

Nov. 11, 1941.

F. P. TAUGHER

2,262,477

AIR CONDITIONING APPARATUS

Filed June 28, 1935

3 Sheets-Sheet 1

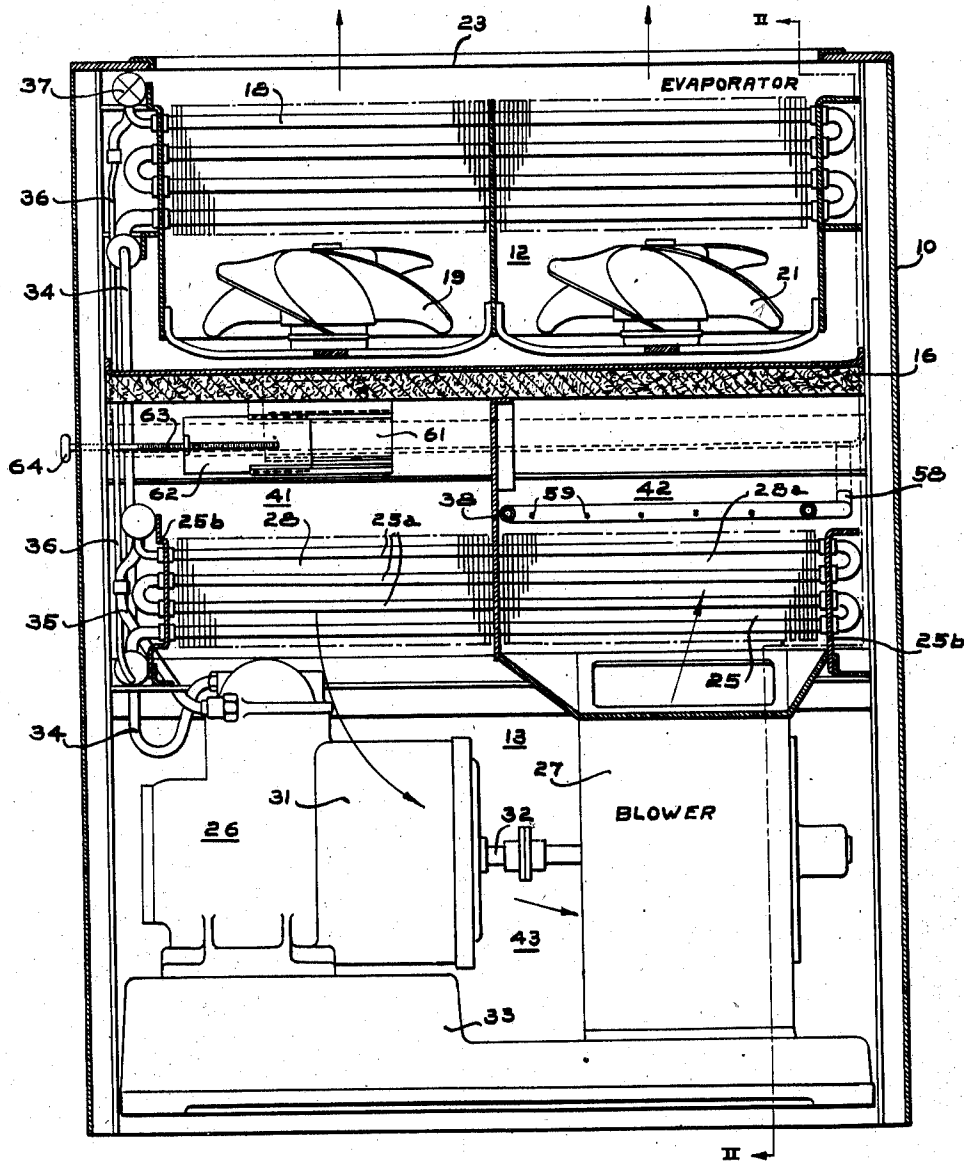


FIG. 1.

WITNESSES:

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3 Sheets-Sheet 2

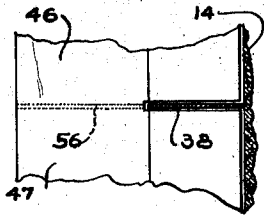


FIG. 5.

