Jan. 25, 1966 D. E. RUTISHAUSER ETAL 3,230,732

WATER COOLING SYSTEM FOR REFRIGERATING FIXTURES, AND FIXTURE THEREFOR

Filed Jan. 7, 1965 3 Sheets-Sheet 1

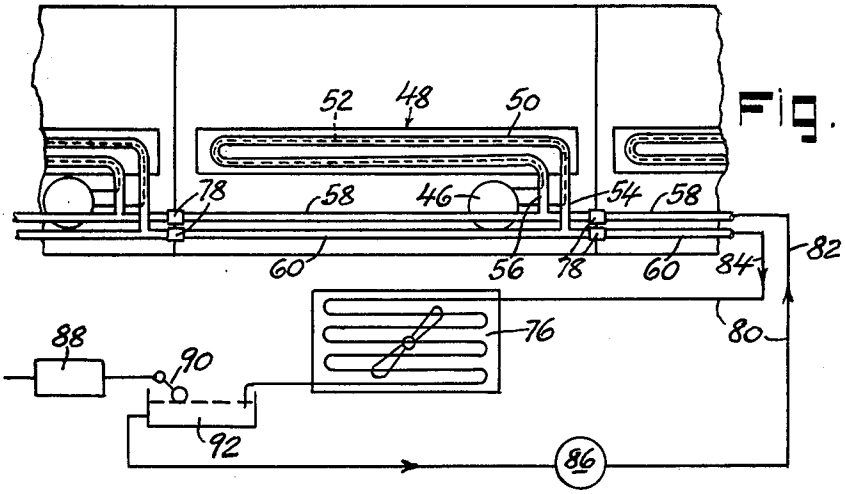

Fig. 1.

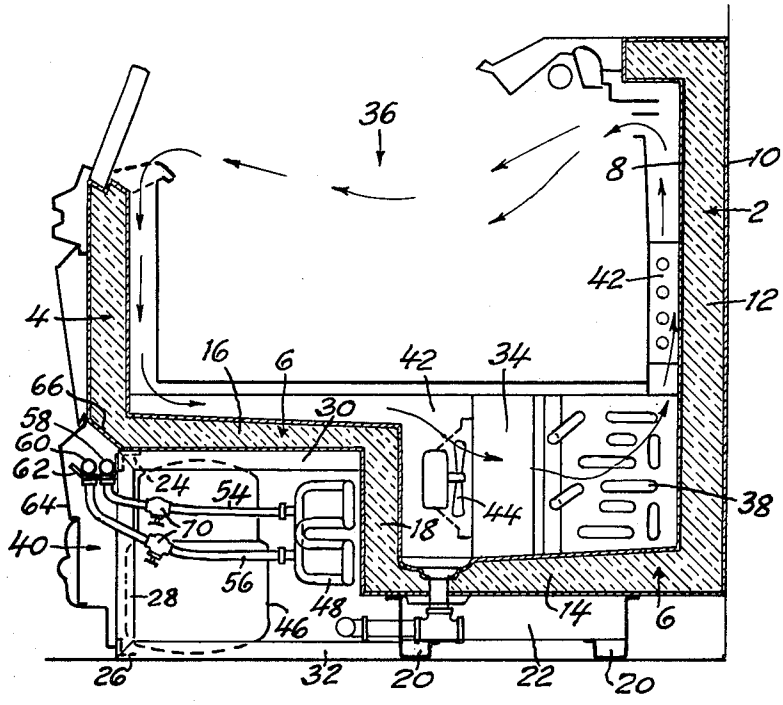

Fig. 3.

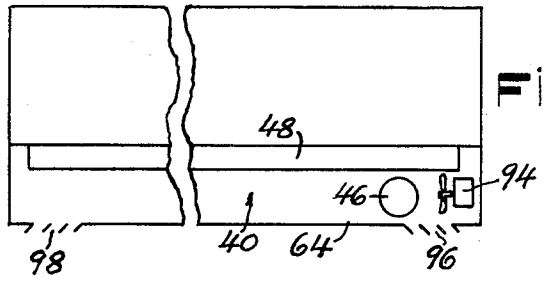

Fig. 2.

