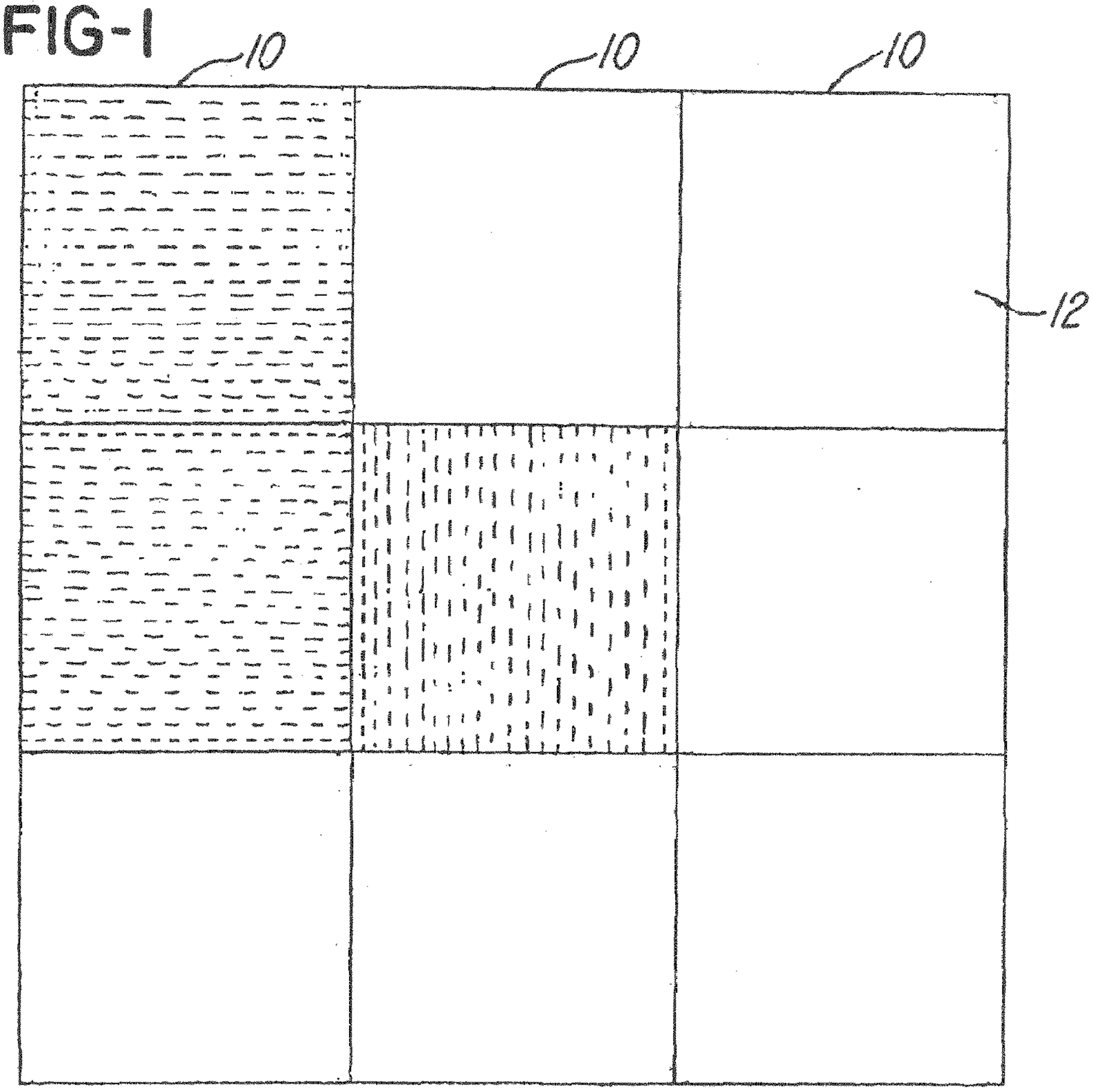


FIG-3

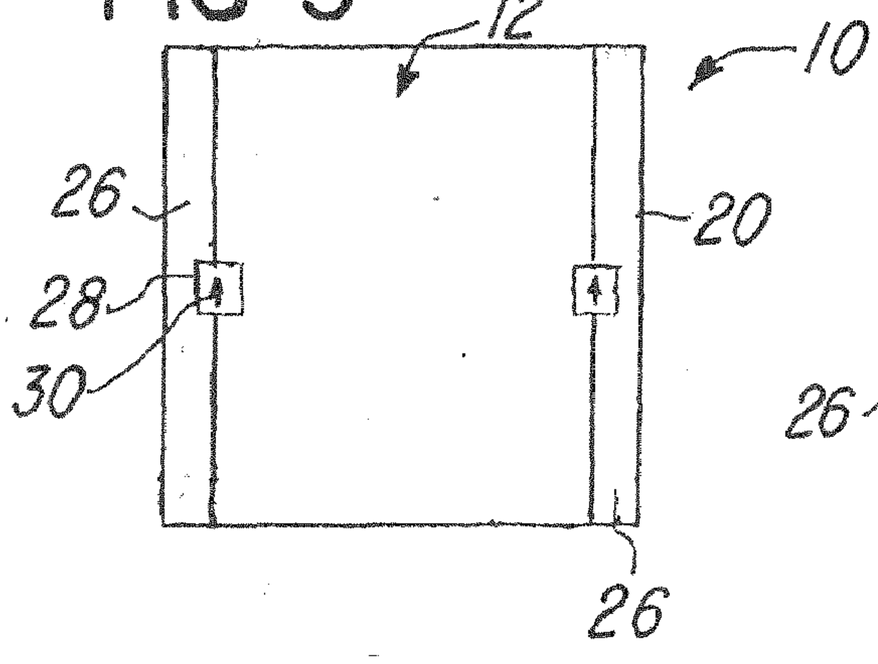


FIG-2

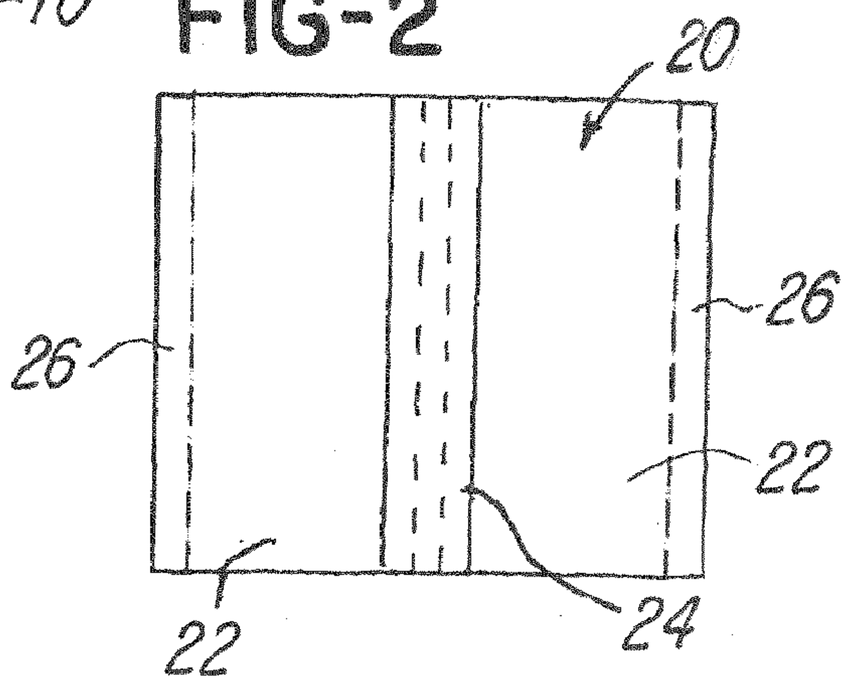


FIG-4

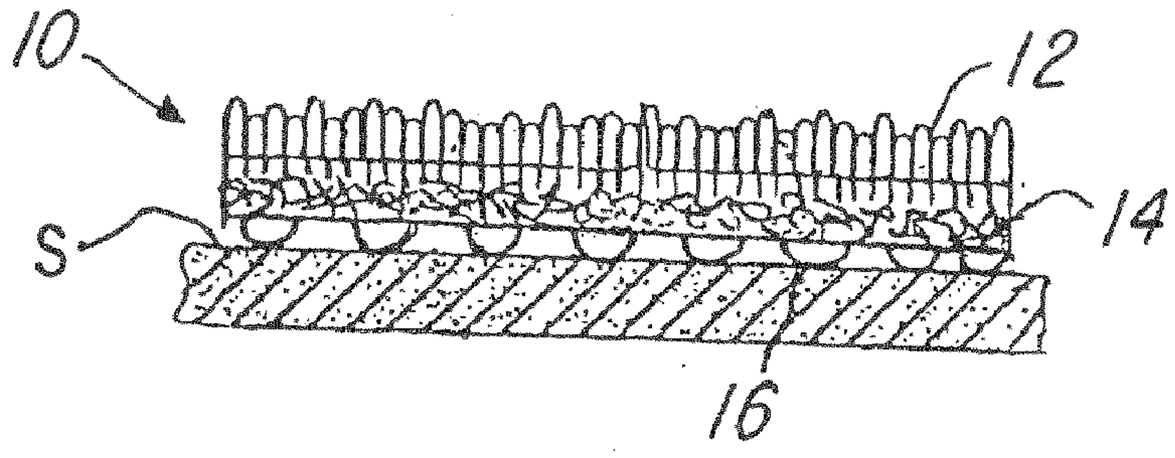


FIG-5

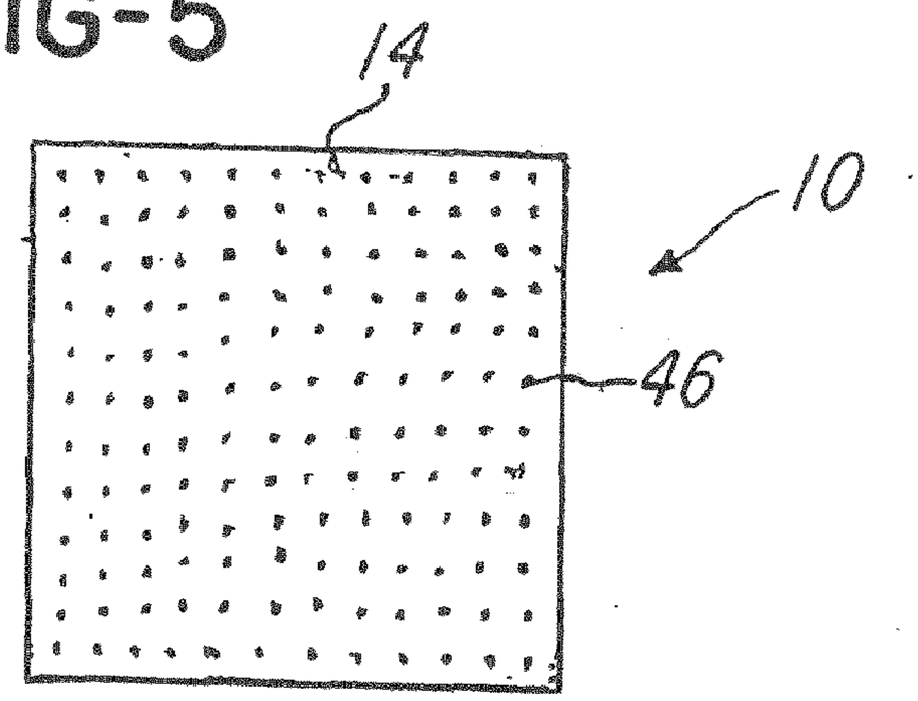
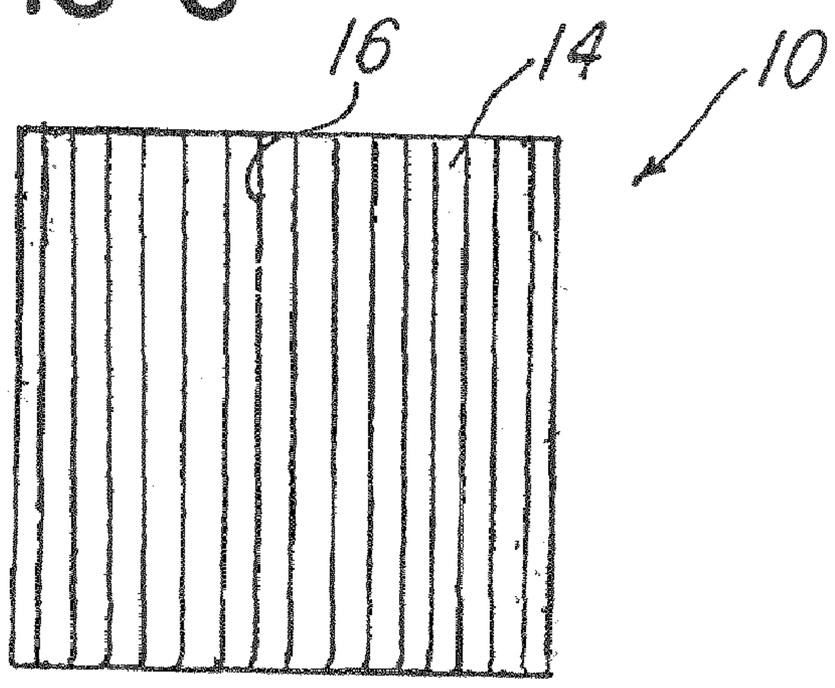


