June 14, 1938. R. E. GRAY 2,120,744

REFRIGERATED DISPLAY COUNTER

Filed Sept. 24, 1934 2 Sheets-Sheet 1

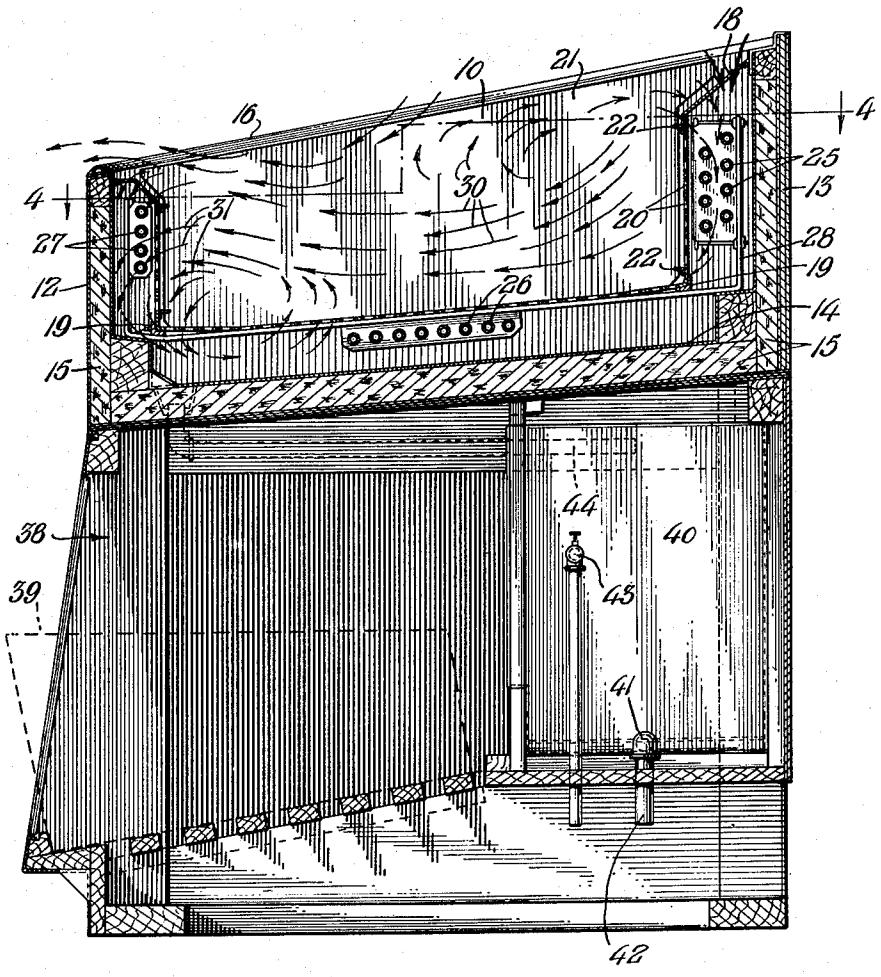


Fig. 1.

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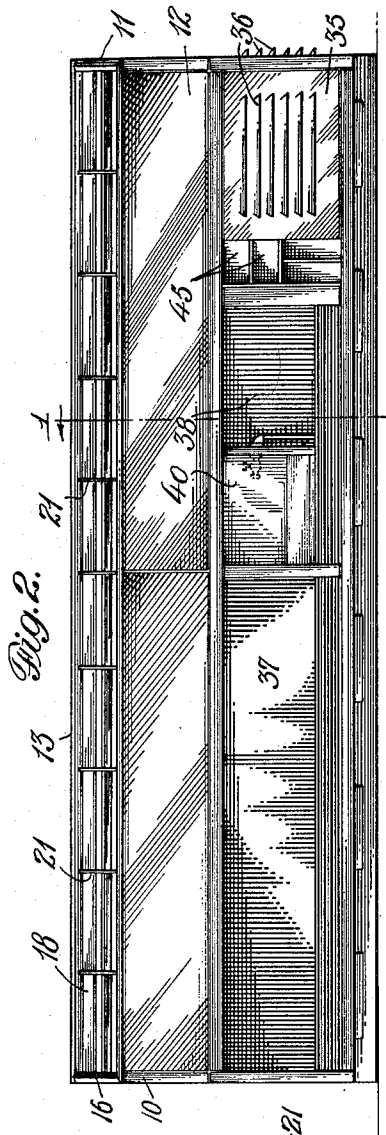


Fig. 2.

