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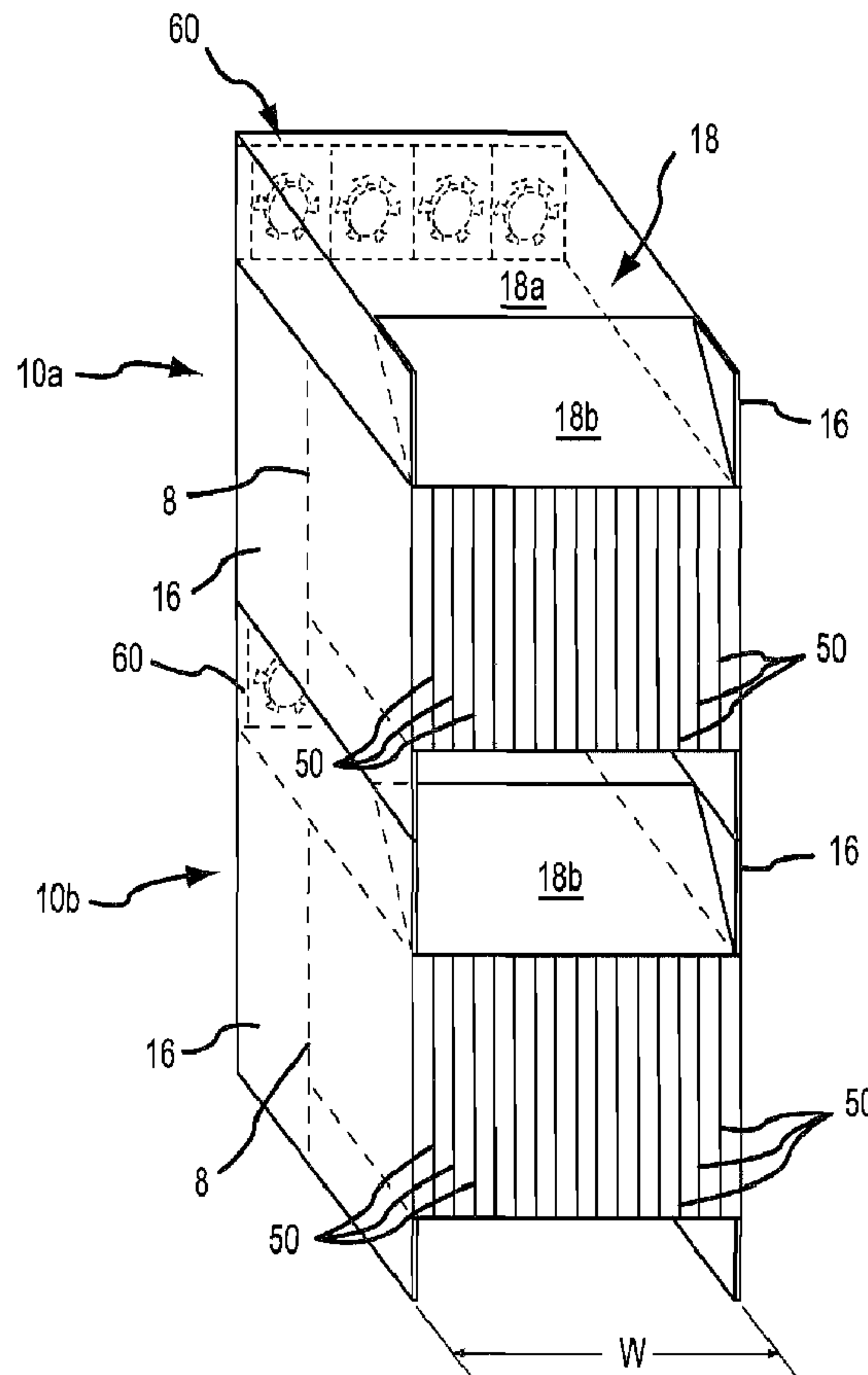
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(54) Titre : AMELIORATIONS APPORTEES A LA TAILLE D'ENTREE/ DE SORTIE D'AIR POUR UN CHASSIS D'ELECTRONIQUE

(54) Title: INCREASING AIR INLET/OUTLET SIZE FOR ELECTRONICS CHASSIS



(57) Abrégé/Abstract:

Provided are electronics chassis having air inlets with increased cross-sectional area that facilitate airflow through the chassis and thereby provide improved cooling. As electronics chassis are often stacked, it has been determined that the upper surfaces of a



(57) **Abrégé(suite)/Abstract(continued):**

lower chassis may be utilized to at least partially define the air inlet of the upper chassis. In this regard, an upper portion of the lower chassis may be removed to increase the size of an air inlet. That is, portions of an upper wall and/or the top wall of a lower chassis are removed and connected by a connecting wall (e.g. a tapered and/or a chamfered wall). Likewise, the bottom wall of an upper chassis may be removed. When stacked, the air inlet of the upper chassis may be disposed above the truncated portion of the lower chassis. In such an arrangement, the size of the resulting air intake is significantly increased.

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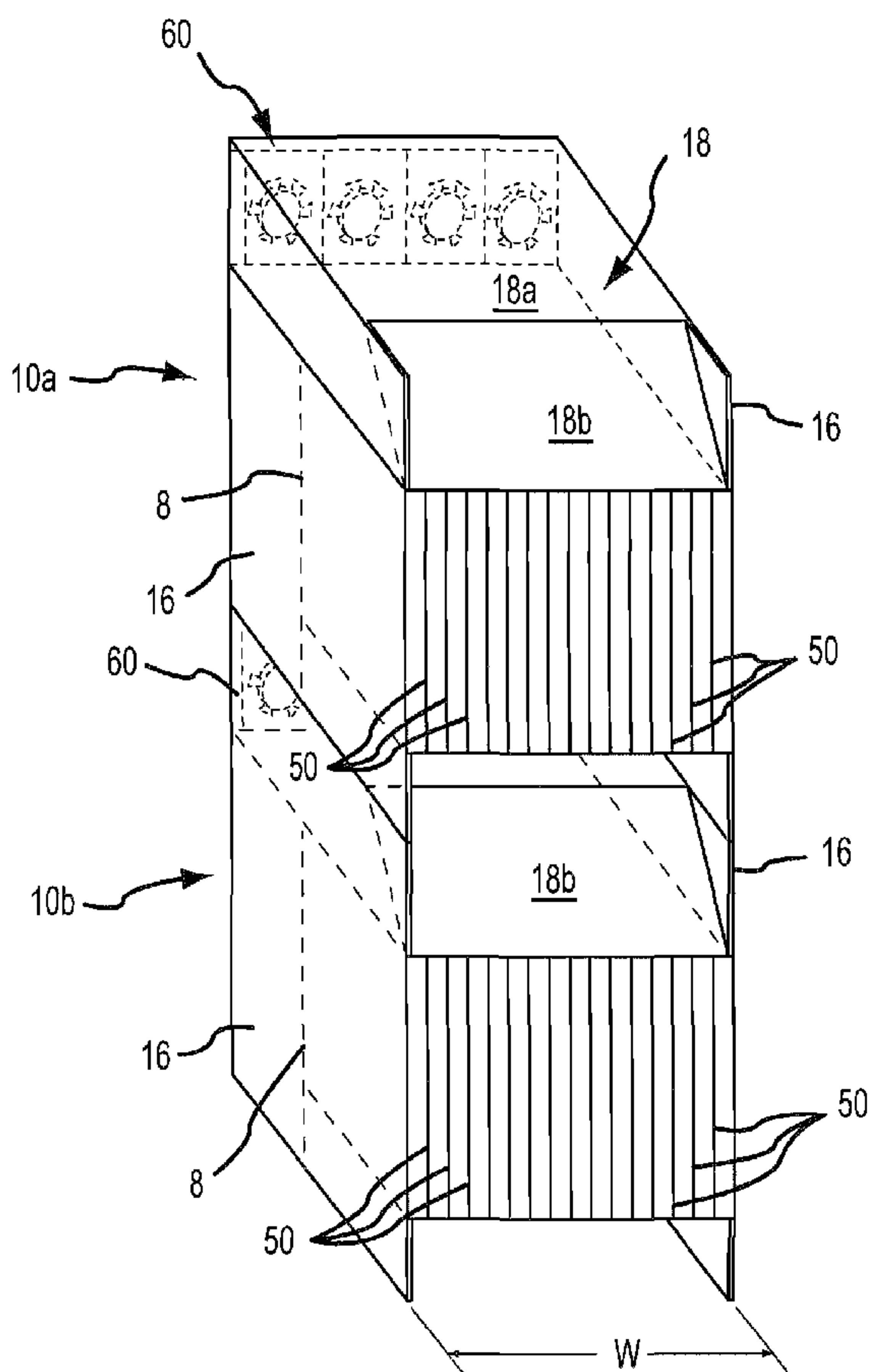
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(54) Title: INCREASING AIR INLET/OUTLET SIZE FOR ELECTRONICS CHASSIS



