April 21, 1953 G. K. BENTLY 2,635,434

OPEN-TOP REFRIGERATED DISPLAY CASE

Filed Oct. 6, 1950 9 Sheets-Sheet 1

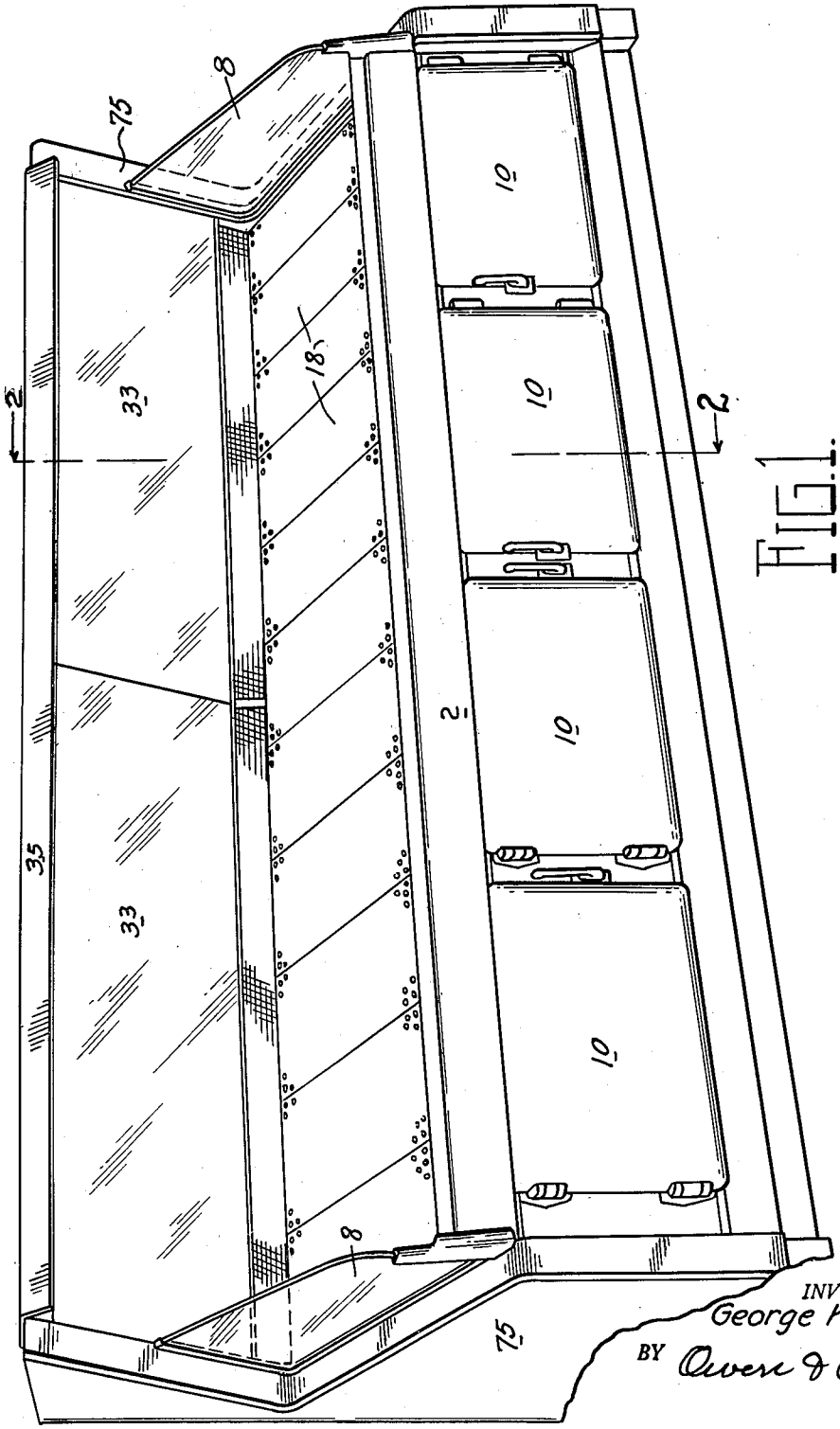

FIG. 1.

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OPEN-TOP REFRIGERATED DISPLAY CASE