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Filed Jan. 7, 1965 3 Sheets-Sheet 2

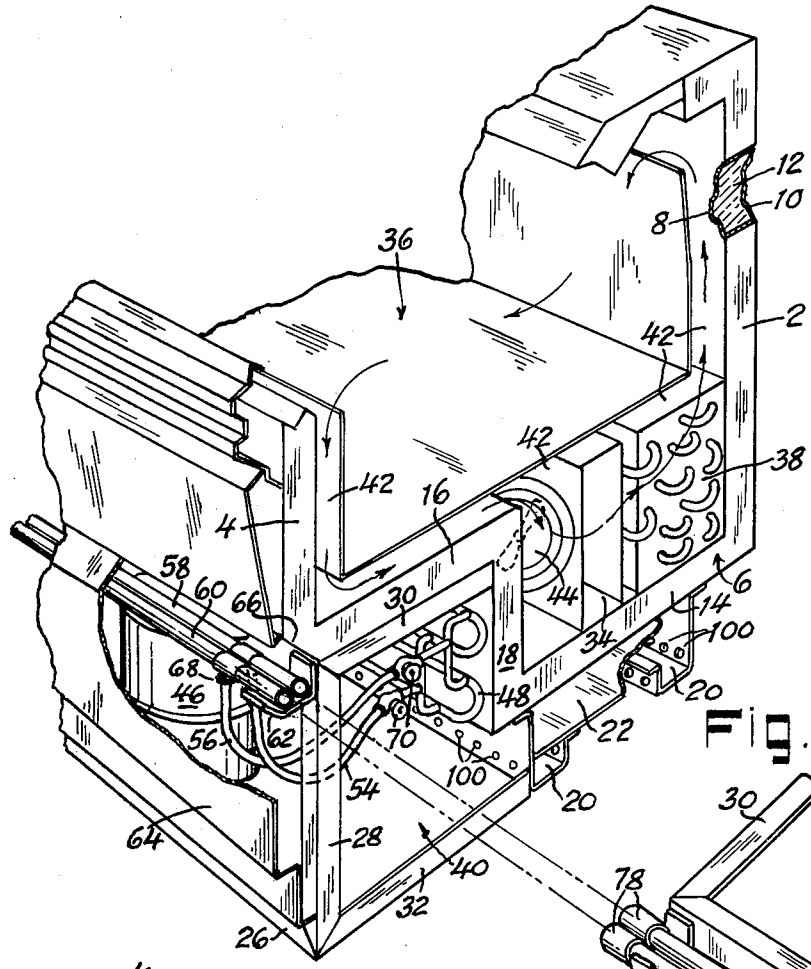

Fig. 4.

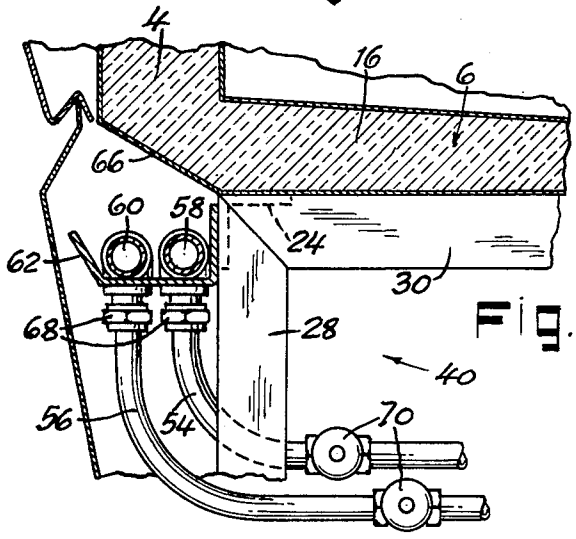

Fig. 5.

