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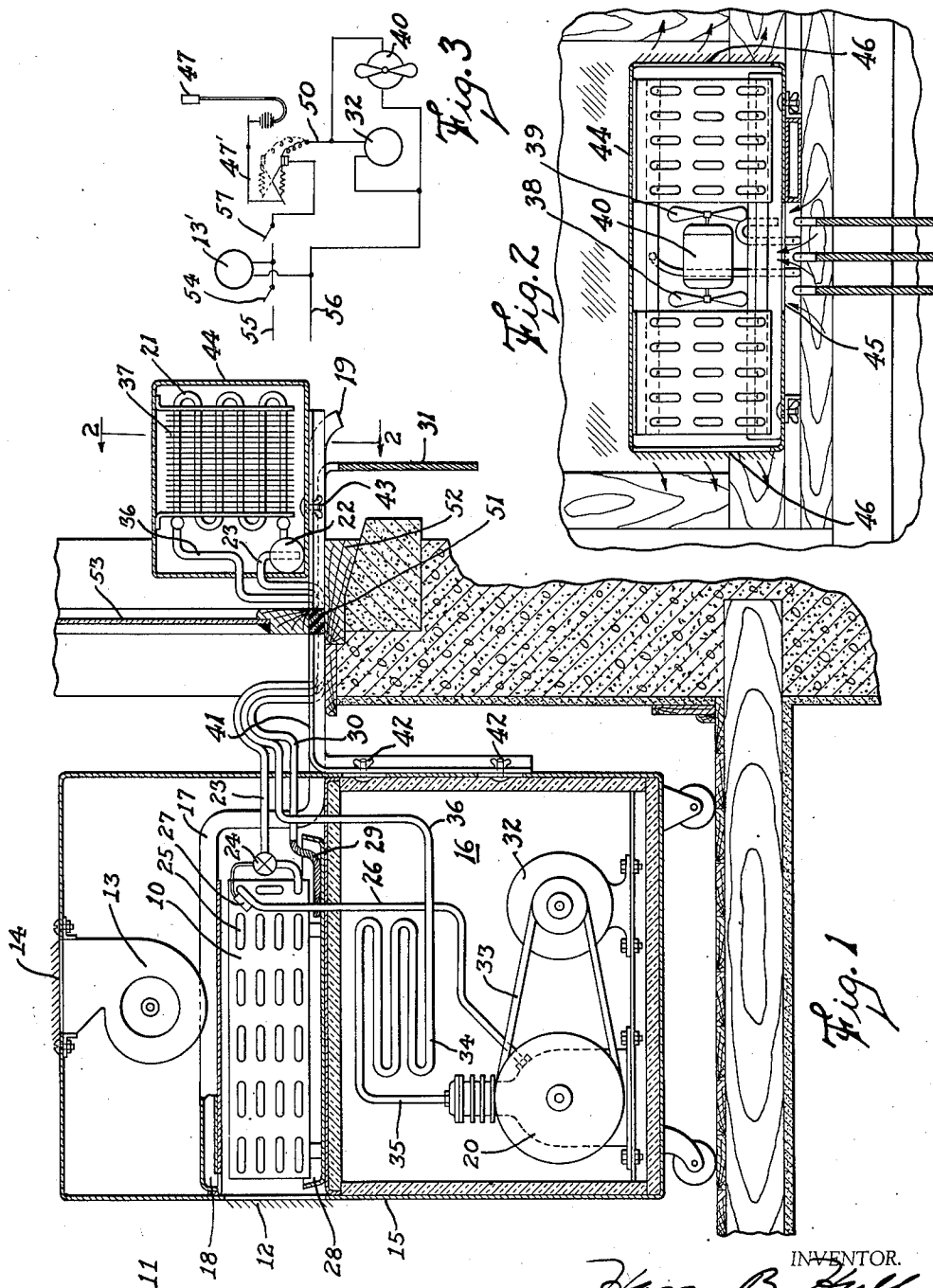
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2,362,698