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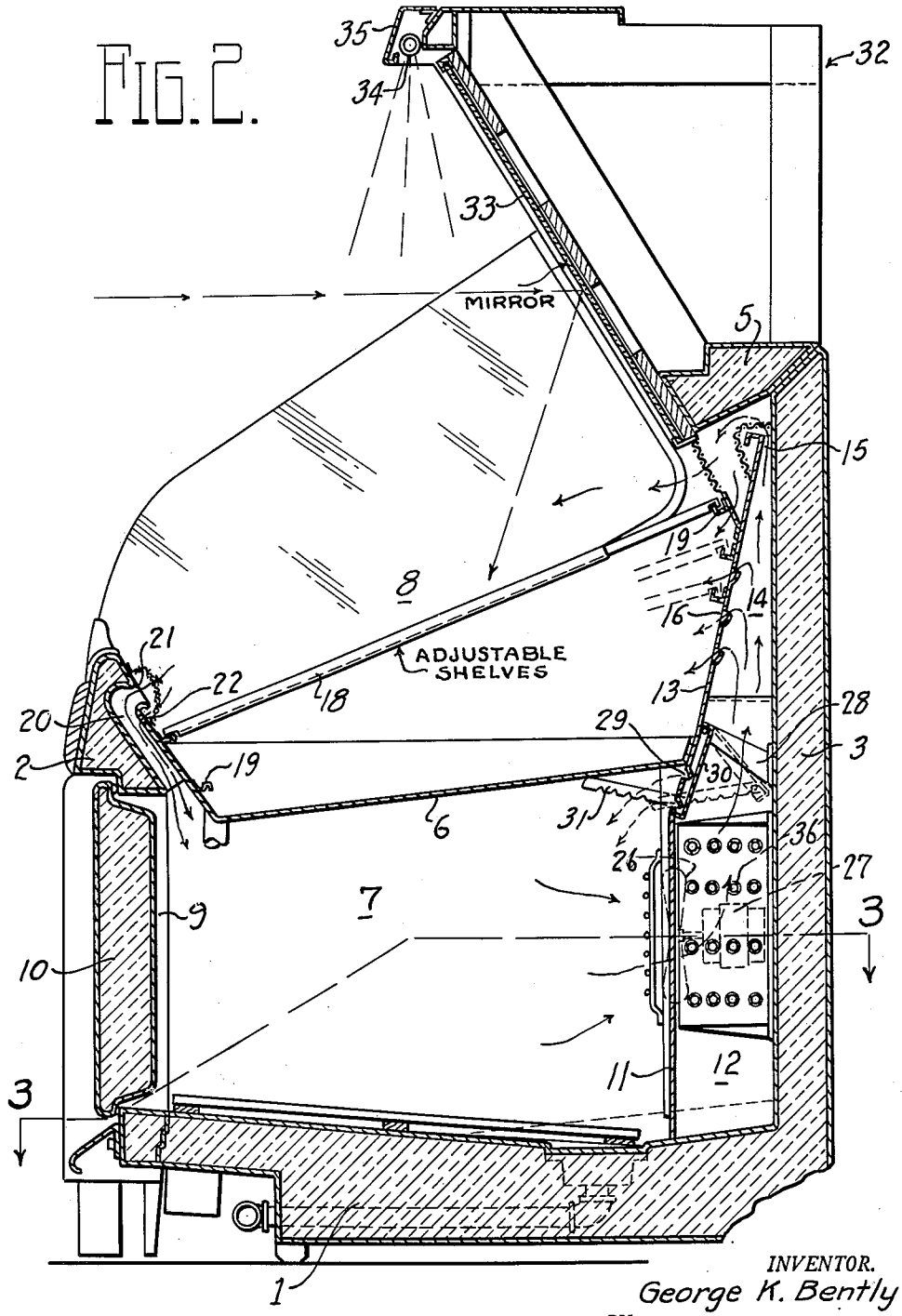
FIG. 2.



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OPEN-TOP REFRIGERATED DISPLAY CASE

Filed Oct. 6, 1950 9 Sheets-Sheet 3

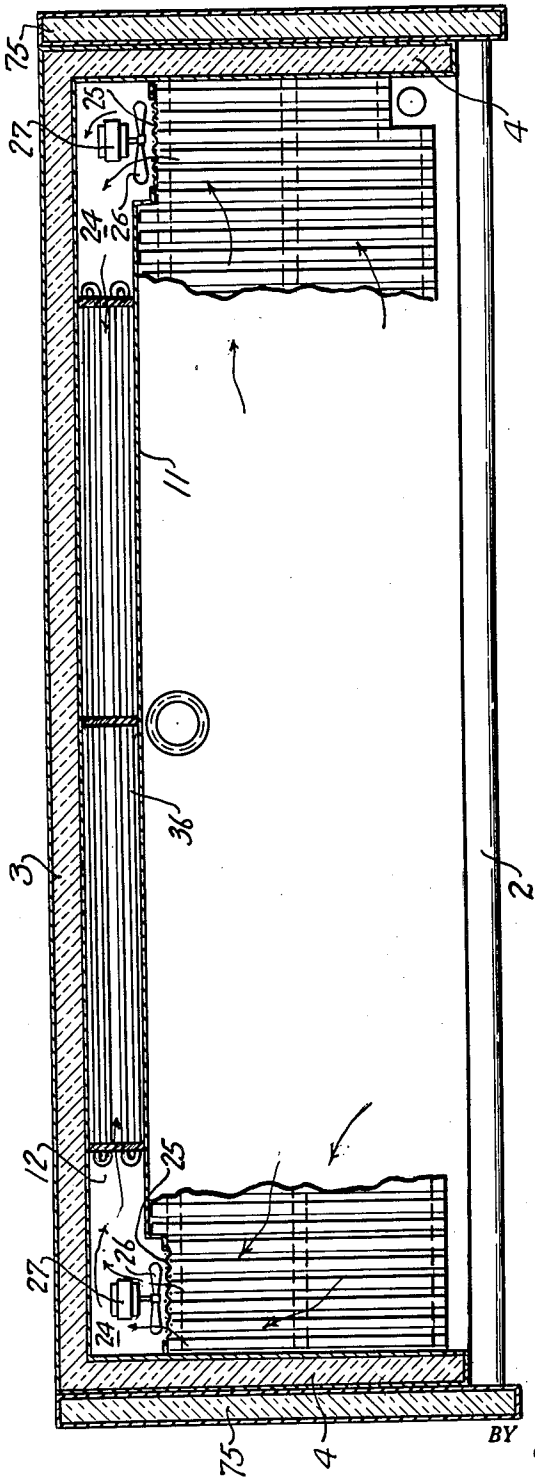

FIG. 7.

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OPEN-TOP REFRIGERATED DISPLAY CASE

