

June 14, 1949.

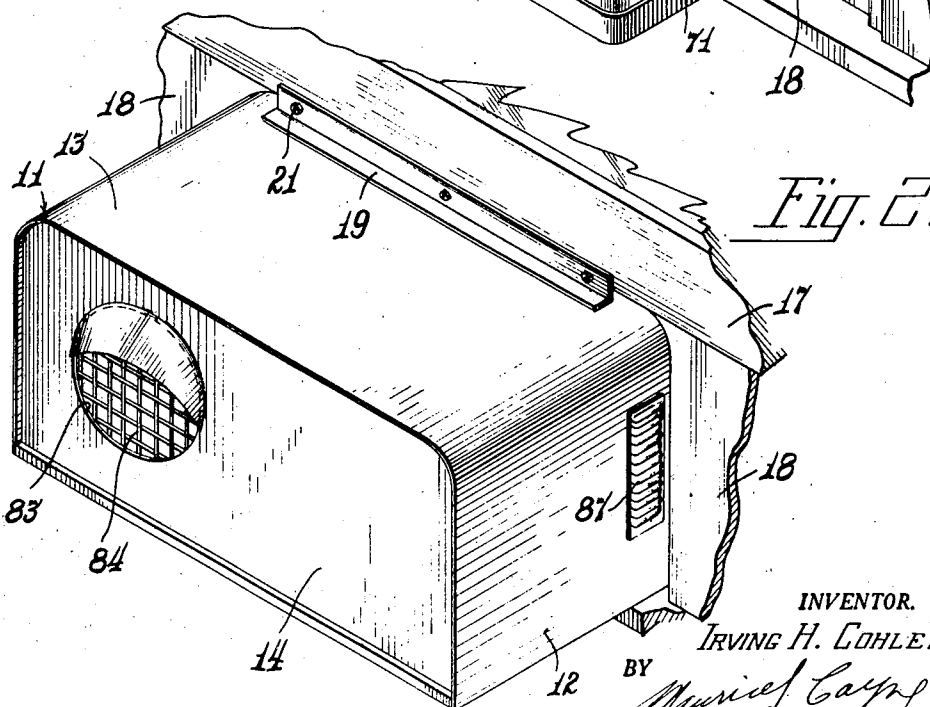
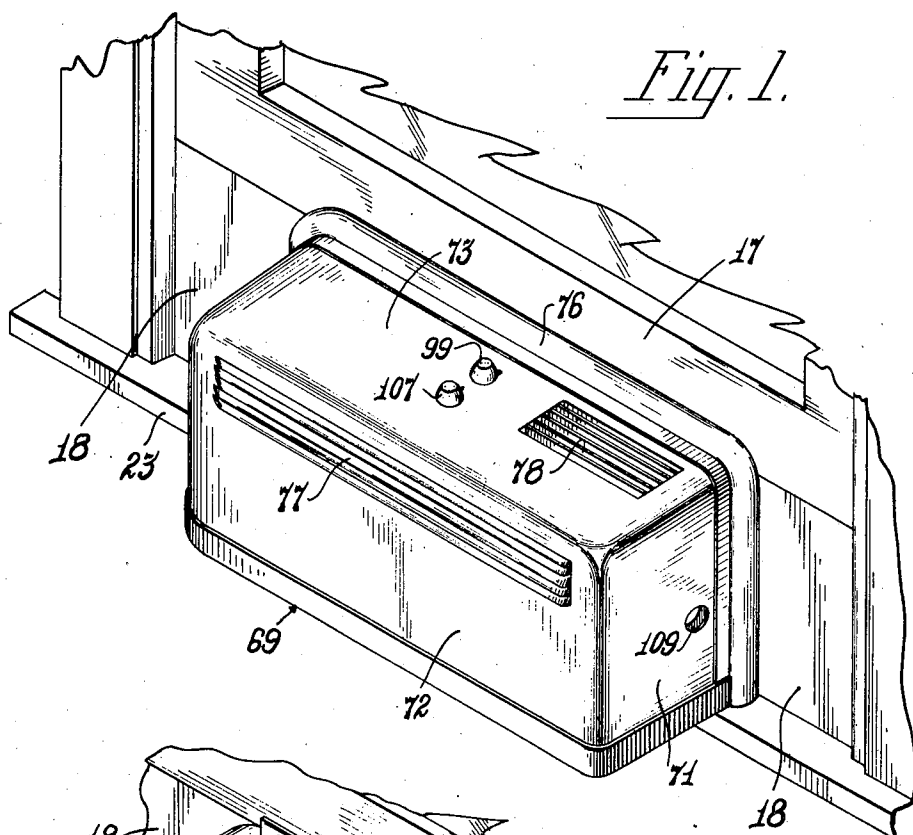
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2,472,792