REFRIGERATING APPARATUS

Filed Oct. 24, 1934

5 Sheets-Sheet 1



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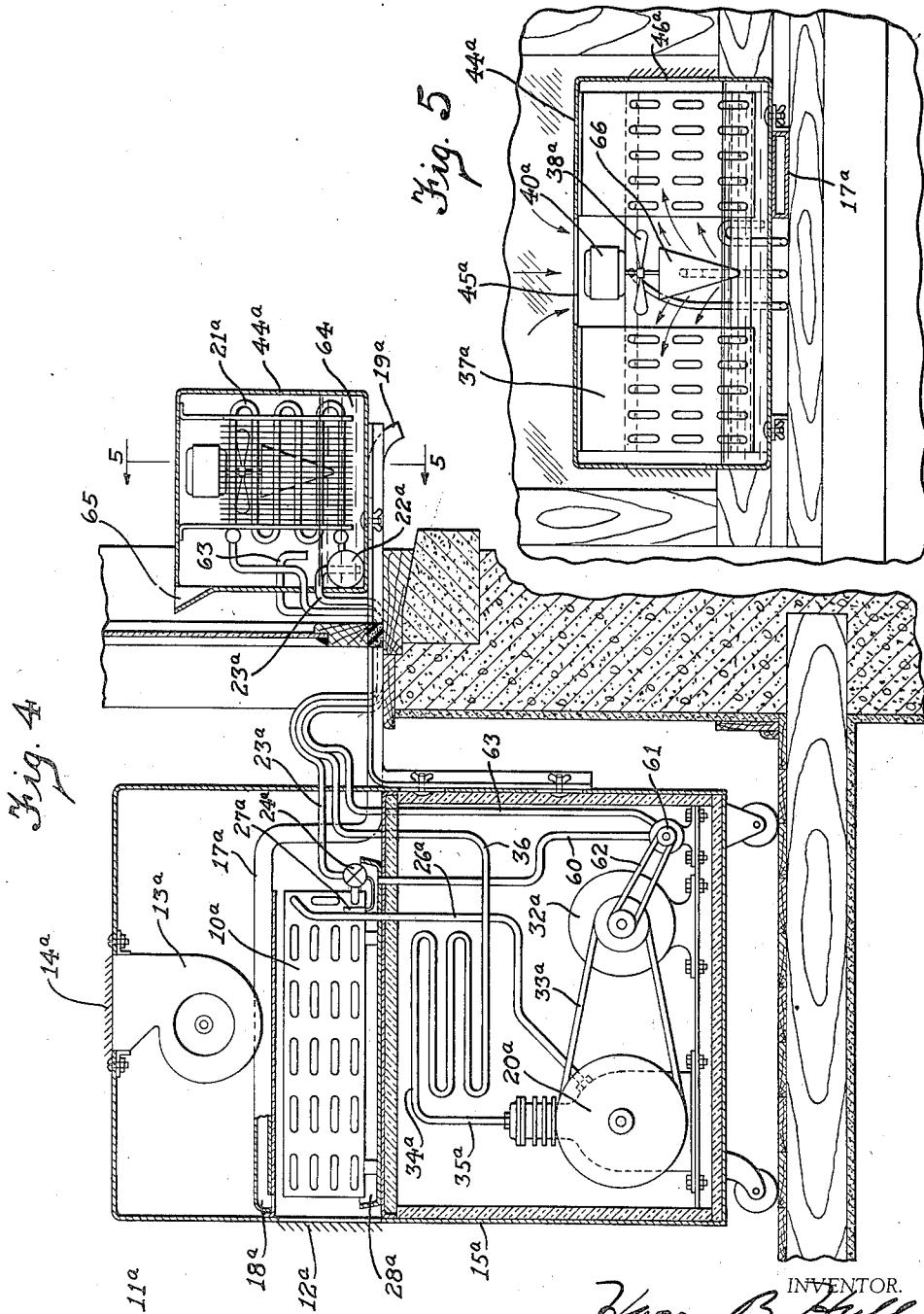
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REFRIGERATING APPARATUS