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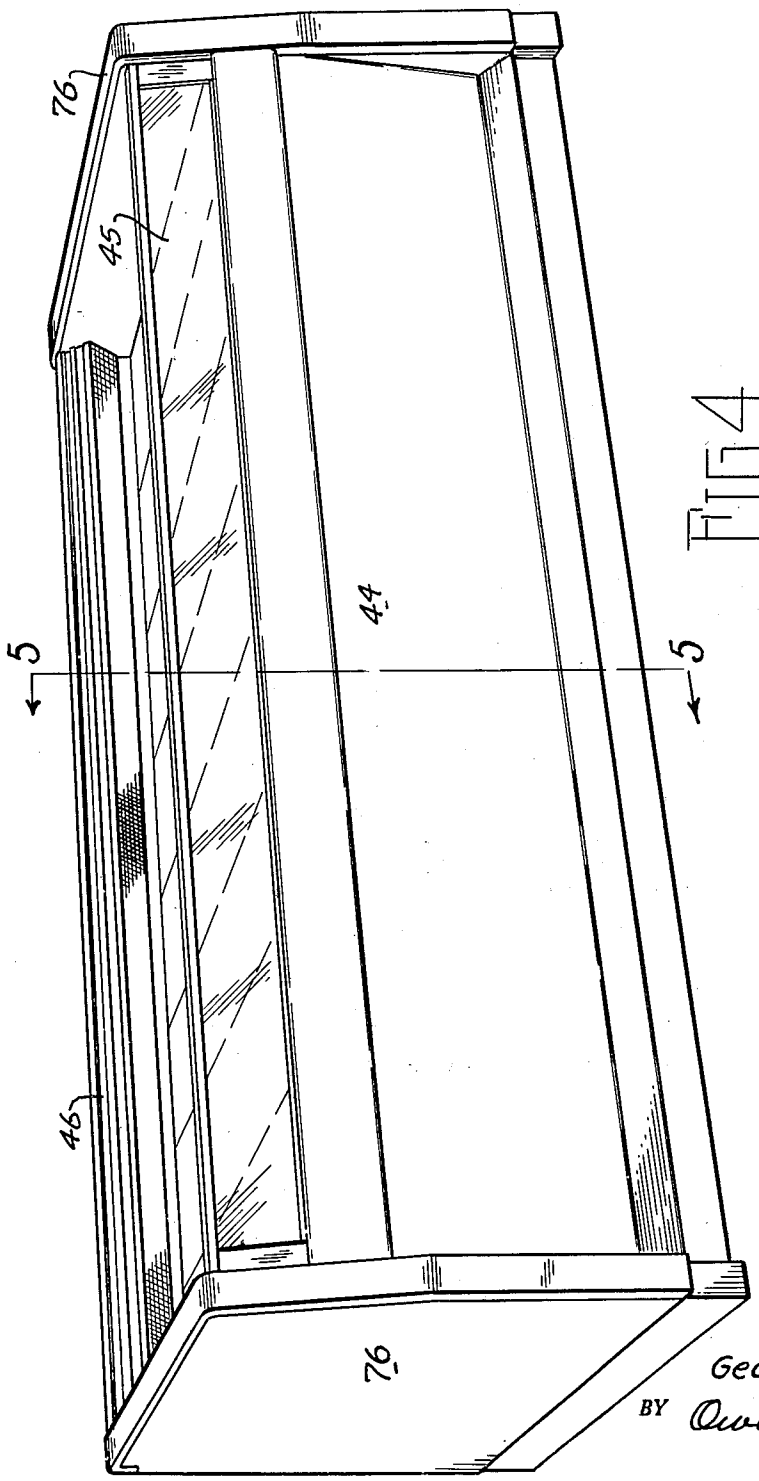

FIG. 4

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OPEN-TOP REFRIGERATED DISPLAY CASE

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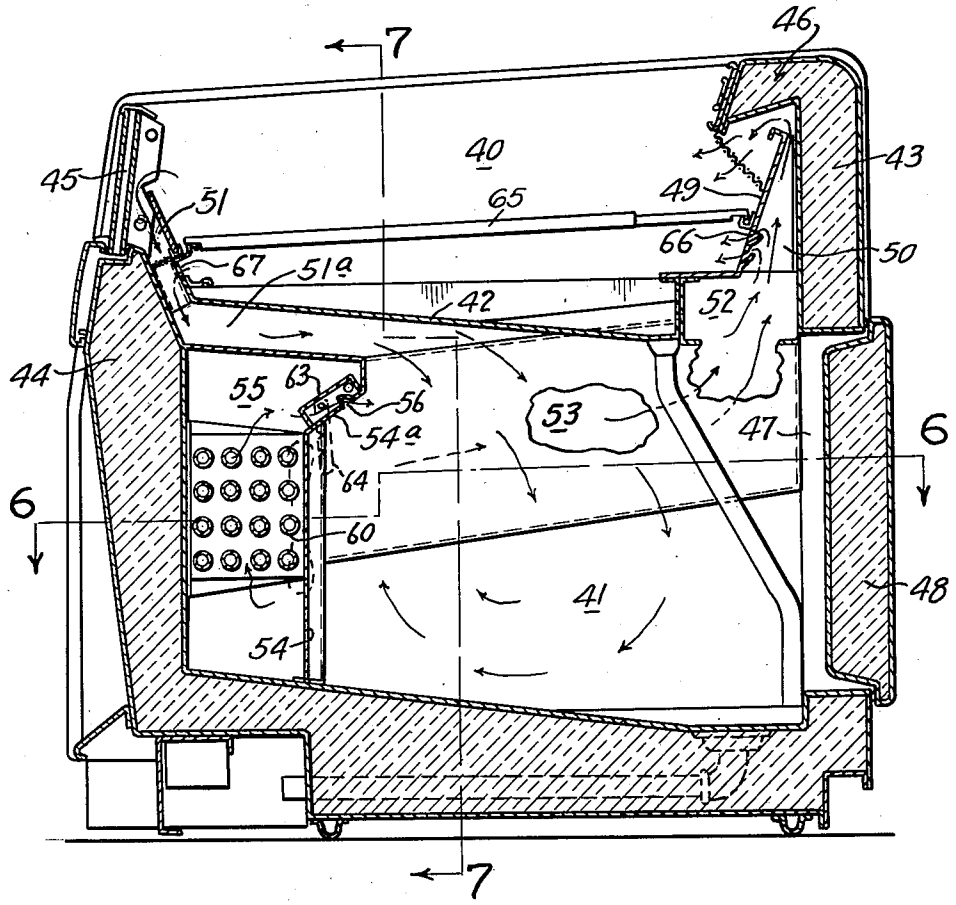
FIG. 5.



