

Nov. 22, 1938.

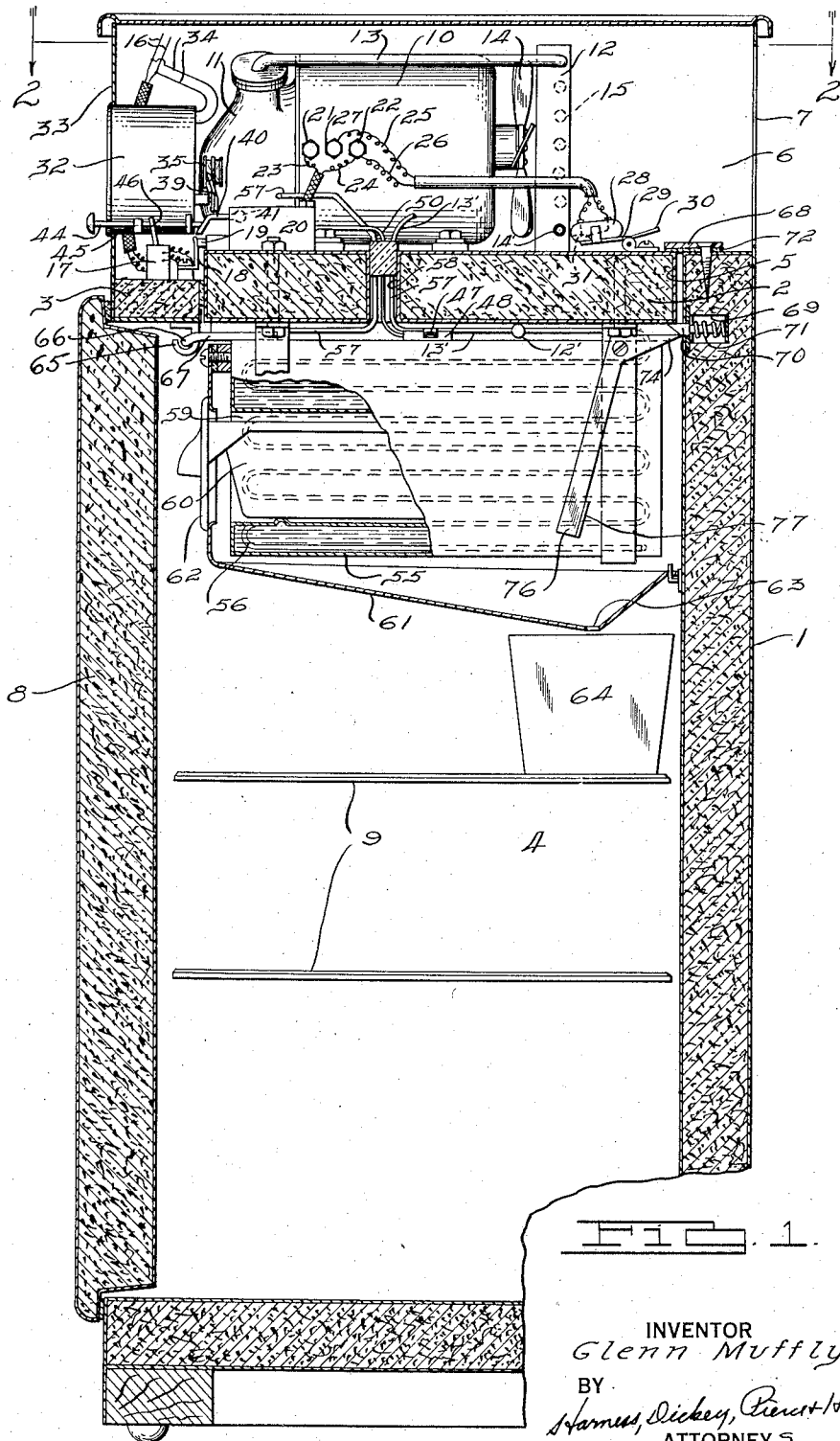
G. MUFFLY

2,137,541

REFRIGERATOR

Filed May 26, 1939

5 Sheets-Sheet 1



Nov. 22, 1938.