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5 Sheets-Sheet 2



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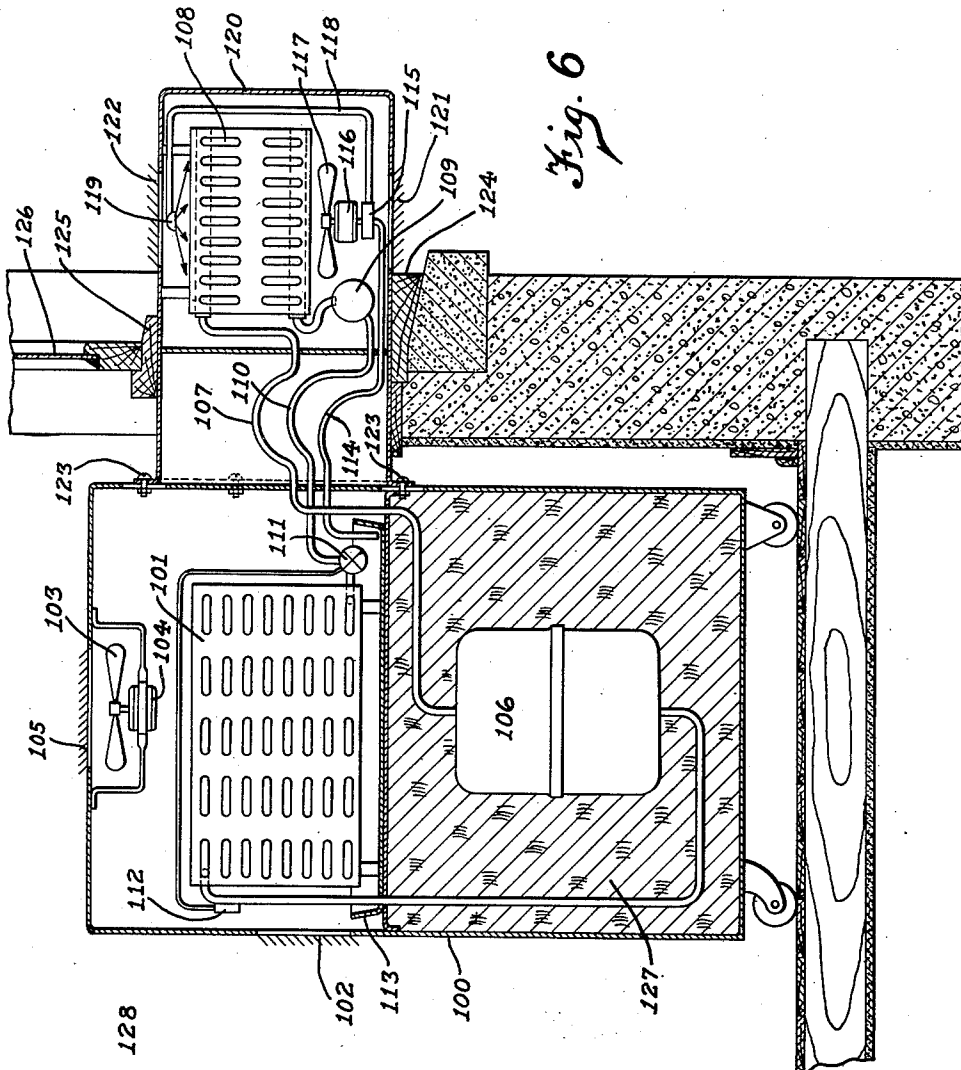
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REFRIGERATING APPARATUS