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WATER COOLING SYSTEM FOR REFRIGERATING FIXTURES, AND FIXTURE THEREFOR
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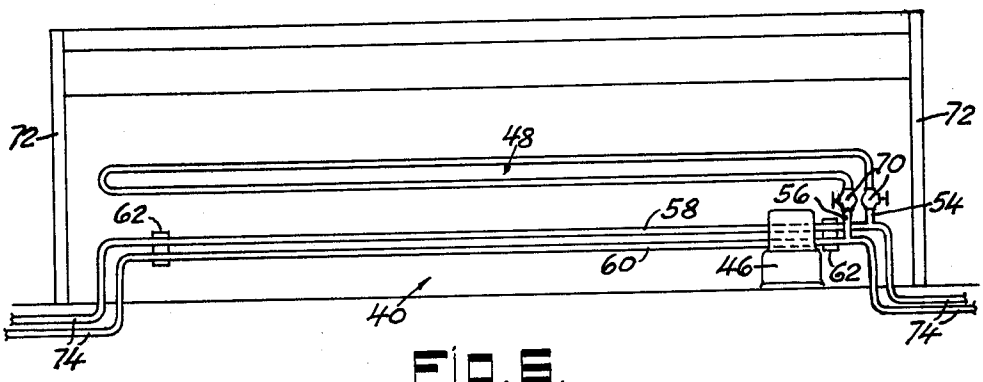

Fig. 6.

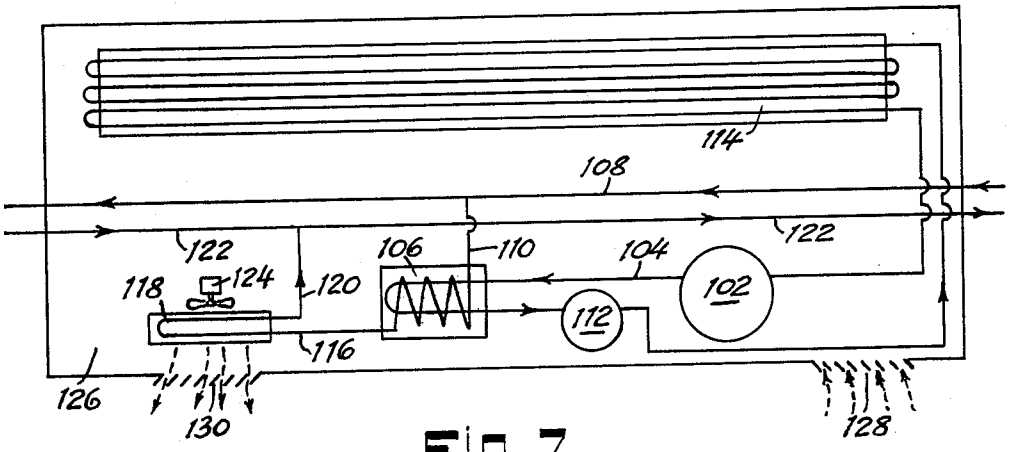

Fig. 7.

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WATER COOLING SYSTEM FOR REFRIGERATING FIXTURES, AND FIXTURE THEREFOR

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Filed Jan. 7, 1965, Ser. No. 423,929
7 Claims. (Cl. 62—255)

This invention relates to refrigerated display cases and is directed particularly to display cases embodying refrigerating means including a water-cooled condenser. This application is a continuation-in-part of applicant's copending application Serial No. 390,312, filed Aug. 18, 1964, now Patent No. 3,210,957 granted October 12, 1965.

In the system described and claimed in said copending application, an assembly of refrigerated display cases is provided wherein each display case has a service space in the front of the case beneath the bottom of the front portion of the display space. In the preferred form of the invention described therein, each display case or section of the assembly is of the "self-contained" type in that it has its own refrigerating unit including a compressor, a water-cooled condenser and an evaporator. Further in accordance with the invention of said copending application, the water-cooled condensers of several or all of the refrigerating units may be connected to a closed water-cooling circuit having water-cooling means located at a point remote from the refrigerated case or cases.

In accordance with the present invention, a novel type of refrigerated display case is provided which is adapted for use either separately or in combination with other similar display cases and with either a closed cooling water circuit or an individual water-cooling system wherein the cooling water is discharged to the sewer or otherwise disposed of. In this way, the refrigerated display case of the present invention has wide application and adaptability permitting standardization of construction while at the same time permitting use of the display case in various systems and under alternative conditions of operation.

Further in accordance with the present invention, the display case is provided with means for circulating air over the condenser, or the compressor, or both, to increase the efficiency thereof and to reduce the load on the water-cooling system. Moreover, the temperature of the air thus circulated is raised and the resulting warm air is utilized to raise the temperature of the air in the aisle or space adjacent the case and/or to remove moisture from beneath the case or from other areas or surfaces where condensation of moisture tends to occur.