(57) Abstract: Provided are electronics chassis having air inlets with increased cross-sectional area that facilitate airflow through the chassis and thereby provide improved cooling. As electronics chassis are often stacked, it has been determined that the upper surfaces of a lower chassis may be utilized to at least partially define the air inlet of the upper chassis. In this regard, an upper portion of the lower chassis may be removed to increase the size of an air inlet. That is, portions of an upper wall and/or the top wall of a lower chassis are removed and connected by a connecting wall (e.g. a tapered and/or a chamfered wall). Likewise, the bottom wall of an upper chassis may be removed. When stacked, the air inlet of the upper chassis may be disposed above the truncated portion of the lower chassis. In such an arrangement, the size of the resulting air intake is significantly increased.

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**INCREASING AIR INLET/OUTLET SIZE FOR ELECTRONICS CHASSIS****BACKGROUND**

Modern electronics, such as telecommunications equipment, is commonly  
5 contained in a housing or chassis. The chassis may serve many functions, including  
providing structural support for the contents, providing a common electrical ground,  
providing protection from electromagnetic interference (EMI), and others.

For many applications (e.g., telecommunications centers, server farms, etc.) it has  
become common practice to stack multiple individual electronics chassis in specialized  
10 racks. Further, multiple racks may be arranged in a side-by-side manner. These  
arrangements allow for reducing the space required to house multiple such electronics  
chassis.

Within certain industries, there are standards organizations that have promulgated  
specifications for certain types of electronics chassis. One example of such an  
15 organization is the PCI Industrial Computer Manufacturers Group (PICMG) and an  
example of such a specification is PICMG 3.0 Rev. 1.0 or as further updated, more  
commonly known as the Advanced Telecom Computing Architecture (ATCA)  
specification.

Along with voluminous other requirements, the ATCA specification specifies the mechanical configuration of a backplane within a housing, the number, size, and relative spacing of circuit boards (referred to as blades) that are retained within the housing and which electrically connect to the backplane. The ATCA specification also specifies the characteristics of the circuit ground provided for the blades, and the cooling and air filtering requirements for the housing.

Although the ATCA has provided a significant improvement with respect to providing standardized component interfaces and operability, several of the design specifications have failed to account for the growth in the processing speed and density of electronics board. For instance, processing speeds of the equipment housed by the chassis has increased faster than anticipated by the ATCA. Further, there is a direct relationship between speed and power consumption; the faster the processor speed the higher the power consumption of the processor. Accordingly, continued growth in processing speeds and/or electronics density results in the need to dissipate a greater amount of heat by an ATCA chassis

It is against this background that the present invention has been developed.

### SUMMARY

In view of the foregoing, various systems and methods (i.e., utilities) are provided herein for improving airflow through electronics chassis including, without limitation, ATCA chassis. Generally, a lower portion of a first surface (e.g., a front surface) of a chassis may include an air inlet and an upper portion of an opposing surface (e.g., a back surface) of the chassis may include an air outlet. In such an arrangement, the upper portion of the front surface of the chassis may be truncated to provide improved airflow

into an air inlet on the front and bottom surfaces of a chassis disposed on top of the truncated chassis.

In a first aspect, there is provided an electronics chassis for housing a plurality of electronics boards comprising:

5 a housing having four vertical sidewalls including first and second lateral sidewalls, a back wall and a front wall, wherein an interior of the housing includes an upper plenum, a lower plenum and a section disposed between the plenums for receiving a plurality of electronics boards;

10 a top wall extending over a portion of the area defined by the four vertical sidewalls; and

a connecting wall extending between the top wall and the front wall, wherein the connecting wall is at least partially transverse to both the top wall and the front wall and wherein the front wall extends from the connecting wall to a position below a top edge of the lower plenum, wherein an area below a bottom edge of the front wall and a bottom  
15 plane of the housing is at least partially open defining a front portion of an air inlet in a front surface of the housing, and

wherein an area below the lower plenum adjacent to a plane defined by the front wall is free of a bottom wall defining a bottom portion of the air inlet in a bottom surface of the housing, wherein upon disposing the chassis on a like-configured chassis, the air  
20 inlet defined by the front air inlet portion and the bottom air inlet portion and a connecting wall of the like-configured chassis has a minimum cross-sectional area that is greater than a cross-sectional area as defined by the height and width of the lower plenum of the chassis.

In one arrangement, the connecting wall may extend between a rearward edge of  
25 the top wall and a top edge of the front wall. In one arrangement, the connecting wall

may be a planar surface. In another arrangement, the connecting wall may be a curved surface. In one arrangement, the top wall may be a substantially horizontal (i.e., in relation to the vertical sidewalls) surface. Further, the top wall may be conformal with the top edges of the lateral sidewalls and/or back wall. Alternatively, the top wall may be disposed a predetermined distance from the top edges of these walls. The lateral sidewalls may be substantially continuous between the front and rear walls such that they provide an upper edge that may be utilized to support a chassis thereon.

The chassis may include one or more fan units that are utilized to displace air through the chassis. In one arrangement, one or more fan units may be disposed adjacent to an air outlet in the upper plenum. Such fan units may be disposed upright such that they are substantially parallel to the vertical surfaces defined by the sidewalls. In another arrangement, one or more fan units may be disposed in the upper plenum above electronics cards within the housing. In such an arrangement, the fan units may be disposed horizontally (i.e., perpendicular to the vertical sidewalls). In further arrangements, the fan units may be disposed in the lower plenum, either vertically and/or horizontally. In one arrangement, the chassis is free of a bottom wall. In this regard, when a chassis free of a bottom wall is disposed on top of another chassis (e.g., having a truncated upper plenum), there is no bottom wall to impede airflow there into the chassis.