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2,137,541

REFRIGERATOR

Filed May 26, 1930

5 Sheets-Sheet 2

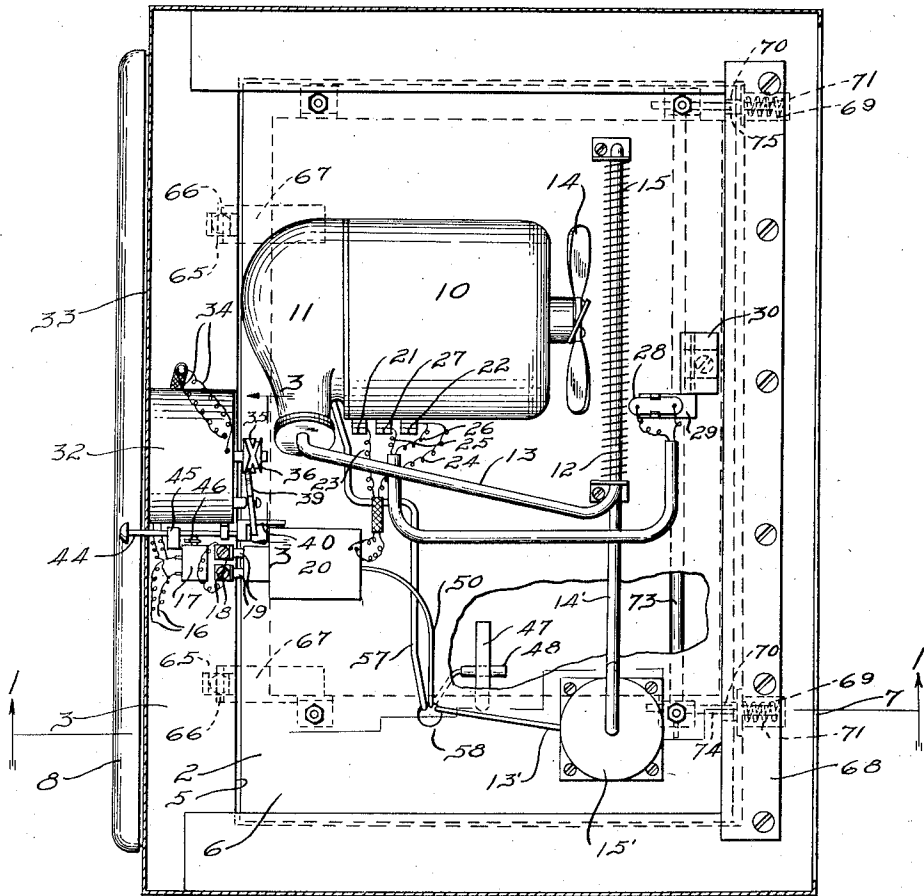


FIG. 2.

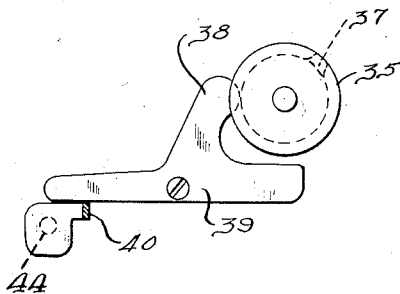


FIG. 3.