Accordingly, the principal objects of the present invention are to increase the versatility, use and application of refrigerated display cases; to permit a common general design of display case to be produced for use either independently or in combination with other similar display cases; to provide improved "self-contained" display cases with refrigerating units embodying water-cooled condensers; to provide constructions which may be readily installed and connected with a source of cooling water with minimum of expense and by relatively unskilled employees; to provide such display cases with air circulating means which serve to reduce the load on the water-cooling system; and to utilize the air thus circulated to raise the temperature of areas or surfaces adjacent the display case.

These and other objects and features of the present invention will appear from the following description thereof wherein reference is made to the figures of the accompanying drawings.

In the drawings:

FIG. 1 is a diagrammatic plan view of a typical system embodying the present invention;

FIG. 2 is a top plan view showing one case or section of the assembly illustrated in FIG. 1;

FIG. 3 is a vertical sectional view of the case shown in FIG. 2.

FIG. 4 is a view partly in section and partly in exploded form illustrating portions of two display cases embodying the present invention as employed in combination with the cooling water system of the present invention;

FIG. 5 is an enlarged detail of the construction shown in FIG. 4;

FIG. 6 is a front elevation of a single display case embodying the present invention as employed as an individual case; and

FIG. 7 is a diagrammatic plan view of an alternative construction embodying the present invention.

In those forms of the invention chosen for purposes of illustration in the drawings, the display case has an outer casing or "tank" embodying a rear wall **2**, a front wall **4** and a bottom indicated generally at **6**. The casing shown has inner and outer metal surfaces **8** and **10** which are spaced apart and preferably are secured to each other by expanded cellular plastic material or other insulation **12**, which may be bonded to the metal surfaces **8** and **10** so as to form a strong, substantially integral insulated case structure.

The bottom **6** of the case is provided with a lower rear portion **14** and an elevated front portion **16** connected by a vertical wall **18**. The lower rear portion **14** of the bottom of the case is preferably supported on rails **20** or the like which serve to hold the lower surface of the rear portion **14** above the floor or surface on which the case is mounted to provide an air space **22** beneath the outer metal surface **10** of the rear portion **14** of the bottom thereof. The elevated front portion **16** of the case preferably is supported by an open-ended frame extending the full length of the case adjacent the front thereof. As shown, the frame has longitudinally extending upper and lower horizontal rails **24** and **26**, respectively which are connected at their ends, and at intermediate locations if desired, to vertical posts **28**. Additional upper and lower horizontal rails **30** and **32** extend rearwardly from the posts **28** of the frame beneath the elevated front portion **16** of the bottom of the case and may be connected to the outer metal surface **10** of the case.

The construction thus provided serves to establish a well **34** at the rear of the display space **36** within the display case in which an evaporator **38** is located. A suitable air duct system **42** is arranged within the case above the inner metal surface **8** thereof so as to communicate with the well **34** and the display space **36**. Blower **44** is located in the air duct system for circulating air through the air ducts and over the evaporator **38** to refrigerate the air circulated through or about the display space and the articles therein. At the same time, the frame and the elevated front portion **16** of the bottom of the case serve to provide a service compartment **40** which opens toward the front of the case and extends the full length of the case.

In accordance with the present invention, the refrigerating mechanism employed includes a motor and compressor assembly 46 which may be of the "can" type and hermetically sealed, if desired, and further includes a water-cooled condenser 48. The condenser shown in FIG. 1 is of the "tube within a tube" type wherein cooling water is circulated through an outer tube 50 in heat exchanging relation with an inner refrigerant carrying tube 52 which receives hot refrigerant gas from the compressor. The outer cooling water tube 50 of the condenser receives cooling water through a flexible or rigid cooling water inlet connection 54 and discharges heated cooling water through a flexible or rigid cooling water outlet connection 56. The condenser preferably is arranged in the form of a longitudinally extending flat series of pipes or tubes located in a vertical plane or planes positioned parallel to and adjacent the vertical wall 18 at the rear of the service compartment 40. The cooling water supplied to the condenser 48 through the inlet connection 54 is received from a supply pipe 58 whereas the water discharged from the condenser after cooling the refrigerant is delivered from the outlet connection 56 to a return pipe 60. The cooling water supply and return pipes 58 and 60 extend longitudinally of the case within the service compartment 40 and preferably are supported by brackets or other suitable means 62 near the front of the service compartment and in front of the posts 28 of the frame but at the rear of a removable front closure plate or panel 64. The lower portion of the front wall 4 of the case preferably is inclined inwardly as shown at 66 and brackets 62 are mounted on the upper longitudinal rail 24 of the frame to hold the supply and return pipes 58 and 60 in a convenient location for ready access or insertion and removal.