According to another aspect, there is provided an electronics chassis for housing a plurality of electronics boards comprising:

an enclosure having first and second lateral sidewalls, a back wall and a front wall, the enclosure adapted to house a plurality of electronics boards;

a lower plenum disposed below the enclosure, the lower plenum having an air inlet defined by:

an opening below a lower edge of the front wall of the enclosure; and

an opening below the lower plenum extending from a plane defined by the front wall toward the back wall, which is free of a bottom wall; and

an upper plenum disposed above the enclosure, the upper plenum including:

rear surface associated with the back wall of the enclosure, the

5 rear surface including an air outlet;

a chamfered surface associated with the front wall of the

enclosure; and

a top surface extending between the rear surface and the

chamfered surface,

10 wherein, when the chassis is disposed on top of a like-configured chassis, an opening into the lower plenum defined by the lower edge of the front wall and a chamfered surface of the like-configured chassis has a minimum cross-sectional area that is greater than a cross-sectional area of a height and width of the lower plenum of the chassis.

15 In one arrangement, the top wall slopes between the front and back walls.

Accordingly, this sloping surface may be a planar surface. In this arrangement, the lower end of the top wall may provide additional space to allow increasing the size of air inlet opening of a chassis disposed above the top wall. In another arrangement, the top wall includes a first section connecting to the back wall and a chamfered section connecting to  
5 the front wall. The first section and the chamfered section may define surfaces that are transverse. In this regard, the first section may form, for example, a horizontal surface and the chamfered section may define an angled, curved or other surface that extends between the first section of the top wall and the front wall. Again, the chassis may be free of a bottom wall.

10 According to another aspect an electronics chassis is provided for housing a plurality of electronics boards. The chassis includes an enclosure having first and second lateral sidewalls, a back wall and a front wall. The chassis also includes upper and lower plenums. The lower plenum is disposed below the enclosure and the upper plenum is disposed above the enclosure. The lower plenum includes an air inlet on a front surface  
15 associated with the front wall of the enclosure and the upper plenum includes an air outlet on a rear surface associated with the back wall. The upper plenum also includes side surfaces, a chamfered surface associated with the front wall of the enclosure and a top surface extending between the rear surface and the chamfered surface.

The chamfered surface is typically transverse to both the front wall and the top  
20 surface. In the present aspect, portions or the entirety of the side surfaces and/or rear surface of the upper plenum may be formed by the lateral sidewalls and back wall of the enclosure, respectively. Alternatively, the surfaces may be formed separately from the walls of the enclosure.

The foregoing examples of the related art and limitations related therewith are intended to be illustrative and not exclusive. Other limitations of the related art will become apparent to those of skill in the art upon a reading of the specification and a study of the drawings.

5

### BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments are illustrated in referenced figures of the drawings. It is intended that the embodiments and figures disclosed herein be considered illustrative rather than limiting.

10 Figure 1 is a cut-away side view of portions of a prior art pair of stacked electronics chassis.

Figure 2 is a cut-away side view of portions of a of stacked electronics chassis defining an air inlet having an increased size.

Figure 3 is a perspective view of the stacked chassis of Figure 2.

15 Figure 4 is a cut-away side view of portions of another embodiment of stacked electronics chassis defining an air inlet having an increased size.

Figure 5 is a cut-away side view of portions of another embodiment of stacked electronics chassis defining an air inlet having an increased size.

20 Figure 6 is a cut-away side view of portions of another embodiment of stacked electronics chassis defining an air inlet having an increased size.

Figure 7 is a cut-away side view of portions of another embodiment of stacked electronics chassis defining an air inlet having an increased size.

### DETAILED DESCRIPTION

Reference will now be made to the accompanying drawings, which assist in illustrating the various pertinent features of the present invention. Although the present invention will now be described primarily in conjunction with electronics chassis, it should be expressly understood that the present invention may be applicable to other applications where it is desired to achieve the objectives of the inventions contained herein. In this regard, the following description of an electronics chassis is presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the form disclosed herein. Consequently, variations and modifications commensurate with the following teachings, and skill and knowledge of the relevant art, are within the scope of the present invention. The embodiments described herein are further intended to explain modes known of practicing the invention and to enable others skilled in the art to utilize the invention in such, or other embodiments and with various modifications required by the particular application(s) or use(s) of the present invention.

Figures 1-7 variously illustrate cross-sectional side and perspective views of an exemplary electronics chassis 10a. Generally, the chassis 10a conform to ATCA specifications and include an enclosure having four vertical sidewalls that house a plurality of electronic boards or “blades.” See for example Figure 3. Specifically, the chassis 10a includes a front wall 12, a back wall 14, two lateral sidewalls 16, as well as a top wall 18. The chassis 10a may be composed of any suitable material including, but not limited to, plastic, steel and aluminum. Further, the physical dimensions of the chassis 10a may also vary according to intended use and/or chassis specific specifications.

The chassis 10a typically houses a plurality of electronic circuit cards, also known as blades. For instance, the chassis may house a plurality of blades 50 (e.g., sixteen blades) that are disposed in parallel fashion and extend from the front wall 18 towards a

backplane 8 within the chassis 10a that is spaced from the back wall 14 (See Figures 2 and 3). In another dimension, the blades generally extend vertically from the top of a lower plenum 32 to the bottom of an upper plenum 42. Further, it will be appreciated that the blades 50 are spaced relative to one another such that air may flow between each individual board for cooling purposes. However, it will be appreciated that the exact configuration of the chassis 10a may vary by application.

The blades within the chassis 10a generate heat during operation and are cooled by air flowing through the chassis 10a. In some instances, such airflow may be due to natural convection within the electronics chassis 10a. More commonly, one or more fan units 60 are utilized to displace air through the electronics chassis for cooling purposes. In this regard, the fan units 60 may be operative to displace ambient air through an inlet 30, into a lower plenum 32, through one or more filters 20, vertically between the blades into an upper plenum 42 and out of the chassis 10a. As the air passes across components on the blades, heat is carried away. Often, the lower plenum 32 includes a slanted filter 20, which is operative to at least partially distribute airflow along the length of the blades such that more even airflow is achieved.

As noted, the ATCA chassis 10a includes a housing having a front wall 12, a back wall 14, and a pair of lateral sidewalls 16 that are sized to houses a plurality of telecommunication circuit boards/cards/blades. Also contained within the housing may be circuitry for power interface and distribution, for control of fans, and for management of all of the other circuitry within the housing. It is a common practice to stack multiple chassis to reduce the amount of room required to house a plurality of such chassis. Further, it will be noted that multiple sets of stacked chassis may be disposed side by side. Often, the only available surfaces for inletting and exhausting air for cooling purposes are the front and rear walls of the individual electronics chassis.