AIR CONDITIONING UNIT FOR MOUNTING IN WINDOWS

Filed Sept. 17, 1945

5 Sheets-Sheet 1



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AIR CONDITIONING UNIT FOR MOUNTING IN WINDOWS

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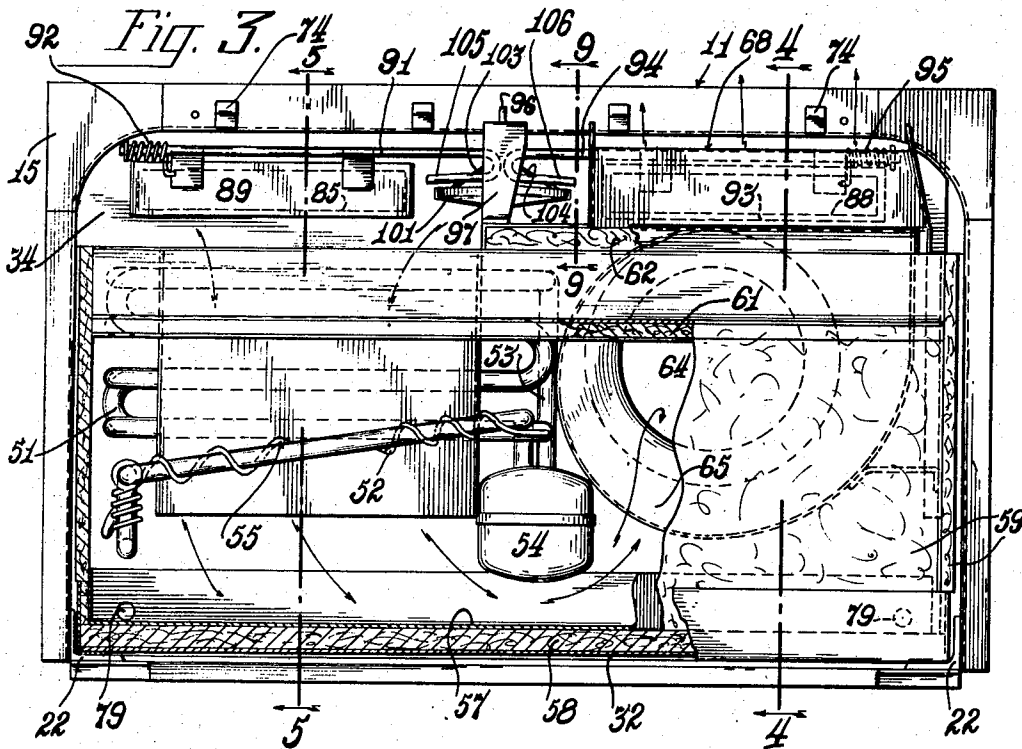


Fig. 9.

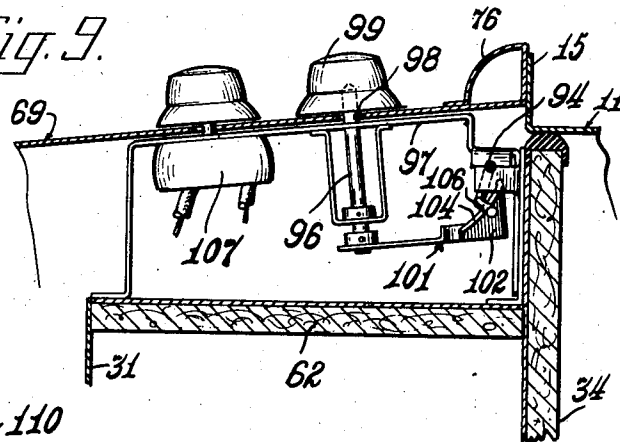
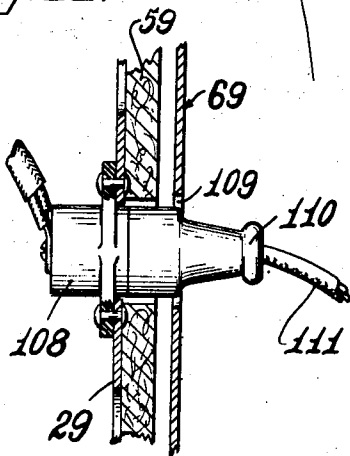


