

Nov. 7, 1961

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3,007,321

REFRIGERATING INSTALLATIONS

Filed April 4, 1958

5 Sheets-Sheet 1

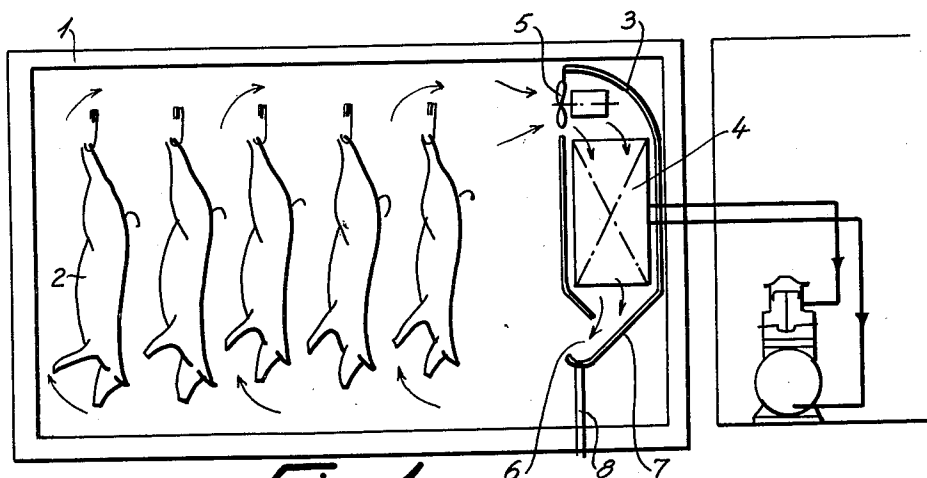


Fig. 1

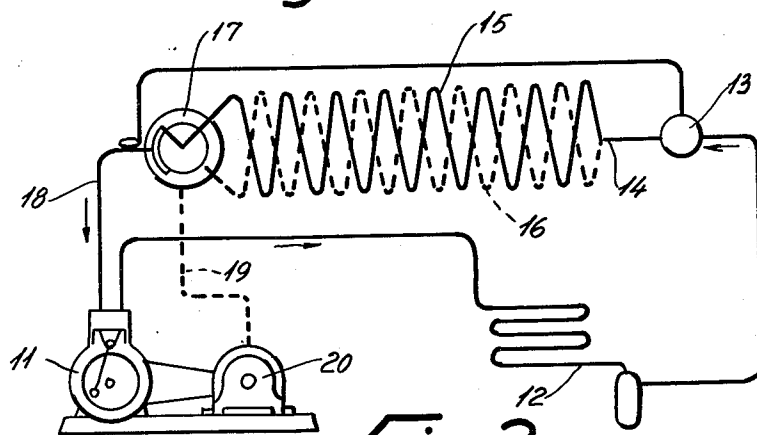


Fig. 2

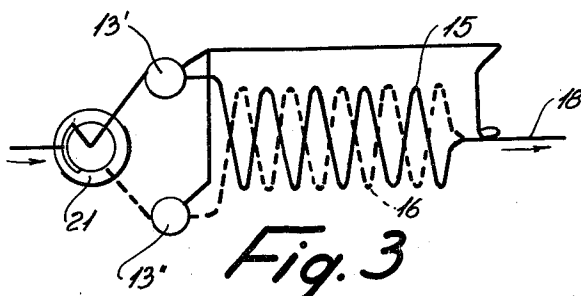


Fig. 3

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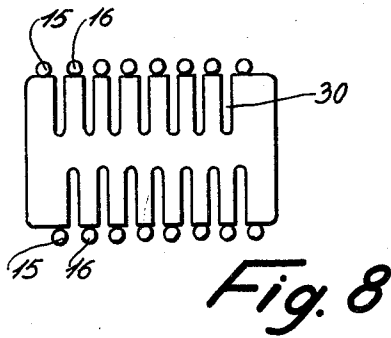
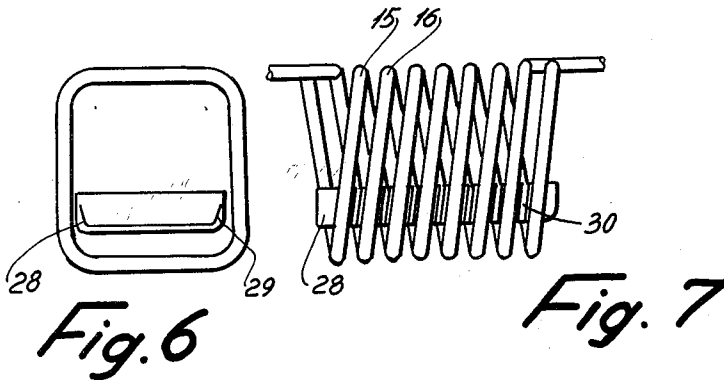
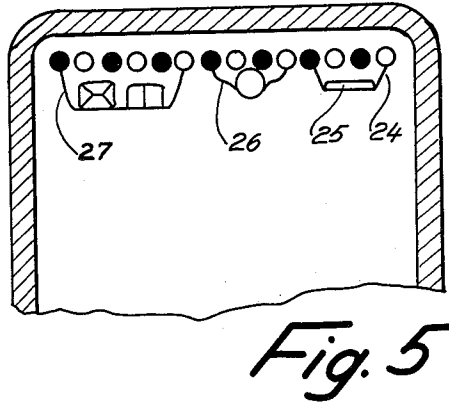
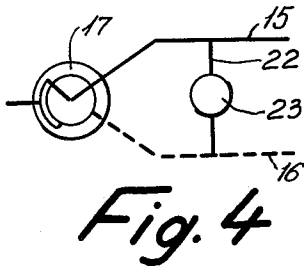
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5 Sheets-Sheet 2



