

DISPLAY CASE

BACKGROUND

[0001] The disclosure relates to refrigerated cases. More particularly, the disclosure relates to service cases/merchandisers.

5 [0002] There are many varieties of refrigerated cases. Self-service cases exist for consumers principally to access product. A variety of self-service refrigerated case configurations exist, including: open front cases; open top cases; sliding front door cases; and hinged front door cases. Distinct groups of cases exist for access principally by food service personnel. Many of these may have glass fronts to display product to consumers but provide principal or exclusive access from the rear by service personnel. Such cases may be used in
10 various situations including: bakery situations; delicatessen situations; and butcher situations where it is desired for customers to see product but not have direct access.

[0003] Various such cases include a stepped rear wall which provides a food preparation counter surface. Such cases may also have sloping glass fronts (e.g., flat or curved glass panels rearwardly inclined). The result of the stepped rear wall and sloping front wall is that
15 the case interior may have a relatively deep lower/base portion and a relatively shallow upper portion.

SUMMARY

[0004] One aspect of the disclosure involves a refrigerated service case having a base. A
20 refrigerated compartment is above the base. The compartment has a relatively deep lower portion and a relatively shallow upper portion. A rear wall along the compartment includes a lower wall portion along the compartment lower portion. The rear wall also includes a food preparation counter above the lower wall portion. The case includes a refrigeration system having a heat absorption heat exchanger. A first fan drives an airflow along a first air
25 flowpath across the heat absorption heat exchanger to recirculate through the compartment. A second fan is positioned to drive a branch airflow through the upper portion of the compartment.

[0005] In various implementations, the case may further include a thermoelectric cooling unit. The thermoelectric cooling unit may be positioned to cool product on the upper shelf.
30 The thermoelectric cooling unit may have an upper heat absorbing portion positioned to cool product on the upper shelf and a lower heat rejecting portion positioned to reject heat to air flowing along a portion of the air flowpath between the upper shelf and a lower shelf. The second fan may be positioned to direct the branch airflow upward behind product on the upper shelf.

[0006] The case may be operated to control the second fan at least partially independently of the first fan so as to provide at least partially independent temperature control for the compartment upper portion and compartment lower portion.

[0007] The case may be implemented as a reengineering of an existing case configuration
5 or a remanufacturing of an existing case.

[0008] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features, objects, and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

- 10 [0009] FIG. 1 is a partially schematic side x-ray view of a display case.
[0010] FIG. 2 is a view of the case of FIG. 1.
[0011] FIG. 3 is a top view of the case of FIG. 1 with front glass removed.
[0012] FIG. 4 is a partially schematic side x-ray view of a baseline case.
[0013] FIG. 5 is a partially schematic side x-ray view of an alternate case.
15 [0014] FIG. 6 is a top view of a cooled shelf of the case of FIG. 5.
[0015] FIG. 7 is a front view of the cooled shelf of FIG. 6.
[0016] FIG. 8 is a side view of the shelf of FIG. 6.
[0017] Like reference numbers and designations in the various drawings indicate like elements.

DETAILED DESCRIPTION

[0018] FIGS. 1-3 show a service case 20. The case 20 (FIG. 2) extends from a first (e.g., left as viewed by a consumer facing the case) end 22 to a second (right) end 24. The case has a front 26 and a rear 28. The exemplary front comprises a rearwardly inclined, forwardly vertically convex, glass window 38 through which consumers can view product stored in the interior/compartments 40. The window may extend from a lower end proximate a base 42 below the compartment. The window may extend to an upper end. The base 42 may contain portions of the refrigeration equipment (discussed below).

[0019] The exemplary rear is formed by a stepped wall structure including an intermediate counter 48. The counter 48 has a food preparation surface 50. A lower portion of the rear wall 52 may extend downward from an upper edge and at a rear edge of the food preparation counter to a lower edge. The compartment 40 has an upper portion 54 of the lower portion 56. An upper shelf 58 and a lower shelf 60 may respectively be positioned to hold product 62, 64 in the upper portion of the compartment and lower portion of the compartment.

[0020] In one example of a use situation, the case is utilized in a delicatessen environment by service personnel standing behind the case. Various meats, cheeses, and the like, are displayed as the product 63, 64 on the shelves. The food service personnel used the food preparation surface 50 to slice the products and bag or otherwise package them or prepare sandwiches and the like.

[0021] Due to the slope of the front wall, the compartment lower portion 56 extends slightly farther forward than the upper portion 54. Due to the step in the rear wall, the compartment lower portion 56 may extend much farther rearward than the upper portion 54 creating a step at the shelf 48. This difference in depth and the step in the rear wall may interfere with airflow in the compartment. One result may be that product on the upper shelf is exposed to higher temperature than product on the lower shelf. For example, FIG. 4 shows a baseline case 68 wherein the refrigeration system's compressor 70 and heat rejection heat exchanger (e.g., gas cooler or condenser) 72 are located in the case base 42. A fan 74 may force an airflow 506 across the condenser 72. Alternative implementations may involve one or more of the refrigeration system components being remote. For example, a remote central compressor and condenser may deliver refrigerant to multiple display cases.

[0022] The expansion device 76 and heat absorption heat exchanger (e.g., evaporator) 78 are located in the compartment below the lower shelf 60. A fan 80 is also positioned below the lower shelf to drive a recirculating airflow 508 along a flowpath 510. The airflow 508

generally passes along a first leg 510-1 of the flowpath 510 below the lower shelf 60 and through the evaporator 78 so as to be cooled. The airflow 508 then flows upward in front of a front surface 82 of the rear wall lower portion along a second leg 510-2. At the underside of the food preparation counter 48, the airflow 508 is deflected forward along a third leg 510-3.