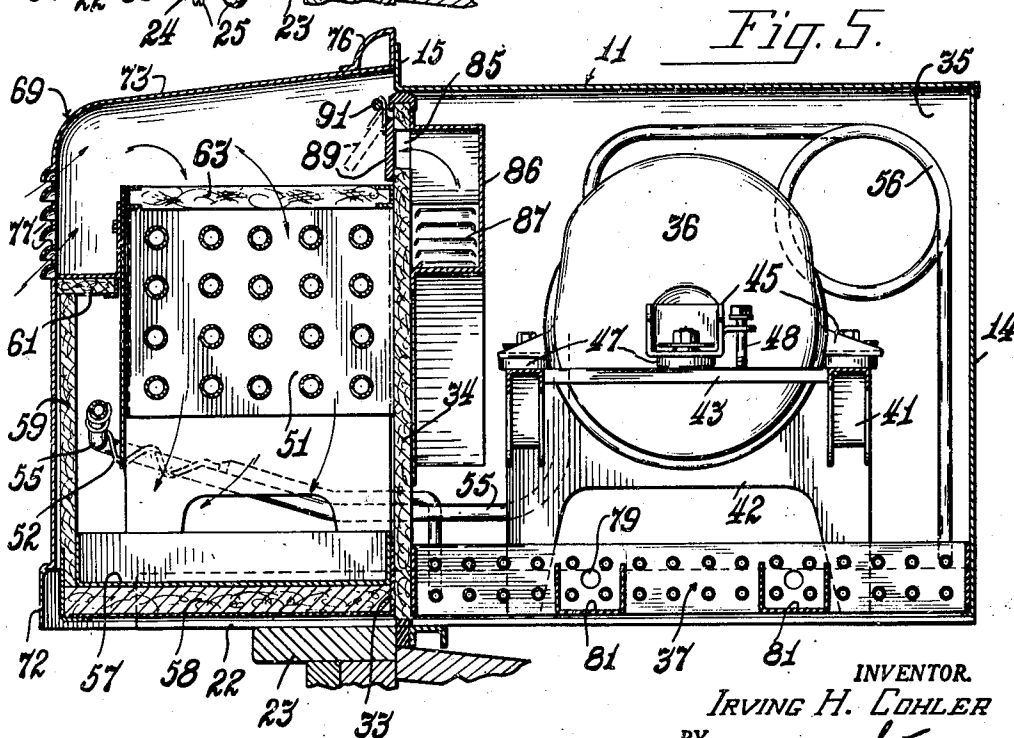
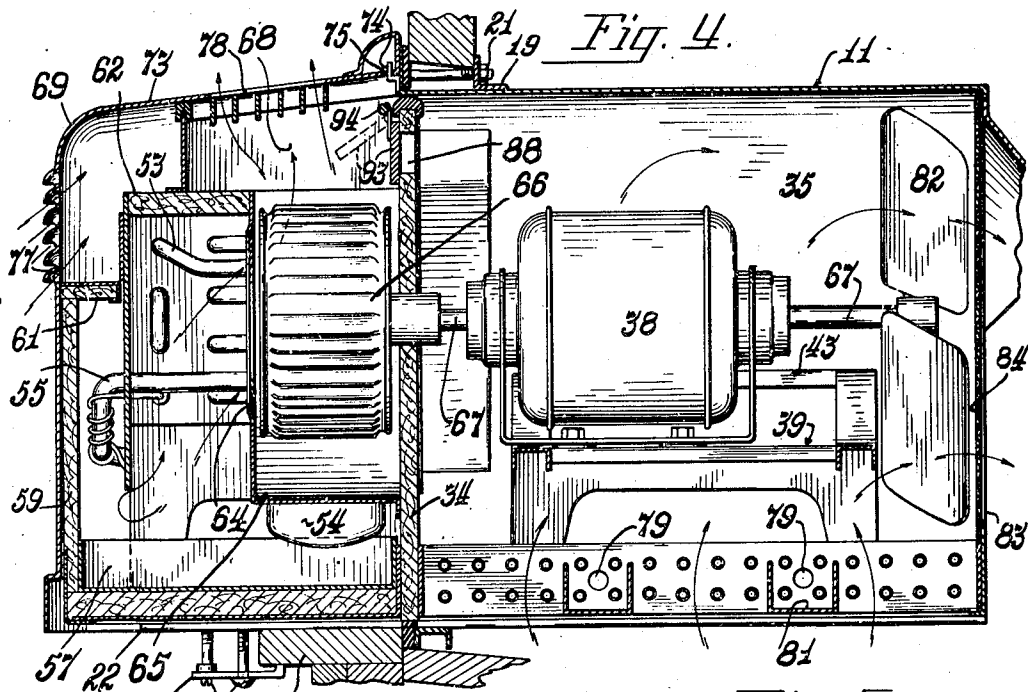
Fig. 10.



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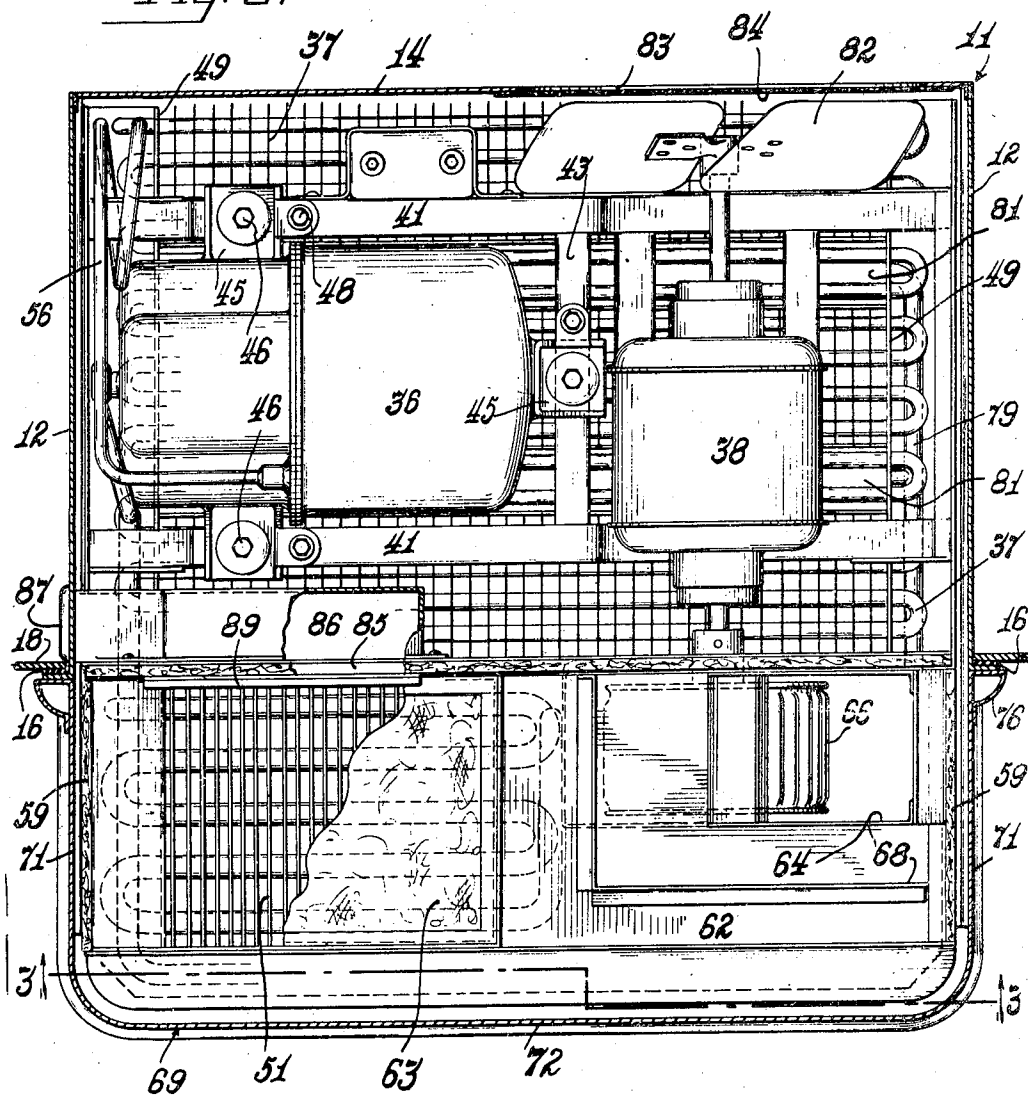
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AIR CONDITIONING UNIT FOR MOUNTING IN WINDOWS

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Fig. 6.



