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(12) United States Patent
Terrero et al.

(10) **Patent No.: US 12,053,973 B2**
(45) **Date of Patent: Aug. 6, 2024**

(54) **ACTIVE SHEET-EDGE AIRFLOW CONTROL FOR VACUUM CONVEYORS WITH MAGNET ASSIST**

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(73) Assignee: **Xerox Corporation**, Norwalk, CT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 188 days.

(21) Appl. No.: **17/815,724**

(22) Filed: **Jul. 28, 2022**

(65) **Prior Publication Data**

US 2023/0278352 A1 Sep. 7, 2023

Related U.S. Application Data

(63) Continuation-in-part of application No. 17/653,687, filed on Mar. 7, 2022, now Pat. No. 11,932,008, and a continuation-in-part of application No. 17/653,686, filed on Mar. 7, 2022.

(51) **Int. Cl.**
B41J 11/00 (2006.01)

(52) **U.S. Cl.**
CPC ***B41J 11/0085*** (2013.01)

(58) **Field of Classification Search**
CPC B41J 11/0085; B41J 11/06; B41J 11/007
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

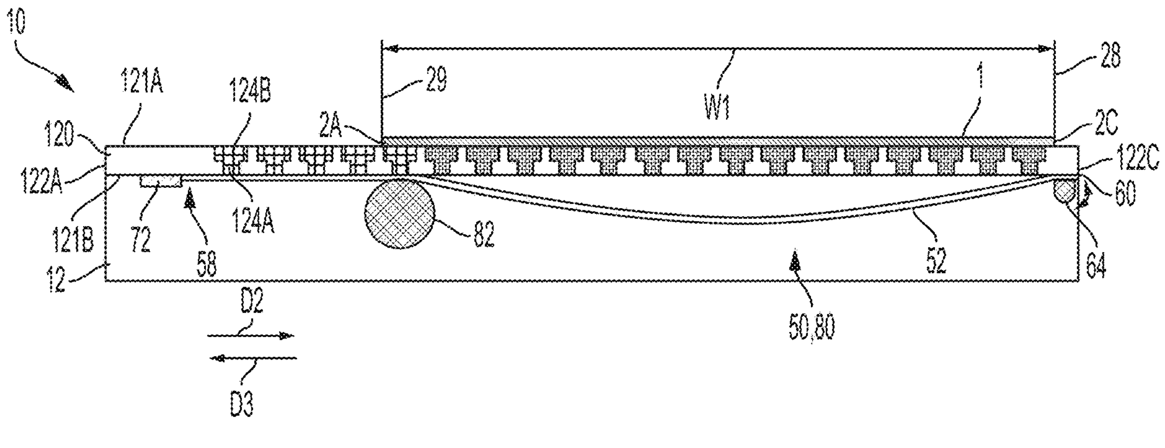
7,980,558	B2	7/2011	Moore et al.
8,157,369	B2	4/2012	Hoover et al.

Primary Examiner — Justin Seo
Assistant Examiner — Tracey M McMillion
(74) *Attorney, Agent, or Firm* — Simpson & Simpson, PLLC

(57) **ABSTRACT**

A valve assembly for controlling airflow along sheet edges on a vacuum transport assembly, the valve assembly including a flexible plate, including a first end, a second end, a first top surface, and a first bottom surface, and a first actuator connected to the second end and operatively arranged to displace the flexible plate. Added is at least one magnet member designed to assist in controlling the valve assembly.

20 Claims, 43 Drawing Sheets



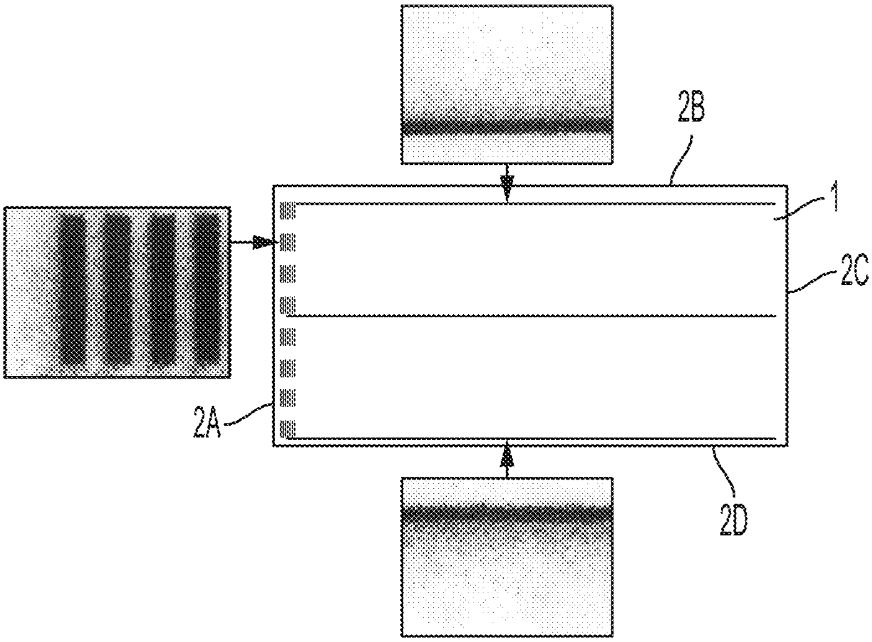


FIG. 1

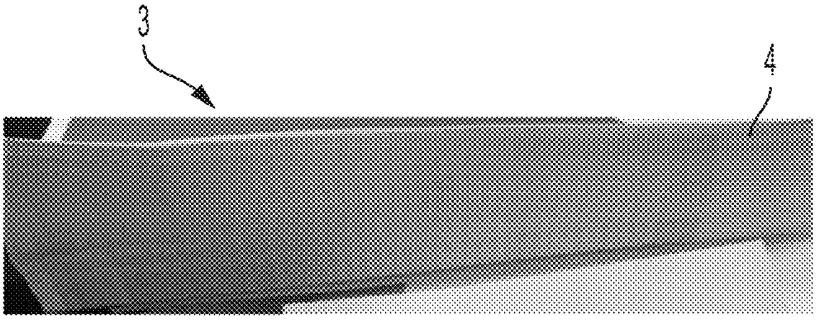


FIG. 2

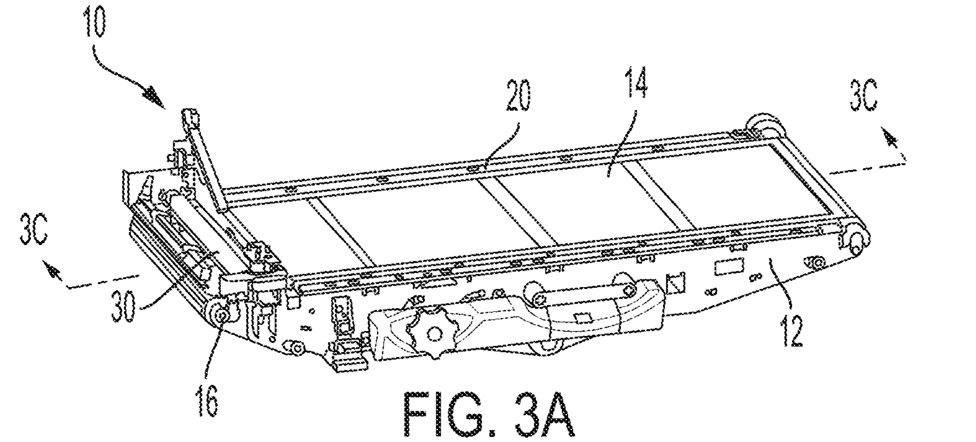

10
20
14
3C
3C
30
16
12

FIG. 3A

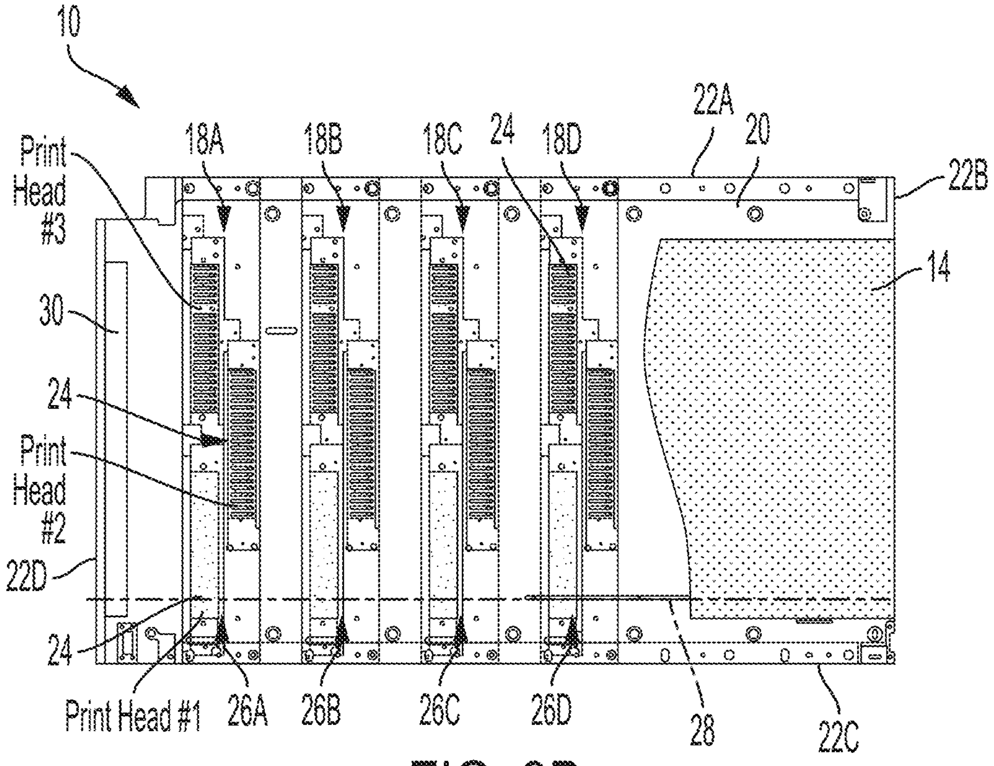

10
Print Head #3
18A
18B
18C
24
18D
22A
20
22B
14
30
24
Print Head #2
22D
24
Print Head #1
26A
26B
26C
26D
28
22C

FIG. 3B

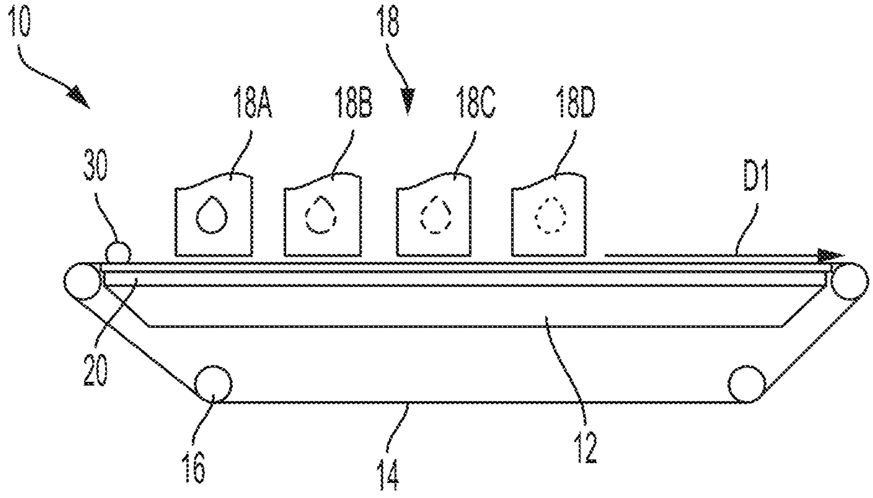

10
18
18A
18B
18C
18D
30
D1
20
16
14
12

FIG. 3C

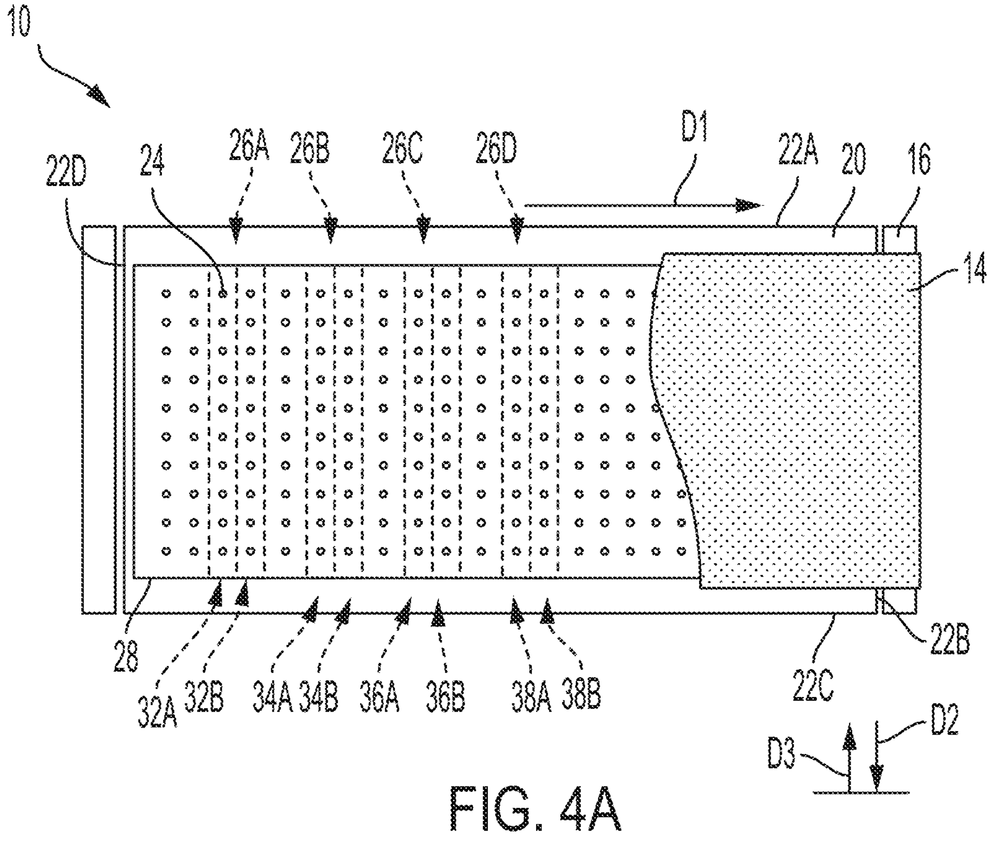

10
22D
24
26A
26B
26C
26D
D1
22A
20
16
14
28
32A
32B
34A
34B
36A
36B
38A
38B
22C
22B
D3
D2

FIG. 4A

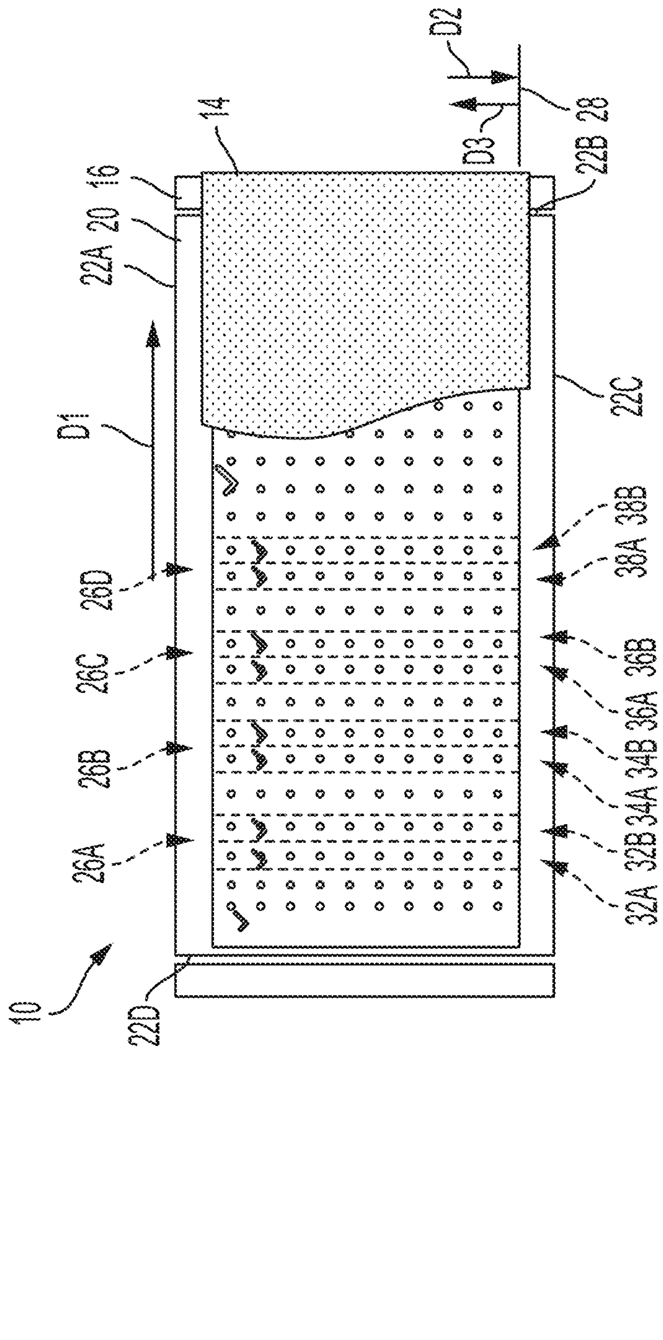

10
22D
26A
26B
26C
26D
D1
22A
20
16
14
D3
D2
22B
28
22C
38B
38A
36B
36A
34B
34A
32B
32A

FIG. 4B

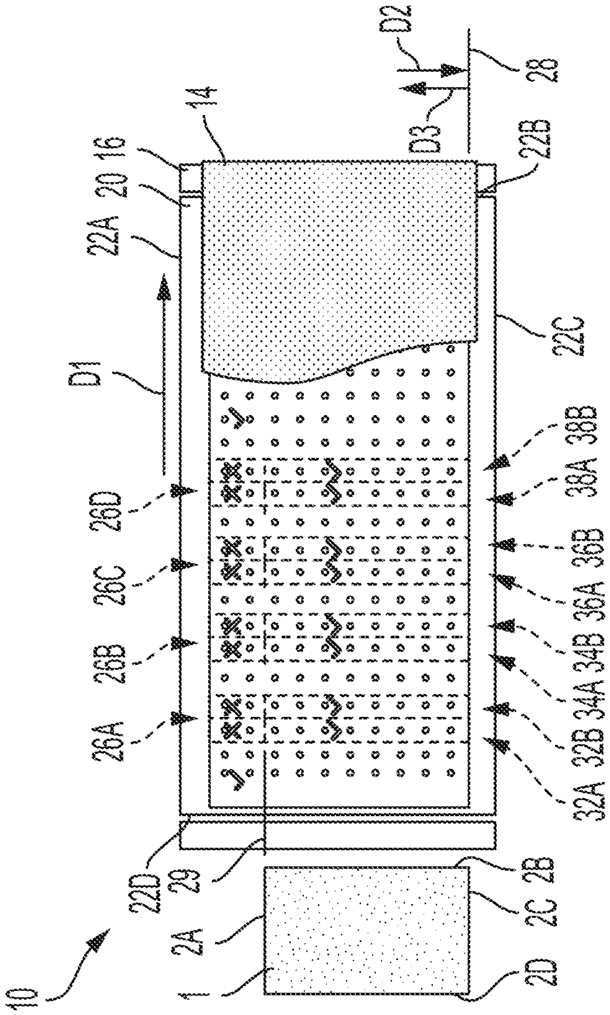
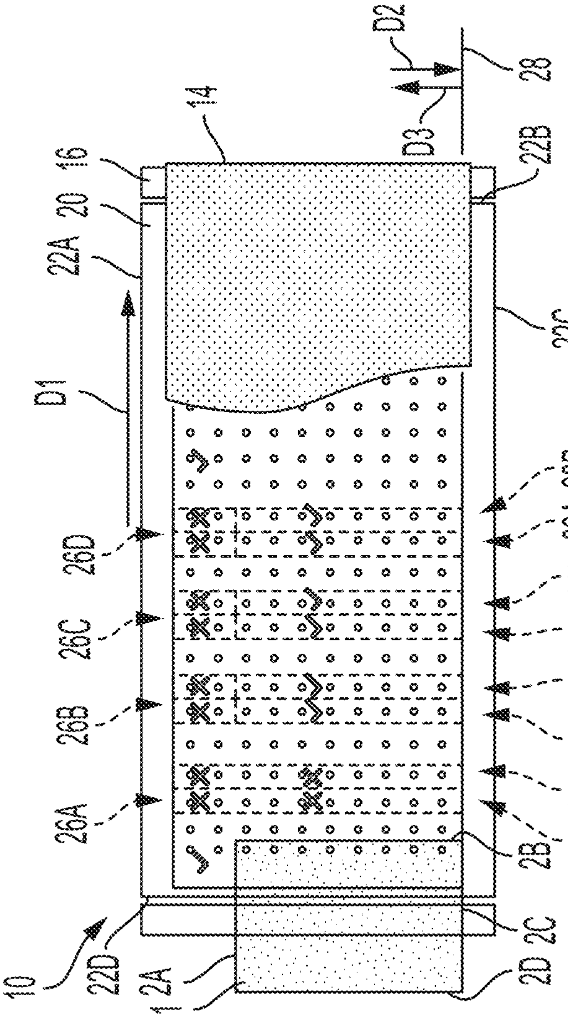
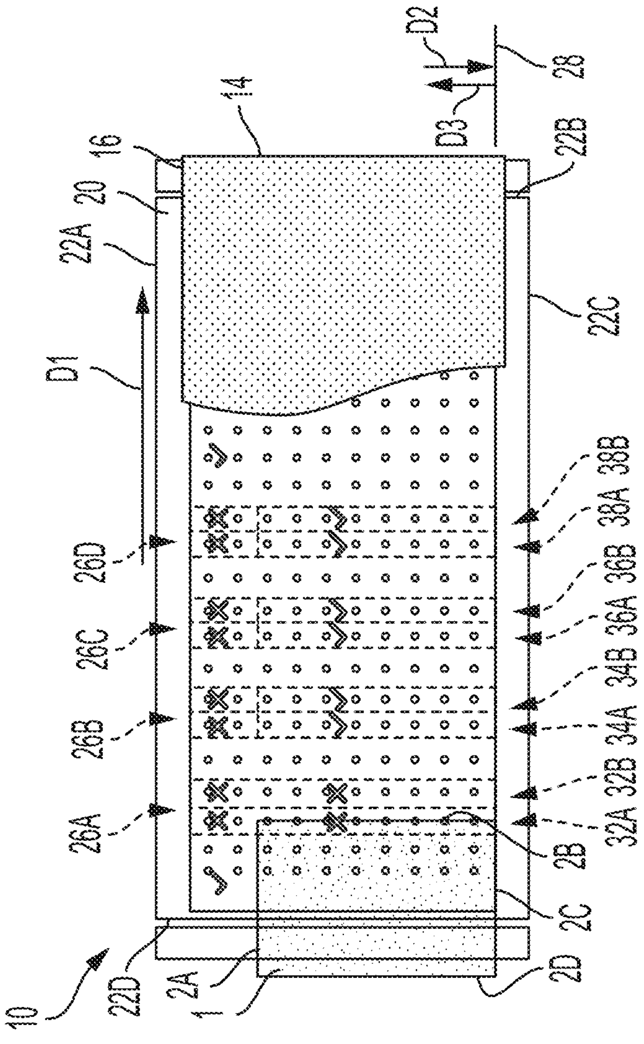

