Feb. 13, 1962 H. H. HOPKINSON ETAL 3,020,822

SELF-CONTAINED AIR CONDITIONING UNITS

Original Filed Dec. 16, 1955 3 Sheets-Sheet 1

FIG. 2

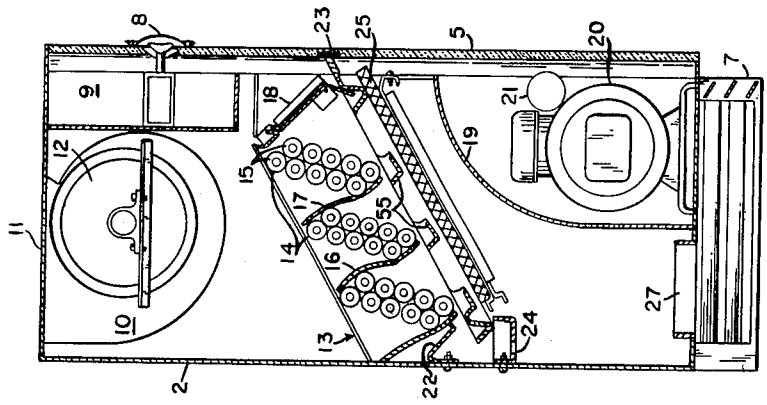
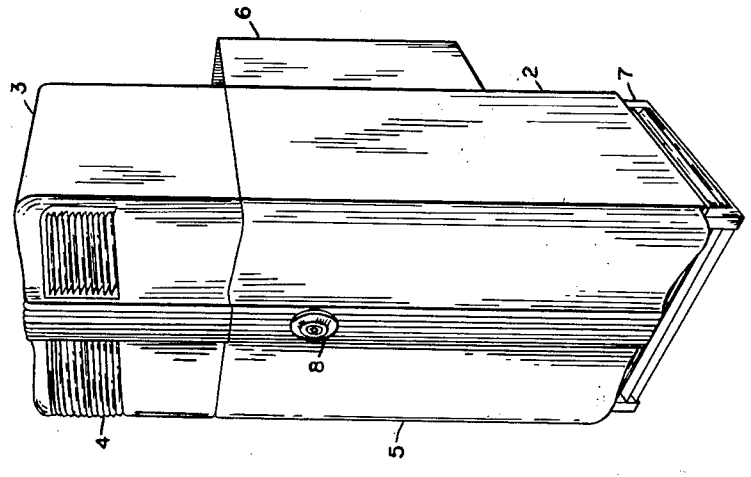



FIG. 1




INVENTORS.
HAROLD H. HOPKINSON.
MAURICE D. IRWIN.
VERNON R. KESSLER.