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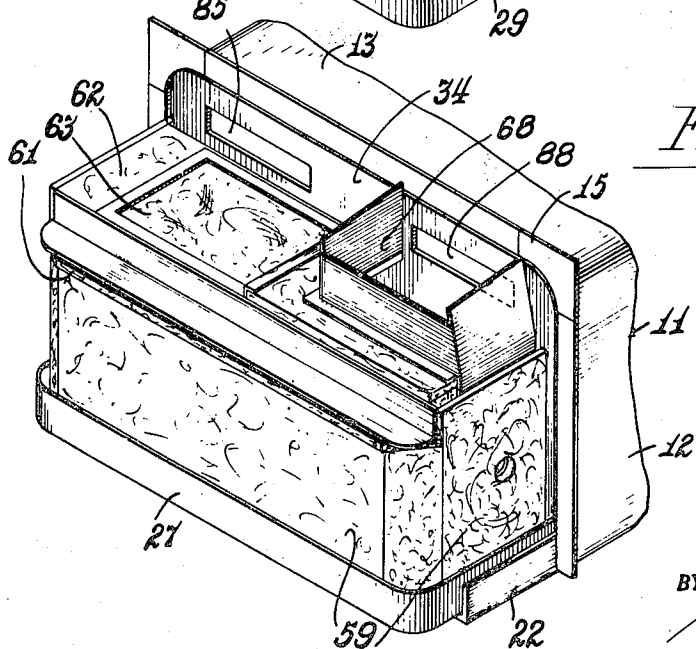
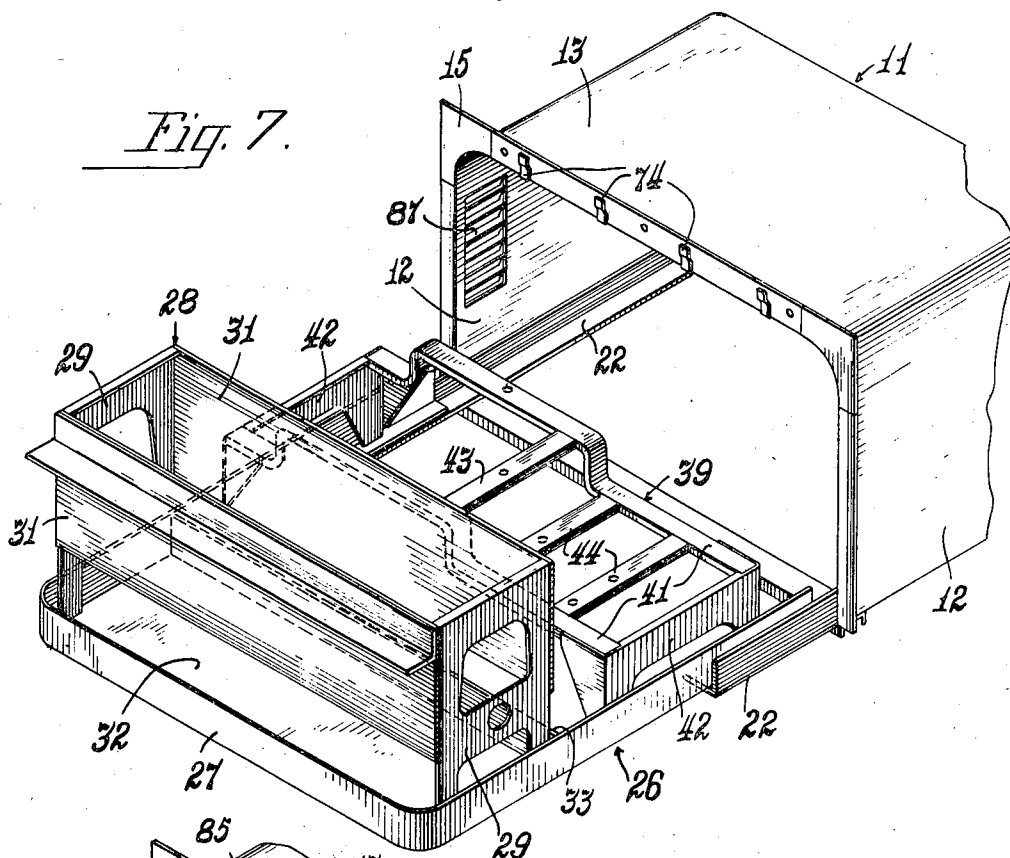
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AIR CONDITIONING UNIT FOR MOUNTING IN WINDOWS

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,472,792

AIR CONDITIONING UNIT FOR MOUNTING
IN WINDOWS

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Application September 17, 1945, Serial No. 616,844

6 Claims. (Cl. 62-140)

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The invention relates to air conditioning apparatus and more particularly to a self-contained unit room cooler of a type adapted to be mounted within a window opening.

It is an object of the present invention to provide a unit room cooler with an improved arrangement of parts for circulating room air therethrough.

Another object of the invention is to provide an air conditioning apparatus with an improved and simplified arrangement of parts which make the device easy to assemble and inexpensive to manufacture and by means of which the parts thereof are made readily accessible for maintenance.