The supply and return pipes 58 and 60 are each provided with a fitting 68 for easy attachment and detachment of the inlet connection 54 and the outlet connection 56 of the condenser. Either the fittings 68 or, as shown, the inlet and outlet connections 54 and 56 may be provided with valves or stop cocks 70 for cutting off or regulating the flow of cooling water to and from the condenser and the supply and return pipes 58 and 60.

With this construction and arrangement of the display case and its refrigerating elements, each case is "self-contained" in that it may be employed independently of any other case in a store or market in which it is located and may be operated at any desired or necessary temperature so as to preserve foods or articles therein at a suitable temperature. Thus the refrigerating elements may be designed or proportioned to maintain a relatively high temperature, say 30 to 40° F. for dairy products, candies, vegetables or the like, or at a relatively low temperature, say zero to −10 or −20° F. for preserving ice cream, frozen foods or the like. In fact, when low temperatures are to be maintained or the case is large, it is possible to provide each case with two or more refrigerating units, each of which has a water-cooled condenser detachably connected to the cooling water supply and return pipes 58 and 60.

As shown in FIG. 6, when the cases are to be used independently, they may be provided with insulated end closure panels 72 and the cooling water circulated through the condenser may be supplied to the supply and return pipes 58 and 60 from the city water supply or other lines 74 laid in the floor or otherwise extending to the display case. The supply and return lines extend substantially the full length of the case and since they are readily accessible in the service compartment 40 upon removal of the closure plate 64, any plumber or handy man can insert or remove the pipes 58 and 60 so that they will be supported by the brackets 62 in position for attachment with the inlet and outlet connections 54 and 56 by means of fittings 68.

On the other hand, the refrigerated case provided is adapted for use in the alternative in combination with other similar display cases and in a system such as that shown in FIG. 1 and in said copending application. In such systems, the cooling water is circulated in a closed cycle through water-cooling means 76 located in a position remote from the display case. When the display cases are thus combined and used, the end closure panels 72 need only be applied to the outer ends of the end cases or sections of the assembly and a plurality of intermediate cases or sections may be arranged in end-to-end relation between the end sections to provide a continuous display space of any desired length. The cooling water supply and return pipes 58 and 60 of each case or section then are connected to the corresponding pipes of an adjacent case by means of slip connections or fittings 78. The cooling water supply and return pipes 58 and 60 of each individual case then become sections or elements of a complete closed cooling water circuit such as that indicated generally at 80 in FIG. 1. In fact, when the display cases are thus used in combination, the supply and return pipes 58 and 60 may be continuous pipes of any desired length since the brackets or support means 62 are located in front of the posts 28 of the frames of the various cases and are accessible to receive and support the pipes throughout the length of the assembly upon removal of the closure plates 64 from all of the cases. It is then only necessary to provide the continuous pipes 58 and 60 with fittings 68 in suitable locations for attachment of the cooling water supply and return connections 54 and 56 thereto.

When used with a closed cooling water circuit of the type disclosed in the copending application Serial No. 390,312, the supply and return pipes 58 and 60 become elements of the supply line 82 and return line 84 of the circuit 80. The cooling water is circulated through supply line 82 by means of a pump 86 so that each case will receive the necessary amount of water for cooling its condenser, or condensers, under control of the valves or stop cocks 70. The cooling water is heated by heat exchange with the refrigerant carrying tubes 52 of the various condensers and the thus heated water is discharged from the various condensers to the return line 84 of the circuit 80. Pump 86 then circulates the heated water to the cooling tower or other water-cooling means 76 which may be located on the roof of the store or at any other point remote from the display cases. The cooling water circulated preferably is purified or otherwise treated by suitable means indicated generally at 88 whereby corrosion of the lines, pipes, condensers and fittings in the system is reduced to a minimum and the amount of water required to assure proper cooling of all of the condensers is limited. Nevertheless, an adequate supply of cooling water is maintained in the system by means of a float control or other supply means 90 in reservoir 92.