Figure 1 illustrates a pair of prior art chassis 10a and 10b that are stacked on top of one another. Specifically, Figure 1 shows a cross-sectional side view for purposes of illustration. As shown, fan units 60 are operative to draw air through the chassis. As shown, ambient air enters the chassis 10a near the bottom wall 19 or “shelf” through the inlet 30, which may include a grate. The air enters the lower plenum 32, turns 90 degrees upward, flows across and between the blades 50, enters the upper plenum 42, again turns 90 degrees and flows through the fan unit(s) 60 and is exhausted from the chassis 10a. In the embodiment shown, the lower plenum 32 includes a slanted filter 20, which is operative to at least partially distribute airflow along the length of the blades 50 such that more even airflow is achieved.

As shown, the air inlet 30 of the upper chassis 10a has a maximum height dimension H, as measured between the lower edge of the front wall 12 and the bottom wall 19 of the chassis 10a and/or the top wall 18 of the lower chassis 10b disposed immediately there below. As will be appreciated, this height, H, multiplied by the width W of the chassis 10a defines the cross-sectional area of the air inlet 30. This cross-sectional area limits the amount of airflow that may be drawn into the chassis 10a.

Accordingly, it may be desirable to increase the cross-sectional area of the air inlet in order to facilitate improved airflow through a chassis and thereby provide improved cooling. That is, a larger air inlet may reduce the resistance to airflow there through and thereby improve cooling of the blades disposed within a chassis. However, it will be appreciated that in many instances, it may not be feasible to increase the size of the inlet 30 if this requires reducing the size of the front wall 12. That is, the lower edge of the front wall 12 typically extends least to the top edge of the lower plenum 32. In this regard, it is typical for the front wall 12, back wall 14 and lateral sidewalls 16 to be continuous over the portion of the chassis 10a that includes the blades 50. That is, the

walls define a continuous housing between the upper and lower plenums 32, 42. This allows the front and back walls 12, 14 as well as the lateral side walls 16 to provide EMI shielding as well as provide an enclosure through which one or more fan units 60 may direct airflow for cooling purposes. That is, it may not be feasible to raise the lower edge  
5 of the front wall 12 and it is not desirable (or permitted by one or more standards) to increase the overall size of the chassis to increase the size of the air inlet. Accordingly, another technique to increase the size of the inlet has been developed.

Specifically, as first and second stacked chassis 10a and 10b may collectively define the air inlet 30 of an upper chassis 10a, it has been determined that a portion of the  
10 upper plenum 42 and/or the top and front walls of the chassis may be removed to increase the size of an air inlet. That is, portions of the upper front wall 12 and/or the top wall 18 of a chassis 10a may be truncated and connected by a connecting wall (e.g. a tapered and/or a chamfered wall). This may be performed in conjunction with the removal and/or truncation of the bottom wall 19 of an upper chassis. In this regard, an upper chassis 10a  
15 having at least a portion of its bottom wall removed may be disposed above the truncated/chamfered portion of a lower chassis 10b. Accordingly, this allows effectively increases the size of the air inlet 30 of an upper chassis 10a.

Figure 2 shows a pair of chassis 10a and 10b stacked on top of each other wherein the chassis each include an upper plenum 42 having a truncated portion (e.g., truncated  
20 front and top walls) that allows for increasing the size of the air inlet 30 of a chassis disposed there above. As can be seen, each chassis 10a includes an air inlet in a lower front portion thereof and an air outlet formed in a rear portion thereof. Further, each chassis 10a includes a top wall 18 having a chamfered portion. Each chassis also has an air filter disposed at a sloped angle near the inlet plenum. Further, each chassis 10a also  
25 includes a bank of one or more fan units 60s disposed proximate to its air outlet. As can

be appreciated, the fan units exhaust air through the air outlet and thereby draw fresh air in through the air inlet 30, through the air filter, and into the interior of the housing where it removes heat from the various electronic circuitry therein. The air then enters the upper plenum 42 and is exhausted by the fans through the air outlet.

5           The size of the air inlet is increased by removing a portion of the upper plenum 42 of a chassis lobe. That is, a portion of a lower chassis 10b is removed in order to increase the size of the air inlet 30 of an upper chassis 10a. As shown, in such an arrangement the top edge of the front wall 12 does not reach to the upper edges of the lateral side walls 16. Likewise, the top wall 18 of the chassis 10a extends over a portion of less than all of the  
10       area projected by the planes of the front, back and lateral side walls 16. In this regard, the top wall 18 may have a generally horizontal portion/surface 18a and a chamfered portion/surface 18b. Such a chamfered portion 18b may extend between the horizontal portion 18a of the top wall 18 and the top edge of the front wall 12. It should be noted that the lateral side walls 16 may not be chamfered. In this regard, the side walls 16 may  
15       provide a continuous support surface between the planes defined by the front and back walls 12, 14 for supporting the lower edges of an upper chassis 10a.

          In order to increase the size of the air inlet, the chassis 10a may also be free of a bottom wall. Alternatively, the chassis may include a bottom wall, which extends over less than an entirety of a projected area defined by the front wall, back wall and lateral  
20       side walls 16. For instance, a bottom wall may be incorporated that substantially matches the horizontal portion 18a of the top wall 19.

          As can be seen by the examination of Figure 2 and 3, the size of the air inlet is greatly increased by the inclusion of the chamfered/truncated portion on a lower chassis 10b and the lack of a corresponding bottom wall on an upper chassis 10a. For instance,  
25       as shown in Figure 2, a minimal cross-dimension of the air inlet 30 is defined by the

distance L measured between the surface of the chamfered portion 18b of the top wall 18 and the lower edge of the front wall 12 of the upper chassis. As shown, this distance, L, is significantly greater than the corresponding height H shown in Figures 1 and 2.

Accordingly, as the length L can be significantly increased in relation to the height H of existing air inlets, the cross-sectional area of the air inlet may be greatly increased.

Figures 2, 4 and 5 illustrate different embodiments of the chassis where the fan unit(s) 60 are disposed at different locations within the chassis 10a. For instance, in Figure 2, the fan units 60 are disposed in a vertical relationship adjacent to an exhaust outlet of the chassis 10a. In Figure 4, one or more fan units 60 are horizontally disposed in the upper plenum 42 above the portion of the chassis that contains the blades 50. In the further embodiment of Figure 5, the fan units 60 are disposed in the lower plenum 32 below the blades 50 disposed within the chassis 10a to these various different arrangements, the fan units 60 are operative to draw and/or push air through the chassis 10. In addition, it will be appreciated that different chassis may utilize different combinations of these fan arrangements. Further, such fan arrangements may include those set forth in U.S. Patent No. 7,430,117, entitled "Airflow Management System for Electronics Chassis".

As noted above, the chamfered portion of the top wall 18 permits increase in the cross-sectional area of an air inlet for a chassis disposed there above. As illustrated above, the chamfered portion 18b is formed of an angled surface interconnected to the horizontal portion 18 of the top wall. However, it would be appreciated that other embodiments of top walls having a chamfered portion are possible and are within the scope of the present invention. For instance, Figure 6 illustrates a top wall 18 having a horizontal portion 18a and a curved chamfered portion 18h. Figure 7 illustrates another embodiment of a chassis wherein the top wall 18 is sloped between the back wall and the

front wall of the chassis 10a. In this embodiment, the top wall does not include a horizontal portion. However, the use of the sloped top wall 18 again permits the increased cross-sectional area of an air inlet for chassis disposed there above. In this regard, it will be appreciated that any top wall configuration that allows for increasing the cross-sectional area of an air inlet of a chassis disposed there above is considered within the scope of the present invention. It will be further appreciated that the configurations of Figures 6 and 7 may also utilize any appropriate fan configuration such of those illustrated in Figures 2 through 3 as well as additional and/or different configurations.