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5 Sheets-Sheet 3



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REFRIGERATING APPARATUS

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5 Sheets-Sheet 5

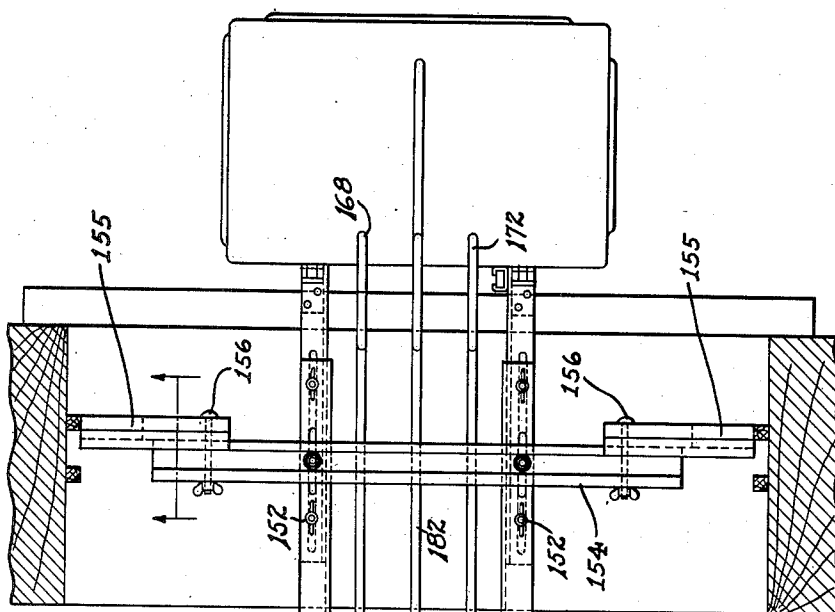


Fig. 10

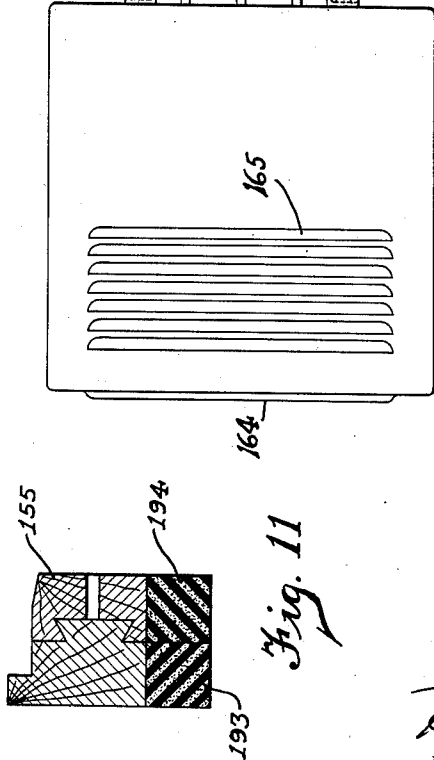


Fig. 11

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REFRIGERATING APPARATUS

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9 Claims. (Cl. 62-129)

This invention relates to refrigeration.

It is an object of this invention to provide a self-contained room cooler or conditioner which is adapted to be installed in rooms and other enclosures without the necessity of connecting water pipes to the cooler.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical cross-sectional view, somewhat diagrammatic, of a room cooler embodying features of my invention;

Fig. 2 is a transverse vertical cross-sectional view of a portion of the apparatus shown in Fig. 1 and taken along the lines 2-2 of Fig. 1;

Fig. 3 is a diagrammatic representation of the electrical control for the motors used in the apparatus shown in Figs. 1 and 2;

Fig. 4 is a view somewhat similar to Fig. 1, but showing a slightly modified form of the invention;

Fig. 5 is a vertical cross-sectional view taken along the lines 5-5 of Fig. 4;

Fig. 6 is a view somewhat similar to Fig. 1, but showing a further modification;

Fig. 7 is a vertical cross-sectional view, somewhat diagrammatic, of a further modification in which the complete high side is placed outside of the room;

Fig. 8 is a vertical cross-sectional view taken along the lines 8-8 of Fig. 7;

Fig. 9 is a view in perspective of a portion of Fig. 7;

Fig. 10 is a horizontal cross-sectional view, with portions of the window removed, of the apparatus shown in Fig. 7; and

Fig. 11 is a cross-sectional view of a detail.

An apparatus embodying features of my invention includes in general an air cooling or conditioning device adapted to be placed in a room or the like, with a heat absorber in the room and with a heat dissipator having at least a portion thereof extending through a window of the room, the entire structure being preferably joined to form a unitary device when it is assembled to cool the room.

In the form shown in Figs. 1, 2 and 3 the air cooling or heat absorbing portion of the apparatus includes an evaporator 10 around which air from the room 11 passes after entering at the inlet 12, and from which the cooled air is discharged by electrically actuated means in the

form of a blower 13, driven by a motor 13', through the opening 14 back into the room. This air cooling portion conveniently may be mounted at the top of a cabinet 15. Also, if desired, a fresh air pipe 17 is connected at 18 to the air inlet of the evaporator 10, and the pipe has its other end located outside the window at 19. Thus air from the room, and, if desired, fresh air is caused to circulate over the cold surfaces of the evaporator 10 and is discharged into the room thus lowering the temperature and/or humidity of the room.