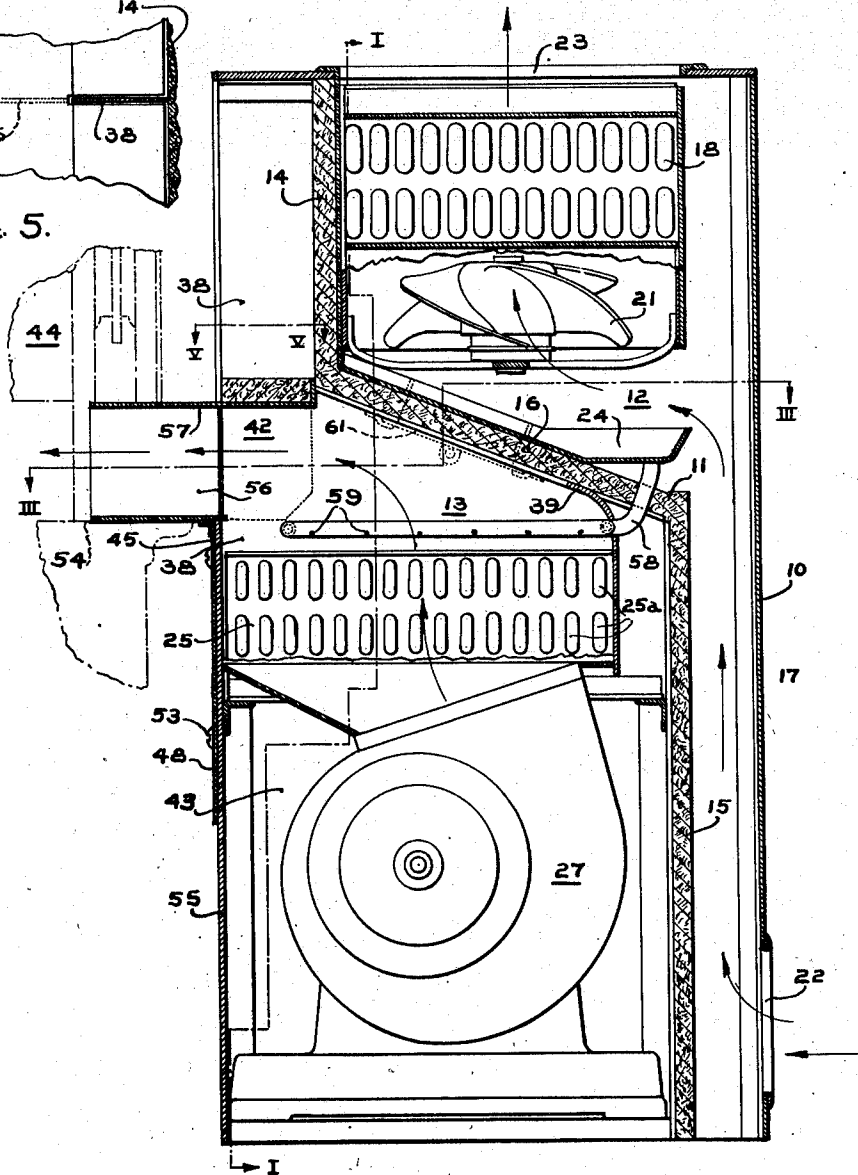


FIG. 2.

WITNESSES:

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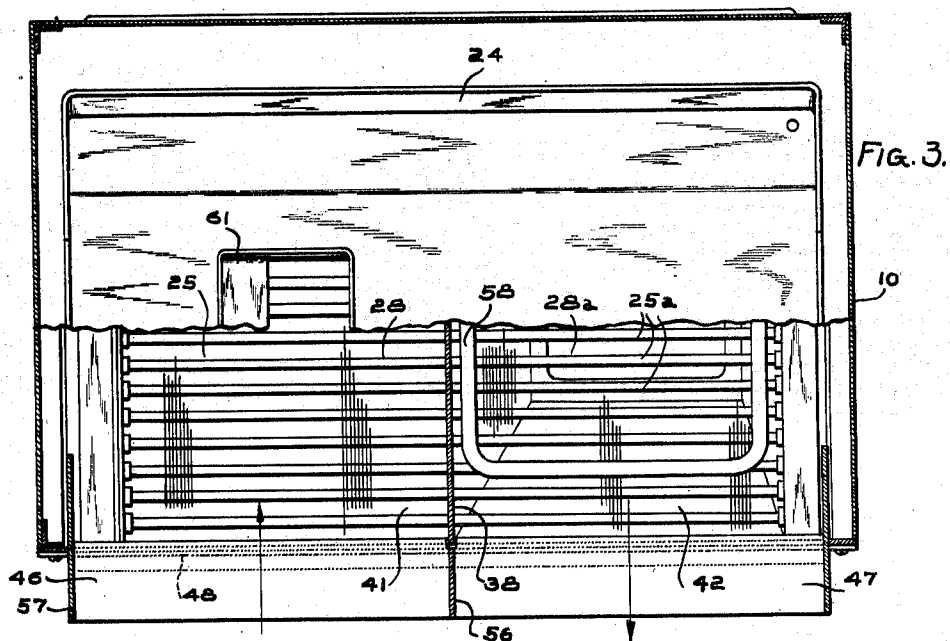
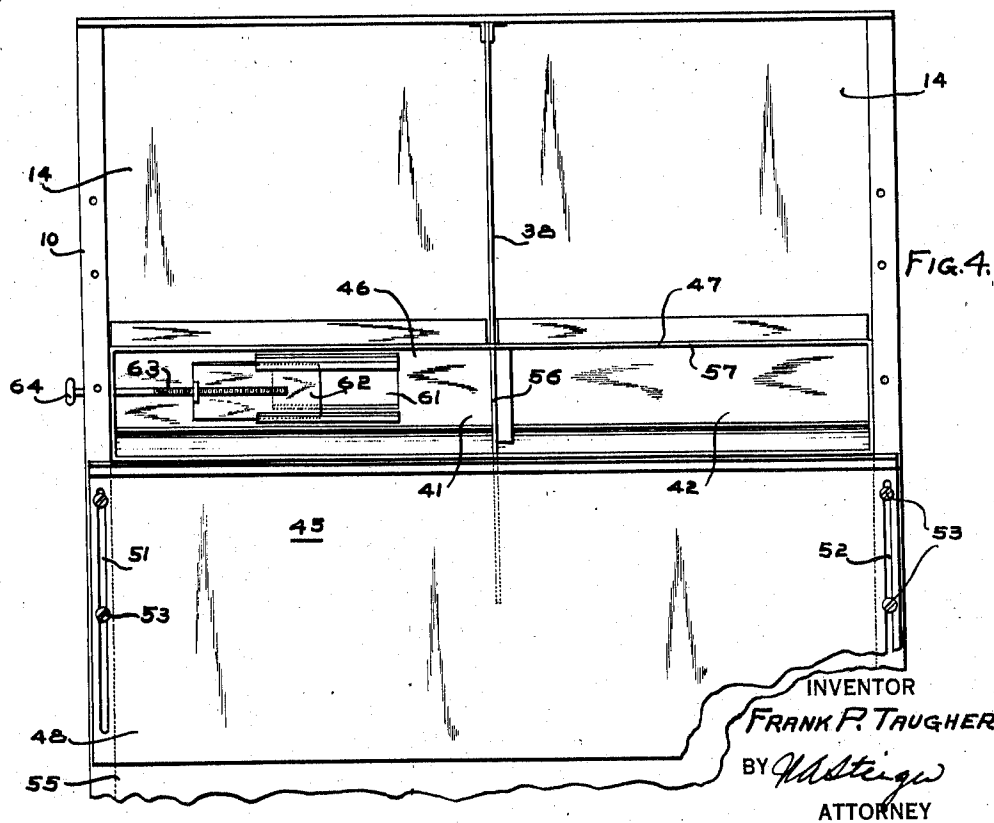
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,262,477

AIR CONDITIONING APPARATUS

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Westinghouse Electric & Manufacturing Com-
pany, East Pittsburgh, Pa., a corporation of
Pennsylvania

Application June 28, 1935, Serial No. 28,825

10 Claims. (Cl. 62—140)

My invention relates to air conditioning apparatus and more particularly to a unit air conditioner or cooler, and it has for an object to provide improved apparatus of this kind.

It is a further object of my invention to provide a compact arrangement of the elements of an air cooled refrigerating system in a device for cooling air in a room.

A further object of my invention is to provide a self-contained and compact air conditioning device employing an air cooled refrigerating system, which may be readily installed in an enclosure to be cooled and which is quiet in operation.

In accordance with my invention, I provide a cabinet structure within which the air cooling and air translating devices are superimposed so that a relatively narrow cabinet is obtained. The evaporator, or air cooling device, and the fan or fans associated therewith are preferably disposed adjacent the top of the cabinet and the compressor, the condenser and their associated blower are arranged beneath the evaporator. A heat insulating wall divides the cabinet structure into two compartments; in one of which the evaporator and fans are disposed and the other of which houses the condenser, the compressor and the blower.