10
1
2A
2B
2C
2D
22D
29
26A
26B
26C
26D
D1
22A
20
16
14
D2
D3
28
22B
22C
32A
32B
34A
34B
36A
36B
38A
38B

FIG. 4C



10
22D
2A
1
2D
2C
2B
32A
32B
34A
34B
36A
36B
38A
38B
26A
26B
26C
26D
D1
22A
20
16
14
D3
D2
28
22B
22C

FIG. 4D



10
22D
2A
1
2D
2C
2B
26A
26B
26C
26D
D1
22A
20
16
14
D3
D2
28
22B
22C
32A
32B
34A
34B
36A
36B
38A
38B

FIG. 4E

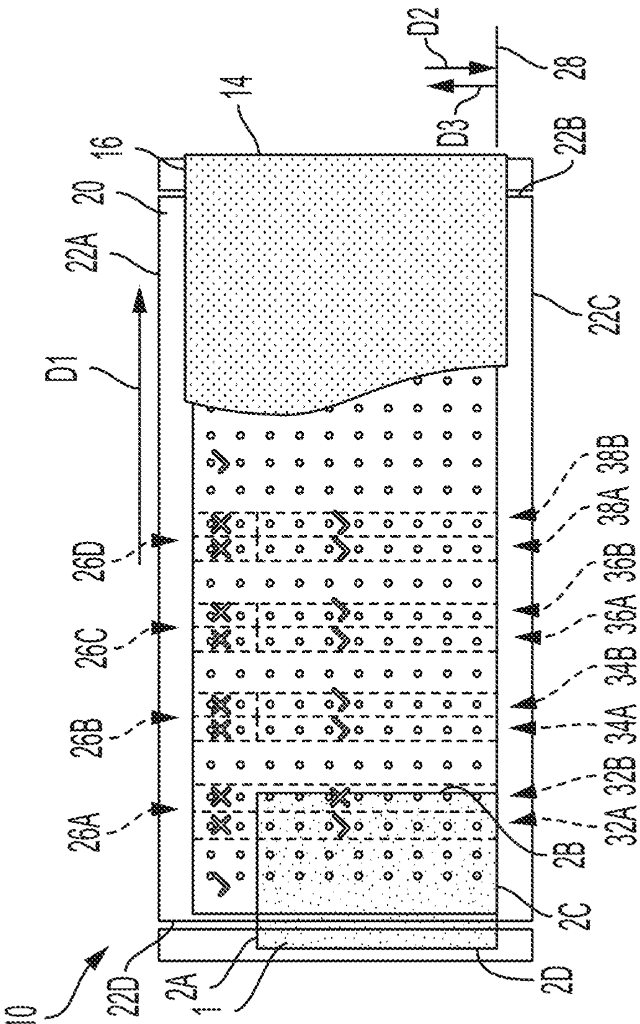

10
22D
2A
1
2D
2C
2B
26A
26B
26C
26D
D1
22A
20
16
14
D2
D3
28
22B
22C
32A
32B
34A
34B
36A
36B
38A
38B

FIG. 4F

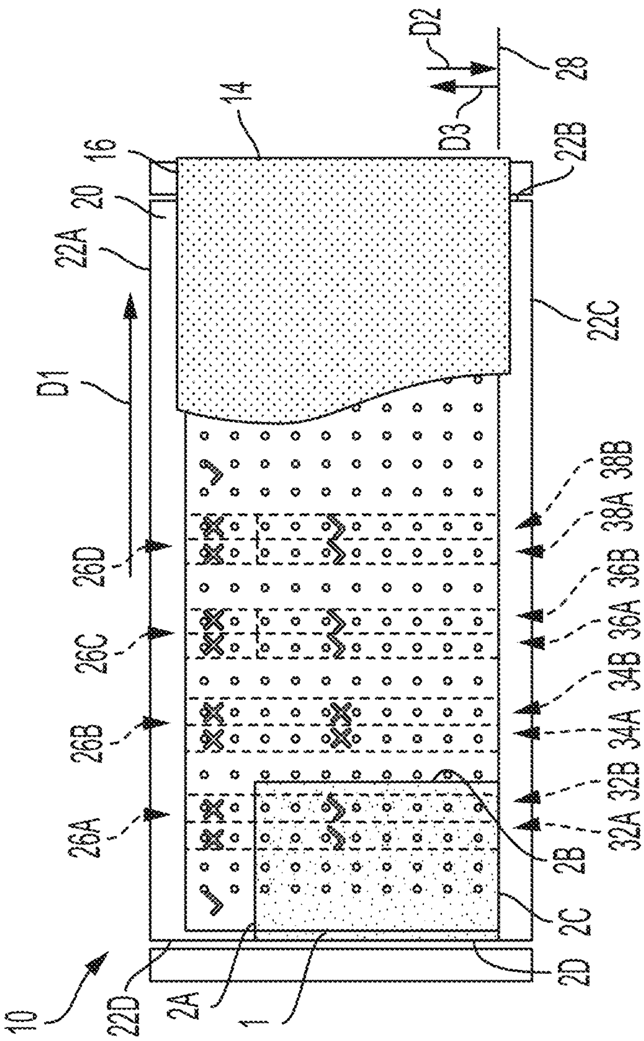

10
22D
2A
1
2D
2C
2B
26A
26B
26C
26D
D1
22A
20
16
14
D3
D2
28
22B
22C
32A
32B
34A
34B
36A
36B
38A
38B

FIG. 4G

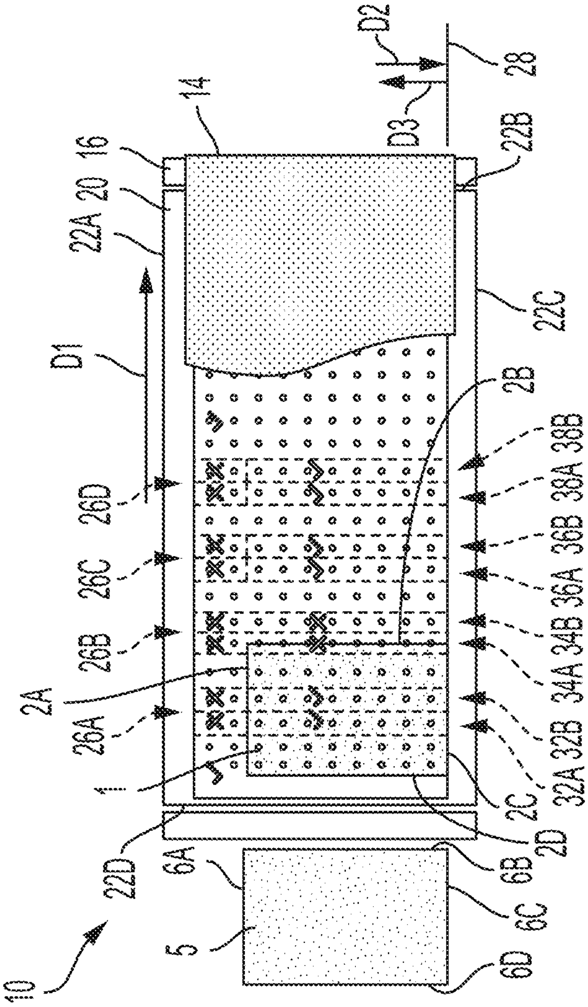
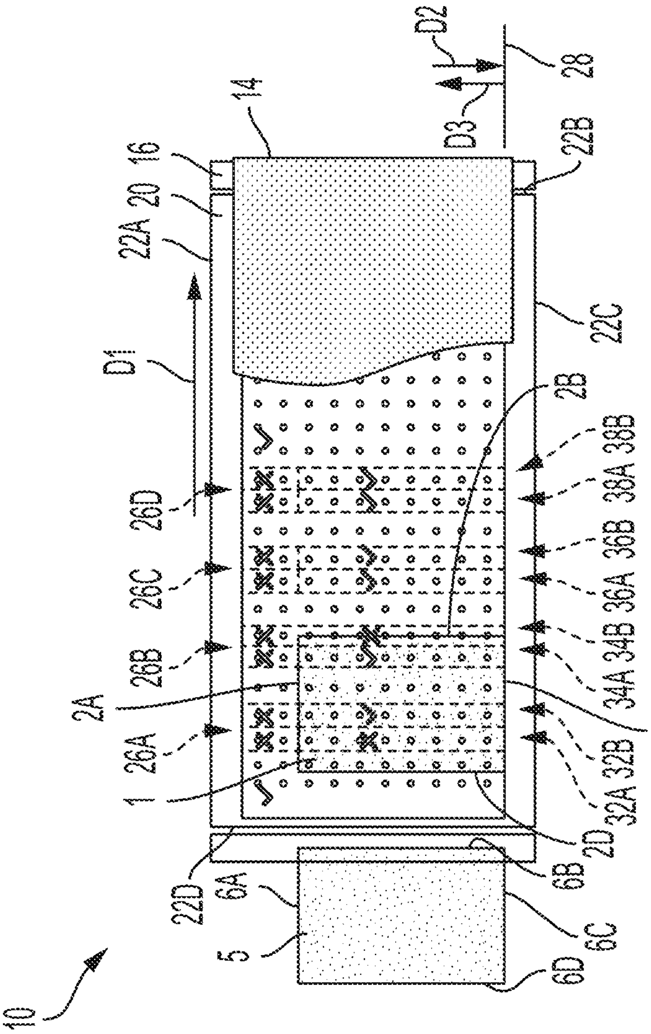
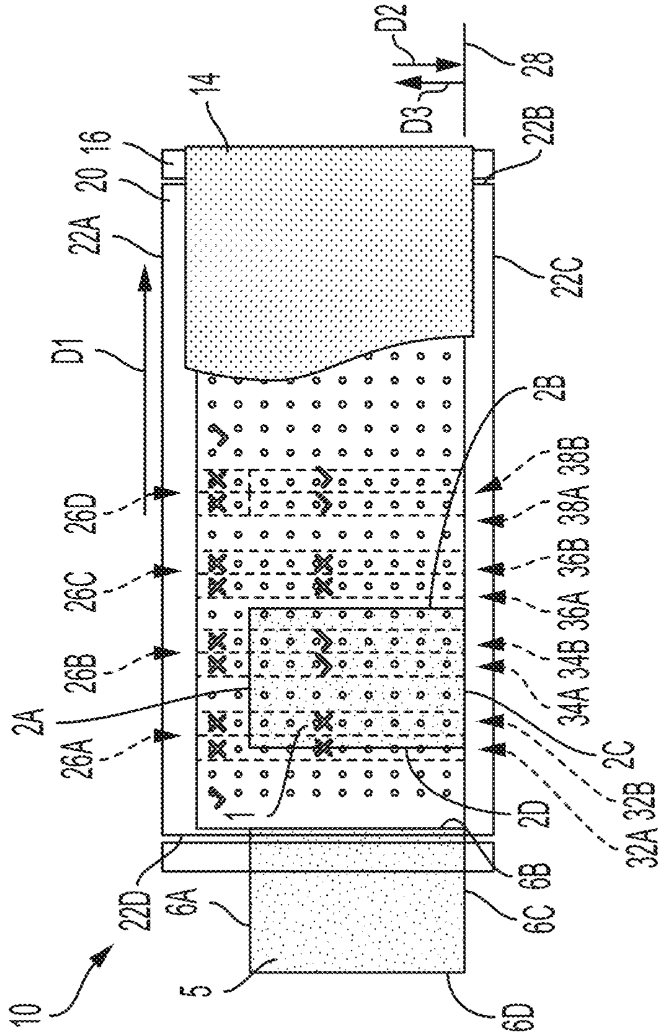