In the lower half of the cabinet there is an insulated compartment 16 in which a portion of the heat dissipating unit is located. The heat dissipating unit of the device includes a refrigerant translator or compressor 20 which may be located in the compartment 16 and which forwards refrigerant to a condenser 21 which forms a portion of the heat dissipating unit located outside of the room, where the heat is discharged into the atmosphere and refrigerant is condensed and accumulated in a liquid refrigerant receiver 22.

The heat absorber or evaporator 10 is supplied with refrigerant from the receiver 22 from whence it flows in liquid form through the line 23 to the expansion valve 24 of the evaporator 10. The refrigerant, at reduced pressure, flows through the evaporator coils 25 of the evaporator and returns through the suction line 26 to the compressor 20. The expansion valve 24 may be of the type in which liquid refrigerant is automatically introduced into the coils 25 whenever the pressure in the coils 25 is reduced below a predetermined pressure. In addition, this valve may be provided with a thermostatic bulb 27 placed at the outlet of the evaporator which throttles the valve 24 whenever the refrigerating effect in the coils 25 cools the outlet below a predetermined temperature. Thus liquid refrigerant is prevented from flooding the compressor 20, as is well understood in the art.

Preferably the calibration of the valve 24 is such that liquid refrigerant is introduced into the evaporator at vapor-pressures above that corresponding to 32° F. The evaporator 10 is thus prevented from accumulating frost and any moisture contained in the air is condensed in liquid form on the surfaces of the evaporator and trickles into the pan 28. Any moisture thus condensed is thereafter discharged outside of the room by any suitable means. In this form, it is discharged by the capillary action of a wick 29 one portion of which is placed in the pan 28, an-

other portion of which is surrounded by an air-tight casing 30 and another portion 31 of which is exposed to the atmosphere outside of the room, preferably in the path of the current of air flowing over the condenser. If desired, a plurality of such wicks may be provided. Thus moisture is absorbed by the wick or wicks at 29 and is evaporated at 31 outside the room.

The heat dissipating portion of the apparatus further includes an electric energizing means in the form of a motor 32 which drives the compressor 20 through the medium of a belt 33. A certain amount of heat is generated by the motor and compressor in the heat insulated compartment 16. This heat may be dissipated to the outside of the room by providing a heat absorber 34 in the compressed refrigerant line 35. The refrigerant compressed by the compressor 20 flows through the heat absorber 34 and picks up any excess heat of the compartment 16 in the form of superheat which is then carried by the refrigerant through the line 36 to the condenser 21. Here the heat is dissipated from its surfaces, and fins 37 on the coils of the condenser, to air circulated thereover by means of the fans 38 and 39 driven by the motor 40.

The instrumentalities thus far described may be held together by any suitable means. Thus bracket means conveniently in the form of arms 41 are adjustably secured at 42 to the cabinet 15 so that the arms may be placed at any height necessary for the particular window with which they are to cooperate. The arms 41 may carry, by adjustable fastening means 43, a casing 44 within which may be placed the condenser 21, fans 38 and 39 and the motor 40 together with the receiver 22 and any other desired portions of the apparatus. Air from outside the room may enter the casing 44 at the inlet 45 and may be discharged through the outlets 46 which may be provided with louvers.

The apparatus may be automatically operated in accordance with conditions within the room. Thus a thermostat, either dry bulb or wet bulb, or a combination of both, as indicated at 47, may be placed in the room 11 or in any position to be representative of conditions therein. This thermostat may be provided with a switch 47' well-known in the art, which controls the operation of the motors 32 and 40.

Controls are provided to permit the circulation of air independently of refrigeration demands. Thus a manually operable master switch 54 is provided in the lead 55 which controls the operation of the entire apparatus. When this switch is closed, the motor 13' operates. If in addition refrigeration is desired, a manually operable switch 57 may be closed which then places the operation of the motors 32 and 40 under the control of thermostat 47.

The arms 41, together with any pipe or other structures which may join portions of the apparatus, may pass through any portion of the window. Thus a false sill 51 may be placed over the regular sill 52 of the window and the arms 41 and pipes 23, 30 and 36 may be imbedded in the false sill 51 so that the window sash 53 may be lowered thereon and substantially seal the window opening. The lower portion of the sash 53 may be cut to compensate for the additional height of the sill 51 or suitable sealing means may be provided at the upper part of the sash 53 to cooperate with the other portions of the window to seal the same or a new sash of proper height may be substituted for the old one.