I prefer to arrange the blower and compressor at the bottom of the cabinet where they may be more conveniently supported. The condenser may be divided into first and second portions disposed, respectively, adjacent and above the compressor and blower. Air translated by the blower passes serially in heat exchanging relation with the condenser portions and the compressor; the air entering and leaving the cabinet above the condenser. Ducts are provided for conveying the air translated by the blower and extend from above the condenser to the atmosphere exterior of the enclosure through any suitable wall opening. Provision is made for adjustably securing the ducts to the cabinet structure so that they may be inserted into wall openings of various elevations.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings forming a part of this application, in which:

Fig. 1 is a vertical sectional view of a self-contained air conditioner arranged in accordance with my invention and is taken along the line I—I of Fig. 2;

Fig. 2 is a section view of the apparatus shown in Fig. 1 and is taken along the line II—II thereof;

Fig. 3 is a sectional view in plan taken along line III—III of Fig. 2;

Fig. 4 is a rear view of the apparatus taken in elevation; and,

Fig. 5 is a sectional view of a detail and is taken along the line V—V of Fig. 2.

Reference will now be had to the drawings in which the numeral 10 generally indicates a cabinet structure which encloses the apparatus for cooling air in a room or enclosure. A wall 11 divides the cabinet 10 into compartments 12 and 13 which I term air cooling and apparatus compartments, respectively. The wall 11, preferably, includes vertical portions 14 and 15 which are offset and joined by a portion 16, which may be inclined as shown in Fig. 2. The wall portion 14 constitutes a rear wall for the compartment 12 and the wall portion 15 constitutes a front wall for the compartment 13.

A relatively narrow passage 17 is defined by the wall portion 15 and the casing 10, which passage 17 extends substantially the entire width of the casing and forms a portion of the air cooling chamber 12. Arranged adjacent the top of the air cooling chamber 12 is an evaporator 18 for cooling the air in the enclosure. Air translating means such as, for example, a pair of fans 19 and 21 are disposed, preferably, beneath the evaporator 18 for translating the air to be cooled. An inlet opening 22 is formed in the casing structure 10 adjacent the bottom of the passage 17 and an outlet opening 23 is arranged above the evaporator 18. These openings communicate with the air in the room in which the unit is located and which is conditioned by the unit. A drip pan 24 may be disposed beneath the evaporator 18 for the collection of moisture which is precipitated from the air as it is cooled. The pan 24 extends upwardly along the inclined wall portion 16 and terminates adjacent the wall portion 14.

The evaporator 18 forms one element of a refrigerating system, the condenser 25 and the compressor 26 of which are disposed within the apparatus compartment 13. The condenser 25 is made in a single unit comprising a bank of tubes 25a extending substantially the entire width of the casing 10 and supported at their ends in vertical support plates 25b. The condenser is divided by a partition 28 extending transversely of the tubes, into two portions 28 and 28a over which the stream of cooling air is circulated in series.

A blower 27 is arranged below the portion 28a

of the condenser 25 and serves to translate air for cooling the condenser 25 and the compressor 26; the latter being disposed below the portion 28 of the condenser 25. A motor 31 serves to drive the compressor 26 and may be provided with a shaft extension 32 for driving the blower 27. A common bedplate 33 is arranged adjacent the bottom of the casing 10 and serves as a support for the compressor 26 and blower 27.

The refrigerating apparatus operates on the well-known compressor-condenser-expander cycle, in which refrigerant vapor is drawn from the evaporator 18 through a conduit 34 by the compressor 26 and is compressed. The compressed vapor then passes at a relatively high pressure from the compressor 26 to the condenser 25 by means of a conduit 35. Condensation of the vapor is effected in the condenser 25 and the heat imparted to the condenser 25 by the vapor is abstracted by the stream of air translated by the blower 27. Liquid refrigerant passes through a conduit 36 from the condenser to a suitable expansion device 37 where its pressure is reduced prior to its admission into the evaporator 18. Chilling of the evaporator 18 is effected by the refrigerant which vaporizes at the low pressure established therein by the suction of the compressor 26. This completes the cycle which is repeated as long as the compressor 26 is operated.