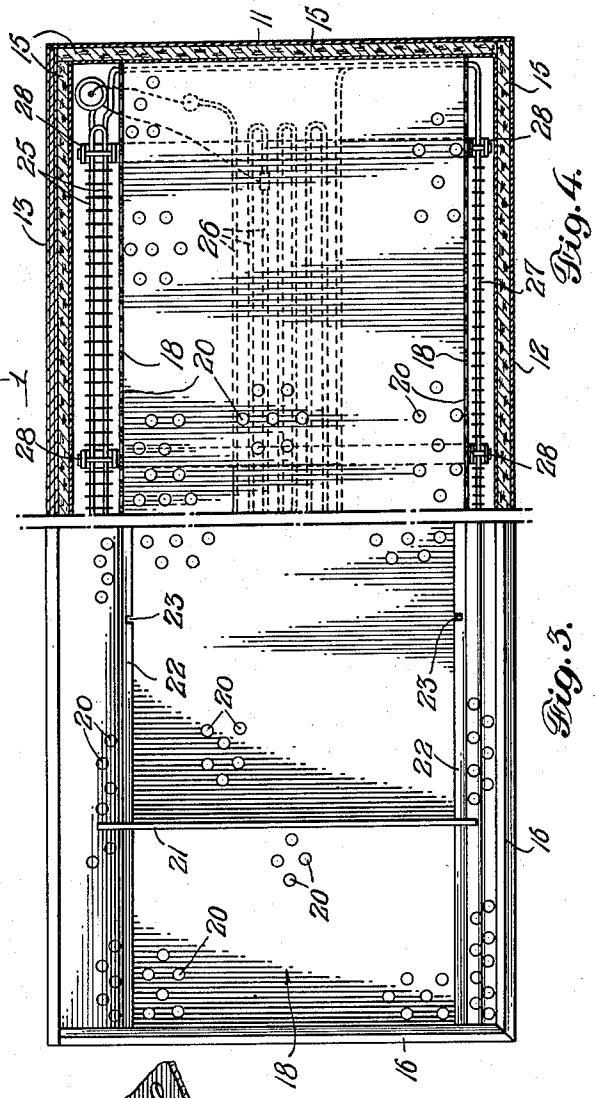


Fig. 4.

Fig. 3.

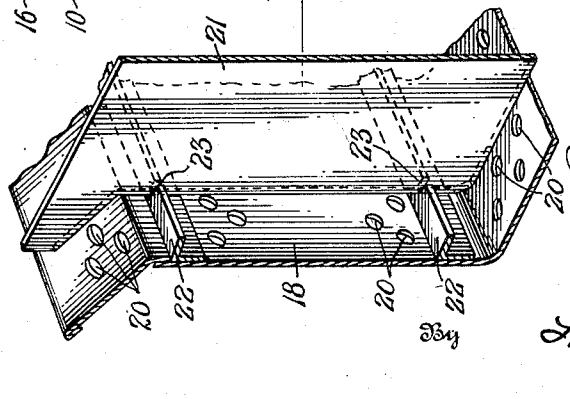


Fig. 5.

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UNITED STATES PATENT OFFICE

2,120,744

REFRIGERATED DISPLAY COUNTER

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Application September 24, 1934, Serial No. 745,331

11 Claims. (Cl. 62—89.6)

This invention relates to refrigerated display counters, and more particularly to display counters of the open-top type adapted for use in self-service stores.

In displaying fruits and vegetables or similar perishable merchandise for retail sale, it is desirable to provide a fixture in which such merchandise is accessible to customers without the necessity of opening inclosing doors. In prior equipment of this character in general use, a completely inclosed refrigerated compartment accessible only through hinged or sliding doors has been provided, or in some cases a compartment of this character with an upper auxiliary bin open at the top and in which a certain amount of refrigeration is obtained by means of cooling coils imbedded in the walls of this upper compartment. In the use of such equipment, there are the disadvantages that the merchandise is not adequately displayed, it is necessary to open doors to gain access to the enclosed compartment and the control of air circulation and humidity in that part of the case or fixture not equipped with doors is inadequate.