Any other combination of all the techniques discussed herein is also possible. This may include, without limitation, having the inlet at the rear and the outlet at the front, using sloped and curved surfaces in the vicinity of the air outlet to increase airflow, and having a bottom wall but no top wall.

The foregoing description has been presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the form disclosed herein. While a number of exemplary aspects and embodiments have been discussed above, those of skill in the art will recognize certain variations, modifications, permutations, additions, and sub-combination thereof. The scope of the claims should not be limited by the preferred embodiments set forth in the examples, but should be given the broadest interpretation consistent with the description as a whole.

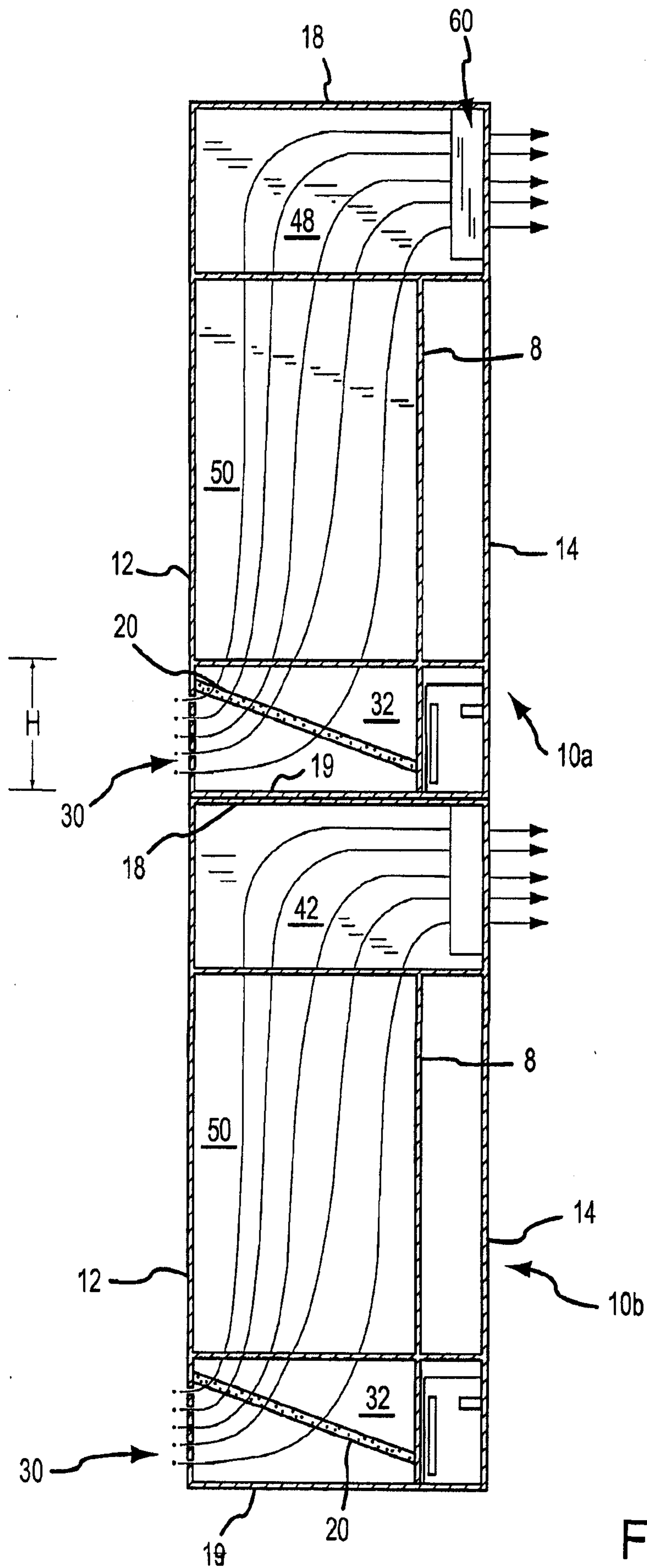
**What is claimed is:**

1. An electronics chassis for housing a plurality of electronics boards comprising:
  - a housing having four vertical sidewalls including first and second lateral sidewalls, a back wall and a front wall, wherein an interior of the housing includes an upper plenum, a lower plenum and a section disposed between the plenums for receiving a plurality of electronics boards;
  - a top wall extending over a portion of the area defined by the four vertical sidewalls; and
  - a connecting wall extending between the top wall and the front wall, wherein the connecting wall is at least partially transverse to both the top wall and the front wall and wherein the front wall extends from the connecting wall to a position below a top edge of the lower plenum, wherein an area below a bottom edge of the front wall and a bottom plane of the housing is at least partially open defining a front portion of an air inlet in a front surface of the housing, and
  - wherein an area below the lower plenum adjacent to a plane defined by the front wall is free of a bottom wall defining a bottom portion of the air inlet in a bottom surface of the housing, wherein upon disposing the chassis on a like-configured chassis, the air inlet defined by the front air inlet portion and the bottom air inlet portion and a connecting wall of the like-configured chassis has a minimum cross-sectional area that is greater than a cross-sectional area as defined by the height and width of the lower plenum of the chassis.
2. The chassis of claim 1, wherein the connecting wall extends between a rearward edge of the top wall and a top edge of the front wall.

3. The chassis of claim 1 or 2, wherein at least a portion of the connecting wall is a planar surface.
4. The chassis of claim 1 or 2, wherein at least a portion the connecting wall is a curved surface.
5. The chassis of any one of claims 1 to 4, wherein the connecting wall forms a portion of the upper plenum.
6. The chassis of any one of claims 1 to 5, wherein the top wall comprises a horizontal portion that is disposed substantially perpendicular to planes defined by the vertical sidewalls.
7. The chassis of any one of claims 1 to 6, further comprising:  
an air outlet extending through a portion of the back wall defining the upper plenum.
8. The chassis of claim 7, further comprising:  
at least a first fan unit is disposed in the upper plenum proximate to the air outlet, wherein the fan unit is in a vertical orientation.
9. The chassis of claim 7, further comprising:  
at least a first fan unit disposed in the upper plenum, wherein the fan unit is disposed horizontally to draw air through electronics cards disposed between the upper and lower plenums.

10. The chassis of claim 7, further comprising:  
at least a first fan unit disposed in the lower plenum.
11. The chassis of any one of claims 1 to 10, wherein the chassis is free of a bottom wall.
12. An electronics chassis for housing a plurality of electronics boards comprising:  
an enclosure having first and second lateral sidewalls, a back wall and a front wall, the enclosure adapted to house a plurality of electronics boards;  
a lower plenum disposed below the enclosure, the lower plenum having an air inlet defined by:  
an opening below a lower edge of the front wall of the enclosure; and  
an opening below the lower plenum extending from a plane defined by the front wall toward the back wall, which is free of a bottom wall; and  
an upper plenum disposed above the enclosure, the upper plenum including:  
rear surface associated with the back wall of the enclosure, the rear surface including an air outlet;  
a chamfered surface associated with the front wall of the enclosure; and  
a top surface extending between the rear surface and the chamfered surface,  
wherein, when the chassis is disposed on top of a like-configured chassis, an opening into the lower plenum defined by the lower edge of the front wall and a chamfered surface of the like-configured chassis has a minimum cross-sectional area that is greater than a cross-sectional area of a height and width of the lower plenum of the chassis.