The vertical partition 38 extends from adjacent the bottom of the condenser 25 to the top of the cabinet 10, rearwardly of the wall portion 14. This partition 38 engages the under side of the wall portion 16 as best shown at 39 in Fig. 2. Therefore, the partition 38 divides the apparatus compartment 13 into a pair of chambers 41 and 42 through which air translated by the blower 27 is circulated. A space 43 beneath the partition 38 constitutes a passage connecting the chambers 41 and 42, in which passage the compressor 26 and the blower 27 are disposed.

Air translated by the blower 27 is drawn from and discharged to the atmosphere exterior of the enclosure, usually through a window opening, which I have indicated in dotted lines at 44 in Fig. 2. Means is provided for connecting the air chambers 41 and 42 to the outside atmosphere through window openings of various sill elevations; said means including an adjustable duct structure 45 carried by the rear of the cabinet 10. Included in the duct structure 45 are air inlet and outlet ducts 46 and 47 carried by a plate 48 which is adjustably secured to the cabinet 10 in any suitable manner. By way of example, I have shown the plate 48 provided with vertical elongated slots 51 and 52, within which a plurality of screws 53 tapped into the casing structure 10, are arranged. As shown in the drawings, the adjustable duct structure 45 is shown adjusted to its lowermost position so that the ducts 46 and 47 rest upon the window sill indicated at 54. By loosening the screws 53, the structure 45 may be moved to other elevations dictated by the height of the sill on which the ducts 46 and 47 are to rest. When the proper adjustment is obtained the screws 53 are tightened for gripping the plate 48.

The stationary rear wall 55 of the casing 10 extends upwardly from the bottom thereof and terminates adjacent the bottom of the ducts 46 and 47 when adjusted to their lowermost position. As the duct structure 45 is adjusted upwardly, the opening, formed between the ducts 46 and 47 and the top of the wall 55, is closed

by the plate 48 which moves upwardly. A vertical partition 56 is carried by the adjustable duct structure 45 in alignment with the partition 38 in the apparatus compartment and serves to separate the inlet and outlet ducts 46 and 47. The top wall 57 of the ducts 46 and 47 extends to and terminates adjacent the wall portion 14, being slotted to accommodate the partition 38, as best shown in Fig. 5.

Air which is translated by the blower 27 and which is drawn from the outside atmosphere enters the duct 46 and passes through chamber 41 into heat exchanging relation with the condenser portion 28. From the latter it passes over and cools the compressor 26 and the motor 31 within the connecting passage 43 and is then forced by the blower 27 into heat exchanging relation with the condenser portion 28a. The heated air then passes through the chamber 42 and the duct 47 to the outside atmosphere. Moisture, precipitated from the air cooled by the evaporator 18 and which collects in the pan 24, is removed, preferably by vaporizing it in the air discharged to the outside atmosphere. Accordingly, a conduit 58 connects with the pan 24 for draining moisture therefrom, which conduit 58 extends into the stream of air translated by the blower 27. The portion of the conduit 58 disposed in the air stream is provided with a plurality of relatively small openings 59 through which the water drips and is vaporized in the air stream. Preferably, the conduit 58 terminates in the air stream above the condenser portion 28a where the air is heated and where its capacity for absorbing moisture is greatest.

Means is provided in my improved air conditioning unit for supplying fresh air for mixture with the stream of air being cooled. An opening or fresh air passage 61 is arranged in the wall portion 16 and provides communication between the chamber 41 and the air cooling compartment 12. A damper 62 controls the amount of air conveyed through the passage 61 and is adjusted by means of a stem 63, journaled in the casing structure 10 and threaded into a portion of the damper 62. A knob or handle 64 is fixed to the stem 63 and is disposed exteriorly of the casing 10 so that it may be readily rotated for controlling the position of the damper 62 and, therefore, the supply of fresh air. Flow of air through the opening 61 toward the compartment 12 is effected by the fans 19 which maintain a slightly lower pressure in compartment 12 than is maintained in the chamber 41 by the blower 27.

From the above description, it will be seen that I have disclosed a novel air-cooled, self-contained room cooling device, which occupies a small amount of floor space when compared to conventional devices of which I am aware. This feature has been obtained, in a large measure, by the compact arrangement of the elements of the air cooled refrigerating system. I have, furthermore, provided an improved air conditioner in which precipitated moisture is effectively removed, and in which the supply of fresh air entering the enclosure being cooled may be readily controlled.