FIG-6



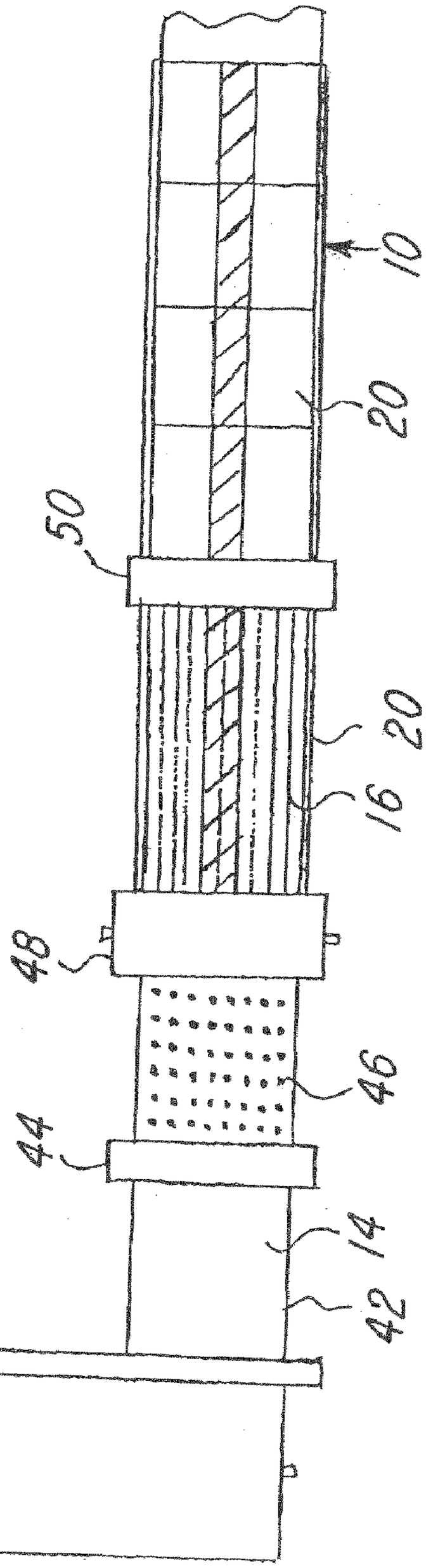


FIG-7

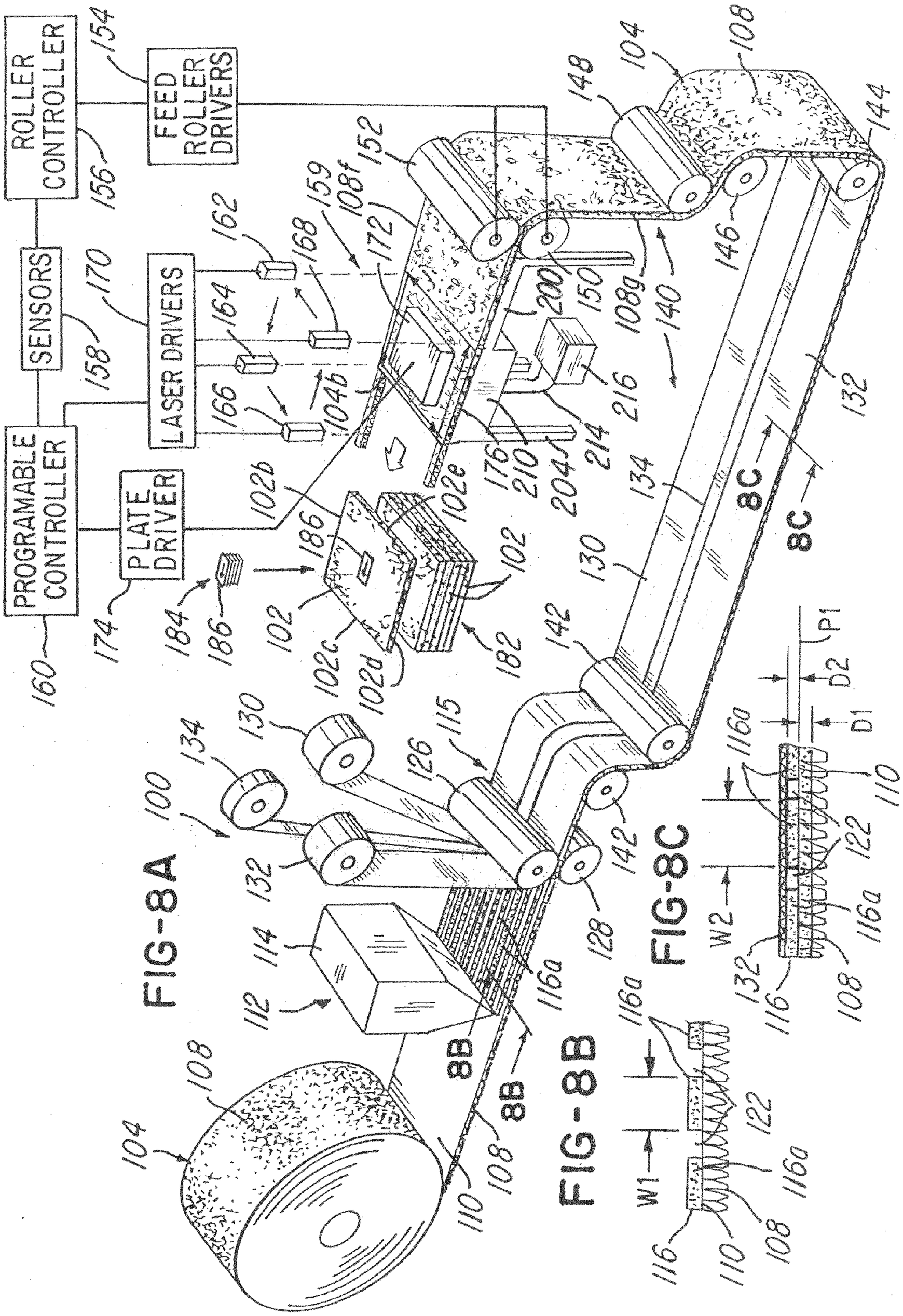


FIG-8A

FIG-8C

FIG-8B

FIG-9

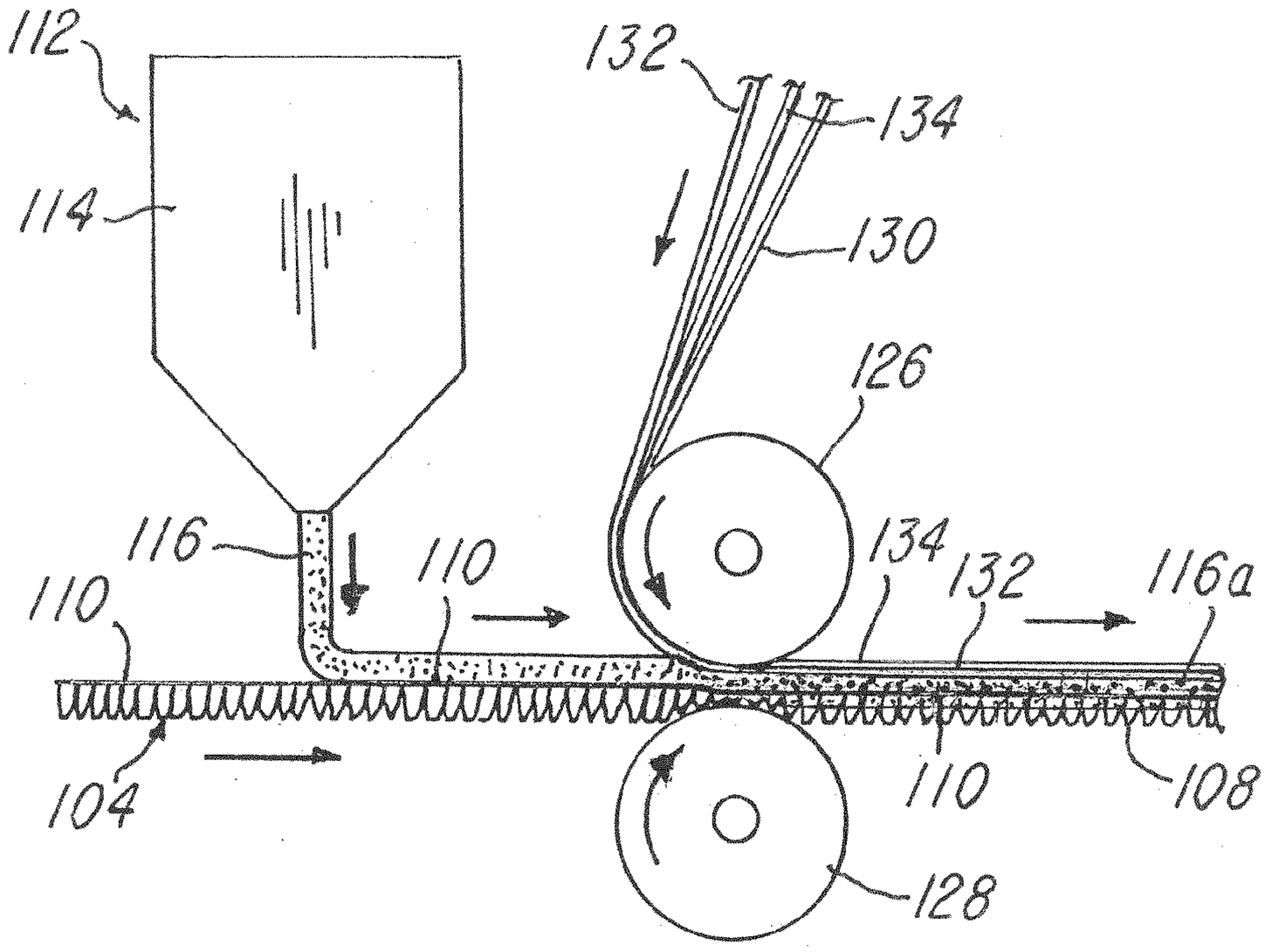


FIG-10

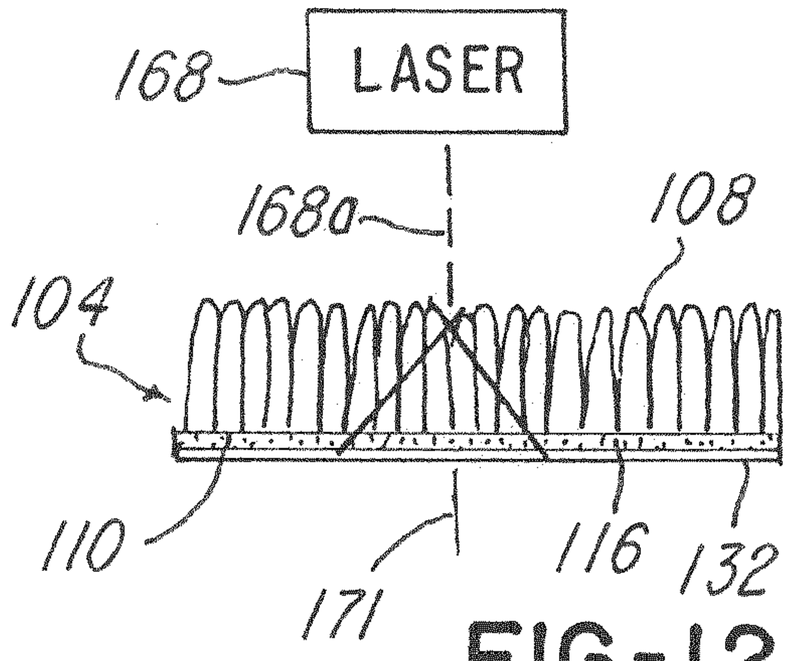


FIG-11

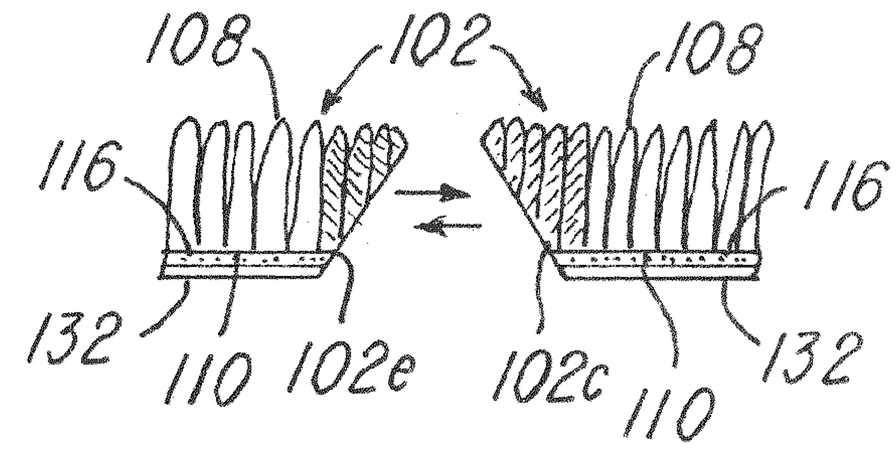


FIG-12

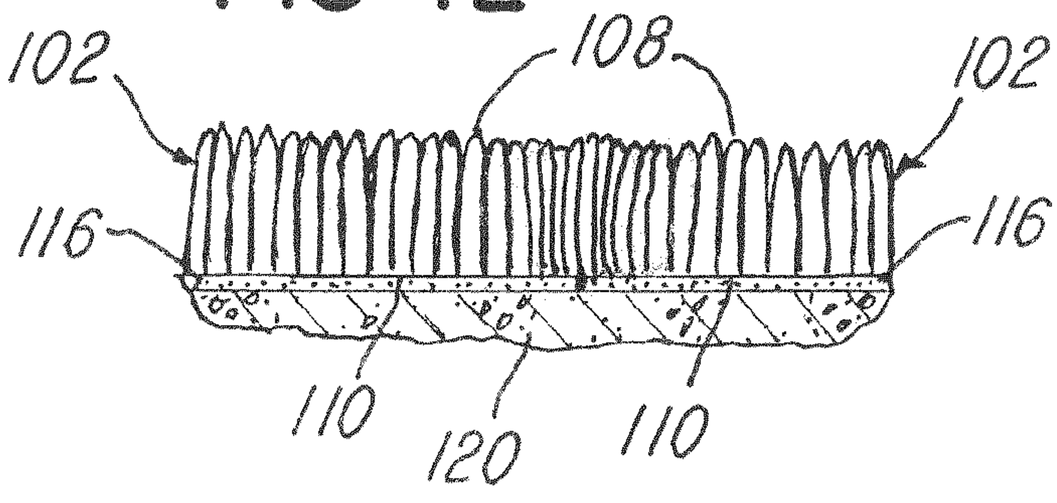


FIG-13

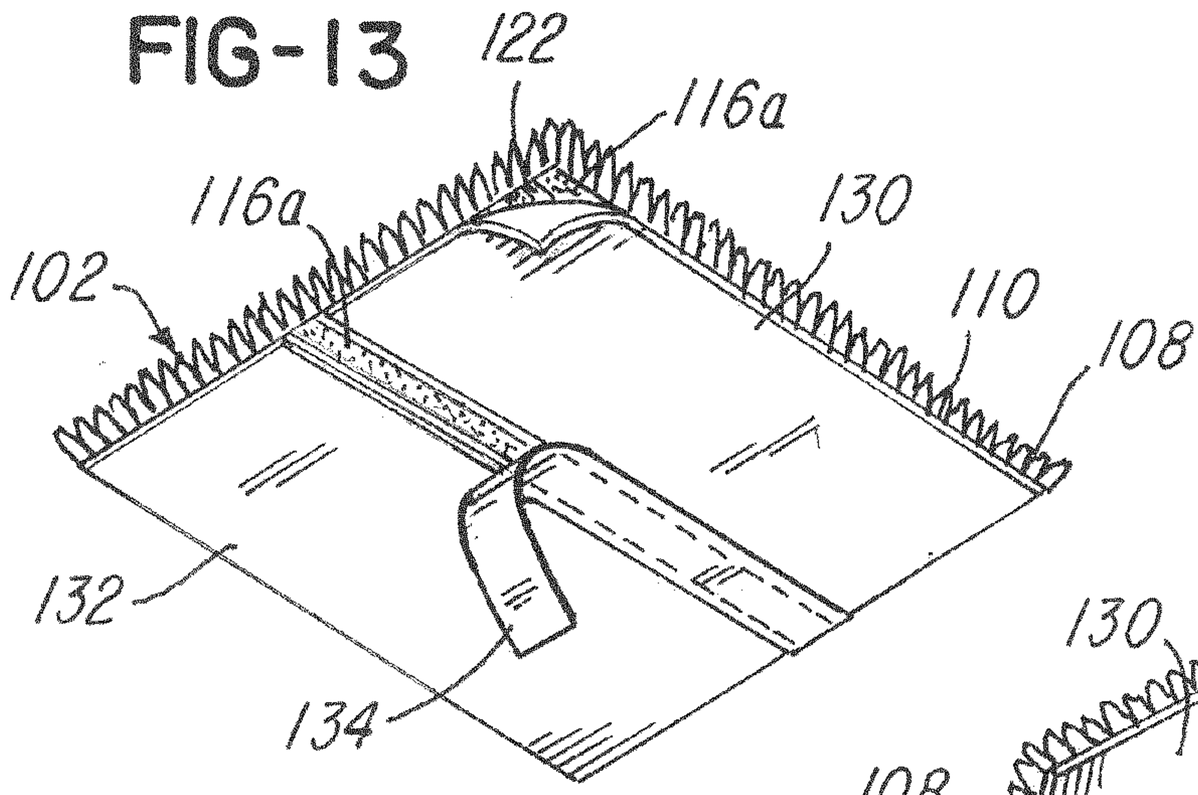


FIG-14

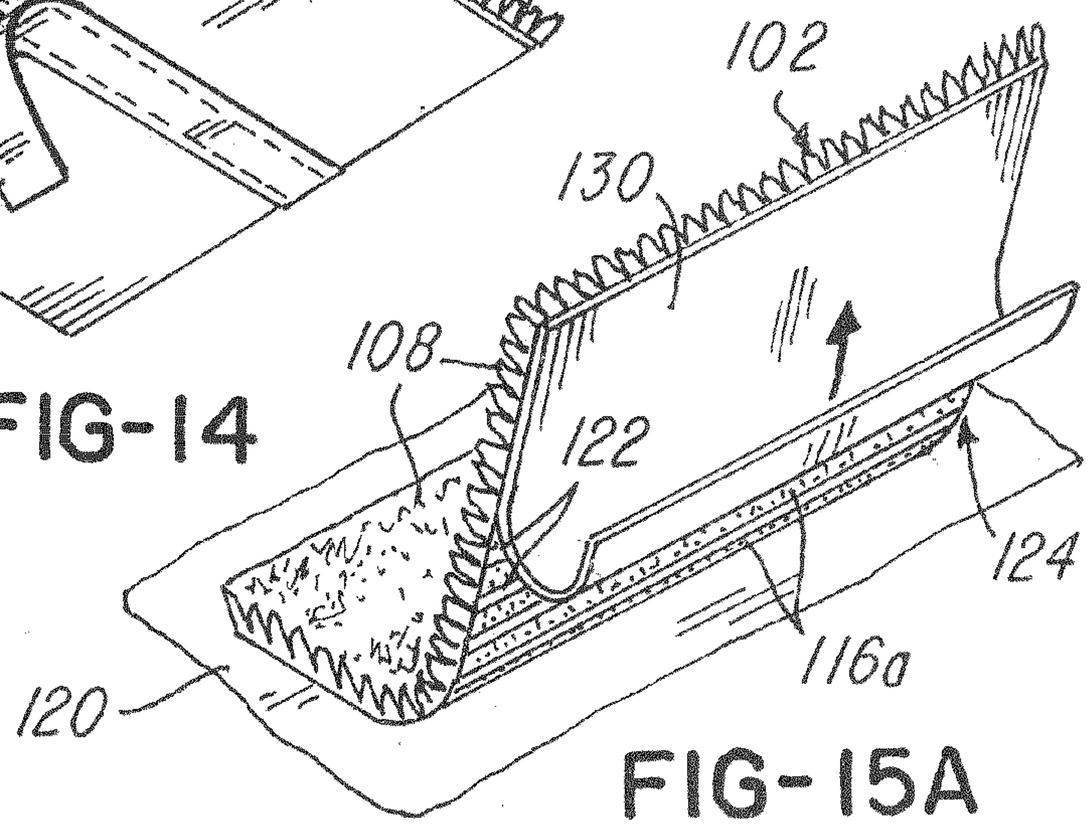


FIG-15A

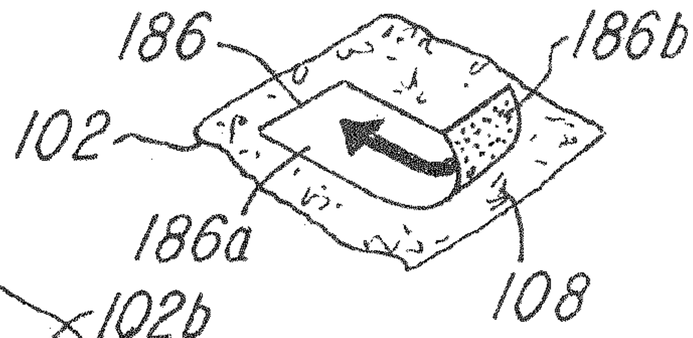


FIG-15B

FIG-16

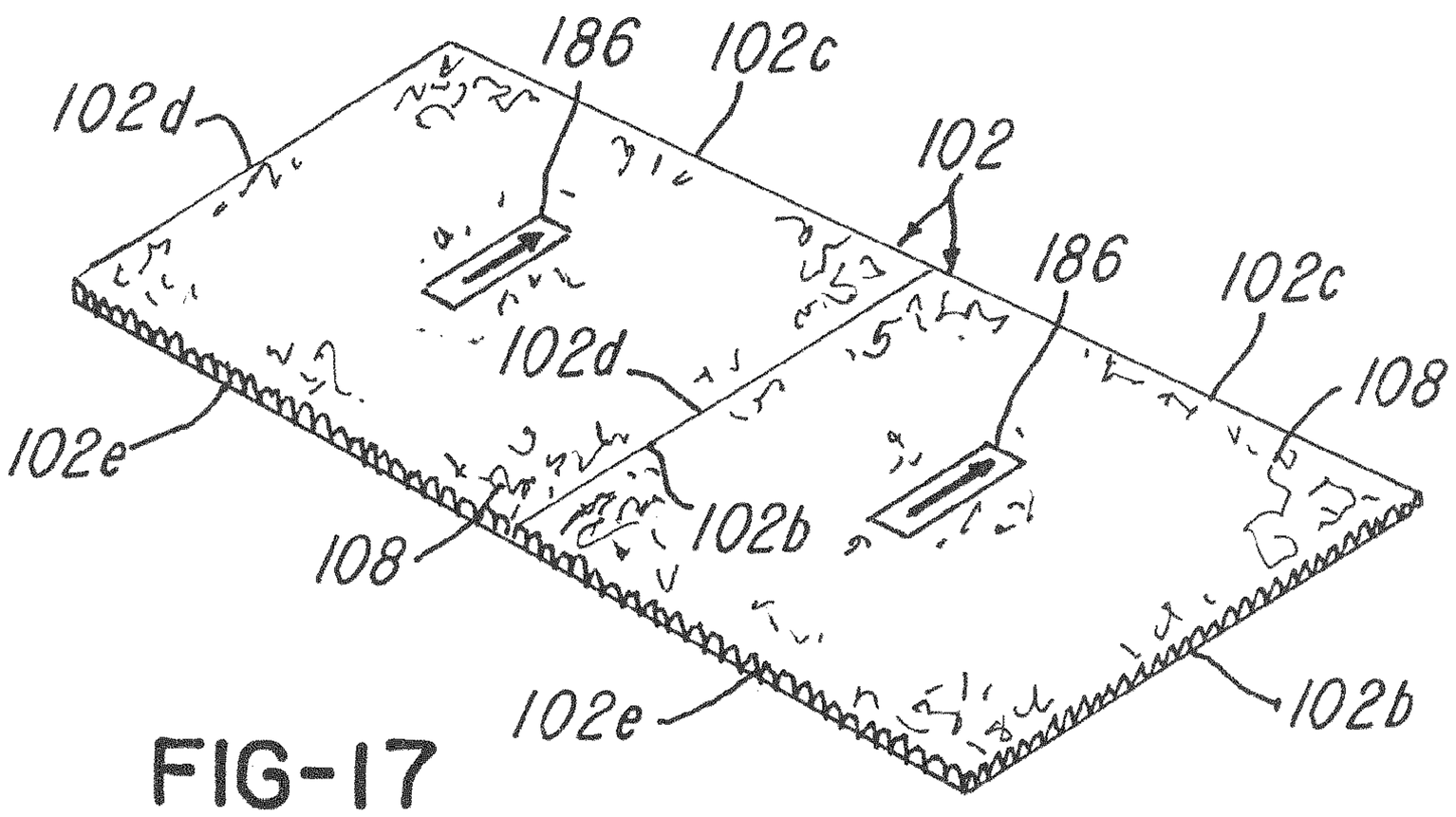


FIG-17

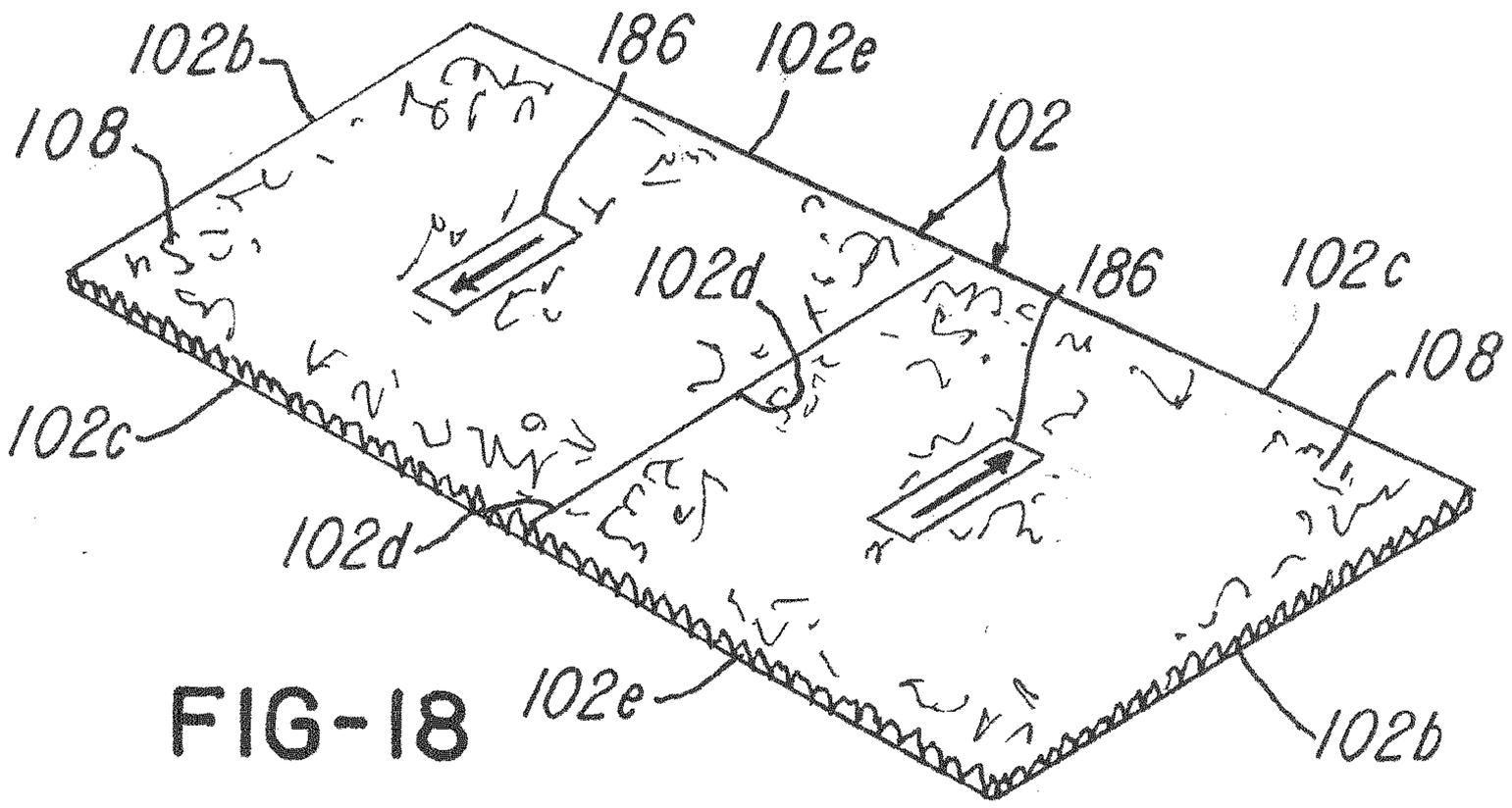
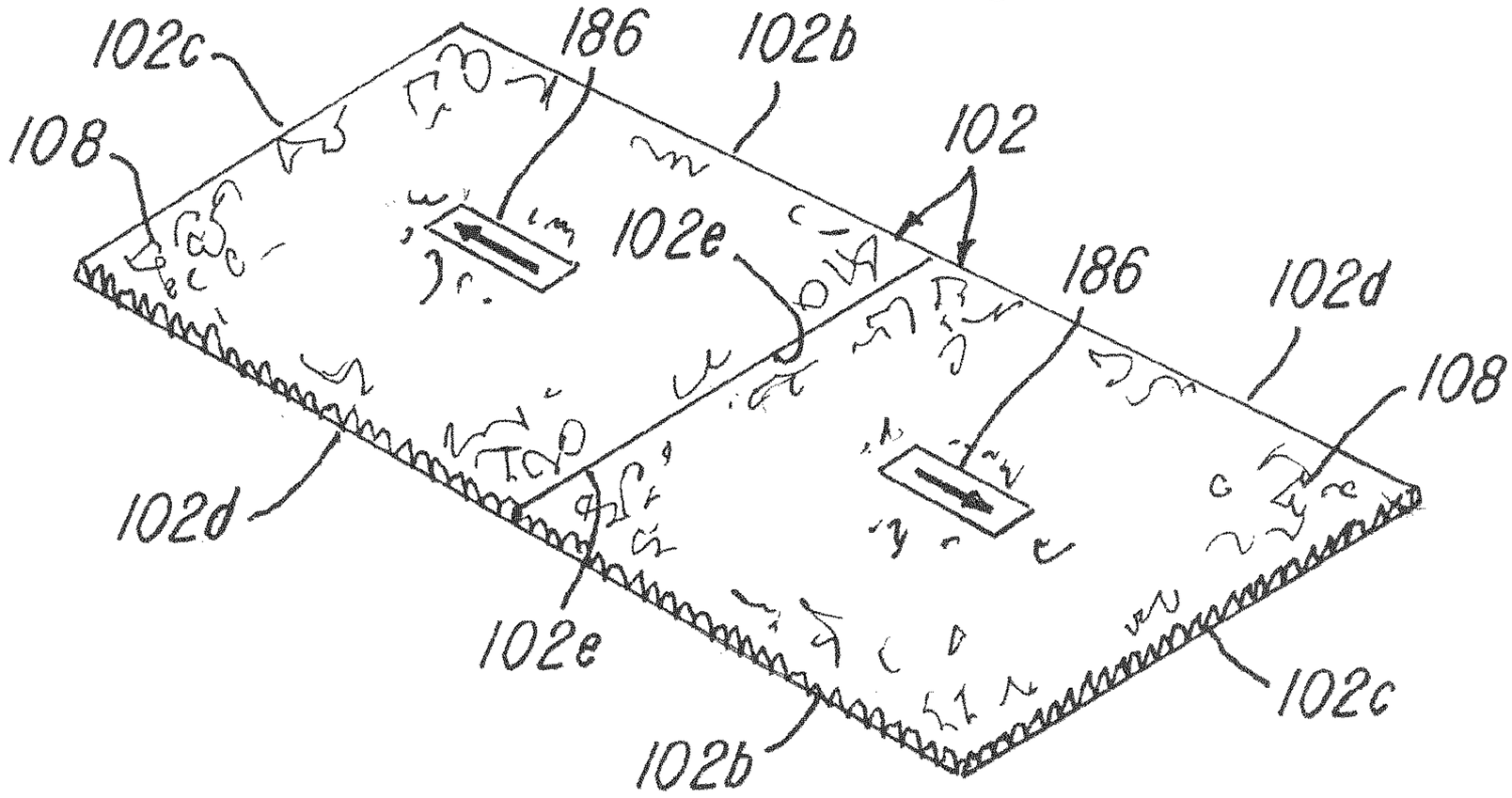


FIG-18



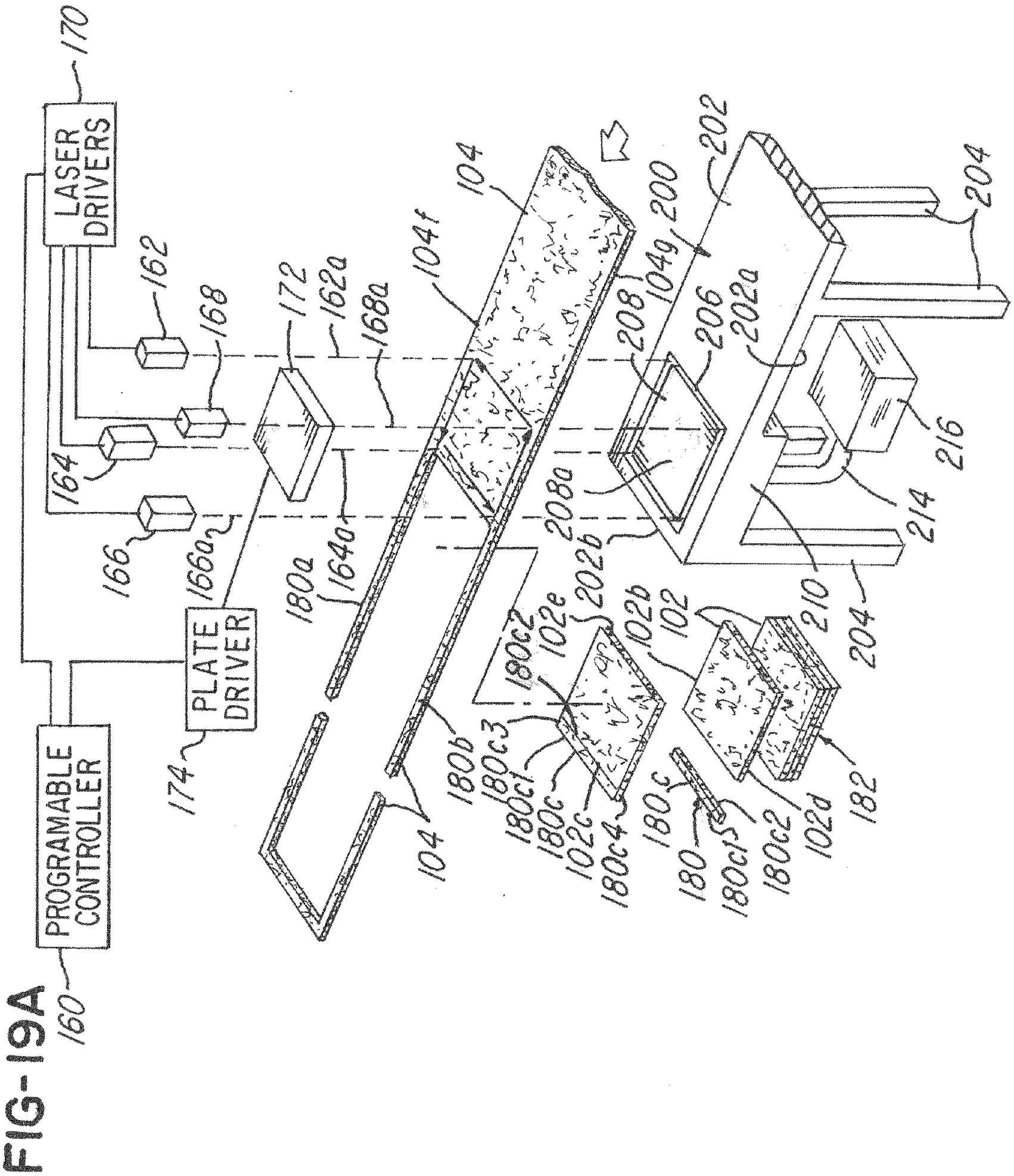

PROGRAMABLE CONTROLLER
160
LASER DRIVERS
170
PLATE DRIVER
174
162
164
166
168
172
180a
180b
180c
180c1
180c2
180c3
180c4
180c5
102
102b
102c
102d
102e
104
104f
104g
200
202
202a
202b
204
206
208
210
212
214
216
162a
164a
166a
168a
172a
180a
1640a
2080
182

