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[54] **UNIVERSAL AIR DISTRIBUTION PLENUM FOR AIR-CONDITIONING UNIT**
8 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **62/326,** 62/455, 62/507, 98/33, 165/48
[51] **Int. Cl.** **F25b 29/00**
[50] **Field of Search** 165/48, 137; 62/262, 326, 454, 455, 456, 507; 98/33

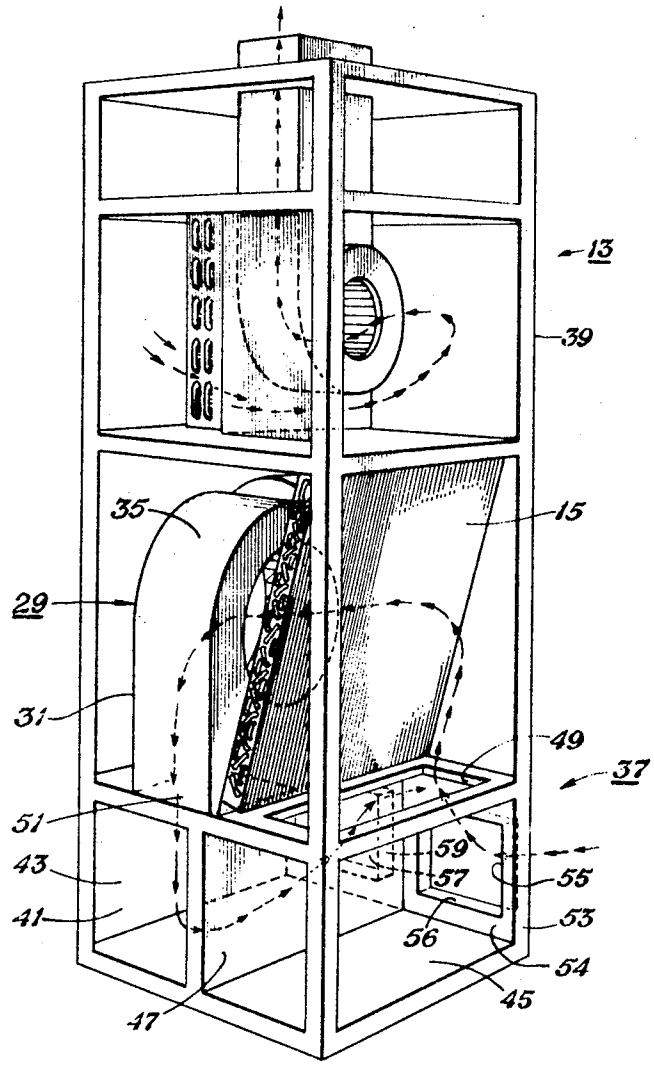
[56] **References Cited**

UNITED STATES PATENTS

2,773,676	12/1956	Boyle et al.	165/48X
3,020,820	2/1962	Hopkinson et al.	165/137X
3,174,541	3/1965	Brandt et al.	165/137X
3,194,305	7/1965	Moore	165/137X

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ABSTRACT: A universal air distribution plenum, for use with a vertically stacked self-contained air-conditioning unit requiring a minimal amount of floor space and having an air-cooled condenser means characterized by an enclosure separated into a suction chamber and a discharge chamber by an internal partition that can be oriented and at least one external panel having a second intake aperture and having a second discharge aperture that can be oriented individually or collectively along any of the axes of the air-conditioning unit. Because of its flexibility, the universal air distribution plenum can be manufactured and assembled right into the air-conditioning unit, yet with only a minor adjustment; such as, changing an external panel and without requiring space-consuming, expensive, custom-built duct turns within the minimal floor space; enable taking in cool air from a source and discharging hot air into a sink in any direction; such as, through the ceiling, beneath the floor, or through any wall of a home in which the air-conditioning unit is installed. Also disclosed are the specific elements allowing the completed unit to function, and specific preferred embodiments; such as, having a cabinet that is square in cross-sectional shape housing the air-conditioning unit, and having a plurality of interchangeable external panels containing, together or separately, the second intake aperture and the second discharge aperture for achieving flexibility in adapting the air-conditioning unit to a small space in the home and effecting connection with a source of cool air and a sink for hot air regardless of direction thereto.



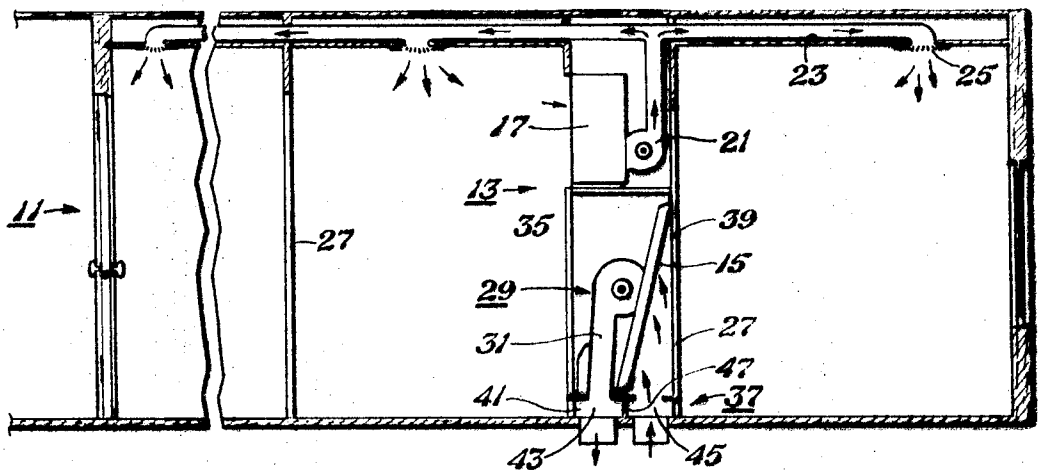


Fig. 1

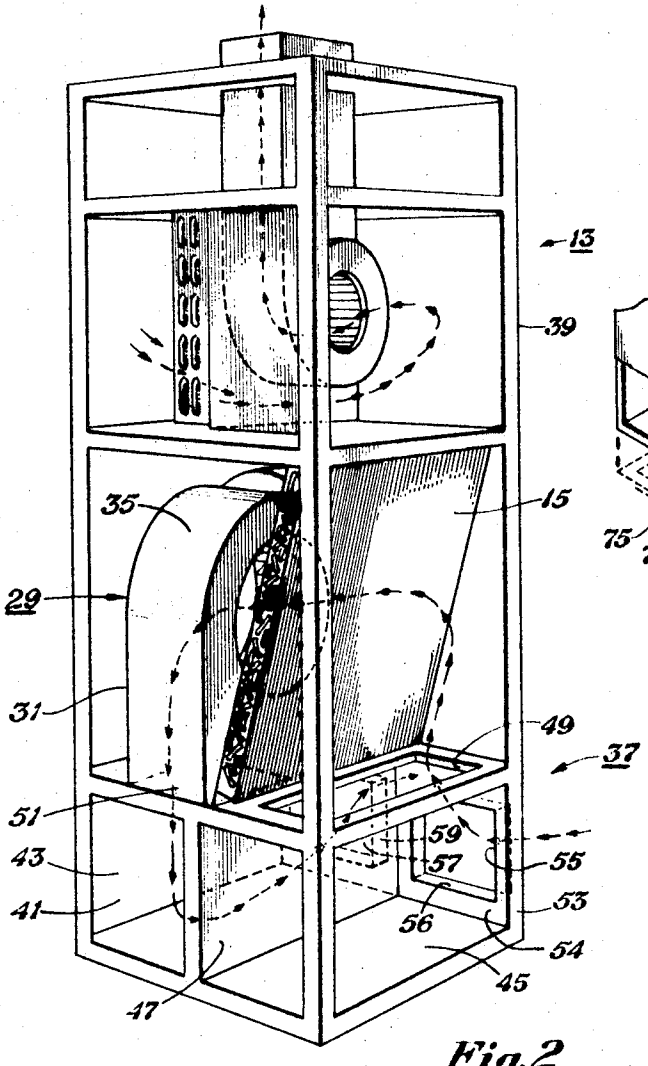


Fig. 2

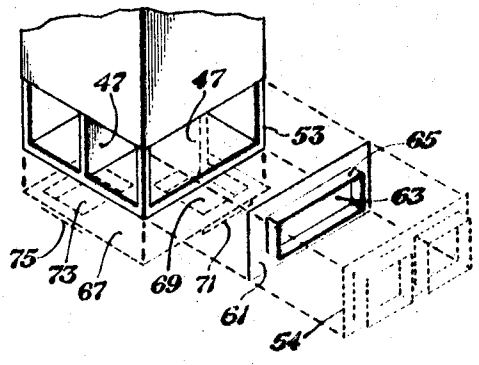


Fig. 3

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UNIVERSAL AIR DISTRIBUTION PLENUM FOR AIR-CONDITIONING UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an air distribution plenum; and, more particularly, to a universal air distribution plenum for use with a vertically stacked, self-contained air-conditioning unit employing an air-cooled condenser means and requiring a minimal amount of floor space.

2. Description of the Prior Art

Effecting proper distribution of air is a problem that can be readily solved where there is adequate space for making space-consuming, expensive, custom-built duct turns. In applications requiring a relatively large flow of air within a small space; such as, circulating air in heat exchange relationship with an air-cooled condenser for an air-conditioning unit employed in a small mobile home or apartment; the severe limitation of space presents problems. Specifically, it has not been possible heretofore to manufacture and assemble, at the factory, a self-contained air-conditioning unit which can be readily adapted to the exigencies of space requirements of small homes into which the unit will be installed. In the past this problem has not shown up since the air-conditioning units that were employed consisted of two major assemblies. One of the assemblies was employed inside the home and consisted of the circulation means and the evaporating coils for circulating and cooling air within the home. The other assembly consisted of the compressor and condenser means which were ordinarily located outside the home, obviating the requirement for any air distribution plenum in connection therewith.

Accordingly, there is no prior art of which I am aware that shows such a universal air distribution plenum that is manufactured and assembled at the factory in conjunction with a self-contained air-conditioning unit employing an air-cooled condenser and arranged in a vertical configuration. Large plenums, individually designed for, respectively, the cool inlet air or the hot discharge air, for a given installation and installed at great expense, are simply not applicable to and are unworkable in solving the problems of mass producing economical units having a universal air distribution plenum for both cool inlet air and hot discharge air, such as described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a small home employing one embodiment of the invention.

FIG. 2 is an isometric view of another embodiment of the invention with part of the panels removed.

FIG. 3 is a partial isometric view of an embodiment of the invention, and showing in dashed lines other embodiments and modifications.

DESCRIPTION OF PREFERRED EMBODIMENT(S)

It is a particular object of this invention to provide a universal air distribution plenum; for use with a vertically stacked self-contained air-conditioning unit requiring minimal floor space, and having an air-cooled condenser means and a circulation means for circulating air in heat exchange relationship with the condenser means; enabling, for a given installation, intake of cool air from a source and discharge of hot air to a sink along either the vertical axis, the front-to-rear axis, or the side-to-side axis of the air-conditioning unit without requiring an air duct turn to be made within the minimal floor space, and allowing the unit to be manufactured and preassembled at the factory, yet to be flexible enough to be adapted to the exigencies of any home in which it is placed by a simple modification such as interchanging panels.

A home employing one embodiment of the invention is illustrated in FIG. 1. Therein, home 11 has self-contained air-conditioning unit 13 having both heating and cooling capabilities. When employed to cool home 11, air-conditioning unit 13 circulates air within home 11 past evaporating coils 17 where heat is removed from the air. Detailed descriptions of the vertically stacked air-conditioning unit and the specific arrangements for effecting cooling of the condenser means are disclosed in my Pat. application Ser. No. 827,704, entitled VERTICALLY STACKED AIR-CONDITIONING UNIT, filed even date herewith. Accordingly, that discussion is not duplicated herein. Briefly, however, by use of a compressor, a refrigerant fluid, and suitable conduit, the heat is transferred from the evaporating coils to an air-cooled condenser means 15, where air from a source outside the home is circulated in heat exchange relationship with condenser means and back into a sink outside the home. Specifically, air is circulated within home 11 by blower 21 through overhead ducts 23 and overhead air diffusers 25. A return of air to evaporating coils 17 is effected via doorways 27 in home 11.

To cool condenser means 15, circulating means 29 circulates cool air in heat exchange relationship with condenser means 15 and discharges the hot air through discharge air distribution plenum 31. A powerful centrifugal blower 35 is employed to effect air circulation regardless of the length of intake and discharge ducts. As illustrated in FIG. 1, it is sometimes advantageous to take in cool air from beneath the floor of home 11. Similarly, the hot air from discharge air distribution plenum 31 may be discharged beneath the floor of my home. Consequently, duct lengths are short. Ordinarily, the floor is insulated and a baffle is provided to direct the hot air away from the cool air source. If desired, the hot air may be ducted beneath the floor and discharged at the side of the home.

Frequently these vertically stacked air-conditioning units 13 can be installed in small closets or other small rooms having access to an external wall of home 11. In such an event, the air intake source is connected via a passageway through the wall with the suction side of blower 35. Similarly, the hot air from discharge air distribution plenum 31 can be discharged through the external wall. Duct length is short in these installations also.

On the other hand, longer ducts may be required where it is necessary to run both air intake duct and air discharge duct in a crawl way space beneath the floor and above the ceiling of a downstairs apartment in the less modern apartment buildings in which there is no air-conditioning and in which there is no small room adjoining an external wall.

A universal air distribution plenum 37 is provided at the base of cabinet 39 housing air-conditioning unit 13. Universal air distribution plenum 37 has external dimensions the same as cabinet 39. In a preferred embodiment, cabinet 39 and universal air distribution plenum 37 are square in cross-sectional area. In this way, universal air distribution plenum 37 can be rotated with respect to cabinet 39 if desired. Ordinarily, rotation of plenum 37 is not necessary because of the high degree of versatility effected by interchanging panels thereon, as described hereinafter. Universal air distribution plenum 37 consists essentially of an enclosure 41 divided into two separate chambers 43 and 45 by partition 47. Chamber 43 serves as a discharge chamber and chamber 45 serves as a suction chamber.

FIG. 2 illustrates the construction of plenum 37 clearly. In addition to the elements delineated hereinbefore, intake aperture 49 at a vertical end; such as, the bottom of cabinet 39; communicates between suction chamber 45 and the suction side of centrifugal blower 35 in circulation means 29. As illustrated, air is drawn through condenser means 15 enroute to the suction side of centrifugal blower 35. Discharge aperture 51 at the bottom of cabinet 39 communicates between discharge air distribution plenum 31 of the circulation means and discharge chamber 43.

Fluid-impermeable panels are fastened, as by sheet metal screws, to the framework 53. At one end of partition 47 at least one removable panel means 54 contains a second intake aperture 55 and lip extension 56 for communicating between a source of cool air and suction chamber 45. Removable panel means 54 also contains a second discharge aperture 57 and lip

extension **59**, shown in dashed lines, for communicating between discharge chamber **43** and a sink for hot air.

Removable panel **54** is interchangeable with the fluid-impermeable panel at the other end of partition **47**. Accordingly, cool air can be readily taken in through second intake aperture **55** and discharged through second discharge aperture **57** in either direction along the front-to-rear axis of air-conditioning unit **13**.

On the other hand, panel **54** may contain either the second intake aperture **55** or the second discharge aperture **57** alone and the panel at the opposite end of partition **47** contain the other of either the second discharge aperture or the second intake aperture. In this way, the source for the cool air and the sink for the hot air can be widely separated to eliminate any tendency to recirculate hot air.

FIG. **3** illustrates other configurations of universal air distribution plenum **37**, showing partition **47** within enclosure **41** and apertures within panels on framework **53**. As illustrated, partition **47** may be oriented along either the front-to-rear axis or the side-to-side axis, shown in dashed lines. It is usually desirable for partition **47** to divide enclosure **41** into chambers of approximately equal volume.

Ordinarily, employing interchangeable panels provides adequate flexibility for the air-conditioning unit to be adapted to any installation. For example, removable panel **61** may contain a single aperture **63** and lip extension **65** for taking in cool air or discharging hot air normal to the axis of partition **47**. Alternatively, by preplanning and appropriate arrangement of intake and discharge apertures, panel **54** and partition **47** may be changed, as illustrated by dashed lines, to align with the side-to-side axis of air-conditioning unit **13** instead of the front-to-rear axis.

Instead of the equidimensional and interchangeable four side panels which are removably fixed to framework **53** and to cabinet **39** to provide for orientation along either of the two major axes of the cross-sectional area of air-conditioning unit **13**, increased viability and flexibility is achieved by employing a bottom **67**, shown in dashed lines, having second intake aperture **69** and lip extension **71** and second discharge aperture **73** and lip extension **75**. Any orientation of the respective apertures in bottom **67** may be employed as long as the integrity of the respective chambers is maintained and cross-communication of air therebetween in prevented.

If desired, bottom **67** may be comprised of two panels. I have found that, with a square plenum **37**, six panels, half as wide as they are long, may be employed, one on each of the four sides and two on the bottom to afford a degree of versatility that will meet exigencies of any installation yet encountered. That is, of the six interchangeable panels a single panel may have both the second intake aperture and the second discharge aperture and provide adequately for intake and discharge of air along any of the three major axes of the unit and provide flexibility which will allow covering more than 90 percent of the installations to be made. If desired, two of the six panels may each contain a single aperture; one panel containing the aperture for use as either the second intake aperture or the second discharge aperture, and the other panel containing the aperture for use as either the second discharge aperture or the second intake aperture. This flexibility covers the remaining 10 percent of the installations in which the source of cool air is located at a point remote from the sink into which the hot air is discharged.

The invention has been described with respect to an air-conditioning unit having the air-cooled condenser vertically beneath the evaporating coils. It may be employed advantageously with inverted units in which the air-cooled condenser vertically overlies the evaporating coil and the universal air distribution plenum is used to effect circulation of cooling air from and toward a given direction or directions through the walls or the ceiling, instead of the floor.

The materials ordinarily employed in construction of air-conditioning units and cabinets may be employed with the universal air distribution plenum of the invention. Preferably, however, the panels attached to the framework and partition between the chambers are thermally and acoustically insulated, because it is desirable to attenuate the noise of the relatively high velocity of air flowing therethrough, and because it is desirable to isolate the chambers, thermally, from each other. The acoustical and thermal insulation is readily supplied by known means; such as, the asphaltic or asphaltic asbestos undercoating commonly employed on automobiles sprayed onto the external panels and the partition. I have found that sheet metal panels are adequate and that metal framework is preferred. Preferably framework **53** is strong enough to support the weight of the entire air-conditioning unit above floor level. The exterior of the metallic panels are painted with an enamel or paint to present a pleasing appearance, coordinated with the remainder of air-conditioning unit **13**.

Although the invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

I claim:

1. In a vertically stacked self-contained air-conditioning unit having a cabinet requiring minimal floor space and having an air-cooled condenser means and a circulation means for circulating air in heat exchange relationship with said condenser means, the improvement comprising a universal air distribution plenum for effecting intake of cool air from a source and discharge of hot air to a sink along either the vertical axis, the front-to-rear axis, or the side-to-side axis of said air-conditioning unit with a multidirection plenum, said universal air distribution plenum consisting essentially of:

a. an enclosure defined by a framework having cross-sectional external dimensions conforming to the cross-sectional dimensions of said cabinet;

b. a fluid-impermeable partition separating said enclosure into two chambers, one for serving as a suction chamber and one for serving as a discharge chamber;

c. an intake aperture at a vertical end of said cabinet and communicating between said suction chamber and the suction side of said circulation means;

d. a discharge aperture at said vertical end of said cabinet communicating between said discharge chamber and the discharge side of said circulation means; and

e. a plurality of panel means adapted to be fixed to said framework defining said enclosure, including at least one panel means containing a second intake aperture and lip extension for communicating between said source of cool air and said suction chamber, and at least one panel means containing a second discharge aperture and lip extension for communicating between said discharge chamber and said sink for hot air; said intake aperture, said discharge aperture, said partition and said plurality of panel means being interchangeably positionable for orientation to effect, individually and respectively, intake of said cool air and discharge of said hot air along either said vertical axis, said front-to-rear axis, or said side-to-side axis.

2. The air-conditioning unit of claim **1** wherein said intake aperture and said discharge aperture are fixed in relation to said cabinet, said partition is oriented to separate said intake aperture and said discharge aperture and one of said plurality of panel means contains both said second intake aperture and its lip extension and said second discharge aperture and its lip extension and is positionable at one end of said partition such that said partition also separates said second intake aperture and said second discharge aperture.

3. The air-conditioning unit of claim **2** wherein said second intake aperture is adopted to take in cool air from said source of cool air at an external wall of a home in which said air-conditioning unit is installed and said second discharge aperture is

adopted to discharge said hot air into said sink for hot air through said wall.

4. The air-conditioning unit of claim 1 wherein said intake aperture and said discharge aperture are fixed in relation to said cabinet, said partition is oriented to separate said intake and discharge apertures and one of said plurality of panel means contains both said second intake aperture and said second discharge aperture and is positioned at the vertical end of said enclosure opposite said cabinet.

5. The air-conditioning unit of claim 4 wherein said second intake aperture is adopted to receive cool air from said source of cool air beneath a floor of a home in which said air-conditioning unit is installed and said second discharge aperture is adopted to discharge hot air into said sink for hot air beneath said floor.

6. The air-conditioning unit of claim 1 wherein said cabinet is equidimensional in cross section, said plurality of panel means comprise four removable panels that are interchangeable, and said partition is removably fixed for orientation along either the front-to-rear axis or the side-to-side axis.

7. The air-conditioning unit of claim 1 wherein said cabinet has a square cross section and said plurality of panel means comprise six panels, the panels being one-half as wide as they are long, said panels are interchangeable on the side and on the vertical end opposite said cabinet; and two of said panels contain a single aperture each for use as said second intake aperture and said second discharge aperture.

8. The air-conditioning unit of claim 1 wherein said cabinet has a square cross section and said plurality of panel means comprise six panels, the panels being one-half as wide as they are long, said panels are interchangeable on the sides and on the vertical end opposite said cabinet; and wherein one of said panels contains two apertures for use as both said second intake and said second discharge apertures.