BY Herman Seid

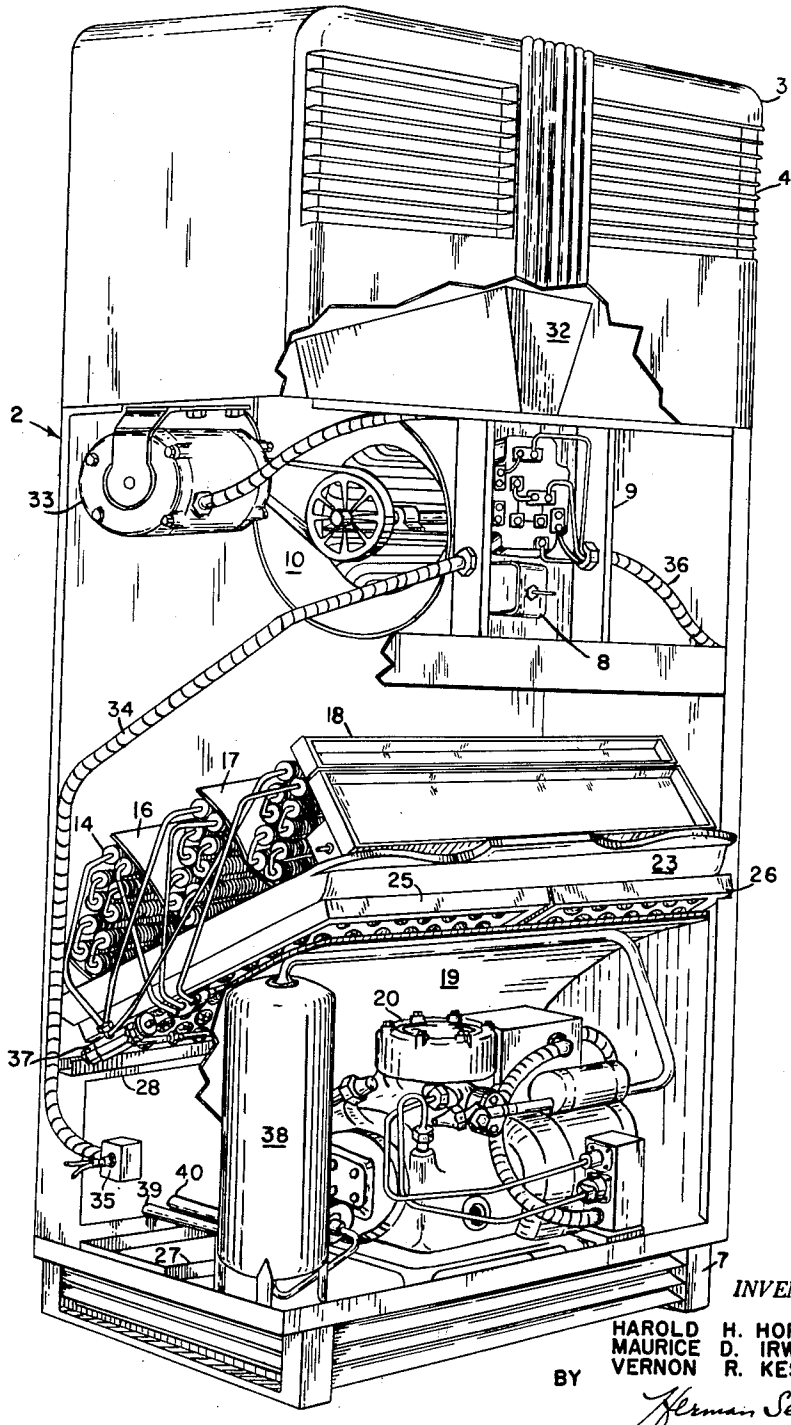
ATTORNEY.

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FIG. 3




INVENTORS.
HAROLD H. HOPKINSON.
MAURICE D. IRWIN.
VERNON R. KESSLER.

BY Herman Seid
ATTORNEY.