Another object of the invention is to provide an improved refrigerating apparatus assembly for a room cooler which may be inserted or withdrawn in its entirety from a housing structure securely mounted in a window opening.

Another object is to provide an air conditioning apparatus with novel single control means operable to selectively actuate means effective to admit fresh outside air into the room and to exhaust room air to the outside.

Another object of the invention is to provide a self-contained unit room cooler which is highly efficient in operation and use.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which illustrate a preferred embodiment and the principle thereof and which is considered to be the best mode contemplated for applying that principle. Other improvements of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the spirit of the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a perspective view of the self-contained unit room cooler as viewed from within the room.

Fig. 2 is a perspective view of the unit room cooler as viewed from the outside of the room.

Fig. 3 is a front elevational view of the unit room cooler viewed from the inside of the room and with the ornamental covering or shroud removed and portions of the evaporator compartment broken away to better illustrate the arrangement of parts therein.

Fig. 4 is a transverse vertical sectional view of

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the unit, taken substantially on line 4-4 of Fig. 3, and showing parts thereof in elevation.

Fig. 5 is a transverse vertical sectional view of the unit, taken substantially on line 5-5 of Fig. 3 and showing parts thereof in elevation.

Fig. 6 is a top plan view of the air conditioning apparatus with the housing structure and shroud shown in section, and the valved opening controls being omitted for simplification.

Fig. 7 is a detailed perspective view illustrating the chassis or apparatus frame construction and showing it partly withdrawn from the housing structure.

Fig. 8 is a fragmentary perspective view of the air conditioning unit with the shroud removed.

Fig. 9 is a sectional detail view, taken substantially on line 9-9 of Fig. 3, showing the control mechanism to control the selective opening and closing of vented openings provided in one wall of the apparatus structure. Fig. 10 is a fragmentary sectional view showing the plug in connection for the current source.

Referring to the disclosures in the accompanying drawings, the air conditioning unit is of a type adapted to be mounted within a window opening in such manner that a portion thereof is positioned on either side of said opening to enable free circulation of two wholly independent air streams through the unit. The portion of the refrigerating apparatus assembly, to be described hereinafter, extending outside of the window opening is suitably encased within a housing structure 11. This housing is formed of sheet material, such as sheet metal, and it includes spaced side walls 12, a top wall 13, and a back wall 14, and it is open on its bottom and on the end disposed toward the inside of the room. The open end of the housing is surrounded by an external flange 15 adapted to have a strip of resilient material 16 arranged on its outwardly disposed face for providing a hermetic seal between the flange 15 on the housing structure top wall and a window sash 17 which is moved into a position substantially in contact with the top wall of the housing structure.

Prior to locating the window sash in such position, suitable filler walls 18 are inserted in the spaces between the side walls 12 of the housing structure and the sides of the window casing so as to completely close the window opening. A clamp plate 19, preferably in the form of an L-bar, is then rested upon the top wall of the housing structure and is brought into tight clamping engagement with the outside face of the window sash by means of bolts and nuts 21 so as to firmly

clamp the upper portion of the housing structure tightly against the window sash 17.

A pair of L-shaped guide rails 22 is provided, one at each lower corner of the housing structure, which rails have their bottom flanges turned inwardly towards each other and extend beyond the open end of the housing structure to overlie the window sill 23 and provide means for supporting and guiding the refrigeration apparatus assembly which is inserted into the housing structure from within the room. Suitable clamps 24 including lock and adjusting screws 25 are carried by the guide rails 22 for clamping engagement with the under side of the sill 23 so as to provide means whereby the housing structure 11 is firmly clamped rigidly on to said sill and within the window opening.

The unit room cooler includes a refrigeration system, preferably of the compression type, which is mounted in its entirety upon the skeleton frame or chassis 26 best shown in Fig. 7. This chassis preferably consists of an open frame-like base 27 of sufficient width to be received for free sliding on and between the guide rails 22 so that it may slide readily into and out of the housing structure. The base frame 27 carries, adjacent its forward end, a substantially open box-like assembly 28 including supporting end walls 29 and connecting side walls 31, which constitutes the mounting structure for an evaporator unit constituting a part of the refrigerating apparatus.

A floor 32 is provided in the skeleton frame 27 adjacent the front end thereof and beneath the evaporator supporting structure 28, which floor has its inner marginal edge turned upwardly to provide a vertical flange 33 extending transversely across the entire width of the skeleton frame 26. When the skeleton frame is slidably inserted endwise into the housing structure 11, the portion carrying the evaporator supporting structure 28 remains outside of said housing structure and, as best shown in Fig. 5, is disposed wholly within the room or other space to be treated.

A vertical partition wall 34 also is carried on the skeleton frame 26 with its lower end resting against the floor flange 33 and this wall extends upwardly and conforms substantially to the inside contour of the housing structure so that, when the skeleton frame is properly positioned within said housing structure, the partition wall 34 provides a closure for the open end of the housing structure to thereby define within said housing structure a machine compartment 35. The machine compartment 35 is adapted to contain other parts of the refrigerating apparatus such as a motor-compressor unit 36, a condenser coil 37 and a motor 38 for operating means to cause separate streams of air to be circulated through the machine compartment and through the structure supporting the evaporator. The motor-compressor unit 36 is mounted upon the skeleton frame 26 and to this end an open frame-work 39 may be provided on said skeleton frame which consists of parallel laterally extending rails 41 supported on vertical end walls 42 and suitably connected together intermediate their ends by cross bars 43 and 44. The motor-compressor unit 36 is best illustrated by Figs. 5 and 6 and, as shown, it includes the usual refrigerating apparatus compressor and operating motor encased within a single housing having a plurality of lugs 45 projecting outwardly therefrom and adapted to be secured, as by bolts 46, to the lateral rails 41 and cross bars 43 of its mounting structure 39. If desired, suitable vibration absorption elements

such as rubber washers 47 may be inserted beneath the lugs 45 and leveling screws 48 may be provided on each lug for adjusting the motor-compressor horizontally.