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REFRIGERATING INSTALLATIONS

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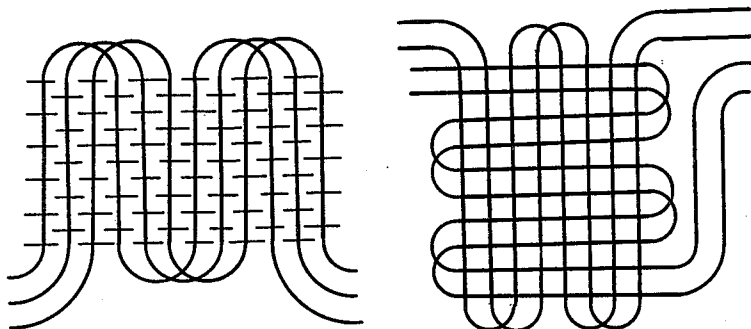


Fig. 9

Fig. 10

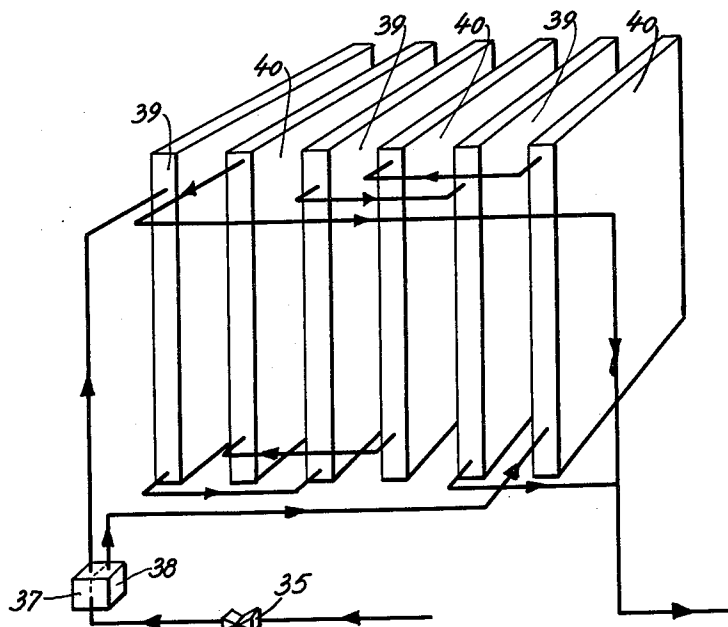


Fig. 11

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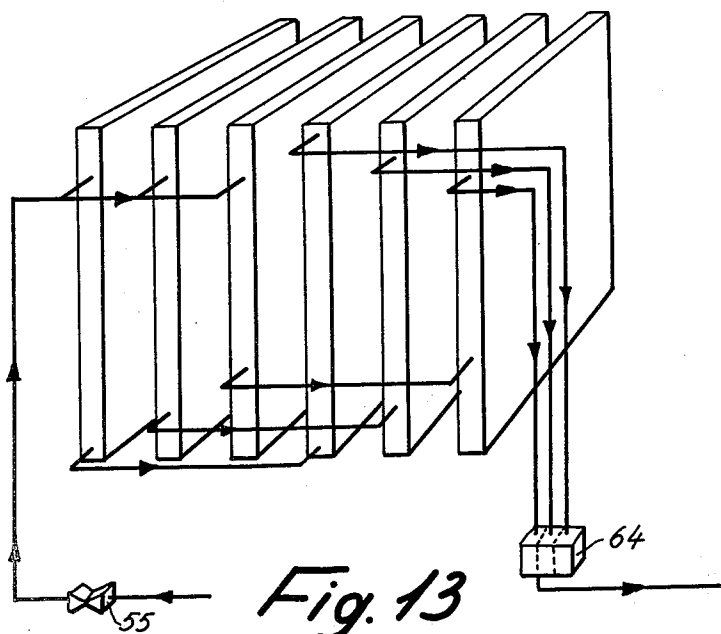
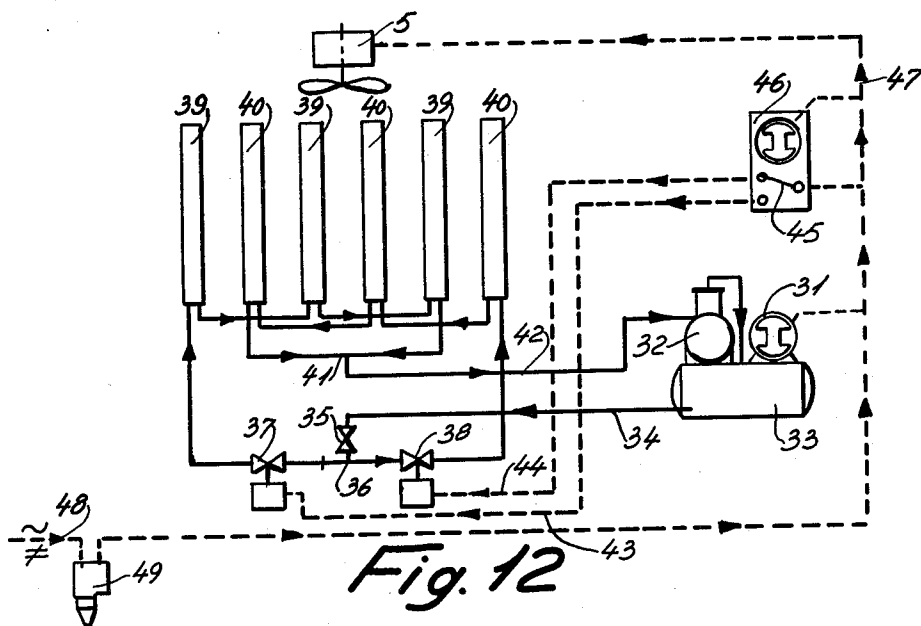
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REFRIGERATING INSTALLATIONS