Feb. 13, 1962 H. H. HOPKINSON ETAL 3,020,822

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FIG. 4

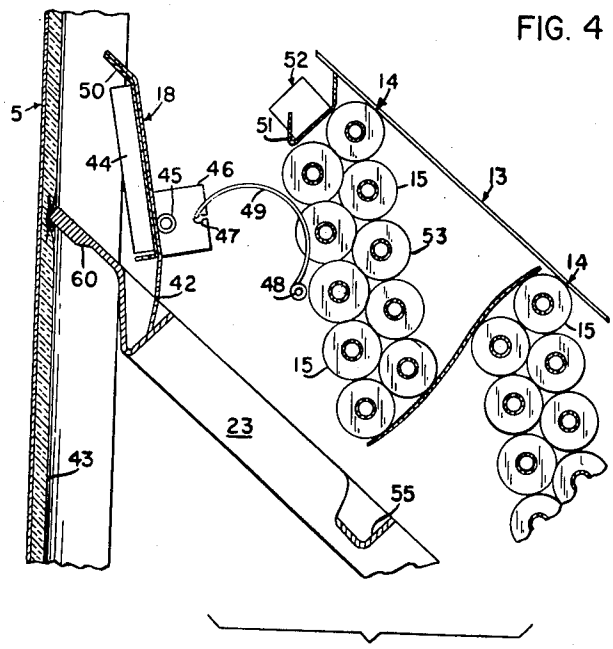



FIG. 5

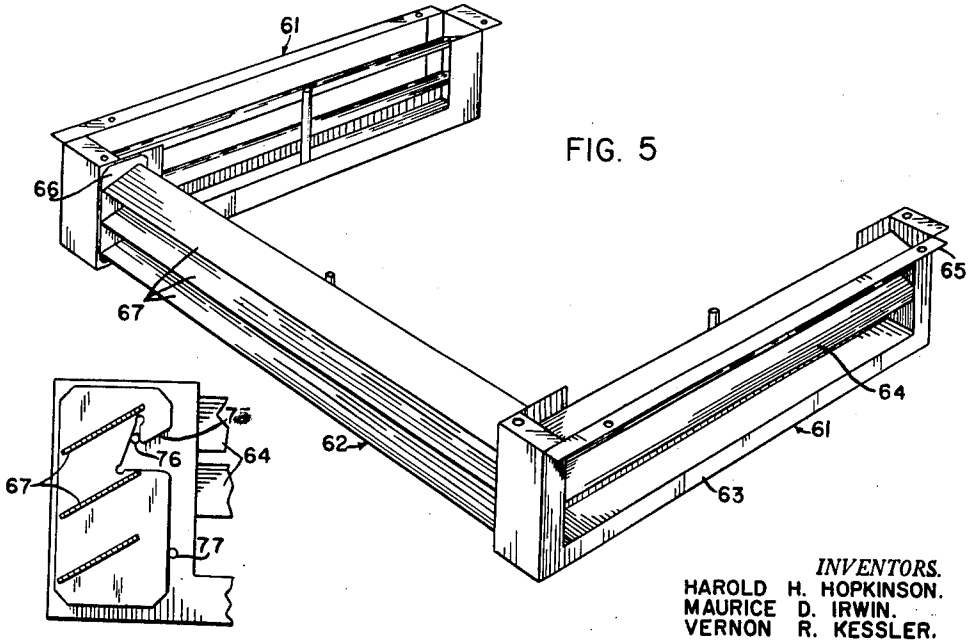






FIG. 6

INVENTORS.
HAROLD H. HOPKINSON.
MAURICE D. IRWIN.
VERNON R. KESSLER.

BY Herman Seid

ATTORNEY.

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3,020,822

# SELF-CONTAINED AIR CONDITIONING UNITS

Harold H. Hopkinson, Manlius, Maurice D. Irwin, De Witt, and Vernon R. Kessler, Fayetteville, N.Y., assignors to Carrier Corporation, Syracuse, N.Y., a corporation of Delaware

Original application Dec. 16, 1955, Ser. No. 553,501. Divided and this application Nov. 9, 1959, Ser. No. 851,653

3 Claims. (Cl. 98—121)

This application is a division of our copending application, Serial No. 553,501, filed December 16, 1955, entitled Self-Contained Air Conditioning Units, now Patent No. 2,959,031; and relates to air conditioning units and more particularly to self-contained air conditioning units in which the air handling equipment and the refrigeration system are enclosed in a common housing.

The use of self-contained air conditioning units in homes, stores, factories and offices, is very often restricted by the inflexible character of these machines. Air in such machines is customarily introduced through an intake grille in the front of the machine and is discharged from a grille spaced above the intake grille. The lower portion of the casing of such a machine is commonly monopolized by the refrigeration equipment. The orientation of components within the machine is normally dictated by the type of evaporator coil used; this in turn controls the method of condensate removal from the coils and the orientation of the filter element. Since banks of fin coils are commonly used in such units the orientation of such components has become very conventional.

The chief object of the present invention is to provide a self-contained air conditioning unit of extreme versatility which will permit application in a wide varriety of situations.

An object is to provide a unit having a novel base member which also furnishes a multi-directional air intake for the unit. Other objects of my invention will be readily perceived from the following description.

This invention relates to a self-contained air conditioning unit comprising a casing and a multi-directional air intake which also serves as a supporting base for the casing. This casing has a first compartment in communication with the air intake and a fan therein secured to an adjustable fan mounting, said fan mounting being of such a nature that air being discharged from the casing may be directed in an upward or backward direction from the machine. A refrigeration system is located within a second compartment within the casing; the evaporator of this refrigeration system is disposed in the air stream induced through the first compartment of the casing. This evaporator comprises a plurality of heat exchange and baffle members which cooperate in pairs so that air impinging upon the baffles will be directed toward the heat exchange members and be in heat exchange relation therewith. These heat exchange members comprise a plurality of parallel serpentine fin coils so arranged that condensate forming thereon will flow in a converging pattern toward the lowermost tube of each heat exchange member. Cooperating with the evaporator is a plastic drip pan adapted to collect condensate which drips from the lowermost tube of each heat exchange member. Disposed below this drip pan is a filter element through which the air passes coming from the air intake. The drip pan is made of a plastic or an insulating material and is so constructed that it does not substantially impede air flow therethrough nor does it permit the formation of condensate on the lower extremities thereof which might moisten the filter element.