Due to the absence of sharp angular turns in the path of the streams of air translated by the blower 27 and fans 19, I have minimized air noises which are so objectionable in apparatus of this kind. Relatively large areas for the air streams are available due to the compact arrangement of the refrigerating system so that

air velocities are low and, therefore, air noises are substantially reduced.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In refrigerating apparatus, the combination of a casing having a compartment therein, an air cooled condenser extending substantially across the compartment and vertically spaced from the bottom thereof, a vertical partition extending upwardly from adjacent the bottom of the condenser for dividing the compartment into a plurality of chambers, a plurality of ducts providing communication between the atmosphere exterior of the casing and said chambers respectively, said ducts having upper and lower walls, said upper walls extending beyond the lower walls and constituting movable top walls for the chambers, means for adjusting the ducts vertically with respect to the casing, means for circulating air serially through said ducts and chambers and in heat exchanging relation with the condenser.

2. In refrigerating apparatus, the combination of a casing comprising a vertical wall whose upper edge is spaced from the top of the casing, a second vertical wall spaced horizontally inwardly from said first wall to provide a passage therebetween and extending upwardly from a level adjacent said upper edge of the first wall, and a horizontally-extending and vertically-adjustable outdoor air duct member communicating with said passage, said duct member including an upper wall extending to said second wall, a lower wall extending horizontally as far as said upper edge of the first wall, and a plate extending downwardly from the lower wall to close the gap between the lower wall and said upper edge of the first wall when the duct is raised above its lowermost position.

3. In refrigerating apparatus, the combination of a casing having an upright wall (1) extending from the top of the casing to the bottom thereof, a second upright wall (5) spaced from the first wall to provide an apparatus compartment therebetween and extending from the bottom of the casing toward the top thereof but terminating in spaced relation thereto, a transverse partition (3) connecting said walls and dividing the apparatus compartment into first and second chambers (4) and (2), a condenser arranged within said chambers, first and second ducts (46) and (47) providing communication between the atmosphere exterior of the casing and said chambers, means for translating air through said ducts and chambers in heat exchanging relation with the condenser, and an adjustable plate (48) arranged contiguous to said second upright wall and slidable thereon for supporting the ducts, said plate complementing the second upright wall for closing the space between said ducts and the top of the second upright wall as the ducts are adjusted upwardly; said ducts including upper wall portions (57) extending inwardly of the casing and terminating adjacent to the first-mentioned upright wall and including bottom wall portions terminating adjacent to said plate.

4. In apparatus for cooling the air in an en-

closure, the combination of a cabinet structure having front and rear walls, a partition disposed generally in a horizontal plane within the cabinet structure, said partition extending from adjacent the front wall toward the rear wall of the cabinet structure and terminating in spaced relation with the rear wall, a second partition connected to the rear end of the first-mentioned partition and extending upwardly therefrom, said second partition defining a space with the rear wall of the cabinet structure, means dividing said space into inlet and outlet passages for air, an evaporator disposed above the first-mentioned partition, means for passing air for the enclosure in heat exchanging relation with the evaporator, a condenser disposed beneath the first-mentioned partition and extending substantially in a horizontal plane between said front and rear walls of the cabinet structure, means for dividing the condenser into first and second portions which communicate, respectively, with said air inlet and outlet passages, a compressor for circulating refrigerant through the condenser and evaporator and disposed beneath the condenser, and a blower for circulating air through said passages and in heat exchanging relation with the condenser portions and the compressor.

5. In apparatus for conditioning the air in an enclosure, the combination of a cabinet structure arranged within the enclosure, a partition dividing the cabinet into an air cooling compartment and an apparatus compartment beneath the air cooling compartment, an evaporator in the air cooling compartment, means for translating air over the evaporator and into the enclosure, a condenser disposed horizontally in the apparatus compartment at least in part beneath said evaporator, a compressor disposed in the apparatus compartment at least in part beneath said condenser, means including a blower disposed beneath said condenser for conveying a stream of air into the apparatus compartment, between said partition and one portion of said condenser, downwardly over said one condenser portion, over the compressor, through the blower, upwardly over a second condenser portion, between said second condenser portion and said partition, and out of the apparatus compartment, means for conveying air from the condenser air stream on the upstream side of the first condenser portion to the air cooling compartment for mixture with the air flowing therethrough, and means for adjusting the quantity of air conveyed by the last-named means.