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5 Sheets-Sheet 4



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3,007,321

REFRIGERATING INSTALLATIONS

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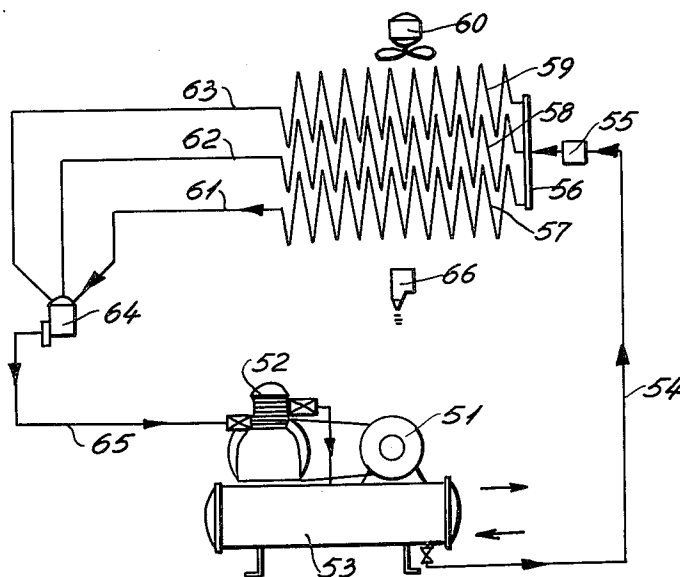


Fig. 14

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3,007,321
REFRIGERATING INSTALLATIONS
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Filed Apr. 4, 1958, Ser. No. 726,392
8 Claims. (Cl. 62-199)

This invention relates to a refrigerating installation for use in the storage of goods at a reduced temperature, and more particularly to installations comprising a refrigerating system in which a liquid refrigerant is evaporated in an evaporator unit mounted in a refrigerating compartment in such a manner as to cool the air circulating therein.

In most refrigerating systems of conventional design, drawbacks and difficulties are encountered owing to the fact that the moisture of the air in a confined space or compartment to be cooled has tendency to condense on the cooling evaporator or evaporators of the system in the form of frost. A direct disadvantage of the accumulation of frost is the necessity of taking special measures to remove the frost from time to time, and moreover, the refrigerating capacity is decreased gradually as the frost layer increases in thickness. The constant extraction of the moisture from the air in the form of frost results in a reduction of the relative humidity of the air in the compartment, frequently down to a value so small as to be harmful to the goods stored in the compartment, e.g. by causing a loss of weight or impairing the quality by drying the goods. In many cases, it is necessary to interrupt the operation at regular intervals in order to perform a defrosting operation, which is very harmful to the goods, because these are then subjected, while at low temperature, to air at a higher temperature whereby moisture will condense on the goods. As a consequence of this, the goods may assume a slimy appearance and the slimy surface of the goods will favor the growth of bacteriae. A further drawback of the frost is that it has a great power of attracting odorants so that the deposition of frost during the running periods and the partial thawing that may occur during the periods of rest, in combination with the periodic vaporization, may result in a very unfavorable exchange of odours between the various goods stored in a refrigerating compartment.

It is also to be observed that on account of the formation of frost, it is as a rule not possible to increase the active surface of the evaporators by corrugations, or by constructing them with ribs or by like measures, because the frost will very soon fill up the spaces between the corrugations or ribs so that the increase of the active surface becomes illusory.