The condenser 37 is of substantially conventional cross-fin radiator construction and it is mounted at its ends in walls 49 constituting a part of the chassis 26 so as to be removable therewith as an integral part thereof. When the skeleton frame 26, with the parts assembled thereon in the manner described, is mounted within the housing structure, the condenser 37 constitutes the bottom of the machine compartment 35.

Upon referring to Figs. 5 and 6, it will be noted that an evaporator coil 51, constituting a part of the refrigerating apparatus, is located adjacent one end of the box-like assembly 28 and completely fills the space between the side walls 31 thereof, at said one end, so that any air flowing through that portion of the box-like assembly in the manner to be described hereinafter, will of necessity flow over and around said evaporator coil in heat transfer relationship therewith.

The refrigerating apparatus functions in the manner common to most apparatus of this kind. In the particular type of refrigerating apparatus selected for illustration, the compressor 36, condenser coil 37 and evaporator coil 51 are suitably connected by piping to form a closed circuit whereby refrigerant, either in liquid or gaseous form, is circulated therethrough. In operation, liquid refrigerant from the condenser coil 37 is delivered through a capillary tube 52, so as to restrict the flow from the condenser coil and maintain the pressure therein, into the evaporator 51 where it expands in taking on heat from surrounding atmosphere. The heated gaseous vapor leaving the evaporator through a conduit 53 is deposited in a receiver 54 which accumulates any liquid refrigerant remaining and said vapor then flows through a suction conduit 55 which is in heat transfer relationship to the capillary tube 52 to the compressor 36 which compresses the refrigerant vapor and delivers it through a conduit 56 to the inlet side of the condenser coil 37.

By arranging the capillary tube 52 in heat transfer relationship with the suction conduit 55, some of the heat of condensation is removed from the liquid flowing therethrough prior to its entrance into the evaporator thus reducing the load necessarily imposed upon the evaporator in effecting complete vaporization of the liquid refrigerant. Similarly, heat removed from the liquid refrigerant flowing through the capillary tube 52 is absorbed by the cold vapor leaving the evaporator through the suction conduit 55 to the compressor.

The chassis 26 has a drip pan 57 arranged over the entire area of the floor plate 32 so as to receive condensate discharged from atmosphere flowing downwardly over the evaporator coil 51. A layer of thermal insulation 58 is arranged between the floor plate 32 and drip pan 57 and the entire boxlike assembly 28 is suitably surrounded by vertical walls of thermal insulation material 59, surmounted by a relatively narrow top wall portion 61 and a main top wall portion 62 which, together with the vertical partition wall 34 and floor plate 32 define an evaporator compartment which is wholly disposed on the inside of the window opening when the apparatus assembly is inserted into the housing structure 11. The evaporator compartment top wall 62 is provided at one end with a suitable opening in vertical alignment with the opening through the evapora-

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tor coil 51, which top opening is adapted to receive a removable filter element 63 so as to provide means whereby room air entering the evaporator is filtered.

Room air flowing downwardly through the evaporator coil is chilled and dehydrated and it is then drawn upwardly through an opening 64 in a housing 65 surrounding a centrifugal fan 66. The fan 66 is mounted on one end of the shaft 67 of the motor 38, which shaft extends through the partition wall 34 as best shown in Fig. 4. When the motor is in operation to operate the centrifugal fan 66, air drawn into the fan housing 65 is discharged upwardly through a passageway 68 formed on and extending upwardly from the top wall 62 of the evaporator compartment. Three of the walls of the passageway 68 preferably are formed of sheet material and the fourth wall of said passageway is provided by the partition 34.

The evaporator compartment thus described is suitably enclosed within an ornamental housing or shroud 69 formed of sheet material suitably shaped to provide end walls 71, a front wall 72 and a top wall 73. A housing or shroud is mounted for easy attachment and removal and to this end suitable hanger brackets 74 are arranged in spaced relation on the inwardly disposed face of the horizontal marginal flange 15 of the housing structure 11. The hanger brackets 74 are adapted to engage in slotted openings 75 provided adjacent the free marginal edge of the top wall 73. If desired, the shroud may have its free marginal edges folded upwardly and then inwardly downwardly against the outside surface of the end and the top walls to provide an ornamental beading 76 to conceal the hanger openings 75.

Room air entering the evaporator compartment is admitted through louvered openings 77 formed in the shroud adjacent the upper end of its front wall 72, as best indicated in Figs. 4 and 5, and it is discharged from the discharge passageway 68 through an opening 78, provided in the top wall 73 of the shroud, in registering alignment with said passageway 68. It should be obvious at this time that room air entering the shroud 69 through the inlet openings 77 is entrained downwardly through the filter 63 and evaporator 51 and then upwardly into and through the centrifugal fan housing 64, passageway 68, outlet opening 78 in the shroud 69 and back into the room.