From a display standpoint, particularly in self-service stores, it is desirable to provide an open-top refrigerated counter for merchandise, such as fruits and vegetables and preferably the compartment should be arranged at such an angle as to provide a better view of the merchandise therein than is afforded by a horizontal compartment.

It is an object of the present invention to provide an improved display counter of this type, although the invention may also be embodied in counters of the horizontal type.

Other objects of the invention are to provide a refrigerated display counter having an open top constructed to minimize the over-flow of cold air over the side walls of the counter while allowing a sufficient circulation of air to supply the required quantity of fresh air; to prevent undue dehydration of the merchandise contained in an open-top display counter; to reduce the amount of heat radiation through the open top of the counter; to provide means whereby the merchandise can absorb moisture from the ambient air; to obtain substantially uniform temperatures throughout the counter; to provide a convenient source of additional moisture when required; to arrange the interior of the counter so that the refrigerating coils and other parts are readily accessible for cleaning; and to provide means whereby the sizes of the compartments within the counter may be changed as desired to accommodate different kinds of merchandise.

Other objects and advantages of the invention will become apparent from the following description of the preferred embodiment thereof shown on the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view of an open-top counter, taken on the line 1—1 of Fig. 2;

Fig. 2, a front elevational view of the counter shown in Fig. 1;

Fig. 3, a fragmentary plan view of the same to an enlarged scale;

Fig. 4, a fragmentary sectional view taken on the line 4—4 of Fig. 1; and

Fig. 5, a detail view illustrating the manner in which the partitions are removably supported in the merchandise tray.

As shown in Figs. 1 and 2, an open-top display counter embodying the invention comprises an enclosure of rectangular or other desired shape defined by side walls 10 and 11, a front wall 12, a rear wall 13 and a bottom wall 14. In accordance with the invention, the enclosure or container defined by said walls is suitably cooled or refrigerated whereby it is adapted to hold fruit, produce and the like in fresh, crisp condition for considerable periods of time. In order to attain this result, as explained hereinafter, the size and arrangement of the cooling elements in the refrigerated enclosure is correlated to the size and shape of the enclosure to produce by convection and radiation substantially uniform temperatures throughout the enclosure, and minimize overflow of cold air over a side wall thereof while permitting sufficient fresh-air circulation to prevent dehydration of the merchandise.

The walls of the counter are insulated in any suitable or desired manner, as indicated at 15, the outer faces of the counter preferably being finished in porcelain enamel to enhance its appearance. A convex finishing strip 16 or other suitable molding may be arranged on the tops of the front and side walls of the counter.

A reticular merchandise tray 18 fitting within the display counter is provided to receive the produce to be displayed. The tray 18 preferably extends the length of the counter, although separate trays may obviously be employed. The tray 18 is removably supported therein, for example upon longitudinal angle irons 19, as shown in Fig. 1, whereby the tray may be lifted out to provide access to the refrigerating coils and other parts of the fixture underneath the same. The merchandise tray may be made of any suitable material, as galvanized iron, and substantially

the entire surface thereof is perforated, as indicated at 20, to enable the convection currents of air from the cooling coils to pass therethrough. Adjustable partition or dividing members 21 are provided for the tray 18 in order to form a plurality of compartments therein of any desired size. As shown in Fig. 5, the tray 18 may be provided with longitudinally extending bars 22 having notches 23 therein spaced apart a few inches and adapted to receive and hold the partitions 21 against lateral displacement.

The back of the tray 18 is turned outward to engage the rear wall 13 of the display counter and overlies a refrigerating coil 25 located adjacent said rear wall 13 and extending a substantial distance above the bottom wall 14 in order to produce efficient circulation of air within the counter. A second or stabilizing refrigerating coil 26 is arranged at the bottom of the counter midway between the front and rear walls thereof. A third refrigerating coil 27, which like the coils 25 and 26 extends the entire length of the counter, is arranged adjacent the front wall 12 of the counter. The coils 25, 26 and 27 may be supported in any convenient manner, as by the transverse bracket members 28.

In the preferred embodiment shown, the open-top display compartment is arranged at an angle to the horizontal plane to provide a better view of the merchandise displayed, i. e. the top of the front wall 12 is lower than the top of the rear wall 13. The bottom wall 14 is also inclined to correspond generally with the inclination of the top of said compartment. An open-top counter of this character, particularly if installed at an angle to the horizontal as described, involves problems in refrigeration that must be solved before the equipment is practical.