FIG-19A

FIG-19B

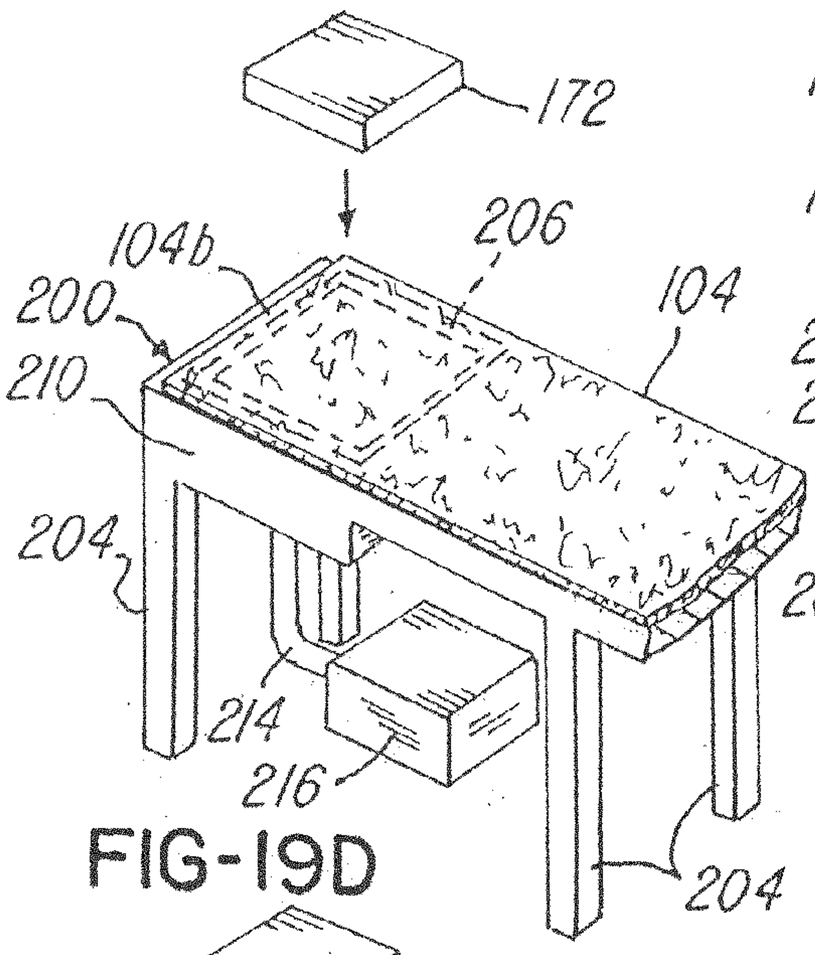


FIG-19C

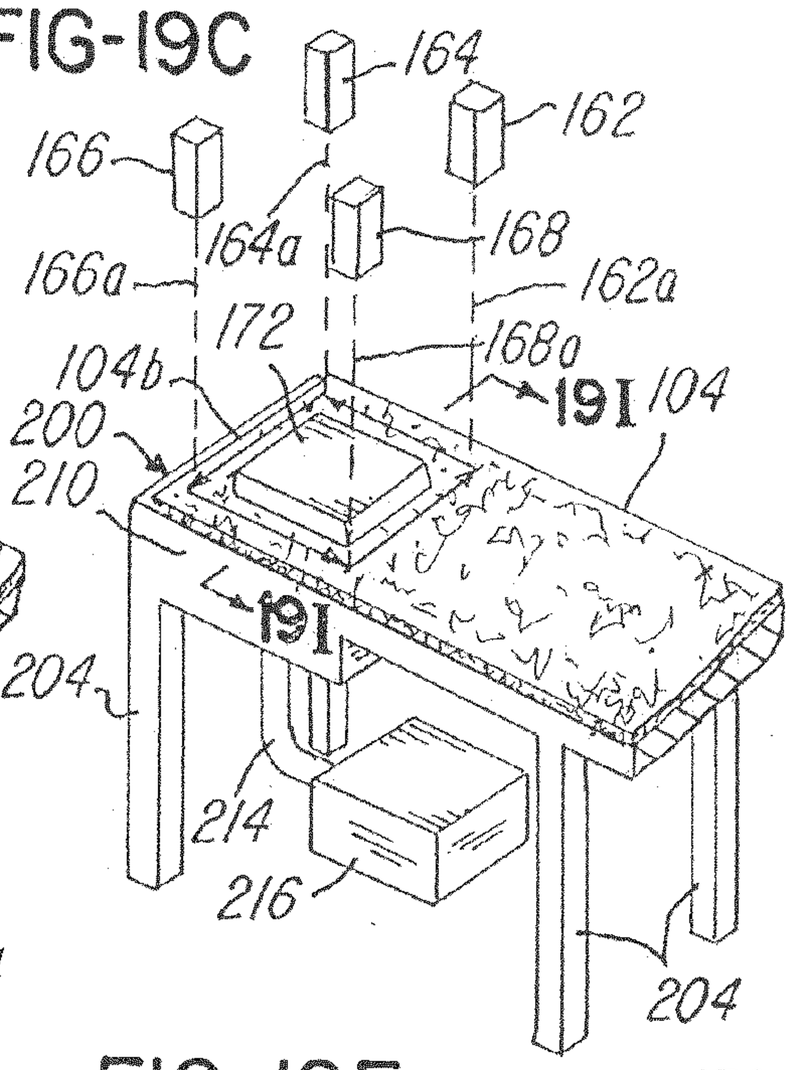


FIG-19D

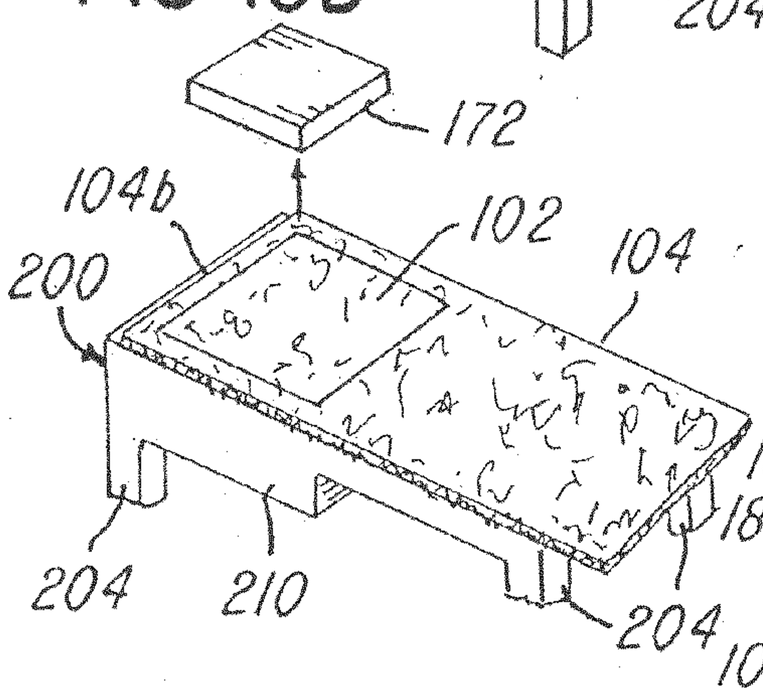


FIG-19E

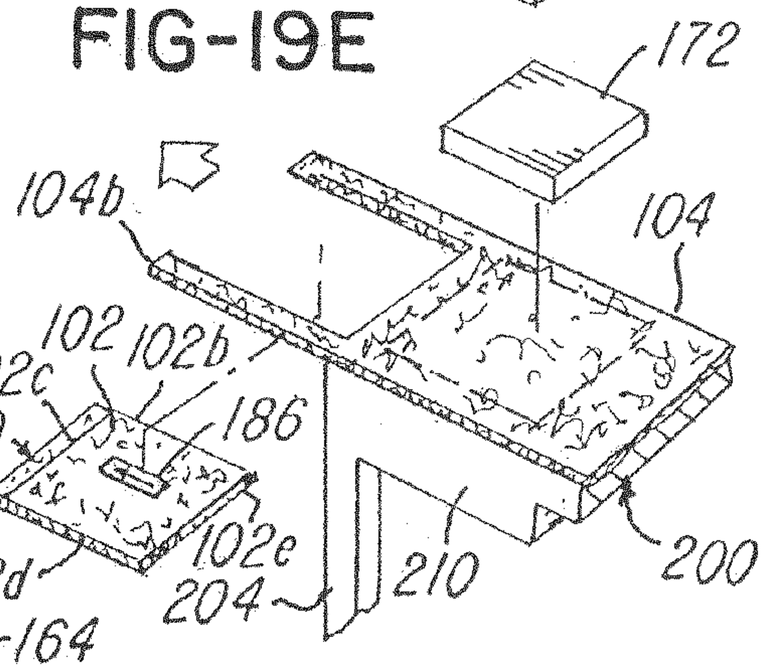


FIG-19F

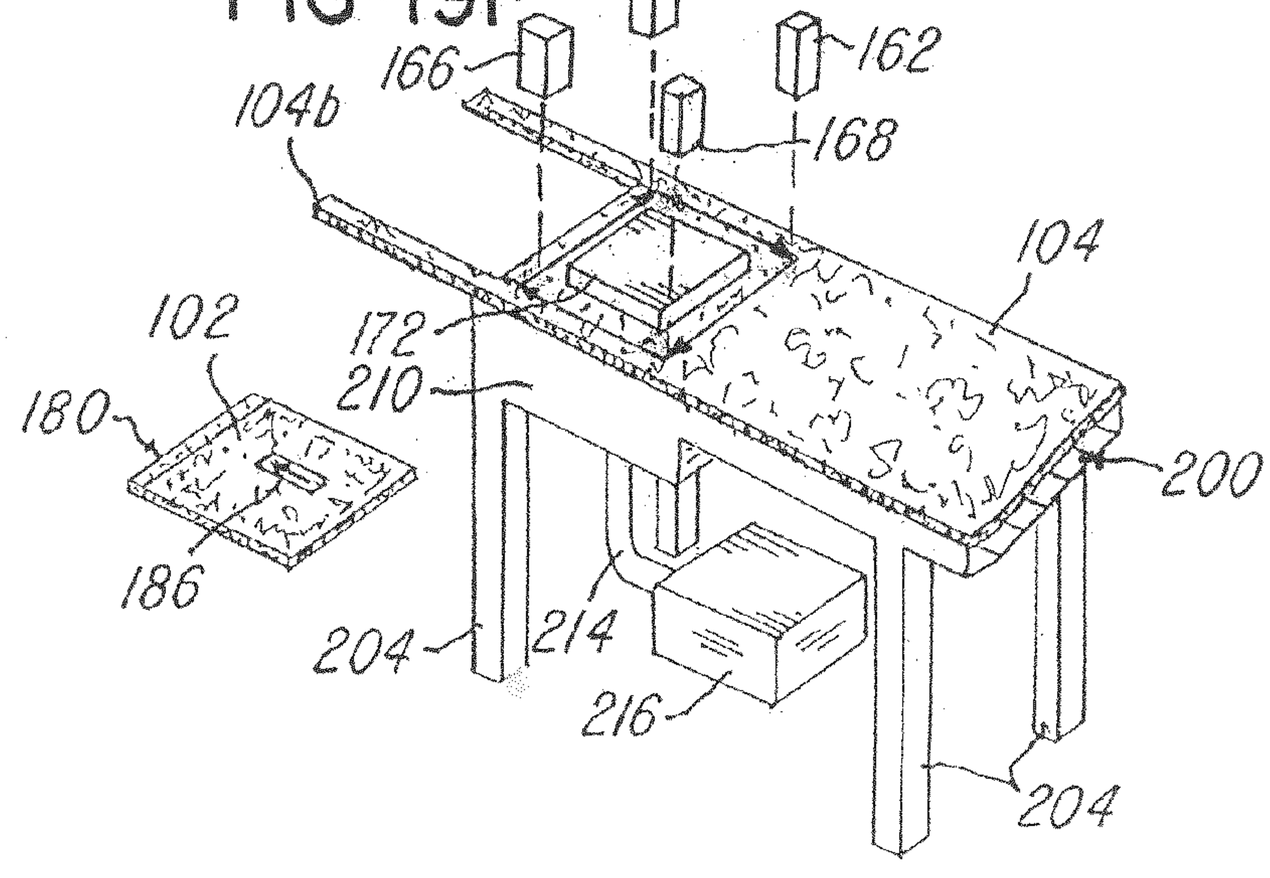


FIG-19G

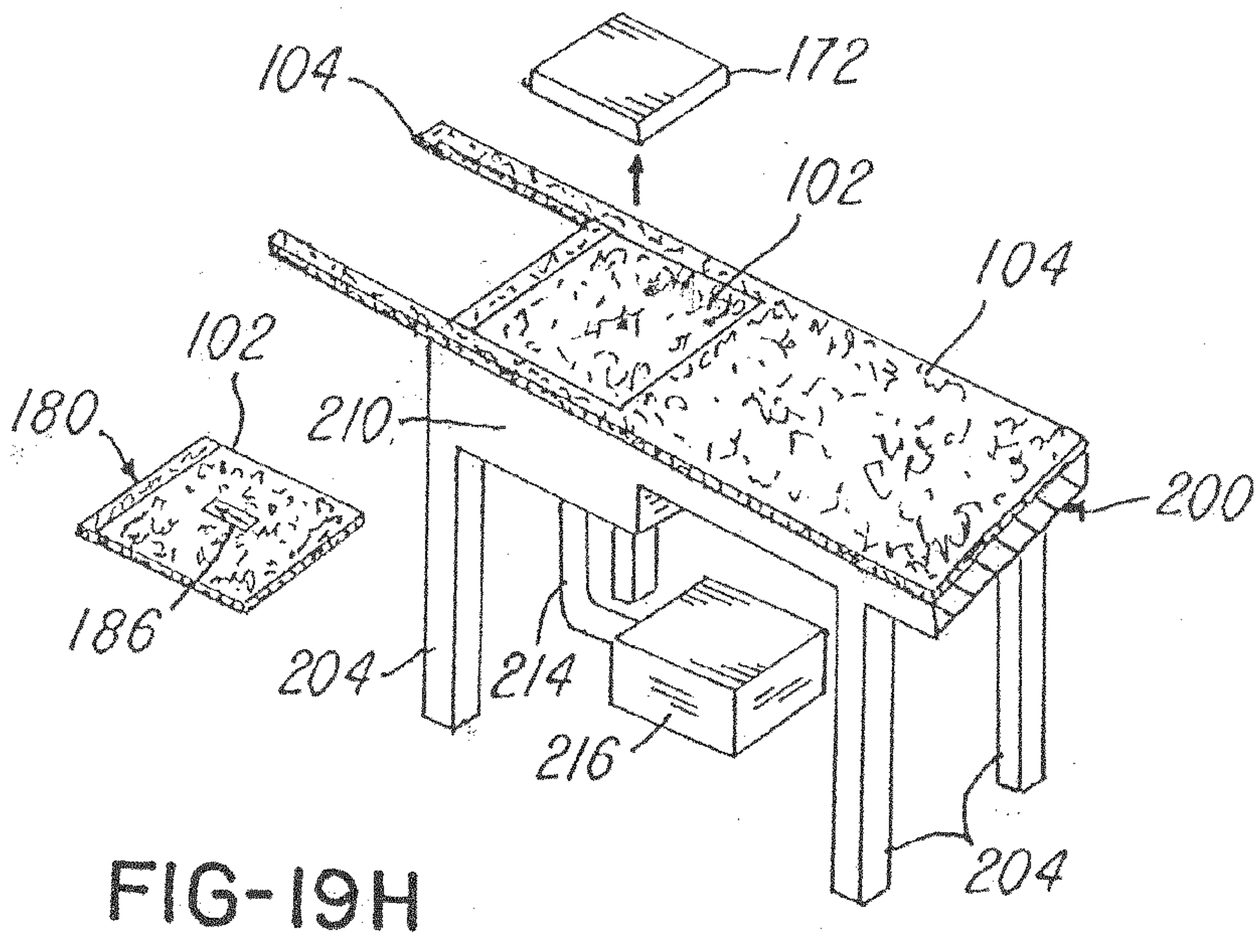


FIG-19H

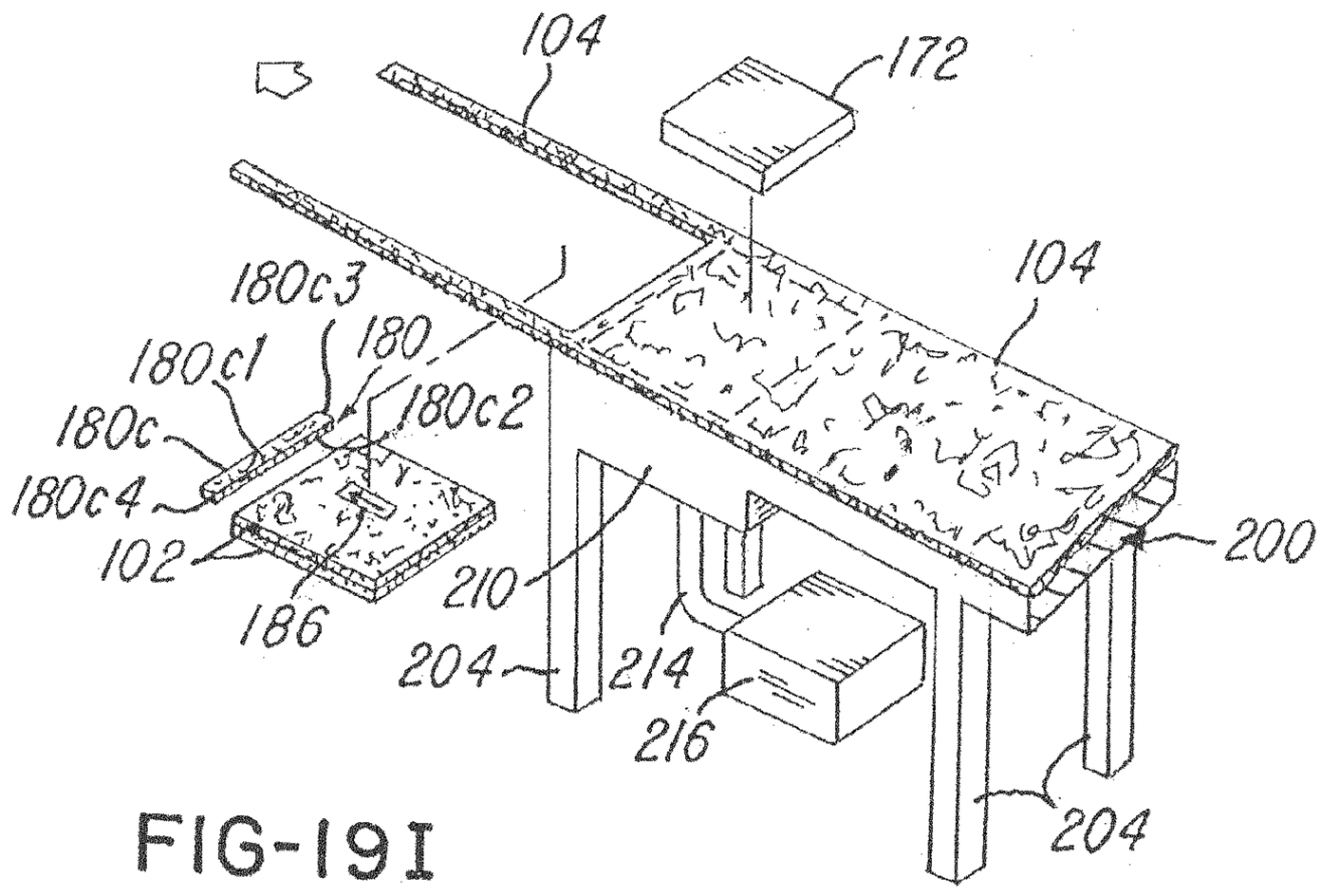
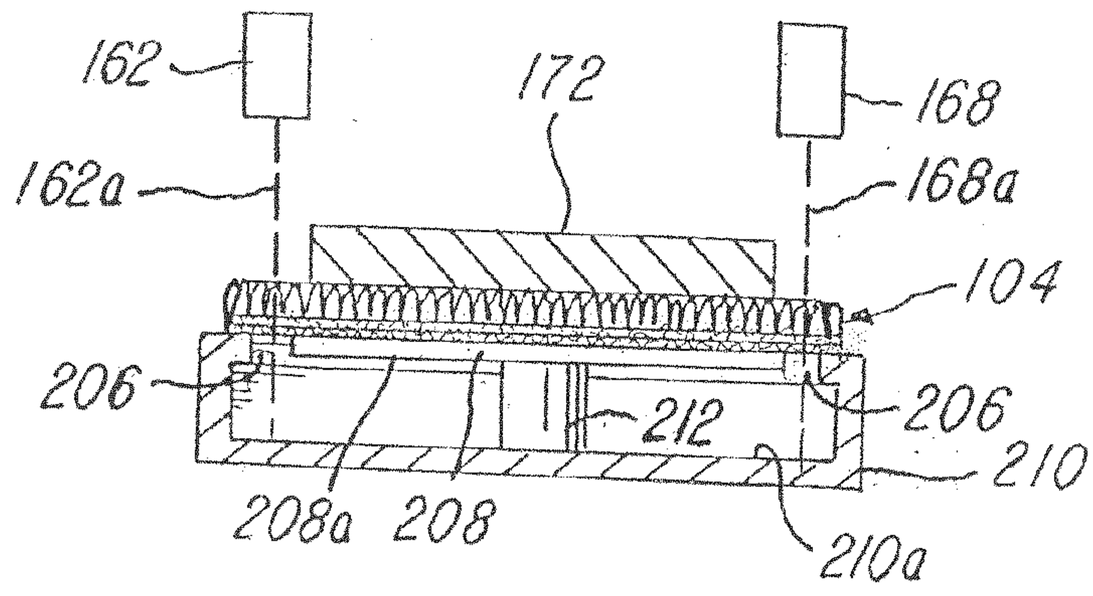