6. In apparatus for cooling the air in an enclosure having an opening in a wall thereof, the combination of a cabinet structure having an air cooling compartment and an apparatus compartment disposed at least in part beneath the air cooling compartment, an evaporator in said air cooling compartment, a condenser disposed in said apparatus compartment below said evaporator, said cabinet having a rear wall for the air cooling compartment offset forwardly from the rear wall of the apparatus compartment, and vertically adjustable duct means providing a horizontally-extending air passage adapted to communicate at its outer end with said wall opening, the inner end of said air passage communicating with the apparatus compartment rearwardly of the rear wall of the air cooling compartment and forwardly of the rear wall of the apparatus compartment, said vertically ad-

justable duct means including an upper wall for said horizontally-extending air passage extending to the rear wall of the air cooling compartment.

7. In a unit air cooler for a room having an opening in a wall thereof, the combination of a cabinet structure having an air cooling compartment and an apparatus compartment disposed below the air cooling compartment, an evaporator in said air cooling compartment, said cabinet structure having a rear wall for the air cooling compartment offset forwardly from the rear wall of the apparatus compartment and having an inlet and an outlet condenser air passage extending between said rear walls, a condenser disposed in said apparatus compartment with a portion thereof in vertical alignment with one of said passages between said rear walls, vertically-adjustable duct means providing horizontal passages communicating with said wall opening at their outer ends and with said inlet and outlet passages at their inner ends, said duct means including upper wall portions for said horizontal passages extending over said inlet and outlet passages to close the upper ends thereof, whereby the vertical length of said inlet and outlet passages is adjusted in accordance with the position of the horizontal passages, and means for effecting forced circulation of condenser cooling air inwardly through one of said horizontal passages and said inlet passage, in a generally vertical direction in contact with said condenser, and outwardly through said outlet passage and another of said horizontal passages.

8. A room cooler adapted to be disposed in a room adjacent a window thereof and comprising an upper and a lower compartment and a vertical passage disposed rearwardly of the upper compartment and in vertical alignment with the rear portion of the lower compartment, a window duct member providing a horizontal air passage and adapted to be connected to a window opening at the rear end of said passage, the front end of said passage communicating with said vertical air passage, said window duct member being vertically adjustable and including an upper wall which extends across and forms a closure for the upper end of said vertical air passage, an evaporator disposed in said upper compartment, a condenser disposed below said upper compartment and with a portion of the condenser in vertical alignment with said vertical air passage, and means including a blower disposed in said lower compartment for effecting flow of air vertically in contact with said condenser and through said vertical air passage and horizontally through said horizontal air passage.

9. A unit air cooler for a room having an opening in a wall thereof and comprising a cab-

inet structure having an air cooling compartment and an apparatus compartment disposed below the air cooling compartment, an evaporator in said air cooling compartment, said cabinet structure having a rear wall for the air cooling compartment offset forwardly from the rear wall of the apparatus compartment, a vertical passage disposed rearwardly of the cooling compartment and above the apparatus compartment and communicating with the apparatus compartment between said rear walls, a vertically-adjustable window duct member providing a horizontal air passage adapted to communicate at one end with said wall opening and at the other end with the upper end of said vertical passage, said vertically-adjustable duct member including an upper wall for the horizontal air passage extending over said vertical air passage and forming a closure for the upper end thereof, whereby the vertical height of said vertical air passage is adjustable in accordance with the vertical position of said horizontal air passage, a condenser in said apparatus compartment disposed with a portion thereof below and in vertical alignment with said vertical passage, and means including a fan or blower in said apparatus compartment for effecting flow of condenser cooling air through said horizontal passage and said vertical passage and in contact with said condenser.

10. A room cooler adapted to be disposed in a room adjacent a window thereof and comprising an upper cooling compartment, a lower apparatus compartment disposed at least in part directly below said upper compartment, a vertical air passage disposed rearwardly of the upper compartment and in vertical alignment and in communication with the rear portion of the lower compartment, a window duct member providing a horizontal air passage and adapted to be connected to a window opening at the rear end of said passage, the front end of said passage communicating with said vertical air passage, said window duct member being vertically adjustable and including an upper wall which extends across and forms a closure for the upper end of said vertical air passage, an evaporator disposed in said upper compartment, refrigerating apparatus including a condenser and a motor-compressor unit disposed below said upper compartment and with a part thereof in vertical alignment with said vertical air passage, and means including a blower disposed in said lower compartment for effecting flow of air vertically in contact with said part and through said vertical air passage and horizontally through said horizontal air passage.

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