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OPEN-TOP REFRIGERATED DISPLAY CASE

Filed Oct. 6, 1950 9 Sheets-Sheet 6

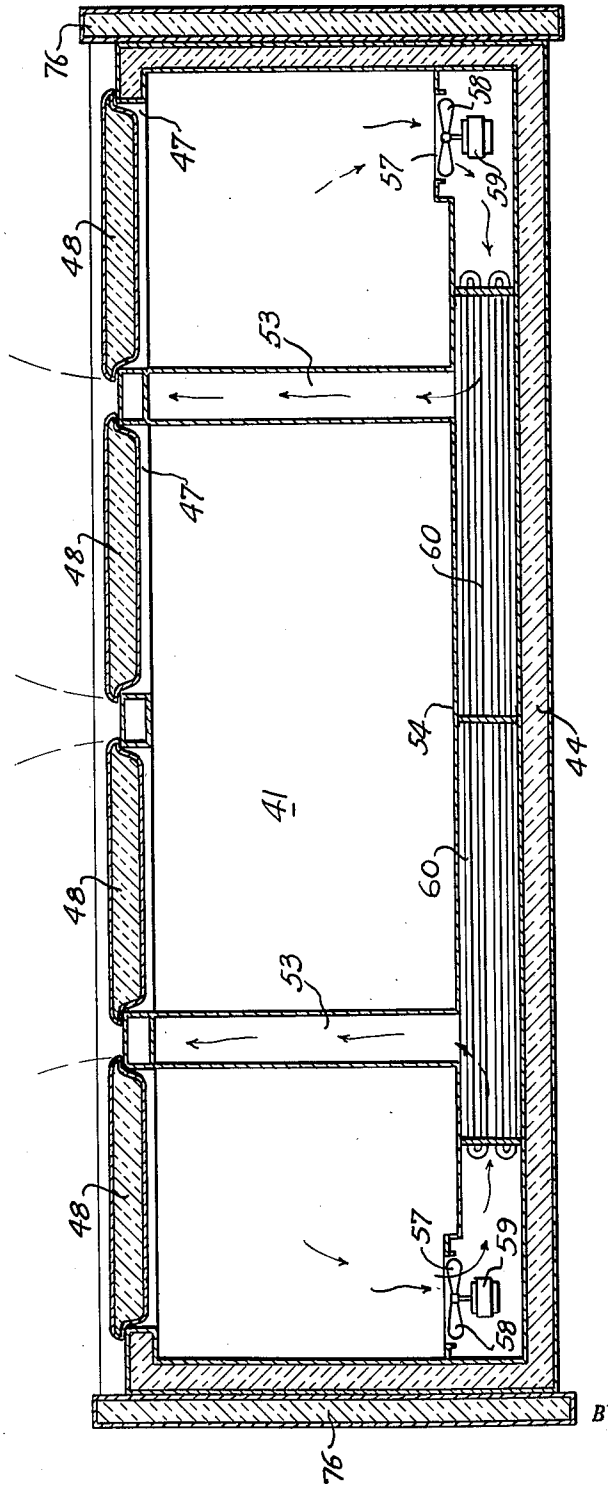

FIG. 6.

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April 21, 1953 G. K. BENTLY 2,635,434

OPEN-TOP REFRIGERATED DISPLAY CASE

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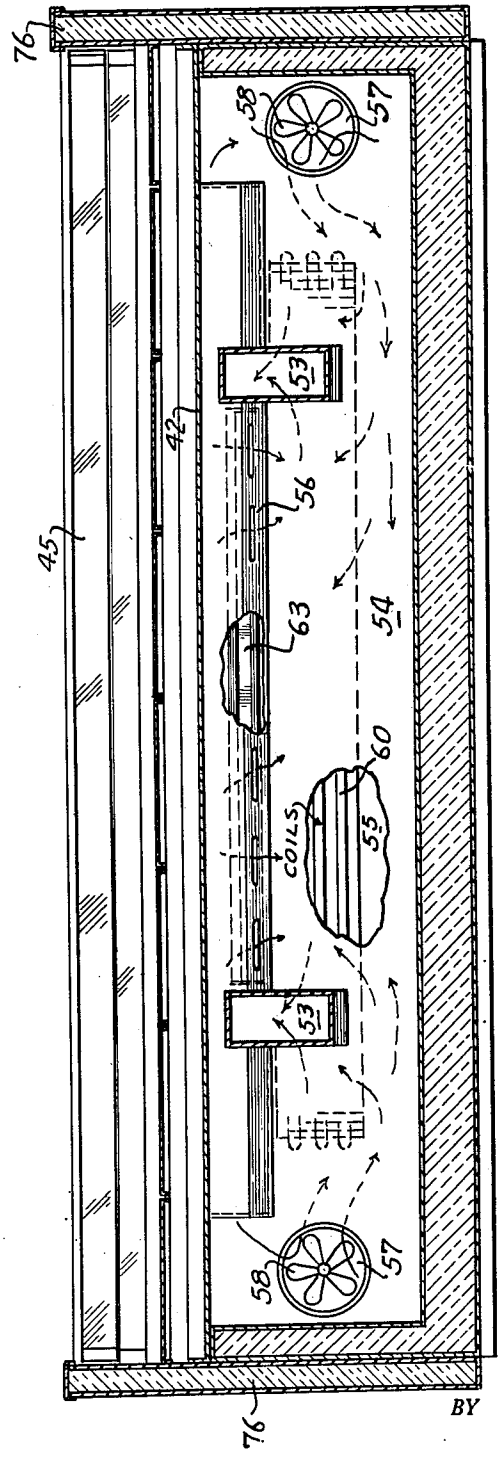
FIG. 7.



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OPEN-TOP REFRIGERATED DISPLAY CASE