FIG-19I



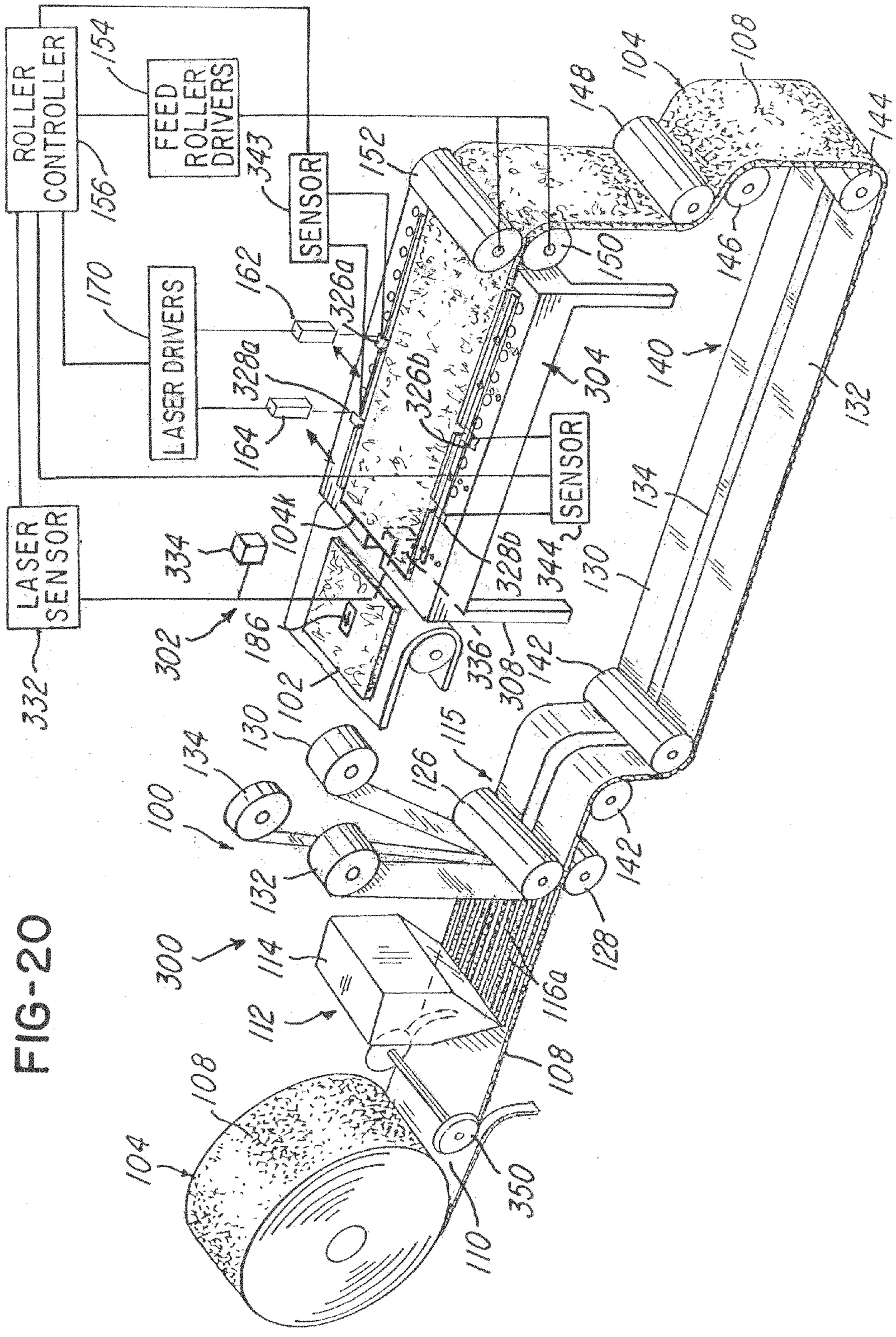
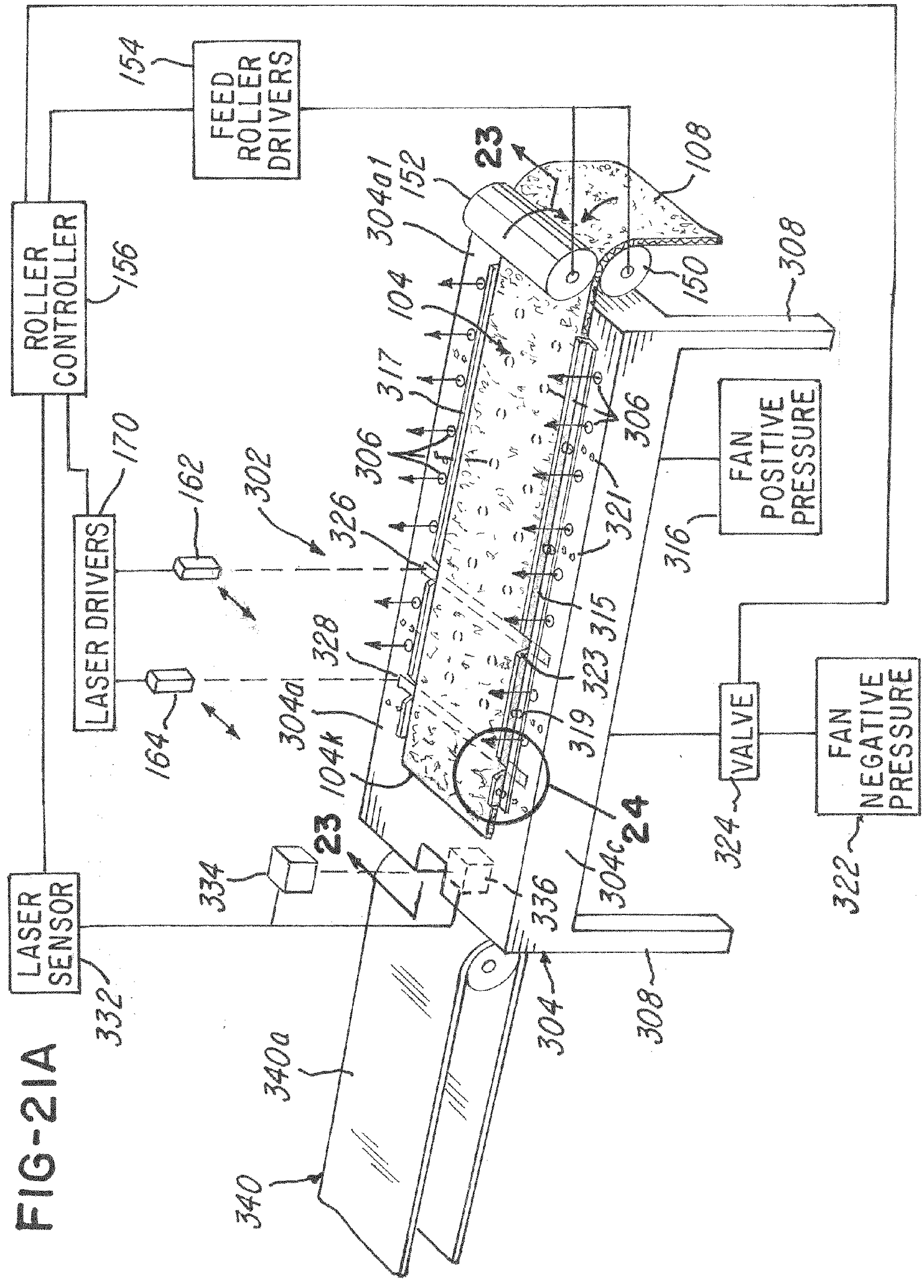

ROLLER CONTROLLER
154
FEED ROLLER DRIVERS
156
343
SENSOR
152
148
104
108
144
170
LASER DRIVERS
162
326a
328a
164
326b
150
146
140
304
SENSOR
134
LASER SENSOR
334
104k
328b
344
130
332
302
186
336'
308
142
102
100
134
130
115
126
132
300
114
112
116a
108
104
110
350
128

FIG-20


ROLLER CONTROLLER
156
FEED ROLLER DRIVERS
154
LASER DRIVERS
170
162
164
302
326
328
306
317
104
304a1
152
23
108
150
308
306
321
315
323
319
316
FAN POSITIVE PRESSURE
VALVE
324
FAN NEGATIVE PRESSURE
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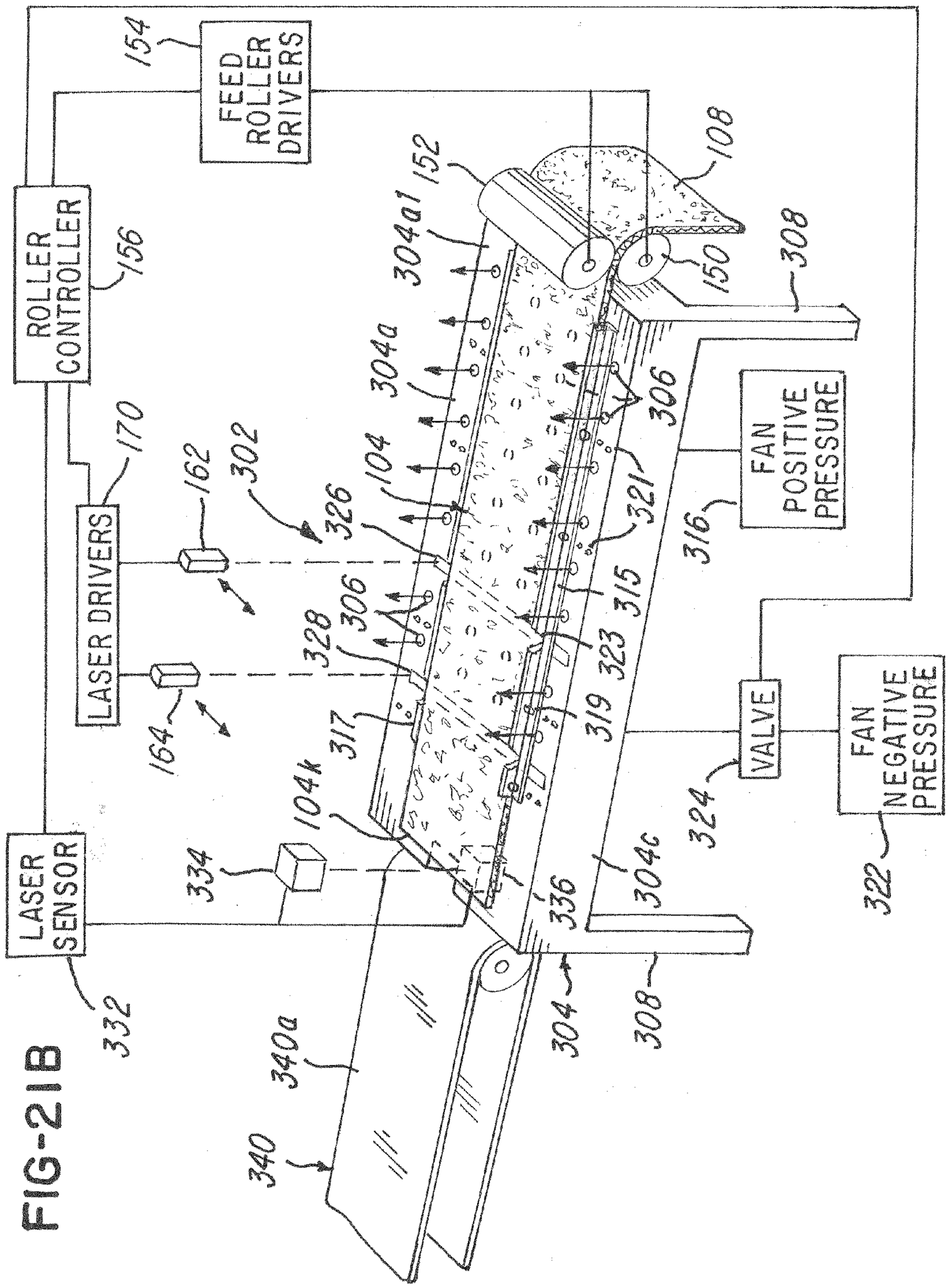
304a
104k
24
304c
336
334
23
LASER SENSOR
332
304
308
340a
340

FIG-21A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FEED ROLLER DRIVERS
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ROLLER CONTROLLER
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104
164
328
306
317
104k
334
LASER SENSOR
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304a1
304a
306
321
315
323
319
316
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VALVE
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FAN NEGATIVE PRESSURE
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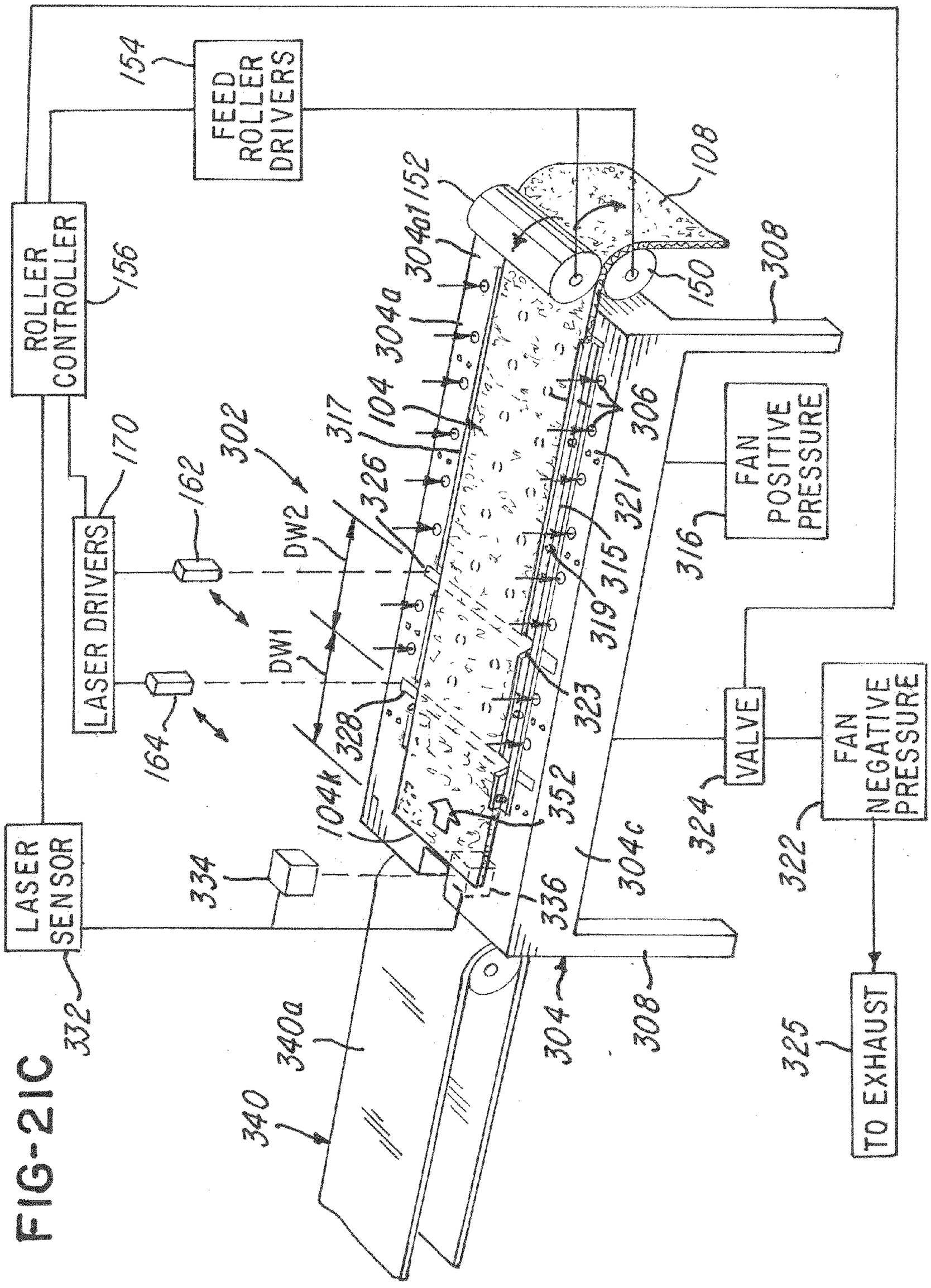
FIG-21B


154
FEED ROLLER DRIVERS
ROLLER CONTROLLER
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152
304a1
308
150
304a
104
317
326
306
321
319
315
316
FAN POSITIVE PRESSURE
170
LASER DRIVERS
162
302
DW2
DW1
164
328
104k
323
352
VALVE
324
FAN NEGATIVE PRESSURE
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334
LASER SENSOR
336
304c
332
340a
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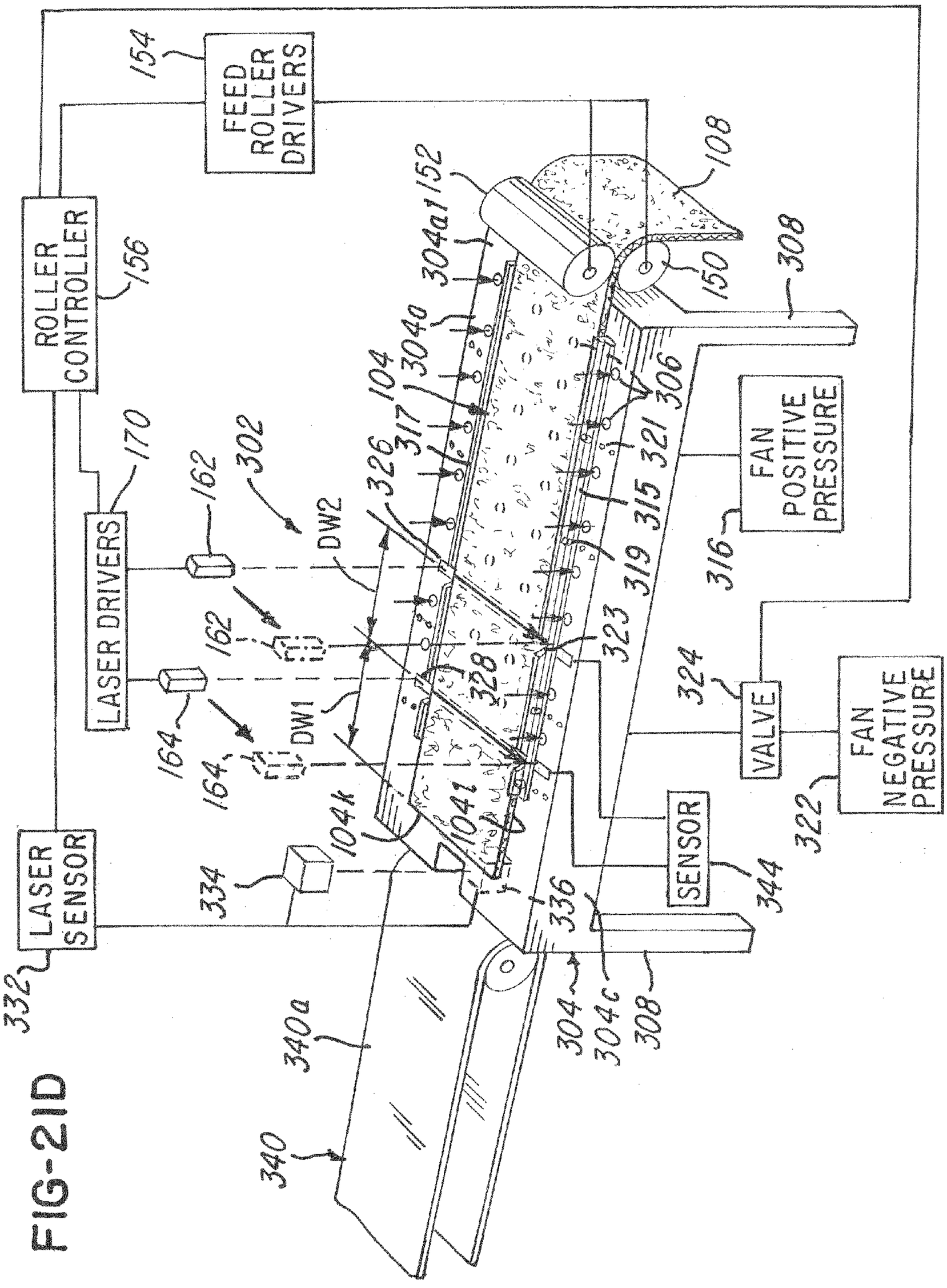
304
308
325
TO EXHAUST

FIG-21C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156
ROLLER CONTROLLER
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LASER DRIVERS
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302
DW2
164
DW1
104k
1041
334
LASER SENSOR
332
340a
340
108
152
304a
150
308
3040
104
326
317
306
321
315
319
323
328
324
VALVE
316
FAN POSITIVE PRESSURE
FAN NEGATIVE PRESSURE
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SENSOR
344
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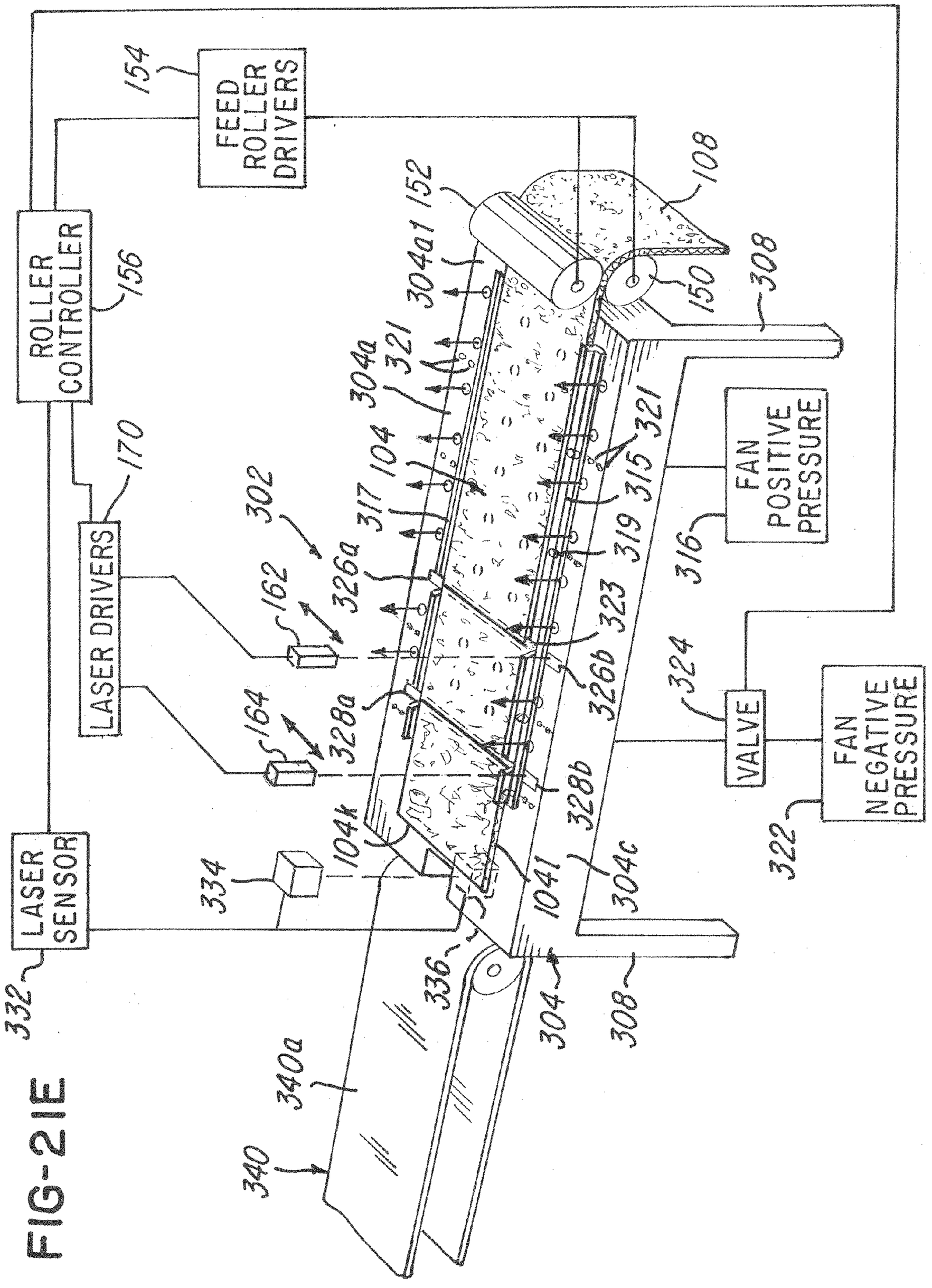
304
304c
308

FIG-21D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FEED ROLLER DRIVERS
ROLLER CONTROLLER
156
170
LASER DRIVERS
LASER SENSOR
332
334
302
162
164
304a1 152
108
150
308
321
104
317
315
319
3264
323
3268
3284
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316
FAN POSITIVE PRESSURE
VALVE
FAN NEGATIVE PRESSURE
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304c
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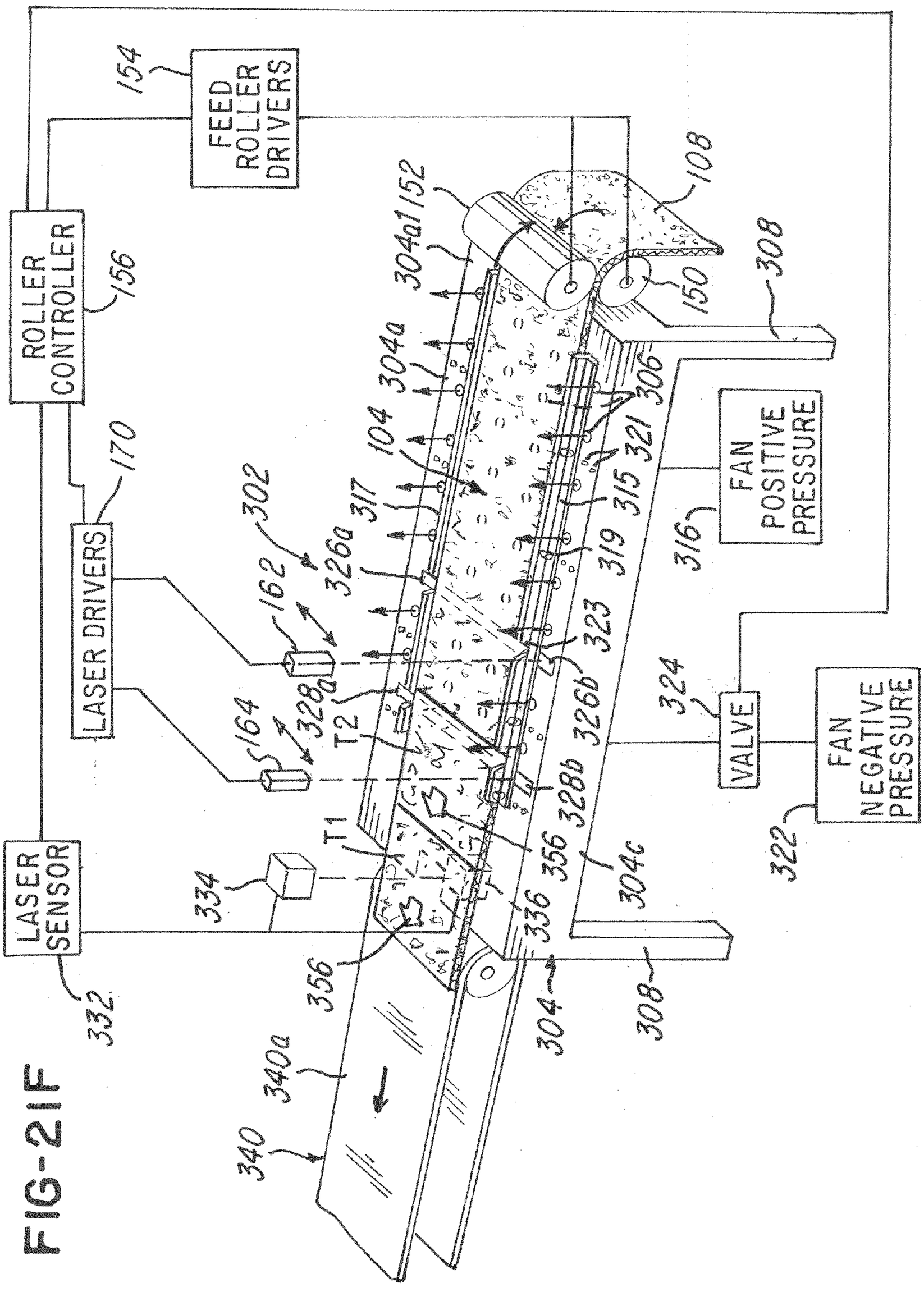
308
340a
340