Various types of refrigerating systems have been proposed in which an attempt has been made at eliminating the drawbacks inherent in the formation of frost. Thus, it has been proposed to use two evaporator sections arranged for alternate operation so that one evaporator section can be defrosted, while the other element is in operation. While it has been possible in this manner to eliminate the building up of a constantly increasing deposit of frost on the surface of the evaporator sections, a number of the drawbacks of the formation of frost have still been left over in the known systems. One reason for this is that the defrosting was mainly effected by dripping, and the vapor resulting from the defrosting and dripping was permitted to be incorporated in the circulating air adjacent one evaporator, while at the same time, more or less independent thereof, a deposition of moisture in the form of frost would take place at the other evaporator, whereby there would inevitably be some transportation of odorants, and the quantity of moisture deposited in the form of frost on one evapora-

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tor section would not necessarily substantially match the quantity of moisture liberated from the other evaporator section.

Moreover, it has been found that in the storage of perishable goods (meat, vegetables, cheese, butter etc.) the quality of the stored goods is influenced not only by the average values of temperature and moisture but also—and much more so than previously expected—by the variations of these values, i.e. their maximum deviations from their mean values.

From this point of view, it will be desirable to keep the operating conditions of a refrigerating compartment as constant as possible. This too, however, is rendered difficult in the conventional refrigerating systems by the formation of frost on the evaporators, necessitating steps to be taken from time to time to remove the frost, during which intervals the operating conditions will be radically different from those prevailing during normal running.

It is the object of the invention to construct a refrigerating installation, in which these drawbacks are reduced or eliminated and by which it is rendered possible not only to keep a relatively high moisture content of the air surrounding the goods, but also to maintain the moisture content and the temperature constant to a very high degree and to avoid undesirable travel of moisture.

With this in view the invention provides a refrigerating installation comprising a closed compartment adapted to receive goods to be stored, a plurality of evaporator sections mounted in such a manner as to cool the air circulating in said closed compartment, said evaporator sections being arranged as alternative branches of a common refrigerant circulation system and having their cooling surfaces entirely spaced from one another and being arranged in intermixed relationship to form an aggregate unit throughout which portions of one evaporator section alternate in space with portions of another or other evaporator sections in close proximity thereto, means being provided for changing over the circulation between the various evaporator sections.

Owing to this arrangement, the exchange of moisture between the surfaces of the evaporator sections and the general flow of air circulating in the refrigerated compartment will be reduced to a minimum. The moisture will virtually be drawn in a direct path from the evaporator section at the higher temperature to the evaporator section at the lower temperature. In the manner it has proved possible in ordinary circumstances to operate a refrigerator in such a manner that there will be no tendency of the building up of a frost layer on the evaporator sections. During the active period of each evaporator section, there will only be formed a relatively thin frost layer, which during the subsequent period, where the relevant evaporator section is inactive, is drawn directly across to the other or another evaporator by sublimation. Thus, there is no necessity of interrupting the operation to perform a defrosting, and there will be no harmful drying of the air in the refrigerator. The transportation of odorants is reduced to a minimum, and it will be possible to use profiled evaporator sections without any danger of the profile being clogged by deposited frost. Such a profiled construction is particularly useful for industrial plants.

Moreover, it is very important that the circulating air will always encounter the same conditions in the combined evaporator unit whether one evaporator section or the other is active at the moment. Thereby the variations of temperature and humidity in each individual point of the refrigerating compartment from their average level can be kept much smaller than in the conventional system.

It is important that in the refrigerating installation according to the invention the periods of time between successive change-overs between the evaporator sections are relatively short, say from 10–30 minutes, so that the needle shaped crystalline ice layer which is formed when the deposition of moisture on an evaporator section below the freezing point does not have time to be wholly or partly filled up, but remains porous during the whole of the period during which sublimation from the evaporator section in question is desired whereby the rate of sublimation is considerably increased owing to the large surface area of the crystals.

It has been found in practice that e.g. the quality of meat stored in a refrigerating installation according to the invention is much less affected than when a conventional plant is used for the storage. Slimy appearance of the meat (resulting from condensation of moisture during certain phases of operation) can be entirely eliminated and the same applies to the parchment-like surface characteristic of temporary excessive drying.

It is an advantage of the refrigerating system according to the invention that even in cases where the air in the refrigerated compartment is to be kept at a temperature above the freezing point of water the dripping of water from the evaporator sections can be eliminated or reduced to a minimum because the evaporator sections may be so arranged, and the operation factors of the system may be so selected that during the inactive period of an evaporator section all or a substantial part of the frost deposited on the relevant evaporator section is drawn across to another, active evaporator section by sublimation and condensation before the first mentioned element reaches the thawing temperature. In fact, e.g. in the case of a domestic refrigerator, the quantity of moisture dripping from the evaporator section may be limited to an amount corresponding to such excess moisture, if any, as may be supplied to the air by vaporization from the goods stored, to the extent this cannot be taken care of by diffusion to the surroundings, and, again, this excess moisture may be kept very small because of the high humidity maintained in the refrigerator.