The operation of the apparatus shown in Figs. 1, 2 and 3 is as follows: The blower 13 is driven by a motor 13'. When it is desired merely to cause a circulation of air in the room, the hand switch 54 is closed which will then permit current to flow through the motor 13' from the lead 55 to the lead 56. When it is desired also to have refrigeration, the hand switch 57 is closed and thereafter the thermostat 47 controls the operation of the motors 32 and 40 as conditions may require. Thus when the temperature, dry bulb or wet bulb or combination of both, rises above a predetermined limit, the switch 47' closes and causes the motors 32 and 40 to operate and they continue to operate until the temperature falls below a predetermined lower limit at which the switch 47' opens. Thereafter the motors 32 and 40 remain idle until the temperature again rises and closes the switch 47'. When the motors 32 and 40 are operating, the air being circulated by the blower 13 is cooled by contact with the outer surface of the evaporator 10. The air to be cooled may be air from the room and, if desired, a certain amount of fresh air from outside the room entering through the pipe 17. The air is discharged into the room through opening 14. The refrigerant flows from the compressor 20 through the pipe 35, heat absorber 34, pipe 36, condenser 21 where the heat is dissipated and the refrigerant is condensed, and from whence the liquid refrigerant flows through the pipe 23 to the expansion valve 24. Here the pressure is reduced and the refrigerant is introduced into the coils 25 of the evaporator 10. There heat is absorbed while the refrigerant is there evaporated and returns in gaseous form through pipe 26 to the compressor 20. Any moisture condensed on the evaporator 10 trickles into the pan 28 and is then discharged by capillary action through the wicks 29—31 to the outside atmosphere. The operation of the motors 32 and 40 is coordinated by the arrangement shown in Fig. 3 as heretofore pointed out.

The arrangement shown in Figs. 4 and 5 is somewhat similar to that shown in Figs. 1, 2 and 3. The evaporator 10a is provided in the upper portion of a cabinet 15a. Air from the room 11a may enter at 12a and may flow over the outer surface of the evaporator 10a by the action of the blower 13a and may be discharged back into the room in a cooled condition through the opening 14a. Air from outside the room may enter the pipe 17a at 19a and may be discharged over the surfaces of the evaporator 10a at 18a in a manner substantially the same as in Fig. 1. The moisture condensed on the evaporator 10a may be gathered in a drip pan 28a and may be dissipated outside of the room in the manner hereinafter more fully to be described.

A refrigerant translator or compressor 20a discharges compressed refrigerant through pipe 35a and heat absorber 34a to the pipe 36 through which it flows to the condenser 21a. The condensed refrigerant is gathered in a liquid refrigerant receiver 22a from whence it flows in liquid form through the pipe 23a to the expansion valve 24a having a thermostatic bulb 27a placed at the outlet of the evaporator 10a where the same is connected to the evaporator refrigerant pipe 26a. The combined action of the valve 24a and thermostatic bulb 27a is substantially the same as that of valve 24 and bulb 27 in Fig. 1. The compressor may be driven by a motor 32a by the medium of a belt 33a as in Fig. 1. Air may be blown over the condenser 21a by means of a

fan 38a driven by a motor 40a. The operation of the motors 32a and 40a together with the motor which drives the blower 13b may be substantially the same as that described with respect to the motors in Figs. 1, 2 and 3, and the circuit shown in Fig. 3 may be used for the motors of the device shown in Figs. 4 and 5.

The instrumentalities for dissipating the condensed moisture have been modified in Figs. 4 and 5. Thus moisture accumulated in the pan 28a flows through the pipe 60 to a pump 61 driven by the motor 32a through the medium of a belt 62. The moisture is then pumped through the pipe 63 to sump 64 placed in the bottom of the casing 44a. Here the condensed moisture, together with additional water poured in occasionally through the opening 65, is sprayed over the condenser portions by the rotating cone 66 driven by the motor 40a. Thus water is caused to flow over the coils of the condenser and its fins 37a where evaporation of the water aids in cooling the condenser. Air from outside the room enters the casing 44a at the opening 45a and leaves through the outlets 46a.