The attached drawings illustrate a preferred embodiment of the invention, in which:

FIGURE 1 is a perspective view of the present invention showing an external air cooled condenser and a plenum for the air discharged from the unit;

FIGURE 2 is a sectional view of the unit employing a water cooled condenser;

FIGURE 3 is a perspective view of the unit shown in FIGURE 2 in which a large portion of the casing is removed to indicate the orientation of the components therein;

FIGURE 4 is a fragmentary view of the evaporator coil showing the pivoted baffle member;

FIGURE 5 is a perspective view of the multi-directional air intake base member;

FIGURE 6 is a sectional view of the base member showing means for mounting the front louvers.

Referring to the drawings there is shown in FIGURE 1 a self-contained air conditioning unit embodying the present invention. The unit comprises a casing **2** having a front removable panel **5** giving the unit the general shape of a rectangular parallelepiped. Mounted above the unit is a plenum **3** having louvers **4** in the front thereof through which conditioned air is discharged from the unit into the space to be conditioned. An air cooled condenser **6** is secured to the rear of the unit and is operatively connected to the refrigeration system employed by the unit. This type of air cooled condenser may be suitably attached in any desired manner to the machine and put in communication with a supply of cooling air or it may be spaced remote from the unit and be operatively connected to the machine by suitable conduits for the refrigerant to be cooled.

This type unit may employ a water cooled condenser as shown in FIGURES 2 and 3 instead of this external air cooled condenser. Located centrally in the front panel of the unit is a control center **8** which may be of the type illustrated in the copending patent application of V. Kessler and W. A. LaGrange, Serial No. 553,502, filed December 16, 1955, now Patent No. 2,869,505.

Referring to FIGURES 2 and 3 there are indicated a sectional view of the machine and a perspective view of the machine with a major portion of the front cover panel and a side panel removed from the unit. FIGURE 2 indicates the control center being connected to a suitable control box **9** wherein are situated the controls for the refrigeration system and blower fan of the unit. Behind the control box is located a suitable fan adapted to induce an air stream through the casing. In the present embodiment there is shown a centrifugal fan **10** having its discharge opening in the upper wall of the unit.

It will be noted that FIGURE 2 does not indicate the plenum **3** shown in FIGURE 1. It will be readily appreciated that suitable duct work may be attached to this fan discharge opening for discharging the conditioned air in a space remote from the machine. This fan may be mounted in an alternate position which will be described hereinafter. During operation of this fan, air is taken in through the inlet **12** and discharged through the discharge outlet **11**.

An evaporator **13** is disposed below the fan. This evaporator comprises a plurality of heat exchange members having a plurality of baffles wherein each baffle is located adjacent a heat exchange member and cooperates therewith to form an alternate arrangement of heat exchange members and baffles. In the present embodiment there is indicated a unit employing three heat exchange members **14**, each heat exchange member comprising a pair of parallel serpentine fin coils. It will be readily apparent to one skilled in the art that a greater number of serpentine coils may be employed without departing from the spirit of the present invention. Dis-

posed between these heat exchange members are the baffles **16**, **17** and **18**. It will be noted at this point that baffle **18** is pivoted in a manner and for a purpose to be described hereinafter.

Disposed below the evaporator and occupying the forward portion of the casing is a compartment defined by the partition **19** and the front cover panel **5**. Within this compartment is located components of the refrigeration system. Appearing in FIGURE 2 is a compressor **20** having a muffler **21**. The partition **19** extends upwardly and curves under the evaporator. Generally the distance between the partition and the evaporator decreases in proximity of the cover panel **5**. The purpose of this construction is to maintain a constant velocity beneath the evaporator by decreasing the cross section of the air stream as it passes each heat exchange member of the evaporator and thereby compensate for the air that has passed through the heat exchange member.