Some examples of carrying out the invention will now be described with reference to the accompanying drawings, in which

FIG. 1 shows a section through one form of a refrigerating installation according to the invention,

FIG. 2, a diagram of one form of a refrigerating system that may be used in the refrigerating installation illustrated in FIG. 1,

FIG. 3, a modification of the system shown in FIG. 2,

FIG. 4, another modification of the system shown in FIG. 2,

FIG. 5, a vertical section through the top portion of a domestic refrigerator constructed with a refrigerating system according to the invention,

FIG. 6, an example of an evaporator system with a built in compartment for an ice tray, in front view,

FIG. 7, a side view of same.

FIG. 8, a horizontal section through same,

FIG. 9, an evaporator system in the form of parallelly disposed ribbed tubes divided between three groups,

FIG. 10, an evaporator system in the form of a network of tubes,

FIG. 11, an evaporator system in the form of a system of flat boxes,

FIG. 12, a flow sheet and electric circuit diagram of a refrigerating plant for use in an installation according to the invention with an evaporator unit of the type illustrated in FIG. 11 and with electrically operated valves,

FIG. 13, a three-section evaporator unit in the form of a system of flat boxes, and

FIG. 14, a flow sheet of a refrigerating plant for use in an installation according to the invention with an evaporator unit of the type illustrated in FIG. 13.

In FIG. 1, 1 is a refrigerating compartment adapted to

receive goods 2 to be stored. At one end of the refrigerating compartment there is formed a separate passage or duct 3, in which an evaporator unit 4 of a compression type refrigerating plant to be described further in the following is located. The duct 3 is constructed with an inlet opening at the top, in which a ventilator or fan 5 is mounted, and an outlet opening 6 at the bottom, below which a collecting tray 7 for condensed water is mounted. A drain pipe 8 connects with the bottom of the collecting tray 7. It will be seen that air is drawn from the refrigerating compartment by means of the fan or ventilator 5 and is then caused to flow along the cooling surface of the evaporator unit 4 so as to re-enter the compartment 1 through the bottom opening 6. In this manner a current of circulating air is produced in the refrigerating compartment as indicated by the arrows, which air is cooled by the evaporator unit 4 and in turn serves to keep the temperature of the stored goods 2 at a predetermined temperature, which may be above or below the freezing point.

One example of the construction of the refrigerating plant of an installation as illustrated in FIG. 1 is shown in FIG. 2.

11 is the compressor and 12 the condenser of a compression type refrigerating system. From the condenser the liquid refrigerant flows to a so-called thermo-valve 13 that may in some cases be replaced by a simple outlet, orifice or passage according to well known practice. While, however, in the conventional systems the refrigerant expands from the outlet into a single evaporator, the thermo-valve 13 is followed, in the system illustrated in FIG. 2, by a branch tube 14, from which the refrigerant can be branched to one or the other of two evaporator sections 15 and 16 combining to form the evaporator unit 4 of FIG. 1, which evaporator sections are in FIG. 2 diagrammatically shown in the form of a twin coil in which the two component coils forming the respective evaporator sections 15 and 16 are located close together. It is however important that the two coils, or more generally the various evaporator sections should be entirely spaced from one another in their entirety, i.e. should not be in direct contact with one another in any point, since this would spoil the thermic cycle to be described below.

At their outlet ends the evaporator coils 15 and 16 are connected to a change-over valve 17 by means of which the coils can be alternately connected to a suction pipe 18 leading to the compressor. To simplify the illustration, the change-over valve 17 is illustrated in the form of a cock having an angular passage in the plug, while the two evaporator coils 15 and 16 are connected to passages at a mutual spacing of 90° in the body of the cock and the suction pipe 18 is connected to a groove in the body of the cock extending over an angle of well over 90° and located diametrically opposite to the angle between the passages to which the evaporator coils are connected, so that the plug of the cock, when turned in steps of 180°, will establish a connection alternately from the evaporator coil 15 and from the evaporator coil 16 to the suction pipe 18. In practice, however, it may be difficult to obtain a satisfactory sealing by means of a cock and it is therefore as a rule preferable to use seat valves for the change-over function.

When, in the operation of the refrigerating system, the valve 17 is changed over at suitable intervals, the two evaporator coils 15 and 16, which in the system illustrated constitute the evaporator sections, will be alternately active and consequently, during the inactive periods of each of the evaporator coils, moisture that has been deposited in the form of frost on the evaporator coil in question will travel therefrom to the other evaporator coil, which during these periods has a lower temperature, as previously described.