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**2,137,541**

REFRIGERATOR

Filed May 26, 1930

5 Sheets-Sheet 3

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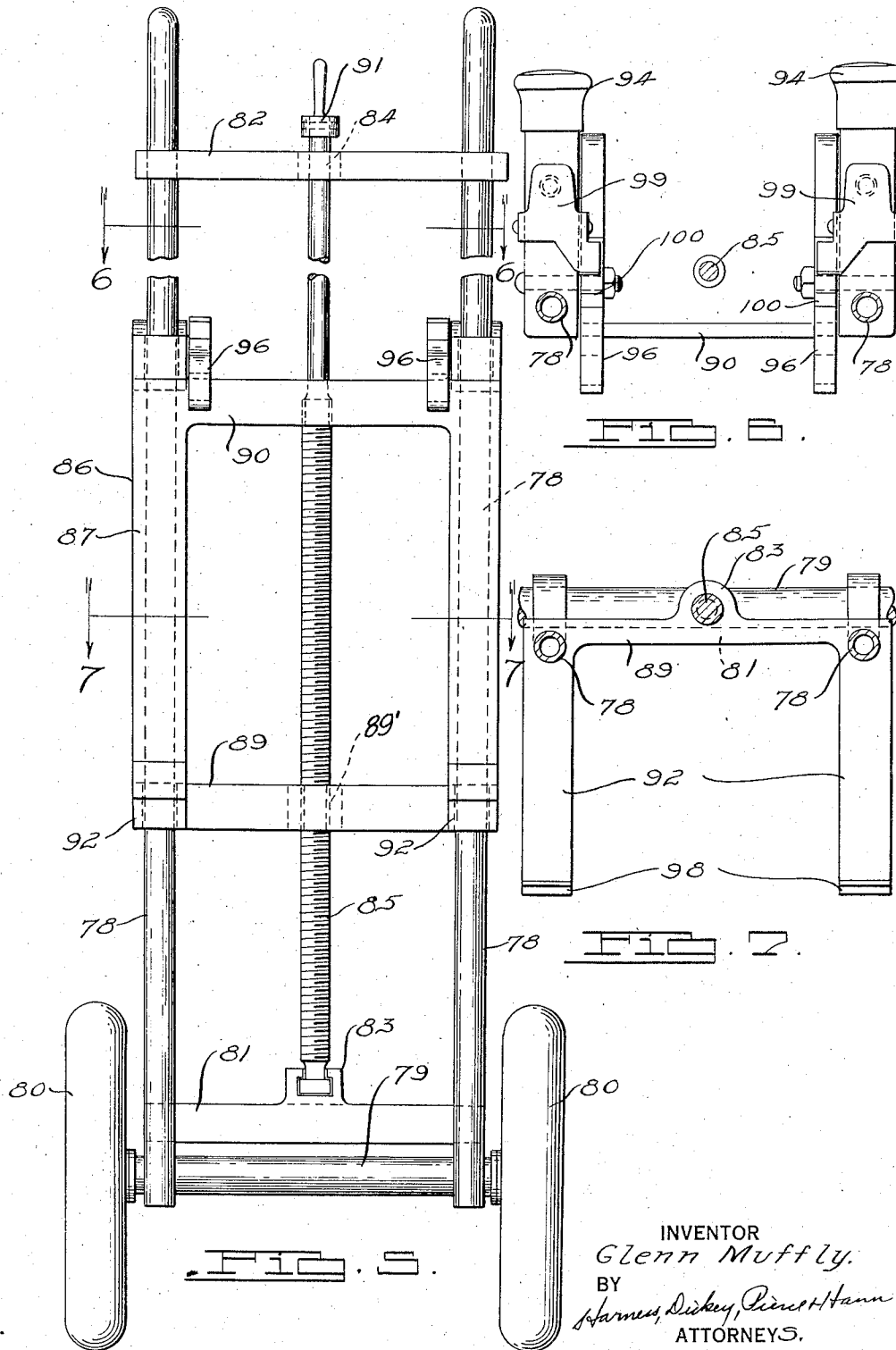
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REFRIGERATOR

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5 Sheets-Sheet 4



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REFRIGERATOR

Filed May 26, 1930

5 Sheets-Sheet 5

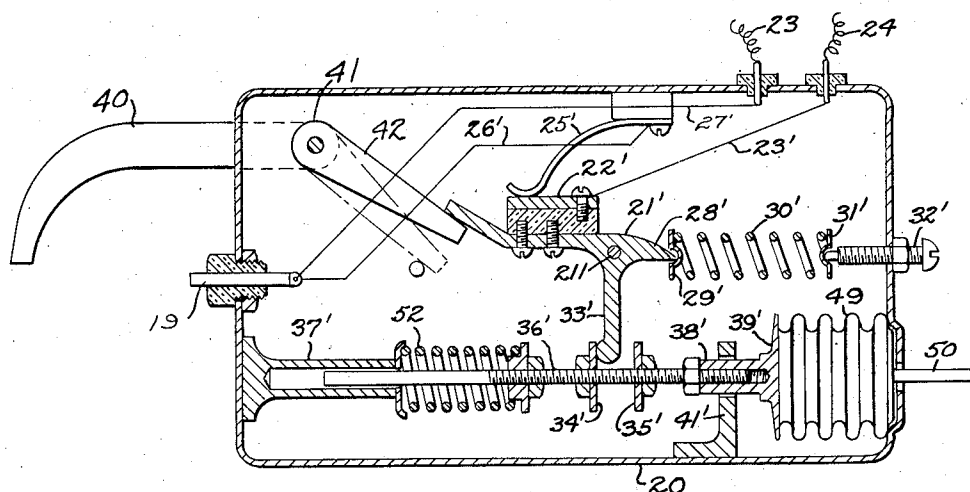


FIG. 8.

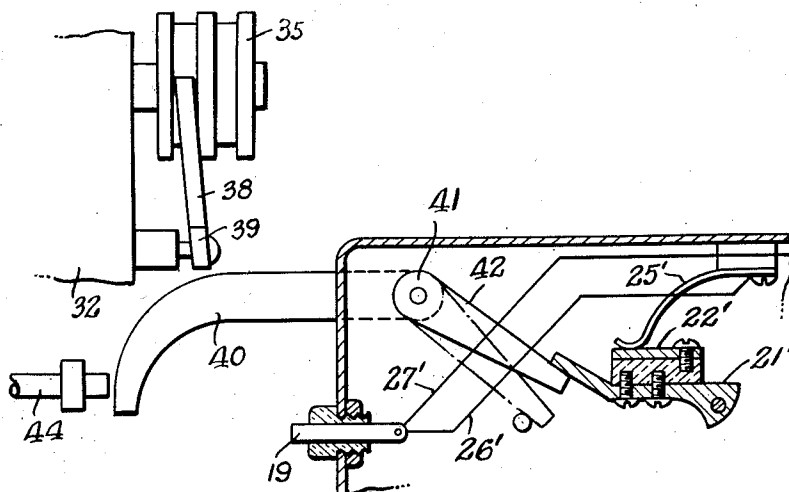


FIG. 9.