5 This may continue as a fourth leg 510-4 approximately between the upper and lower compartment portions 54, 56. A fifth leg 510-5 may return downward along a lower portion of the front wall (window 38) to rejoin the first leg 510-1. Although the open nature of the flow 508 may cause some recirculative cooling in the upper portion 54 of the cabinet, this may be small compared to the cooling of the lower portion 56 (especially when combined
10 with any convection). It may be advantageous to reengineer the baseline case 68 to provide enhanced airflow and cooling to the upper portion of the compartment.

[0023] Returning to FIG. 1, the enhanced airflow and cooling may be achieved by the addition of one or more fans 100 (e.g., a side-to-side array of fans). The cooling airflow 518 may proceed along a flowpath 520 having legs 520-1, 520-2, and 520-3 approximately
15 similar to 510-1, 510-2, and 510-3, respectively. The fan(s) 100 may be positioned to split air from the airflow 518 at the end of the leg 520-3. The fan(s) 100 may drive a first branch flow 521 along a branch flowpath 522 while leaving a second branch flow 524 to flow approximately as in the baseline. For example, the fan(s) 100 may be positioned so that a first
20 leg 522-1 of the branch flowpath 522 passes upward to a lower rear edge of the upper shelf 58. A second leg 522-2 may then pass upward behind the product 62 on the upper shelf. A third leg 522-3 may pass forward over the product 62 on the upper shelf. A fourth leg 522-4 may then pass downward along an upper portion of an inside surface 110 of the front wall (window 38) to merge with the second branch 524 airflow (which has passed over/through
25 product 64 on the lower shelf) and return combined along the leg 520-5 to the front of the leg 520-1.

[0024] FIG. 1 shows a window unit 128 having a pair of sliding windows (panes/panels) 130 extending upward from shelf brackets 132 behind the fan(s) 100 to define the rear boundary of the compartment upper portion 54 along the leg 522-2. The exemplary windows act as a flow guide to help to guide the flow 521 along the leg 522 to better cool the product
30 62 on the upper shelf 58. The exemplary windows 130 leave an open gap 140 between a forward edge of the counter 48 and a lower edge of the doors 130. The exemplary gap 140 provides access for the counter service person to access product 64 along the lower shelf. Optionally, the gap 140 may be closable such as by sliding windows (either 130 or additional windows) or a removable cover.

[0025] A control system (controller (e.g., a micro controller)) 150 (FIG. 1) may be provided to control operation of the case. The controller 150 may receive user input from a user input device 152 (e.g., a control panel) to identify desired temperatures for the compartment upper portion 54 and compartment lower portion 56. The controller 150 may receive temperature data from one or more sensors in the compartment (e.g., a sensor 154 in the upper portion 54 and a sensor 156 in a lower portion 56). The controller 150 may also receive input from various sensors (not shown) directly along the refrigeration system (e.g., various refrigerant pressure and temperature sensors). The controller may thus control the fan(s) 100 at least partially independently of the fan(s) 80 so that desired respective temperatures may be maintained in the compartment upper portion 54 and compartment lower portion 56. For example, in a reengineering situation, basic control parameters could be preserved relative to the baseline with control of the fan(s) 100 superimposed. For example, the fan(s) 100 may be on-off modulated and/or speed modulated to maintain a desired temperature in the compartment upper portion 54 as measured by the sensor 154 while preserving the basic control method of the baseline. In a reengineering or remanufacturing situation, a window unit may be present in the baseline and may be preserved or modified to the unit 128. For example, in a reengineering from the baseline of FIG. 4, the window unit may be reoriented to bring its lower end forward with a corresponding shrinking of the windows. An exemplary reorientation is by 5-40°. The exemplary resulting window unit may be inclined an exemplary 5-50° off vertical.

[0026] FIG. 5 shows an alternate case 220 otherwise similar to the case 20 but including one or more thermoelectric cooling units 222 in the upper shelf. The thermoelectric cooling unit has a heat absorbing section 224 and a heat rejecting section 226. The exemplary heat absorbing section is positioned to directly cool product on the upper shelf (i.e., via conduction or convection rather than via a forced airflow). For example, FIGS. 6-8 show an upper shelf unit 230 having an exemplary five thermoelectric cooling units 222 arrayed from left-to-right. The shelf unit 230 has a front edge 234, a rear edge 236, a left edge 238, and a right edge 240. The shelf unit 230 has a top or upper surface 242 and a bottom or lower surface/underside 244. The exemplary shelf unit 230 includes a central heat spreader core 246 (e.g., a metal plate (for example, aluminum)). The plate 246 may serve to draw heat from the product 62 to the heat absorbing section 224. An exemplary heat absorbing section 224 of each unit 222 is a contact plate (e.g., fastened (e.g. by screws) or bonded (e.g., by brazing or conductive epoxy)) to the plate 246. To limit condensation, the plate 246 may be encapsulated in insulation, with an upper insulating layer 250 and a lower insulating layer

252 shown. Each exemplary contact plate 224 is secured in an associated gap in the layer 252. The top surface 242 may be along the top surface of the layer 250. In the exemplary unit 222, the heat rejecting section 226 is a fin array behind the contact plate. The unit 222 includes an exemplary fan 260 positioned to draw an airflow 550 over the heat rejecting section 226 along a flowpath 552. The exemplary flowpath 552 branches off of and returns to the flow 524 along leg 520-4. Exemplary power and local control electronics for the thermoelectric cooling unit 222 are not shown. An insulated duct 270 may surround a portion of the flowpath 552 so as to keep warmed air exiting the heat rejecting section 226 away from the product 64 on the lower shelf therebelow. If there is sufficient height along the leg 520-4 (e.g., between the top of the product on the lower shelf and the heat rejecting section), the heat rejecting section will have only slight effect (if any) on the temperature of the air encountering the product. By warming the air that reaches the inside surface 110 of the front wall (window 38), the thermoelectric cooling units 222 may warm the front wall and reduce condensation. The controller 150 may similarly control operation of the thermoelectric cooling units 222 (e.g., via on-off duty-cycle modulation, power modulation, or the like). For example, they may be operated to supplement cooling provided by the branch airflow 521 if the branch airflow alone is ineffective to maintain the compartment upper portion 54 at a sufficiently low temperature (e.g., relative to the compartment lower portion 56 or relative to ambient temperature).