It is to be observed that the evaporator coil, which at any time is not active, is not completely cut off, but

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remains in open connection with the other evaporator coil—and thus indirectly with the suction side of the compressor—at the branching point 14 at the input end. If the inactive evaporator coil were completely cut off, it would relatively soon be heated by the air circulating in the refrigerator, the pressure would increase and the refrigerant vapor would be condensed, whereby the evaporator coil might sometimes be raised to a temperature above the freezing point of water too rapidly, so that the frost layer would thaw and drip off prematurely. When, however, the inactive evaporator coil is all the time in open connection with the active one so that there is maintained substantially the same pressure in the inactive evaporator coil as in the active one, the inactive evaporator coil will be sucked clean of liquid refrigerant that may be present, and by suitably selecting the operation factors it may in many cases be arranged that all or a very substantial part of the frost layer is completely sublimated off before the evaporator coil is raised above the freezing point. In fact, even in a refrigerating compartment that is to be kept at a temperature above the freezing point, say at about 40° F., it may be arranged that neither the active nor the inactive evaporator coil never gets above the freezing point. In this connection it is, of course, important that the inactive evaporator coil is located in the strongest cold field directly surrounding the active evaporator coil.

The change-over of the valve 17 may on principle be effected in any suitable manner. As an example, the change-over valve 17 may be controlled by an electric motor 20 driving the compressor, as indicated by a dotted line. Thus, if the refrigerating system is of the intermittently operating type, e.g. arranged for thermostatic control so that the motor 20 is started to operate the system each time the temperature in the compartment served by the refrigerating system increases beyond a certain maximum permissible value, the control of the change-over valve 17 may be effected by arranging a magnet in series or parallel to the motor, the said magnet having an armature which e.g. by way of suitable gearing and a one-way coupling turns the plug of the change-over valve 17 through 180° every time the motor 20 is switched on. If it is found that by this arrangement the active and inactive periods of the respective refrigerating elements result too short, the arrangement may be so modified that the change-over will take place only every second time, every third time etc. the motor is switched on.

The change-over valve may also be arranged to operate responsive to the extra surge occurring every time the motor 20 is started, or a change-over depending on the starting and stopping of the refrigerating system could be effected by other means, e.g. responsive to temperature or pressure changes in the refrigerant circulation system, seeing that these factors are considerably changed when the system is started and stopped.

The change-over may also be effected by means of clockworks, particularly in the case of continuously operating systems, or systems having very long running periods. A further possibility is to have the change-over controlled by means of hygrometers in such a manner that a change-over is performed every time the humidity of the air circulating in the refrigerating compartment falls below a certain limit.

In the embodiment shown in FIG. 2, the thermo-valve 17 and the connection from the latter to the branching point 14 is common to the two evaporator coils. If this part of the system is cooled down to such an extent that frost is deposited on the thermo-valve, this frost will not take part in the cyclic travel of moisture to which the other parts of the evaporators are subjected, because the thermo-valve is active all the time. On the other hand, the thermo-valve is constantly in contact with the relatively warm liquid refrigerant tending to keep it at a relatively high temperature. If, however, a

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layer of frost is built up on the thermo-valve, the latter may be heat insulated and arranged outside the compartment served by the refrigerating system, or alternatively, the system may be modified as shown in FIG. 3, where there is arranged a change-over valve 21 at the inflow end of the evaporators, and a thermo-valve 13' and 13'' respectively for each evaporator, while the evaporators are in constant open connection with one another and with the suction pipe 18 at their outlet end. In this case, the common change-over valve 17 of FIG. 2 is omitted. In this embodiment, also the two thermo-valves 13' and 13'' will be alternately active, and provided the thermo-valve 13' is located close to the evaporator coil 16, and the thermo-valve 13'' close to the evaporator coil 15, both of the thermo-valves may be defrosted in their respective inactive periods in the same manner as the evaporator coils proper.

The change-over valve 21 may be entirely omitted, if the thermo-valves are so constructed that they can be alternately completely closed by the control impulses otherwise serving to change over the valve 21.

Likewise, the change-over valve 21 may be replaced by individual cut-off valves in each of the two parallel branches.

As previously described, it is possible, by means of a refrigerating system as described, to maintain a relatively high humidity of the air in the compartment served by the refrigerating system. In ordinary circumstances, this is very desirable. Moreover, since the system may at will be changed over to a condition tending to reduce the humidity to a value comparable to that prevailing in conventional refrigerators, as will be described below, an accurate control of the humidity within wide limits becomes possible. Such accurate control is very desirable for some special kinds of goods to be stored. An example of this additional control is diagrammatically shown in FIG. 4. In this case, a change-over valve 17 is used in the same manner as in FIG. 2, and immediately ahead of the latter the two evaporators 15 and 16 are connected with one another through a short-circuiting conduit 22 in which a cut-off valve 23 is incorporated. This cut-off valve may be arranged for manual control, or it may be controlled by a contact hygrometer, so as to be opened if the humidity in the compartment becomes too high. As long as this valve is open, the two evaporators are permanently connected in parallel and they are therefore both constantly active, or at least active in all running periods, if the refrigerating system is of the intermittently operating type. Consequently, the two evaporators co-operate as an ordinary single evaporator on which a frost layer may be built up. When a sufficient quantity of moisture has been thus withdrawn from the air, so that the humidity in the compartment has been reduced to the desired value, the valve 23 is again shut, whereafter, the two evaporators will again be alternately operative. If the frost layers built up in the meantime are so thick as to be of inconvenience, and will not disappear during the continued operation of the system, the frost may be removed according to well known principles.