The supporting arm structure together with the sill structure used in Figs. 4 and 5 may be substantially the same as that shown and described with respect to Figs. 1, 2 and 3 and are therefore not further again described in detail.

A slightly modified form of the invention is shown in Fig. 6. Here a cabinet 100 houses an evaporator 101 in its upper part. Air from the room enters at 102 flows over the outer surfaces of the evaporator 101 through the action of the fan 103 driven by the motor 104. The cooled air is discharged through the opening 105. The refrigerant from the evaporator 101 is compressed by a motor-compressor unit hermetically sealed within casing 106, where the refrigerant is compressed and discharged through the pipe 107 to the condenser 108. The condensed refrigerant is gathered in the receiver 109 and flows through the pipe 110 to the expansion valve 111. The expansion valve 111 is provided with a thermostatic bulb 112 and the valve and bulb operate substantially the same as the valve 24 and bulb 27 of Fig. 1. Moisture condensed on the evaporator 101 is gathered in the drip pan 113 and flows therefrom through the pipe 114 to a pump 115 driven by a motor 116. This motor may also conveniently drive the fan 117 which circulates air over the condenser 108. The condensed moisture pumped through pump 115 may then flow through the pipe 118 to the spray-head 119 placed over the condenser 108. Here the condensed moisture is evaporated on the outer surface of the condenser 108 and is absorbed by the air flowing over the condenser. The air which is circulated by the fan 107 may enter the casing 120 through opening 121 and leave the casing through opening 122. The casing 120 may be adjustably secured at 123 to the cabinet 100 so that the same may rest on the sill 124. If the width of the casing 120 is not identical with that of the window, a suitable structure made of wood, rubber or the like may be placed along the sides of the casing 120 to seal the sides of the casing with the sides of the window, and the false sill 125 may be placed on top of the casing 120. The sash 126 may be made of a size to compensate for the new height of the sill 125. The casing of the motor 106 of the motor-compressor unit may be embedded in insulation 127. Thus all the heat generated by the motor and compressor in the casing 106 is dissipated through gaseous refrigerant

flowing through pipe 107 to the condenser 108. The motor in casing 106 and motor 116 may be controlled by any automatic thermostatic switch similar to switch 47' while the motor 104 may be controlled in a manner similar to 13'. Thus the motor in casing 106 and motor 116 operate in response to conditions in the room 128 simultaneously through the action of the thermostat corresponding to thermostat 47 and motor 104 may be caused to operate through the medium of a hand switch corresponding to hand switch 54.

In the modification shown in Figs. 7 to 11 inclusive, the compressor, together with its motor, may also be placed outside of the window. In this modification a U-shaped bracket means or structure is formed by the arms 150 and 151 adjustably secured together at 152 to compensate for any wall width. This U-shaped structure is hung over the sill 153, and a false sill structure 154 is arranged therewith to engage with the sash. Thus the false sill is provided with lateral adjusting strips so that the false sill may be adjusted to any width of window desired. This lateral adjustment is secured by means of the bolts 156.

The air cooling casing 157 is secured to the arms 150 and hangs in the room 158 while the heat dissipating casing 159 is secured to the arms 151 through the medium of the hinged brackets 160. An evaporator 161 is placed in the casing 157 together with a motor 162 which drives the fan 163. The fan 163 causes air to flow from the room 158 through the opening 164 over the evaporator 161 and be discharged back into room through the opening 165. The refrigerant is caused to circulate through the system by means of a compressor 166 which is driven by a motor 167 both located within the casing 159. Refrigerant in the evaporator 161 flows through the pipe 168 to the compressor 166 from whence it is discharged in compressed condition through the pipe 169 to the condenser 170. The refrigerant there condensed is gathered in the receiver 171 and flows therefrom through the pipe 172 to the expansion valve 173. The motor 167 also drives a fan 175 which causes air to flow from the inlet 176 over the condenser 170 and be discharged through the outlet 177. In addition, if desired, a small air inlet may also be provided at 178 along one side of the casing 159. All of the connections between the casings 157 and 159 may pass through the false sill 154 as will be readily understood.

The moisture condensed on the evaporator 161 gathers at the lower portion of the casing 157 and enters the pump 180 through the pipe 181. The pump 180 may be driven by the fan motor 162 and discharges the condensate through the pipe 182 to the spray-head 183 placed over the condenser 170. As heretofore described with respect to Fig. 6, this condensate then evaporates as it flows over the condenser 160 and is discharged to the atmosphere outside of the room.