20 [0027] In other variations (not shown), the thermoelectric cooling unit(s) 222 could be present (e.g., added relative to a baseline) in the absence of the fan(s) 100.

[0028] One or more embodiments have been described. Nevertheless, it will be understood that various modifications may be made. For example, the present teachings may be implemented in the context of a remanufacturing or reengineering of a variety of existing or yet-developed cases and configurations thereof. These include combinations of fixed front, flat front, top counter, and three-shelf cases. Accordingly, other embodiments are within the scope of the following claims.

CLAIMS

What is claimed is:

1. A refrigerated service case (20; 220) comprising:
a base (42);
5 a refrigerated compartment (40) above the base and having:
a relatively deep lower portion (56); and
a relatively shallow upper portion (54);
a rear wall along the refrigerated compartment and having:
a lower wall portion (52) along the compartment lower portion; and
10 a food preparation counter (48) above the lower wall portion;
a refrigeration system comprising:
a heat absorption heat exchanger (78); and
a first fan (80) driving an airflow (518) along a first air flowpath (520) across
the heat absorption heat exchanger (78) to recirculate through the compartment; and
15 a second fan (100) positioned to drive a branch airflow (521) through the upper
portion (54) of the compartment.
2. The case (220) of claim 1 further comprising:
a thermoelectric cooling unit (222).
20
3. The case (220) of claim 2 wherein:
the thermoelectric cooling unit has a heat absorbing portion (224) positioned to cool
product on an upper shelf and a heat rejecting portion (226) positioned to reject heat to air
(550) flowing along a branch (552) from the air flowpath (520) between the upper shelf (58)
25 and a lower shelf (60).
4. The case (220) of claim 3 wherein:
there are a plurality of said thermoelectric cooling units (222); and
each said thermoelectric cooling unit (222) has a third fan positioned to draw the air
30 (550) across the associated heat rejecting portion (226).
5. The case (20; 220) of claim 1 wherein:
the second fan (100) is positioned to direct the branch airflow (521) upward behind
product (62) on an upper shelf (54).

6. A refrigerated service case (20; 220) comprising:
a base (42);
a refrigerated compartment (40) above the base and having:
5 a relatively deep lower portion (56); and
a relatively shallow upper portion (54);
a rear wall along the refrigerated compartment and having:
a lower wall portion (52) along the compartment lower portion; and
a food preparation counter (48) above the lower wall portion;
10 a refrigeration system comprising:
a heat absorption heat exchanger (78); and
a first fan (80) driving an airflow (518) along a first air flowpath (520) across
the heat absorption heat exchanger (78) to recirculate through the compartment; and
means (100; 222) for enhancing cooling of product in the upper portion (54).
15
7. The case (220) of claim 6 wherein:
the means comprises a thermoelectric cooling unit (220).
8. The case (20; 220) of claim 7 wherein:
20 the means comprises a second fan (100).
9. The case (220) of claim 7 wherein:
the thermoelectric cooling unit has a heat absorbing portion (224) positioned to cool
product on an upper shelf and a heat rejecting portion (226) positioned to reject heat to air
25 (550) flowing along a branch (552) from the air flowpath (520) between the upper shelf (58)
and a lower shelf (60).
10. The case (20; 220) of claim 9 wherein:
the means comprises a second fan (100).
30
11. The case (220) of claim 10 wherein:
there are a plurality of said thermoelectric cooling units (222); and
each said thermoelectric cooling unit (222) has a third fan positioned to draw the air
(550) across the associated heat rejecting portion (226).

12. The case (20; 220) of claim 6 wherein:
the means comprises a second fan (100).
- 5 13. The case (20; 220) of claim 12 wherein:
the second fan (100) is positioned behind product on an upper shelf.
14. The case (20; 220) of claim 13 wherein:
the first fan (80) is positioned below product on a lower shelf.
- 10 15. The case (20; 220) of claim 6 wherein:
the case has a sloping front window (38).
16. The case (20; 220) of claim 6 wherein:
15 the case has a rear sliding window unit behind the upper portion (54).
17. The case (20; 220) of claim 6 further comprising:
a controller (150) coupled to the means and configured by at least one of software and
hardware to at least partially independently cool the compartment upper portion (54) and
20 compartment lower portion (56).
18. The case (20; 220) of claim 17 further comprising:
an input device (152), wherein the controller (150) is configured to receive input from
the input device to provide at least partially independent control of temperature of the
25 compartment upper portion (54) and compartment lower portion (56).
19. A method for operating the case of claim 6 comprising:
operating the first fan; and
modulating the first means while operating the first fan so as to at least partially
30 independently control cooling of the compartment upper portion (54) relative to the
compartment lower portion (56).
20. The method of claim 19 including:

receiving different input temperatures for the upper portion (54) and the lower portion (56).

21. A method for engineering the case of claim 6 or retrofitting a baseline case to become
5 the case of claim 6 comprising:
receiving an initial case or case configuration; and
adding the first means.