Condensate collected in the drip pan 57 is drawn therefrom and flows by gravity through drain pipes 79 into collecting troughs 81 which extend laterally across the open bottom of the chassis 26 within the machine compartment 35. The troughs 81 are arranged so that a number of lengths of the coil constituting the condenser coil 37 are disposed therein so that such portions of the coil are immersed in cold water collected therein. This arrangement affords means for effecting heat transfer from the refrigerant in the condenser coil whereby said refrigerant is preliminarily chilled so as to relieve the evaporator of some of its work in gasifying the liquid refrigerant delivered thereto. Additional cooling of the refrigerant in the condenser coil 37 is obtained by heat transfer with outside air which is circulated through the coil by means of a fan 82 mounted upon the other end of the motor shaft 67 within the machine compartment 35. The fan 82 is located closely adjacent to the back wall 14 of the housing structure 11 and said wall has an opening 83 suitably covered by a screen 84 of

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relatively large mesh. When the fan 82 is operating, outside air is drawn upwardly through the open bottom of the machine compartment 35 and through and around the condenser coil 37. This air flow serves to evaporate water from the troughs 81 and it circulates freely within the machine compartment 35 so as to effectively cool the motor 38 and motor-compressor 36, whereupon it is discharged through the discharge opening 83. It is submitted that the motor 38 provides single means for circulating independent streams of air through the evaporator compartment and through the machine compartment, thus causing room air to be chilled and dehydrated through contact with the evaporator, and the condenser coil to be suitably cooled through its heat transfer relationship with outside atmosphere and with water contained in the troughs 81.

The apparatus includes means to admit outside atmosphere into the interior of the room. Thus, the partition wall 34 has a horizontally disposed slotted opening 85 (Fig. 5) within the area of said wall extending above the top wall 62 of the evaporator compartment. A relatively shallow conduit 86 is mounted upon the outwardly disposed face of the partition 34 in direct communication with the opening 85, said conduit extending downwardly-laterally to register with a louvered opening 87 provided in the side wall 12 of the housing structure 11. In this manner outside air may be admitted for co-mingling with room air flowing through the filter 63. This particular arrangement is extremely desirable inasmuch as outside air entering the room frequently has excessive humidity and, consequently, said outside air is dehydrated during dehydration of the recirculated room air.

Means is also provided to exhaust room air flowing out of the evaporator compartment and to this end a horizontally disposed slotted opening 88 (Fig. 4) is provided in the partition wall 34 to communicate with the passageway 68. This opening provides means for exhausting the room air directly into the machine compartment 35 where it co-mingles with outside atmosphere circulated therethrough and is discharged through the discharge opening 83.

As best shown in Figs. 3, 4, and 5, the outside air inlet opening 85 and exhaust outlet opening 88 are provided with means whereby both openings may be closed to prevent the flow of air therethrough. As illustrated, a door 89 consisting of a substantially rectangular plate, of such size as to overlie the marginal area of the partition wall 34 surrounding the opening 85, is firmly mounted on a rod 91 having a coil spring adjacent one of its ends for normally retaining the plate 89 in a closed position. A rectangular plate 93, of sufficient size to overlie the marginal area of the partition wall 34 surrounding the opening 88, similarly is firmly mounted on a rod 94 having a spring 95 adjacent one of its ends to normally hold the plate 93 in closed position. Each of the rods 91 and 94 are formed with means to cooperate with a manual control element whereby either one may be selectively rotated to swing the respective cover plate 89 or 93 away from the partition wall 34 to thereby enable air to flow through the opening normally covered thereby.

The control element operable to control selective rotation of the rods 91 and 94 preferably consists of a rotatable shaft 96 suitably journaled in a bracket 97 formed of a strap of sheet material firmly secured upon the top wall 62 of the

evaporator compartment. As best shown in Fig. 9, the shaft 96 extends upwardly through the strap 97 so as to project through an opening 98 in the shroud 69 and receive a knob 99 which is removably secured thereto. The lower extremity of the shaft 96 carries a cam element 101 which includes an arcuate wall portion 102 having its upper edge inclined downwardly in both directions from the medial portion thereof so as to define a pair of like oppositely disposed cam surfaces 103 and 104.

The ends of the rods 91 and 94 opposite to the ends carrying the springs 92 or 95, are bent back upon themselves to define cam engaging portions 105 and 106 respectively, which portions normally rest on the respective cam surfaces 103 and 104 when the cam element 101 is in neutral position. It should be obvious that rotation of the knob 99 in either direction from its normal position of rest will cause one or the other of the cam surfaces 103 and 104 to ride beneath the respective rod portion 105 or 106 to thereby rotate the related shaft sufficiently to move its cover plate 89 or 93 into an open position.

The motor compressor 36 and fan motor 38 are, of course, supplied with electrical energy through conventional wiring connecting them with a source of current supply. A switch 107, generally indicated in Fig. 9, is carried upon the bracket 97 so as to provide means whereby the current supply to said motors may be controlled. Since it is one of the features of the present construction to provide a unitary organization capable of being disassembled readily to afford access to the refrigerating mechanism for maintenance, the wiring for the electrical units therein contained includes a conventional female socket 108 (Fig. 10) which in the present disclosure is mounted on one of the end walls 29 of the box-like assembly 28 and the shroud 69 has an aligning opening 109 through which a male socket member 110, carried on the end of a conventional extension cord 111, may be inserted for cooperative engagement with the socket 108. This form of electrical connection enables the extension cord to be removed prior to removal of the shroud while dismantling.

The unit room cooler shown and described herein is of a construction which facilitates ready withdrawal and insertion of the chassis carrying the refrigerating apparatus and further said chassis includes the evaporator compartment which contains the evaporator coil and circulating fan all suitably enclosed so as to enable them to function in the manner intended irrespective of whether or not the shroud or ornamental housing 69 is positioned thereover.