The coil arrangement that would at first appear the most logical would comprise coils such as the coils 25 installed in the higher parts of the compartment in order to produce rapid convection currents of air from the warmer upper portions of the compartment. It was found however, that with such an arrangement there was an extremely large temperature difference between the lower or front portions of the compartment and the parts nearer the coils because the air cooled by contact with the upper coils at the rear of the compartment, being heavier than that at a higher temperature, settled to the lower front part of the compartment. The convection currents produced by the coil 25 are indicated by the arrows 30 in Fig. 1. In addition the inclination of the compartment resulted in a decided tendency for the cooled air flowing from the rear coil as indicated by the arrows 30 to overflow the front lower wall 12 of the compartment, causing a rapid circulation of air through the counter which resulted in a considerable refrigeration loss and a dehydration of the merchandise contained in the counter. Thus, after only a short period of cooling, the level of the cooler and consequently heavier air in the counter reached a height equal to the height of the front wall 12 after which there was a constant substantial overflow of refrigerated air over the top of the front wall. The addition of the stabilizing coil 26 which is in the center of the bottom of the counter was found helpful in obtaining uniform temperatures in the refrigerated compartment but did not prevent the overflow of cold air from the upper coils 25 over the opposite side wall.

After further experimentation it was found that by the use of a coil 27 on the inside of the front wall 12, the overflow of refrigerated air could be materially reduced, at the same time retarding the movement or flow of air from the rear portions of the compartment to the front. This effect results from the cooling of the air surrounding the coil 27, thus creating a downdraft that draws in air that would otherwise flow over the front of the counter, as indicated by the arrows 31 in Fig. 1.

The refrigerating coils arranged in this manner serve to increase the moisture content or humidity of the air within the counter by reducing the rate of recirculation of air, by cooling it to a relatively low temperature, and by permitting a limited intake of fresh or outside air.

If the contained air is recirculated continuously, first past the cooling coil and then by (or thru) fruits or vegetables, the practical effect will be as follows: The temperature of the air surrounding the coil will be lowered sufficiently to cause moisture to be deposited on the coil. By the time the air reaches the merchandise, its temperature has increased sufficiently to enable it to absorb a considerable quantity of moisture. As the air moves along its route of circulation, it continues to increase in temperature and moisture content, absorbing the moisture from the merchandise with which it comes in contact. On re-entering the space around the coil the air temperature is again reduced to exactly the same temperature and humidity condition that existed when the volume of air in question left the coil compartment before. Therefore, the moisture condensed on the coil is equal to and is the same as that taken up from the fruits and vegetables. It is evident from the above that, since recirculated air removes from the merchandise and deposits on the coils a certain quantity of moisture during each cycle, it is desirable to reduce the rate of circulation as much as possible without causing the development of other unfavorable conditions.

The cooling of the air to a relatively low temperature also contributes to the increase in moisture content of the air in the counter. The air is cooled by a limited circulation of air over the coils, by contact with metal parts which are in direct contact with coils and by contact with merchandise which is maintained at a low temperature by direct contact with or radiation to the coils or metal parts. Any cold object will absorb moisture from warm, relatively humid air if left in contact with it, and the cool surfaces of the merchandise and metal parts as well as the cool air, serve to attract moisture from the warmer air above, and condense it on the merchandise or metal surfaces, thus very materially increasing the moisture content of the enclosed air.

The addition of a limited quantity of new or outside air is another factor in the maintenance of the desired humidity in the air. Replacement air, brought in by the natural air currents in the counter, has a comparatively high temperature and moisture content. As it approaches the top of the merchandise in the counter, the temperature is reduced to such an extent that the air is practically saturated, and a further reduction in the temperatures will cause precipitation of the moisture. Therefore, when the outside air actually enters the counter, the relatively abrupt drop in its temperature, caused by contact with cooler surroundings, condenses moisture from the air on the various surfaces to which it is exposed.