10
22D
6A
5
6B
6C
6D
1
2A
26A
26B
26C
26D
D1
22A
20
16
14
D3
D2
28
22B
22C
2B
38B
38A
36B
36A
34B
34A
32B
32A
2C
2D

FIG. 4H



10
5
6A
6B
6C
6D
22D
2D
1
2A
2B
2C
26A
26B
26C
26D
D1
22A
20
16
14
22B
22C
28
D2
D3
32A
32B
34A
34B
36A
36B
38A
38B

FIG. 4I



10
22D
6A
5
6D
6C
6B
2D
32A
32B
2C
34A
34B
36A
36B
38A
38B
2B
2A
1
26A
26B
26C
26D
D1
22A
20
16
14
D3
D2
28
22B
22C

FIG. 4J

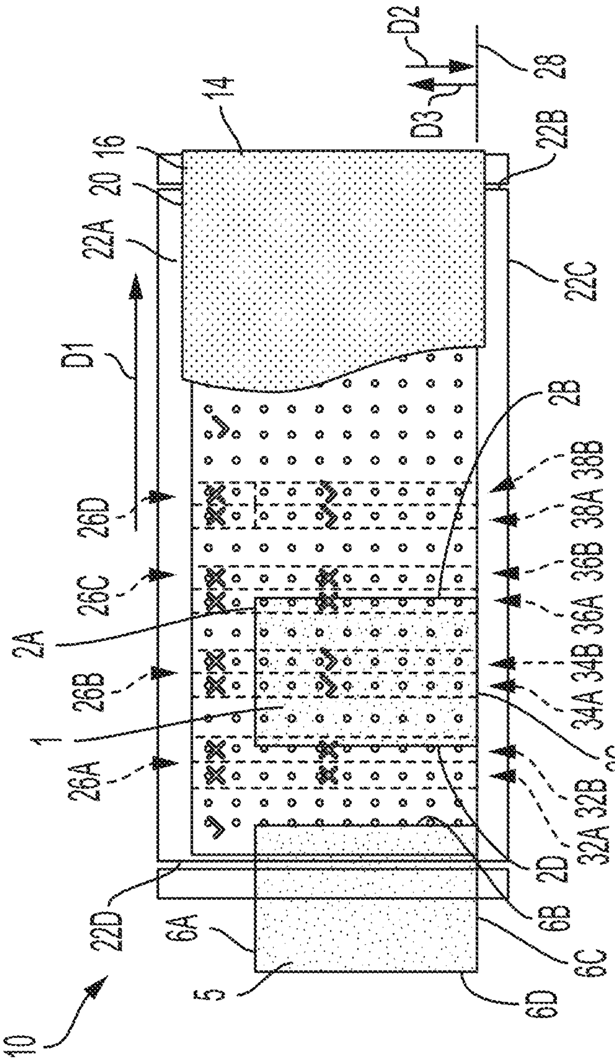

10
5
6A
6B
6C
6D
22A
22B
22C
22D
20
16
14
28
D1
D2
D3
26A
26B
26C
26D
1
2A
2B
2C
2D
32A
32B
34A
34B
36A
36B
38A
38B

FIG. 4K

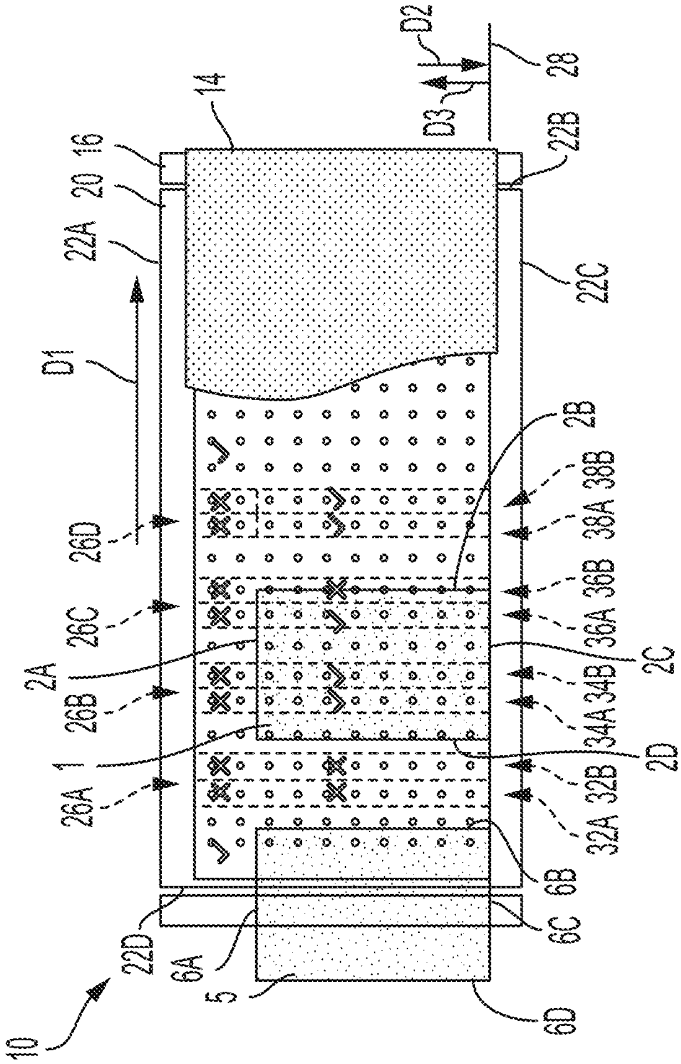

10
5
6A
6B
6C
6D
22A
22B
22C
22D
20
16
14
D1
D2
D3
28
1
2A
2B
2C
2D
26A
26B
26C
26D
32A
32B
34A
34B
36A
36B
38A
38B

FIG. 4L

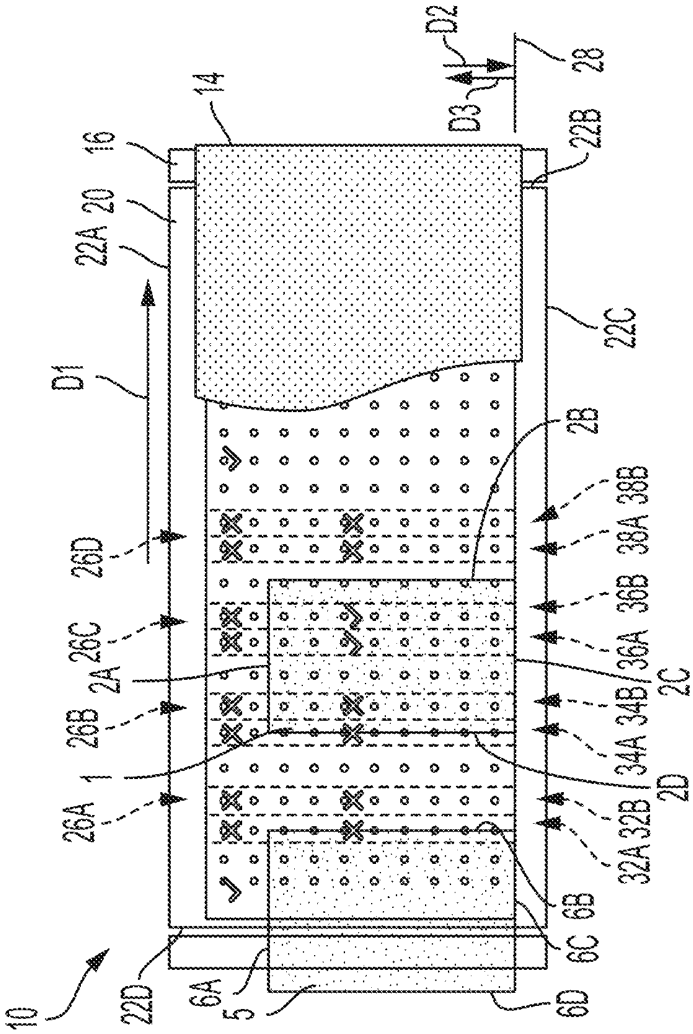

10
14
16
20
22A
22B
22C
22D
28
D1
D2
D3
26A
26B
26C
26D
1
2A
2B
2C
2D
5
6A
6B
6C
6D
32A
32B
34A
34B
36A
36B
38A
38B

FIG. 4M

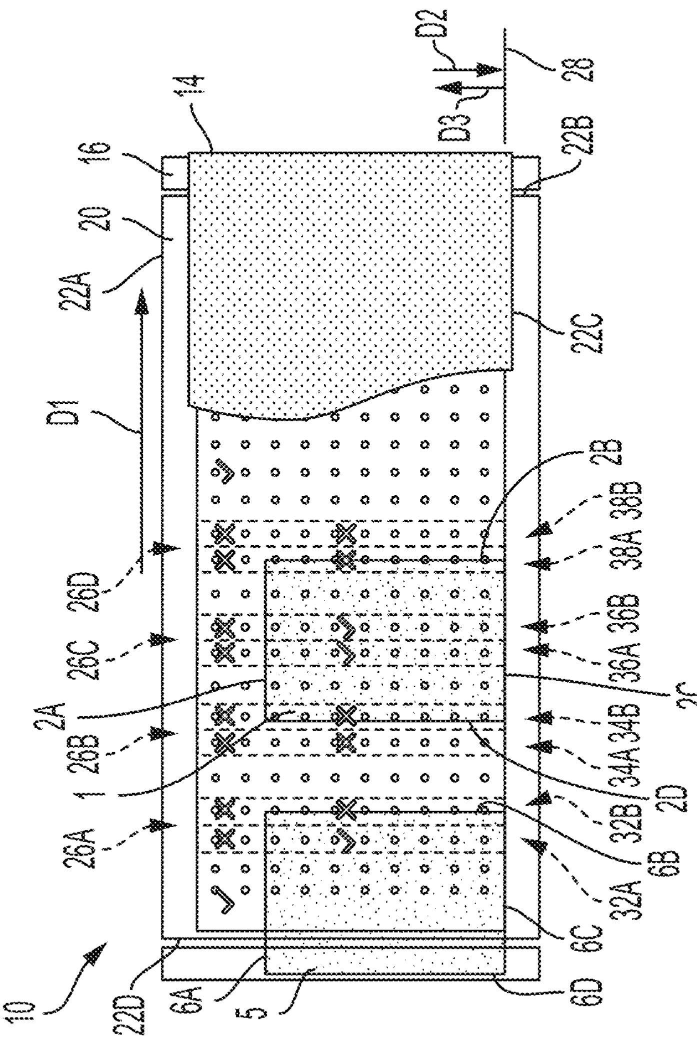

10
22D
6A
5
6D
6C
26A
1
26B
2A
26C
26D
D1
22A
20
16
14
D3
D2
28
22B
22C
2B
38B
38A
36B
36A
2C
34B
34A
2D
32B
6B
32A

FIG. 4N

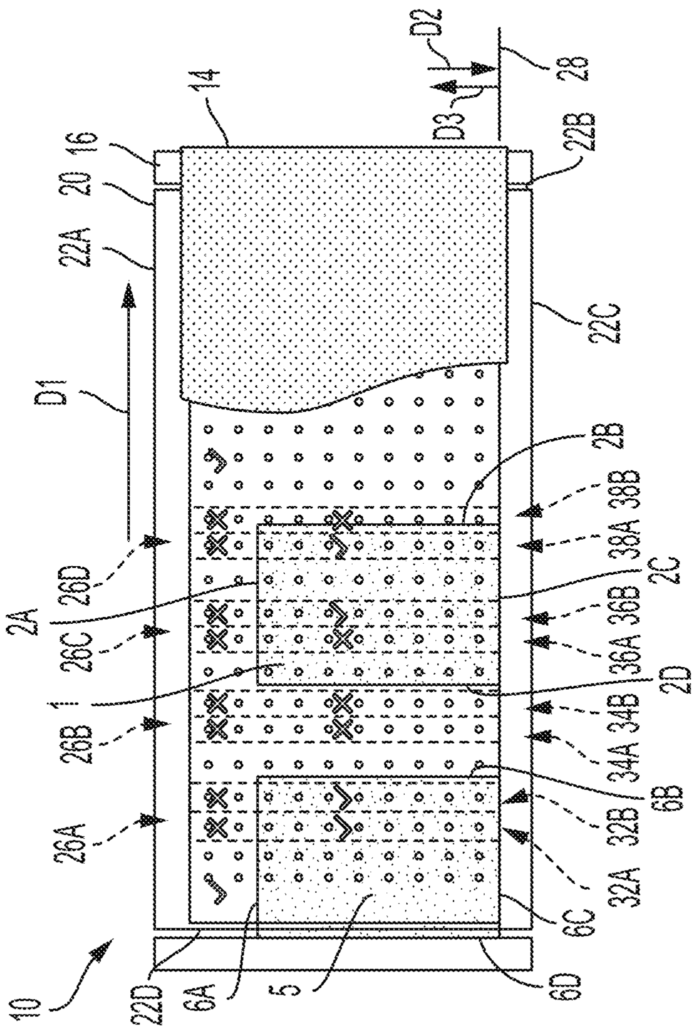

10
22D
6A
5
6D
6C
26A
26B
26C
26D
2A
1
D1
22A
20
16
14
D3
D2
2B
22B
22C
2B
38B
38A
2C
36B
36A
2D
34B
34A
6B
32B
32A

FIG. 4O

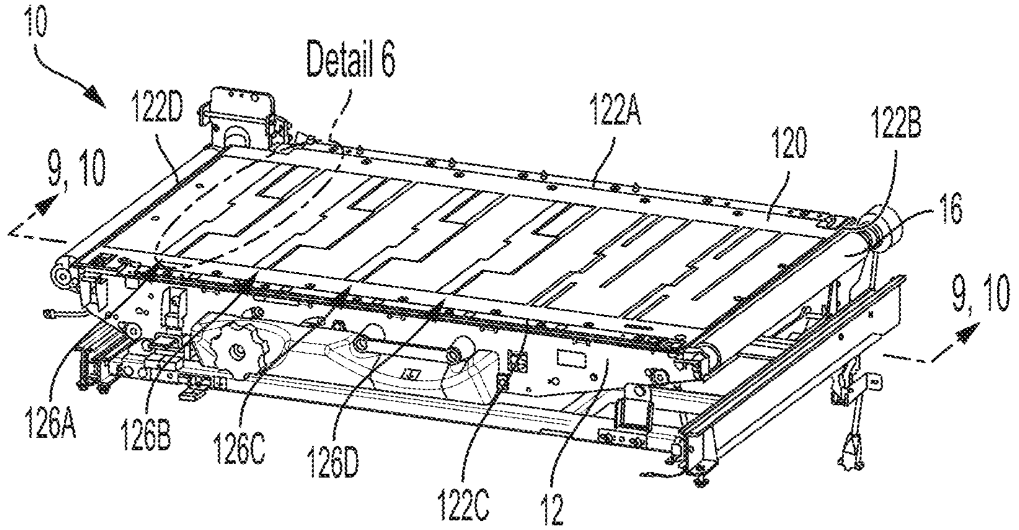

10
Detail 6
122D
122A
120
122B
16
9, 10
9, 10
126A
126B
126C
126D
122C
12

FIG. 5

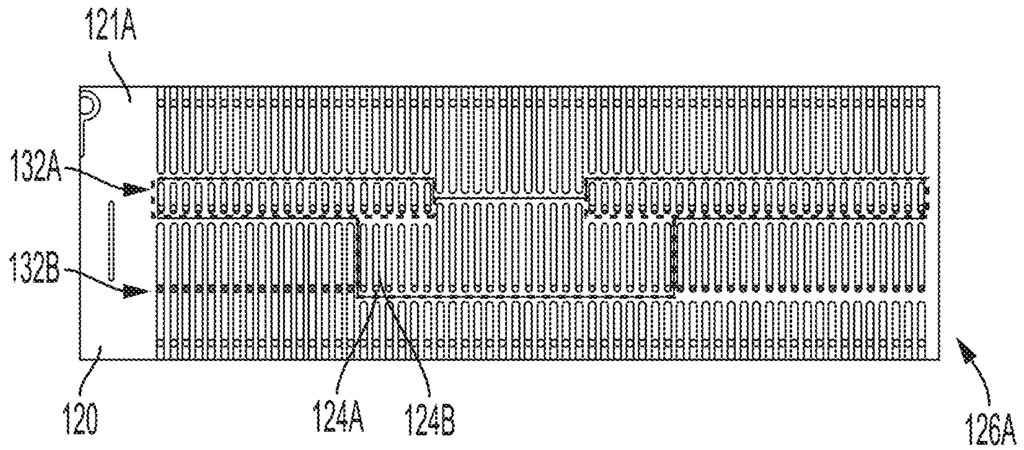

121A
132A
132B
120
124A
124B
126A

FIG. 6

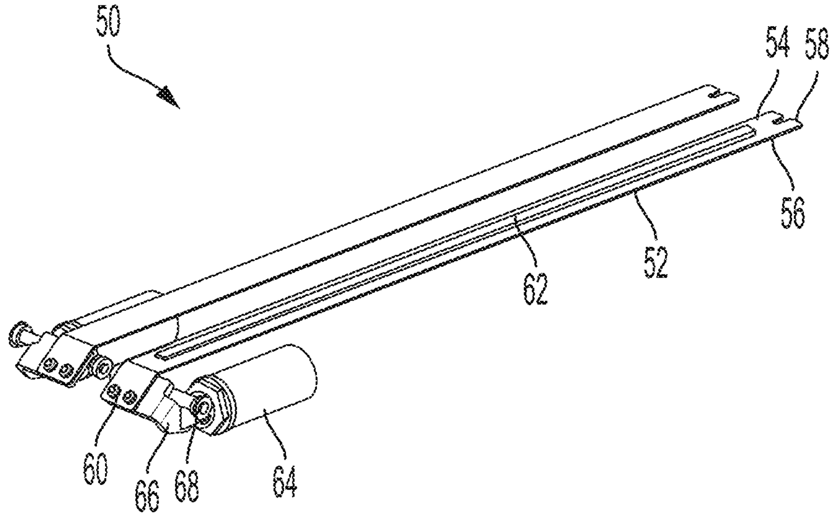


FIG. 7

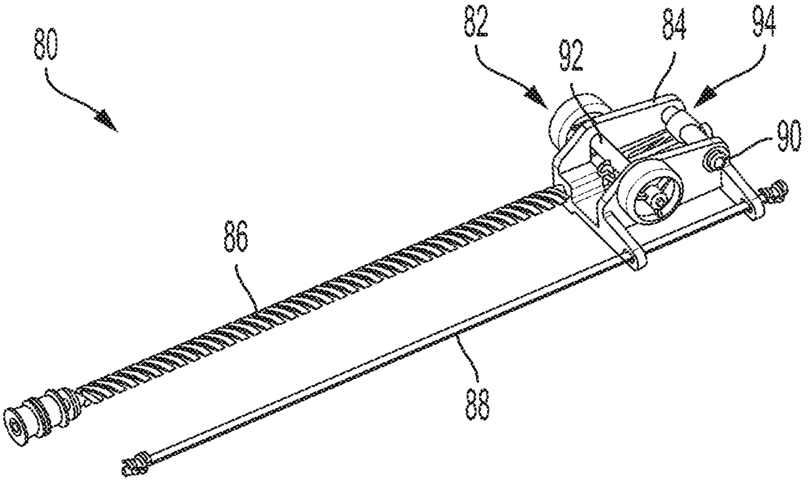


FIG. 8

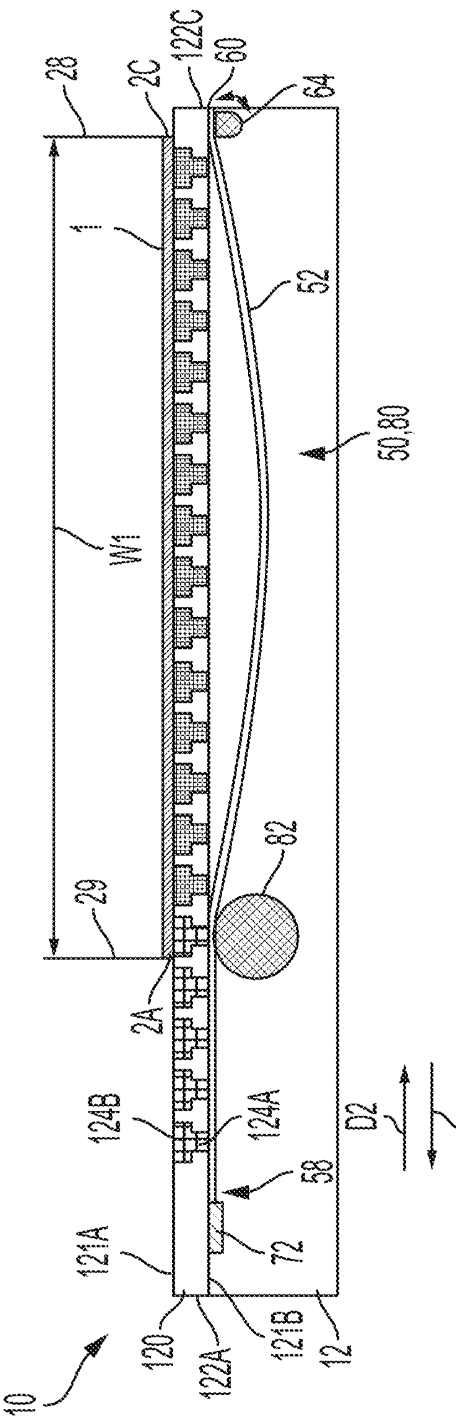
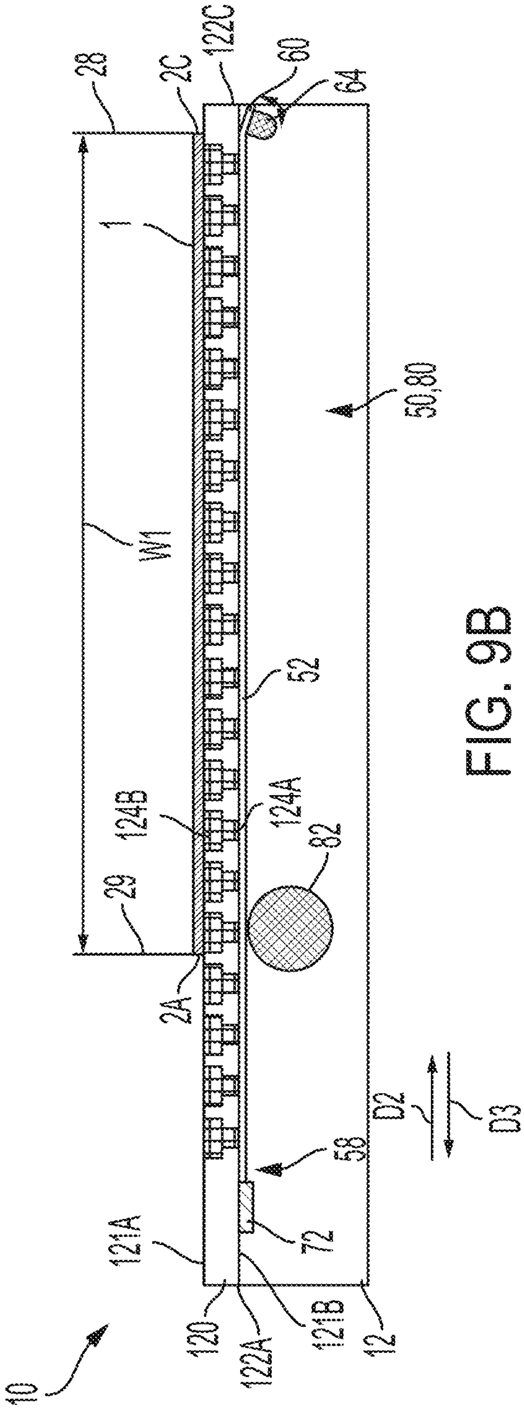