As pointed out above, the present invention thus renders it possible to produce a standard or generally similar type of display case adapted for use individually or in combination with other display cases and in systems supplied with cooling water from a closed circuit or from any other source. Moreover, each case or section of an assembly of cases is "self-contained" in that the construction is such that the condenser, compressor, controls and other elements of the refrigerating unit are located within the individual cases and positioned so that they are accessible for ready installation, adjustment and removal. In particular, the construction renders it possible to employ water-cooled condensers of high efficiency and to install and remove the cooling water supply and return pipes and to regulate the flow of cooling water through the various condensers with a minimum of time and expense and when using readily available employees, plumbers or handy men.

Further, in accordance with the present invention and as shown in FIG. 2, means are provided for increasing the efficiency of the compressor and condenser and for improving the operation and simplifying the maintenance

of the cases and assembly. For this purpose, a blower **94** located in the service compartment **40** of at least one case in an assembly thereof and preferably in each case, is arranged to direct air over the condenser **48** and preferably also over the compressor **46** to reduce the temperature thereof. The air thus circulated removes heat from the water-cooled condenser so as to reduce the load on the water-cooling system and water-cooling means **76**. The amount of cooling water required to condense the refrigerant in the inner refrigerant carrying tubes **52** of the condensers or the rate of flow thereof may, therefore, be reduced. Similarly the air flowing over the compressor serves to reduce its temperature and increase the efficiency thereof.

Heat removed from the condenser or the compressor or both serves to raise the temperature of the air circulated by the blower **94** and the warm air thus produced is utilized to raise the temperature of surfaces or areas adjacent the case and or to remove or prevent the creation of moisture which would otherwise condense on surfaces of the case. Thus as shown in FIG. 2, the closure panel **64** at the front of the service compartment **40** of each case may be provided with an air inlet opening or lourves **96** near one end of the case. The blower **94** is located adjacent opening **96** and serves to draw air inward from the space in front of the case and to direct such air over the compressor **46** and water-cooled condenser **48**. In this way, the temperature of the air is raised and it is thereafter discharged from the service compartment **40** through air outlet openings **98** in the closure panel **64** near the opposite end of the case. The temperature of the air in the aisle adjacent the front of the case may thus be raised to overcome chilling of the aisle by spill-over air from the refrigerated space within the case. If desired, the case may be constructed as shown in the U.S. Patent to Ural No. 3,125,864 and the heated air being circulated may raise the temperature of spill-over air being discharged from the case through a separate air duct.

At least a portion of the air heated by passage over the condenser and compressor by the blower **94** is preferably also passed rearwardly from the service compartment **40** through the air space **22** beneath the rear portion **14** of the bottom **6** of the case. In this way, it is possible to counteract heat losses through the bottom **6** which might otherwise cause moisture to condense on the bottom and result in sweating thereof. For this purpose, the rails **20** which extend beneath the case may be provided with air passages **100** therethrough (FIG. 4) to facilitate the circulation of the heated air through the space **22** and evaporation of moisture from the chilled surfaces of the case. The air circulated by blower **94** also serves to overcome any tendency for moisture to condense on the vertical wall **18** of the service compartment or other surfaces over which it is passed.

In the alternative construction shown diagrammatically in FIG. 7, each self-contained case may embody a water-cooled condenser specifically designed with heat exchange means for heating air to be utilized in raising the temperature of the aisle or space adjacent the case or for preventing condensation of moisture on surfaces of the case. For this purpose, the hot refrigerant gas from a compressor **102** is passed through the line **104** to a condenser **106** supplied with cooling water from a supply line **108** through a connection **110**. The condensed refrigerant is returned from condenser **106** to a receiver **112** and the evaporator **114** whereas the water heated in condensing and cooling the refrigerant gas is passed through a line **116** to a heat exchange element **118** and then flows through connection **120** to a water return line **122**. A blower **124** serves to draw room air into the service compartment **126** through lourves or an opening **128** so that it will pass over the compressor **102** and condenser **106** to heat exchanger **118**. The air then is forced through the heat exchanger **118** and the air outlet openings **130** for return to the aisle to raise the temperature of the air in the space adjacent the case.