The produce in the tray 18 is surrounded by

refrigerating coils on three sides, the coils being so arranged as to provide uniform temperatures in all parts of the counter except for a temperature gradient of a few degrees from the bottom to the top at any point. In addition the coils are almost completely covered by the produce in the tray which thus acts as insulation to prevent the radiation of heat from the outside to the refrigerating coils and cool air within the compartment. While the upper layers of merchandise, being shielded by the lower layers, are at a somewhat higher temperature than the merchandise nearer the refrigerating coils, this is logical and permissible from both the refrigerating and merchandising points of view. From the refrigeration standpoint it results in an increase in operating efficiency. From the merchandising standpoint it is apparent that the upper layers of merchandise are removed by customers before the cooler portion near the bottom of the case and thus a higher temperature in the upper layers of merchandise is satisfactory. Furthermore, the display is being shifted constantly by customers in making a selection, thereby causing the merchandise at the top to be so moved as to come in contact with the cooler air in the bottom of the counter.

From the foregoing description it will be apparent that a limited circulation of fresh warm air is necessary to minimize dehydration of the contents of the display counter since moisture from such air replaces that deposited in the form of water or frost on the cooling coils by the recirculated air. Condensation on the fruit or produce takes place under these conditions because the fruit or produce is maintained, partly by radiation of heat to the cooling coils, below the temperature of the mixture of fresh and recirculated air. It is also necessary however to restrict the influx of fresh air to avoid excessive hydration and keep the refrigeration requirements and cost within reasonable limits. In accordance with the principal feature of the invention, the display counter is arranged and constructed to provide sufficient fresh air circulation through the counter and the contents thereof whereby dehydration is minimized or substantially prevented.

A compressor compartment 35 having louvres 36 in the walls thereof is provided in the base portion 37 of the counter. Compartments 38 adapted to receive wire baskets or containers 39 for merchandise which does not require refrigeration are also provided in the base portion 37.

When the store is closed at night, a cloth may be spread over the top of the display counter. The resulting lowering of the temperature of the compartment causes a greater amount of moisture to be precipitated therein with the result that the condition of the merchandise in the counter is greatly improved during the period between the closing of the store and the opening of the store the next morning. While the natural condensation of moisture upon the produce formed as described above by the cooling of the ambient air will, in most cases, be sufficient to maintain the merchandise in perfect condition, it may be desired to supply additional moisture at certain times. For this purpose the base portion 37 of the counter is provided with a metal-lined compartment or hose box 40, having a drain 41 connected with a drain pipe 42. A faucet 43 extends into the hose box 40 to which a flexible hose may be connected for use in sprinkling the display or flushing out the interior of the refrigerated compartment, exposed by removal of the tray 18. A drain pipe 44 is preferably arranged to drain fluid from the lower portion of the refrigerated compartment into the hose box 40. The base 37 of the display counter may be further provided with a bag bin as shown at 45.

The counter shown and described above may be ten or twelve feet long and about three feet wide. The refrigerating coils extend the length of the counter and therefore a change in the length thereof does not affect the refrigerating effect obtained. The invention may be applied to horizontal open-top display counters and the shape and size of the refrigerated compartment may be altered to a considerable extent, providing a corresponding change is made in the arrangement of the refrigerating coils. It is necessary in the first place to maintain substantially uniform temperatures from the front to back of the open-top counter. This is accomplished by an arrangement of coils as described which create heat transfer by radiation and convection from the interior of the compartment to the respective coils. The bottom or stabilizing coil 26 tends to equalize the flow of convection currents and the amount of radiation between the front and the back of the compartment. In the second place it is necessary to prevent an undue overflow of cooled air over one side wall of the compartment which in the case of an inclined counter is the lower side wall. This result is accomplished by a provision of the auxiliary coil 27 of such size as to minimize but not entirely prevent overflow of cooled air at the front wall.

For an inclined counter where the difference between the height of the front and rear walls is about six inches, and the width of the counter is about three feet between said walls, the relative sizes of the front and back coils are substantially as shown in the drawings. Thus the front coil 27 may be a 4-tube finned coil five inches high with one-half inch outside-diameter tubes. The back coil 25 may consist of eight similar tubes forming substantially a double coil. The above dimensions are suitable for use with sulphur dioxide and similar refrigerants, and larger coils would be required if a refrigerant such as ammonia is used. It is believed that the proper arrangement and sizes of coils can be readily determined in any individual case of a change in the shape or size of the compartment from a consideration of the general principles outlined above.