28
2C
122C
60
64
1
52
50,80
W1
82
29
2A
124B
124A
D2
D3
58
121A
72
120
122A
121B
12
10

FIG. 9A



28
2C
122C
60
64
1
50,80
W1
52
124B
124A
82
29
2A
D2
D3
58
72
121A
120
122A
121B
12
10

FIG. 9B

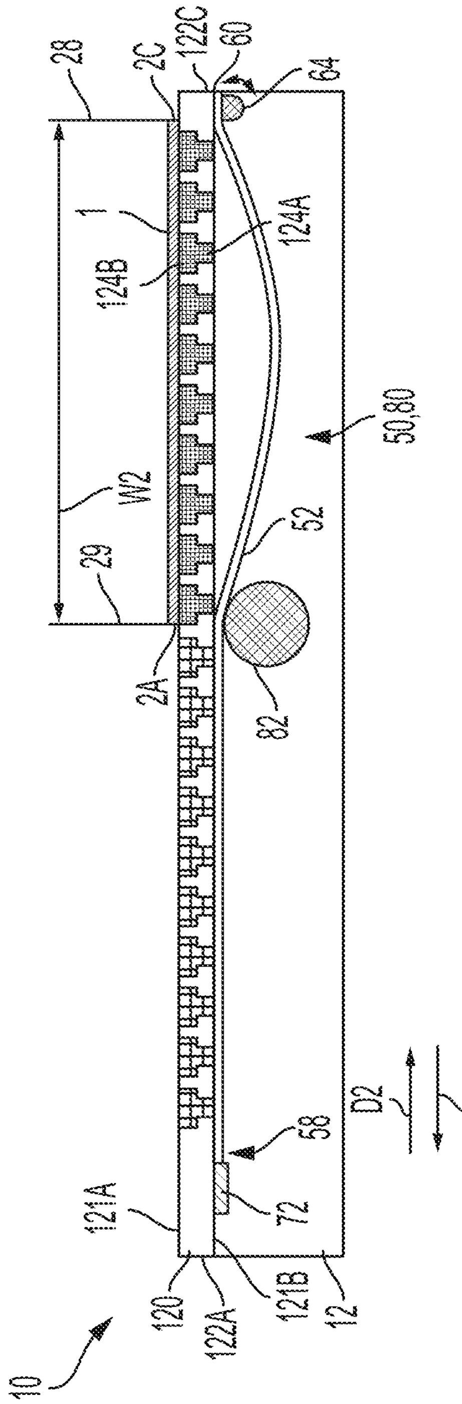

28
2C
122C
60
64
1
124B
124A
W2
29
50,80
52
2A
82
D2
D3
58
121A
72
120
122A
121B
12
10

FIG. 10A

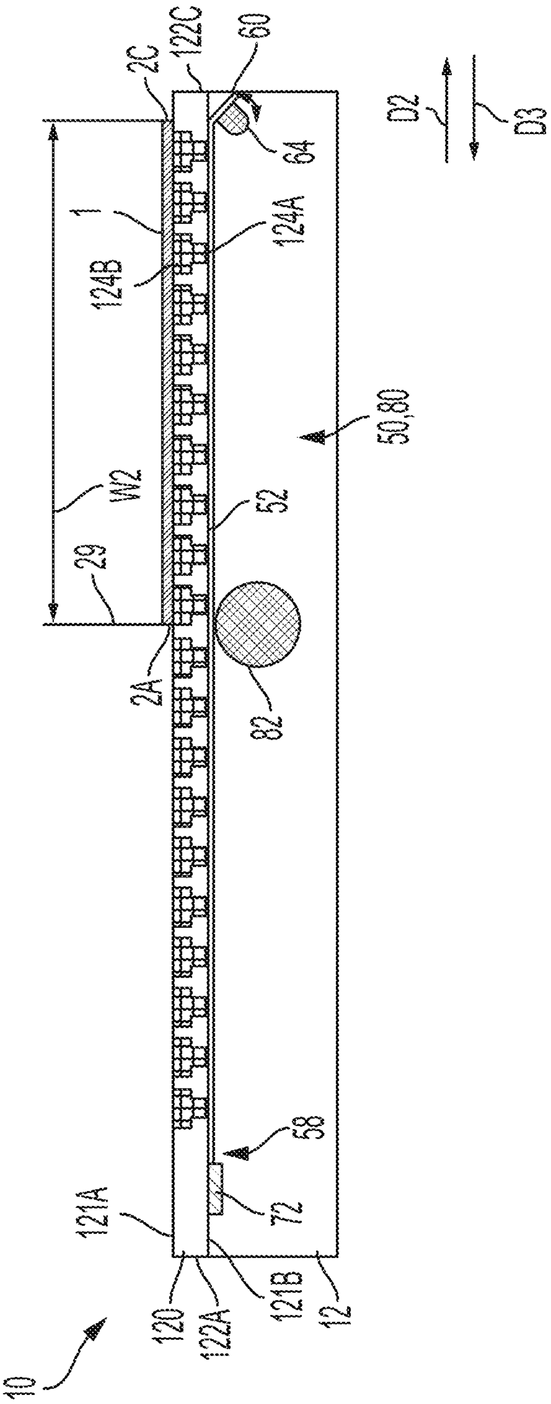

2C
122C
60
64
D2
D3
1
124A
124B
50,80
W2
52
29
2A
82
58
121A
72
120
122A
121B
12
10

FIG. 10B

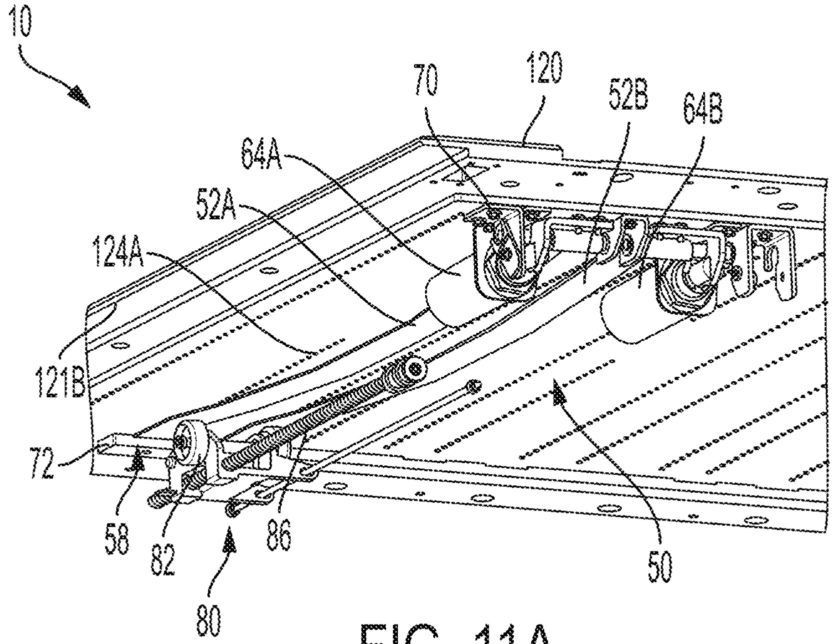


FIG. 11A

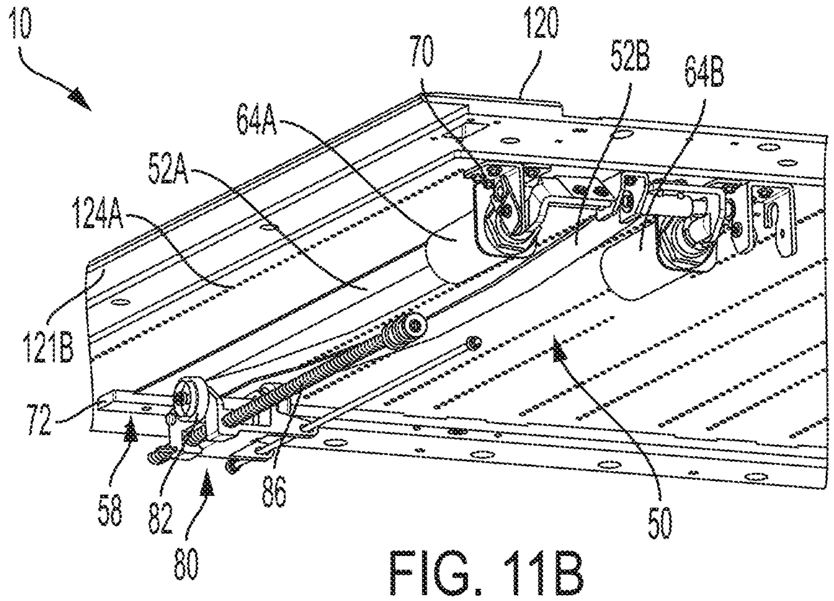


FIG. 11B

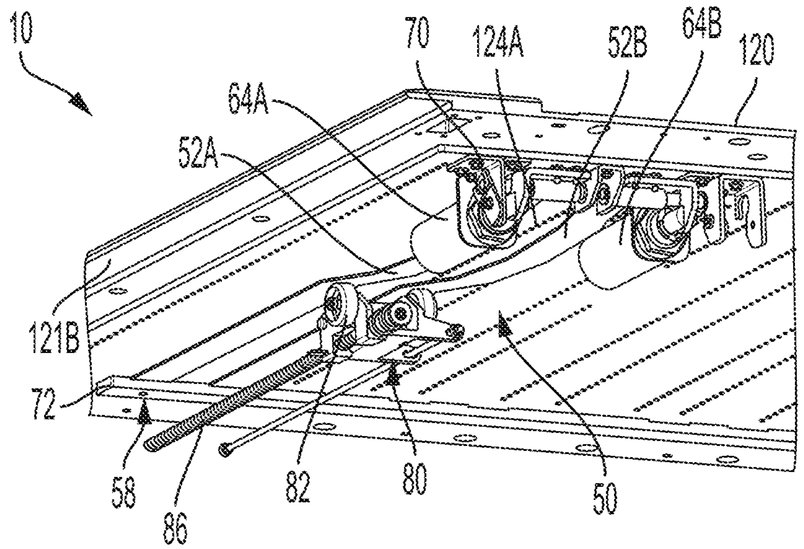


FIG. 12A

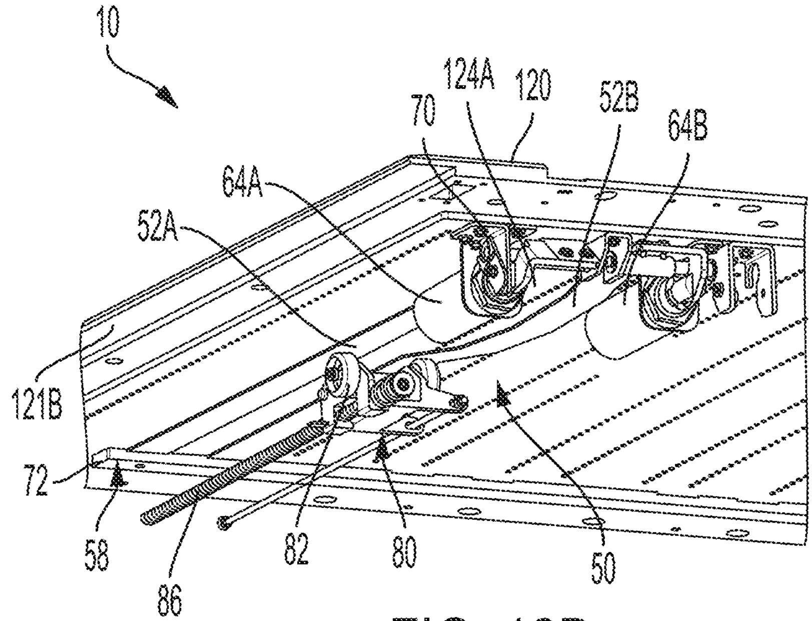


FIG. 12B

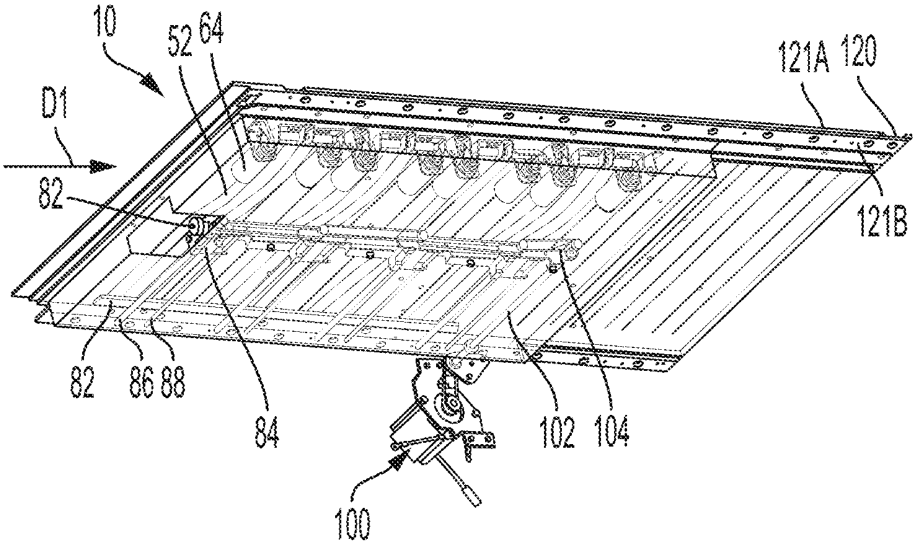


FIG. 13

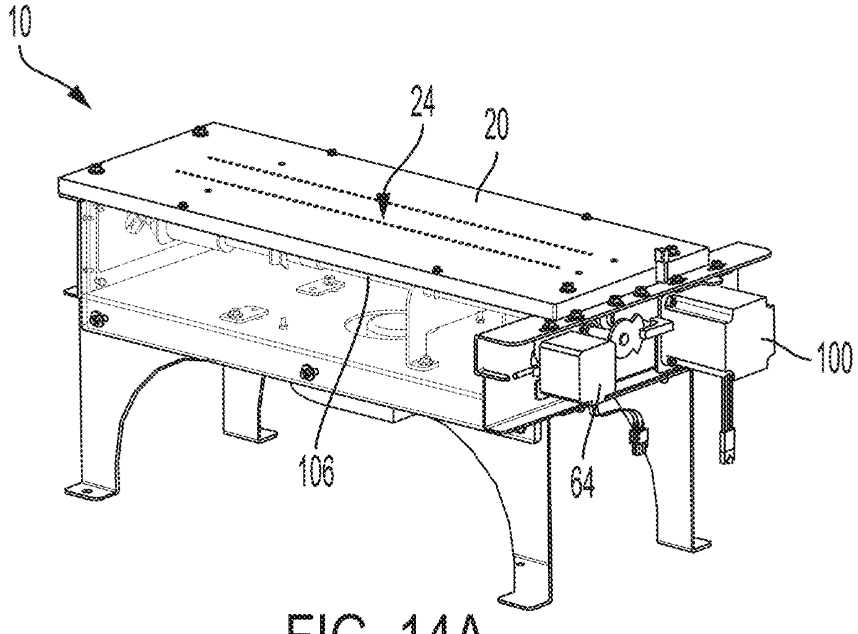


FIG. 14A

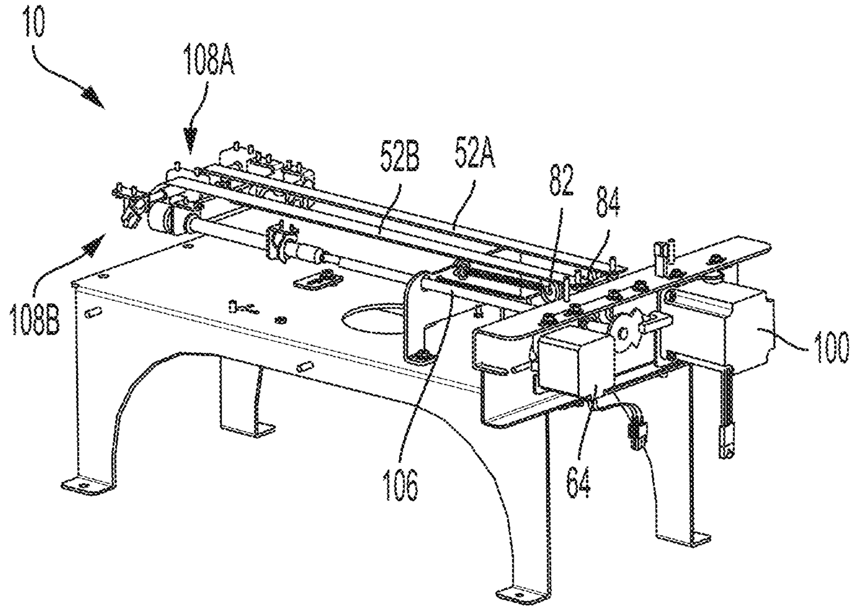


FIG. 14B

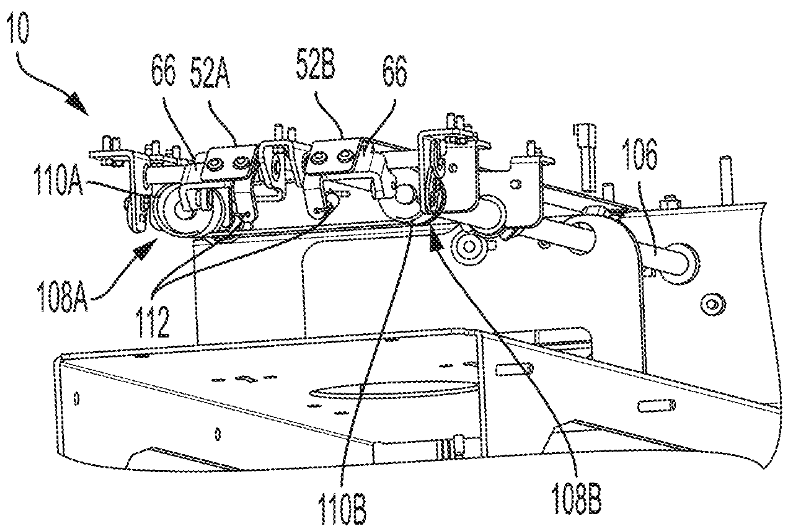


FIG. 15A

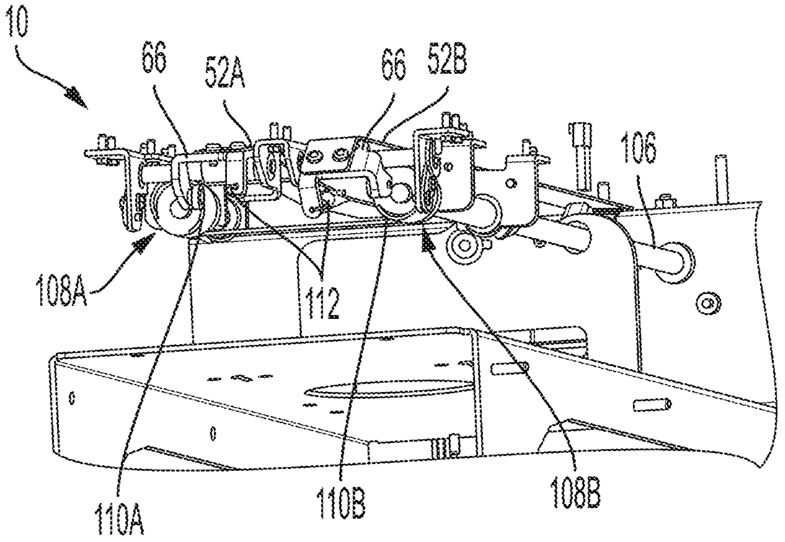


FIG. 15B

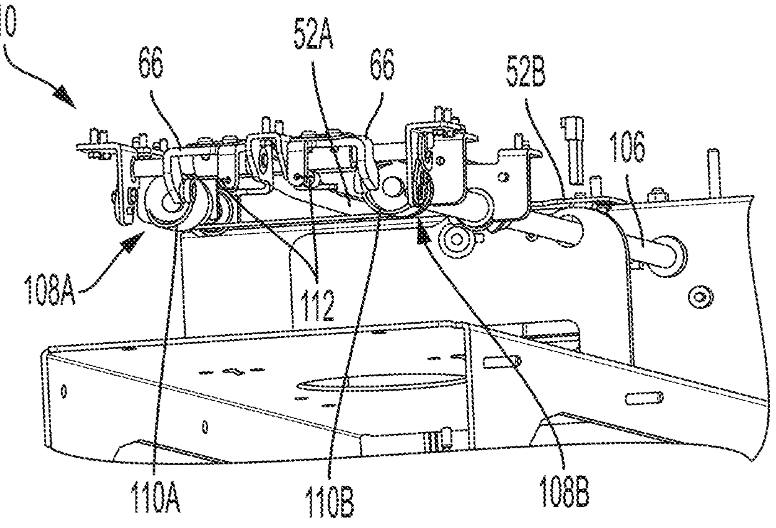


FIG. 15C

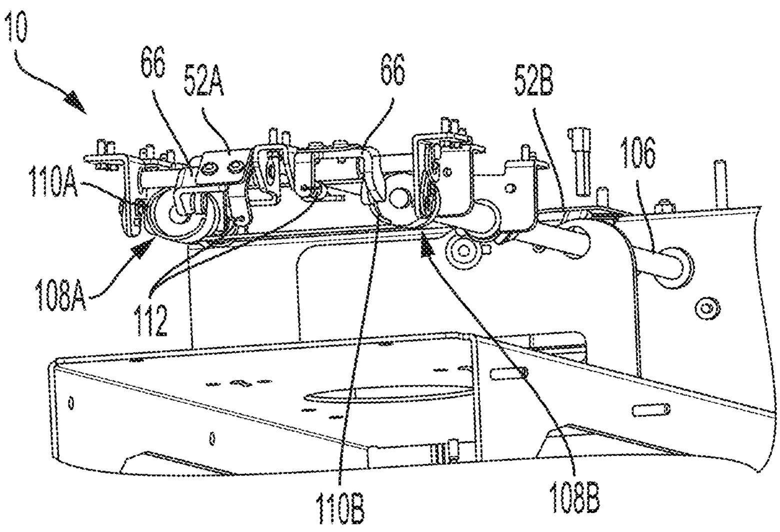


FIG. 15D

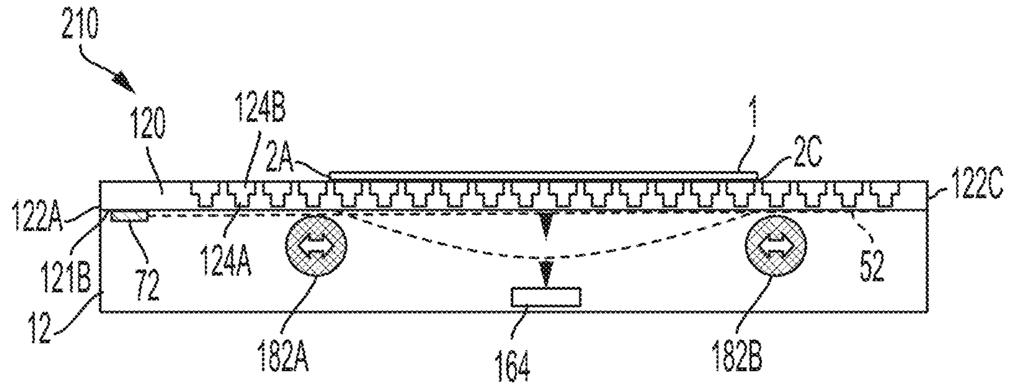


FIG. 16

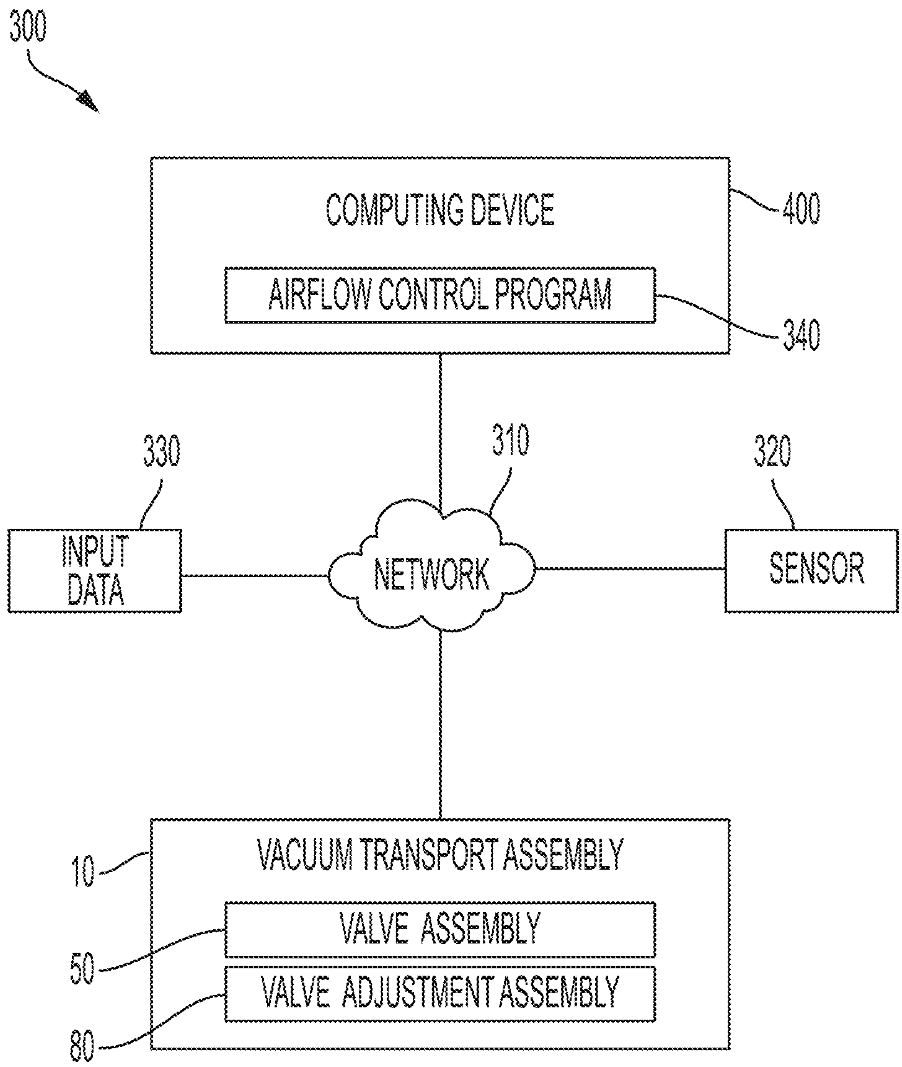

300
COMPUTING DEVICE
AIRFLOW CONTROL PROGRAM
400
340
330
310
320
INPUT DATA
NETWORK
SENSOR
VACUUM TRANSPORT ASSEMBLY
VALVE ASSEMBLY
VALVE ADJUSTMENT ASSEMBLY
10
50
80

FIG. 17

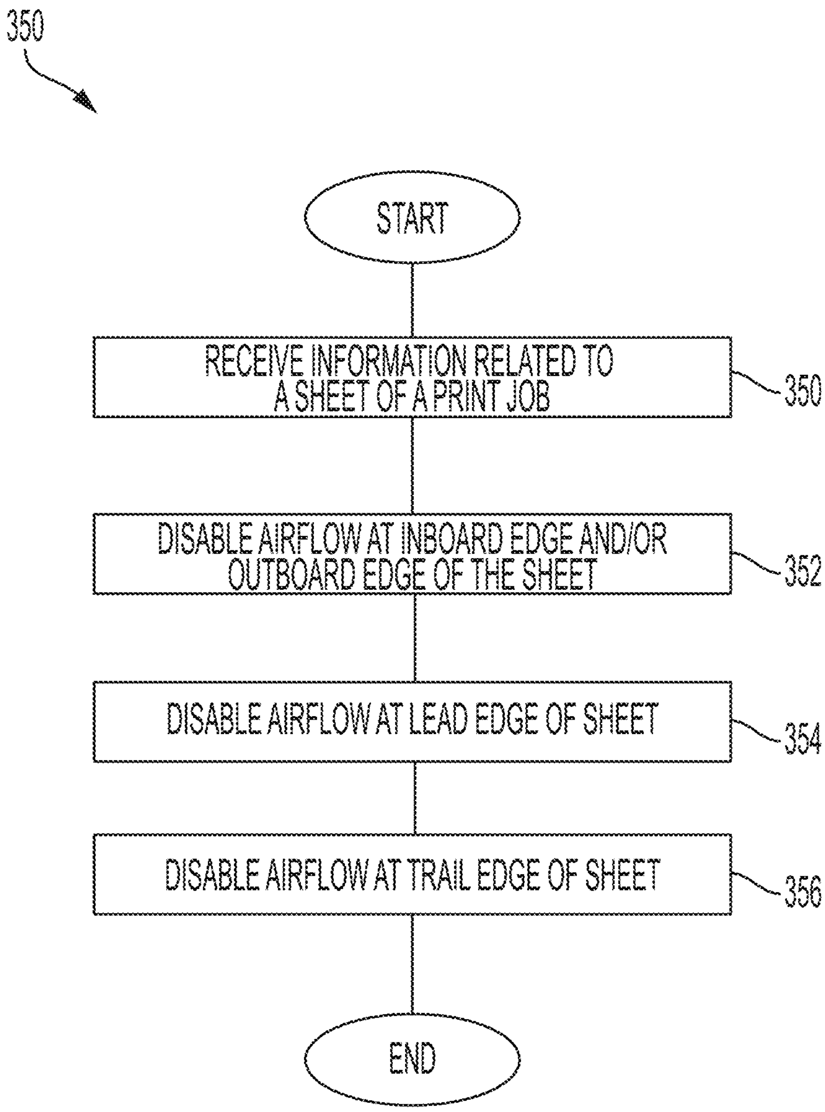
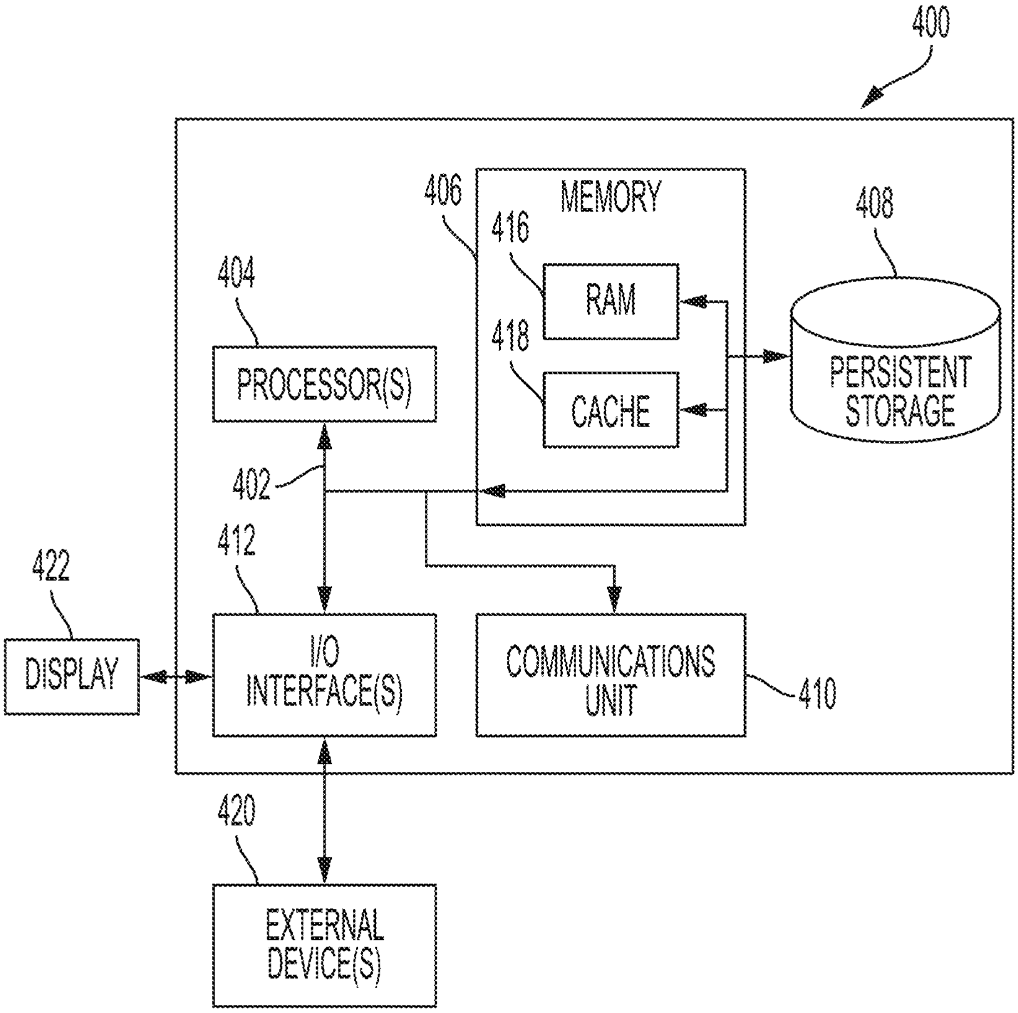

350
START
RECEIVE INFORMATION RELATED TO A SHEET OF A PRINT JOB
350
DISABLE AIRFLOW AT INBOARD EDGE AND/OR OUTBOARD EDGE OF THE SHEET
352
DISABLE AIRFLOW AT LEAD EDGE OF SHEET
354
DISABLE AIRFLOW AT TRAIL EDGE OF SHEET
356
END

FIG. 18



400
406
MEMORY
416
RAM
418
CACHE
408
PERSISTENT STORAGE
404
PROCESSOR(S)
402
412
422
DISPLAY
I/O INTERFACE(S)
COMMUNICATIONS UNIT
410
420
EXTERNAL DEVICE(S)