Although an exemplary form of the invention has been illustrated in the drawings and described in detail in the foregoing specification, it should be understood that the invention is capable of embodying a wide variety of modifications in detail construction and arrangement of parts without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a window mounted unit air conditioner, the combination of, a window mounting structure comprising a top wall, side walls, an end wall and an open bottom extending outwardly through the window opening and having guide rails at its bottom extending inwardly of said window opening, means for fastening the mounting structure to the window and to the window sill, and an air circulating and cooling unit mounted in said

mounting structure comprising an open frame-like base and a vertical partition mounted on said base, a condenser mounted on the open frame-like base on one side of the partition, said condenser and partition cooperating with said top, side and end walls of the mounting structure to form a machine compartment, a fan in said machine compartment to cause air to flow into the compartment over the condenser, a floor on said frame-like base on the other side of the partition, an evaporator supported above said floor, and walls arranged around said evaporator and cooperating with the floor and vertical partition to form an evaporator compartment, a shroud covering said walls, said shroud having air-flow openings communicating with the evaporator compartment, and selectively controlled openings in said vertical partition communicating with outside atmosphere to selectively control the intake and exhaust of air into and out of the evaporator compartment.

2. In a window mounted unit air conditioner, the combination of, a window mounting structure comprising a top wall, side walls, an end wall and an open bottom extending outwardly through the window opening and having guide rails at its bottom extending inwardly of said window opening, means for fastening the mounting structure to the window and to the window sill, and an air circulating and cooling unit mounted in said mounting structure comprising an open frame-like base and a vertical partition mounted on said base, a condenser mounted on the open frame-like base on one side of the partition, water pans underlying portions only of said condenser, said condenser and partition cooperating with said top, side and end walls of the mounting structure to form a machine compartment, a fan in said machine compartment to cause air to flow into the compartment over the condenser, an evaporator and a centrifugal fan mounted on said base on the other side of said partition wall, a pan to receive condensate from the evaporator closing the bottom of the frame-like base on said other side of the partition wall, vertical walls surrounding the evaporator and centrifugal fan and cooperating with the pan and partition wall to form a cooling compartment, and means connecting said condensate pan with the water pans so that condensate from the evaporator may flow into the water pans and be entrained by evaporation into the air flow around the condenser.

3. In a window mounted unit air conditioner, the combination of a window mounting structure comprising a top wall, side walls, an end wall and an open bottom extending outwardly through the window opening and having guide rails at its bottom extending inwardly of said window opening, and an air circulating and cooling unit mounted in said mounting structure comprising an open frame-like base and a vertical partition mounted on said base, a condenser mounted on the open frame-like base on one side of the partition, said condenser and partition cooperating with said top, side and end walls of the mounting structure to form a machine compartment, a fan in said machine compartment to cause air to flow into the compartment over the condenser, a floor on said frame-like base on the other side of the partition, an evaporator supported above said floor, and walls arranged around said evaporator and cooperating with the floor and vertical partition to form an evaporator compartment, a shroud covering said walls, said shroud having air-flow openings communi-

cating with the evaporator compartment, and selectively controlled openings in said vertical partition communicating with outside atmosphere to selectively control the intake and exhaust of air into and out of the evaporator compartment.

4. In a window mounted unit air conditioner, the combination of a window mounting structure comprising a top wall, side walls, an end wall and an open bottom extending outwardly through the window opening and having guide rails at its bottom extending inwardly of said window opening, means for fastening the mounting structure to the window and to the window sill, and an air circulating and cooling unit mounted in said mounting structure comprising an open frame-like base and a vertical partition mounted on said base, a condenser mounted on the open frame-like base on one side of the partition, said condenser and partition cooperating with the mounting structure to form a machine compartment, a fan in said machine compartment to cause air to flow into the compartment over the condenser, a floor on said frame-like base on the other side of the partition, an evaporator supported above said floor, walls arranged around said evaporator and cooperating with the floor and vertical partition to form an evaporator compartment, a shroud covering said walls, said shroud having air-flow openings communicating with the evaporator compartment, and selectively controlled openings in said vertical partition communicating with outside atmosphere to selectively control the intake and exhaust of air into and out of the evaporator compartment.

5. In a window mounted unit air conditioner, the combination of a window mounting structure comprising a top wall, side walls, an end wall and an open bottom extending outwardly through the window opening and having guide rails at its bottom extending inwardly of said window opening, and an air circulating and cooling unit mounted in said mounting structure comprising an open frame-like base and a vertical partition mounted on said base, a condenser mounted on the open frame-like base on one side of the partition, said condenser and partition cooperating with the mounting structure to form a machine compartment, a fan in said machine compartment to cause air to flow into the compartment over the condenser, a floor on said frame-like base on the other side of the partition, an evaporator supported above said floor, walls arranged around said evaporator and coop-

erating with the floor and vertical partition to form an evaporator compartment, a shroud covering said walls, said shroud having air-flow openings communicating with the evaporator compartment, and selectively controlled openings in said vertical partition communicating with outside atmosphere to selectively control the intake and exhaust of air into and out of the evaporator compartment.

6. In a window mounted unit air conditioner, the combination of a window mounting structure comprising a top wall, side walls, an end wall and an open bottom extending outwardly through the window opening and having guide rails at its bottom extending inwardly of said window opening, means for fastening the mounting structure to the window and to the window sill, and an air circulating and cooling unit mounted in said mounting structure comprising an open frame-like base and a vertical partition mounted on said base, a condenser mounted on the open frame-like base on one side of the partition, said condenser and partition cooperating with said top, side and end walls of the mounting structure to form a machine compartment, a fan in said machine compartment to cause air to flow into the compartment over the condenser, a floor on said frame-like base on the other side of the partition, an evaporator supported above said floor, walls arranged around said evaporator and cooperating with the floor and vertical partition to form an evaporator compartment, and a shroud covering said walls, said shroud having air-flow openings communicating with the evaporator compartment.

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