13. The chassis of claim 12, wherein the chamfered surface is transverse to both the front wall and the top surface.
14. The chassis of claim 12 or 13, wherein the lateral sidewalls of the enclosure form the sidewalls of the upper plenum.
15. The chassis of any one of claims 12 to 14, wherein the back wall of the enclosure forms the rear surface of the upper plenum.
16. The chassis of claim 12, wherein the chamfered surface extends between the top surface and an upper edge of the front wall of the enclosure.
17. The chassis of claim 16, wherein the chamfered surface is a planar surface.
18. The chassis of claim 16, wherein the chamfered surface is a curved surface.
19. The chassis of any one of claims 12 to 18, further comprising:  
at least a first fan unit disposed within at least one of the upper and lower plenums.



(PRIOR ART)

FIG. 1

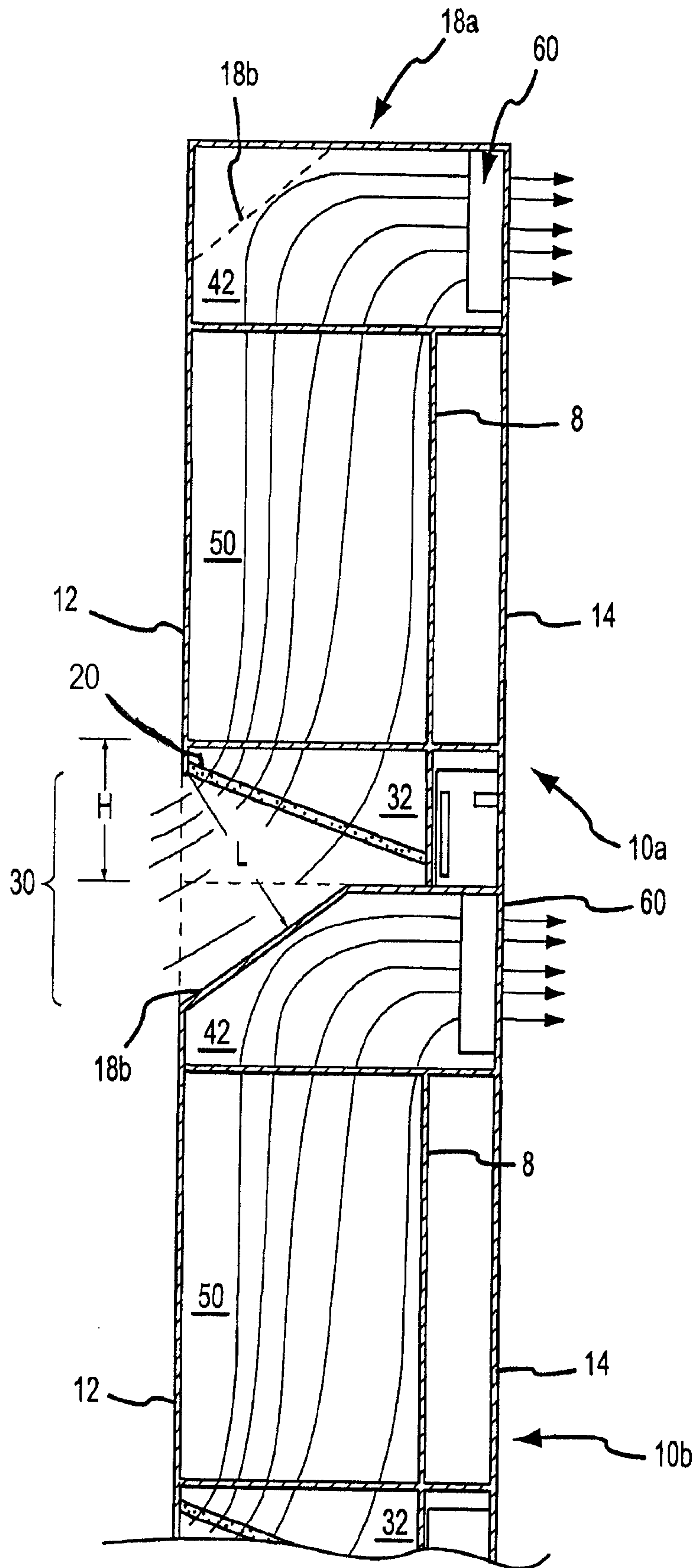


FIG.2

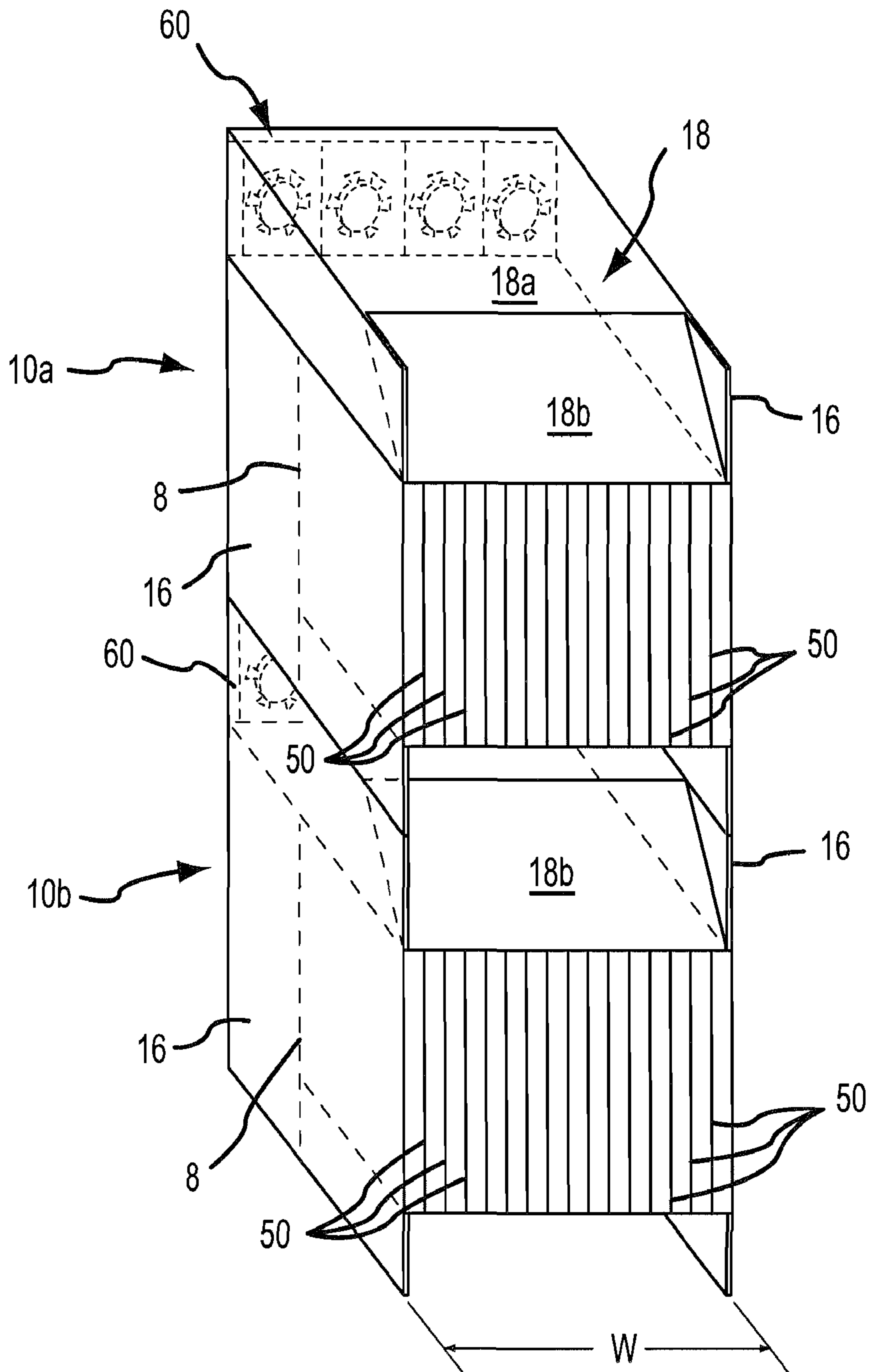


FIG.3

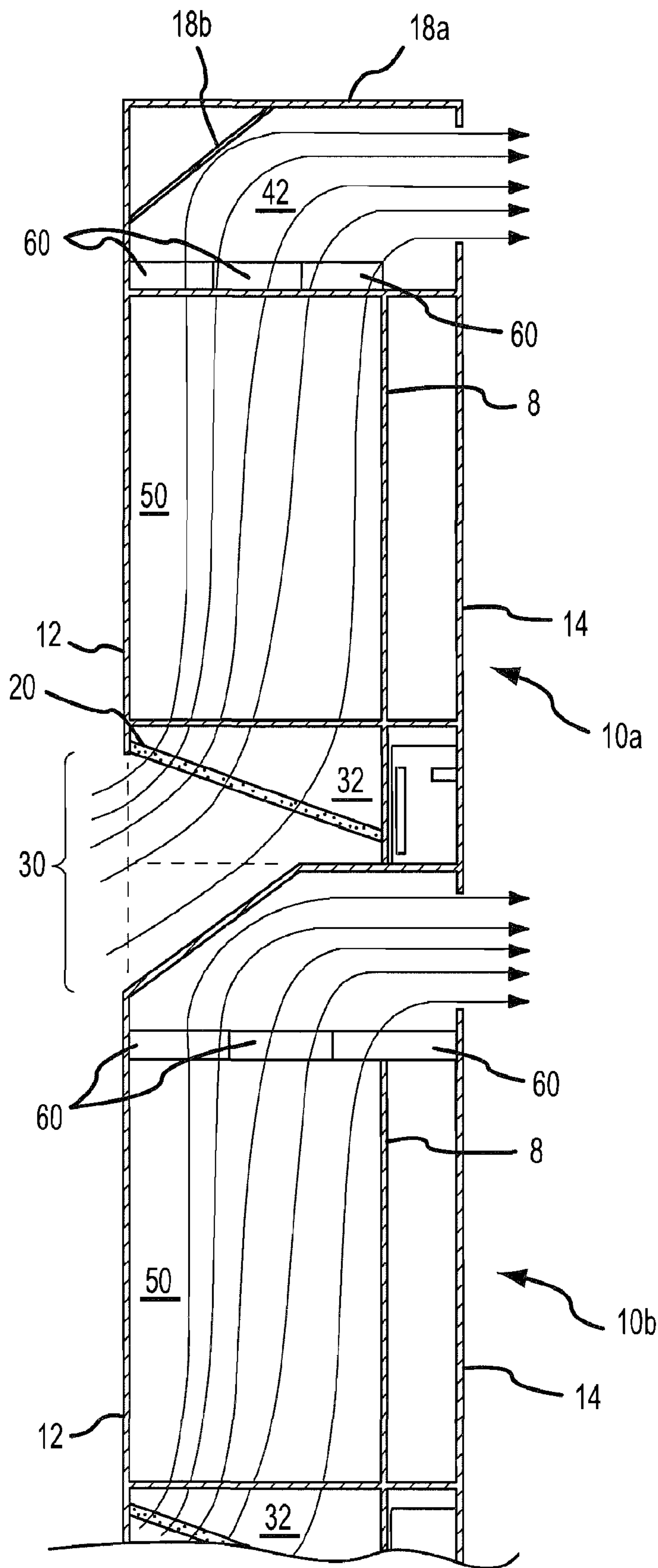


FIG.4

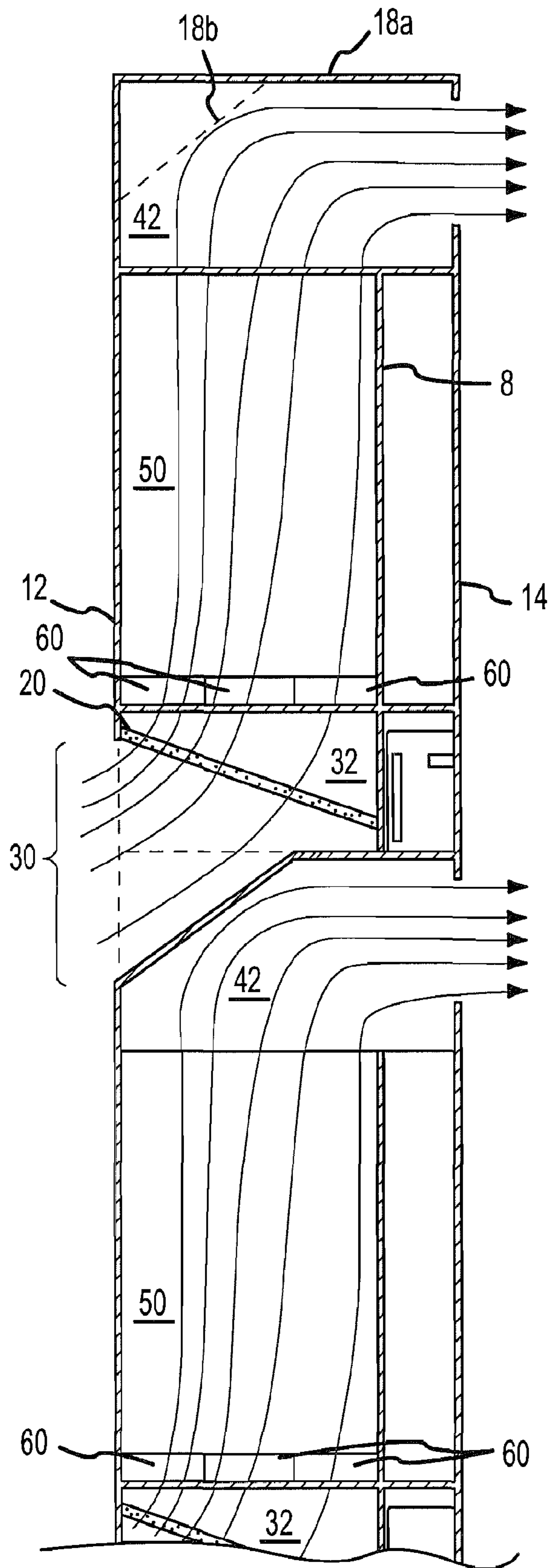


FIG.5

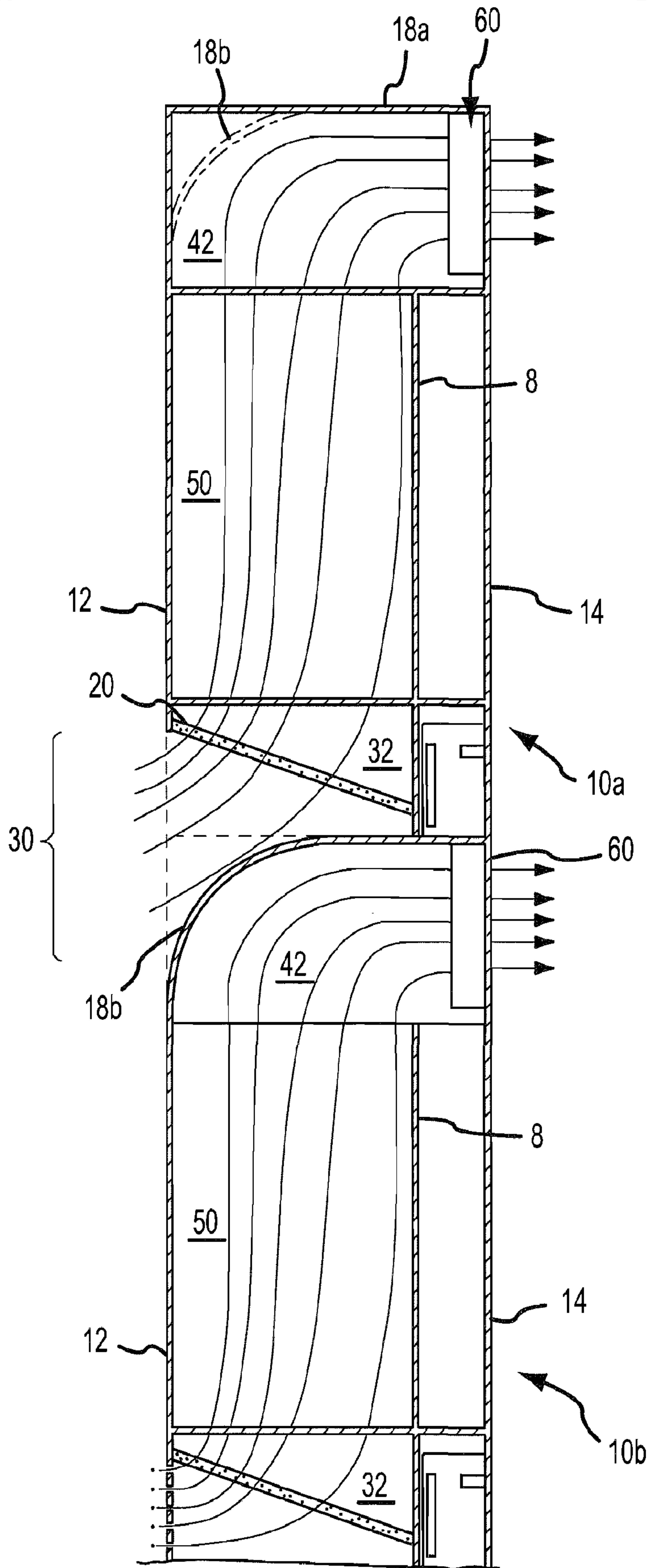


FIG.6

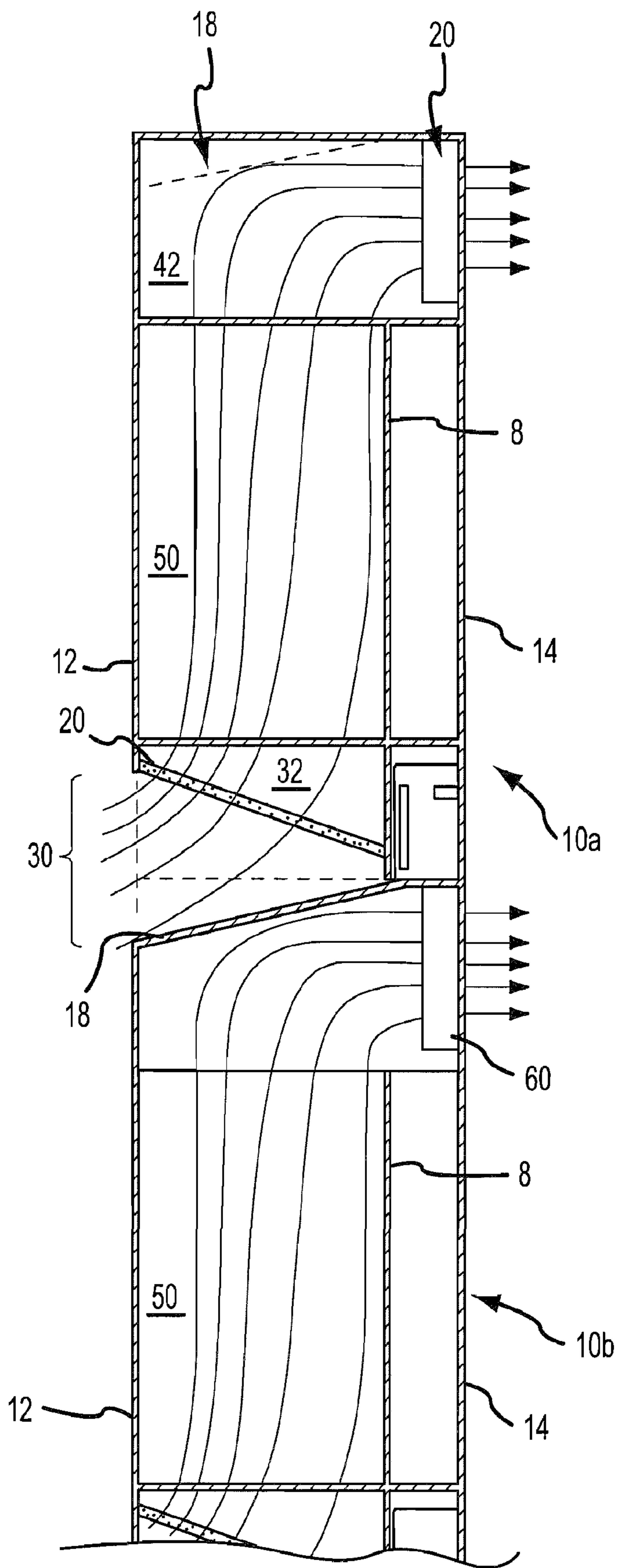


FIG.7