FIG. 19

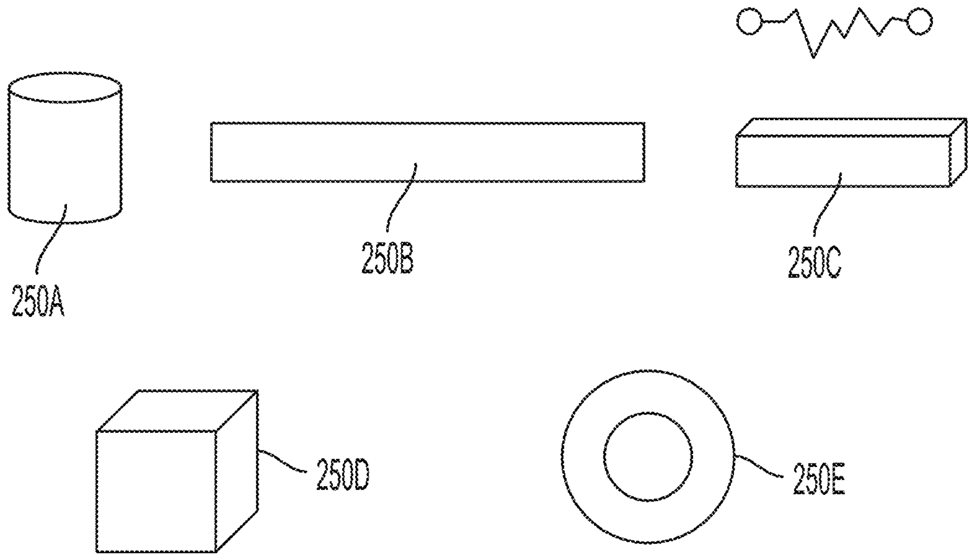


FIG. 20

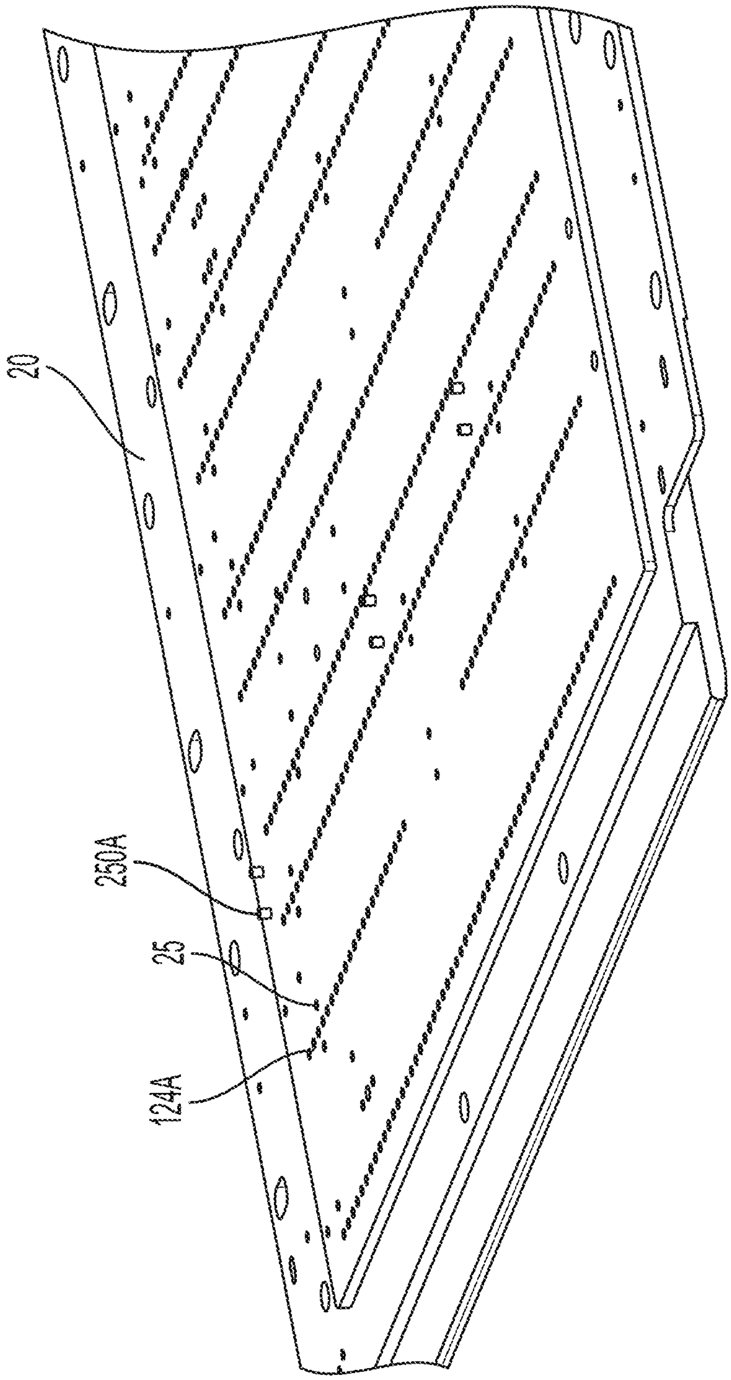


FIG. 21

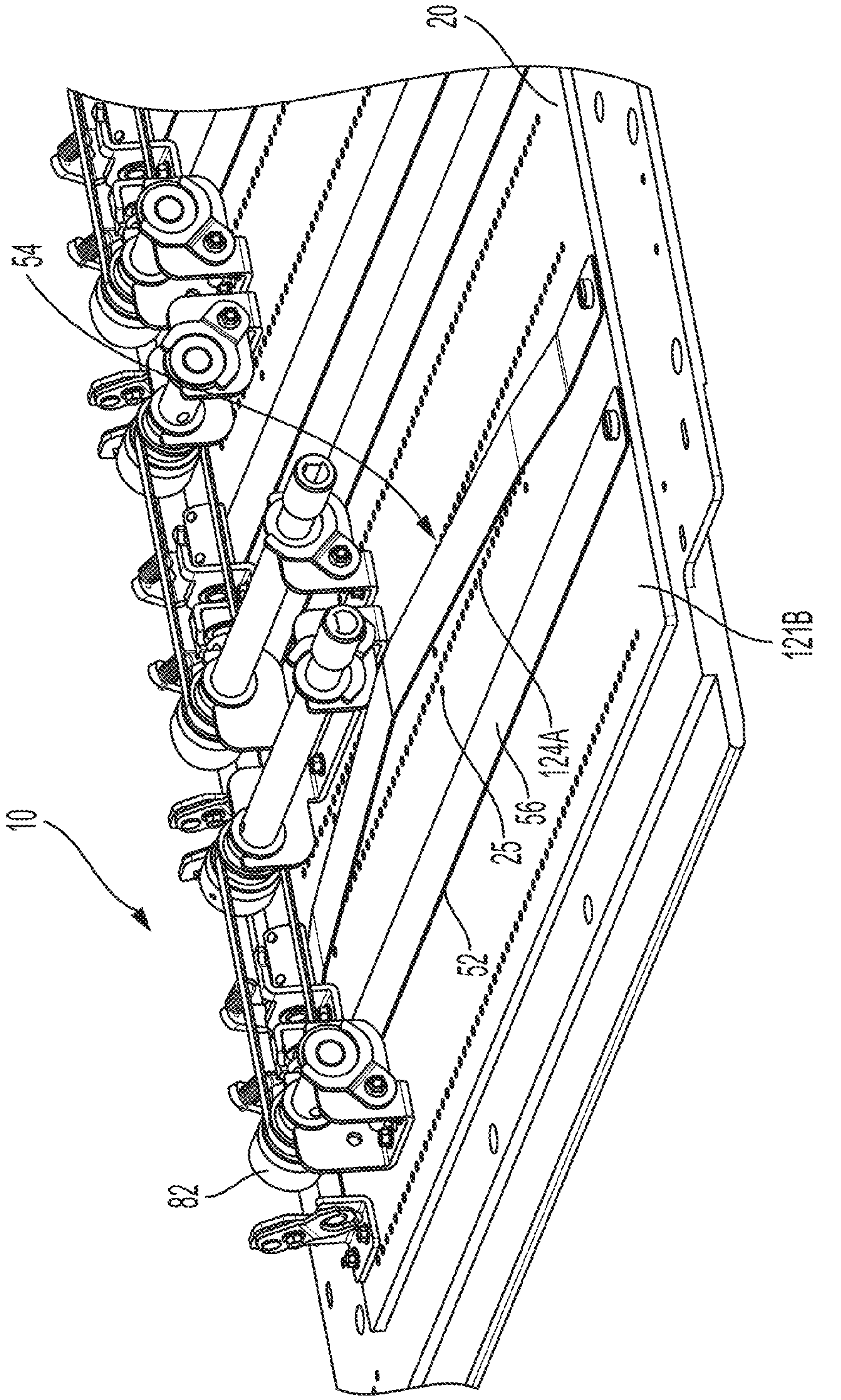


FIG.22

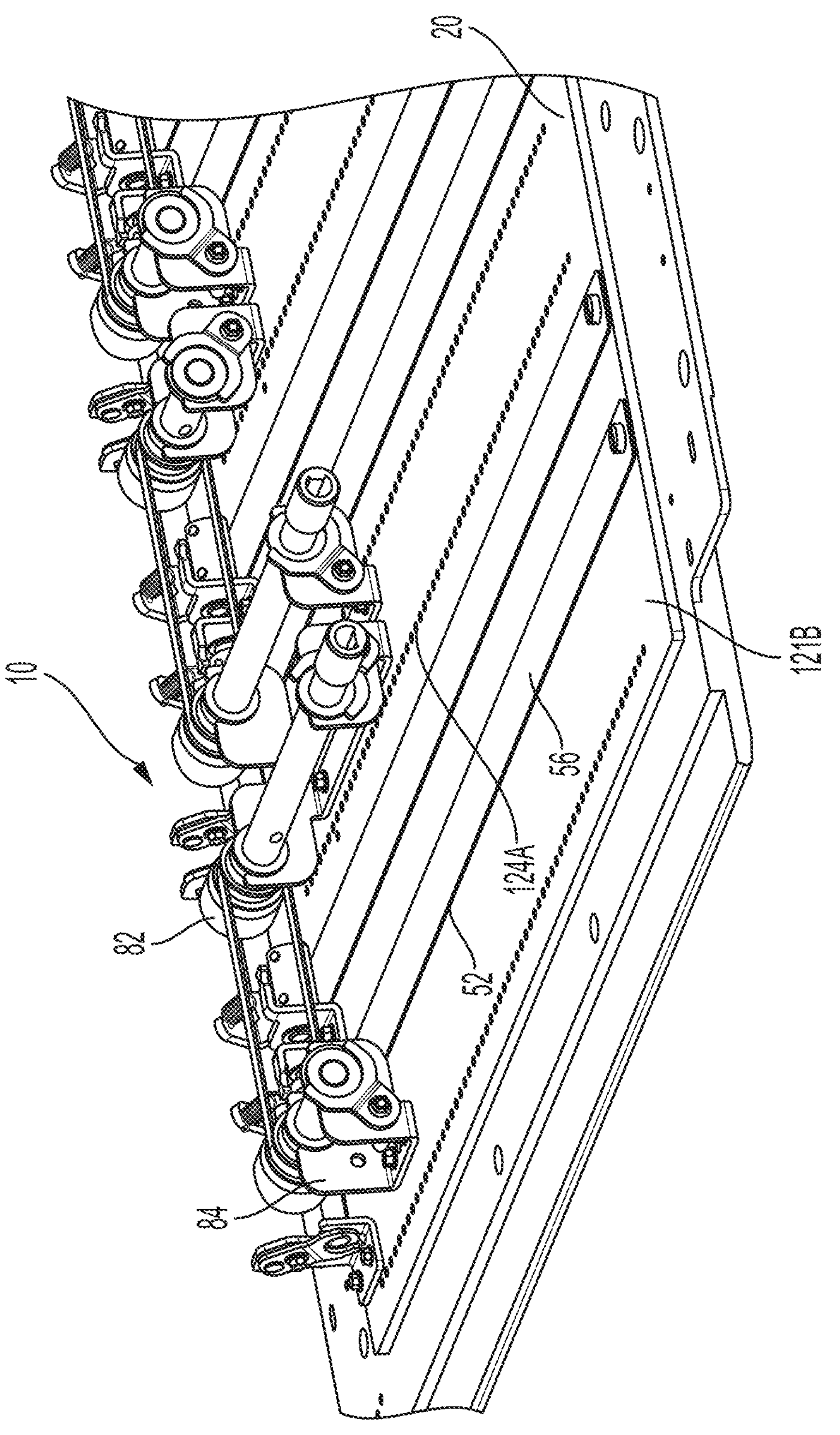


FIG. 23

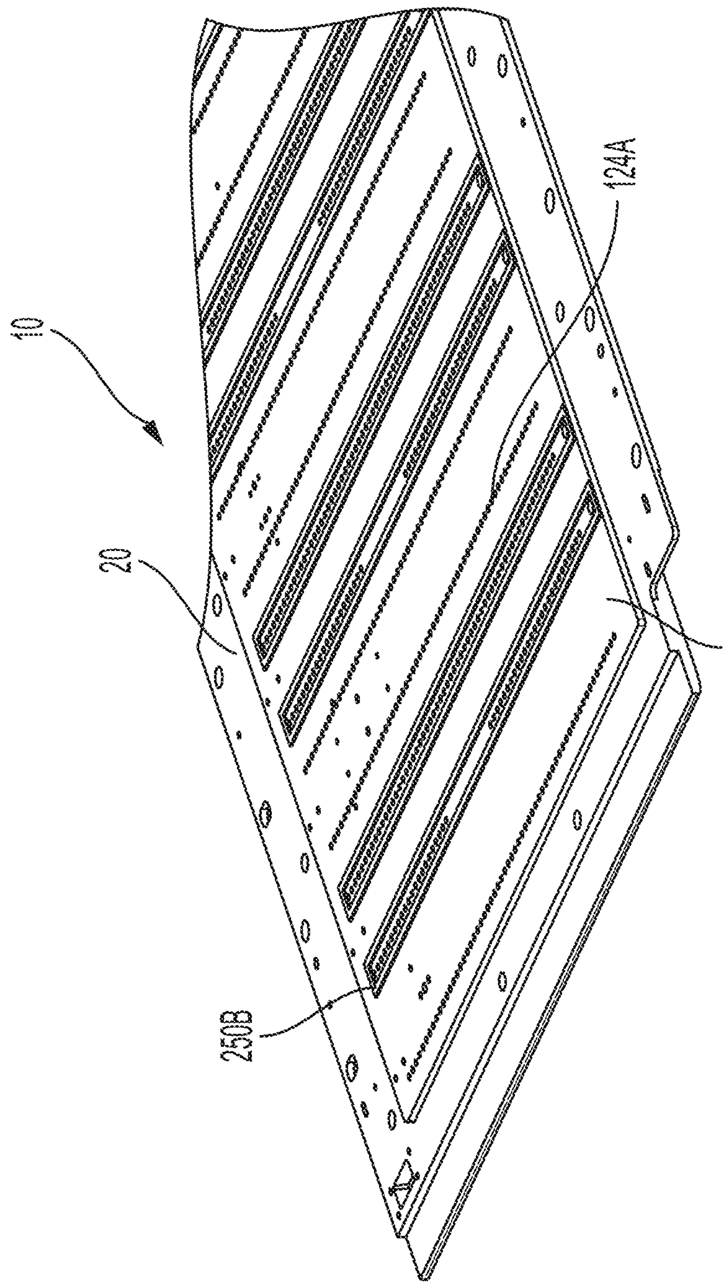


FIG. 24

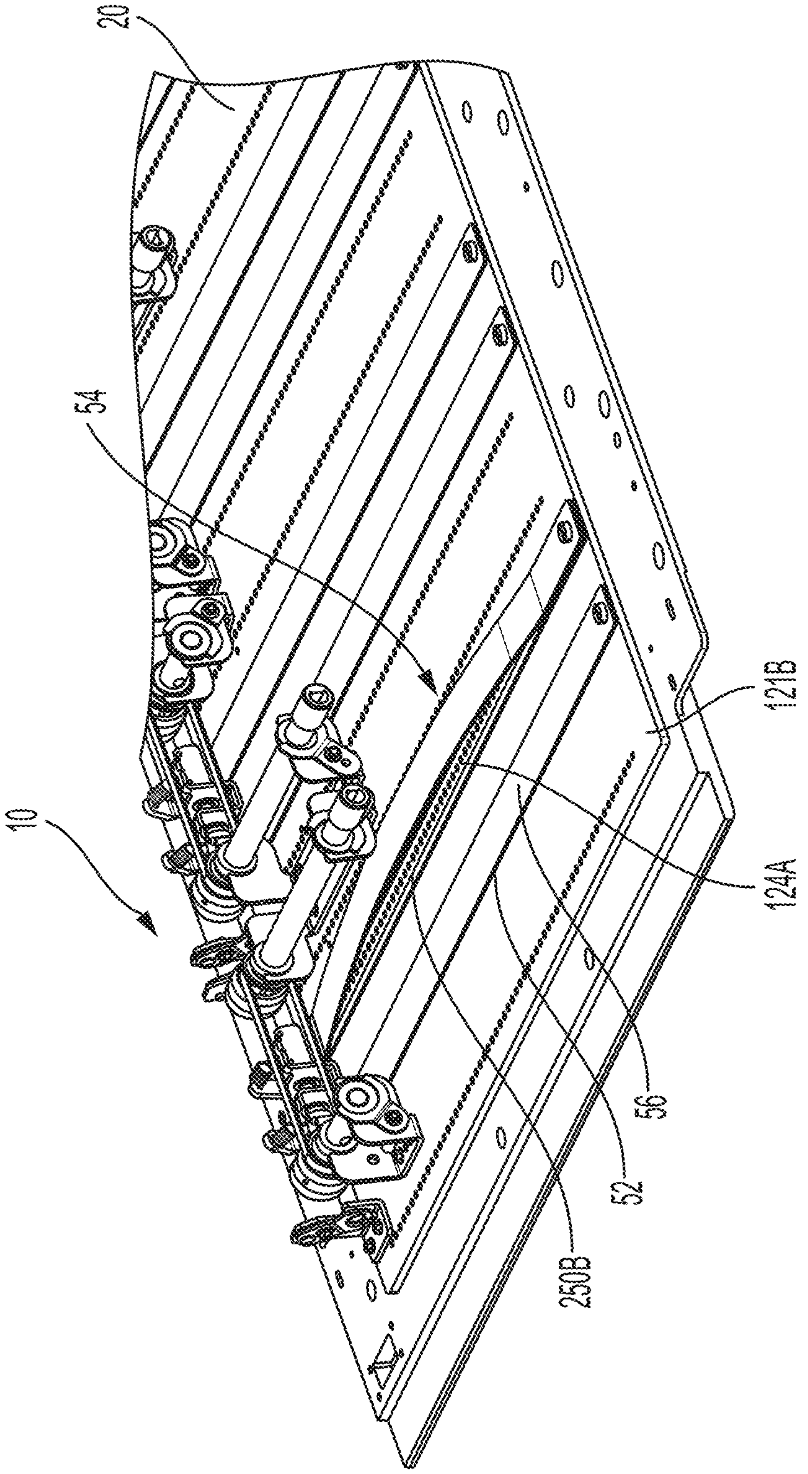


FIG. 25

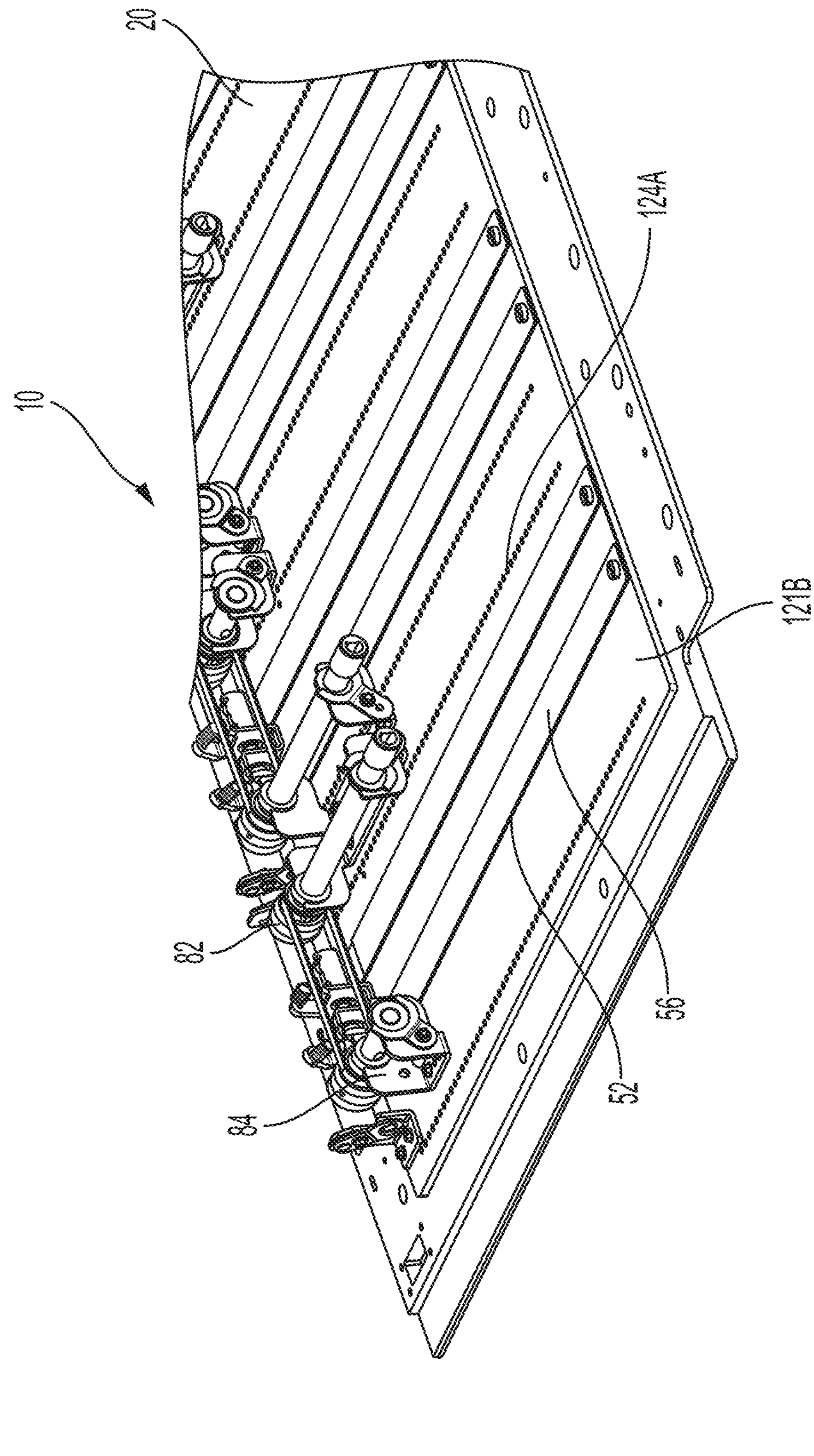


FIG. 26

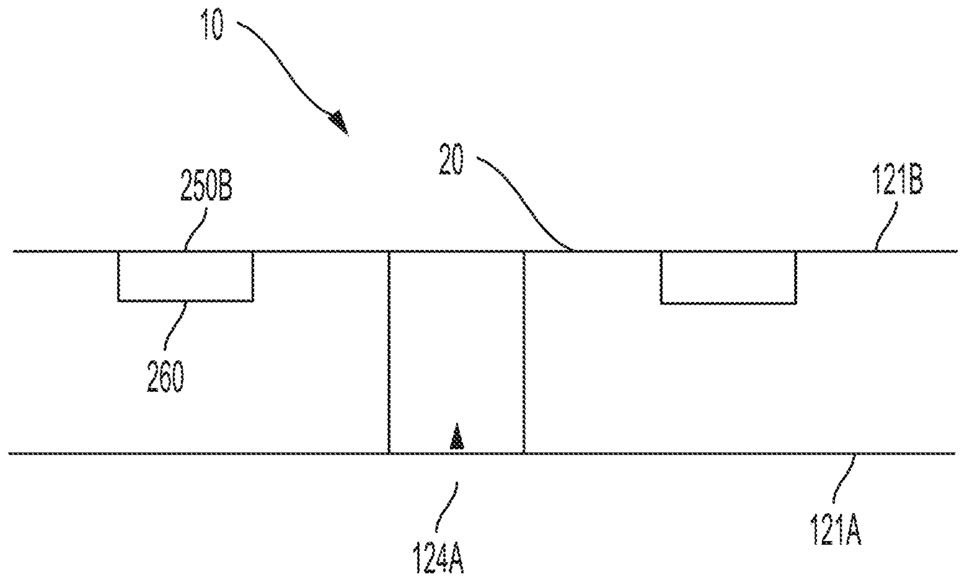


FIG. 27

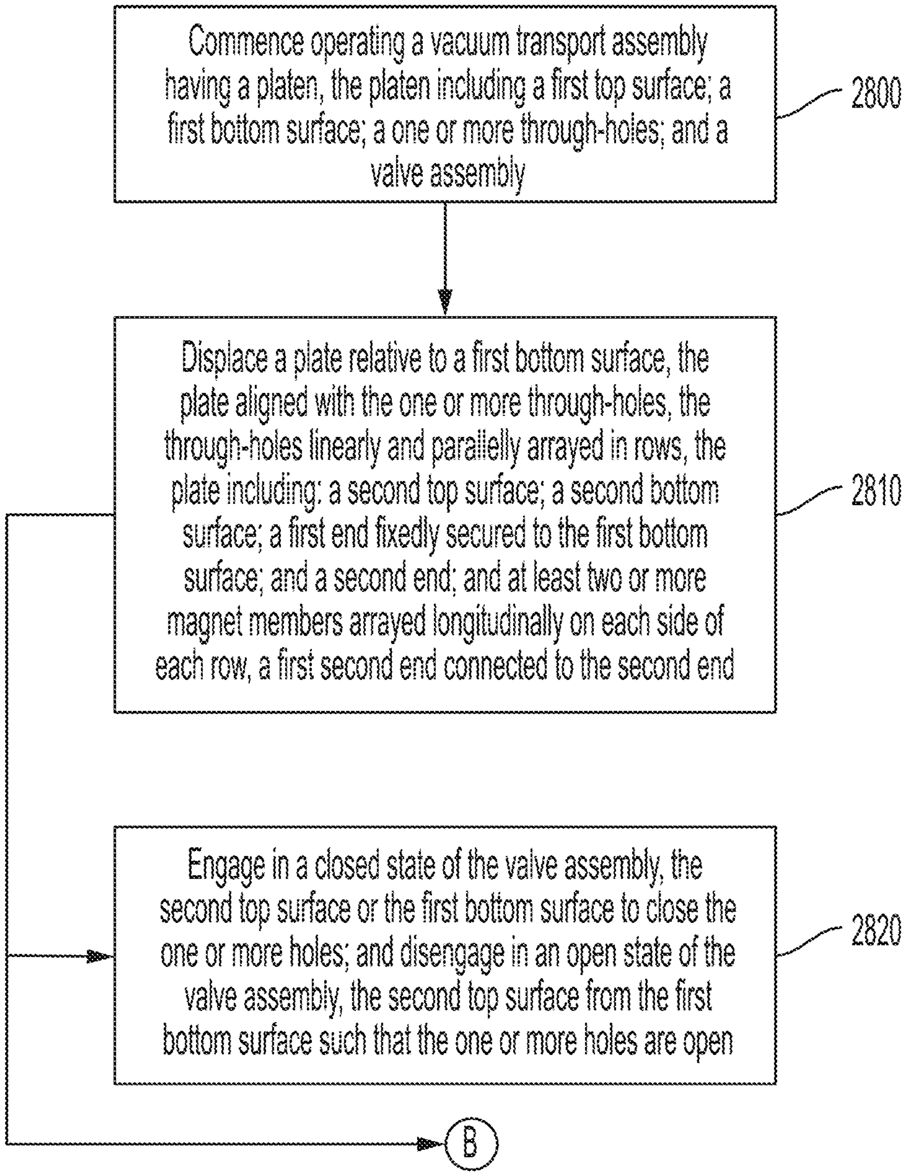

Commence operating a vacuum transport assembly having a platen, the platen including a first top surface; a first bottom surface; a one or more through-holes; and a valve assembly
2800
Displace a plate relative to a first bottom surface, the plate aligned with the one or more through-holes, the through-holes linearly and parallelly arrayed in rows, the plate including: a second top surface; a second bottom surface; a first end fixedly secured to the first bottom surface; and a second end; and at least two or more magnet members arrayed longitudinally on each side of each row, a first second end connected to the second end
2810
Engage in a closed state of the valve assembly, the second top surface or the first bottom surface to close the one or more holes; and disengage in an open state of the valve assembly, the second top surface from the first bottom surface such that the one or more holes are open
2820
B

FIG. 28A

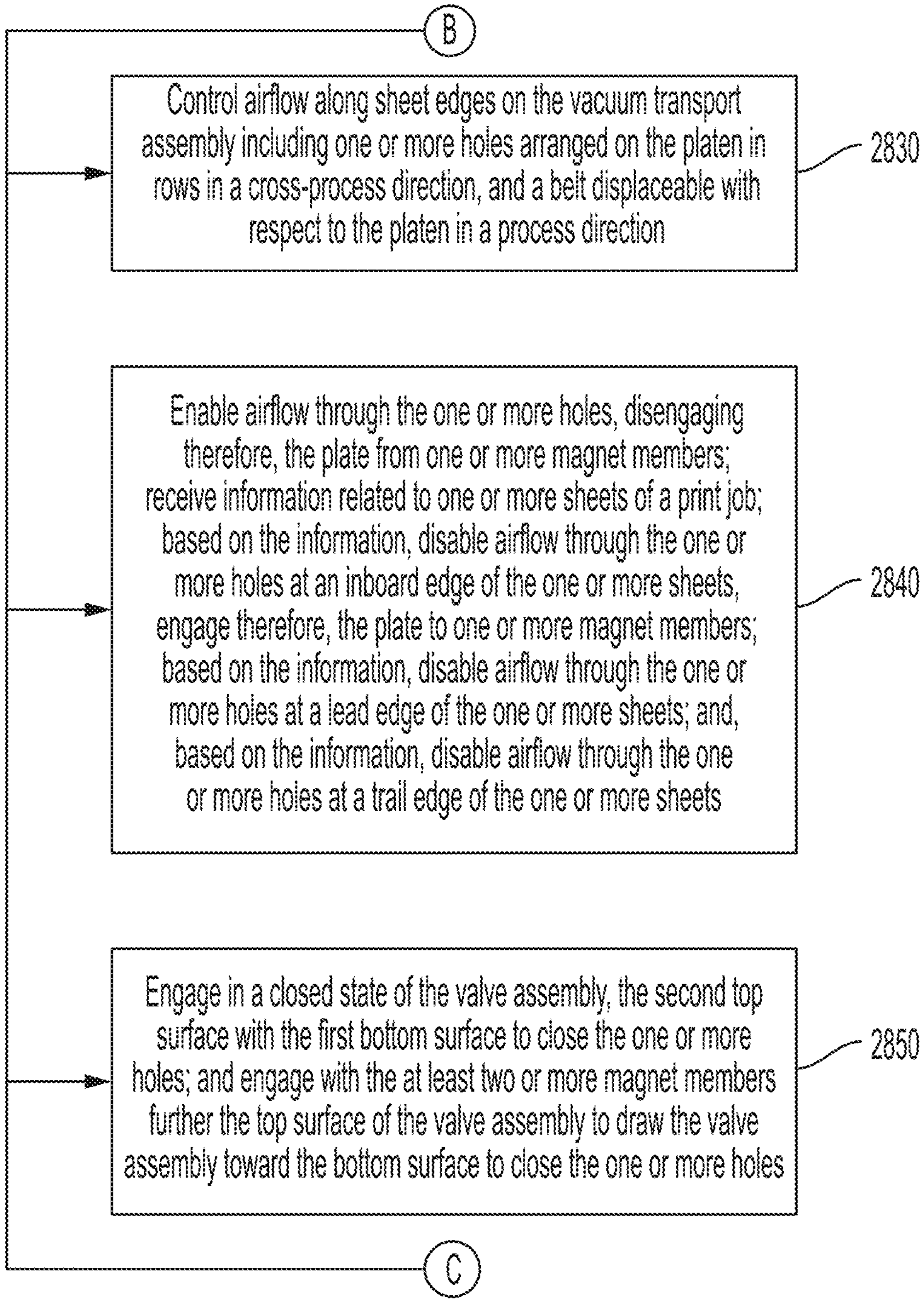

B
Control airflow along sheet edges on the vacuum transport assembly including one or more holes arranged on the platen in rows in a cross-process direction, and a belt displaceable with respect to the platen in a process direction
2830
Enable airflow through the one or more holes, disengaging therefore, the plate from one or more magnet members; receive information related to one or more sheets of a print job; based on the information, disable airflow through the one or more holes at an inboard edge of the one or more sheets, engage therefore, the plate to one or more magnet members; based on the information, disable airflow through the one or more holes at a lead edge of the one or more sheets; and, based on the information, disable airflow through the one or more holes at a trail edge of the one or more sheets
2840
Engage in a closed state of the valve assembly, the second top surface with the first bottom surface to close the one or more holes; and engage with the at least two or more magnet members further the top surface of the valve assembly to draw the valve assembly toward the bottom surface to close the one or more holes
2850
C