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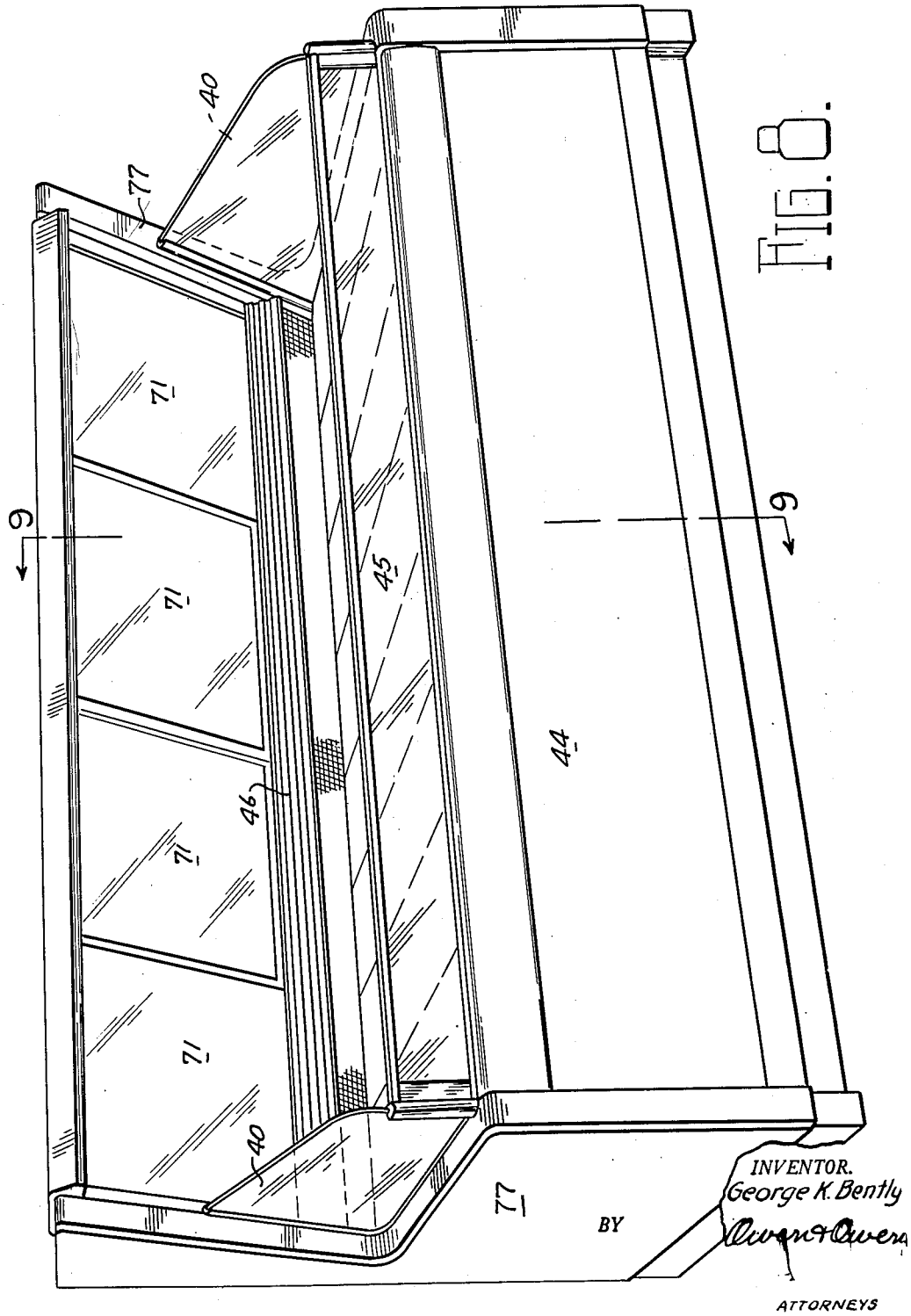

FIG. 9.

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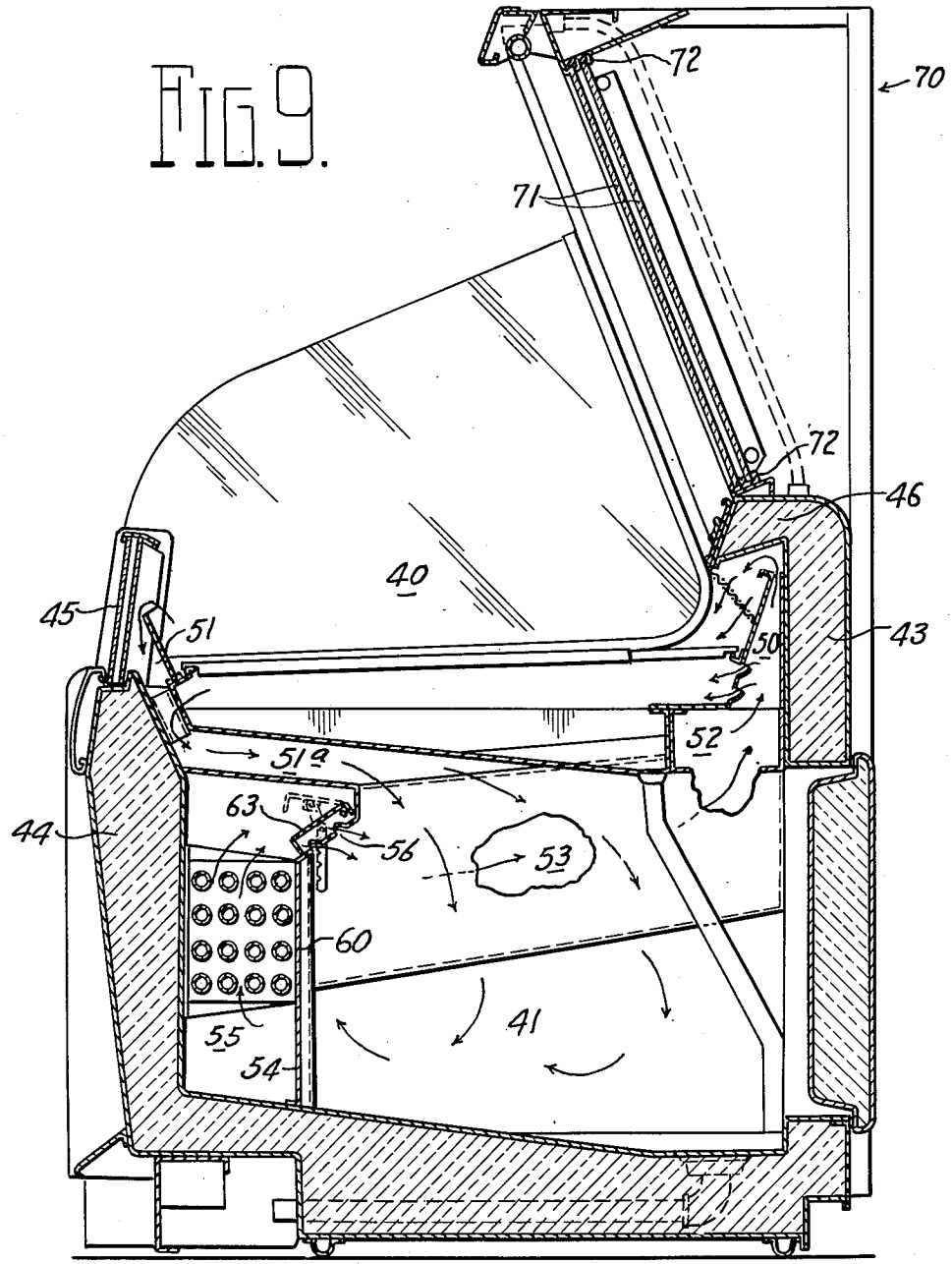
FIG. 9.