Adjacent the evaporator and attached to the rear wall of the casing is a partition **22** which extends laterally across the machine and is adapted to prevent the by-pass of air about the evaporator without being in heat exchange relation therewith. A drip pan **23** having a plurality of channels is located beneath the evaporator. The purpose of this drip pan is to prevent condensate formed on the evaporator from dripping onto and moistening the filter elements **25** and **26**. Condensate that falls into the drip pan **23** flows therefrom into a trough **24** which is connected to a suitable drainage system (not shown). Located in the bottom wall of the casing is an opening **27**. The entire unit may be mounted upon a base member having suitable louvered openings around the periphery thereof, the base member acting as an air inlet and being in communication with the opening **27**.

It will be appreciated at this point than fan **10** serves to draw air through the louvered openings of the base member **7** (to be described hereinafter), through the opening **27**, through the filter elements **25** and **26**, and through openings in the drip pan and the evaporator **13**. In the evaporator **13**, the air will either directly impinge upon the heat exchange members **14** and be in heat exchange relation therewith or will come into contact with the baffles **16**, **17** and **18**. These baffles deflect these air currents towards the heat exchange members. The air is chilled as it passes through the evaporator. Condensate may be formed which subsequently flows into the drip pan **23** and then into the trough **24** and from the unit. The air having been in heat exchange relation with the evaporator is then discharged by fan **10** into the space to be conditioned.

Referring to FIGURE 3, the unit is indicated with the plenum **3** having the louvered openings **4**. In this particular application the unit is located within the space to be air conditioned. Extending into the plenum is an air diffuser **32** which may be of the type shown in the patent to F. D. Stevens, Patent No. 2,704,971, issued March 29, 1955. This diffuser is directly mounted upon the unit and is in communication with the discharge **11** of the fan **10**. In this view there is also shown the drive means employed to operate the fan **10**. In the present embodiment a motor **33** is attached to the rotor of the fan by means of a belt and pulley drive. This motor is operatively connected to the control box **9**. Also extending from this control box are the cables **34** and **36**, cable **34** being a power cable which is connected to the power supply at the junction box **35** which is wired to a suitable source of electricity. The cable **36** is operatively connected to the refrigerant compressor in the unit.

Disposed beneath the control box and the fan, there are shown the serpentine coils which comprise the evaporator and the means of supplying refrigerant to the individual serpentine coils from the expansion valve **37**. It will be readily seen from this view that the baffle **18** is of a different construction than baffles **16** and **17**.

Located beneath the filter elements **25** and **26** is shown



the refrigeration system which is of a conventional type and employs a compressor **20** which is of the reciprocating semihermetic type. Adjacent this compressor is a water cooled condenser **38** which is connected to a supply of water by line **39** and discharged through a drain line **40**.

In FIGURE 3, the opening **27** is indicated and also an opening **28** which extends through the back wall of the unit. These openings are provided to increase the range of application of the machine. Air can be taken in from the sides and front of the machine and if desired, outside air may be employed with the present machine wherein a suitable duct may be attached to either opening **27** or **28**.

Referring to FIGURE 4 there is shown an enlarged fragmentary view of the evaporator with the construction of the baffle **18**. There is shown the front cover panel of the unit and the drip pan **23** which abuts against the insulation **43** which is secured to the back of the cover panel **5**. The purpose of this abutment is to provide a partition between the upper and lower sections of the casing and prevent air passing therethrough without being in heat exchange relation with the evaporator.

On extremely damp days it is often desired to employ an air conditioning unit in a dehumidifying capacity. It is appreciated that as air is refrigerated the capacity of the air to retain moisture is decreased thereby precipitating the moisture in the form of droplets upon the evaporator coil. It will also be readily appreciated that if the evaporator coil is permitted to become very cold it will dehumidify to a greater extent. This is accomplished in most self-contained air conditioning units by a by-pass. This by-pass unloads the coil and permits a portion of the air passing through the unit to avoid coming into heat exchange relation with the coil. In such an operation the unloading of the evaporator permits the refrigeration system to reach lower temperatures and in this way increase the dehumidifying character of the air conditioning process. In many applications this by-pass is merely a damper door placed above the evaporator putting the outside air in communication with the fan without passing through the evaporator. In such an operation it will be readily appreciated that the filter of the unit is not used and unfiltered air is being recirculated by the machine.