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## UNITED STATES PATENT OFFICE

2,137,541

## REFRIGERATOR

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Application May 26, 1930, Serial No. 455,741

7 Claims. (Cl. 62-4)

This invention relates to an improved refrigerator, particularly of the type which has a removable refrigerating system.

Heretofore in installing and removing refrigerator units from their cabinets, the services of at least two workmen have been required and frequently it is necessary to move the refrigerator from beneath overhead shelves or cabinet in order to provide sufficient clearance. In some instances, low ceilings render it impossible to install or remove the unit in the room or space in which it is normally located. The unwieldiness of the unit often causes the cabinet in which it is housed to be injured during installation and removal. When one unit is removed and replaced by another, electrical and mechanical connections have to be broken and reestablished at the expense of considerable time and effort.

The main objects of this invention are to provide a refrigerating system that is compactly assembled so as to be conveniently installed or removed by a single workman; to provide an improved cabinet for receiving a refrigerating system of this kind which has a refrigerated space and communicating door openings through which the assembly is insertable; to provide connectable hinge elements on the interior of the cabinet and on the assembly respectively by which the latter may be pivotally suspended in the door opening and rotated therefrom into a horizontal operative position; and to provide means for releasably holding the assembly in an operative position with the heat absorbing means thereof located in the refrigerated space and the heat dissipating means located outside of the refrigerated space.

Other objects of my invention are to provide means for automatically forming electrical connections in a power circuit of the system and mechanical connections in clock switch operating mechanism thereof as the assembly is moved into an operative position; to provide means of this kind for automatically breaking the above operative connections when the assembly is removed.

Further objects of this invention are to provide an improved truck upon which removable refrigerator units may be conveniently transported; to provide manually shiftable supports in a device of this kind for raising and lowering a unit so as to bring the connectable hinge elements of the unit into and out of cooperating relation with the hinge elements of the cabinet; to provide improved means for releasably clamping a refrigerator unit on a truck; and to provide

a truck of this kind with the aid of which a single workman can install and remove units conveniently.

An illustrative embodiment of my invention is shown in the accompanying drawings, in which:

Fig. 1 is a vertical section taken on the line 1-1 of Fig. 2, showing a refrigerator embodying my invention.

Fig. 2 is a horizontal section taken on the line 2-2 of Fig. 1.

Fig. 3 is a vertical section taken on the line 3-3 of Fig. 2.

Fig. 4 is a side elevation of a truck for installing and removing refrigerator units, illustrating in dotted lines the manner in which the latter is pivotally mounted in a cabinet.

Fig. 5 is a front elevation of the truck shown in Fig. 4.

Fig. 6 is a horizontal transverse section taken on the line 6-6 of Fig. 5.

Fig. 7 is a horizontal transverse section taken on the line 7-7 of Fig. 5.

Fig. 8 is a vertical section view taken centrally through and axially of the control switch shown in Figs. 1 and 2, showing the construction of the same in detail.

Fig. 9 is a view similar to Fig. 8, but also showing the cooperative relation between the clock mechanism and the manual control.

In the forms shown, the refrigerator includes a cabinet 1 having side walls which are either formed of or provided with heat insulating material and a top wall which includes a removable wall section 2 and stationary wall parts 3. Formed in the cabinet 1 is a refrigerating space or compartment 4 which communicates through the opening 5 in the top wall of the cabinet in which the removable wall section 2 is located, with a chamber 6 in a casing 7 preferably formed as an integral upward extension of the side walls of the cabinet. The cabinet 1 has a door opening which is provided with a door 8. The door opening communicates with the refrigerating space 4 permitting access thereto for allowing insertion and removal of articles to be refrigerated. Shelves 9 are mounted in the refrigerating space 4 for receiving the articles.