FIG. 5 shows diagrammatically the top portion of a domestic refrigerator in which the evaporators are arranged along the top wall in the form of parallel tubes grouped in such a manner that every second tube forms part of one evaporator and the other tube of the other evaporator. FIG. 5 also shows a separate freezing box 24 adapted to receive an ice freezing tray 25. The freezing box 24 is suspended in the evaporator tubes in such a manner that it can be cooled by metallic heat conduction, but at the same time it is, of course, important that the freezing box is located directly in the strongest radiation and convection field around the evaporators. If desired, the metallic heat conducting connection with the evaporators can be completely omitted. If, however, such a connection is present, it is important to take precau-

tions to avoid a thermal short-circuit between parts of the two evaporators, because otherwise there would be metal surfaces on which frost could be constantly deposited since these surfaces do not take part of the rhythmic temperature variations. In FIG. 5, the freezing box is only connected to the evaporators at its sides, one side being connected with a tube of one evaporator, and the other side being connected with a tube of the other evaporator. The heat conducting path between these two tubes is relatively great and can be made still greater by the provision of suitable slits in the freezing box.

If a metallic connection between the freezing box and the evaporators is provided, the arrangement may alternatively be such that the freezing box is only in metallic connection with one of the evaporators. In this case there is, of course, no danger of a thermal short-circuit.

In FIG. 5 there is also provided a strap 26 to receive a bottle and a compartment 27 to receive goods to be frozen or kept at a particularly low temperature.

FIGS. 6-8 show in more detail an example of an evaporator system in the form of a twin helix, as diagrammatically indicated in FIG. 2. In the example illustrated, the helix is wound in rectangular form so as to provide a kind of evaporator box of similar shape as in some known refrigerators. A box 28 to receive an ice freezing tray 29 is arranged inside the evaporator coil in the same manner as usual, and the space above the box 28 may be used to receive goods to be kept at a lower temperature than the other goods in the refrigerator. The sides of the box 28 are connected with all the turns of the evaporator coil e.g. by means of soldering, but thermal short-circuits between adjacent points of connection with the two evaporator coils 15 and 16 are avoided by providing the box with slits 30 extending over the whole height of the side walls and about $\frac{1}{3}$ of the width of the top and bottom walls.

FIG. 9 shows diagrammatically a system of parallel tubes divided between three groups each constituting an evaporator or evaporator section. In this manner, a longer period is available for the defrosting of each individual evaporator. It will be seen from the drawing that since each tube of the system is located between two tubes forming part of one and the other respectively of the two other evaporators, it will always be located immediately adjacent an active tube during the whole of its inactive period.

In FIG. 9, the tubes are provided with interengaging ribs. The provision of the ribs results in an increase of the active refrigerating surface, and this will not be reduced in operation because there is no building up of frost. Owing to the interengaging relationship of the ribs, a compact construction is obtained, and moreover the hygrostatic suction between the various evaporators is promoted.

FIG. 10 shows diagrammatically a system in which four groups of tubes are built together to form a network, two interengaging groups of tubes running in one direction and two other interengaging groups of tubes running in a direction perpendicular thereto. The tubes are interengaged similarly as the warp and weft of a fabric though they must, of course, be constructed with bends in such a manner that there will be no metallic contact between the tubes at the points of intersection.

A further form of an evaporator unit comprising two sections each composed of elements, the elements of the two sections being arranged in intermixed relationship is illustrated in FIG. 11. As will be seen each element is formed in the embodiment illustrated as a flat box and the elements 39 and 40 of the two evaporator sections are arranged alternately in space so that a cooling surface of an element belonging to one of the sections will be located closely adjacent a cooling surface of an element belonging to the other section. It will be understood that in practice the number of elements will be much larger than illustrated in the drawing.

A refrigerating system incorporating the evaporator unit of FIG. 11 is illustrated in FIG. 12.

31 is an electric motor, which drives a refrigerant compressor 32, in which refrigerant vapor is compressed and supplied to a condenser 33, in which it is condensed and then flows through a pipe 34 and an automatic control valve or thermo-valve 35 to a branching point 36, from which the refrigerant is branched through switch-over valves 37 and 38 to two evaporator sections composed of the intermixed elements 39 and 40 respectively. The refrigerant vapor leaving the evaporator sections is re-combined in a point 41 and then returns through a pipe 42 to the suction side of the compressor 32.

In the operation of the refrigerating installation of FIG. 12 the two evaporator sections 39 and 40 are intended to be in action alternately so that only one of the sections at a time is used for refrigeration, while the temperature of the other section is allowed to rise. In this manner like in the previously described embodiments, the necessity for defrosting from time to time can be eliminated because the layer of frost depositing on each section when in operation will tend to move directly from that section to the adjacent section, which is not in operation and is therefore at a higher temperature. Since there is no constant building up of a layer of frost, the extraction of moisture from the circulating air will be less than with the conventional refrigerating plants so that the air in the refrigerating compartment can be kept at a relatively high moisture content. Moreover, it will be seen that the circulating air when passing through the duct or passage 3 will always encounter the same conditions therein whether one or the other evaporator section is in operation, because the two evaporator sections are intermixed in space. Consequently the current of air leaving the bottom opening 6 will be in exactly the same condition irrespective of the switching over between the two evaporator sections, and this again means that the conditions in the compartment 1 will be constant to a very high degree at all times. This constancy of temperature and moisture at every individual location of the compartment 1 is very favorable for the storage of goods such as pointed out above.