FIG. 28B

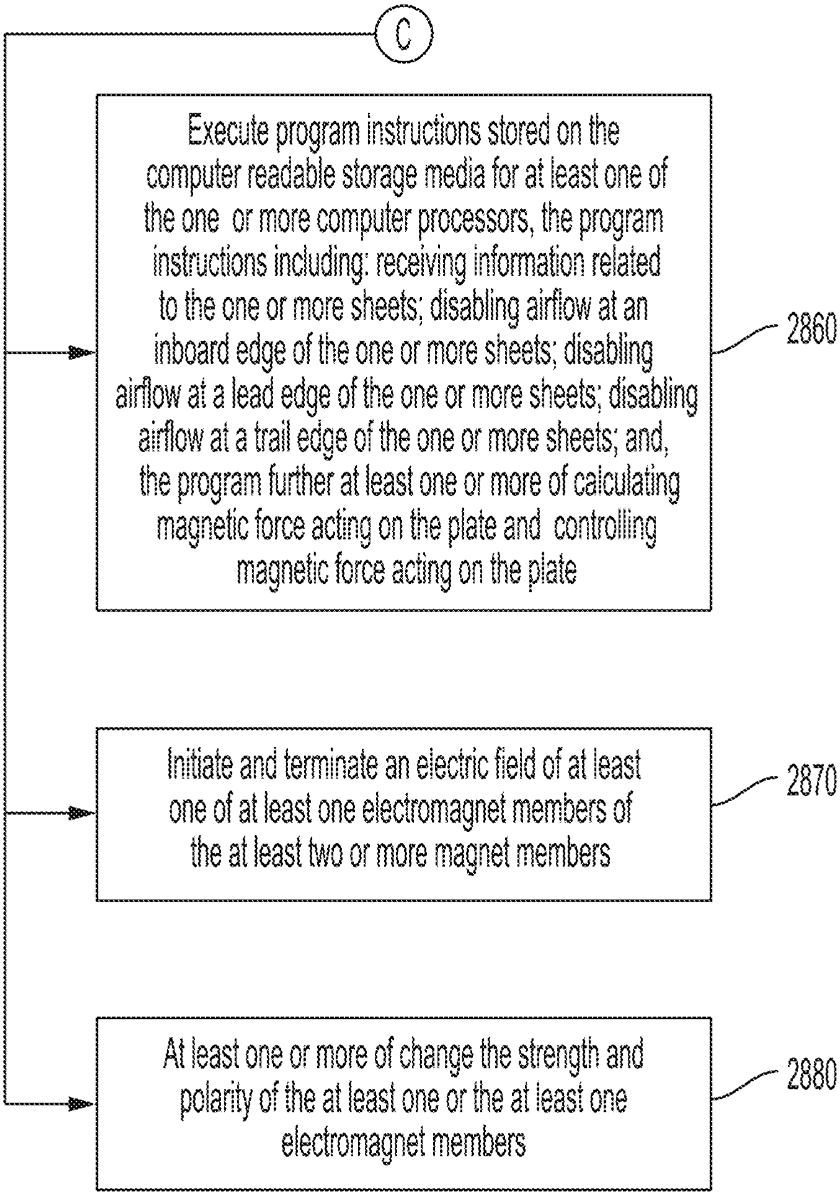

C
Execute program instructions stored on the computer readable storage media for at least one of the one or more computer processors, the program instructions including: receiving information related to the one or more sheets; disabling airflow at an inboard edge of the one or more sheets; disabling airflow at a lead edge of the one or more sheets; disabling airflow at a trail edge of the one or more sheets; and, the program further at least one or more of calculating magnetic force acting on the plate and controlling magnetic force acting on the plate
2860
Initiate and terminate an electric field of at least one of at least one electromagnet members of the at least two or more magnet members
2870
At least one or more of change the strength and polarity of the at least one or the at least one electromagnet members
2880

FIG. 28C

ACTIVE SHEET-EDGE AIRFLOW CONTROL FOR VACUUM CONVEYORS WITH MAGNET ASSIST

CLAIM

This application claims priority to and the benefit of U.S. application Ser. No. 17/653,686, titled ACTIVE SHEET-EDGE AIRFLOW CONTROL FOR VACUUM CONVEYORS, filed on Mar. 7, 2022, and Ser. No. 17/653,687, also titled ACTIVE SHEET-EDGE AIRFLOW CONTROL FOR VACUUM CONVEYORS, filed on Mar. 7, 2022, which are incorporated herein by reference in their entirety.

FIELDS

The present disclosure relates to the field of printing systems, and more particularly, to an assembly that selectively controls the vacuum along sheet edges in a marker transport of a printing system having the addition of magnetic assists for controlling valve assemblies.

BACKGROUND

In some printing systems or devices, the marker transport is a vacuum conveyor system that transports sheets under one or more print heads. The marker transport comprises a perforated belt driven over a vacuum platen. Air is drawn through the belt and platen by a vacuum system. Once the sheet is acquired the vacuum system provides the necessary hold-down force to transport the sheets along the belt.

However, printing systems, for example direct-to-paper ink-jet systems using vacuum conveyors in the marking area are susceptible to airflow disturbances during printing. In certain printing systems wherein the outboard edge (edge closest to the operator) is registered and thus not exposed to vacuum, the inboard edge (edge furthest from the operator), trail edge, and lead edge are exposed to the airflow from the marker vacuum transport. In certain non-registered printing systems all edges (i.e., lead, trail, inboard, and outboard) are exposed to vacuum. The airflow affects the ink drop placement near the edges of the sheet resulting in degraded print quality. As shown in FIG. **1**, displacement of the main drop and its satellites on sheet **1** results in an image blur near the exposed sheet edges, for example, inboard edge **2**A, lead edge **2**B, and trail edge **2**D (outboard edge **2**C is unaffected since this is a registered system and there is no airflow outboard of outboard edge **2**C). Additionally, the ink droplets that are drawn into the vacuum belt holes may mark the edge of the sheet resulting in stack edge contamination. FIG. **2** shows stack **3** of sheets having stack edge **4**, which is contaminated with ink.

Thus, there is a need for an assembly and method for controlling the vacuum to minimize or prevent the defects described above.

SUMMARY

According to aspects illustrated herein, there is provided a valve assembly for controlling airflow along sheet edges on a vacuum transport assembly, the valve assembly comprising a flexible plate, including a first end, a second end, a first top surface, and a first bottom surface, and a first actuator connected to the second end and operatively arranged to displace the flexible plate.

In some embodiments, the first actuator is a solenoid. In some embodiments, the second end is connected to a

bracket, the bracket is connected to the solenoid and a shaft, and the solenoid is operatively arranged to rotate the second end about the shaft. In some embodiments, the first actuator is a motor. In some embodiments, the valve assembly further comprises a platen, including a second top surface, a second bottom surface, and one or more holes extending from the second bottom surface to the second top surface. In some embodiments, the first end connected to the second bottom surface. In some embodiments, the second end is connected to the second bottom surface. In some embodiments, in a closed state of the valve assembly, the first top surface is engaged with the second bottom surface to close the one or more holes, and in an open state of the valve assembly, the first top surface is disengaged from the second bottom surface such that the one or more holes are open.

In some embodiments, the valve assembly further comprises a gasket connected to the first top surface. In some embodiments, the valve assembly further comprising a valve adjustment assembly, including a fulcrum operatively arranged to engage the first bottom surface, and a second actuator operatively arranged to displace the fulcrum with respect to the flexible plate. In some embodiments, the valve adjustment assembly further comprises a carriage translatably connected to the second actuator, and the fulcrum is connected to the carriage. In some embodiments, the fulcrum is a roller. In some embodiments, the second actuator is a screw drive. In some embodiments, the flexible plate is a leaf spring.

According to aspects illustrated herein, there is provided a vacuum transport assembly, comprising a platen, including a first top surface, first bottom surface, and one or more through-holes, and a valve assembly, including a plate aligned with the one or more through-holes, the plate including a second top surface, a second bottom surface, a first end fixedly secured to the first bottom surface, and a second end, and a first actuator connected to the second end.

In some embodiments, the first actuator is operatively arranged to displace the plate relative to the first bottom surface.

In some embodiments, in a closed state of the valve assembly, the second top surface is engaged with the first bottom surface to close the one or more holes, and in an open state of the valve assembly, the second top surface is disengaged from the first bottom surface such that the one or more holes are open. In some embodiments, the vacuum transport assembly further comprises a valve adjustment assembly, including a fulcrum engaged with the second bottom surface, and a second actuator operatively arranged to displace the fulcrum with respect to the plate. In some embodiments, the fulcrum forces the plate into contact with the platen at a position along the plate such that a first portion of the plate extending from the first end to the position abuts against the first bottom surface, and a second portion of the plate extending from the position to the second end is displaceable with respect to the first bottom surface. In some embodiments, the first actuator is connected to the second end via a cam.

According to aspects illustrated herein, there is provided a method of controlling airflow along sheet edges on a vacuum transport assembly, the method comprising receiving information related to one or more sheets of a print job, disabling airflow at an inboard edge of the one or more sheets, disabling airflow at a lead edge of the one or more sheets, and disabling airflow at a trail edge of the one or more sheets.

In some embodiments, the step of disabling airflow at the inboard edge comprises closing holes in a platen of the vacuum transport assembly between the inboard edge and an inboard side of the platen. In some embodiments, the information is received from one or more sensors. In some embodiments, the information comprises a position of at least one sheet of the one or more sheets. In some embodiments, the information comprises a predetermined spacing between the one or more sheets during the print job. In some embodiments, the step of disabling airflow at the inboard edge of the one or more sheets comprises adjusting an active length of a valve assembly such that the active length is equal to a width of the one or more sheets. In some embodiments, the step of adjusting an active length of the valve assembly such that the active length is equal to a width of the one or more sheets comprises positioning a valve adjustment assembly along a valve assembly such that the valve adjustment assembly aligns with the inboard edge of the one or more sheets. In some embodiments, the step of disabling airflow at the lead edge of the one or more sheets comprises determining a location of the lead edge with respect to one or more holes in a platen of the vacuum transport assembly, closing the one or more holes just prior to the lead edge being aligned therewith, and closing the one or more holes when the lead edge is aligned therewith.

In some embodiments, the method further comprises, once the lead edge has surpassed the one or more holes, opening the one or more holes. In some embodiments, the step of disabling airflow at the trail edge of the one or more sheets comprises determining a location of the trail edge with respect to one or more holes in a platen of the vacuum transport assembly, closing the one or more holes just prior to the trail edge being aligned therewith, and closing the one or more holes when the trail edge is aligned therewith. In some embodiments, the method further comprises once the trail edge has surpassed the one or more holes, opening the one or more holes. In some embodiments, the method further comprises disabling airflow at an outboard edge of the one or more sheets. In some embodiments, the step of disabling airflow at the lead edge comprises closing the one or more holes in a platen via a valve assembly.

According to aspects illustrated herein, there is provided a system for controlling airflow along sheet edges during transport of one or more sheets of a print job, the system comprising one or more computer processors, one or more computer readable storage media, a vacuum transport assembly including a platen comprising a plurality of holes, a vacuum operatively arranged to create airflow through the plurality of holes, and a belt operatively arranged to carry the one or more sheets over the platen in a process direction, a valve assembly, and program instructions stored on the computer readable storage media for execution by at least one of the one or more computer processors, the program instructions comprising program instructions to receive information related to the one or more sheets, program instructions to disable airflow at an inboard edge of the one or more sheets, program instructions to disable airflow at a lead edge of the one or more sheets, and program instructions to disable airflow at a trail edge of the one or more sheets.

In some embodiments, the program instructions to disable the airflow at the inboard edge comprise closing a portion of the plurality of holes between the inboard edge and an inboard side of the platen. In some embodiments, the system further comprises one or more sensors, and the program instructions to receive information related to the one or more sheets comprise receiving a position of at least one sheet of the one or more sheets from the one or more sensors.

In some embodiments, the program instructions to disable airflow at the inboard edge of the one or more sheets comprise program instructions to adjust the active length of the valve assembly such that the active length is equal to a width of the one or more sheets. In some embodiments, the program instructions to disable airflow at the lead edge of the one or more sheets comprise program instructions to determine a location of the lead edge with respect to a first portion of the one or more holes, program instructions to close the first portion just prior to the lead edge being aligned with the first portion, and program instructions to close the first portion when the lead edge is aligned with the first portion. In some embodiments, the program instructions further comprise program instructions to, once the lead edge has surpassed the first portion, open the first portion. In some embodiments, the program instructions to disable airflow at the trail edge of the one or more sheets comprises program instructions to determine a location of the trail edge with respect to the one or more holes, program instructions to close the one or more holes just prior to the trail edge being aligned therewith, and program instructions to close the one or more holes when the trail edge is aligned therewith.

According to aspects illustrated herein, there is provided an assembly that selectively and actively blocks airflow under the print stations of a printing device. In some embodiments, the invention comprises a mechanism that blocks the airflow adjacent to the edges of the sheet as it is being printed. The mechanism blocks a fixed zone directly inboard of the paper edge for the entirety of the run. Simultaneously, the mechanism actively blocks a zone under the print stations immediately upstream or downstream of the leading or trailing edge, respectively. Once the leading or trailing edge of the sheet passes the print zone the mechanism unblocks the airflow to reestablish the vacuum "hold-down" force.

In some embodiments, the mechanism comprises a flexible leaf spring used as a valve and a translating pinch roller that sets the length of the valve. The roller moves to the inboard edge of the sheet and provides a pinch point preventing the leaf spring from separating from the platen inboard of the sheet. An actuator (e.g., solenoid, motor, etc.) will cause the leaf spring to separate from the platen outboard of the roller. The holes inboard of the roller will continue to be blocked as the holes outboard of the roller will selectively be blocked or unblocked by the actuation of the leaf spring. This will control the airflow to the partitioned areas on the platen.

In some embodiments, when the actuator is de-energized, the leaf spring is in the open position (i.e., separated from the platen) thereby allowing the air-ports of the platen to be open. When the actuator is energized, the leaf spring is in the closed position (i.e., abuts against the platen) and closes the air-ports. The pinch roller is displaceable in inboard and outboard depending on the sheet size, and controls the vacuum on the inboard edge of the sheet. Specifically, the pinch roller is moved to the location of the sheet inboard edge, such that the portion of the leaf spring inboard of the pinch roller closes the inboard ports. In some embodiments, the top surface of the leaf spring comprises a gasket to help seal the air flow through the air-ports in the platen when the leaf spring is in the closed position.

The assembly of the present disclosure comprises a flexible leaf spring material used as a valve to control vacuum of a long section of platen air-ports. The assembly of the present disclosure comprises a marking transport platen with unique pattern of air-ports and channels in fluid communication therewith, which allows partitions of the vacuum to be actively controlled. The assembly of the present disclosure provides a system with media or sheet tracking that moves with the sheet through the printing process. The sheet tracking provides simultaneous vacuum control for all exposed edges (i.e., lead, trail, inboard, and outboard edges) as it travels through the printing process.

The assembly of the present disclosure provides the following benefits: a single integrated mechanism that addresses blur at all exposed sheet edges; it reduces or eliminates any disturbance caused by airflow moving across the sheet (e.g., image blur, stack edge contamination, etc.), especially on glossy or waxy paper on which water-based ink is printed; it minimizes the loss of "hold-down" vacuum as vacuum is maintained on the majority of the sheet; it can be used within current printing systems and does not require a re-design of the marking transport belt; it reduces missing jets and thus purging and run cost (i.e., it reduces ink misting, the ink mist particles clog up the ink jets and require the printing device to be shut down in order to purge the jets); and, it reduces or eliminates ink being drawn through the vacuum system resulting in a reduction of contamination from ink.

In some embodiments, the assembly comprises two partitions per printing station and two leaf spring valves per print station, an actuator (e.g., solenoid) for each leaf spring, a pinch roller for each leaf spring, and a lead screw to position the pinch roller.

In some embodiments, the invention may be reconfigured for a center registered system, rather than an edge registered system, by having two translating pinch rollers and centering the actuator. The assembly comprises multiple partitions per print stations resulting in multiple leaf spring valves per print station, a motor mechanism actuating multiple valves (for example a single motor with a camshaft), and a translating mechanism (cable system, rack and pinion, etc.).

According to aspects illustrated herein, there is provided a mechanism comprising flexible shims or plates, a movable roller to adjust flexible length of the shim, and a camming device to flex the shims based on paper size and position on a vacuum platen. The shims are pulled tight against the bottom surface of the platen to block the airflow adjacent to the edges of the sheet as it is being printed. The movable roller prevents the shim from flexing and blocks a fixed zone directly inboard/outboard of the paper edge for the entirety of the run. Simultaneously, the camming device actively tightens the shims to block a zone under the print stations immediately upstream or downstream of the leading edge or trailing edge, respectively. Once the leading edge or trailing edge of the sheet passes the print zone, the camming device flexes the shim to unblock the airflow and reestablish the vacuum "hold-down" force. Benefits of the present disclosure include the ability to control the air flow at both the inboard edge of the vacuum platen, as well as the lead and trail edges of the media. The leaf spring concept is simple and efficient in providing bidirectional flow control in each leaf.

According to aspects illustrated herein, there is provided a valve assembly for a vacuum transport comprising a platen including a plurality of holes, a vacuum, and a belt, the valve assembly comprising a flexible plate connected to a bottom surface of the platen, and an actuator connected to the flexible plate, wherein the actuator is operatively arranged to displace the flexible plate to close and open the plurality of holes. In some embodiments, the valve assembly further comprises a valve adjustment assembly operatively arranged to adjust a fulcrum of the flexible plate. The valve adjustment assembly comprises a pinch roller or fulcrum rotatably connected to a bracket or carriage via a shaft. The pinch roller engages a bottom surface of the flexible plate. The bracket, and thus the pinch roller, is linearly displaceable via an actuator (e.g., leadscrew) such that when the leadscrew rotates the bracket translates linearly therealong. The valve adjustment assembly further comprises a guide shaft to which the bracket is slidably connected. In some embodiments, the valve adjustment assembly further comprises a spring connected to one or more shafts.

The valve assembly is operatively arranged to prevent edge blur by shutting off vacuum air flow through the platen under the print heads. The valve adjustment assembly adjusts the valve assembly based on the sheet size. In some embodiments, the valve adjustment assembly is connected to a plenum or vacuum container, which is connected to the marker transport assembly. The valve assembly is connected to the bottom surface of the platen. The platen is then connected to the plenum sealing the top thereof, at which point the valve adjustment assembly engages the valve.

Added are vacuum transport assembly embodiments that use magnets to aid in controlling valve assemblies. The additional embodiments include the platen including the second top surface; the second bottom surface; the first end fixedly secured to the first bottom surface; and the second end; and, the first second end connected to the second end, but include at least two or more magnet members arrayed longitudinally on each side of given rows. The magnet members are designed to assist closing the through-holes with the leaf valve assemblies when the leaf valve assemblies are engaged in a closed state. In these added embodiments, the at least two or more magnet members are designed to engage with the top surface of the valve assembly to draw the valve assembly toward the first bottom surface to close the one or more holes.

The added embodiments can be designed with many types of magnet members, represented by but not limited to, magnetic plug members, the magnet plug members which may further be disposed within magnet hole members to keep the magnet plug members substantially flush to the first bottom surface; magnetic strip members, the magnetic strip members which may further be deployed in slot members to the magnetic strip members substantially flush to the first bottom member; and magnet members designed as electromagnet members in the aforementioned or different dispositions. The electromagnet members may further be able to at least one or more of change strength and polarity. An associated method using the magnet members is disclosed herein.

These and other objects, features, and advantages of the present disclosure will become readily apparent upon a review of the following detailed description of the disclosure, in view of the drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments are disclosed, by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, in which:

FIG. **1** shows detail views of defects on a printed sheet;

FIG. **2** shows a stack of sheets with a contaminated edge;

FIG. **3**A is a perspective view of a vacuum transport assembly;

FIG. **3**B is a partial top elevational view of the vacuum transport assembly shown in FIG. **3**A;

FIG. 3C is a simplified cross-sectional schematic view of the vacuum transport assembly taken generally along line 3C-3C in FIG. 3A;

FIGS. 4A-O are partial top elevational views illustrating various states of holes in a platen of a vacuum transport assembly as sheets pass therealong;

FIG. 5 is a perspective view of a vacuum transport assembly with the belt removed;

FIG. 6 is a detail view of the vacuum transport assembly taken generally along Detail 6 in FIG. 5;

FIG. 7 is a perspective view of a valve assembly;

FIG. 8 is a perspective view of a valve adjustment assembly;

FIG. 9A is a schematic cross-sectional view of the vacuum transport assembly taken generally along line 9-9 in FIG. 5, with the valve in an open position;

FIG. 9B is a schematic cross-sectional view of the vacuum transport assembly taken generally along line 9-9 in FIG. 5, with the valve in a closed position;

FIG. 10A is a schematic cross-sectional view of the vacuum transport assembly taken generally along line 10-10 in FIG. 5, with the valve in an open position;

FIG. 10B is a schematic cross-sectional view of the vacuum transport assembly taken generally along line 10-10 in FIG. 5, with the valve in a closed position;

FIGS. 11A-12B are partial bottom perspective views of a vacuum transport assembly showing the valve assemblies and valve adjustment assemblies in various positions;

FIG. 13 is a partial bottom perspective view of a vacuum transport assembly;

FIG. 14A is a front perspective view of a vacuum transport assembly;

FIG. 14B is a partial front perspective view of the vacuum transport assembly shown in FIG. 14A;

FIGS. 15A-D are detailed rear perspective views of the vacuum transport assembly shown in FIG. 14B, with the valves in various positions;

FIG. 16 is a schematic view of a vacuum transport assembly;

FIG. 17 is a functional block diagram illustrating an environment, in accordance with some embodiments of the present disclosure;

FIG. 18 is a flow chart depicting operational steps for controlling airflow along sheet edges;

FIG. 19 is a block diagram of internal and external components of a computer system, in accordance with some embodiments of the present disclosure;

FIG. 20 illustrates magnet member types;

FIG. 21 is a partial top view of the platen;

FIG. 22 is a partial bottom view of the vacuum transport assembly;

FIG. 23 is a second partial bottom view of the vacuum transport assembly shown in FIG. 22;

FIG. 24 is a partial bottom view of the platen assembly with magnetic strips, in accordance with some embodiments of the present disclosure;

FIG. 25 is a third partial bottom view of the vacuum transport assembly shown in FIG. 22;

FIG. 26 is a fourth partial bottom view of the vacuum transport assembly shown in FIG. 22;

FIG. 27 is a cutaway view of the platen, in accordance with some embodiments of the present disclosure; and,

FIG. 28A-28C is a representative method of using the vacuum transport assembly.

DETAILED DESCRIPTION

At the outset, it should be appreciated that like drawing numbers on different drawing views identify identical, or functionally similar, structural elements. It is to be understood that the claims are not limited to the disclosed aspects.

Furthermore, it is understood that this disclosure is not limited to the particular methodology, materials and modifications described and as such may, of course, vary. It is also understood that the terminology used herein is for the purpose of describing particular aspects only, and is not intended to limit the scope of the claims.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which this disclosure pertains. It should be understood that any methods, devices or materials similar or equivalent to those described herein can be used in the practice or testing of the example embodiments. The assembly of the present disclosure could be driven by hydraulics, electronics, pneumatics, and/or springs.

It should be appreciated that the term "substantially" is synonymous with terms such as "nearly," "very nearly," "about," "approximately," "around," "bordering on," "close to," "essentially," "in the neighborhood of," "in the vicinity of," etc., and such terms may be used interchangeably as appearing in the specification and claims. It should be appreciated that the term "proximate" is synonymous with terms such as "nearby," "close," "adjacent," "neighboring," "immediate," "adjoining," etc., and such terms may be used interchangeably as appearing in the specification and claims. The term "approximately" is intended to mean values within ten percent of the specified value.

It should be understood that use of "or" in the present application is with respect to a "non-exclusive" arrangement, unless stated otherwise. For example, when saying that "item x is A or B," it is understood that this can mean one of the following: (1) item x is only one or the other of A and B; (2) item x is both A and B. Alternately stated, the word "or" is not used to define an "exclusive or" arrangement. For example, an "exclusive or" arrangement for the statement "item x is A or B" would require that x can be only one of A and B. Furthermore, as used herein, "and/or" is intended to mean a grammatical conjunction used to indicate that one or more of the elements or conditions recited may be included or occur. For example, a device comprising a first element, a second element and/or a third element, is intended to be construed as any one of the following structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element.