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Patented Apr. 21, 1953

2,635,434

UNITED STATES PATENT OFFICE

2,635,434

OPEN-TOP REFRIGERATED DISPLAY CASE

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Application October 6, 1950, Serial No. 188,800

10 Claims. (Cl. 62—89.5)

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This invention relates more particularly to open-top refrigerated display cases of the type generally referred to as "self-serve cases," and especially to the air circulating and distributing characteristics thereof.

Display cases of this class customarily are provided with an upper open-top produce display and self-serve compartment and a lower storage compartment, and the primary object of the present invention is the provision of improved air circulating and distributing means for such compartments.

A further object of the invention is the provision of control means for the circulating air whereby the quantity flow of cold air to both compartments may be easily regulated and controlled.

Other objects and advantages of the invention will be apparent from the following detailed description, and from the accompanying drawings, illustrating different embodiments thereof, and in which—

Fig. 1 is a perspective front elevation of a refrigerated display case with the access doors to the storage compartment located at the front of the case and with a part broken away; Fig. 2 is an enlarged vertical section on the line 2—2 in Fig. 1, with a part broken away; Fig. 3 is a cross-section through the storage compartment on the line 3—3 in Fig. 2, with parts broken away; Fig. 4 is a front perspective view of a low-type case embodying the invention, and in which the access doors to the storage compartment are located in the rear; Fig. 5 is a vertical section on the line 5—5 in Fig. 4, with parts broken away; Fig. 6 is a horizontal section on the line 6—6 in Fig. 5; Fig. 7 is a vertical section on the line 7—7 in Fig. 5, with parts broken away; Fig. 8 is a perspective view of another form of case embodying the invention, with a part broken away, and Fig. 9 is an enlarged vertical section on the line 9—9 in Fig. 8, with a part broken away.

Referring to Figs. 1, 2 and 3, the refrigerated case is formed by the bottom wall 1, the front and rear walls 2 and 3, respectively, and the opposing end walls 4, 4. These walls are all of suitable insulated construction, as is common with cases of this type, and the rear wall extends a distance above the top level of the front wall and has a forwardly extending narrow top portion 5 with its under side preferably inclined downwardly and forwardly from the rear wall, as shown in Fig. 2. In this particular case, the lowest portion of the top 5 is above the top level of the front wall 2.

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The case is divided by a partition 6 of pan-like form into a lower storage compartment 7 and an upper display compartment 8. Access is had to the storage compartment 7 through a plurality of openings 9 located, in the present instance, in the front wall 2, and these are closed by doors 10.

The rear of the storage compartment is spaced from the rear wall 3 by a longitudinally extending vertical partition 11 to form a plenum chamber 12 therebetween which is substantially coextensive in length with said compartment. The upper portion 13 of the partition 11 extends upward on a rearward incline from adjacent to the rear end of the partition 6 to near the top portion 5 to form, with the rear wall 3, an up flue 14 at the rear of the display compartment 8. This flue, by reason of the inclination of its front wall, provides a large air inlet from the plenum chamber 12 and is gradually upwardly restricted in area to a narrow outlet 15 at its upper end below the top part 5. A portion of the air passing up through the flue 14 enters the compartment 8 through a plurality of louvered openings 16 in the partition 13, and a portion passes from the outlet 15 and is then directed forwardly and downwardly into the compartment 8 by the top portion 5. A produce supporting shelf 18, preferably perforated, is disposed in the compartment 8, which for vertical adjustment as to height and inclination may be mounted on front and rear brackets 19.

A screened outlet or return flue 20 from the display compartment 8 to the compartment 7 is provided in the front wall 2 at the front edge of the pan 6. This flue is substantially coextensive in width with the length of the compartments and has a correspondingly broad inlet 21 opening from the display compartment slightly below the upper edge of the front wall 2. The lower end of this flue opens into the storage chamber 7 substantially throughout its length. In the present instance, a series of small inlet openings 22 are provided from the display compartment through the rear wall of the flue 20 above the front end of the shelf 18. An even distribution of air from the lower front portion of the display compartment to the upper front side portion of the storage compartment throughout the length of both is thus insured.

The plenum chamber 12 has end spaces 24 (Fig. 3), each with an opening 25 through the partition 11 into the storage compartment. A fan 26 driven by a respective motor 27 is provided for each opening 25 and induces air flow from the

storage compartment to each end space 24 of the plenum chamber 12. Disposed in the plenum chamber 12 between the end spaces 24 are cooling coils 36 that are raised from the bottom of the chamber so that air from said spaces passes under the coils from each end and thence up through the coils into a distributing space 28 (Fig. 2) above the coils. This space 28 preferably extends not only over the coils but over the end spaces 24 and is open at its top for a considerable portion of its length to the lower or inlet end of the up flue 14.

A plurality of louvered openings 29 are provided in the rear wall of the plenum space 28 and open therefrom into the upper rear portion of the storage compartment 7. This permits a portion of the cooled air in the plenum space 28 to pass into the storage compartment instead of all of such air passing up through the flue 14, across the display compartment 8 and in a warmed state into the storage compartment through the flue 20. The openings 29 are disposed in a substantial portion of the partition 13 lengthwise of the case. The passage of air through these openings 29 is controlled by a damper 30 that closes the openings from within the plenum space. The damper opens inwardly and upwardly in such space and when open restricts the communication between said space and the flue 14 a greater or less extent depending on the degree of opening. A control handle 31 projects from the damper through an opening in the partition 13 and into the storage compartment to permit manipulation from within said compartment. This handle is held in various positions of adjustment by notched engagement of its lower edge with the bottom edge of the opening.