Mounted on the upper side of the wall section 2 is a sealed compressor unit including a motor 10 which operates a compressor 11 of the type commonly used in refrigerating units. The compressor 11 communicates with a condenser 12 which is also mounted on the upper side of the wall section 2 through a pipe 13. A fan 14 magnetically driven through the sealed casing of

the compressor unit by the rotor of the motor 10 is rotatably mounted on the housing of the motor 10 adjacent the condenser 12, between the latter and the motor, for cooling the coil 15 of the condenser. The back wall of the casing 7 is provided with an opening for the circulation of cooling air through the compartment 6 in accordance with conventional practice, and additional openings may be provided optionally, in the front and side walls for the same purpose.

The motor 10 is provided with an electrical circuit which includes line wires 16 and an overload safety switch 17 connected in series with the line wires 16, a pair of contact members 18 which are mounted on the stationary wall portion 3 of the cabinet, a pair of registering contact members 19 mounted on the removable wall section 2 of the cabinet and a control switch mechanism 20 which is also carried by the removable wall section 2. The control switch 20 is electrically connected with terminals 21 and 22 of the motor 10 by wires 23 and 24 respectively, the terminals 21 and 22 of the motor being connected with the running winding thereof.

A starting circuit including conductors 25 and 26 is electrically connected with a terminal 27 and with the terminal 22 for supplying a current to the starting winding of the motor 10. Connected in series with the starting circuit is a mercury bulb switch which includes a tube 28 that is carried by a rocker arm 29 having a vane 30 located in the path of the air current created by the fan 14. Normally the mercury bulb switch is in the position shown in Fig. 1 and the globule 31 of mercury in the tube 28 is in contact with the terminals of the switch.

When the fan 14 is driven at a predetermined speed, the air current created thereby acting upon the vane 30 tilts the bulb 28 to the right as viewed in Fig. 1 causing the globule of mercury 31 to move out of engagement with the contacts of the switch. This action opens the starting circuit allowing the motor to be thereafter energized solely by the running circuit.

The control switch 20 is provided with actuating mechanism including an electrical clock 32 which is mounted in the chamber 6 and supported by the front wall 33 of the casing 7. The clock 32 is electrically connected in parallel with the line circuit 16 by conductors 34. A cam member 35 is driven by the clock mechanism 32 which is adapted to rotate the cam through two complete revolutions each 24 hours. Formed in the periphery of the cam 35 is a cam groove 36 consisting of two intersecting convolutions and having a projection 37 in one convolution which is adapted to engage an arm 38 of a bell crank lever 39 once each twenty four hours. One extremity of the bell crank lever 39, which is pivotally mounted on the housing of the clock 32, registers with an arm 40 of a bell crank lever 41 of the control switch 20.

The switch 20 includes a rotatable contact member 21' pivoted at 211 and having an insulated contact plate 22' secured thereto which is electrically connected with the conductor 24 by a wire 23' and a fixed yieldable contact member 25' which is electrically connected by a wire 26' with one of the contact members 19, the other contact member 19 being connected by a wire 27' with the conductor 23. The rotatable member 21' has a laterally extending arm 28' upon which a disc 29' on the end of a spring 30' has rocking contact. The other end of the spring 30' carries a disc 31' against which an adjustable

screw 32' bears. These discs have depressions for receiving the ends of the screw 32' and arm 28'. A downwardly extending arm 33' on the rotatable member 21' has its lower end located between spaced collars 34' and 35' which are threaded on a shiftable rod 36', the rod 36' being received at one end in a tubular guide 37'. The other end of the rod 36' is threaded in the boss 38' formed on the head 39' of a bellows 49, the boss 38' being guided for slidable movement in an aperture of the fixed bracket 41'.

The bellows 49 communicates through a tube 50 with a bulb 48 which is located in the refrigerating compartment 4 and held in contact with the brine tank 55 therein by a spring clip 47. The bulb 48, tube 50 and bellows 49 are filled with a suitable volatile fluid which gasifies upon heating and condenses upon cooling.

When the projection 37 of the cam 35 engages the arm 38 of the bell crank 39, the latter rotates the bell crank 41 of the control switch 20 in a counter-clockwise direction, as viewed in Fig. 1, thereby causing the arm 42 of the bell crank to tilt the rotatable member 21' so as to bring the contact 22' into engagement with the fixed contact member 25' and to close the circuit of the motor 10. This tilting of the rotatable member 21' about the pivot 211 throws the pressure of the spring 30' upon it either above or below the center of the pivot 211 and this pressure thus retains the rotatable member in the position shown in the Fig. 8 when the pressure of the spring acts below the axis of the pivot 211, in which position the block 22' bears against the contact 25', and when the pressure of the spring acts above the center of the pivot 211 it rotates the arm 28' to maintain the lower end of the arm 33' against the stop 35' and moves the block 22' out of contact with the contact member 25'. When the arm 28' is in the position indicated in Fig. 8 the spring 30' maintains it in such position until the bellows 49 is contracted sufficiently by the attainment of a predetermined low temperature in the brine tank 55 and consequently in the bulb 48, to shift the rod 36' far enough to the right to shift the line of pressure of the spring 30' from below the center of the pivot 211 to above the center of the pivot 211, at which time the spring 30' causes the member 21' to rotate until the arm 33' contacts with the collar 35', at which time, as above described, the contact block 22' is moved out of contact with the member 25', thereby opening the motor circuit. In this manner the compressor 11 is periodically driven by the motor 10 until a predetermined temperature is produced in the brine tank.