In the present unit, a by-pass is provided within the evaporator by providing a baffle which may be movable so that its deflecting action may be discontinued and air permitted to pass about the heat exchange member without coming into heat exchange relation therewith. This principle of operation is carried out in the present invention by the baffle **18**. It will be readily appreciated that a plurality of baffles may be provided to accomplish this function without departing from the spirit of the invention.

This baffle comprises a damper **44** having a bracket **46** which is rotatably mounted upon a shaft **45**. On this bracket eccentric of the pivot **45**, is a notch **47**. Spaced from this pin is a pin **48** mounted upon the casing and operatively connected to the notch **47** by means of a C-shaped spring **49**. FIGURE 4 shows the damper in an open position. Referring to FIGURES 2 and 3 the damper is shown in a closed position. In closed position the lip **50** on the damper **44** is in contact with the corresponding flange **51** of the stationary portion **52** of the baffle **18**. This portion **52** extends horizontally across the top portion of the heat exchange member **14**. The lip **50** is normally lined with a felt material **42** which provides an air tight gasket when the damper **44** is in closed position. It will be noted that this felt strip extends from the lip **50** along the face of the damper **44** and includes a flap which seals against the drip pan thereby assuring no uncontrolled by-passing of the evaporator by the air stream.

Again referring to FIGURE 4, the spring **49** comprises a part of a snap action bias for the damper **44**. On installation the spring is pre-stressed so that there is a con-

tinuous tendency on the part of the spring to expand. Being eccentrically connected to the bracket **46** at notch **47** it can be readily seen that the spring exerts a counterclockwise torque upon the damper **44**. As the damper **44** is rotated in a clockwise position the C-shaped spring **49** is compressed until the notch **47** passes through the plane which is defined by the axes of the pin **48** and the pivot **45**. Having intersected and passed this plane the spring is partially released and exerts a clockwise torque urging the damper member with its lip **50** into sealing engagement with the corresponding lip **51** of the horizontal section **52**.

In this enlarged view the individual serpentine coils **15** are shown and each serpentine coil comprises a parallel row of horizontal tubes **53**. These horizontal tubes are finned to increase their heat exchange area. The serpentine coils are placed in parallel relation with the plane of each serpentine coil being askew to a vertical plane. Referring to the drawing the tubes are placed in a staggered relation with the fins slightly overlapping. In this construction, as condensate is formed on the surface of the heat exchange member, the condensate will flow downwardly from tube to tube in a converging path to the lowermost tube of each heat exchange member. Should any of the condensate be entrained in the air stream it will fall upon an adjacent baffle and flow downwardly until it comes into contact with the lowermost tube of a heat exchange member. As the condensate collects on this lowermost tube it begins to drip downwardly into a channel of the drip pan **23**.

This drip pan comprises a structure fabricated of polystyrene having a generally rectangular shape. Longitudinally across the rectangular shape are channels **55** which have a general L-shape. These channels are disposed under the individual heat exchange members and are adapted to collect condensate falling from the lowermost tube of each heat exchange member. The drip pan is more fully shown and described in Patent No. 2,959,031.

At the opposite side of the drip pan is the front section **60**, the outline of which conforms generally with the shape of the cover panel **5**. As previously mentioned this section of the drip pan is in an abutting contact with the insulation on the back of the cover panel and is intended to prevent the by-pass of air around the evaporator.

It will be noted this drip pan is fabricated of polystyrene for the specific purpose of preventing formation of condensate on the underside of the structure. The temperature of condensate formed on the evaporator is relatively low and as the condensate falls into the drip pan should this drip pan be of a heat conductive material the underside of the drip pan would be chilled whereby air coming into contact with the underside would have moisture condensed therefrom. A build-up of moisture would subsequently drip on to the filter elements **25** and **26**. It will be doubtlessly appreciated that after a short interval of operation under such conditions the filter would turn into a soggy mass which would impede the passage of air therethrough and subsequently make the unit totally inoperative.