In addition to directing some of the cooled air from the plenum space 28 into the storage compartment to maintain a lower temperature therein than would otherwise be the case, the damper when opened performs the function of reducing the supply of air to the display compartment. Thus, if the spill over the front wall from the display compartment is abnormal or excessive, it can be reduced by adjusting the damper and allowing more air to flow out into the storage compartment, or if more refrigeration seems necessary in the display compartment, the damper can be closed off, allowing more of the refrigerated air to flow into the display compartment and less into the storage compartment.

This case is shown as having a top extension 32 rising above the top portion 5 and carrying an upwardly and forwardly inclined mirror 33 for reflecting the contents of the display compartment, as well understood in the art. The mirror extends down to the lower front edge of the top portion 5. The extension may also have the customary display light 34 and guard 35 at the upper edge of the mirror. This extension may be omitted if desired.

In the operation of this form of the invention, the fans 26 draw the air from the storage chamber 7 at each end thereof into the respective plenum spaces 24 of the plenum chamber 12 at the rear of the chamber and the air flow then passes under the closed ends of the cooling coil section 36 and up through the cooling coils and into the superposed distributing chamber 28. If the damper 30 is closed, a greater portion of such air then passes from the chamber 28 up through the flue 14 and into and across the display compartment 8 in cooling relation to the produce therein and then in a warmed state returns to the storage chamber through the front flue 21. Should it be desired to raise the temperature in the display compartment and to lower the temperature in the storage compartment, the damper 30 is opened a greater or less extent, thus permitting refrigerated air to pass from the chamber 28 through the openings 29 into the upper portion of the storage compartment. At the same time, the extent of opening of the damper determines the amount of cold air flowing to the display compartment.

In Figs. 4 to 7 is shown a open-top refrigerated display case of a design in which the access doors to the storage compartment are at the rear and the plenum chamber in which the cooling coils are located is at the front portion of the case. In this particular instance, the case is also shown as of the low back type so that meats or other produce may be conveniently supplied to the display compartment over the back from the rear. An attendant at the rear can also conveniently see the interior of such compartment to determine when replenishing is necessary.

This case, in its illustrated embodiment, has a comparatively shallow display compartment 40 that is separated from the bottom storage compartment 41 by a partition 42 preferably of pan-like form the same as in the case first described. The back 43 of the case has its top substantially on a level with or only slightly above the top of the front wall extension 45, and the forward top extension 46 of the back, in the present instance, has its lower forward edge below the top level of the front wall. Access openings 47 to the storage compartment are provided in the rear wall and closed by doors 48.

An upwardly and rearwardly inclined partition 49, at the rear of the display compartment, combines with the rear wall to form an up flue 50 that directs chilled air from a point at the rear of the storage compartment to the upper rear portion of the display compartment beneath the rear top extension 46 by which it is directed forwardly and downwardly across the display compartment to a return flue 51 at the front. In the present instance, the up flue 50 receives its air supply from a plenum or distributing chamber 52 disposed across the rear top portion of the storage compartment at the rear of the bottom pan or partition 42. The chamber 52 is closed at its bottom to the storage compartment and receives its chilled air supply through conduits 53, as hereinafter described.

The storage compartment at its front is spaced from the front wall 44 by a vertical partition 54, extending from one end to the other of the compartment and forming a plenum chamber 55. This partition is provided near its top, in the present instance, and for a portion at least of its length, with an upwardly and rearwardly inclined partition 54a in which a longitudinally extending series of louvered openings 56 is provided for the discharge of air from such chamber into the upper forward portion of the storage compartment. The warm air return flue 51 has a rearwardly extending portion 51a that spaces the top of the plenum chamber 55 from the partition 42 and opens at its rear end into the top of the storage compartment.

The partition 54 has an opening 57 at each end (Figs. 6 and 7) providing communication between the storage compartment and the plenum space 55, and a rotary fan 58 is disposed in each opening and driven by a respective motor 59 to

induce a flow of air from the compartment to said space.

Refrigerating coils 60 are located in the plenum chamber 55 between the two fans 58 and in vertically spaced relation to the top and bottom of said chamber in a manner requiring the fan induced air streams to pass under the coils from the respective ends and then up around the coils in cooling contact therewith and into the top air distributing portion of said chamber. This cooled air may then be directed to some extent into the storage compartment through the openings 56 and to a greater extent rearwardly to the chamber 52 through the rearwardly extending conduits 53 that are located in the upper portion of the storage compartment. These conduits 53 align rearwardly with some at least of the mullions between the door openings so as not to interfere with access to the storage space through the openings. The conduits 53 are vertically elongated in cross-section with a portion opening from the plenum space 52 above the coils.

The discharge of cooled air from the space 55 into the storage compartment through the openings 56 is regulated by one or more dampers 63 pivotally mounted within the upper portion of the plenum space 55 and adjustable by means of notched bars 64 extending down into the storage compartment.

The inlet end of the return flue 51 is located below the top level of the front wall extension 45, and the produce supporting trays 65 are supported between the rear partition 49 and the rear wall of the flue 51 by suitable brackets for the purpose. The trays are of the foraminous type, as is customary in refrigerated display cases, and the space between them and the partition 42 preferably has communication at the rear with the flue 50 through louvered openings 66 and at the front with the return flue 51 through a plurality of small openings 67. This feature is claimed in a companion application Serial No. 70,555.

In the operation of this form of the invention, the action of the fans 58 draws warm air from the storage compartment 41 into the plenum space 55 at each end and forces it under and up through the space around the cooling coils 60. The cooled air then passes from the coil space into the space 55 and is returned partially to the storage compartment through the openings 56, if open, and to a greater extent through the conduits 53 to the plenum or distributing space 52 where it is substantially equalized throughout the length of said space and passes upwardly therefrom through the flue 50. The air discharging from the flue 50 passes forwardly through the display compartment 40 around the produce therein by which it is warmed, and then returns to the storage compartment through the front flue 51, 51a.