FIG-21E


154
FEED ROLLER DRIVERS
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ROLLER CONTROLLER
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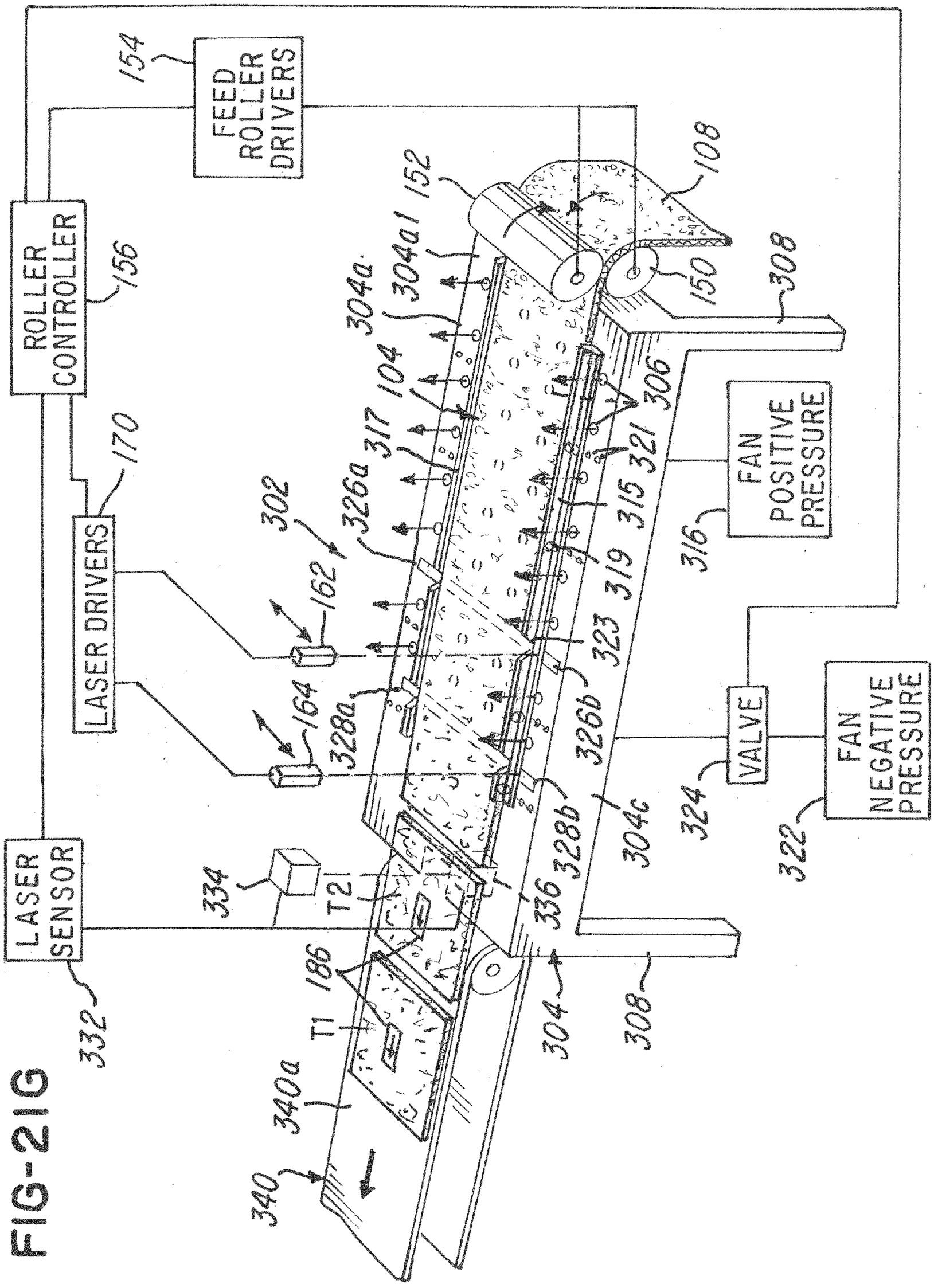
LASER DRIVERS
LASER SENSOR
332
334
302
162
164
328a
328b
T1
T2
356
336
340
340a
304a
304b
304c
152
108
150
308
104
317
315
321
306
319
323
326a
326b
316
FAN POSITIVE PRESSURE
324
VALVE
322
FAN NEGATIVE PRESSURE

FIG-21F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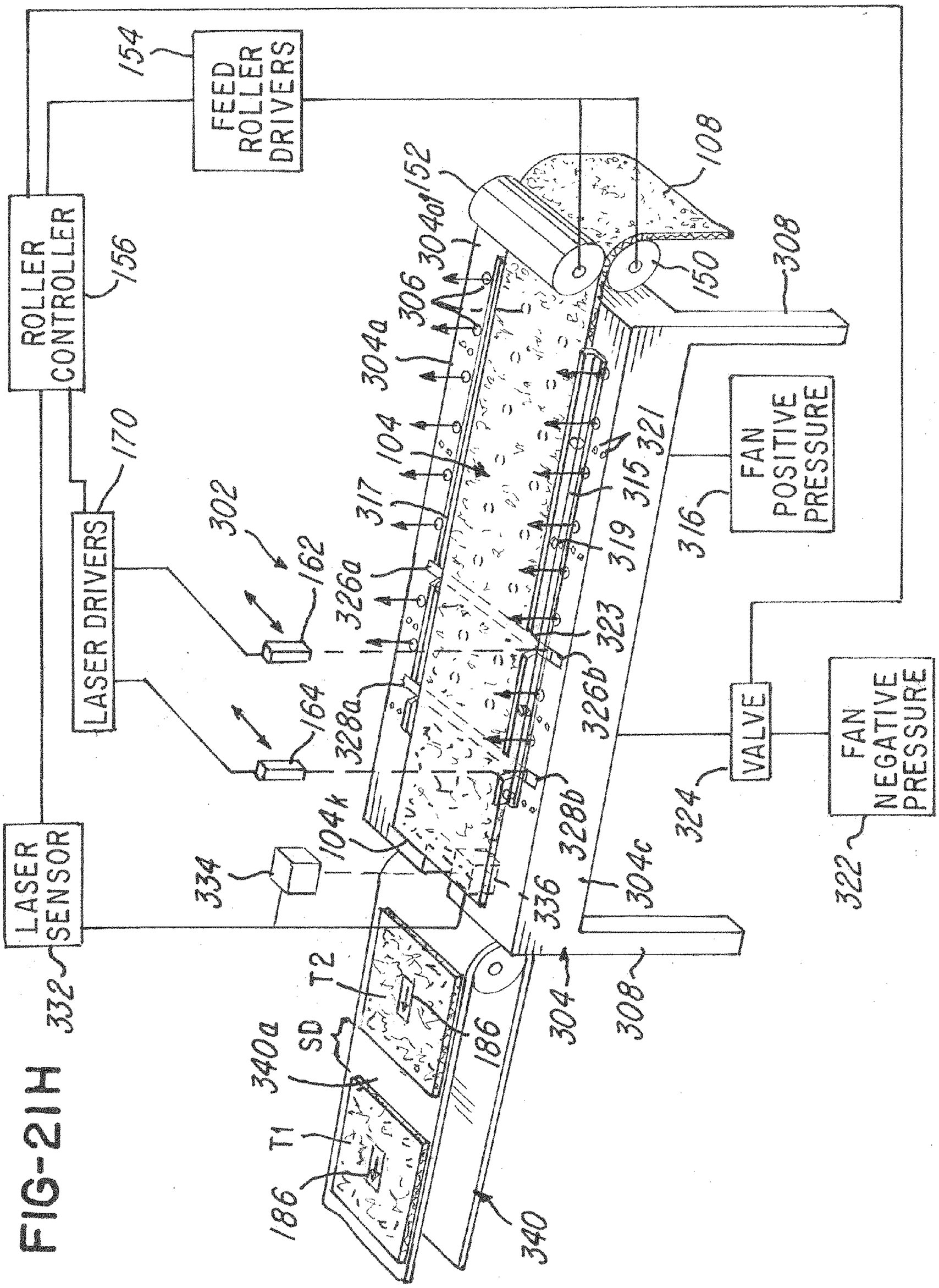
FEED ROLLER DRIVERS
152
108
ROLLER CONTROLLER
156
304a1
304a
104
317
306
302
326a
321
315
319
LASER DRIVERS
170
162
323
164
328a
326b
FAN POSITIVE PRESSURE
316
VALVE
324
FAN NEGATIVE PRESSURE
322
334
T21
328b
304c
336
LASER SENSOR
332
186
T1
304
308
340a
340

FIG-21G


154
FEED ROLLER DRIVERS
ROLLER CONTROLLER
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LASER DRIVERS
170
LASER SENSOR
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302
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164
152
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304d
304a
104
317
315
321
319
323
326a
326b
328a
328b
104k
334
336
304c
304
308
FAN POSITIVE PRESSURE
316
VALVE
324
FAN NEGATIVE PRESSURE
322
150
T2
SD
T1
340a
186
340

FIG-21H

FIG-22

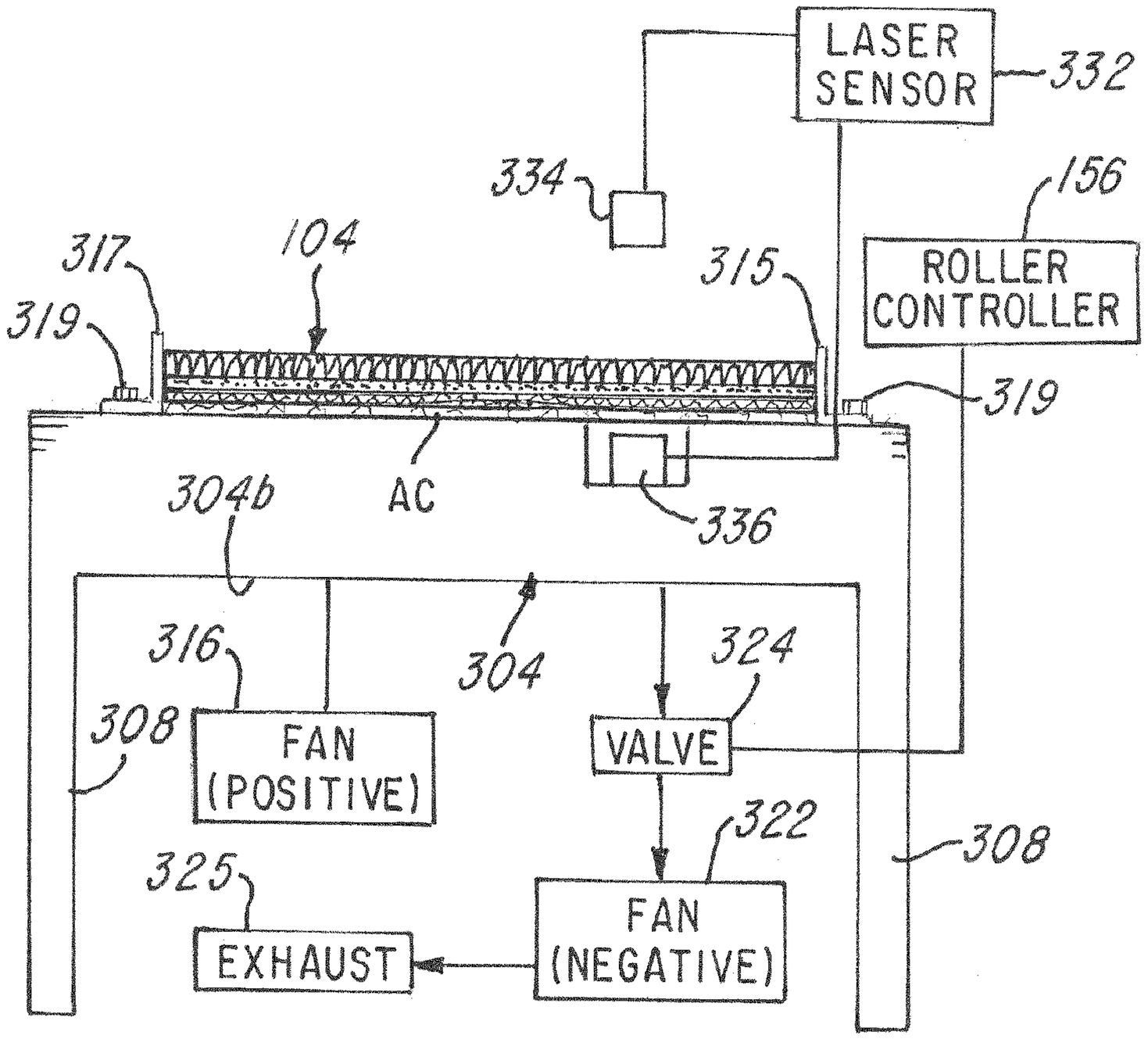
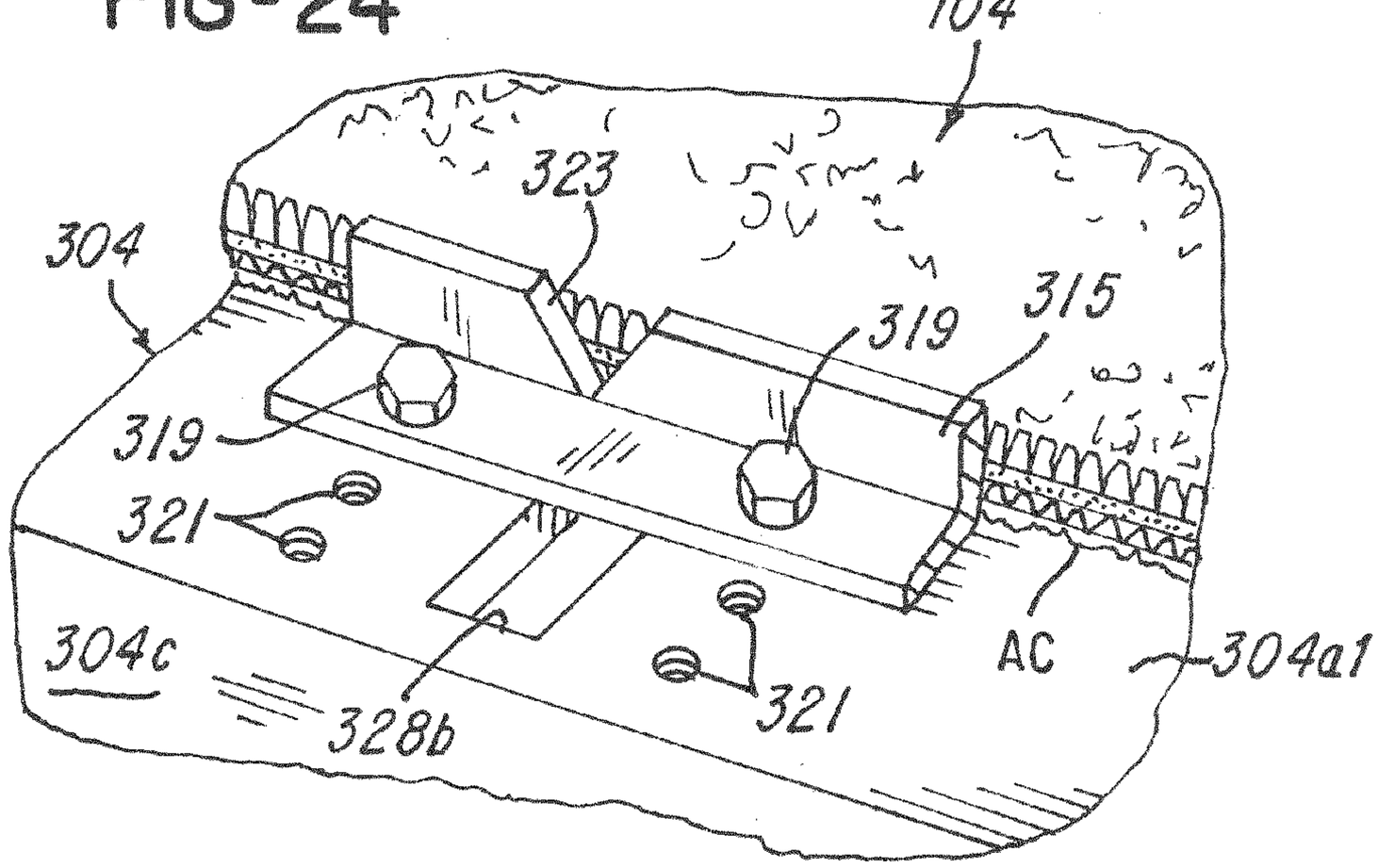

LASER SENSOR
332
334
156
ROLLER CONTROLLER
317
104
315
319
319
304b
AC
336
316
304
324
308
FAN (POSITIVE)
VALVE
322
308
325
EXHAUST
FAN (NEGATIVE)

FIG-24


104
323
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315
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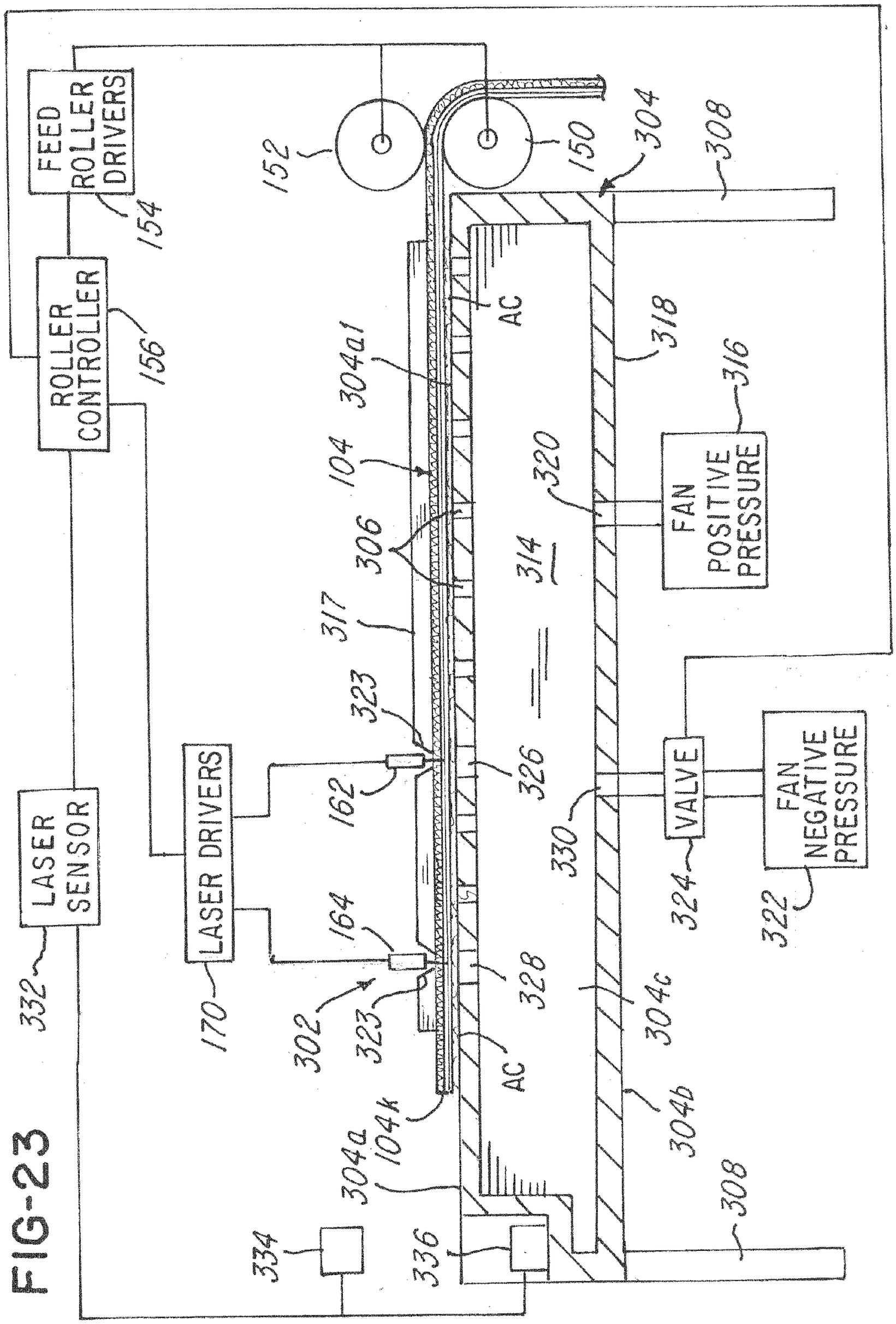
321
304c
328b
321
AC
304a1


FEED ROLLER DRIVERS
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ROLLER CONTROLLER
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LASER SENSOR
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LASER DRIVERS
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306
317
323
162
164
170
302
104k
304a
334
336
326
328
330
314
320
318
316
324
322
VALVE
FAN POSITIVE PRESSURE
FAN NEGATIVE PRESSURE
AC
304c
304b

FIG-23

SYSTEM AND METHOD FOR CUTTING A WEB TO PROVIDE A COVERING

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This patent application is related to provisional patent application Ser. No. 60/953,519 filed Aug. 2, 2007, to which Applicant claims the benefit of the earlier filing date. That application is incorporated herein by reference and made a part hereof.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates to surface coverings for exterior or interior use. In particular, this invention relates to fibrous coverings suitable for use on solid surfaces, particularly on concrete, such as garage floors, patios or walkways.

[0004] 2. Description of the Related Art

[0005] It is known to provide coverings, such as indoor/outdoor carpet, on walkways or patios to provide traction on potentially slippery surfaces and to cover unsightly surfaces. Due to the difficulty in affixing coverings to exterior surfaces that are irregular and exposed to the elements, most coverings are merely laid over the surface or tacked in place. However, this does not provide a secure covering and can slip or easily become displaced.

[0006] There has been an interest in designing garages that are more organized, attractive and comfortable in recent years. Typically, a garage floor is formed of concrete, which is difficult to keep clean, particularly dust free. Concrete is also a very hard and unforgiving surface to stand or work on. The problems with covering a garage floor involve providing a surface that can withstand typical uses, particularly vehicular traffic. Coverings merely laid over concrete cannot be driven on without bunching and slipping.

[0007] In the past, coverings were manufactured with a backing to which an adhesive or a double-sided adhesive tape was applied. Typically, the adhesive was applied to the entire backing, especially for very demanding traffic applications. The covering was then applied to a surface, such as a garage floor. It was extremely difficult to remove the covering from the surface, if, for example, the covering was damaged or otherwise needed to be removed.

[0008] Another problem with prior art coverings is that during installation, it was necessary to orient the coverings in a predetermined pattern or orientation. Some coverings had a release liner that covered the adhesive and the release liner had arrows or other indicia to assist the installer with installing the tile in the correct orientation. Unfortunately, even with such indicia, after the tiles are turned fabric side up the indicia cannot be seen and/or the orientation of the indicia gets lost relative to the tiles that are already situated on the surface that causes misplaced tiles or coverings. Unfortunately, because of the bond between the adhesive and the tiles, such tiles were difficult to remove and prolong the installation time.

[0009] Still another problem with prior art systems is that the covering was cut with contact cutters that did not provide for accurate cutting of the edges. Consequently, when such coverings were placed into a surface adjacent other coverings, they could not be properly fit and/or if fit would not look proper.

[0010] There is, therefore, a need for a system and method for making a covering product that is suitable for exterior or interior use, and particularly suitable for use in a garage that is subject to vehicular traffic and can withstand high loads and traction forces while remaining in place. There is also a need for providing a covering that is easy to install and maintain or repair if necessary.

SUMMARY OF THE INVENTION

[0011] Aspects of embodiments of the invention relate to a product that provides a durable covering for exterior and interior surfaces.

[0012] Another aspect of embodiments of the invention relates to a product that is easy to install and remains securely fastened to an underlying surface.

[0013] An additional aspect of embodiments of the invention relates to product that may be easily replaced and maintained.

[0014] This invention is directed to fibrous covering for outdoor or indoor use having an adhesive coating on the underside for adhesion to a surface, which can be a solid surface, such as a concrete patio, walkway, driveway or garage floor. It is contemplated that this covering can be applied to most solid surfaces, also including wood.