In the event that the temperature of the brine tank 55 increases above a predetermined degree, the volatile fluid in the bulb 48 will expand and cause the bellows 49 to expand. The bellows 49 in expanding will move the rod 36' to the left, as viewed in Fig. 8, against the pressure of the spring 52 until the line of pressure of the spring 30' is again shifted to below the axis of the pivot 211, at which time the member 21' will be rotated by the pressure of the spring 30' in a clockwise direction, as viewed in Fig. 8, until the lower end of the arm 33' again contacts with the stop 34', at which time, as above described, the block 22' will move into engagement with the contact 25' and will again close the motor circuit, thus starting another refrigerating cycle.

The control switch 20 is provided with a manual actuating device comprising a rod 44 which

is slidably mounted on the housing of a clock 32. The inner extremity of the rod 44 co-acts with a downwardly curved extremity on the arm 40 of the bell crank 41 so as to rotate the latter in a counter-clockwise direction, as viewed in Fig. 1, thereby closing the switch when the rod 44 is pushed inwardly. The rod 44 carries a collar 45 which registers with a lever 46 of the overload switch 17. When the overload switch 17 is opened by an excessive load, the lever 46 is moved to the left as viewed in Fig. 1 and it may be re-set by pushing the rod 44 inwardly.

With the above mechanism, the motor 10 may be manually started by manipulation of the rod 44, it may be started by the temperature sensitive mechanism, and by the time clock 32.

The system generally is operable in the following manner. Assuming that it is functioning under thermostatic control, it will operate until the temperature of the refrigerator is at a predetermined low point and then will stop operating as a result of the thermostatic control. Between times that the clock becomes effective for initiating operation of the refrigerator, the system may function dependent on the thermostatic control, but it will be appreciated that the refrigerator will have a substantial idle period between starting and stopping under thermostatic control.

The clock-driven cam 35 acts at a predetermined time to modify the thermostatic cycling of the system by forcing the switch in the control 20 to close, and by holding the switch forcibly closed for a fixed period of time dependent upon the angular length of the cam projection 37. After the cam has rotated through the necessary angle to carry the hump 37 out of engagement with arm 38, the thermostatic means comes back into action and normal thermostatic cycles are resumed. The length of the operating period initiated by the clock may be greater than the length of time during which the hump 37 is engaging the arm 38, but it can be no shorter than this.

The thermostatic means will act, in the event that the desired minimum temperature has been attained during the clock-controlled running period, to re-open the switch immediately upon the movement of the cam to a position which allows the switch to be re-opened. Manually pushing on the rod 44 acts to start the system in the same way that the cam does, except that the cam holds the switch closed for a period of time sufficient to remove a considerable amount of latent heat from the brine, thus storing up a reserve of refrigerating effect during the hours when electric power consumption is at a minimum and its cost low so that the system need not operate so many hours during peak-load conditions of the power line or during hours when its operation is for any reason undesirable.

Mounted on the lower side of the removable wall section 2 of the top of the cabinet 1 is the brine tank 55 in which expansion coils 56 are located. The condenser coils 15 communicate with a receiver 15' through a pipe 14' and the receiver is connected with the inlet end of the expansion coils 56 by a pipe 13' in which an expansion valve 12' is connected in series. The outlet end of the expansion coils 56 is connected to compressor 11 by a conduit 57, the latter and the pipe 13' extending through an opening 58 in the removable wall section 2. The brine tank 55 has a compartment 59 in which ice trays 60 are received and the tank is sur-

rounded by a combined baffle and drip pan 61 having an opening in its front wall in registration with the compartment 59, and the tray is provided with a front plate 62 adapted to close the opening. The bottom wall of the drip pan 61 has a forward section which is rearwardly inclined and a rear section which is forwardly inclined, there being an aperture 63 at the intersection of these sections. A bucket 64 is supported by one of the shelves 9 in the refrigerating compartment and is located directly below the opening 63 in the drip pan 61.