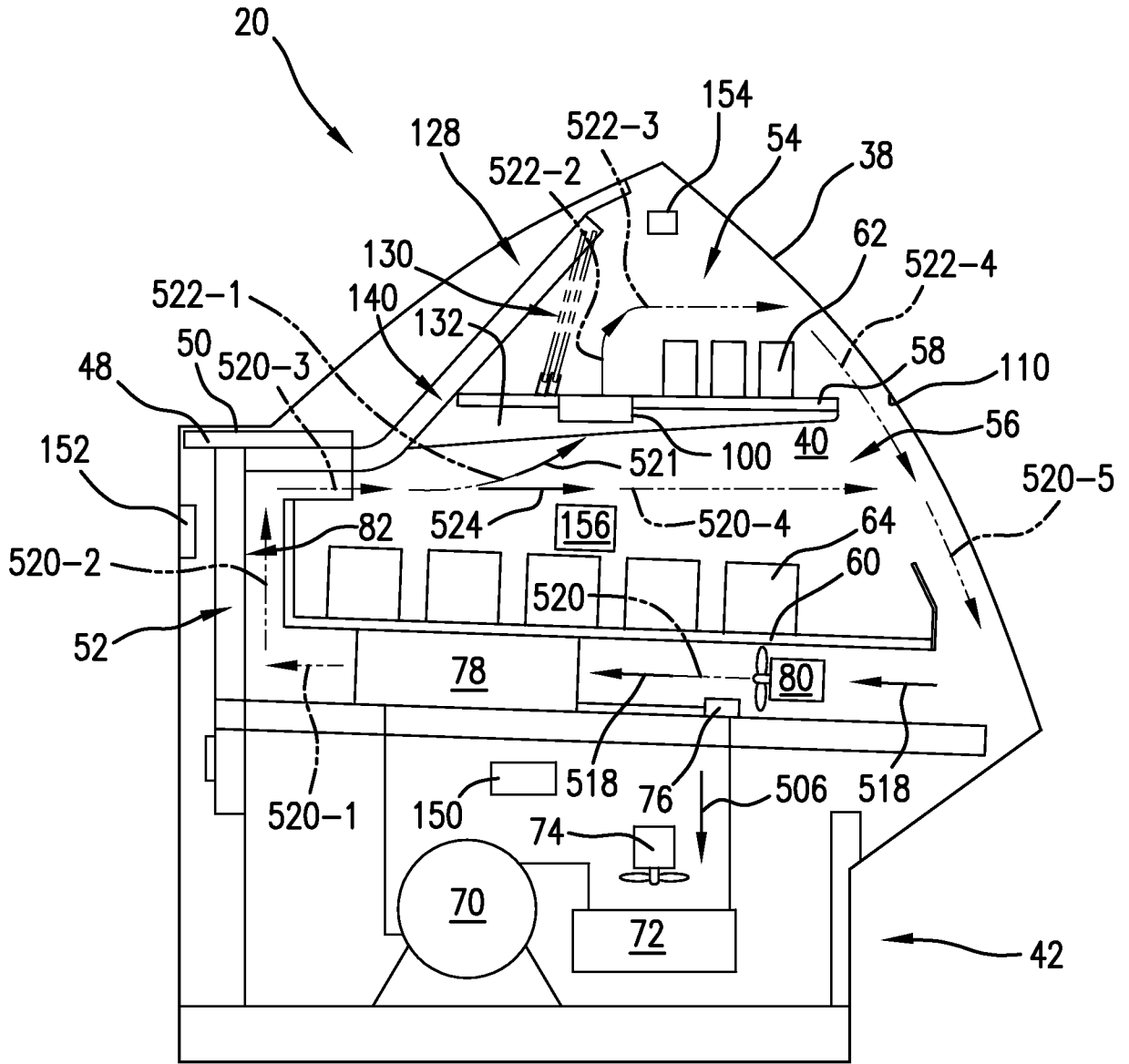


FIG. 1

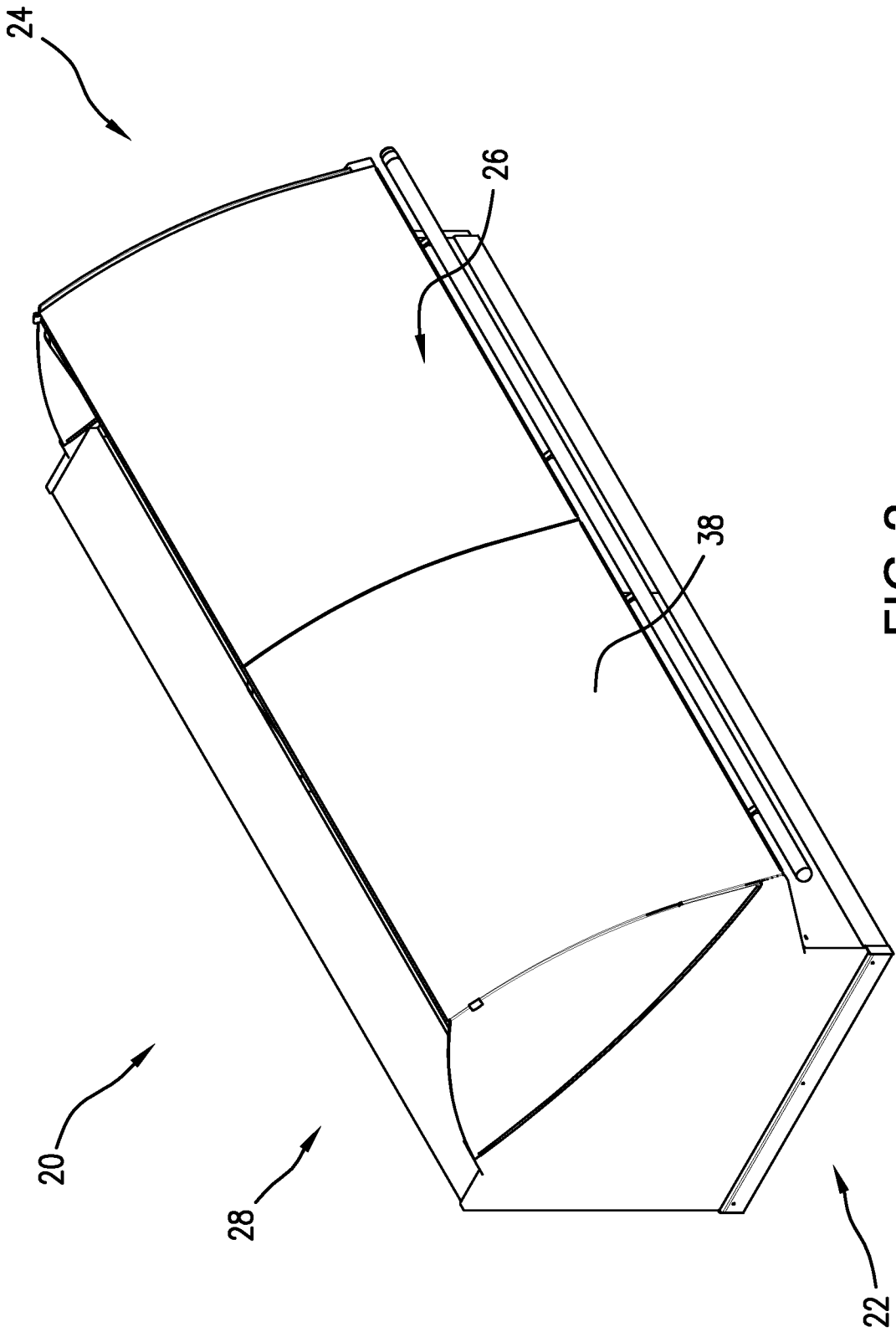


FIG. 2

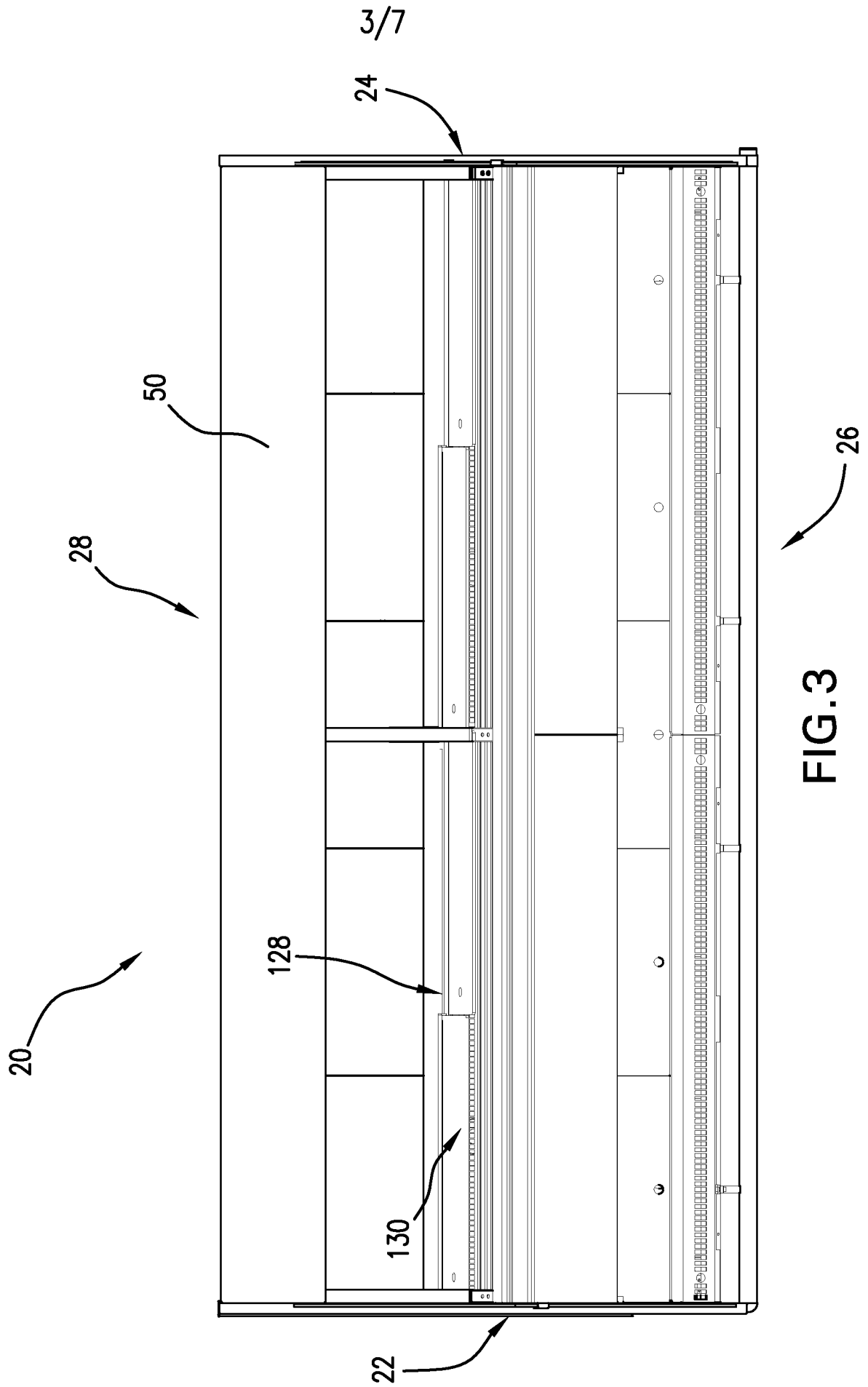


FIG. 3

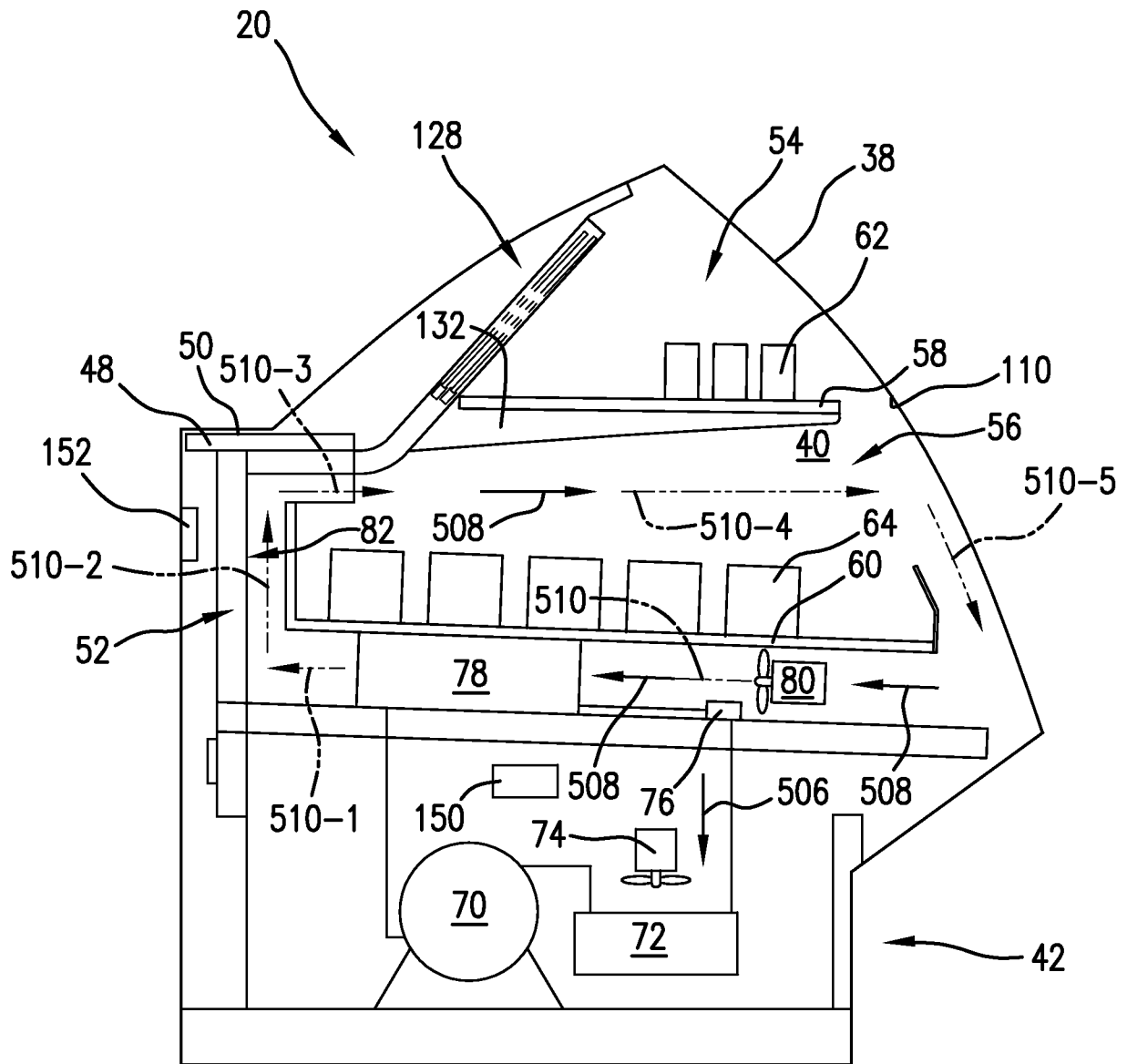


FIG. 4 PRIOR ART

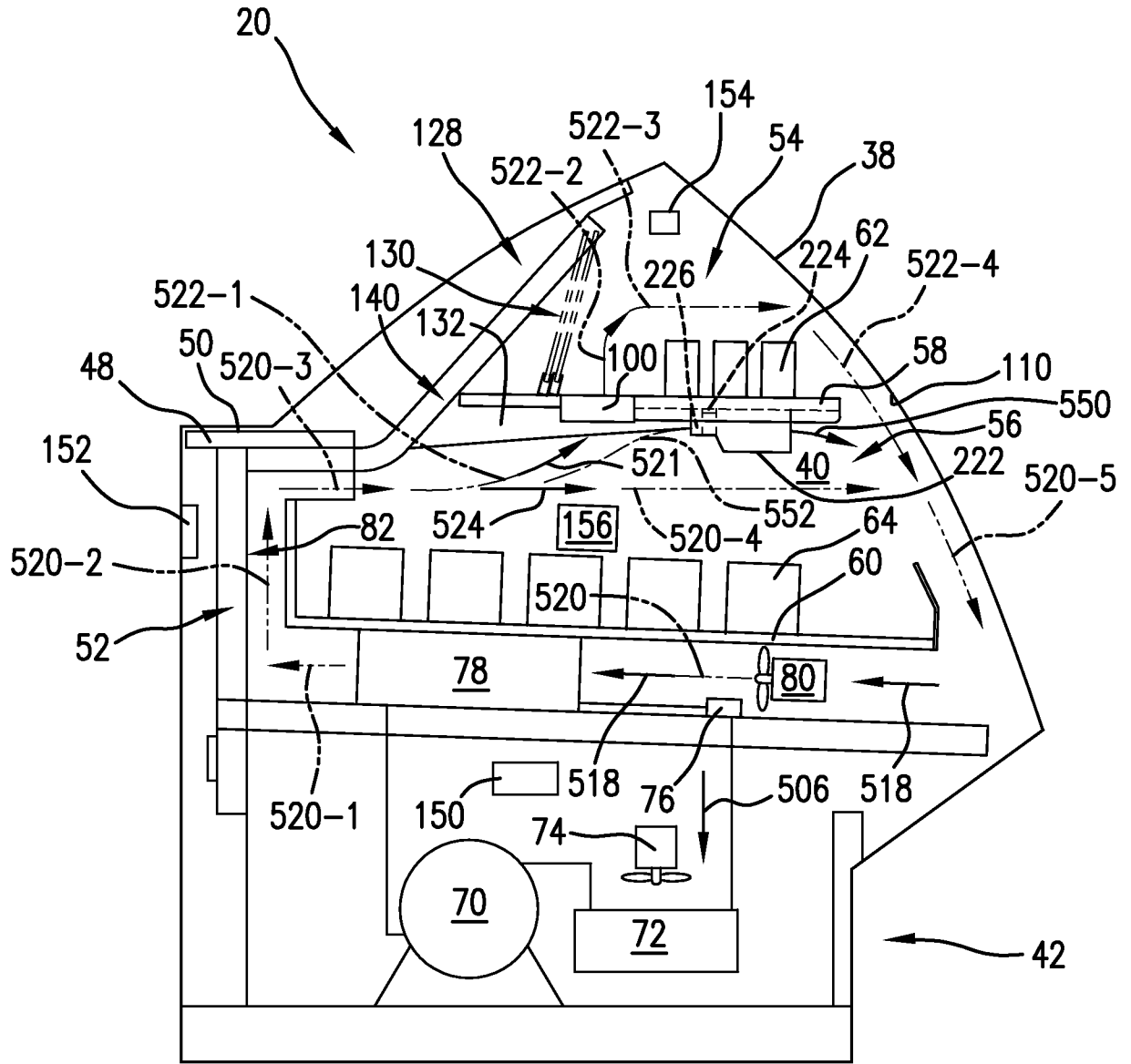


FIG. 5

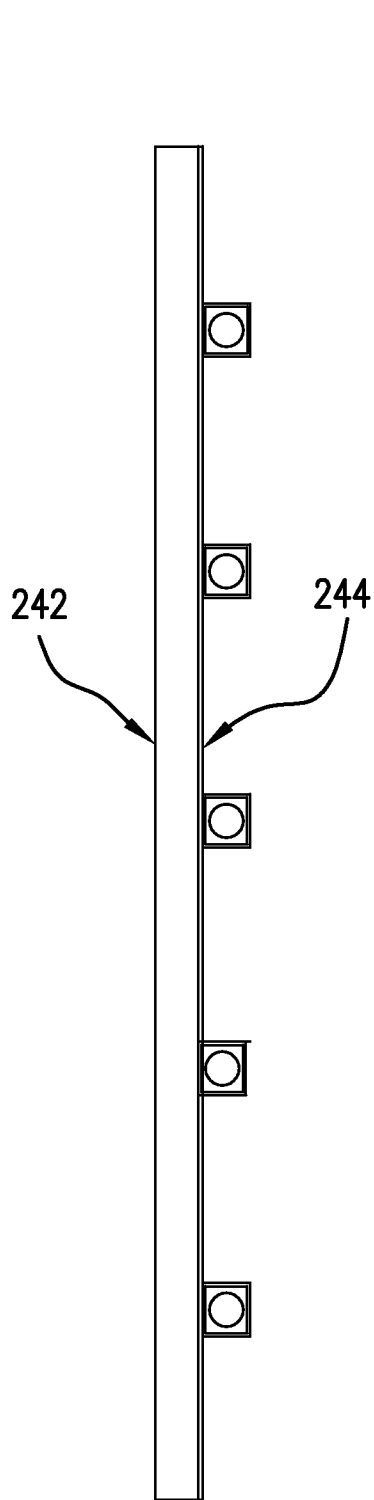


FIG. 7

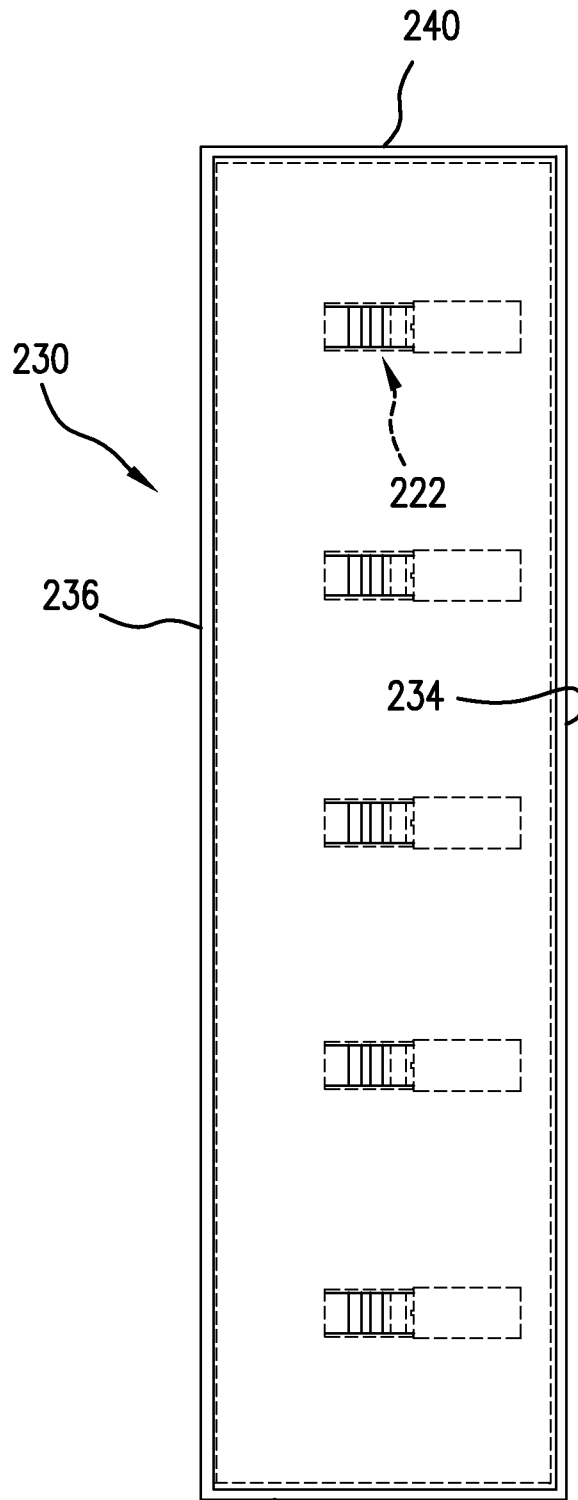