If during the inactive period of an evaporator section the temperature of the latter rises above the freezing point of water so that condensed water is formed on the evaporator section, this may drip off to the tray 7 and from the latter through the draining pipe 8.

In the embodiment shown in FIG. 12, the switching-over is performed electrically, the two valves 37 and 38 being constructed in the form of magnetic valves, which are operated over conductors 43 and 44 respectively from a switch 45, which is controlled by means of a synchronous clockwork 46. The latter is connected to a supply line 47, which also supplies the current over the switch 45 to the magnetic valves 37 and 38. Moreover, the fan or ventilator 5 is also connected to the supply line 47 and the same applies to the motor 31 driving the compressor 32. The supply line 47 is in turn connected to a supply network 48 by way of a thermostat switch 49, which is responsive to the temperature conditions in the refrigerating compartment.

In the embodiment illustrated in FIGS. 13 and 14, the evaporator is divided into three evaporator sections 57, 58 and 59 and the switching over is performed by means of a switching over valve device 64, which is mounted on the discharge side of the evaporator. More particularly, in FIG. 14, 51 is an electric motor which drives a refrigerant compressor 52 in which refrigerant vapor is compressed and supplied to a condenser 53 in which it is condensed and then flows through a pipe 54 and an automatic control valve to a header pipe 56. From the latter the refrigerant is branched to three separate evaporator sections 57, 58 and 59, the discharge ends of which are connected to a switch-over valve 64 through pipes 61, 62 and 63. A common return pipe 65 extends from the switch-over valve 64 back to the compressor 52.

is a fan and 66 a thermostat for starting and stopping the whole refrigerating system dependent on the temperature in the compartment to be cooled.

The switch-over valve 64 may be of any convenient type as explained above. The diagrammatic scope of this valve in FIG. 14 is intended to represent a switch-over valve controlled by the quantity of refrigerant passing therethrough, as described in my co-pending application No. 565,713, now Patent No. 2,884,765.

It is to be understood that the use of a fan 5 and the separate duct 3 for the mounting of the combined evaporator unit is not compulsory, since the object of the invention can also be achieved if the combined evaporator unit is mounted directly in the refrigerating compartment and is only exposed to the circulation of air naturally occurring in such a compartment owing to differences of temperature. However, it is essential that the combined evaporator unit should be exposed to air circulating in a refrigerating compartment.

I claim:

1. A refrigerating installation comprising a closed compartment adapted to receive goods to be stored, a pair of evaporator sections mounted in such a manner as to cool the air circulating in said closed compartment, said evaporator sections being arranged as alternative branches of a common refrigerant circulation system and having cooling surfaces entirely spaced from one another and being arranged in intermixed relationship to form an aggregate unit throughout which portions of one evaporator section alternate in space with portions of another or other evaporator sections in close proximity thereto with each of a plurality of the cooling surfaces of one section disposed between relatively adjoining cooling surfaces of the other section, means being provided for directing the flow of refrigerant through each said section in turn, while diverting it from the other said section.

2. A refrigerating installation as in claim 1 in which the evaporator sections are in the form of interengaging helices.

3. A refrigerating installation as in claim 1 in which the evaporator sections consist of interengaging systems of parallel tubes.

4. A refrigerating installation as in claim 1, in which the evaporator sections comprise ribbed tubes, the ribs of one section engaging between the ribs of another or other sections.

5. A refrigerating installation as in claim 1 in which each of the evaporator sections comprises a plurality of flat boxes mounted parallel to one another, the boxes of one section alternating with and disposed between adjoining boxes of the other section.

6. A refrigerating installation as claimed in claim 1, comprising an ice freezing or deep cooling compartment mounted in metallic heat conducting connection with a plurality of the evaporator sections, arrangements being made to increase the heat conduction resistance between the points of connection with the various evaporator sections to a value such that a thermal short-circuit between the latter is avoided.

7. A refrigerating system comprising a plurality of cooling elements arranged as alternative branches of a common circulation system, said cooling elements having mutually spaced cooling surfaces and being arranged in intermixed relationship to form an aggregate unit throughout which portions of one cooling element alternate in space with portions of another or other cooling elements, said system further comprising an ice freezing or deep cooling compartment mounted in metallic heat conducting connection with a plurality of cooling elements, arrangements being made to increase the heat conduction resistance between the points of connection with the various cooling elements to a value such that a thermal short circuit between the latter is avoided.

8. A refrigerating installation as defined in claim 1, wherein said evaporator sections are disposed with their refrigerant intake ends in constant communication, to maintain substantially the same pressure at all times in both sections.

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