[0015] Aspects of the invention are directed to a covering to be installed on a surface, comprising a fibrous layer having a top fibrous surface, a bottom surface and a plurality of edges, an adhesive layer applied to the bottom surface of the fibrous layer, and a release sheet removably secured to the adhesive layer. The adhesive layer is formed in spaced bands, lines, strips or rows across the bottom surface. The release sheet includes at least one main sheet and a positioning sheet overlapping the main sheet for removal prior to the main sheet to expose only a portion of the adhesive layer. In one embodiment illustrated in FIGS. **1-7**, the main sheet includes an overhanging edge that is folded over the edge of the fibrous layer and onto the top fibrous surface.

[0016] The invention is further directed to the covering in the form of a tile with a plurality of tiles assembled directly adjacent to each other.

[0017] The folded edge can be secured with a tab to the fibrous layer. The tab can include indicia for installing the tile in a particular orientation.

[0018] Aspects of the invention are also directed to a method of installing a covering on a surface comprising providing a plurality of pieces of covering, each piece formed as a tile made of a fibrous layer having a top fibrous surface, a bottom surface and a plurality of edges. An adhesive layer is applied to the bottom surface of the fibrous layer, wherein the adhesive layer is formed in spaced bands, lines, strips or rows across the bottom surface. A release sheet is removably secured to the adhesive layer, wherein the release sheet includes at least one main sheet and a positioning sheet overlapping the main sheet, wherein the main sheet includes an overhanging edge carrying positioning indicia that is folded over the edge of the fibrous layer and onto the top fibrous surface. The method includes positioning one of the tiles at a determined location on the surface using the positioning indicia on the folded edge of the main sheet, removing the positioning sheet to expose only a portion of the adhesive layer and tacking the tile at the desired location, and removing the main sheet to adhere the tile in the determined location. In accordance with the method, another tile is positioned at a determined location directly adjacent to the first tile, the positioning sheet of the second tile is removed to expose only a portion of the adhesive layer and tacking the tile at the

desired location, and the main sheet is removed to adhere the tile in the determined location next to the first tile.

[0019] Other aspects of the invention are directed to a method of manufacturing a covering for installation on a surface comprising providing a strip of fibrous material having a top fibrous surface, a bottom surface and opposed edges, applying adhesive in an intermittent or spaced-apart pattern, spaced beads or strips on the bottom surface of the strip, applying a release sheet over the adhesive on the bottom surface of the strip, and separating the strip with the adhesive and release sheet thereon by a non-mechanical mechanism into individual pieces.

[0020] In one aspect, this invention comprises a system of manufacturing a covering for installation on a surface, the system comprising at least one web handler for driving a web of fibers to a cutting station, an air table adapted to provide air pressure to facilitate movement and positioning the web at the cutting station, and a cutter located at the cutting station for cutting the web of fibers into the covering having a predetermined shape.

[0021] In still another aspect, this invention comprises method for cutting a covering or tile comprising the steps of positioning a web of fabric at a cutting station using an air table having a working surface and a plurality of apertures for providing a cushion of air, and cutting the web of fabric with a cutter to provide the covering or tile having a predetermined shape.

[0022] Separating the strip into pieces can include cutting the strip with a laser.

[0023] The method can further comprise the step of providing a roll of fibrous material and slitting the roll into the strip.

[0024] Applying the adhesive in an intermittent pattern can include applying rows of beads or strips of adhesive. The adhesive beads or strips can be pressed into the bottom surface to form the beads or strips into bands, lines, strips or rows. Applying the release sheet can include pressing the release sheet onto the bottom surface and thereby pressing the beads or strips of adhesive into the bottom surface and forming the beads or strips into bands, lines, strips or rows.

[0025] A further object of the invention is to provide a system and method that accurately cuts coverings or tiles by providing a non-contact cutter that will accurately cut edges within tighter tolerances than what could be achieved with contact cutters.

[0026] Another object is to provide a system and method for providing indicia that facilitates installing the covering or tile.

[0027] Still another object is to provide a system and method for applying an adhesive directly to fabric, without any backing or liner.

[0028] Yet another object is to provide a system, method and tile that achieves one or more of the objects or advantages described herein.

[0029] These and other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0030] The invention will now be described in conjunction with the accompanying drawings in which:

[0031] FIG. **1** is a top view of a plurality of carpet pieces in accordance with the invention installed on a surface;

[0032] FIG. **2** is a bottom view of one of the carpet pieces of FIG. **1** before installation;

[0033] FIG. **3** is a top view of the carpet piece of FIG. **2**;

[0034] FIG. **4** is an enlarged side view in cross section of a carpet piece installed on a surface;

[0035] FIG. **5** is a bottom view of a carpet piece during manufacture;

[0036] FIG. **6** is a bottom view of a carpet piece during manufacture at a later stage than seen in FIG. **5**;

[0037] FIG. **7** is a schematic view of a manufacturing process for making the carpet pieces in accordance with the invention;

[0038] FIG. **8**A is an isometric view of a system and method for making a covering or tile in accordance with one embodiment;

[0039] FIG. **8**B is an enlarged sectional view taken along line **8**B-**8**B of FIG. **8**A;

[0040] FIG. **8**C is an enlarged sectional view similar to **8**B, taken along the line **8**C-**8**C of **8**A, showing various details of a web after an adhesive and liner has been applied;

[0041] FIG. **9** is a fragmentary elevation view of an adhesive application and roller;

[0042] FIGS. **10**, **11** and **12** are enlarged fragmentary elevation views showing diverging cuts and joining of adjacent coverings or tiles;

[0043] FIGS. **13** and **14** are isometric views showing a system and means for attaching the tile to a surface;

[0044] FIG. **15**A is a fragmentary perspective view illustrating at least one removable label having an indicia for indicating a nap or pattern in the covering or tile;

[0045] FIGS. **15**B-**18** are isometric views of alternative arrangements of coverings or tiles in accordance with various embodiments of the invention;

[0046] FIGS. **19**A-**19**H are various illustrations showing an operation of the process and system in accordance with another embodiment of the invention;

[0047] FIG. **19**I is a cross-sectional view, taken along the line **19**I-**19**I in FIG. **19**C showing various details of a cutting table and cutting aperture;

[0048] FIG. **20** is a perspective view of another embodiment of the invention;

[0049] FIGS. **21**A-**21**H are various views illustrating the method and system for cutting in accordance with the embodiment illustrated in FIG. **20**;

[0050] FIG. **22** is a view of an end of an air table used in the embodiment illustrated in FIG. **20** illustrating the sensors and air cushion on which the web moves over a surface of the air table;

[0051] FIG. **23** is a sectional view taken along the line **23**-**23** in FIG. **21**A; and

[0052] FIG. **24** is a fragmentary enlarged view of the area **24** in FIG. **21**A illustrating an adjustable guide and notched out portion for permitting a laser to move past the guides.

[0053] In the drawings, like reference numerals indicate corresponding parts in the different figures.

DETAILED DESCRIPTION OF THE DRAWINGS

[0054] This invention is directed to a surface covering in the form of tiles, particularly suited for covering a solid exterior surface, such as a garage floor, an exterior environment, an environment subject to exposure to the elements, or an environment subject to heavy traffic and high loads. The invention is particularly suited for covering large expanses of exterior solid surfaces or surfaces subject to the elements or harsh

conditions. The invention can also be used for covering other types of surfaces including, for example basement floors, factory floors, walkways or patios.

[0055] The tiles in accordance with the invention are particularly suited for connection to surfaces formed of concrete. Such surfaces can range from smooth to finished depending on the finish technique and wear. The invention may also be used on other exterior surfaces including concrete, synthetic composites, wooden boards, and plastic or plastic composite boards.

[0056] Referring to FIG. **1**, the covering in this form of the invention includes a plurality of carpet pieces or tiles **10** that are applied to a surface S to form a solid covering. Each carpet piece **10** is formed as a tile that can be affixed to an underlying surface. The tile may be any size or shape. In one preferred configuration, the tiles are square for easy installation and measure about 12 inches by 12 inches, 18 inches by 18 inches, 24 inches by 24 inches, 36 inches by 36 inches, or 48 inches by 48 inches.

[0057] Carpet piece **10** has a top layer or surface **12** preferably made of a fibrous material, such as carpet material, which provides a surface with good traction and appearance. The fibrous material can be manufactured in various forms, with one particularly desirable form forming a ribbed surface. A desirable weight of fibers would fall within the range 18-60 ounces per square yard. One useful weight for exterior high traffic areas is 28 ounces per square yard. A good range for durability is 22-40 ounces per square yard. It is preferred that the weight and form of the carpet surface **12** be resistant to compression and denting to avoid damage from parked vehicles, for example.

[0058] Preferably, the carpet material could be formed from any suitable material that can receive an adhesive and that can be cut subsequently with a non-contact cutter as described herein. Such material could be wool, nylon, polymer or other materials suitable for accommodating a traffic surface, such as a walking or rolling traffic surface and may be dispersed or combined with polypropylene carpet fibers. The dispersal of these fibers results in a firmer, more stable structure. Due to the improved structure, it is not necessary to use a backing, such as latex as is commonly used, but such backing could be used with the invention described herein. One problem with latex backings in a wet environment is that the foaming agent used during manufacturing becomes reactivated when wet, which causes the material to become slippery. If desired, UV treated fibers may be included in the mix to provide protection to the carpet piece **10** in installations exposed to sunlight. Of course, other materials may be used depending on the particular application, including for example polyester or other blends.

[0059] The underside of the top layer **12** forms a bottom layer or surface **14**, which has adhesive applied directly thereto with no intermediate foam layer, as is common with interior use carpeting. Directly coating the adhesive onto the bottom surface **14** of the fibrous material forms an integral structure that adds to the durability. If it is desired to add an intermediate layer, to form a liquid barrier for example, an incompressible layer can be disposed over the bottom surface **14** of the fibrous layer.

[0060] The adhesive is applied to form narrow adhesive bands, lines, strips or rows **16**, as seen in FIGS. **4** and **6**. The process for forming the band **16** is described below. The adhesive bands, lines, strips or rows **16** are spaced across the entire width of the carpet piece **10** with free areas of the bottom surface **14** between each band **16**. The adhesive bands, lines, strips or rows **16** allow the carpet piece **10** to be removed from the surface S when desired while still maintaining a secure connection to the surface. Preferably less than half, and most preferably about 25-30%, of the surface area of the bottom surface **14** is coated with the adhesive bands, lines, strips or rows **16**. As seen in FIG. **4**, the spaced bands, lines, strips or rows **16** form a discontinuous connection between the carpet piece **10** and the surface S, which allows the bond to be broken more easily when pulled free from the surface for repair or replacement.

[0061] The adhesive band **16** is preferably made of a removable adhesive (PSA) that is a hot melt, meaning it is applied at 100% solids. Suitable adhesive compositions are available from many different manufacturers and can be used as a hot melt adhesive. It may be desirable to use an adhesive band **16** that is water insoluble to resist deterioration due to the elements.

[0062] The viscosity of the adhesive band **16** may also be varied to affect penetration or wetting into the back surface of the fibrous layer. Lowering the viscosity, increases the wetability (tack) of the adhesive, thereby allowing it to penetrate deeper into the bottom surface **14**. As would be appreciated by those of ordinary skill with adhesives, the viscosity of the adhesive will affect the coating weight.

[0063] The bottom surface **14** with the adhesive bands, lines, strips or rows **16** is covered by a release sheet **20** that is removable upon installation. Referring to FIG. **2**, the release sheet **20** is preferably formed as plural sheets, including, for example, two main sheets **22** and a positioning sheet or strip **24**. The main sheets **22** are installed on the bottom surface **14** with a gap between, shown by the dashed lines in FIG. **2**. The positioning sheet **24** is installed over the gap to overlap the main sheets **22**. During installation, the positioning sheet **24** can be removed first to expose adhesive in the gap between the main sheets **22** to locate and tack the tile **10** in place prior to final placement. Of course, the sheets **22** and **24** can be any relative sizes or even a single sheet that tears apart.

[0064] Preferably, the main sheets **22** each have an edge **26** that extends outwardly from opposed sides of the tile **10**. The edges **26** function as a gripping flange during installation for easy removal of the release sheet when the tile **10** is in the proper position. The edges **26** are folded over onto the fibrous surface **12**, as seen in FIG. **3** for convenient packaging and easy access. The edges **26** can be secured by a tab **28** that also carries indicia **30** regarding the nap and/or instructions for installation. For example, the indicia **30** can indicate the direction of the pile so that the tiles **10** can be placed in an alternating configuration or an aligned configuration. Samples of both patterns are shown in FIG. **1**. If desired, other portions of the release sheet can carry instructions or indicia, especially the positioning strip **24**.

[0065] The release sheet **20** is removed during installation and discarded. The release sheet **20**, which is also called a release liner, can be formed of any releasable sheet material that is easily pulled from the bottom surface **14**. A suitable material is silicone coated polyester film or silicon coated paper. A preferred material is a silicone coated polyester sheet about ½-2 mils (0.0005 inch to 0.002 inch) thick. The important features of the release sheet **20** are that it releases reliably from the adhesive surface and avoids tearing so that it is easy for an installer to use, and it has the thermal stability to tolerate temperatures in the 300 degree Fahrenheit range.

[0066] The carpet pieces **10** can be installed on a surface S using the following procedure. First, the center of the surface S is located and marked with alignment marks such as two perpendicular lines or simply a straight edge. Then, the first tile is placed at the center mark. The positioning strip **24** is removed, and the carpet piece **10** is tacked in the desired position. The indicia **30** on the tabs **28** is used to properly orient the carpet piece **10**. When the position is finally determined, the tabs **28** are released, and the main sheets **22** are removed by lifting each side of the carpet piece **10** leaving the center portion tacked in place. Each subsequent carpet piece **10** is installed in the same manner using the adhered carpet piece or carpet pieces **10** as a guide. The indicia **30** can be used to form a pattern as desired. It is also possible to form or print a pattern or design in or on the top surface **12** of the fibrous material, which can be repeated or pieced together during installation.

[0067] Due to the intermittent application of adhesive band **16**, the connection between the carpet piece **10** and the surface S can be broken by applying an upward force to the carpet piece **10**. By this, carpet pieces **10** may be selectively replaced. This provides for a longer life to the overall covering since damaged or worn pieces **10** may be replaced when necessary while leaving the remainder of the covering in tact. On the other hand, since the adhesive band **16** spans the entire width of the bottom surface **14**, the carpet piece **10** is securely bonded to the surface S and resists shifting or bunching when a load is applied. For example, it is possible to drive a vehicle over the covering with no adverse affects.

[0068] Referring to FIG. **7**, a technique for manufacturing the carpet pieces **10** is explained. The fibrous material is typically provided in a mill roll **40**. The mill roll **40** is slit into strips **42**, using a slitter or other conventional slitting mechanism, having the desired width for each carpet piece **10**. A strip **42** is then fed with the bottom surface **14** facing up to an adhesive applying station **44** where in this illustration beads, rows or strips **46** of adhesive are deposited in a pattern of rows or lines across the width of the bottom surface **14**. As illustrated relative to the embodiment shown in FIGS. **8**A-**15**B, the preferred embodiment applies the adhesive in strips, lines or rows of adhesive, not beads, that become flattened and pressed into the web as described later herein. This is shown in FIG. **6**.

[0069] The application techniques can vary depending on the particular adhesive composition, but one effective method is for the adhesive to be extruded and, if desired, treated with pressure and/or vacuum to enhance physical penetration of the fibrous bottom layer **14**. Other suitable methods known to those of ordinary skill in the art are also possible, such as spraying, extrusion, or other methods of coating. It is preferred that hydrophobic adhesive be used to prevent water contaminating the bond between the adhesive and underlying surface.

[0070] At the next station **48**, the release sheet **20** is applied to the bottom surface **14** to cover the adhesive beads or strips **46**. The release sheet **20** is pressed onto the bottom surface **14**, thereby flattening the beads or strips **46** and forming the bands, lines, strips or rows **16** of adhesive. This is shown in FIG. **6**. This operation presses the adhesive into the bottom surface **14**, which creates a stronger connection with the fibrous material, and causes the beads or strips to blend into bands, lines, strips or rows **16**, which provides more secure adhesion to surface S during installation.

[0071] Application of the release sheet **20** is shown in a simplified form for purposes of explanation, but would include several nip rolls for applying each main sheet **22** and the overlapping positioning sheet **24**. The release sheet **20** is pressed onto the bottom surface **14** with the edges **26** overhanging the edges of the strip **42**. It is also possible to use multiple stations to press the adhesive beads or strips **46** into the surface and then apply the release sheet **20**.

[0072] The strip **42** now carrying the adhesive bands, lines, strips or rows **16** and the release sheet **20** is fed to a separating station **50** where the strip **42** is separated into individual pieces **10**. Due to the adhesive band **16** and the release sheet **20** formed into a composite strip, it is not possible to use a mechanical cutting mechanism to effectively and precisely separate the carpet pieces **10**. In accordance with this invention, a transverse cut is made through the entire composite strip **42** by using non-mechanical means, such as a laser. It would also be possible to use other non-mechanical means, such as a water jet. The laser, in this case, provides an accurate and neat transverse cut to separate the strip **42** into carpet pieces **10**.

[0073] In the embodiment illustrated in FIGS. **1**-**7**, the overhanging edges **26** are then folded over the top surface **12** and attached with the tabs **28**. It is also possible to merely crease the edges **26** so that they remain overlapped onto the top surface **12** without use of tabs **28** or even to leave them extending outwardly from the edges.

[0074] When packaged, it is preferred that the carpet pieces **10** are also alternated so that the sides of the tiles **10** that do not have the release sheet overlapping edge **26** are not aligned within a stack. As these sides have exposed adhesive edges it is desirable to space them apart with the release sheet edges **26** to avoid inadvertent sticking between stacked tiles **10**.

[0075] Referring now to FIGS. **8**A-**19**I, another embodiment of the invention is shown. This embodiment is also directed to a surface covering or overlay in the form of tiles, particularly suited for covering a solid surface, such as a floor, garage floor, patio, an exterior or interior environment, an environment subject to exposure to elements or an environment subject to heavy traffic and high loads, such as airports, retail stores and the like. This embodiment is particularly suited for covering large expanses of exterior or interior solid surfaces or surfaces subject to the elements, or harsh conditions. The invention can also be used for covering other types of surfaces including, but not limited to, basement floors, factory or retail floors, common areas, public areas, walkways or patios as mentioned earlier.

[0076] The tiles in accordance with this embodiment are particularly suited for connection to surfaces formed of concrete. Such surfaces must be smooth or finished. The embodiment may also be used on other exterior surfaces including concrete, synthetic composites, wood boards and plastic or plastic composite boards or any other suitable flat surface.

[0077] A key feature of this embodiment is that the coverings or tiles are manufactured in accordance with a system and method that provides an adhesive that is pressed directly into the surface of the fibers or the backing. In the embodiment being described herein, it should be understood that the fibrous layer is not supported with a backing or coating, but rather has an adhesive, described below, applied directly to the fibers and pressed therein relating to needle-punched products. It should be understood that the adhesive described herein is selected to provide a desired amount of bond between the covering and the surface area to be covered so

that if it is desired to remove the covering from the surface it can be done by hand or with a simple tool, such as a pair of pliers. If desired, UV treated fibers may be included in the mix of fibers to make the covering or tile to provide protection to the covering or tile in installations exposed to sunlight. Of course, other materials may be used depending on the particular application, including for example polyester or other blends.

[0078] Referring now to FIG. **8**A, a system **100** is provided for making a plurality of coverings or tiles **102**, which in the illustration being described have a predetermined shape, such as square or substantially square, although it should be understood that the covering or tile **102** may be any size or shape. In one illustrative configuration, the covering or tile shape is square for easy installation and measure 18 inches by 18 inches, 12 inches by 12 inches, 24 inches by 24 inches, 48 inches by 48 inches, or 96 inches by 96 inches, but could be bigger or smaller if desired.

[0079] As with the embodiment described earlier herein, the carpet material that makes up the web **104** is formed from any suitable material that can receive an adhesive and that can be cut with a non-contact cutter as described herein. Such material could be wool, nylon, polyester, polypropylene or other materials suitable for accommodating a traffic surface, such as a walking or rolling traffic surface. The dispersion of these fibers results in a firmer, more stable structure. As mentioned earlier, it is not necessary to use a backing, such as latex as is commonly used in the past, but one could be used if desired. Of course, other materials may be used depending upon the particular application, including, for example, polyester or other blends.

[0080] Referring back to FIG. **8**A, notice that the web **104** comprises the first or top surface **108** and a second or bottom surface **110**. The system **100** comprises an application station **112** (FIGS. **8**A and **9**) comprising an adhesive applicator **114** that applies an adhesive **116** directly to the bottom surface **110** in strips, bands, rows or lines **116***a*. The invention may be used with an unbacked web **104** or with a web (not shown) that has an intermediate layer, backing or the like. In the embodiment being described, the web **104** is supported during non-contact cutting of the covering or tile **102**, so no backing or support material on the web **104** is necessary to perform the cutting. As mentioned later herein, the system and method permit non-contact cutting of the web **104** after the adhesive **116** is applied, which cannot be done as efficiently or accurately with traditional contact cutters, such as cutters that used a knife, blade, die or jig.

[0081] As illustrated in FIG. **9**, note that the adhesive applicator **114** applies adhesive **116** in strips, bands, rows or lines **116***a* directly to the bottom surface **110** of the web **104**, which causes the adhesive **116** to form an integral structure with the fibrous material of the web **104** that adds to durability. The adhesive applicator **114** applies the adhesive **116** in strips, bands, rows or lines **116***a* that get pressed and "flattened" into flattened strips, lines, rows or bands **116***a*. It should also be understood that the bond between the fibrous material and the adhesive **116** is greater than the bond between the adhesive **116** and a surface **120** (FIG. **14**) on which the covering or tile **102** is adhered or mounted, so that when the covering or tile **102** is pulled from the surface **120** in FIGS. **14** and **15**B the bond between the adhesive **116** and the surface **120** will give way prior to the bond between the fibrous material and the adhesive **116**. This facilitates removing the covering or tiles **102** after installation in a manner that causes a majority of the adhesive to be removed when the covering or tile **102** is removed from the surface **120**.

[0082] If it is desired to add an intermediate layer (for example, to form a liquid barrier), an incompressible layer can be disposed over the bottom surface **110** of the fibrous layer or web **104**.

[0083] Referring back to FIG. **8**A, notice that the adhesive **116** is applied to the bottom surface **110** at the application station **112** in strips, lines, rows or bands that get pressed into flattened bands, lines, strips or rows **116***a* as they exit a pressing station **115** as shown. As with the embodiment described earlier, the adhesive bands, lines, strips or rows **116***a* are spaced across the width of the covering or tile **102** and across the bottom surface **110** of the web **104**, with open or free areas **122** (FIG. **14**) between the adhesive bands, lines, strips or rows **116***a*. The adhesive is not applied completely to the edge so that during cutting, the non-contact cutters do not have to cut through the adhesive. It should be understood that after the covering or tile **102** is situated on the surface **120**, the areas between the adhesive bands, lines, strips or rows **116***a* and the surface **120** and area **122** defines a channel **124** which may facilitate directing fluid flow if desired.

[0084] As mentioned earlier, the adhesive bands, lines, strips or rows **116***a* allow the covering or tile **102** to be removed from the surface **120** when desired while maintaining a secure connection to the surface **120**. Preferably, less than half and most preferably about 25-30% of the surface area of the bottom surface **110** is coated with the adhesive bands, lines, strips or rows **116***a*. Any amount of adhesive could be used to meet the demands of different applications. As with the embodiment described earlier, the spaced adhesive bands, lines, strips or rows **116***a* form a discontinuous connection between the covering or tile **102** and the surface **120**, which, again, allows the bond to break more easily when the covering or tile is pulled from the surface for repair or replacement.

[0085] As with the embodiment described earlier, the adhesive **116** is preferably made of a removable pressure sensitive adhesive (PSA) that is a hot melt, meaning it is applied at 100% solids. Suitable adhesive compositions are available from many different manufacturers and can be used as a hot melt adhesive. The viscosity of the adhesive **116** may also be varied to affect penetration or wetting into the bottom surface **110** of the fibrous web **104**. As would be appreciated by those of ordinary skill with adhesives, the viscosity of the adhesive will affect the coating weight.

[0086] The pressing station **115** comprises a plurality of nip rollers **126** and **128** that cooperate to press the adhesive **116** into the bottom surface **110**. As illustrated in FIG. **8**C, notice that the adhesive **116** is pressed into the bottom surface **110** and extends beyond a first plane P**1** a predetermined distance. In the illustration being described, the predetermined distance may be at least ten-thousandth of an inch, and this may vary depending on the web material used. Moreover, the adhesive **116** may be applied at a basis weight of 50-200 gsm.

[0087] Note that the thickness D**2** of the adhesive above the bottom surface **110** in plane P**1** will typically be less than the distance D**1** for a non-tufted material or application unsupported by web. For applications where the fibrous material is supported by a backing, the distance D**1** will typically impregnate the backing to the top surface of the backing. In such an application, the distance D**2** may be greater than the distance D**1**. Accordingly, it should be understood that the

degree of adhesive penetration is largely dependent upon the porosity of the web **104** and the viscosity of the adhesive **116**.