In Figs. 8 and 9 is shown a case the same as in Figs. 4 to 7, except that a top extension 70 is mounted on the case back and the end walls are changed to suit the changed form of the case and to provide a display compartment of greater depth than in said former figures. Like reference characters are applied to corresponding parts. The air circulation and control are the same as in Figs. 4 to 7 and need not, therefore, be again described.

The top extension 70 is substantially the same as the extension 32 in the form shown in Fig. 2, except that instead of having a stationary produce reflecting mirror 33, it is provided with a plurality of mirror sections 71 mounted for relative sliding movements lengthwise of the case to permit any section to be moved to provide an opening in the extension through which the contents of the display compartments may be viewed from the rear and the produce in the case replenished. The adjustable mirror sections lap each other to permit a sliding of one past the other and the sections operate in guide channel members 72 at top and bottom of the extension.

The end members of the several cases, which are designated 75 in Figs. 1 and 3; 76 in Figs. 4, 6 and 7, and 77 in Fig. 8, are separate from and suitably attached to the respective end walls of the case structure.

I wish it understood that my invenion is not limited to any specific construction, arrangement or form of the parts, as it is capable of numerous modifications and changes without departing from the spirit of the claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent, is:

1. In a refrigerated display case having an open-top display compartment and a lower storage compartment with an up-flue at the rear of the display comartment in communication therewith at is top and with a front return flue from the display compartment to the storage compartment, the provision of means in the storage compartment forming a plenum chamber lengthwise of one side thereof with an inlet opening from the storage compartment adjacent to each end and outlet communication intermediate said openings with the lower end of said up-flue, means for creating a draft through said end openings into said chamber and thence to and upward through said up-flue, and air cooling means in said chamber between said end openings and through which air must flow before passing to said up-flue.

2. A combination as called for in claim 1, wherein said first means has openings for discharging some of the cooled air directly into the storage compartment from the upper portion of the plenum chamber.

3. A combination as called for in claim 2, together with damper means operable to control the passage of air into the storage compartment through said last opening.

4. In a refrigerated display case having an upper open-top display compartment and a lower storage compartment with communication from said upper compartment at its front side to the upper portion of said storage compartment and an up-flue at the rear of the display compartment for supplying cooled air thereto, together with means forming a distributing chamber at the bottom of said up-flue and open thereto, the combination of means forming a plenum chamber at one side of the case lengthwise thereof in inlet communication at a restricted point therein with said storage chamber and having its upper portion in outlet communication with said distributing chamber to supply air thereto, said plenum chamber forming means having a lengthwise extending series of openings from the upper portion of said chamber into said storage compartment for discharging cooled air from said chamber into the storage compartment, refrigerating means in said plenum chamber between said inlet and outlet communications, and means for creating a forced draft from the storage compartment through said inlet and refrigerating means and thence through said outlet, said distributing

chamber and said up-flue to the display compartment.

5. A combination as called for in claim 4, together with damper means in connection with said series of openings operable to regulate the quantity of air flow therethrough.

6. In a refrigerated display case having an upper open-top display compartment and a lower storage compartment with communication between said compartments at front and an up-flue at the rear of the display compartment for supplying cooled air thereto, a vertical partition disposed lengthwise of the storage compartment adjacent to its rear wall and forming a plenum chamber therebetween with its upper portion in air distributing communication with the lower end of said up-flue, said partition having at each end an inlet opening from the storage chamber, refrigerating means in the plenum chamber between said openings and through which all of the air passes from bottom to top of the plenum chamber, and means for creating a forced air flow through said openings and under and up through the refrigerating means and from the upper portion of the plenum chamber through said up-flue and into the display compartment.

7. An arrangement as called for in claim 6, together with damper controlled means for discharging a portion of the air from the upper portion of the plenum chamber into the storage compartment after passing through the refrigerating means.

8. In a refrigerated display case having an upper open-top display compartment and a lower storage compartment with an up-flue at the rear of the display compartment for supplying cooled air thereto and a flue at the front of said compartment for returning warmed air therefrom to the storage compartment, the combination of means forming a distributing chamber at the bottom of said up-flue, means forming a plenum chamber at the front of the storage chamber lengthwise thereof, said plenum chamber having inlet communication with the storage chamber and having outlet conduits at its upper portion leading to said distributing chamber rearwardly through the storage compartment, damper means operable to regulate the discharge through said inlet communication, air refrigerating means between said inlet communication and outlet conduits for cooling the air passing from one to the other, and means for creating a draft into the plenum chamber from the storage compartment and thence through the refrigerating means and conduits to said distributing chamber and therefrom through said up-flue into the display compartment.

9. In a refrigerated display case having an upper open-top display compartment and a lower storage compartment with down communication between said compartments at front and an up-flue at the rear of the display compartment in communication therewith, and a distributing chamber at the lower entrance end of the up-flue in communication therewith, the combination of a vertical partition lengthwise of the storage compartment at its rear portion forming a plenum chamber with inlet communication through the partition with the storage compartment and outlet communication with said distributing chamber, refrigerating means in the plenum chamber intermediate said communications and through which all air passes in its flow therebetween, means for creating a forced draft from the storage compartment into and through said plenum chamber and said refrigerating means to said distributing chamber and up-flue, said plenum chamber having damper controlled communication from its top portion for discharging cooled air therefrom directly into said storage compartment.

10. In a refrigerated display case having an upper open-top display compartment and a lower storage compartment with a down communication between said compartments at front and an up-flue at the rear of the display compartment, and a distributing chamber at the lower entrance end of the up-flue in communication therewith, the combination of a vertical partition lengthwise of the storage compartment at its front portion forming a plenum chamber lengthwise of said compartment with inlet communication through the partition from the storage compartment, means forming outlet conduits from the plenum chamber rearwardly to said distributing chamber at the inlet end of said up-flue, damper controlled communication between the upper portion of said plenum chamber and storage compartment, a refrigerating means in said plenum chamber between its inlet and outlet communications whereby all air passing therebetween must flow through said means, and means for forcing air into and through the plenum chamber, the refrigerating means and said outlet communications from the storage compartment.

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