The false sill structure may be of any character desired. Conveniently the central section 154 may rest on a central rubber section 193. The extensions 155 may rest on extension rubber sections 194. The sections 154 and 155 are laterally adjustable as heretofore described for any size window and they are of such a width that a sash 195 may rest on both the sections 154 and 155 and thus may make a substantially air-tight joint at the lower portion. The sash may be shortened by cutting off the lower portion, or, if necessary, a new sash of proper length may be substituted. The sill structure herein shown

is merely exemplary and it is to be understood that any sill structure may be used, as for example, a sill of the exact dimensions to fit the window.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a room or the like, a window, a false window sill, an air conditioner, said air conditioner including a bracket extending through said window sill, said air conditioner comprising an evaporator within the room, and a condenser mounted on the bracket without the room.

2. In a room or the like, a window, an air conditioner, said air conditioner including a bracket, said conditioner comprising an evaporator within the room, and a condenser mounted on the bracket without the room, means for adjusting said bracket vertically, and means to adjust the spacing between the evaporator and the condenser.

3. In a room or the like, a window, a bracket passing through said window, a first casing adjustably secured to said bracket within said room, a second casing adjustably secured to said bracket outside said room, a first heat exchange element in said first casing, a second heat exchange element in said second casing, refrigerant flow connections between said elements, and a refrigerant translating device located in said first casing.

4. In a room or the like, a window, an air conditioner comprising an evaporator unit within the room, a cabinet for said evaporator, a condenser unit without the room, and refrigerant flow connections between said units passing through said window, said condenser unit comprising a condenser coil, a water receptacle below said coil, a fan assembly for circulating air over said condenser coil and means operated by said fan assembly and projecting into said receptacle for spraying water onto said coil.

5. In combination with a wall of a building having a window in a room thereof, an air conditioning unit projecting through said windows comprising, in combination, an evaporator disposed at the room side of said wall, means supporting the evaporator within said room, means for circulating room air over the evaporator, means providing an atmospheric air passageway disposed at the exterior side of said wall, a condenser disposed within said passageway wholly outside said room, means in said air passageway for circulating outside air over the condenser therein, means for collecting condensate from said evaporator and conducting it into and dis-

charging the same in said air passageway, and means for conditioning said condensate for vaporization in said passageway.

6. In a conditioner adapted to be placed in an enclosure, an evaporator containing refrigerant, means to cause thermal exchange between said refrigerant and air to be conditioned for said enclosure, heat dissipating means connected in refrigerant flow relationship with said evaporator and including a refrigerant translating device and a condenser, a water reservoir adapted to be located outside said enclosure, at least a portion of said heat dissipating means being mounted within said water reservoir, and means for circulating air in thermal exchange relationship to said water.

7. In a portable air conditioner having an evaporator located within an enclosure, means for circulating air from said enclosure thereover to cool and partially dehumidify the air, means for collecting moisture condensed from the air passing over the evaporator, means for conveying the moisture to a point outside said enclosure, a condensing unit connected to said evaporator, a portion of said unit being located outside the enclosure, and means for causing heat absorbed by said evaporator and dissipated by said condensing unit to be utilized for evaporating said moisture and disposing of the same into outside atmospheric air.

8. In a conditioner adapted to be placed in an enclosure, an evaporator containing refrigerant, means to supply air from said enclosure to said evaporator to cause a thermal exchange between said refrigerant and air to be conditioned for said enclosure, heat dissipating means connected in refrigerant flow relationship with said evaporator and including a refrigerant translating device and a condenser, at least a portion of said heat dissipating means being adapted to be located outside said enclosure, a sump outside said enclosure, and means for introducing condensate water into said sump, said heat dissipating means including a portion disposed in said sump so as to heat said condensate water.

9. In a room or the like, a window, an air conditioner comprising an evaporator unit within the room, a cabinet for said evaporator, a condenser unit without the room, and refrigerant flow connections between said units passing through said window, said condenser unit comprising a condenser coil, a water receptacle, a fan assembly for circulating air over said condenser coil and means operated by said fan assembly and projecting into said receptacle for spraying water onto said coil.

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