[0088] When the adhesive **116** is placed in adhesive bands, lines, strips or rows **116***a* on the bottom surface **110**, it comprises a first, pre-pressed width W**1** (FIG. **8**B). After the adhesive bands, lines, strips or rows **116***a* are pressed into the bottom surface **110**, the adhesive bands, lines, strips or rows **116***a* comprise a second width W**2** (FIG. **8**C), which is wider than the first width W**1**. In the illustration being described, the second width is less than one-quarter of an inch, but both widths W**1** and W**2** could be larger or smaller if desired. Thus, it should be understood that after the adhesive bands, lines, strips or rows **116***a* are pressed into the bottom surface **110** they become wider which provides more adhesive surface area for the adhesive **116** to bond to the surface **120** (FIGS. **14** and **15**B).

[0089] Referring back to FIG. **8**A, notice that at least one or a plurality of release liners, rolls or sheets **130**, **132** and **134** are provided at the pressing station **115**, as illustrated in FIGS. **8**A and **9**. The bottom surface **110** with the adhesive bands, lines, strips or rows **116***a* is covered by the sheets **130-134** that are removable upon installation. As illustrated in FIGS. **8**A and **9** and similar to the embodiment described earlier, a release sheet (FIGS. **13** and **14**) is preferably provided or formed as one or from the plurality of sheets **130-134**, including, for example, two main sheets **130** and **132** and the positioning sheet **134**. The main sheets **130** and **132** are installed on the bottom surface **110** with a gap between them that exposes at least one or a part of one of the adhesive bands, lines, strips or rows **116***a* as illustrated in FIG. **13**. The positioning sheet **134** is installed over the gap to overlap the main sheets **130** and **132**, as illustrated in FIGS. **13** and **14**. During installation, the positioning sheet **134** can be removed to expose a strip of adhesive bands, lines, strips or rows **116***a* in the gap between the main sheets **130** and **132** to locate and tack the covering or tile **102** in place prior to final placement. After the covering or tile **102** is finally placed in position, the main sheets **130** and **132** are removed and the covering or tile **102** is secured in place. As alluded to earlier, the release sheets **130**, **132** and **134** could be provided in a single sheet that tears apart or has other areas that are removable to expose at least a portion of the adhesive bands, lines, strips or rows **116***a*.

[0090] The release liners **130**, **132** and **134** can be formed of any releasable sheet material that is easily pulled from the surface **120**. A suitable material is silicone coated polyester film of the type described earlier herein with the previous embodiment. It is desirable to use release liners **130**, **132** and **134** that can withstand the temperature of the adhesive when it is hot. As also mentioned earlier, other materials may be used, such as a silicon coated paper. A preferred material is a silicon coated sheet about one to two mils thick. For example, a silicon coated paper or silicon-coated polyester may be used, and a preferred material is a silicone coated polyester sheet about ½-2 mils (0.0005 inch to 0.002 inch) thick. The important features of the release sheets **130**, **132** and **134** are that it releases reliably from the adhesive surface and avoids tearing so that it is easy for an installer to use and install.

[0091] Referring back to FIG. **8**A, notice that the system **100** further comprises a transfer station **140** comprising a plurality of rollers **142**, **144**, **146**, **148**, **150** and **152** that are driven by at least one feed roller driver **154** that causes the web **104** to be moved through the system **100**. As illustrated in FIG. **8**A, the feed roller driver **154** is coupled to a roller controller **156** that in turn is coupled to various sensors **158**. The sensors **158** are also coupled to a programmable controller **160** as shown. In the illustration being described, the feed roller driver **154** is programmable and drives the roller **150** to drive the web **104** a predetermined distance, which depends on the dimension of the covering or tile **102** being cut. For example, for an 18 inch by 18 inch square tile, the feed roller driver **154** drives the roller **150** to drive the web **104** in increments of approximately 18.25 inches.

[0092] The system **100** further comprises a cutting station **159** that has a cutting table or support **200** for supporting the web **104** during cutting at the cutting station **159**. The cutting station **159** further comprises at least one or a plurality of drivable or moveable lasers or non-contact cutters **162**, **164**, **166** and **168** that are coupled to at least one or a plurality of drivers **170** that are mounted to a frame or support (not shown for ease of illustration) that supports the non-contact cutters **162**, **164**, **166** and **168** over the table or support **200** as shown.

[0093] Notice that the table or support **200** comprises a generally planar surface **202** that is supported by a plurality of legs **204**. The surface **202** comprises a cutting aperture or opening **206** (FIGS. **8**A, **19**A and **19**I) that generally corresponds to the predetermined shape to be cut into the web **104** for defining the covering or tile **102**. Although the illustration shown shows the predetermined shape of the covering or tile **102**, and consequently the cutting aperture **206**, being generally square, it should be understood that the predetermined shape could be any desired shape.

[0094] The table or support **200** also comprises a second planar member or platen **208** (FIG. **19**A) having a bottom surface **208***a* that is generally coplanar with the surface **202** to support the covering or tile **102** after it has been cut from the web **104**. Note that a pan or reservoir **210** (FIGS. **8**A, **19**A-**19**H) is secured by conventional means, such as by a weld or with fasteners, to the underside **200***a* of the table or support **200**. A pedestal support **212** (FIG. **19**I) is secured to a bottom surface **210***a* of the pan or reservoir **210** and to a bottom surface **208***a* of the second planar member **208** to support the second planar member **208** in the position shown.

[0095] An exhaust conduit or tube **214** couples the pan or reservoir **210** to an exhaust fan **216** for exhausting air and gases resulting from the non-contact cutting from the pan or reservoir **210** to atmosphere.

[0096] The laser or non-contact cutters **162-168** are coupled to and under the control of the programmable controller **160** (FIG. **19**A). During cutting as described later herein, the programmable controller **160** causes the non-contact cutters **162-168** to generate laser beams **162***a*-**168***a* to cut through the web **104**, while the web **104** is in a resting position at the cutting station **159**, to provide the covering or tile **102**. In the illustration being described, the laser or non-contact cutters **162-168** are 180 Watt lasers manufactured by Coherent, Inc. of Santa Clara, Calif. Although not shown for ease of illustration, the laser or non-contact cutters **162-168** are mounted on a track, frame or gantry and the lasers **162-168** and the laser drivers **170** may comprise the laser system available from Kern Electronics & Lasers, Inc. of Wadena Minn. Moreover, as is known in the laser art, one or more mirrors (not shown) may be provided to facilitate adjustment of the laser beam to the optics lens. Notice that during cutting, the laser beams **162***a*-**168***a* are received in the cutting aperture **206** in the table **200**. The programmable controller **160** energizes the laser drivers **170** to drive the lasers **162-168** to cut the predetermined shape or pattern, and during such cutting, the laser beams **162***a*-**168***a* are continuously received in the

cutting aperture **206**. Applicants have found that the cutting aperture **206** facilitates reducing or eliminating reflection of the laser beams **162***a*-**168***a* as can occur if there is a reflective surface underneath the web **104** and in line with the laser beams **162***a*-**168***a*. The cutting aperture **206**, therefore, facilitates providing a clean cut of edges **102***b*, **102***c*, **102***d* and **102***e* (FIG. **8**A) in the web **104** to provide the covering or tile **102**. Further description of the system and process for cutting are provided later herein relative to FIGS. **19**A-**19**I.

[0097] Advantageously, the non-contact cutting system utilizing at least one non-contact cutter, such as one or more of the moveable lasers **162**, **164**, **166** and **168**. The laser cut(s) vaporizes the fibers along the edges that provide a "clean" and accurate cut at the edges **102***b*-**102***e*.

[0098] The operation of the system **100** and method will be described relative to FIGS. **8**A and FIGS. **19**A-**19**I, which are simplified for ease of illustration. During operation, the programmable controller **160** and the roller controller **156** energizes the at least one or a plurality of feed roller drivers **154** to move the web **104** through the system **100** until an end **104***b* reaches a desired location (FIGS. **8**A and **19**B). The sensors **158** sense the position of the end **104***b* and of the lasers or non-contact cutters **162**-**168** and provide this information to the programmable controller **160** and the roller controller **156**. When the end **104***b* reaches the desired position, at least one or a plurality of feed roller drivers **154** cause the at least one roller **142**-**152** to cease moving the web **104**. At least a portion of the web **104** is now positioned at a cutting station **159**, as illustrated in FIGS. **8**A and **19**B. Notice that the web **104** is not cut or held in place by mechanical means that would cause distortion or displacement, and the web **104** lies and rests generally flat at the cutting station **159**. Because the web **104** is not being distorted or displaced during cutting, the web **104** can be cut very accurately and within tight tolerances.

[0099] After the web **104** is in the desired position at the cutting station **159** (FIG. **8**A and **19**B), the programmable controller **160** energizes a plate driver **174** to drive a plate **172** into engagement with the top surface **108** (FIG. **19**A) and to hold the web **104** against a platen **208**. The plate **172** engages the top surface **108** and gently secures the web **104** against the platen **208** during cutting as shown. It should be appreciated that the plate **172** holds the web **104** substantially flat during cutting; however, the plate **172** does not apply enough pressure on the web **104** to cause distortion or displacement of the material making up the web **104** while the web **104** is being held or cut. This facilitates accurately cutting the web **104** within tight tolerances. Next, the programmable controller **160** energizes the laser drivers **170** and the lasers or non-contact cutters **162**-**168** to cut into the top surface **108** of the web **104** in the desired predetermined shape or pattern. In the illustration being described, the predetermined shape of the covering or tile **102** is a square.

[0100] In the illustration being described, it should be understood that each of the edges **102***b*, **102***c*, **102***d* and **102***e* (FIGS. **8**A and **19**E) of the covering or tile **102** are cut with the laser beams of the **162***a*, **164***a*, **166***a* and **168***a* (FIG. **19**C), respectively, of the lasers or non-contact cutters **162**-**168**. As mentioned earlier, the laser beams **162***a*-**168***a* are received in the cutting aperture **206** during cutting, and the exhaust fan **216** (FIG. **19**A) exhausts any smoke or debris through the tube **214** to the atmosphere.

[0101] In the illustration being described, the lasers or non-contact cutters **162**-**168** are laser cutters, but they could be other types of non-contact cutters, such as water jets or the like. By non-contact cutting as described herein, there is no mechanical contact between the cutter and the web **104**, as opposed to a traditional mechanical cut with a knife or blade. In the past, cutting a web with adhesive was difficult because the adhesive would contaminate the blade or knife. Thus, it should be understood that each of the edges **102***b*-**102***e* defines a non-contact cut that were laser-cut by the lasers or non-contact cutters **162**, **164**, **166** and **168**, respectively. The laser driver **170** drives the lasers or non-contact cutters **162**-**168** in a direction indicated by the arrows in FIGS. **8**A and **19**C, and the laser beams **162***a*-**168***a* cut edges **102***b*-**102***e* as the lasers or non-contact cutters **162**-**168** are driven by the laser drivers **170** over the bottom surface **110**. Note in the illustration being described that the plurality of edges **102***b*-**102***e* define substantially a 90 degree angle with respect to any adjacent edge and in the illustration in the being described, is cut within a tolerance of less than five-thousandths of an inch.

[0102] As previously mentioned, the web **104** is cut in a relaxed state, without tension, pressure, pulling, deformation or distortion of the web during cutting or the use of backing, which facilitates achieving a very accurate desired cut. The system and method enables the cutting of a web **104** that does not have a backing, but that does have a pre-applied adhesive **116** and release liner(s) **130**-**134**. As mentioned earlier, this is difficult to do with contact cutters, such as a knife or blade, because of the tendency for the adhesive to stick to and contaminate the knife or blade.

[0103] As described herein, the system and method provide the non-contact cutter means and method that facilitates cutting any desired size and shape because the size and shape are not bound by the limitations of traditional mechanical cutting knives, blades, dies and jigs required with traditional contact cutters of the past. In the past, the displacement of the web that occurred as a result of the cutting, knives, blades, dies and jigs used during contact cutting had to be accounted for in the final cut product because of cupping and curling problems encountered while the material was being held and/or cut. Advantageously, the embodiments described herein utilize at least one non-contact cutter, such as the moveable lasers **162**-**168**, that eliminates the need to use the dies, jigs and contact cutters, like knives and blades, that caused pressure on the web or that resulted in undesired displacement of the material during the cut. As illustrated and described herein, the system and method utilize at least one non-contact cutter, **162**-**168**, and no knives, blades, jigs or dies on the web **104** to apply a cutting pressure on the web **104** during cutting. This reduces or eliminates displacement of the material making up the web **104**, which in turn provides coverings or tiles **102** that can be cut within tight tolerances.

[0104] Notice as illustrated in FIGS. **10**-**12**, that each of the non-contact cuts diverge (as viewed in cross section) away from a cutting plane or line **171** (FIG. **10**). This provides a beveled undercut as illustrated in FIG. **11**. Although not shown, at least one of the lasers **162**-**168** could be positioned at a desired angle relative to the web **104** to create the angled or beveled cut. FIG. **10** shows the laser or non-contact cutter **168** generating the laser beam **168***a* that cuts the top surface **108**. As the laser beams **166***a* and **168***a* cut through the bottom surface **110** and toward the top surface **108**, the laser beams **166***a* and **168***a* diverge away from the cutting line **171** to provide an edge **102***c* and **102***e* that is generally not perpendicular to either the top surface **108** or the bottom surface **110**.

Thus, it should be understood that each laser cut through the web **104** diffuses or diverges away from the cutting line **171** as the cut extends away from cutting plane **171** as it extends from the top surface **108** toward the bottom surface **110** when viewed in cross section. Each of the edges **102***e* and **102***c,* as well as the edges **102***b* and **102***d,* define a beveled cut or an acute angle relative to the cutting line **171**.

[0105] Referring to FIGS. **11** and **12**, the inventor has found that the diverging cut mentioned earlier along the edges **102***b*-**102***e* provides a very tight seam between adjacent coverings or tiles **102** when the separate covering or tile **102** are placed adjacent each other during installation, as illustrated in FIGS. **11** and **12**. The fibrous materials at the edges, such as **102***c* and **102***e,* engage each other and the fibers at the edges become bunched and/or compressed to provide the tight seam as shown in FIG. **12**. This facilitates providing a tiling system that provides a "tight" seam between adjacent coverings or tiles **102** if desired.

[0106] Returning to the illustration in FIGS. **8**A and **19**A-**19**H, after the lasers or non-contact cutters **162-168** are finished cutting the covering or tile **102**, the programmable controller **160** ceases energizing the lasers or non-contact cutters **162-168** and causes the laser drivers **170** to cease moving them. The programmable controller **160** then energizes the plate driver **174** to raise the plate **172** (FIG. **19**D). The roller controller **156** energizes the feed roller drivers **154** to drive, advance or increment the web **104** (FIG. **19**E) so that the next covering or tile **102** can be cut, as illustrated in FIGS. **19**F-**19**H).

[0107] Notice that the cut edge **180***c***1** (**19**H) of scrap piece **180***c* drives the edge **102***e* of the previously cut covering or tile **102** toward a storing station **182** where the coverings or tiles **102** are stacked for storing or packing. When the next covering or tile **102** is to be cut (FIG. **19**E), the roller controller **156** energizes the feed roller drivers **154** to increment the web **104** so that another covering or tile **102** can be cut. After the web **104** is incremented, the plate **172** is then caused to engage the web **104** (FIG. **19**F). Programmable controller **160** energizes the laser drivers **170** to drive the lasers or non-contact cutters **162-168** (FIG. **19**F) in the direction (i.e., back to their previous position) opposite that indicated by the arrow shown in FIGS. **8**A and **19**C. Accordingly, it should be understood that the laser drivers **170** move or drive the lasers or non-contact cutters **162-168** back and forth in one linear plane in the illustration being described to cut the plurality of coverings or tiles **102**. After cutting, the plate **172** is again raised (FIG. **19**G) and the web **104** is again advanced (FIG. **19**H) so that the next covering or tile **102** can be cut. The process repeats until the desired number of coverings or tiles **102** are cut.

[0108] It is to be noted that during each cutting, the lasers or non-contact cutters **162-168** cut slightly beyond each adjacent edge in order to provide a clean and accurate cut. In this regard, the moveable lasers **162** and **166** cut through the web **104** and beyond the edges **102***c* and **102***e* until they meet with the cut-out edges **102***c* and **102***e* of the preceding cut. In contrast, notice that the moveable lasers **164** and **168** do not cut entirely through side edges **104***f* and **104***g* (FIG. **19**A) of the web **104**. Note that the side scrap pieces (that is, the scrap pieces **180***a* and **180***b* (FIG. **19**A) resulting from the cut of edges **102***b* and **102***d,* respectively) remain attached to the scrap pieces **180***a* and **180***b,* respectively, of any preceding or succeeding cut to provide a continuous length of scrap. In contrast, an individual scrap piece **180** is created as well. In this regard, notice that the scrap piece **180***c* has an edge **180***c***1** corresponding to the cut of edge **102***e* by laser beam **164***a,* an edge **180***c***2** corresponding to the cut of edge **102***c* by laser beam **166***a,* and edges **180***c***3** and **180***c***4** created by moveable lasers **162** and **166**, respectively. It has been found that this scrap piece **180***c* either falls from the cut covering or tile **102** by gravity after it clears an end **202***b* of the table or surface **202**, or the scrap piece **180***c* may remain with the cut covering or tile **102** because of the adhesive **116**. If the piece remains, an operator may simply pull the piece off and discard or recycle it.

[0109] It should also be understood that the system **100** could use a single high-speed laser cutter that could effectively cut all edges, such as the four edges in the illustration, if desired. Alternatively, a plurality of laser cutters, such as the plurality of lasers or non-contact cutters **162-168**, or some smaller or larger number of laser cutters may be used if desired.

[0110] Advantageously, the inventor has found that by using the lasers or non-contact cutters **162-168** to cut the edges **102***b*-**102***d,* very tight tolerances in cuts and shapes of cuts can be achieved. By cutting all the edges **102***b*-**102***e* with at least one or a plurality of non-contact cutters, such as with a laser, tighter tolerances than the past can be achieved and the web **104** can be cut after the adhesive is applied. In the illustration, a square is cut within a tolerance of five-thousandths of an inch. Also, notice that the web **104** is cut after the adhesive **116** and release liner(s) **130-134** is applied, and the system and method cut all three simultaneously as shown and described.

[0111] Referring back to FIG. **8**A, the system **100** may further comprise a removable label applying station **184** for applying a removable label **186** (FIGS. **8**A and **15**A) to the top surface **108** of the covering or tile **102** as best illustrated in FIG. **15**A. Notice that the removable label **186** comprises a first side **186***a* and a second side **186***b*. A portion of the second side **186***b* may have a removable adhesive and also a portion or area of the second side **186***b* may have no removable adhesive to facilitate grabbing and removing the removable label **186** from the top surface **108**.

[0112] Importantly, notice that the first side **186***a* comprises an indicia, such as an arrow, that provides an indication of the direction of the nap of the fibers that make up the web **104**. Although in the embodiment being described, the at least one removable label **186** may indicate a direction of the nap, they may also be placed to indicate a pattern, an opposite direction or some other direction that may facilitate installation of a plurality of coverings or tiles **102** onto the surface **120**. In some installations, it may be desired or necessary to arrange the coverings or tiles **102** in a predetermined order or pattern to have a design pattern (not shown) or nap of the coverings or tiles **102** facing the same direction, as illustrated in FIG. **16**, situated in the direction illustration in FIG. **17**, situated in opposite directions as shown in FIG. **18**, or perhaps in a perpendicular direction as shown in FIG. **15**A. An important point is that at least one removable label **186** provides indicia for the user to use while installing a plurality of the coverings or tiles **102** onto the surface **120** which facilitates quick and proper installation in a predetermined or desired pattern. It has been found that having the at least one removable label **186** situated on the top surface **108** of each covering or tile **102** provides quick and easy means or indicia for the installer to correctly position and orient the covering or tile **102**.

[0113] After the at least one of removable label **186** is situated on the top surface **108** of each covering or tile **102**, the scrap piece **180***c* may be removed (FIG. **19**H) from the covering or tile **102** if it remains therewith. The covering or tile **102** may be packaged for distribution or further processing. An inventory of, for example, five or more coverings or tiles **102** may be situated in a box or other packaging, as described earlier, and shipped for further processing, distribution or sale.

[0114] Contrary to the embodiment described earlier herein relative to the embodiment shown In FIGS. **1-7**, notice that the coverings or tiles **102** are provided in cleanly cut squares, without any overhanging release liners **130**, **132** and **134**. In the embodiment of FIGS. **8**A-**19**I, the release liners **130** and **132** do not extend beyond edges **102***b* and **102***d* because all release liners **130**, **132** and **134** and adhesive **116** are cut when the edges **102***c* and **102***e* are cut by the laser or non-contact cutters **162** and **168** during the cutting of the web **104**, unlike the embodiment described relative to FIGS. **1-7** which utilized indicia **30** on the tabs **28** for proper orientation of the covering or tile **102**.

[0115] As with the embodiment described earlier herein, during installation, the release sheet **134** is removed and discarded (FIG. **13**), and the covering or tile **102** is tacked into place. When the position of the covering or tile **102** is properly positioned on the surface **120**, the other release liners **130** and **132** are removed by lifting each side of the top surface **108**, as illustrated in FIG. **14**, leaving the center portion of the covering or tile **102** tacked in place. Each subsequent covering or tile **102** is installed (FIGS. **15**B-**18**) and the adhered coverings and tiles **102** are used as a guide as well as using the indicia on the at least one removable label **186** as a guide. Because the adhesive **116** is applied in the adhesive bands, lines, strips or rows **116***a* and does not entirely cover the bottom surface **110**, the bond or connection between the bottom surface **110** and the surface **120** can be broken by applying an upward force (as viewed in FIG. **15**B) to the covering or tile **102**. As mentioned earlier, because of the difference in bond strength, the adhesive **116** is pulled from the surface **120** and a majority of it remains with the covering or tile **102**, rather than adhering to the surface **120** which is a significant improvement over the prior art.

[0116] This feature also enables covering or tiles **102** to be selectively replaced. As with the embodiment described earlier, this feature provides for a longer life to the overall surface covering because damaged or worn pieces may be replaced while leaving the remainder of the coverings or tiles **102** in tact. Because the adhesive **116** spans the entire width of the bottom surface **110**, the covering or tile **102** is securely bonded to the surface **120** and resists shifting or bunching when a load is applied, such as when a vehicle rides over it.

[0117] Referring now to FIGS. **20-24**, another embodiment of the invention is shown. This embodiment is also directed to a surface covering or overlay in the form of tiles, particularly suited for covering a solid surface, such as a floor, garage floor, patio, an interior or exterior environment, an environment subject to exposure to elements or an environment subject to heavy traffic and high loads, such as airports, retail stores and the like. This embodiment is particularly suited for covering large expanses of exterior or interior solid surfaces or surfaces subject to the elements or harsh conditions. The embodiment can also be used for covering other types of surfaces including, but not limited to, basement floors, factory or retail floors, common areas, public areas, walkways or patios as mentioned earlier.

[0118] As with the other embodiments, the tiles in accordance with this embodiment are also suited for connection to surfaces formed of concrete. This embodiment may also be used on other exterior surfaces including concrete, synthetic composites, wood boards and plastic or plastic composite boards or any other suitable flat surface.

[0119] A feature of this embodiment is that it utilizes the same system and method for providing an adhesive that is pressed directly into the surface of the fibers of the backing. In this embodiment, the web **104** could be provided with or without a backing or coating, but it could have an adhesive, described earlier herein, applied directly to the fibers and pressed therein. As with the embodiment described earlier, this feature facilitates using the system and method with needle-punched products or webs. It should be understood that the adhesive described herein is selected to provide a desired amount of bond as described earlier herein.

[0120] Accordingly, those parts in FIGS. **20-24** that bear the same part number as the parts identified relative to the prior embodiments identify the same or substantially the same part.

[0121] In the embodiment of FIGS. **20-24**, another system and method **300** is shown for applying adhesive and release liners to the web **104** in the manner described earlier herein and then presenting the web **104** to a cutting station **302** (FIGS. **20** and **23**) and cutting the web **104** in the matter described herein.

[0122] As illustrated in FIGS. **20-24**, the system **300** comprises an air table **304** comprising a top planar member **304***a* that defines a working area, working surface or surface **304***a***1**, a generally opposed second or bottom planar member **304***b* (FIG. **23**) and a plurality of side walls **304***c* (FIGS. **21**A and **21**C). The table **304** comprises a plurality of legs **308** secured to the bottom planar member **304***b* for supporting the table **304** above the ground. The members **304***a*, **304***b* and side walls **304***c* are aluminum and welded together to provide and define an area or air chamber **314** as best shown in FIG. **23**.

[0123] The top planar member **304***a* comprises a plurality of apertures **306** (FIGS. **21**A and **23**) for permitting airflow and providing negative and positive pressure to the web **104** in the manner described herein. Note that the chamber or area **314** is in fluid communication with the plurality of apertures **306**. The table **304**, pressure and feed rollers **150** and **152** provide or define a web handler for handling the web **104** prior to, during and after cutting.