It will be seen that in the above construction the heat absorbing portion of the refrigerating system is mounted on the lower side of the removable wall section 2 and the heat dissipating portion of the refrigerating system is mounted on the upper side of the removable wall section. In this manner, a compact assembly is provided in which the heat absorbing means is located in the refrigerating space 4 and the heat dissipating means is located outside the refrigerated space.

One of the most important features of this invention is the provision of a refrigerating system assembly which may be inserted through the normal door opening of the refrigerated space and partially through the opening 5 in the top wall of the cabinet so as to position the heat absorbing and heat dissipating means in the above relations. This is accomplished by the provision of spaced hinge elements 65 rigidly mounted on the stationary part 3 of the top wall of the cabinet, and co-operating hinge elements 67 rigidly secured to the front portion of the removable wall section 2 or to the upper side of the brine tank 55. The outer ends of the hinged elements 67 are each provided with a cross pin 66 which are adapted to be received and retained in the hooked lower ends of the parts 65. Mounted on the outer extremity of the rear wall of cabinet 1 is a metal strip 68 which extends transversely of the chamber 6 and overhangs the opening 5 in the upper wall of the cabinet 1. This strip limits the upward rotation of the removable wall section 2 about the hinged elements. Slidably mounted in recesses 69 in the rear wall of the cabinet 1 are a pair of catches 70 which are normally urged outwardly by springs 71 so as to engage under and support the rear extremity of the removable wall section 2. The strip 68 and catches 70 retain the removable wall section 2 in a horizontal position thereby closing the aperture 5 between the interior of the chamber 6 and the refrigerated space 4 of the cabinet. A layer of yieldable material 72 is located between the upper edge of the rear wall of the cabinet 1 and the strip 68 for permitting the removable wall section 2 to be rotated slightly above the catches 70, thereby allowing the latter to be extended to engage under the section 2.

Rotatably mounted on the lower side of the wall section 1 is a shaft 73 which extends transversely of the cabinet and is provided with arms 74 and 75 each engaging an inclined inner extremity of one of the catches 70. The arm 74 has an integral lever 76 on which a flange 77 is provided. The flange 77 extends outwardly from the lever 76 and is adapted to be engaged by the thumb of a workman so as to rotate the arms 74 and 75 in a counter-clockwise direction as viewed in Fig. 1, thereby urging the catches 70 inwardly with respect to their recesses 69 so as to disengage the catches from the lower sides of the removable wall section 2. In this manner,

the wall section 72 is released and permitted to rotate in a clockwise direction as viewed in Fig. 1 until it hangs in a vertically suspended relation in the refrigerated space 4, (see Fig. 4) it being understood that the upper shelf 9 and bucket 64, as well as the baffle 61, are removed prior to releasing the rear end of the wall section 2.

During this clockwise rotation of the wall section 2 and the refrigerating system assembly carried thereby, the contacts 15 are moved out of engagement with the contacts 18 so as to automatically disconnect the refrigerating system from its power circuit. In the same manner, the arm 40 of the bell crank lever 41 of the control switch 20 is rotated out of registration with the bell crank 39 of the switch actuating mechanism, thereby automatically disconnecting the mechanical means by which the switch 20 is operated. When the wall section 2 together with the refrigerating system assembly carried thereby is rotated from a vertical position to the horizontal position shown in Fig. 1 the electrical connections between the contacts 19 and 18 are automatically reestablished and the mechanical means by which the switch 20 is actuated is reconditioned for operation. The electrical contacts of the stationary and removable parts of the cabinet are located with respect to each other so that they register only when a unit having a motor of proper voltage and frequency is installed in the cabinet. For example, units which operate upon 110 volts have their contact elements in a different relation than units which operate upon 220 volts so that should a workman install an improper unit in a cabinet, current would not be supplied to the motor, thus avoiding damage to the motor.

Units of the above type are necessarily very heavy and in order that they may be installed and removed conveniently by a single workman, I have provided an improved truck which, as shown in Figs. 4 to 7, inclusive, comprises a frame having spaced side members 73 and a transverse member or axle 72 at one end on which spaced wheels 86 are journaled. Mounted between these side members 73 are transverse bars 81 and 82, the bar 81 being adjacent to the axle 72 and the bar 82 being at the opposite ends of the side members 73. Journaled in bearings 83 and 84 of the transverse bars 81 and 82 respectively is a threaded shaft 85 with which the carriage 86 is connected. The carriage is mounted on the side members 73 and moved on them by the shaft 85. The carriage 86 has spaced side members 87 which are connected together by cross members 88 and 89. The cross member 89 has a nut part 83' thereon in which the shaft 85 is threaded. Mounted on the end of the shaft 85 which extends beyond the cross members 82 of the frame is a crank 91 by means of which the shaft 85 may be rotated for shifting the carriage 86 in respectively opposite directions longitudinally of the frame. The shiftable carriage 86 has a pair of supports 92 on its lower end as viewed in Fig. 4 for receiving a refrigerating system assembly of the type described above. The other end of the carriage 86 is provided with a pair of legs 93 each having a rubber-foot 94 thereon or similar material for supporting the truck when the latter is in a horizontal position. Pivotally mounted on each leg 93 of the truck is a releasable clamping lever 95 having an arm 96 on which a projection 97 is formed. The arm 96 is adapted

