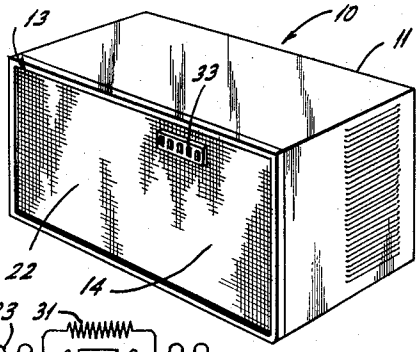
Jan. 28, 1964 W. F. KRAMER 3,119,242

AIR CONDITIONING APPARATUS

Filed Aug. 8, 1962

FIG. 1.



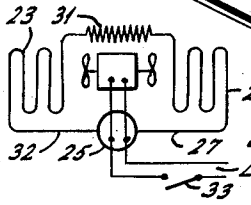
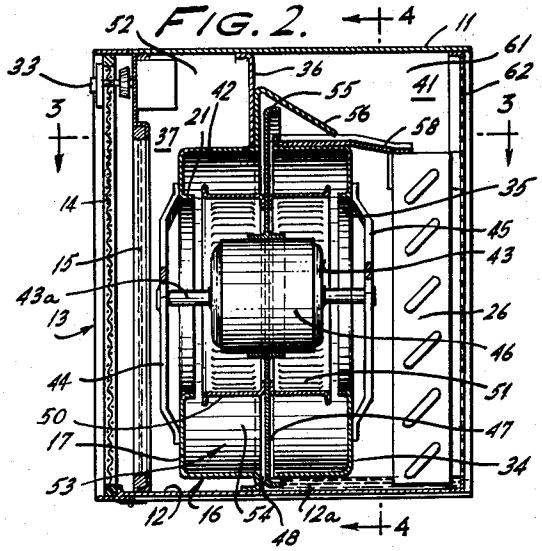


FIG. 6.

FIG. 2.



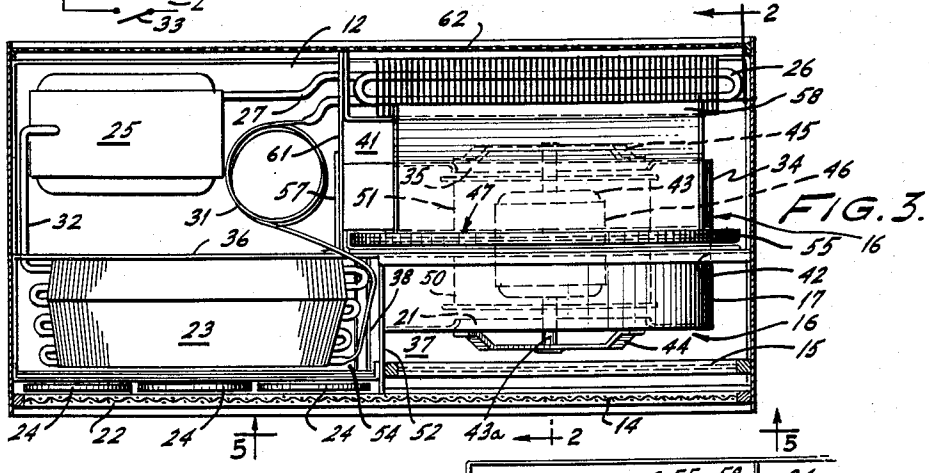


FIG. 3.

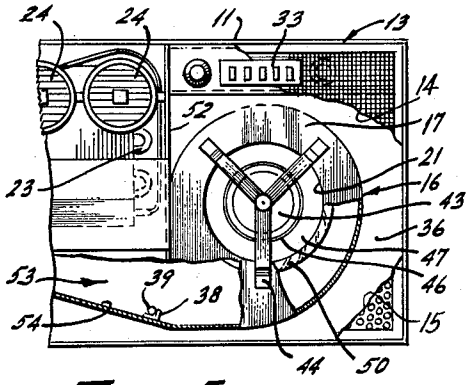


FIG. 5.

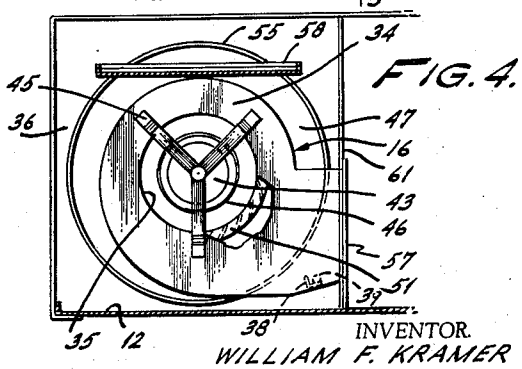


FIG. 4.

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AIR CONDITIONING APPARATUS

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3 Claims. (Cl. 62—230)

This invention relates to refrigeration, and more particularly to air conditioning apparatus of a compact and unitary type.

In air conditioners, and particularly in unitary apparatus of the type commonly referred to as "single-room coolers," it is of substantial importance that the overall dimensions of the apparatus or unit be as small as possible. Achievement of this end has presented problems, especially in view of the relatively large capacity which is desired in units of this kind. Basically, the refrigeration circuit employed in such units is well known, and the measure of public acceptance accorded apparatus of this type depends to a substantial degree on reducing its overall dimensions to the smallest possible limits. It is important, however, that such reduction be accomplished without sacrifice of either capacity or flexibility of operation.

It is therefore the primary object of this invention to provide a room cooling unit which is unusually small and compact.

It is another object of the present invention to provide, in an air conditioner, novel compact air moving apparatus of a unitary nature.

The invention is featured by provision of novel compact air moving means in which air impeller elements serve also as means for defining the air flow path.

To the foregoing general ends, the invention comprises, in a preferred embodiment thereof, air conditioning apparatus of the type including unitary fan means for forcibly circulating air in heat exchange relation with cooling elements, which fan means includes novel movable partition means so cooperatively disposed as respects fixed elements of the apparatus as to define air passages minimizing the overall dimensions of the unit while maintaining optimum operating characteristics thereof. In a more specific aspect of the invention, the objectives are achieved by using a blower motor of the external rotor type, in which the fan blading and movable partition means are carried by said rotor.

The manner in which the foregoing as well as other objects and advantages are realized will be more fully understood from a consideration of the following description taken in light of the accompanying drawing forming a part of this disclosure and in which:

FIGURE 1 is a perspective showing of air conditioning apparatus embodying the invention;

FIGURE 2 is a sectional view in elevation of the apparatus seen in FIGURE 1 and looking in the direction of arrows 2—2 applied to FIGURE 3 described below;

FIGURE 3 is a plan view, partly in section and with parts removed, of the apparatus seen in FIGURES 1 and 2 and looking in the direction of arrows 3—3 applied to FIGURE 2;

FIGURE 4 is an elevational showing, partly in section and with parts broken away, of apparatus as seen in FIGURE 2 and looking in the direction of arrows 4—4 applied to the latter figure;

FIGURE 5 is an elevational showing of apparatus seen in FIGURE 3, and looking in the direction of arrows 5—5 applied to the latter figure; and

FIGURE 6 is a diagrammatic showing of the refrigerant and electrical circuitry which may be used in combination with apparatus embodying the invention.

With more detailed reference to the drawing, and first

to FIGURES 1, 2, and 3, the window mounted air conditioner 10 includes a cabinet or housing 11 rectangular in configuration and having a base portion 12 and a conventional decorative panel 13, the latter comprising inlet and outlet room air passage means for the air moving means to be hereinafter more fully described. The inlet air passage means includes grill portion 14 and a filter 15 disposed in registry with the latter and in air flow communication with the inlet opening 21 of indoor blower scroll 17 of the air moving means 16. The outlet air passage means includes grill portion 22 disposed in air flow communication with an evaporator 23 preferably of coil form, hereinafter also referred to as the indoor coil. As seen also in FIGURES 3 and 5 a plurality of independently rotatable louvers 24 are disposed between the evaporator coil 23 and outlet grill portion 22 and are adapted to provide selectivity of the direction of discharge air flow.

With reference to FIGURES 3 and 6, evaporator coil 23, preferably of the finned type, is part of the usual refrigerating system which comprises a motor compressor 25, condensing or outdoor heat exchanger, or coil 26, and associated conduits through which the motor compressor, condensing, and evaporator coils are coupled in series flow circuit. The conduits include a line 27 through which the refrigerant normally is delivered to condensing coil 26 and a restrictive feed line 31 which may advantageously comprise a capillary tube through which liquid refrigerant is normally fed from condensing coil 26 to the indoor or evaporator coil 23. Refrigerant is withdrawn by the compressor from the evaporator coil through the suction line 32 to complete the refrigerant flow circuit. Compressor 25 is selectively energized through line L having in series therewith control switch means 33 which may comprise one of a number of known type manually or thermostatically actuatable switches.

As best seen in FIGURES 2, 3, and 4, the air moving means 16 comprises, in addition to the "indoor" blower scroll 17, an "outdoor" scroll 34 including an inlet opening 35. Scrolls 17 and 34 are substantially symmetric and are disposed to either side of a partition 36 that divides housing 11 into an indoor chamber 37 and an outdoor chamber 41. Partition 36 has an opening 42 therein, and scrolls 17 and 34 have open adjacent sides disposed in substantial registry with opening 42.

With reference also to FIGURE 5, an electric motor stator 43 is mounted on the scrolls 17 and 34 by attachment of shaft-like portion 43*a* to brackets 44 and 45. Stator 43 further is axially aligned with scroll inlets 21 and 35 and with opening 42 in the partition. The motor is of the external rotor type and an annular rotor 46 is disposed about stator 43 and is axially aligned with the latter. Suitable bearing means (not shown) are disposed and adapted to support rotor 46 and provide for rotation thereof in spaced relation to stator 43.

In particular accordance with the invention, rotatable disk means 47 is supported on external rotor 46 and, while axially aligned with the latter, spans the opening 42 and extends within a slot 48 (FIGURE 2) formed by confronting spaced edge portions of scrolls 17 and 34. A series of blower vanes 50 and 51 are also mounted for rotation with rotor 46 and extend transversely of disk means 47 into scrolls 17 and 34. In the illustrated embodiment, vanes 50 are supported by disk means 47 within indoor scroll 17, and vanes 51 are supported by disk means 47 within outdoor scroll 34. However, it will be understood that vanes 50 and 51 may be formed singly, as a unit, and extend to either side of disk means 47.

As best seen in FIGURE 5, the mouth portion 53 of indoor scroll 17 extends through a partition 52 into position to direct indoor air upwardly through finned portions of evaporator coil 23 for flow outwardly through

louvers **24** and outlet grill **22**, which air first is withdrawn from indoors (see also FIGURE 3) through inlet air grill **14**, filter **15**, and inlet opening **21** of scroll **17**. Mouth portion **53** comprises a sloping air directing baffle **54** onto which condensate drips from evaporator coil **23**, and which condensate is directed by a trough **38** extending across baffle **54** into an opening **39** in partition **36**, which opening leads to a sump-like portion of base **12***a* disposed below scroll **34**. This construction is disclosed and claimed in U.S. Patent 3,000,192, issued September 19, 1961, and assigned to the assignee of the present invention.

As appears with reference to FIGURES 2, 3, and 4, disk **47** may, and preferably does, include a flanged slinger ring **55** disposed along its periphery and adapted to dip into collected condensate and entrain the same as it is rotated. As best seen in FIGURE 2, entrained condensate is thrown against a suitably positioned sloping baffle **56** and drains therefrom onto a sloping plate **58** disposed and adapted to direct condensate onto coil **26** for evaporation from the same.

With further reference to FIGURES 3 and 4, outdoor scroll **34** includes a mouth portion **57** that extends through a partition **61** and into position to direct air over compressor **25** thence outwardly through an outdoor grill **62**. Air discharged in this manner is first drawn from outdoors through grill **62**, over finned condensing coil **26**, and into the inlet opening **35** of blower **34**.

In order to minimize air leakage between the outdoor and indoor chambers, **41** and **37** respectively, through spaces between adjacent portions of rotating disk **47** and partition **36**, those structural characteristics which affect air flow through chambers **37** and **41** are so established experimentally as to provide substantially equal absolute air pressures within the chambers. This can be done for example by modifying cross-sectional areas of inlet and outlet air passages of the respective chambers while measuring pressures to establish the optimum arrangement for maintaining pressure equalization. For example, areas of inlet and outlet air flow openings in respective indoor and outdoor grills **13** and **62** can be predetermined to establish the desired air pressure to either side of panel **36** in the region of opening **42**.

While a pair of like blower wheels and scroll housings have been illustrated in the preferred embodiment, it will be appreciated that the blower assemblies may take other forms. For example either blower wheel, or both, may comprise propellor-type fans having blades disposed to either side of a rotating disk and adapted to effect both axial and radial flow relative thereto, whereby air may be drawn axially of the fans into the housing and discharged radially from the blade tips into the adjacent chamber. One such fan arrangement is disclosed and claimed in the U.S. Patent No. 2,952,997 of William H. Mullin, which patent is assigned to the assignee of the present invention. It will however be appreciated that the invention is susceptible of the foregoing and such other modifications as fall within the scope of the appended claims.

In summation, the invention advantageously achieves a high degree of compactness in a room air conditioner through the novel positional relationship, between the motor and air impeller elements, achieved by the use of a rotating partition with substantially equalized air pressures, as disclosed. Moreover the impeller elements per se advantageously contribute to the compactness by incorporating a condensate slinger ring with the combination partitioning and vane supporting disk means.

I claim:

1. In air conditioning apparatus, the combination comprising: means defining a housing; partition means dividing said housing into a pair of chambers, said partition means having an opening; a refrigerant evaporator in one of said chambers; a refrigerant condenser in the other of said chambers; a pair of axially aligned blower scroll portions having open lateral wall portions confronting one another and disposed in registry with said opening, said scroll portions being so axially spaced from one another as to form a generally annular slot therebetween; and means defining a blower wheel within said scroll portions, substantially axially aligned therewith, and including a generally disk-shaped partition rotatable with said wheel and extending radially outwardly from the axis of said wheel and said scroll portions and into the slot formed by the latter, a portion of the blower wheel being disposed to one side of said disk-shaped partition and adapted to move air over said evaporator, and a portion of the blower wheel being disposed to the other side and adapted to move air over said condenser.

2. Apparatus according to claim 1 and further characterized by including means defining a sump for collecting condensate formed upon said evaporator, said disk-shaped partition being disposed and adapted, as it is rotated, to entrain collected condensate and to elevate the latter for flow over said condenser.

3. In an air conditioner including an evaporator and a condenser, a blower assembly comprising: a blower scroll having a peripheral slot; means defining a stator axially mounted within said scroll; rotor means disposed about said stator and axially aligned therewith; bearing means disposed and adapted to support said rotor means and providing for rotation thereof in spaced relation to said stator; disk means supported on said rotor means in axial alignment therewith, said disk means including a portion projecting through said slot and having flange means extending along its periphery; means for directing condensate formed upon said evaporator, in the normal operation thereof, onto said flange means whereby upon rotation of said disk means said flange means entrains condensate and discharges it through said slot in the scroll for flow over said condenser; and blower vanes extending transversely to either side of said disk means and mounted for rotation with said rotor means, said disk means being disposed in cooperative relationship with said scroll to provide a pair of independent flow paths through said scroll to either side of said disk means, one of said flow paths being adjacent said evaporator, and the other of said flow paths being adjacent said condenser.

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