FIG. 6

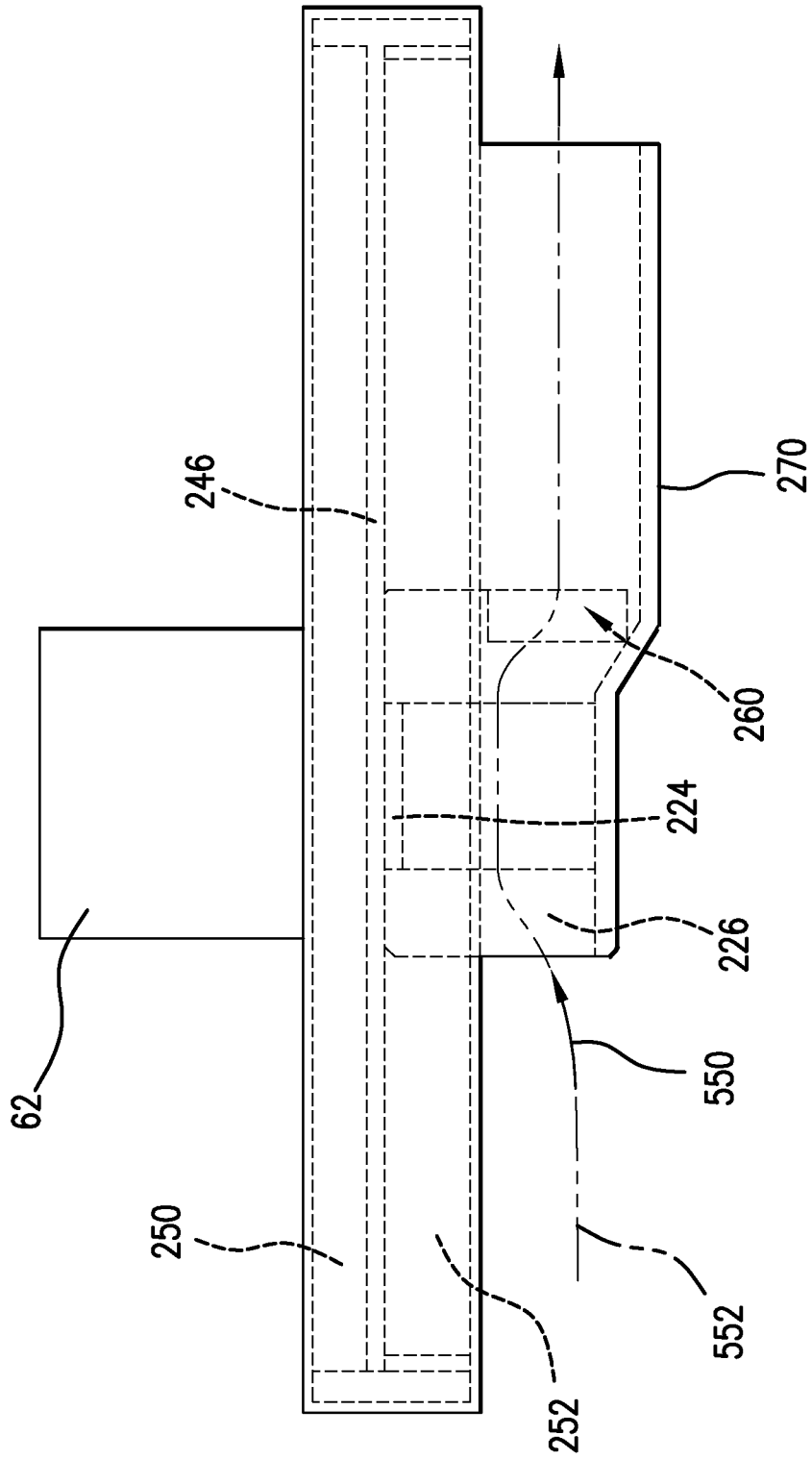


FIG. 8

A. CLASSIFICATION OF SUBJECT MATTER*A47F 3/04(2006.01)i*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8: A47F3/04

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

Korean utility models and applications for utility models since 1975

Japanese utility models and applications for utility models since 1975

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

eKIPASS (KIPO internal) & keywords: service case, showcase, refrigerator, cold storage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5606863 A (KICKLIGHTER, B. C., NAJMI, S.) 4 MAR. 1997 See abstract and figure 1	1-21
A	KR 100459622 B1 (SANYO ELECTRIC CO.) 3 DEC. 2004 See abstract and figure 9	1-21
A	JP 07151450 A (NAKANO REIKI CO.) 16 JUN. 1995 See abstract and figure 1	1-21

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

05 AUGUST 2008 (05.08.2008)

Date of mailing of the international search report

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Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu,
Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KWON, JANG SEOB

Telephone No. 82-42-481-8178



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2007/084056

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5606863 A	04.03.1997	NONE	
KR 100459622 B1	03.12.2004	JP 2003-047543 JP 2003-047543 A2 KR 2003014120 A	18.02.2003 18.02.2003 15.02.2003
JP 07151450 A	16.06.1995	NONE	