Moreover, as used herein, the phrases "comprises at least one of" and "comprising at least one of" in combination with a system or element is intended to mean that the system or element includes one or more of the elements listed after the phrase. For example, a device comprising at least one of: a first element; a second element; and, a third element, is intended to be construed as any one of the following structural arrangements: a device comprising a first element; a device comprising a second element; a device comprising a third element; a device comprising a first element and a second element; a device comprising a first element and a third element; a device comprising a first element, a second element and a third element; or, a device comprising a second element and a third element. A similar interpretation is intended when the phrase "used in at least one of:" is used herein.

"Printer," "printer system," "printing system," "printer device," "printing device," and "multi-functional device (MFD)" as used herein encompass any apparatus, such as a digital copier, bookmaking machine, facsimile machine, multi-function machine, etc., which performs a print outputting function for any purpose.

As used herein, "sheet," "web," "substrate," "printable substrate," and "media" refer to, for example, paper, transparencies, parchment, film, fabric, plastic, photo-finishing papers, or other coated or non-coated substrate media in the form of a web upon which information or markings can be visualized and/or reproduced. By specialty sheet it is meant a sheet which includes a card, label, sticker, pressure seal envelopes, mailers, or other element that is thicker than the substrate on or in which it resides.

"Printed sheet" as used herein is a sheet on which an image is printed as part of the print job.

As used herein, "process direction" is intended to mean the direction of media transport through a printer or copier, while "cross process direction" is intended to mean the perpendicular to the direction of media transport through a printer or copier.

Referring now to the figures, FIG. **3**A is a perspective view of marker transport assembly **10**. FIG. **3**B is a partial top elevational view of marker transport assembly **10**. FIG. **3**C is a simplified cross-sectional schematic view of marker transport assembly **10** taken generally along line **3**C-**3**C in FIG. **3**A. Marker transport assembly **10** comprises vacuum **12**, belt **14** arranged on a plurality of rollers **16**, a plurality of marker modules **18**, and a platen **20**. Perforated belt **14** is driven over platen **20** by rollers **16** in process direction D**1**. Vacuum **12** is connected to platen **20** and draws air through belt **14** and platen **20** via a vacuum system. Platen **20** comprises inboard side **22**A, lead side **22**B, outboard side **22**C, and trail side **22**D, plurality of holes **24** through which air is drawn by vacuum **12**. Marker modules **18** are arranged over platen **20** to apply ink to sheets (i.e., the printing process). In some embodiments, marker transport assembly **10** comprises marker modules **18**A-D arranged over zones **26**A-D of platen **20**, respectively. Each of marker modules **18**A-D may comprise one or more print heads. For example, marker module **18**A comprises three print heads arranged over zone **26**A. In each of zones **26**A-D, holes **24** are arranged in two or more partitions or rows. For example, and as shown in FIG. **3**B, the print head #**1** and print head #**3** are arranged over first partition of holes **24** and the print head #**2** is arranged over second partition of holes **24**. Once a sheet is acquired at acquisition roller **30**, vacuum **12** provides the necessary hold-down force to transport sheets under marker modules **18**A-D. The sheets are typically aligned on their outboard edge with registration edge **28**. There are no holes **22** outboard of registration edge **28** in platen **20**, and thus in registered printing systems the outboard edge of the sheet is not exposed to the airflow from vacuum **12**.

FIGS. **4**A-O are partial top elevational views illustrating various states of holes **24** in platen **20** of vacuum transport assembly **10** as sheets **1**, **5** pass therealong. Belt **14** is shown cutaway such that partitions **32**A-**38**B can be seen more clearly. As previously described, one or more print heads are arranged over partitions **32**A-**38**B. As a sheet passes along platen **20** via belt **14**, and thus under marker modules **18**A-D, it is an object of the present disclosure to stop the flow of air at the edges of the sheet under marker modules **18**A-D. To do this, holes **24** are actively and selectively closed and opened, as will be described in greater detail below.

As shown in FIG. **4**A, each of zones **26**A-D comprises two rows or partitions of holes **24**. "Partition" as used herein means one group or section of holes **24**. Specifically, zone **26**A includes partitions **32**A-B, zone **26**B includes partitions **34**A-B, zone **26**C includes partitions **36**A-B, and zone **26**D includes partitions **38**A-B. While the partitions are shown in linear rows (i.e., holes **24** are linearly aligned), they may be arranged in any manner suitable for operation with valve assembly **50**, for example, a curvilinear line or a geometric shape such as a square, triangle, rectangle, etc.

As shown in FIG. **4**B, when no sheet is arranged on platen **20** or immediately incoming, all partitions are enabled, as indicated by check marks (✓). When a partition or a portion of the partition is enabled or turned on, holes **24** within that partition or portion are open, and thus air passes through those open holes enabling vacuum/suction. When a partition or a portion of the partition is disabled or shut off, the holes within that partition or portion are closed, and thus air does not pass through those closed holes disabling vacuum/suction. It should be appreciated that a portion of a partition may be enabled and a portion of the same partition may be disabled, as will be described in greater detail below.

When sheet **1** is immediately incoming, as shown in FIG. **4**C, portions of partitions **32**A-**38**B inboard of inboard edge **2**A (i.e., the portion between inboard edge **2**A and inboard side **22**A, or line **29**, in inboard direction D**3**) are disabled. The disabled portions of partitions **32**A-**38**B are indicated by exes (X). By disabling these portions, a second registered edge is created at line **29**, similar to that of registered edge **28**. This is desirable in order to prevent the flow of air at inboard edge **2**A as sheets pass along platen **20**. To disable these portions, holes **24** in these portions are closed via leaf springs **52**, specifically, by displacing fulcrums **82** in outboard direction D**2** until they are aligned with inboard edge **2**A, or line **29**. Operation of valve assemblies **50** and valve adjustment assemblies **80** will be described in greater detail below. It should be appreciated that the portions of partitions **32**A-**38**B inboard of line **29** will remain disabled for the duration of the print job, or until a different size sheet is to be printed, at which point fulcrums **82** will be adjusted, and thus line **29** moved, to the inboard edge of the different size sheet.

Just prior to lead edge **2**B entering zone **26**A, as shown in FIG. **4**D, portions of partitions **32**A-B between line **29** to registration edge **28** are disabled by closing holes **24** arranged therein. To shut off these portions, actuators **64** displace leaf springs **64** such that they abut against the bottom surface of platen **20** and prevent air from passing through holes **24** in those portions. Operation of leaf springs **52** and actuators **64** will be described in greater detail below.

Both partition **32**A and partition **32**B remain off when lead edge **2**B is aligned with partition **32**A, as shown in FIG. **4**E. As shown in FIG. **4**F, when lead edge **2**B is aligned with partition **32**B (i.e., lead edge **2**B has surpassed partition **32**A), partition **32**A is turned on thereby enabling the vacuum through holes **24** therein. It is desirable that the partitions be enabled whenever possible to maintain as much vacuum/suction on sheet **1** as possible.

As shown in FIG. **4**G, when lead edge **2**B surpasses partition **32**B, partition **32**B is also turned on and thus vacuum through holes **24** in both partitions **32**A-B are enabled. Additionally, portions of partitions **34**A-B between line **29** and registered edge **28** are disabled in anticipation of lead edge **2**B passing thereover (i.e., the vacuum/suction through holes **24** in partitions **34**A-B is disabled).

As shown in FIG. **4**H, lead edge **2**B is aligned with partition **34**A and thus partitions **34**A-B remain disabled. Additionally, sheet **5** is shown as approaching platen **20**.

As shown in FIG. **41**, partition **32**A is disabled as trail edge **2**D approaches, but partition **32**B remains enabled. Additionally, lead edge **2**B is aligned with partition **34**B and as such, partition **34**B remains disabled and partition **34**A is enabled.

As shown in FIG. **4J**, lead edge **2**B has surpassed partition **34**B and as such, partition **34**B is enabled. Trail edge **2**D is aligned with partition **32**A, which is still disabled.

Additionally, partition **32**B is disabled in anticipation of alignment with trail edge **2**D (i.e., partition **32**B is disabled just prior to trail edge **2**D passing thereover).

As shown in FIG. **4**K, lead edge **2**B is aligned with partition **36**A, which is disabled. Partition **36**B is also disabled in anticipation of alignment with lead edge **2**B. Partitions **34**A-B are enabled as no edges of sheet **1** are close to alignment therewith. Trail edge **2**D is aligned with partition **32**B, which is disabled. Additionally, partition **32**A is disabled in anticipation of alignment with lead edge **6**B of sheet **5**.

As shown in FIG. **4**L, lead edge **2**B is aligned with partition **36**B, which is disabled. Partitions **36**A and **34**A-B are enabled. Partitions **32**A-B are disabled in anticipation of alignment with lead edge **6**B.

As shown in FIG. **4**M, lead edge **2**B has surpassed partition **36**B and thus partitions **36**A-B are enabled. Partitions **38**A-B are disabled in anticipation of alignment with lead edge **2**B. Trail edge **2**D is aligned with partition **34**A and thus partitions **34**A-B are disabled. Additionally, lead edge **6**B is aligned with partition **32**A and thus partitions **32**A-B remain disabled.

As shown in FIG. **4**N, lead edge **2**B is aligned with partition **38**A and thus partitions **38**A-B remain disabled. Partitions **36**A-B are enabled. Trail edge **2**D is aligned with partition **34**B, which is disabled. Lead edge **6**B is aligned with partition **32**B, which is disabled. Additionally, partition **34**A is disabled in anticipation of alignment with lead edge **6**B. Since lead edge **6**B has surpassed partition **32**A, partition **32**A is enabled.

As shown in FIG. **4**O, lead edge is aligned with partition **38**B, which is disabled. Partitions **38**A and **36**B are enabled. Partition **36**A is disabled in anticipation of alignment with trail edge **2**D. Partitions **34**A-B are disabled in anticipation of alignment with lead edge **6**B. Lead edge **6**B has surpassed partition **32**B, and thus partitions **32**A-B are enabled.

FIG. **5** is a perspective view of vacuum transport assembly **10** with belt **14** removed for simplicity. FIG. **6** is a detail view of vacuum transport assembly **10** taken generally along Detail **6** in FIG. **5**. Zones **126**A-D demonstrate the target areas for air suction/vacuum shut off located under the print heads (refer to FIG. **3**B for an example arrangement of print heads). Each zone, for example zone **126**A, comprises a plurality of holes **124**A in fluid communication with respective channels **124**B. Channels **124**B extend from top surface **121**A of platen **120** at least partially to bottom surface **121**B. Holes **124**A extend from bottom surface **121**B of platen **120** to channels **124**B. Air is sucked from top surface **121**A through channels **124**B and then through holes **124**A to an area under bottom surface **121**B. As best shown in FIG. **6**, in some embodiments, each channel **124**B is in fluid communication with only one hole **124**A such that, when said one hole **124**A is closed, there is no airflow through the closed hole **124**A or its respective channel **124**B. This will be described in greater detail below. In some embodiments, each channel **124**B is in fluid communication with a plurality of holes **124**A. In some embodiments, each hole **124**A is in fluid communication with a plurality of channels **124**B.

FIG. **7** is a perspective view of valve assembly **50**. Valve assembly **50** generally comprises at least one leaf spring or valve or (flexible) plate **52** and actuator **64**. In some embodiments, valve assembly **50** comprises two leaf springs **52**, each connected to a respective actuator, operatively arranged to enable and disable partitions **132**A-B (see FIG. **6**).

Plate **52** comprises top surface **54**, bottom surface **56**, end **58**, and end **60**. Top surface **54** is operatively arranged to engage bottom surface **121**B to open and close holes **124**A to disable vacuum in a partition or a portion of a partition. In some embodiments, top surface **54** comprises gasket **62** to provide for a better seal between leaf spring **52** and platen **120** and thus closure of holes **124**A. End **58** is connected, for example fixedly secured, to platen **120**. In some embodiments, end **58** is connected to bottom surface **121**B via connector or clamp or bar **72** (see FIGS. **9**A-**13**). End **60** is connected to actuator **64**, for example, via bracket **66** and/or shaft **68**.

In some embodiments, and as best shown in FIG. **7**, end **60** is arranged at an angle relative to bottom surface **56**, for example at approximately 135 degrees. This angled portion is connected to bracket **66**. Bracket **66** is connected to actuator **64**, which is operatively arranged to rotate bracket **66** about an axis, for example shaft **68**. For example, in some embodiments, actuator is a solenoid with a plunger that displaces linearly. The plunger is connected to bracket **66** and when plunger is displaced linearly, bracket **66** rotates about shaft **68**. In some embodiments, and as will be describe in greater detail below, actuator **64** may comprise any actuation mechanism suitable for rotating end **68** about an axis (i.e., shaft **68**), for example, a motor. Bracket **66**, and specifically shaft **68**, is rotatably connected to platen **120** via one or more brackets **70** (see FIGS. **11**A-**13**).

In some embodiments, when actuator **64** is in a first state (e.g., de-energized), top surface **54** is separated from bottom surface **121**B and holes **124**A in the partition aligned with leaf spring **52** are open (i.e., the partition is enabled). When actuator **64** is in a second state (e.g., energized), top surface is engaged with and/or abuts against bottom surface **121**B and holes **124**A in the partition aligned with leaf spring **52** are closed (i.e., the partition is disabled). In some embodiments, leaf spring **52** is biased to the open position (i.e., holes **124**A are open). In some embodiments, plate **52** is a flexible plate and is not biased to any position, but rather actuator engages and disengages plate **52** with bottom surface **121**B.

FIG. **8** is a perspective view of valve adjustment assembly **80**. Valve adjustment assembly **80** comprises fulcrum or pinch element or roller **82** operatively arranged to engage bottom surface **56** to adjust the active length of plate **52**. By “active length” it is meant the portion of plate **52** that can be engaged and disengaged with bottom surface **121**B via actuator **64**. Fulcrum **82** linearly displaceable along bottom surface **56** and set at the inboard edge of the sheet or sheets of the print job, thus disabling all holes **124**A of the partition between end **58** and fulcrum **82**. In some embodiments, fulcrum **82** is displaceable via bracket or carriage **84** and actuator **86**. For example, fulcrum **82** is rotatably connected to carriage **84** via shaft **92**. Carriage **84** is linearly displaceable along plate **52** via actuator or screw drive **86**. Actuator **86** is threadably engaged with carriage **84** and guide shaft is slidably engaged with carriage. Thus, as actuator **86** is rotated, carriage **84** linearly displaces therealong. In some embodiments, carriage **84** further comprises spring **94** connected to shaft **90**. In some embodiments, carriage **84** comprises two fulcrums **82** that engage two plates **52** (i.e., on carriage **84** is capable of adjusting the active length of the valves in one zone or two partitions).

FIG. **9**A is a schematic cross-sectional view of vacuum transport assembly **10** taken generally along line **9-9** in FIG. **5**, with valve **52** in an open position. As shown, fulcrum **82** has been displaced from end **58** in outboard cross process direction D**2** to line **29**. Line **29** is aligned with inboard edge **2**A, and together with registered edge **28**, represents width W**1** of sheet **1** in the cross process direction. Positioning fulcrum **82** at line **29** effectively closes all holes **124**A and their respective channels **124**B between end **58** and line **29**, disabling that portion of the partition (i.e., plate **52** abuts against bottom surface **121**B in that portion of the partition). The portion of the partition between line **29** and registered edge **28**, however, is enabled (i.e., plate **52** does not abut against bottom surface **121**B in that portion of the partition). Vacuum **12** draws air through the open holes **124**A and channels **124**B.

FIG. **9**B is a schematic cross-sectional view of vacuum transport assembly **10** taken generally along line **9-9** in FIG. **5**, with valve **52** in a closed position. As shown, actuator **64** has rotated end **60** in a first circumferential direction, which in turn displaces plate **52** such that it abuts against bottom surface **121**B and blocks holes **124**B arranged between line **29** and registered edge **28** (i.e., disables the portion of the partition between line **29** and registered edge **28**). Vacuum **12** cannot draw air through any holes **124**A or channels **124**B.

FIG. **10**A is a schematic cross-sectional view of vacuum transport assembly **10** taken generally along line **10-10** in FIG. **5**, with valve **52** in an open position. Similar to FIG. **9**A, fulcrum **82** is displaced to line **29**; however, line **29** is arranged closer to registered edge **28** reflective of width W**2** of sheet **1**, width W**2** being less than width W**1**. Actuator **64** maintains plate **52** in an open position such that, between line **29** and registered edge **28**, plate **52** is separated from bottom surface **121**B and holes **124**A and channels **124**B are open. FIG. **10**B is a schematic cross-sectional view of vacuum transport assembly **10** taken generally along line **10-10** in FIG. **5**, with valve **52** in a closed position. Actuator **64** is rotated end **60** in a first circumferential direction to displace plate **52** into abutment with bottom surface **121**B, thus closing holes **124**A and channels **124**B and disabling the partition. In some embodiments, when plate **52** is in an open position, end **60** abuts against bottom surface **121**B, and when plate **52** is in a closes position, end **60** is separated from bottom surface **121**B.

FIGS. **11**A-**12**B are partial bottom perspective views of vacuum transport assembly **10** showing valve assemblies **50** and valve adjustment assemblies **80** in various positions. As shown in FIGS. **11**A-B, fulcrums **82** are arranged toward ends **58** of valves **52**A-B. In FIGS. **12**A-B, fulcrums **82** are displaced in outboard cross process direction D**2**, thereby shortening the active length of valves **52**A-B. In some embodiments, fulcrums **82** are displaced by rotating drive screw **86**.

FIG. **11**A shows both of valves **52**A-B in the open position, and thus holes **124**A aligned with valves **52**A-B, and their respective channels **124**B, are open. In some embodiments, valves **52**A-B remain in the open position when actuators **64**A-B are not energized (i.e., valves **52**A-B are leaf springs biased toward the open position). FIG. **11**B shows valve **52**A in the closed position and valve **52**B in the open position. Actuator **64**A is energized thereby rotating bracket **66** and end **60** such that valve **52**A abuts against bottom surface **121**B and closes holes **124**A aligned therewith, and their respective channels. FIG. **12**A shows both of valves **52**A-B in the open position, and thus holes **124**A aligned with valves **52**A-B, and their respective channels **124**B, are open. FIG. **12**B shows valve **52**A in the closed position and valve **52**B in the open position.

FIG. **13** is a partial bottom perspective view of vacuum transport assembly **10**. As shown, vacuum transport assembly **10** comprises eight valves **52** operatively arranged to enable and disable eight partitions (e.g., partitions **32**A-**28**B). Each of valves **52** comprises a respective actuator **64**. Vacuum transport assembly **10** further comprises four valve adjustment assemblies **80**, or eight fulcrums **82**. Valve adjustment assemblies **80** are controlled by actuator or motor **100**. Specifically, drive screws **86** are connected to belt or gear system **104**, which is connected to drive shaft **102**. Actuator **100**, drive shaft **102**, belt system **104**, and drive screws **86** are non-rotatably connected meaning, as one component rotates, all components rotate. Thus, as actuator **100** rotates drive screws **86** rotate thereby displacing carriages **84** and fulcrums **82** linearly along valves **52**. The system shown in FIG. **13** allows the inboard registered edge to be set based on the width of the sheets (i.e., closes all holes **124**A inboard of the inboard edge of the sheet).

FIG. **14**A is a front perspective view of vacuum transport assembly **10**. FIG. **14**B is a partial front perspective view of vacuum transport assembly **10**, with platen **20** including holes **24** removed. FIGS. **15**A-D are detailed rear perspective views of vacuum transport assembly **10** with valves **52**A-B in various positions. In the embodiment shown in FIGS. **14**A-**15**D, vacuum transport assembly **10** comprises one or more valves (e.g., valves **52**A-B), and carriage **84** comprising one or more fulcrums **82** engaged with the valves. Actuator or motor **100** is operatively arranged to displace the valve adjustment assembly, namely, fulcrums **82**, along valves **52**, as previously described. Vacuum transport assembly **10** further comprises actuator or motor **64** operatively arranged to rotate shaft **106**. Shaft **106** is connected to motor **64** at a first end and to cams **108**A-B at a second end. Thus, as motor **64** rotates, cams **108**A-B rotate. Cams **108**A-B engage brackets **66** of valves **52**A. For example, each of brackets **66** comprises a wheel rotatably connected thereto. The wheel engages its respective cam **108**A, **108**B. Cam **108**A comprises projection or raised lip **110**A and cam **108**B comprises projection or raised lip **110**B. Raised lips **110**A-B engage brackets **66** and rotatably displace them so as to move valves **52**A-B between the open position and the closed position, respectively. In some embodiments, springs **112** bias brackets **66** in a first circumferential direction and thus bias valves **52**A-B toward a closed position.

When projections **110**A-B engage their respective brackets **66**, brackets **66** are displaced in a second circumferential direction, opposite the first circumferential direction, thus moving valves **52**A-B to the open position. Cams **108**A-B and their respective projections **110**A-B are arranged such that valves **52**A-B can exhibit four states, as described below.

FIGS. **14**B and **15**A illustrate a first state of valves **52**A-B. In the first state, projection **110**A and projection **110**B are not engaged with their respective brackets **66** and as such, springs **112** bias brackets **66** and valves **52**A-B into the closed position.

FIG. **15**B shows a second state of valves **52**A-B. In the second state, projection **110**A is engaged with its respective bracket **66** thereby rotating bracket **66** and moving valve **52**A to the open position. Projection **110**B is not engaged with its respective bracket **66** and as such, spring **112** biases bracket **66** and valve **52**B into the closed position.

FIG. **15**C shows a third state of valves **52**A-B. In the third state, projection **110**A and projection **110**B are engaged with their respective brackets **66** thereby rotating brackets **66** and moving both of valves **52**A-B to the open position.

FIG. **15**D shows a fourth state of valves **52**A-B. In the fourth state, projection **110**B is engaged with its respective bracket **66** thereby rotating bracket **66** and moving valve **52**B to the open position. Projection **110**A is not engaged with its respective bracket **66** and as such, spring **112** biases bracket **66** and valve **52**A into the closed position. Thus, by using a camming system as shown, one actuator (e.g., motor **64**) can be used to control a plurality of valves (e.g., valves **52**A-B), which may be desirable instead of using one actuator for every valve.

FIG. **16** is a schematic view of vacuum transport assembly **210**. Similar to vacuum transport assembly **10**, vacuum transport assembly **210** comprises platen **120** comprising top surface **121**A, bottom surface **121**B, inboard side **122**A, outboard side **122**C, holes **124**A, channels **124**B, vacuum **12**, and valve **52** engageable with bottom surface. Vacuum transport assembly **210** further comprises fulcrums **182**A-B engaged with and displaceable along valve **52**. This arrangement is desirable for non-registered printing systems when all edges (i.e., lead, trail, inboard, and outboard) are exposed to vacuum. Thus, fulcrum **182**A is displaced along valve **52** in a cross process direction and aligned with inboard edge **2**A of sheet **1**. This closes holes **124**A and channels **124**B between inboard side **122**A and inboard edge **2**A. Fulcrum **182**B is displaced along valve **52** in a cross process direction and aligned with outboard edge **2**C of sheet **1**. This closes holes **124**A and channels **124**B between outboard side **122**C and outboard edge **2**C. Vacuum transport assembly **210** further comprises actuator **164** operatively arranged to move the enable and disable the portion of the partition between fulcrums **182**A and **182**B (i.e., to close holes **124**A and channels **124**B between fulcrums **182**A-B).

It should be appreciated that the method and assemblies disclosed herein can be controlled by a controller or computing device. For example, a controller may communicate with one or more sensors that detect sheets entering and passing through vacuum transport assembly **10**. Based on detection of the size and location of the sheet, via the one or more sensors, the controller adjusts the active length of valves **52** via valve adjustment assemblies **80**, and opens and closes valves **52** via actuators to enable and disable specific partitions, respectively. As such, the controller can be programmed with software or program instructions to carry out the method disclosed herein. In some embodiments, controller receives information related to a print job, for example, sheet size, total number of sheets, distance between each sheet when moving in the process direction D1, etc. Based on this information, controller adjusts the active length of valves **52** via valve adjustment assemblies **80** and opens and closes valves **52** based on a precalculated location of the sheets (i.e., based on the time the first sheet is to enter platen **20** and the separation between each sheet).

FIG. **17** is a functional block diagram illustrating a sheet edge airflow control environment, generally environment **300**, in accordance with some embodiments of the present disclosure. FIG. **17** provides only an illustration of one implementation, and does not imply any limitations with regard to the environments in which different embodiments may be implemented. Many modifications to the depicted environment may be made by those skilled in the art without departing from the scope of the disclosure as recited by the claims. In some embodiments, environment **300** includes one or more of the following connected to network **310**: computing device **400**, sensor **320**, input data **330**, and vacuum transport assembly **10**. In some embodiments, environment **300** further comprises valve assembly **50** and/or valve adjustment assembly **80**, which may be included on or as a separate component from vacuum transport assembly **10**. In some embodiments, environment **300** may further comprise or communicate with a print server or central controller, which communicates with vacuum transport assembly **10** and/or computing device **400** regarding print jobs.