Referring to FIGURE 5 the construction of the base member is shown. This structure comprises two side members **61** and a connecting piece **62**. Each side section comprises a U-shaped sheet metal construction **63** which is intended to support physically the machine thereon. Integrally connected with this U-shaped sheet metal member are suitable flanges **65** having holes therein for suitable bolt connection to the casing **2**. These side members **61** are bolted along the bottom edges of the casing member and extend along the sides thereof. In this manner the casing is supported spaced from the floor. Extending between the side portions of the U-shaped members **63** are louvers **64** which are angularly disposed. A center member **62** which comprises a plurality of louvers in parallel relation and two connecting end plates **66**, extends along the front edge of the casing below the cover panel **5**. Each end plate **66** has a suitable indentation **75** (FIGURE 6) which engages protruding pin **76** extending from the side member **61**. Pin **76** in conjunction with pin **77** is adapted to hold and retain the center member **62** in a manner by which simple lifting of the center member permits removal from the machine. It will be perceived that a unique support has been provided which serves a dual purpose, namely, of supporting the machine and also providing a multidirectional air intake.

In reviewing this machine it is perceived that there is presented a unit having great versatility. Heretofore, air intake means were normally confined to the front section of the self-contained air conditioning unit. In this invention air is taken in at the bottom of the machine in an unobtrusive manner from all directions and there is provided means for a duct supply of air to the machine. It will be noted that the refrigeration equipment in the present machine does not monopolize the entire bottom portion of the casing but permits air to pass from the base member through an opening in the bottom wall of the casing up to the filter elements. Above these filter elements are located the drip pan and the evaporator. A unique drip pan is presented which in cooperation with a unique evaporator design only minutely impedes the flow of air through the drip pan. This drip pan is also fabricated of an insulating material which will not sweat and it is also fabricated in a shape which makes it readily removable from the machine for easy cleaning.

The present invention provides a unique evaporator which comprises a series of parallel heat exchangers, each of which has a unique scheme of condensate collection and removal. This evaporator has a novel series of baffles which deflect the air in such a manner as to provide a compact arrangement and also permits the provision of an integral dehumidification system by permitting one of the baffles to provide a by-pass about the evaporator.

A versatile fan mounting is provided which permits the fan to discharge air from the machine in an upward or backward direction. Ducts may be connected to the machine if desired to direct the air to a space remote from the machine location. A plenum may be used when the machine is placed in the space to be air conditioned.

While we have described a preferred embodiment of the invention it will be understood the invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

We claim:

1. In a base member for an air conditioning unit, the combination of first and second side members and a front member, said side members being parallel and disposed in spaced relationship, said side members each comprising a U-shaped member having an elongated base portion to the ends of which are secured upright legs, a plurality of parallel louvers angularly disposed between said legs, flanged portions extending from said legs, said flanged portions adapted to be connected to said air conditioning unit, one leg of each side member having an upper pin member and a lower pin member extending therefrom, said front member including a plurality of parallel louvers and parallel end plate members connected to the ends of said louvers, each of said end plate members having an indentation for engaging said upper pin member on a leg whereby the said front member is removably disposed between said side members.

2. In a base member for an air conditioning unit, the combination of first and second side members and a connecting member, said first and second side members being parallel and disposed in spaced relationship, said first and second side members each comprising a U-shaped member having an elongated base portion to the ends of which are secured two vertical legs, a plurality of parallel louvers angularly disposed between said legs, flanged portions extending from said legs means associated with said flanged portions for connecting said side members to the unit, one leg of each side member having a support

pin and a stop pin extending therefrom, said connecting member including a plurality of parallel louvers and parallel end plates connected to the ends of said louvers, each said end plate having at least one indentation for engaging said support pin forward of the center of gravity of said connecting member so that the connecting member pivots into abutting relationship with the stop pins and is removably mounted on said support pins.

3. In combination, a casing for an air conditioning unit, said casing having an open bottom, and a base member for spacing the casing from the floor and providing a multi-directional air intake to the open bottom of the casing, said base member comprising first and second side members and a front member, said side members being parallel and disposed in spaced relationship, said side members each comprising a U-shaped member having an elongated base portion to the ends of which are secured upright legs, a plurality of parallel louvers angularly disposed between said legs, flanged portions extending from said legs, means for connecting said flanged portions to



the casing, one leg of each side member having an upper pin member and a lower pin member extending therefrom, said front member including a plurality of parallel louvers and parallel end plate members connected to the ends of said louvers, each of said end plate members having an indentation for engaging each upper pin member forward of the center of gravity of said front member so that the front member pivots into abutting relationship with the lower pin members and is removably mounted on the upper pin members.

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