In a display counter embodying the present invention the merchandise is dry, fresh and crisp at all times and is therefore more attractive than merchandise which has been subjected to a water spray. Vegetables such as celery or beans which are on the verge of becoming spoiled and present a bad appearance may be placed in the compartment at night and appear fresh and crisp when the store is opened the next morning. The merchandise is kept in a saleable condition in said counter for three or four days so that spoilage is completely eliminated in a store where the turnover is accomplished in this period of time. The display counter is also of considerable value in the winter time where the store is artificially heated and the dry air tends to cause rapid dehydration of fruits and vegetables. Such dehydration is counteracted by the condensation of water vapor on the surfaces of the fruits and vegetables contained in the counter.

Various modifications of the specific embodiment of the invention herein described will occur to those skilled in the art and may be made

without departing from the scope of the invention as defined by the appended claims.

I claim:

1. In an open-top display counter having closed side walls, the top of one of said side walls being lower than the top of the opposite wall, refrigerating means for reducing the temperatures of the contents of said counter, said means comprising a plurality of separated cooling units in remote positions in the counter exposed to the air enclosed by said walls and arranged to minimize the convection currents of air tending to flow over the lower side wall.

2. In an open-top display counter having closed side and bottom walls, the top of one of said side walls being lower than the top of the opposite wall, said bottom wall sloping to maintain said side walls of substantially uniform depth, refrigerating means for reducing the temperature of the contents of said counter, said means comprising a plurality of separated cooling units in remote positions in the counter exposed to the air enclosed by said walls and arranged to minimize the convection currents of air tending to flow over the lower side wall.

3. In an open-top display counter having side walls arranged with the top of one wall lower than the top of the opposite wall, refrigerating means for reducing the temperature of the contents of said counter, said means comprising cooling surfaces arranged to produce cooperating convection air currents in such a manner as to minimize the resultant flow of air from inside said walls over said lower wall.

4. In an open-top display counter having side walls and an inclined bottom wall, the top of the side wall adjacent the lower end of said bottom wall being lower than the top of the opposite wall, a refrigerating element adjacent said opposite wall and means including a second refrigerating element adjacent the side wall at the lower end of said bottom wall for minimizing the flow of air over the top of said last-mentioned side wall.

5. In an open-top display counter having closed side walls, the top of one side wall being lower than the top of the opposite wall, a refrigerating coil near the top of the enclosure defined by said side walls and a second refrigerating coil adjacent the top of said lower side wall to retard the flow of convection currents of air from the first-mentioned coil over said lower side wall.

6. In an open-top display counter having closed side walls, the top of one side wall being lower than the top of the opposite wall, refrigerating coils near the top and along the bottom of the enclosure defined by said side walls and another refrigerating coil adjacent the top of said lower side wall to retard the flow of convection currents of air from the first-mentioned coils over said lower side wall.

7. In an open-top display counter having closed side walls defining a compartment, a removable reticular tray for merchandise fitting in said compartment, said tray having a bottom and side walls, and means for maintaining said walls in spaced relation with respect to the compartment, a plurality of separated refrigerating units in certain walls of the counter adjacent to the walls of said tray, an impervious lining for said compartment whereby the compartment may be flushed to clean the same, and a drain pipe from said compartment.

8. In an open-top display counter having closed side walls defining a compartment, a refrigerating coil adjacent one side wall thereof and a removable reticular tray for merchandise supported in said compartment, said tray having a flaring rim portion overlying said coil and extending substantially to said side wall which is adjacent the coil.

9. In an open-top display counter having side walls defining a compartment, a removable basket element having a bottom and side walls for receiving merchandise with its side and bottom walls spaced from the walls of the compartment, and refrigerating units in said compartment adjacent to the side and bottom walls of said basket.

10. An open top display counter comprising a bin type receptacle with side and bottom walls, refrigerating elements constructed and so arranged relative to certain of said walls as to produce such a difference in refrigerating effects as to create independent convection air currents in portions of the receptacle and to retard circulation in other portions of the receptacle thereby providing an improved refrigerating effect and serving to build up an accumulation of cold air in said receptacle.

11. In an open-top display counter having closed side walls forming a box-shaped compartment, a refrigerating coil extending adjacent the top of said compartment at one side thereof producing convection currents of air therein and a refrigerating coil on the opposite side of said compartment, said coils being so constructed and arranged as to produce a difference in refrigerating effects such as to induce a limited circulation of fresh air into said compartment sufficient to minimize dehydration of said contents of the display counter.

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