to embrace the lower forward edge of the brine tank 55 and the projection 97 is adapted to extend into the ice tray opening which is formed in the brine tank 55. Formed on each support 92 is a lug 98 which extends between the removable wall section 2 and the brine tank 55 as shown in Fig. 4 in the space into which the catches 70 normally extend when the assembly is in an operative position. The clamping levers 95 are normally held in clamped relation by a spring pressed detent 99 which co-acts with teeth 100 formed on the edge of the clamping member.

In installing units of this kind in a refrigerator cabinet they are mounted on the truck in the position shown by dotted lines in Fig. 4 and the truck is wheeled up to the front side of the cabinet. Then the crank 91 is turned in one direction or the other as required until the assembly is positioned at a correct elevation so that the unit registers with the door opening 20 of the cabinet. Then the truck is rolled further toward the cabinet so as to insert the heat dissipating portion of the system and the removable wall section 2 into the refrigerated space 4. The truck and carriage are then maneuvered so as to move the unit inwardly and upwardly sufficiently to engage the hinge elements 67 on the system assembly with the hinge elements 65 which are rigidly mounted on the permanent wall part 3. The outer end of the pawl 99 is then depressed, releasing it from the ratchet 100 so as to free the clamping member 95 which may be rotated out of engagement with the unit thereby permitting the carriage 86 to be lowered until the lugs 98 on the supports 92 are disengaged from the unit. Then the truck may be wheeled away from the cabinet allowing the unit to remain in a suspended relation as shown in dotted lines in Fig. 4. After the truck has been removed, the refrigerating assembly may then be rotated inwardly with respect to the cabinet until it reaches its horizontal position shown in Fig. 1. The catches 70 are then extended by their springs 71 so as to retain the unit in an operative position.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

What I claim is:

1. A refrigerating system, an electric motor arranged to drive said system, a thermostatically opened and closed electric switch for controlling the normal operating cycles of the motor, clock-driven means for modifying said operating cycles during definitely spaced time intervals, and manual means for initiating a running period of the system to be terminated thermostatically.

2. A refrigerating system, temperature responsive means for controlling the operating cycles of the system, clock-actuated means for modifying said cycles from their normal lengths of operating and idle periods, and manually-actuated means for starting the operation of the system at times when it is idle under the normal control of said temperature responsive and clock-actuated means, the temperature responsive means being adapted to stop the operation of the system initiated by the manually-actuated means.

3. A refrigerating system, temperature responsive means for controlling the operating cycles of the system, clock-actuated means modi-

10 fying said cycles from their normal temperature  
controlled periods and manually actuated means  
for starting the operation of said system at times  
when it is idle due to the action of said clock-  
6 actuated means, the operating period initiated  
by operation of the manually actuated means  
being terminable automatically by operation of  
one of the two first mentioned means.

10 4. A refrigerator cabinet, a refrigerating sys-  
tem installed in the cabinet, an electric motor  
operating said system, a switch in the motor cir-  
cuit for opening and closing the latter, thermally  
responsive means for opening and closing the  
switch, means including a clock mounted on the  
15 cabinet for actuating the switch, and manual  
means for actuating the switch independently of  
the clock.

20 5. A refrigerating system comprising an elec-  
tric switch for controlling the running periods  
of the system, thermostatic means for opening

and closing the switch, and time controlled  
means for effecting an operation of said switch  
at a predetermined time independently of said  
thermostatic means.

6 6. A refrigerating system including a clock  
mechanism, a compressor motor, a switch in the  
motor circuit, thermostatic means for normally  
governing operation of said switch, and means  
actuated by the clock for closing said switch  
independently of said thermostatic means. 10

7. A refrigerating system comprising an elec-  
tric switch for controlling the running periods  
of the system, thermostatic means for opening  
and closing the switch, time controlled means  
for effecting an operation of said switch at a  
predetermined time independently of said ther-  
mostatic means, and means for manually actu-  
15 ating the switch. 15

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