[0124] As shown in FIGS. **21**A-**23**, a positive pressure fan **316** is coupled to a bottom portion **318** of the chamber **314** and in fluid communication with an aperture **320** to provide positive air pressure into the area **314**, through the apertures **306** and to the surface **304***a***1**. During positive pressure, air flows through the apertures **306** over the surface **304***a***1** and provides an air cushion AC (see FIGS. **21**A-**21**H) that provides a low friction surface. The positive airflow through the apertures **306** provides a low friction, air cushion (labeled AC in FIGS. **22** and **24**) or air support for the web **104** to move across a surface **304***a***1** of the member **304***a*. In a manner described later herein, the air cushion AC supports the web **104** over the surface **304***a***1** to facilitate movement and transferring of the web **104** in the manner described herein.

[0125] The system **300** further comprises a negative pressure fan **322** that is coupled to a valve **324** which, in turn, is coupled to, and under the control of, the roller controller **156** as shown. During operation and as described later herein, when the valve **324** is open, the fan **322** evacuates the chamber **314** through an aperture **330** and provides a negative pressure and vacuum to the surface **304***a***1** via the apertures **306**. When the valve **324** is open, the negative pressure is greater than the positive pressure provided by the fan **316** and overcomes the positive pressure to provide a vacuum through the apertures **306**. This vacuum facilitates holding the web **104** against the surface **304***a***1** and providing tension or resistance against movement of the web **104**, which feature is described later.

[0126] The surface **304***a***1** further comprises a plurality of laser apertures **326** and **328** that receives the laser beams from the lasers **162** and **164**, respectively, and exhaust fumes created during the laser cutting of the web **104**.

[0127] For ease of illustration, the lasers **162** and **164**, as with the lasers **162-168** in the prior embodiment, are shown above or exploded away from the cutting station; however, it should be understood that during operation, the lasers **162-168** are situated typically less than one inch from the top surface **108**. Also, the lasers **162-168** in all embodiments are supported on a conventional metal frame or track (not shown for ease of illustration understanding) for transverse movement across the path of the web **104**.

[0128] As described later herein, when the lasers **162** and **164** are energized, the valve **324** is caused to be opened to provide the negative pressure in the chamber **314** which causes the chamber **314** to be exhausted through the aperture **330** (FIG. **23**) in member **304***b* to which the fan **322** and valve **324** are in fluid communication. When the lasers **162** and **164** are energized to cut the web **104**, any fumes are exhausted through the apertures **326** and **328** and port **330** by the fan **322**. In this illustration, the fans **316** and **322** run continuously. However, the fan **322** is coupled to the chamber **314** through the valve **324**, which is opened, for example, when the lasers **162** and **164** are energized, thereby exhausting any fumes resulting from the laser cutting while substantially simultaneously securing the web **104** at the cutting station **302** during cutting. In the illustration being described, the fan **316** provides airflow of about 250 cfm to provide the positive pressure, while fan **322** provides an airflow of about 500 cfm to provide the negative pressure. The operation and airflow will be described later herein.

[0129] Referring to FIGS. **20-23**, notice that the system **300** comprises a laser sensor **332** having a transmitter **334** and a target or receiver **336**. The laser sensor **332** is coupled to the roller controller **156** that energizes laser drivers **170** to drive the lasers **162** and **164** across the table in order to cut the web **104** in the manner described herein. As best illustrated in FIGS. **21**A and **23**, transmitter **334** and receiver **336** are operatively positioned to capture and sense an end **104***k* of the web **104**. The roller controller **156** receives the sensed information from the laser sensor **332** and uses it to energize the feed roller drivers **154** to accurately position the web **104** at the cutting station **302** so that tiles T**1** and T**2** (FIG. **21**H) in the illustration may be accurately cut. This operation will be described in more detail later herein.

[0130] As best illustrated in FIGS. **21**A-**21**H, after tiles T**1** and T**2** are cut at cutting station **302**, they are moved onto a moving conveyor **340** for transporting to a stacking or packaging area where they can be stored or packaged in containers for shipping. In the illustration being described, it should be understood that the conveyor **340** is coupled to a conveyor drive (not shown) that drives the conveyor **340** at a speed that is greater than the speed at which the feed rollers **150** and **152** drive the web **104** to the cutting station **302**. Consequently, when a portion of the tile, such as tile T**1** in FIG. **21** F, is received on the conveyor **340** it is "grabbed" or "pulled" off the surface **304***a***1** at a speed that is greater than the speed at which the tile T**2** and web **104** travels. This provides a separation distance SD (FIG. **21**H) between the cut tiles T**1** and T**2**, which in turn facilitates processing the tiles T**1** and T**2** for packaging or shipping as may be desired.

[0131] A plurality of end-of-run sensors **342** and **344** are associated with the ends **326***a*, **328***a* and ends **326***b* and **328***b* of the apertures **326** and **328**, respectively, as shown in FIG. **20**. The end-of-run sensors **342** and **344** sense when the lasers **162** and **164** have finished a cut. The end-of-run sensors **342** and **344** are coupled to the roller controller **156** which deenergizes the laser drivers **170** and lasers **162** and **164** when the lasers **162** and **164** have finished a laser cut across the web **104** in the manner described herein. In the illustration, the end-of-run sensors **342** and **344** are provided in laser controller driver **170** software which may be programmed by a user. In this regard, the laser controller driver **170**, mechanisms, support, including any frames, gantries, support structures or drivers necessary for controlling and driving the lasers **162** and **164** are available from Kern Electronics & Lasers, Inc. of Wadena, Minn. As mentioned earlier herein, as is known in the laser art, one or more mirrors (not shown) may be provided to facilitate adjustment of the laser beam to the optics lens. As mentioned herein, the lasers **162** and **164** may be CO_2 150 watt lasers available from Coherent Inc. of Santa Clara, Calif. The system and method for cutting the web **104** will now be described relative to FIGS. **20-21**H.

[0132] With the prior embodiment and as illustrated in FIG. **20**, the web **104** is provided in a predetermined width for applying the adhesive and release liners **130**, **132** and **134** in the manner described earlier herein relative to the embodiments of FIGS. **1-19**I. If necessary, one or more slitters **350** (FIG. **20**) may be provided for slitting a supply of material into the web **104** having a desired or predetermined width. The adhesive and release liners **130**, **132** and **134** are applied as in prior embodiments.

[0133] A pair of guides **315** and **317** are provided to guide the web **104** to the cutting station **302**. As illustrated in FIGS. **21**A, **21**E-**21**F and **24**, notice that at least one of the guides, guide **315** in the example, is adjustable and can be moved to different positions relative to the opposing guide **317** using the bolts **319** and complementary threaded holes **321** in member **304***a*. Note that the guides **315** and **317** have a plurality of notched out or V-shaped openings **323** (FIGS. **23** and **24**) to facilitate permitting the lasers **162** and **164** to travel past the guides **315** and **317** after cutting. After the web **104** is slit and the adhesive and release liners **130**, **132** and **134** are applied in the manner described earlier herein, the web **104** is fed between the guides **315** and **317** which guides the web **104** to the cutting station **302** for cutting in the manner that will now be described.

[0134] For ease of illustration, FIGS. **21**A-**21**H are views that do not show the various application steps upstream of the rollers **150** and **152** for ease of illustrating various features of this embodiment. As illustrated in FIGS. **21**A-**21**B, the roller controller **156** energizes the feed roller driver **154** to rotatably drive the feed rollers **150** and **152** to advance the web **104**

until the end **104***k* is sensed by the sensor **332** using the transmitter **334** and target **336**. It should be appreciated that when the web **104** is being advanced or moved over the surface **304***a***1**, the valve **324** is closed and fan **316** provides positive air pressure to enable the web **104** to easily float or move with low friction on the air cushion AC (FIGS. **22** and **23**) over or across the surface **304***a***1**.

[0135] When the sensor **332** senses the end **104***k*, the sensor **332** generates a signal which is received by the roller controller **156** which internally marks the position and which causes the feed roller driver **154** to cease advancing the web **104** as shown. The roller controller **156** actuates valve **324** to open which causes the negative pressure to vacuum and force web **104** against surface **304***a***1**. The roller controller **156** substantially simultaneously energizes feed roller driver **154** to cause the feed rollers **150** and **152** to reverse the rotation so that the web **104** is driven backwards (as viewed in FIG. **21**C) against the vacuum pressure and in the direction of arrow **352** in FIG. **21**C for a predetermined distance from the position, such as distance DW**1**, which is programmed into the roller controller **156**. In the illustration being described, the roller controller **156** can be programmed so that the distance DW**1** can be any desired or predetermined distance, dimension or size. In the illustration being described, the roller controller **156** is a programmable controller available from Kern Electronics & Lasers, Inc. of Wadena, Minn.

[0136] Thus, it should be understood that the roller controller **156** comprises means for accurately energizing the feed roller drivers **154** to cause the rollers **150** and **152** to reverse the direction of the web **104** a desired distance so that the edge **104***k* becomes situated at the predetermined distance from laser **164** so that when the laser **164** moves transversely across the web **104** and cuts the tile T**1**, the tile T**1** is cut at the desired dimension width or distance DW**1**. In the illustration being described, square tiles are cut and the dimension is approximately 12 inches in the illustration, but as with the prior embodiments, other non-square shapes (e.g. polygonal, circular, elliptical, irregular, non-symmetrical and the like) sizes or dimensions (e.g., 18 inches, 24 inches, 36 inches, 48 inches and other sizes.) may be selected as well.

[0137] Returning to the illustration, once the web **104** has been retracted so that the distance DW**1** is achieved, the roller controller **156** ceases energizing the feed roller drivers **154**. It should be understood that the web **104** is retracted while the valve **324** is open and the negative pressure is applied thereto. The inventor has found that this negative pressure provides resistance or tension that facilitates registering and accurately positioning the web **104** and cutting the web **104** at the cutting station **302**.

[0138] As illustrated in FIG. **21**C, the plurality of lasers **162** and **164** are provided, in the example, but it should be understood that more or fewer lasers could be used if desired. Also in the illustration, it is desired to cut square tiles of the same size so the dimensions or distances in the illustration are DW**1**, DW**2** and the width across the web **104** is substantially the same, but it should be understood that these dimensions or distances could be different if desired.

[0139] After the web **104** is moved to the position such that the dimension or distance between the surface **304***a***1** and laser beam **164***a* is substantially the distance DW**1**, the web **104** is laser cut as mentioned earlier. As mentioned, the valve **324** remains open which not only provides negative pressure and resistance to the web **104**, but also causes the exhaust fumes from the laser cut and/or debris to be evacuated by the fan **322**. As mentioned earlier herein, it should be understood that the pressure provided by the fan **322** is greater than the pressure provided by the fan **316** so that a negative pressure is created at surface **304***a***1**. Advantageously and as shown in FIG. **21**C and **21**D, this negative pressure also facilitates securing the web **104** against the surface **304***a***1** without the use of any platen or other means for holding the web **104** to the surface **304***a***1**, as well as functions to evacuate the fumes resulting from the laser cut to exhaust **325**.

[0140] Continuing with the illustration, as the web **104** is being held to the surface **304***a***1**, the roller controller **156** energizes the laser drivers **170** to drive the lasers **162** and **164** across and over the web **104** from the position shown in FIG. **21**D to the phantom position shown in FIG. **21**D, thereby resulting in the tiles T**1** and T**2** being cut. In the illustration being described, the end-of-run sensor **344** senses the lasers **162** and **164** reaching the end of the cut, which corresponds to the width or dimension of the web **104** selected distance past the side edges, such as edge **104***l* (FIG. **21**D). The sensed information is provided to the roller controller **156** which then actuates the valve **324** to the closed position which ceases negative pressure from fan **322** and enables positive pressure from fan **316** (FIGS. **21**E and **21**G) to resume and to provide the air cushion AC to support the web **104** above the surface **304***a***1**. The roller controller **156** also energizes the feed roller drivers **154** to advance web **104** which pushes the cut tiles T**1** and T**2** toward the conveyor **340** and in the direction of arrow **356** (FIG. **21**F). As the web **104** is driven, the tile, such as tile T**1**, is received on the conveyor **340** as illustrated in FIG. **21**G. At this time or preferably after the tiles T**1** and T**2** have been cut, the label **186** may be applied to the tiles T**1** and T**2**.

[0141] As mentioned earlier herein, the conveyor **340** is driven at a higher speed than the speed at which the rollers **150** and **152** drive the web **104** so that when the tile T**1** is picked up by the conveyor **340** it is pulled onto the conveyor's surface **340***a* and the separation distance SD (FIG. **21**H) is created between the cut tiles T**1** and T**2**. As illustrated in FIGS. **21**F-**21**G, the second tile T**2** is also received on the conveyor surface **340***a* and pulled and separated form the end **104***l* (FIG. **21**H) as shown. Note that the web **104** is advanced until the end **104***k* (FIG. **21**H) is sensed by the laser sensor **332** at which time the process and system repeats the cutting procedure in the manner described earlier relative to FIGS. **21**B-**21**H.

[0142] Advantageously, this system and method provide means for supporting the web **104** above the surface **304***a***1** and for facilitating moving the web **104** over the surface **304***a***1** and to the cutting station **302**. The system and method also provide means for securing the web **104** against the surface **304***a***1** during cutting by the lasers **162** and **164** and substantially simultaneously exhausting any fumes created by the lasers **162** and **164** through the apertures **326** and **328**. The system and method **300** provide means and apparatus for supporting the web **104** with the air cushion AC and/or for facilitating low friction movement and travel of the web **104** over the surface **304***a***1**, while substantially simultaneously providing resistance to movement of the web **104***a***1** and facilitating securing the web **104** with negative pressure against the surface **304***a***1** without the need for any platens or other holding devices which can cause misalignment and misregistration of the web **104** during cutting.

[0143] Advantageously, the various embodiments enable, among other things, cutting of the web **104** after the adhesive **116** is applied and the release liners **130**, **132** and **134** are

applied. The system enables cutting the web **104** from the top surface **108** if desired, and without any backing or support of the type used with prior art cutters like knifes and blades. Various advantageous unique features are achieved by the embodiments described herein, including but not limited to:

[0144] Utilizing multiple release tapes or liners **130**, **132** and **134** (FIGS. **13** and **14**);

[0145] Illustrating a nap direction on surface of the tile with label **186** (FIGS. **15**A-**17**);

[0146] Using a diffusing laser beam to create an angled cut or undercut bevel (FIGS. **10-12**), with most cases, laser cuts through from the top surface of the tile; and

[0147] Providing the air table **304** that provides ease of maneuvering the web **104** and tile material utilizing positive and negative pressure with a mode of operation at this time to apply constant positive air flow and pressure during forward movement of the web **104** and then applying negative pressure exceeding the positive air flow or pressure when necessary, such as when backing up the web **104** and while cutting the tiles T**1** and T**2**.

[0148] Various modifications can be made in my invention as described herein, and many different embodiments of the device and method can be made while remaining within the spirit and scope of the invention as defined in the claims without departing from such spirit and scope. It is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

What is claimed is:

1. A system of manufacturing a covering for installation on a surface, said system comprising:

at least one web handler for driving a web of fibers to a cutting station;

an air table having a working surface and adapted to provide air pressure to facilitate movement and positioning the web at said cutting station; and

a cutter located at said cutting station for cutting the web of fibers into the covering having a predetermined shape.

2. The system as recited in claim **1** wherein said air table comprises an air chamber, said working surface comprising a plurality of apertures for permitting airflow between said air chamber and said working surface.

3. The system as recited in claim **1** wherein said system further comprises:

at least one fan for providing positive and negative pressure to said working surface of said air table in response to a position of said web.

4. The system as recited in claim **3** wherein said system further comprises:

a controller for controlling operation of said at least one fan in order to apply positive air flow, and apply negative pressure exceeding the positive air flow when desired.

5. The system as recited in claim **4** wherein said negative pressure is applied when either the web of fabric is backed up or the web of fabric is cut.

6. The system as recited in claim **3** wherein said at least one fan comprises:

a first fan in fluid communication with an air chamber in said air table for providing said positive pressure to said working surface of said air table;

a second fan in fluid communication with an air chamber in said air table for providing said negative pressure to said working surface of said air table;

wherein said negative pressure exceeds said positive pressure to urge a side of said web of fabric against said working surface.

7. The system as recited in claim **4** wherein said negative pressure is also sufficient to exhaust any fumes or debris created by said cutter.

8. The system as recited in claim **7** wherein said cutter comprises at least one laser cutter situated above said working surface.

9. The system as recited in claim **3** wherein said system comprises:

at least one sensor for sensing a position of said web of fabric;

a controller coupled to said sensor, said controller switching between said positive pressure and negative pressure in response thereto.

10. The system as recited in claim **9** wherein when said controller causes said negative pressure, said web handler drives said web in a direction opposite a feeding direction to cause said web to be positioned at said cutting station.

11. The system as recited in claim **4** wherein when said web is positioned at said cutting station, said controller causes said cutter to cut said web while said negative pressure is applied, said working surface being adapted so that said negative pressure exhausts fumes debris arising from said cutting and also retains the web of fabric against said working surface at the cutting station.

12. The system as recited in claim **9** wherein said controller is programmed to cause said at least one web handler to drive said web of fabric past said cutting station and subsequently retract said web of fabric a predetermined distance and against said negative pressure.

13. The system as recited in claim **12** wherein said controller energizes said at least one fan to generate said negative pressure in response to said at least one sensor sensing an end of said web of fabric.

14. The system as recited in claim **1** wherein said system comprises:

an application station upstream of said air table for applying an adhesive directly to a fibrous layer of said web of fibers.

15. The system as recited in claim **14** wherein said system comprises:

a pressing station for pressing the adhesive into said web of fibers.

16. The system as recited in claim **1** wherein said cutting station comprises:

at least one laser cutter that cuts said web of fibers.

17. The system as recited in claim **1** wherein said cutting station comprises:

at least one laser cutter and at least one laser driver that drives said at least one laser cutter to laser cut said web in a direction that is transverse the direction of movement of said web through said cutting station.

18. The system as recited in claim **17** wherein said at least one laser cutter is positioned to cut said web of fabric through at least one of a fabric side or a top surface thereof.

19. The system as recited in claim **18** wherein said at least one laser cutter cuts an angled or beveled undercut of said web of fabric that diverges away from said top surface.

20. The system as recited in claim **16** wherein said at least one laser cutter cuts said web of fibers from a non-adhesive side of said web of fibers and after an adhesive is applied to an adhesive side.

21. The system as recited in claim **16** wherein said at least one laser cutter comprises a plurality of laser cutters that are driven in a path that is substantially perpendicular or transverse to adjacent paths.

22. The system as recited in claim **21** wherein said predetermined shape is a square.

23. The system as recited in claim **1** wherein said system further comprises:

a removable label applying station for applying at least one removable indicia to a top surface of said covering, said removable indicia providing an indication of a nap of said fibers.

24. The system as recited in claim **15** wherein said pressing station causes said adhesive to be flattened on a bottom surface.

25. The system as recited in claim **15** wherein said application station comprises:

an adhesive applier for applying said adhesive on said web of fibers in beads or strips;

said pressing station comprising at least one roller for pressing each of said beads or strips so that a first portion of each of said beads or strips becomes pressed into said web of fibers and a second portion of said beads or strips becomes flattened out on a bottom surface of said web of fibers to form bands, lines, strips or rows.

26. The system as recited in claim **25** wherein said adhesive is a removable adhesive that is pressed into said bottom surface and extends beyond said bottom surface a distance of at least ten thousandths of an inch.

27. The system as recited in claim **14** wherein said system further comprises:

a release liner application station located downstream of said application station for removably securing a plurality of release sheets to said adhesive.

28. The system as recited in claim **1** wherein said covering defines a carpet tile.

29. A method for cutting a covering or tile comprising the steps of:

positioning a web of fabric at a cutting station using an air table having a working surface and a plurality of apertures for providing a cushion of air; and

cutting said web of fabric with a cutter to provide the covering or tile having a predetermined shape.

30. The method as recited in claim **29** wherein said positioning step further comprises the steps of:

using positive pressure to provide said cushion of air when said web is being moved to said cutting station;

using negative pressure on said web of fabric during a predetermined event.

31. The method as recited in claim **30** wherein said predetermined event is at least one of said web of fabric being moved in a direction opposite a feeding direction of said web of fabric or cutting during said cutting step.

32. The method as recited in claim **29** wherein said method further comprises the step of:

using an air table comprising an air chamber in fluid communication with said working surface over which said web of fabric may move on said cushion of air, said working surface comprising a plurality of apertures for permitting airflow between said air chamber and said working surface.

33. The method as recited in claim **32** wherein said method further comprises the step of:

using at least one fan coupled to said air chamber for providing positive and negative pressure to said working surface of said air table in response to a position of said web of fabric.

34. The method as recited in claim **33** wherein said method further comprises the step of:

controlling operation of said at least one fan in order to apply positive pressure, and apply negative pressure exceeding the positive pressure during a predetermined event.

35. The method as recited in claim **34** wherein said predetermined event is at least one of said web of fabric is being positioned for cutting at said cutting station or cutting of said web of fabric occurs.

36. The method as recited in claim **33** wherein said method comprises the steps of:

using a first fan in fluid communication with said air chamber for providing said positive pressure to said working surface of said air table;

using a second fan in fluid communication with said air chamber for providing said negative pressure to said working surface of said air table;

wherein said negative pressure exceeds said positive pressure to hold said web of fabric during said cutting step.

37. The method as recited in claim **36** wherein said air table comprises a plurality of apertures, at least one of which being associated with said cutter, said negative pressure being sufficient to exhaust any fumes or debris created by said cutter.

38. The method as recited in claim **29** wherein said cutter comprises at least one laser.

39. The method as recited in claim **30** wherein said method comprises:

sensing a position of said web of fabric;

switching between said positive pressure and negative pressure in response thereto.

40. The method as recited in claim **29** wherein said method comprises the step of slitting the web of fabric to a predetermined width prior to said positioning and cutting steps.

41. The method as recited in claim **34** wherein said method comprises the step of:

controlling air pressure at said working surface to facilitate movement of said web of fabric thereover or to urge said web of fabric thereagainst.

42. The method as recited in claim **41** wherein said controlling step comprises the step of:

controlling the operation of at least one fan coupled to said air chamber to perform said controlling step.

43. The method as recited in claim **34** wherein said method comprises the step of:

causing said negative pressure when said web of fabric is driven in a direction opposite a feeding direction.

44. The method as recited in claim **34** wherein said cutter comprises at least one laser, said method comprising the step of:

causing said at least one laser to cut said web while said negative pressure is applied to said web, said working surface being adapted so that said negative pressure exhausts at least one of fumes and debris arising from said cutting and also urges the web of fabric against the working surface at the cutting station during cutting.

45. The method as recited in claim **29** wherein said method further comprises the steps of:

moving said web of fabric on said cushion of air past said cutting station;

causing negative pressure at said working surface to force said web of fabric against said working surface;

retracting said web of fabric against said negative pressure to said cutting station.

46. The method as recited in claim **45** wherein said cutting step further comprises the step of:

laser cutting said web of fabric during said negative pressure.

47. The method as recited in claim **45** wherein said cutter is a laser cutter and said working surface is adapted to receive fumes and/or debris caused by laser cutting, said step of causing negative pressure further comprising the step of:

causing negative pressure at said working surface sufficient to exhaust said fumes and/or debris.

48. The method as recited in claim **45** wherein said method further comprises the steps of:

sensing an end of said web of fabric;

causing negative pressure in response to said sensing of said end of said web of fabric.

49. The method as recited in claim **29** wherein said method comprises the step of:

applying adhesive directly to said web of fabric upstream of said air table.

50. The method as recited in claim **29** wherein said method comprises the step of:

pressing an adhesive into said web of fabric.

51. The method as recited in claim **29** wherein said cutting station comprises:

using a plurality of laser cutters to perform said cutting step.

52. The method as recited in claim **29** wherein said cutting station comprises:

driving at least one laser cutter in a direction that is transverse the direction of movement of said web to laser cut said web.

53. The method as recited in claim **52** wherein said method further comprise the step of:

cutting said web of fabric through at least one of a fabric side or a top surface thereof.

54. The method as recited in claim **52** wherein said at least one laser cutter cuts an angled beveled undercut or cut in said web of fabric that diverges away from a top surface of said web of fabric.

55. The method as recited in claim **52** wherein said at least one laser cutter cuts said web of fabric from a non-adhesive side of said web of fibers and after an adhesive is applied to an adhesive side.

56. The method as recited in claim **52** wherein said at least one laser cutter cuts said web of fibers to define at least one edge, said at least one edge lying in a plane that is not perpendicular with respect to either a non-adhesive side or an adhesive side.

57. The method as recited in claim **52** wherein said at least one laser cutter comprises a plurality of laser cutters that are driven in a path that is substantially perpendicular or transverse to a direction of said web of fabric to perform said cut.

58. The method as recited in claim **29** wherein said predetermined shape is a square.

59. The method as recited in claim **29** wherein said method further comprises the step of:

applying at least one removable indicia to a top surface of said covering, said removable indicia providing an indication of a nap of said web of fabric.

60. The method as recited in claim **29** wherein said covering defines a carpet tile.

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