Network **310** can be, for example, a local area network (LAN), a wide area network (WAN) such as the Internet, or a combination of the two, and can include wired, wireless, or fiber optic connections.

Computing device **400** may be a hardware device that controls airflow along the edges of sheets passing over or through vacuum transport assembly **10** using airflow control program **340**. Computing device **400** is capable of communicating with network **310**, sensor **320**, input data **330**, and vacuum transport assembly **10**, and in some embodiments, a print server. In some embodiments, computing device **400** may include a computer. In some embodiments, computing device **400** may include internal and external hardware components, as depicted and described in further detail with respect to FIG. **19**. In some embodiments, airflow control program **340** is implemented on a web server, which may be a management server, a web server, or any other electronic device or computing system capable of receiving and sending data. The web server can represent a computing system utilizing clustered computers and components to act as a single pool of seamless resources when accessed through a network. The web server may include internal and external hardware components, as depicted and described in further detail with respect to FIG. **19**.

Airflow control program **340** is primarily installed on computing device **400**, although it may additionally or alternatively be installed on vacuum transport assembly **10**. Airflow control program **340** is operatively arranged to, based on a size and position of a sheet on vacuum transport assembly **10**, enable and disable airflow about the edges of the sheet, as previously described. In some embodiments, airflow control program **340** receives sheet size and or position from sensor **320**. In some embodiments, airflow control program **340** receives information related to the print job, for example from input data **330** or a print server. This information may include how many sheets are to be printed, the sheet size, the spacing between each sheet on the belt, and other data. Airflow control program **340** uses this information to calculate what holes the sheet edges will encounter and at what time, and disable and enable those holes at specific times such that airflow is disabled along the sheet edges.

Sensor **320** is operatively arranged to detect a position of the sheets within vacuum transport assembly as well as outside of vacuum transport assembly **10**, for example, just prior to entering vacuum transport assembly **10**. In some embodiments, sensor **320** is also arranged to detect the size of the sheet. Sensor **320** may include any sensor suitable to perform these functions, for example, proximity sensors, optical sensors, position sensors, etc.

Input data **330** is data inputted by a user or from a print job, for example, an input that includes the number and size of sheets in a print job, the spacing between sheets on the belt, and the speed of the sheets traveling through vacuum transport assembly **10**. Airflow control program **340** can use this information to determine what holes the sheet edges will align with and when in order to disable and enable such holes.

FIG. **18** shows flow chart **350** depicting operational steps for controlling airflow along sheet edges, for example, while being transported under print heads in a printing system.

In step **352**, airflow control program **340** receives information related to a sheet of a print job. This information can include sheet size and position, the number of sheets in a print job, spacing between sheets traveling on the belt, and speed of the sheets traveling on the belt,

In step **354**, airflow control program **340** disables airflow at inboard edge **2**A of sheet **1**. As previously described, in some embodiments, valve adjustment assemblies **80** are displaced along valve assemblies **50** to line **29**, which aligns with inboard edge **2**A. This effectively closes all holes inboard of inboard edge **2**A. In some embodiments, in step **354**, airflow control program **340** alternatively or additionally disables airflow at outboard edge **2**C (i.e., in non-registered printing systems).

In step **356**, airflow control program **340** disables airflow at lead edge **2**B of sheet **1**. As previously described, just prior to lead edge **2**B aligning with one or more holes, for example a partition or portion of holes, airflow control program **340** disables that partition to stop airflow through such holes. In some embodiments, the partition of holes is disabled by displacing valve assembly **50** into engagement with bottom surface **121**B of platen **120**. This partition of holes remains disabled when lead edge **2**B is aligned therewith. After lead edge **2**B surpasses the partition of holes, airflow control program **340** enables airflow through that partition of holes by releasing valve assembly **50** from engagement with platen **20**, **120**.

In step **358**, airflow control program **340** disables airflow at trail edge **2**D of sheet **1**. As previously described, just prior to trail edge **2**D aligning with one or more holes, for example a partition or portion of holes, airflow control program **340** disables that partition to stop airflow through such holes. In some embodiments, the partition of holes is disabled by displacing valve assembly **50** into engagement with bottom surface **121**B of platen **120**. This partition of holes remains disabled when trail edge **2**D is aligned therewith. After trail edge **2**D surpasses the partition of holes, airflow control program **340** enables airflow through that partition of holes by releasing valve assembly **50** from engagement with platen **20**, **120**.

FIG. **19** is a block diagram of internal and external components of computer system **400**, which is representative of the computing device of FIG. **17**, in accordance with some embodiments of the present disclosure. It should be appreciated that FIG. **19** provides only an illustration of one implementation and does not imply any limitations with regard to the environments in which different embodiments may be implemented. In general, the components illustrated in FIG. **19** are representative of any electronic device capable of executing machine-readable program instructions. Examples of computer systems, environments, and/or configurations that may be represented by the components illustrated in FIG. **17** include, but are not limited to, personal computer systems, server computer systems, thin clients, thick clients, laptop computer systems, tablet computer systems, cellular telephones (i.e., smart phones), multiprocessor systems, microprocessor-based systems, network PCs, minicomputer systems, mainframe computer systems, and distributed cloud computing environments that include any of the above systems or devices.

Computing device **400** includes communications fabric **402**, which provides for communications between one or more processing units **404**, memory **406**, persistent storage **408**, communications unit **410**, and one or more input/output (I/O) interfaces **412**. Communications fabric **402** can be implemented with any architecture designed for passing data and/or control information between processors (such as microprocessors, communications and network processors, etc.), system memory, peripheral devices, and any other hardware components within a system. For example, communications fabric **402** can be implemented with one or more buses.

Memory **406** and persistent storage **408** are computer readable storage media. In this embodiment, memory **406** includes random access memory (RAM) **416** and cache memory **418**. In general, memory **406** can include any suitable volatile or non-volatile computer readable storage media. Software is stored in persistent storage **408** for execution and/or access by one or more of the respective processors **404** via one or more memories of memory **406**.

Persistent storage **408** may include, for example, a plurality of magnetic hard disk drives. Alternatively, or in addition to magnetic hard disk drives, persistent storage **408** can include one or more solid state hard drives, semiconductor storage devices, read-only memories (ROM), erasable programmable read-only memories (EPROM), flash memories, or any other computer readable storage media that is capable of storing program instructions or digital information.

The media used by persistent storage **408** can also be removable. For example, a removable hard drive can be used for persistent storage **408**. Other examples include optical and magnetic disks, thumb drives, and smart cards that are inserted into a drive for transfer onto another computer readable storage medium that is also part of persistent storage **408**.

Communications unit **410** provides for communications with other computer systems or devices via a network. In this exemplary embodiment, communications unit **410** includes network adapters or interfaces such as a TCP/IP adapter cards, wireless Wi-Fi interface cards, or 3G or 4G wireless interface cards or other wired or wireless communications links. The network can comprise, for example, copper wires, optical fibers, wireless transmission, routers, firewalls, switches, gateway computers and/or edge servers. Software and data used to practice embodiments of the present disclosure can be downloaded to computing device **400** through communications unit **410** (i.e., via the Internet, a local area network, or other wide area network). From communications unit **410**, the software and data can be loaded onto persistent storage **408**.

One or more I/O interfaces **412** allow for input and output of data with other devices that may be connected to computing device **400**. For example, I/O interface **412** can provide a connection to one or more external devices **420** such as a keyboard, computer mouse, touch screen, virtual keyboard, touch pad, pointing device, or other human interface devices. External devices **420** can also include portable computer readable storage media such as, for example, thumb drives, portable optical or magnetic disks, and memory cards. I/O interface **412** also connects to display **422**.

Display **422** provides a mechanism to display data to a user and can be, for example, a computer monitor. Display **422** can also be an incorporated display and may function as a touch screen, such as a built-in display of a tablet computer.

The present disclosure may be a system, a method, and/or a computer program product. The computer program product may include a computer readable storage medium (or media) having computer readable program instructions thereon for causing a processor to carry out aspects of the present disclosure. Added, the computer program product may at least one or more of account for the magnetic field of added magnet members designed to assist controlling valves and control the magnetic field of the added magnet members.

The computer readable storage medium can be a tangible device that can retain and store instructions for use by an instruction execution device. The computer readable storage medium may be, for example, but is not limited to, an electronic storage device, a magnetic storage device, an optical storage device, an electromagnetic storage device, a semiconductor storage device, or any suitable combination of the foregoing. A non-exhaustive list of more specific examples of the computer readable storage medium includes the following: a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), a static random access memory (SRAM), a portable compact disc read-only memory (CD-ROM), a digital versatile disk (DVD), a memory stick, a floppy disk, a mechanically encoded device such as punch-cards or raised structures in a groove having instructions recorded thereon, and any suitable combination of the foregoing. A computer readable storage medium, as used herein, is not to be construed as being transitory signals per se, such as radio waves or other freely propagating electromagnetic waves, electromagnetic waves propagating through a wave-guide or other transmission media (e.g., light pulses passing through a fiber-optic cable), or electrical signals transmitted through a wire.

Computer readable program instructions described herein can be downloaded to respective computing/processing devices from a computer readable storage medium or to an external computer or external storage device via a network, for example, the Internet, a local area network, a wide area network and/or a wireless network. The network may comprise copper transmission cables, optical transmission fibers, wireless transmission, routers, firewalls, switches, gateway computers and/or edge servers. A network adapter card or network interface in each computing/processing device receives computer readable program instructions from the network and forwards the computer readable program instructions for storage in a computer readable storage medium within the respective computing/processing device.

Computer readable program instructions for carrying out operations of the present disclosure may be assembler instructions, instruction-set-architecture (ISA) instructions, machine instructions, machine dependent instructions, microcode, firmware instructions, state-setting data, or either source code or object code written in any combination of one or more programming languages, including an object oriented programming language such as Smalltalk, C++ or the like, and conventional procedural programming languages, such as the "C" programming language or similar programming languages. The computer readable program instructions may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider). In some embodiments, electronic circuitry including, for example, programmable logic circuitry, field-programmable gate arrays (FPGA), or programmable logic arrays (PLA) may execute the computer readable program instructions by utilizing state information of the computer readable program instructions to personalize the electronic circuitry, in order to perform aspects of the present disclosure.

Aspects of the present disclosure are described herein with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems), and computer program products according to embodiments of the disclosure. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer readable program instructions.

These computer readable program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks. These computer readable program instructions may also be stored in a computer readable storage medium that can direct a computer, a programmable data processing apparatus, and/or other devices to function in a particular manner, such that the computer readable storage medium having instructions stored therein comprises an article of manufacture including instructions which implement aspects of the function/act specified in the flowchart and/or block diagram block or blocks.

The computer readable program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other device to cause a series of operational steps to be performed on the computer, other programmable apparatus or other device to produce a computer implemented process, such that the instructions which execute on the computer, other programmable apparatus, or other device implement the functions/acts specified in the flowchart and/or block diagram block or blocks.

The flowchart and block diagrams in the figures illustrate the architecture, functionality, and operation of possible implementations of systems, methods, and computer program products according to various embodiments of the present disclosure. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of instructions, which comprises one or more executable instructions for implementing the specified logical function(s). In some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustration, and combinations of blocks in the block diagrams and/or flowchart illustration, can be implemented by special purpose hardware-based systems that perform the specified functions or acts or carry out combinations of special purpose hardware and computer instructions.

Added is a representative vacuum transport assembly that uses, as illustrated in FIG. **20**, magnet members **250**A-**250**E to aid in controlling valve assembly where **250**A is a plug magnet, **250**B is a strip magnet, **250**C is an electromagnet, **250**D is a magnet in the form of a cube, and **250**E is a donut magnet. Other magnet shapes and electrified components of the inventive concept may be used. Magnets **250**A-**250**E are used considering equations known in the art and appropriate to the magnets used such as, but not limited to $\mu_0\vec{M}=\vec{B}$ and $\vec{F}=q\vec{v}*\vec{B}$, where B is the magnetic field vector.

FIGS. **21**-**26** illustrate that the additional embodiments include the platen **20**, including the first top surface **121**A; the first bottom surface **121**B; and the one or more through-holes **124**A. Representative additional embodiments include the valve assembly **50** including the plate **52** aligned with the one or more through-holes **124**A, the through-holes **124**A parallelly arrayed in rows. The additional embodiments include the plate **52** including the second top surface **54**; the second bottom surface **56**; the first end **58** fixedly secured to the first bottom surface **121**B; and the second end **60**; and, the first second end **64** connected to the second end **60**, but including at least two or more magnet members **250**A-**250**E arrayed longitudinally on each side of given rows. The magnets **250**A-**250**E are designed to assist closing the through-holes **124**A with the leaf valve assemblies **52** when the leaf valve assemblies **52** are engaged in a closed state.

The added embodiments may further include the carriage **84** translatably connected to the second actuator **84** and the fulcrum **82** connected to the carriage **84**. The added embodiments may further include the fulcrum **82** being a roller. The added embodiments may further include the second actuator **84** being a screw drive. The added embodiments may further include the flexible plate **52** being the leaf spring **52**. The added embodiments may further include the first second end **64** being operatively arranged to displace the plate **52** relative to the first bottom surface **121**B.

The added embodiments may further include, in a closed state of the valve assembly **50**, the second top surface **54** designed to engage with the first bottom surface **121**B to close the one or more holes **124**A; and in an open state of the valve assembly **50**, the second top surface **54** designed to disengage from the first bottom surface **121**B such that the one or more holes **124**A are open. In this added embodiment, the at least two or more magnet members **250**A-**250**E are designed to engage with the top surface **54** of the valve assembly **50** to draw the valve assembly **50** toward the first bottom surface **121**B to close the one or more holes **124**A.

The added embodiment can be designed with many types of magnet members **250**A-**250**E, represented by but not limited to, magnetic plug members **250**A, the magnet plug members **250**A which may further be disposed within magnet hole members **25** to keep the magnet plug members **250**A substantially flush to the first bottom surface **121**B; magnetic strip members **250**B, the magnetic strip members **250**B which may, as illustrated in FIG. **27**, further be deployed in slot members **260** to the magnetic strip members **250**B substantially flush to the first bottom member, and magnet members designed as electromagnet members **250**C in the aforementioned or different dispositions. The electromagnet members **250**C may further be able to at least one or more of change strength and polarity, may further be designed with wire coils, and are operationally coupled to electrical power source operating the printing system.

The added embodiments may further include, the valve adjustment assembly **80**, including: the fulcrum **82** engaged with the second bottom surface **56**; and the second actuator **84** operatively arranged to displace the fulcrum **82** with respect to the plate **52**.

The added embodiments may further include: the fulcrum **82** forces the plate **52** into contact with the platen **20** at a position along the plate **52** such that: the first portion of the plate **52** extending from the first end **58** to the position abuts against the first bottom surface **121**B; and the second portion of the plate **52** extending from the position to the second end **60** is displaceable with respect to the first bottom surface **121**B. The added embodiments may further include the first second end **64** connected to the second end **60** via the cam **108**A, **109**B. Other embodiments previously disclosed may be included as a part of the added embodiments.

FIG. **28** illustrates that another representative added embodiment is a representative vacuum transport method, the method including the step of **2800**, commencing operating the vacuum transport having a platen **20**, the platen **20** including the first top surface **121**A; the first bottom surface **121**B; the one or more through-holes **124**A; and the valve assembly **50**. The added embodiment further includes the step of **2810**, displacing the plate **52** relative to the first bottom surface **121**B the plate **52** aligned with the one or more through-holes, the through-holes **124**A linearly and parallelly arrayed in rows, the plate **52** including: the second top surface **54**; the second bottom surface **56**; the first end **58** fixedly secured to the first bottom surface **121**B; and, the second end **60**; and at least two or more magnet members **250**A-**250**E arrayed longitudinally on each side of each row, the first second end **64** connected to the second end **60**.

The added representative vacuum transport method may further include the step of **2820** engaging in a closed state of the valve assembly **50**, the second top surface **54** or the first bottom surface **121**B to close the one or more holes **124**A; and disengaging in an open state of the valve assembly **50**, the second top surface **54** from the first bottom surface **121**B such that the one or more holes **124**A are open.

The representative method may further include the step of **2830**, controlling airflow along sheet **1** edges on a vacuum transport assembly comprising the platen **20** including one or more holes **124**A arranged in rows in a cross-process direction, and a belt displaceable with respect to the platen **20** in a process direction. The method may further include the step of **2840**, enabling airflow through the one or more holes **124**A, disengaging therefore, the plate **52** from one or more magnet members **250**A-**250**E; receiving information related to one or more sheets **1** of a print job; based on the information, disabling airflow through the one or more holes **124**A at an inboard edge of the one or more sheets **1**, engaging therefore, the plate **52** to one or more magnet members **250**A-**250**E; based on the information, disabling airflow through the one or more holes at a lead edge of the one or more sheets; and, based on the information, disabling airflow through the one or more holes **124**A at a trail edge of the one or more sheets **1**.

The added vacuum transport method may further include the step of **2850**, engaging in a closed state of the valve assembly **50**, the second top surface **54** with the first bottom surface **121**B to close the one or more holes **124**A; and engaging with the at least two or more magnet members **250**A-E further the top surface **54** of the valve assembly **50** to draw the valve assembly **50** toward the bottom surface **56** to close the one or more holes **124**A.

The method may further include the step of **2860**, executing program instructions stored on the computer readable storage media for, as illustrated in FIG. **19**, by at least one of the one or more computer processors **404**, the program instructions including: receiving information related to the one or more sheets **1**; disabling airflow at an inboard edge of the one or more sheets; disabling airflow at a lead edge of the one or more sheets **1**; disabling airflow at a trail edge of the one or more sheets **1**; and, the program further at least one or more of calculating magnetic force acting on the plate **52** and controlling magnetic force acting on the plate **52**.

Added embodiments of the vacuum transport method may further include the step of **2870**, initiating and terminating an electric field of at least one of at least one electromagnet members **250**C of the at least two or more magnet members **250**C. Added embodiments of the vacuum transport method may further include the step of **2880**, at least one or more of changing the strength and polarity of the at least one of the at least one electromagnet members **250**C.

It will be appreciated that various aspects of the disclosure above and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. Various presently unforeseen or unanticipated alternatives, modifications, variations, or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

LIST OF REFERENCE NUMERALS

1 Sheet
2A Inboard edge
2B Lead edge
2C Outboard edge
2D Trail edge
3 Stack
4 Stack edge
5 Sheet
6A Inboard edge
6B Lead edge
6C Outboard edge
6D Trail edge
10 Vacuum transport assembly
12 Vacuum
14 Belt
16 Rollers
18 Marker modules
18A Marker module
18B Marker module
18C Marker module
18D Marker module
20 Platen
22A Inboard side
22B Lead side
22C Outboard side
22D Trail side
24 Holes
25 Magnet hole
26A Zone
26B Zone
26C Zone
26D Zone
28 Registration edge
29 Line
30 Acquisition roller
32A Row or partition of holes
32B Row or partition of holes
34A Row or partition of holes
34B Row or partition of holes
36A Row or partition of holes
36B Row or partition of holes
38A Row or partition of holes
38B Row or partition of holes
50 Valve assembly
52 Leaf spring or valve or plate
52A Leaf spring or valve or plate
52B Leaf spring or valve or plate
54 Top surface
56 Bottom surface
58 End
60 End
62 Gasket
64 Actuator or motor or solenoid
64A Actuator
64B Actuator
66 Bracket
68 Shaft
70 Bracket
72 Connector or clamp or bar
80 Valve adjustment assembly
82 Fulcrum or pinch element or roller
84 Bracket or carriage
86 Actuator
88 Guide shaft
90 Shaft
92 Shaft
94 Spring
100 Actuator
102 Drive shaft
104 Belt and/or gear system
106 Shaft
108A Cam
108B Cam
110A Projection or raised lip
110B Projection or raised lip
112 Spring(s)
120 Platen
121A Top surface
121B Bottom surface
122A Inboard side
122B Lead side
122C Outboard side
122D Trail side
124A Holes
124B Channels
126A Zone
126B Zone
126C Zone
126D Zone
132A Row or partition of holes
132B Row or partition of holes
164 Actuator
182A Fulcrum or pinch element or roller
182B Fulcrum or pinch element or roller
210 Vacuum transport assembly
250A Plug magnet
250B Strip magnet
250C Electromagnet
250D Cube magnet
250E Donut magnet
260 Slot
300 Sheet edge airflow control environment
310 Network
320 Sensor
330 Input data
340 Airflow control program
350 Flowchart
352 Step
354 Step
356 Step
358 Step

D1 Process direction
D2 Outboard cross process direction
D3 Inboard cross process direction
W1 Width
W2 Width

What is claimed is:

1. A vacuum transport assembly, comprising:
a platen, including:
a first top surface;
first bottom surface; and,
one or more through-holes; and,
a valve assembly, including:
a plate aligned with the one or more through-holes parallelly arrayed in rows, the plate including:
a second top surface;
a second bottom surface;
a first end fixedly secured to the first bottom surface; and,
a second end;
a first actuator connected to the second end; and
at least two or more magnet members arrayed on each side of each row.

2. The valve assembly as recited in claim **1**, wherein: the valve adjustment assembly further comprises a carriage translatably connected to a second actuator; and, a fulcrum connected to the carriage.

3. The valve assembly as recited in claim **2**, wherein the fulcrum is a roller.

4. The valve assembly as recited in claim **2**, wherein the second actuator is a screw drive.

5. The valve assembly as recited in claim **1**, wherein the plate is a leaf spring.

6. The vacuum transport assembly as recited in claim **1**, wherein the first actuator is operatively arranged to displace the plate relative to the first bottom surface.

7. The vacuum transport assembly as recited in claim **1**, wherein:
in a closed state of the valve assembly, the second top surface is engaged with the first bottom surface to close the one or more holes; and,
in an open state of the valve assembly, the second top surface is disengaged from the first bottom surface such that the one or more holes are open.

8. The vacuum transport assembly as recited in claim **7**, wherein:
the at least two or more magnet members are adapted to engage with the top surface of the valve assembly to draw the valve assembly toward the first bottom surface to close the one or more holes.

9. The vacuum transport assembly as recited in claim **1**, wherein:
the magnet members are magnetic insert members from at least one or more from a group of: plug members, cube members, and donut members.

10. The vacuum transport assembly as recited in claim **1**, wherein:
the magnet members are magnetic strip members.

11. The vacuum transport assembly as recited in claim **1**, wherein:
the magnet members are electromagnet members.

12. The vacuum transport assembly as recited in claim **11**, wherein:
the electromagnet members are adapted to at least one or more of change strength and polarity.

13. The vacuum transport assembly as recited in claim **1**, further comprising a valve adjustment assembly, including:
a fulcrum engaged with the second bottom surface; and,
a second actuator operatively arranged to displace the fulcrum with respect to the plate.

14. The vacuum transport assembly as recited in claim **13**, wherein the fulcrum forces the plate into contact with the platen at a position along the plate such that:
a first portion of the plate extending from the first end to the position abuts against the first bottom surface; and,
a second portion of the plate extending from the position to the second end is displaceable with respect to the first bottom surface.

15. The vacuum transport assembly as recited in claim **1**, wherein the first actuator is connected to the second end via a cam.

16. A method of controlling airflow along sheet edges on a vacuum transport assembly comprising a platen including one or more holes arranged in rows in a cross-process direction, and a belt displaceable with respect to the platen in a process direction, the method comprising:
enabling airflow through the one or more holes, disengaging therefore, a plate from one or more magnet members;
receiving information related to one or more sheets of a print job;
based on the information, disabling airflow through the one or more holes at an inboard edge of the one or more sheets, engaging therefore, the plate to one or more magnet members;
based on the information, disabling airflow through the one or more holes at a lead edge of the one or more sheets; and,
based on the information, disabling airflow through the one or more holes at a trail edge of the one or more sheets.

17. The vacuum transport method as recited in claim **16**, the method including:
engaging in a closed state of the valve assembly, the second top surface with the first bottom surface to close the one or more holes; and,
engaging with the at least two or more magnet members further the top surface of the valve assembly to draw the valve assembly toward the bottom surface to close the one or more holes.

18. The method as recited in claim **16**, the method further including:
executing program instructions stored on the computer readable storage media by at least one of the one or more computer processors, the program instructions including:
receiving information related to the one or more sheets;
disabling airflow at an inboard edge of the one or more sheets;
disabling airflow at a lead edge of the one or more sheets; and,
disabling airflow at a trail edge of the one or more sheets; and,
the program further at least one or more of calculating magnetic force acting on the plate and controlling magnetic force acting on the plate.

19. The vacuum transport method as recited in claim **18**, the method further including initiating and terminating an electric field of at least one of at least one electromagnet members of the at least two or more magnet members.

20. The vacuum transport method as recited in claim **19**, the method further including at least one or more of changing the strength and polarity of the at least one of the at least one electromagnet members.

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