In this construction, the cooling water flowing from the heat exchanger **118** back to return line **122** may be sufficiently cooled by the air directed through the heat exchanger by blower **124** so as to require little or no further cooling before being recirculated through the condenser **106**. Under such circumstances, a by-pass line **132** having a water pump **134** therein may be connected to the supply and return lines by valve means **136** and **138**. The water cooling system itself may thus be self-contained for use under some conditions of operation whereas it may be connected into a closed circuit employing a remote water cooling device as shown in FIG. 1 when desired.

While the form, type and arrangement of the display cases and the various elements thereof which have been shown and described above are typical of those embodying the present invention, it will be apparent that the desired versatility, accessibility and adaptability of display cases may be attained when employing various other constructions, shapes and types of elements and combinations thereof. In view thereof, it should be understood that the particular embodiment of the invention shown in the drawings and described above is intended to be illustrative only and is not intended to limit the scope of the invention.

We claim:

1. A refrigerated display case having a display space therein, said case being provided with an insulated rear wall, an insulated front wall and an insulated bottom, the bottom having a lower rear portion and an elevated front portion connected to the rear portion of the bottom by a vertical wall, said walls and bottom cooperating to form a well above the rear portion of the bottom of the case, an evaporator in said well, a duct system above the bottom of the case having means therein for circulating air over said evaporator to and from said display space, a service compartment extending substantially the full length of said case and located beneath the elevated front portion of the bottom of the case in front of said vertical wall, a frame in said service compartment supporting the elevated front portion of the bottom of the case, a closure plate closing the front of the service compartment, a compressor and a condenser located in the service compartment and connected to said evaporator, said condenser being of the water-cooled type, support means mounted on said frame, cooling water supply and return pipes extending substantially the full length of said service compartment and mounted on said support means, connections extending from said cooling water supply and return pipes to said condenser and other connections extending from the cooling water supply pipe to a source of cooling water external to the case and from said cooling water return pipe to water receiving means external to said case.

2. A refrigerated display case as defined in claim **1** wherein said supply and return pipes are separably connected to said condenser and removable from said support means and service compartment upon displacement of said closure panel.

3. A refrigerated display case as defined in claim **1** wherein means are provided for controlling the flow of cooling water through said condenser from and to said cooling water supply and return pipes.

4. A refrigerated display case as defined in claim **1** wherein the cooling water supply and return pipes constitute elements of a closed circuit water cooling system.

5. A refrigerated display case as defined in claim **1** wherein air inlet and outlet openings communicate with said service compartment and with a space adjacent the case to be heated, and a blower is located in said compartment and arranged to circulate air through said inlet and over said condenser to said outlet.

6. A refrigerated display case as defined in claim **5**

wherein at least a portion of the air from said blower is passed beneath the lower portion of the bottom of the case.

7. The combination comprising a plurality of refrigerated display cases as defined in claim 1 arranged in end-to-end relation with the service compartments therein communicating with each other and separable connections between the supply and return pipes in said cases, the supply and return pipes in all of said cases being connected in series and forming elements of a closed circuit water-cooling system.

References Cited by the Examiner

UNITED STATES PATENTS

2,125,542	8/1938	Catterlin	62—299
2,279,945	4/1942	Hoffman	62—252
2,288,166	6/1942	Kucher	62—506
2,290,647	7/1942	Lowell	62—254
2,706,387	4/1955	Swanson	62—255
2,730,867	1/1956	Salisbury	62—419
3,056,274	10/1962	Pouchert	62—255

WILLIAM J. WYE, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,230,732 January 25, 1966

Donald E. Rutishauser et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, lines 8 to 11, strike out "Under such circumstances, a by-pass line 132 having a water pump 134 therein may be connected to the supply and return lines by valve means 136 and 138."

Signed and sealed this 26th day of September 1967.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents