

June 23, 1936.

L. W. CHILD

2,044,832

AIR CONDITIONER

Filed June 26, 1934

2 Sheets-Sheet 1

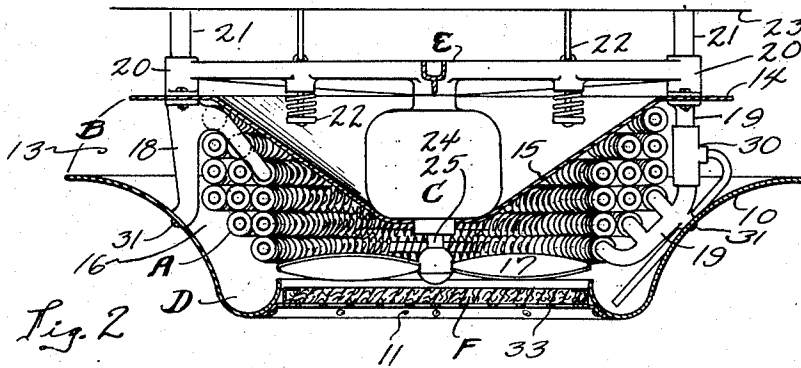


Fig. 2

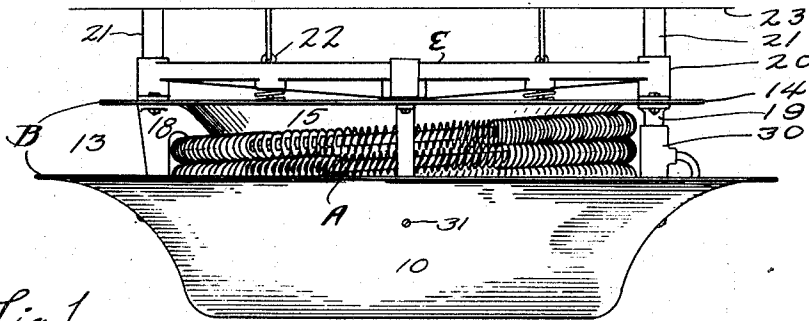


Fig. 1

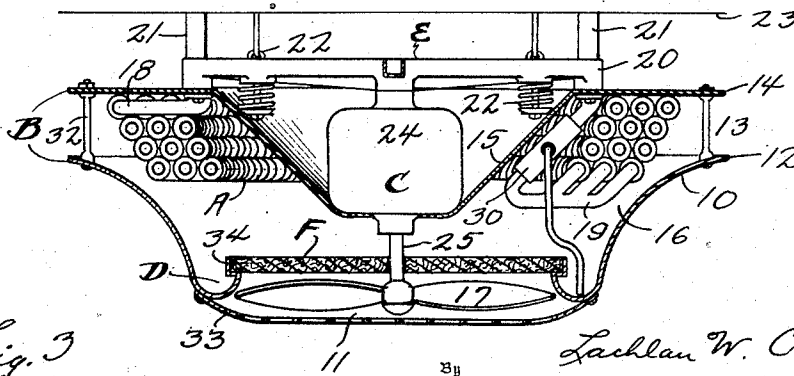


Fig. 3

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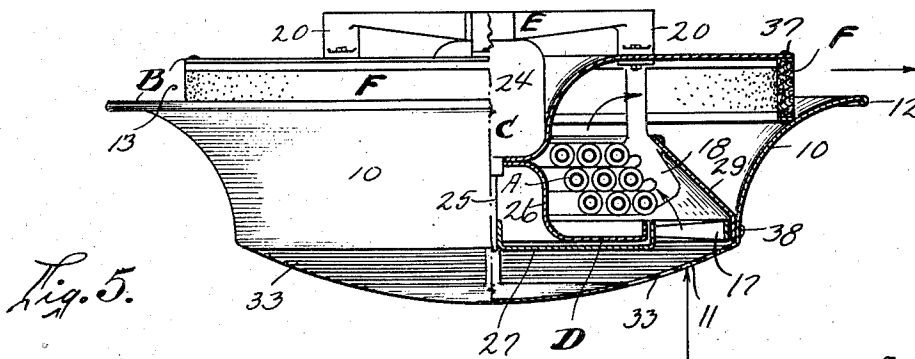
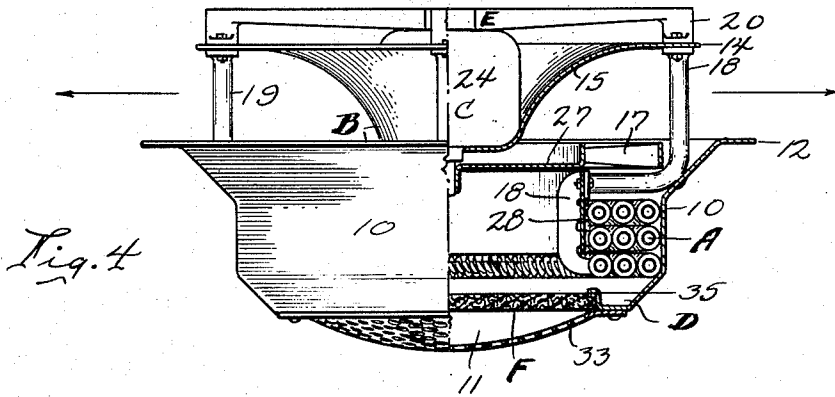
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,044,832

AIR CONDITIONER

Lachlan W. Child, Toledo, Ohio, assignor, by
mesne assignments, to Aeriet Air Conditioner
Company, a corporation of Illinois

Application June 26, 1934, Serial No. 732,411

13 Claims. (Cl. 257—244)

This invention relates to air conditioners of the ceiling suspended type wherein a fan and heat transfer element are coaxially mounted on a vertical axis, as illustrated in my application Serial No. 729,544, filed June 8, 1934, of which the present application is a continuation in part.

An object of the invention is to provide a unit of this type adapted to discharge the air conditioned by it, in such a manner as to produce the best possible distribution of such air to the region of occupancy in the room in which it is installed. To this end, the unit is adapted to distribute cooled air radially in all directions in a substantially horizontal plane above the region of occupancy in the room in which it is installed.

An object of the present invention is to provide a successful unit of this type in which the air circulating means is in the form of a propeller type fan.

An object of the invention is to provide a successful arrangement of propeller type fan and annular heat transfer coil on a common vertical axis, with means for collecting and disposing of condensate from the coil when it is operating on the cooling side.

Another object is to provide a unit of this type which is adapted for both heating and cooling, and which is adapted to secure maximum efficiency in the distribution of conditioned air to the region of occupancy when operating either as a heater or as a cooler.

To this end, the invention contemplates the employment of reversible air propelling means, adapted when operated in connection with a heat transfer unit operated as a cooler, to take air into the unit through a bottom opening in the unit, and to discharge cooled air in a generally horizontal direction through a peripheral opening near the top of the unit, and, when operated in connection with the same heat transfer unit operating as a heater, to take air in through said peripheral opening and to discharge heated air downwardly through said bottom opening.

Other objects are to provide a unit of this type which is relatively simple and inexpensive in comparison to its capacity, is easily disassembled for adjustment or repair, and yet is strong and durable in construction.

With these and other objects in view my invention consists in the combination and construction and arrangement of the various parts thereof, whereby the objects contemplated are attained, as more fully set forth in the accompanying specifications, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevation of one form of the invention.

Fig. 2 is a vertical sectional view of the same.

Fig. 3 is a similar view of another form of the invention.

Fig. 4 is a view, partly in section and partly in elevation, of another form of the invention.

Fig. 5 is a similar view of another form of the invention.

The invention employs a heat transfer element A, in the form of a hollow coil, a casing B which serves to protect and conceal the coil A and to direct air therethrough, a motor-fan assembly C for producing air circulation through the unit, a condensate trough D for collecting condensate that drips from the coil A, a frame or spider E on which the remainder of the unit is suspended, and an air filter F.

The casing B includes a lower main member 10, which conceals the operating parts of the unit, provides a central bottom opening 11, and flares upwardly to a much wider periphery 12, above which is formed the top peripheral opening 13. The casing B also preferably includes a top member 14 having a central dished portion 15 roughly paralleling the flaring lower casing 10.

Between the casing members 10 and 14 is formed a roughly bell-shaped annular passageway 16 terminating at its lower end in the bottom opening 11, relatively centrally located, and at its upper end in the annular peripheral opening 13, of greater diameter and at a higher elevation. The passageway 16 makes an elbow bend in all directions from the axis of the unit, which is also the axis and general direction of air movement through the bottom opening 11, whereas the air movement through the top opening 13 is at right angles thereto, in substantially horizontal direction. The fan 17 propels the air in the direction of movement through the lower opening 11, i. e., axially of the unit, and the casing members 10 and 14 guide the air currents through the right angled bends from the opening 11 to the opening 13, or vice versa as the case may be.

The lower opening 11 may be either a single central opening as in Figs. 1-4 incl., or an annular opening, spaced somewhat from the center of the unit but very substantially within the circumference of the upper opening 14 as in Fig. 5. The latter form has the advantage of greater possible area. In either case, the lower casing member 10 serves to reduce to a minimum, cross air currents between the two openings.

Where the lower opening 11 is central, as in Figs. 1-4, the air moves through the conditioner

in upward and outward directions, or in inward and downward directions, depending upon whether cooling or heating is being effected. In Fig. 5, however, the air moves inwardly, upwardly, thence outwardly; or inwardly, thence downwardly, thence outwardly, as the case may be.

In order to guide the air in this manner, the form shown in Fig. 5 includes a central air guiding dome 26 which is a separate member secured to the underside of the central dished portion 15 of the upper casing member, and an air guiding skirt 29 which is trunco-conical, converging upwardly around the coil A.

In Fig. 4, the air is constrained to pass through the coil A, by the sleeve 28 forming a wall inside the coil, and between the lower casing member 10, and the solid web 27 of the fan 17. An annular opening between the inner edge of the trough D and the lower edge of the sleeve 28, allows the air to pass from the filter F to the element A or vice versa.

The coil A occupies a section of the space 16. In Figs. 2 and 5 it is substantially halfway between the upper and lower extremities of the space 16. In Fig. 3 it is near the top thereof. In Fig. 4 it is near the bottom thereof. In each case it extends annularly and coaxially in the space and its general cross section substantially traverses the space from the inner to the outer extremity of the cross section thereof which is occupied by the coil.

The coil A is preferably made from what is known in the art as "fin tubing" and is supplied with a heating or cooling fluid, and supported, by manifolds. The manifolds in turn are supported by the spider E, the latter having on the ends of its arms unions 20 to which the manifolds 18, 19 are connected with the upper casing member 14 intervening and thereby supported.

Flexible tubes 21 carry the heating or cooling fluid to the unions 20. Spring mountings 22 suspend the spider E from the ceiling 23 and absorb vibrations for sound deadening purposes.

The motor 24 is hung from the center of the spider E and is accommodated in the dished central region 15 of the upper casing member 14. The motor shaft 25 carries the fan 17.

Either the motor 24 or the fan 17 is reversible. In the form shown in Figs. 4 and 5 the reversibility is in the motor. In the form shown in Figs. 2 and 3, the fan 17 is reversible, or may be removed and replaced by a fan of opposite pitch.

The condensate trough D either completely underlies the element A, as in Figs. 4 and 5, or is connected thereto by an inclined drainway which in Figs. 2 and 3 is formed by the lower casing member 10.

In Figs. 1-4 incl., the condensate trough D encircles the opening 11. In Fig. 5 it lies within the outer circumference of the opening 11 and above the plane thereof, in which case the opening 11 may extend beneath the trough as shown. In fact, in the form shown in Fig. 5, the whole bottom of the casing member 10 may, if desired, be open.

The fan and the passage 16 are in each case arranged so that the area traversed by the fan is substantially coextensive with one horizontal cross section of the passage 16 or with the opening 11, which forms the lower terminus of the passage. In Fig. 3, the fan traverses the opening 11 and is below the trough D. In Fig. 2, the fan traverses the passage 16 between the trough D and the element A. In Fig. 5, the fan substantially registers with the annular opening 11, and

encircles the trough D. In this case, the fan has a web or spider 27 which extends below the trough D.

In Fig. 4, the fan traverses the passage 16 above the coil A.

The filter F also is arranged in each case to traverse the passage 16. It may traverse the opening 11, as in Figs. 2 and 4, it may traverse the passage 16 between the fan 17 and the coil A, as in Fig. 3, or it may traverse the upper opening 13 as in Fig. 5.

In each case the collected condensate is withdrawn from the trough D by a Venturi pump 30 located in the fluid line carrying cooling or heating fluid to and from the coil D. The pump is shown in Figs. 2 and 3, and is embodied in but not disclosed in the forms shown in Figs. 4 and 5.

The surplus water thus introduced into the system is disposed of at the refrigerating unit (not shown) which supplies refrigerated water to the coil A, as illustrated in my prior application above mentioned.

The upper casing member 14 is supported by its attachment to the spider E. The lower casing member 10 is detachably hung from the manifold 18 and 19 as by means of screws 31 (Figs. 2 and 4) or from the upper casing member 14 as by hangers 32. In either case, the lower casing may be dropped, leaving the upper casing member, the coil A, and the fan D suspended. In Fig. 5 the skirt 29 serves as the suspending means, and the detachable connection is at 38.

A grille 33 is mounted over the opening 11. In Fig. 3, it is detachable to give access to the fan 17 for removing the same prior to dropping the lower casing member. In Fig. 5 it forms an integral part of the lower casing member 10.

The filter F in Fig. 2 is supported on the grille 33 and retained in position laterally by the trough D. It may be lifted from the seat formed by the grille 33 and trough D.

In Fig. 3, the filter F is similarly seated in a flange 34 on the inner rim of the trough D.

In Fig. 4, the filter is retained against an inverted seat 35 formed on the trough D, by the grille 33, which is detachable to allow removal of the filter.

In Fig. 5, the filter is cylindrical, and is hung from the upper casing member 14 as at 37.

It will be understood that the term "annular" as applied to the coil, or casing member does not mean that the coil or casing must necessarily be circular, but is intended to include open polygonal shapes as well.

I claim as my invention:

1. In a combined air cooling and air heating air conditioner, an annular heat transfer coil, an annular trough suspended below said coil and a fan positioned coaxially on a vertical axis above the space to be conditioned, said fan being selectively operable to move air either upwardly or downwardly.

2. In a combined air cooling and air heating air conditioner, an annular heat transfer coil and a fan positioned coaxially on a vertical axis above the space to be conditioned, said fan being selectively operable to move air either upwardly or downwardly, and means encasing said fan and coil for resolving said upwardly moving air stream into a substantially horizontal discharge issuing radially at the top of the conditioner, and for guiding said downwardly moving air stream into a column projected downwardly from the central region of the bottom of the conditioner, said

means being formed to provide a trough below the coil.

3. In a combined air cooling and air heating air conditioner, an annular heat transfer coil and a fan positioned coaxially on a vertical axis above the space to be conditioned, said fan being selectively operable to move air either upwardly or downwardly, and means encasing said fan and coil providing a peripheral opening of maximum diameter at the top of the conditioner, and for guiding air currents through said opening in a generally horizontal plane, and providing a central opening of considerably smaller diameter at the bottom of the conditioner and for guiding air streams in a generally vertical direction through said smaller opening, said means being rolled upward about the periphery of said central opening to provide a trough.

4. In an air conditioner, a propeller-type fan, a heat transfer element through which air handled by said fan is passed, and a condensate collecting trough below said element, all coaxially positioned on a vertical axis above the space to be conditioned.

5. In an air conditioner, a propeller-type fan, an annular heat transfer element, and an annular condensate collecting trough coaxially positioned on a vertical axis above a space to be conditioned, said condensate collecting trough being hung below the heat transfer element.

6. In an air conditioner, a fan, an annular heat transfer element, and an annular condensate collecting trough coaxially positioned on a vertical axis above a space to be conditioned, said condensate collecting trough being hung below the heat transfer element, and an air filter positioned in the space surrounded by said trough, through which the column of air handled by said fan is passed.

7. In an air conditioner, a propeller type fan and a heat transfer element, coaxially positioned on a vertical axis above the space to be conditioned, an upwardly and outwardly flaring casing enclosing said element and providing a discharge opening above its rim and an opening of less diameter in its bottom, and an annular condensate collecting trough forming the lower extremity of said casing, and defining said bottom opening.

8. In an air conditioner, a propeller type fan and a heat transfer element, coaxially positioned on a vertical axis above the space to be conditioned, an upwardly and outwardly flaring casing enclosing said element and providing a discharge opening above its rim and an opening of less diameter in its bottom, an annular condensate collecting trough forming the lower extremity of said casing, and defining said bottom opening,

and a filter surrounded by said trough and traversing said opening, the fan being positioned just above said filter.

9. In an air conditioner, an annular upwardly flaring casing providing a top opening above its rim, an annular condensate trough forming the lower extremity of said casing and defining a bottom opening of smaller diameter than said top opening, a heat transfer element within said casing, a filter horizontally traversing said bottom opening, and a propeller type fan also traversing said opening below the filter, said fan being mounted on a vertical axis.

10. In an air conditioner, an annular casing providing a top opening above its rim, an annular condensate collecting trough forming the lower extremity of said casing and defining a bottom opening of smaller diameter than said top opening, a sleeve within the casing, forming with the casing an annular air passage, an annular heat transfer element in said passage, a filter traversing said bottom opening, and a fan, positioned in said casing coaxial with the vertical axis of the casing, and traversing said passage above the said element.

11. In an air conditioner, an upwardly and outwardly flaring annular casing, providing a top opening above its rim, a condensate collecting trough forming the lower extremity of said casing, an annular heat transfer element above said trough, a fan above said element, and an annular filter above said fan, said casing, trough, coil, fan and filter being coaxial.

12. In an air conditioner, an annular upwardly and outwardly flaring casing providing a top opening above its rim and, in its bottom, a bottom opening of less diameter, a propeller type fan above said bottom opening, an annular condensate collecting trough within the periphery of said fan, an annular heat transfer element above said trough, and an air filter traversing said top opening, said casing, fan, trough, element and filter being coaxial.

13. In an air conditioner, an upper casing member comprising a stamping with a generally conical central depression, a motor mounted within said depression having an armature shaft projecting below it, a fan on said shaft, a lower casing member comprising a stamping having openings below said fan and flaring upwardly and outwardly to define an annular air passage between the two members, and a heat transfer element in said passage having a pair of headers which also serve as supports for said element and said lower member.

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