

May 12, 1936.

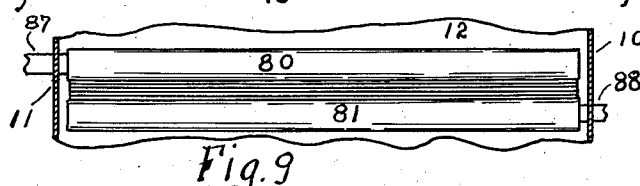
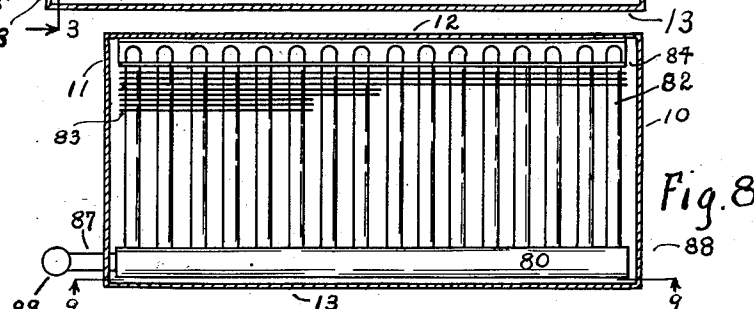
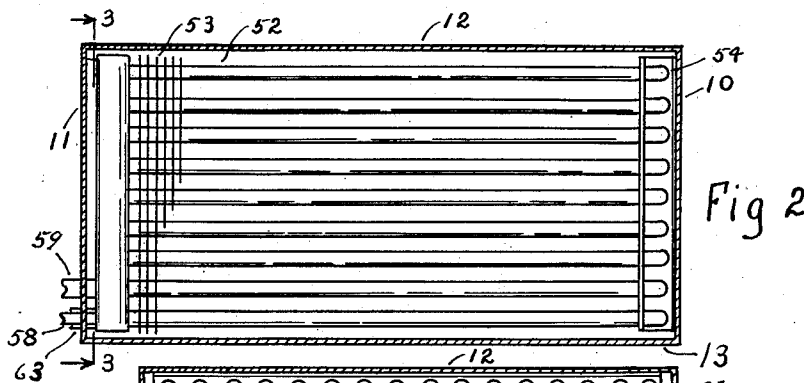
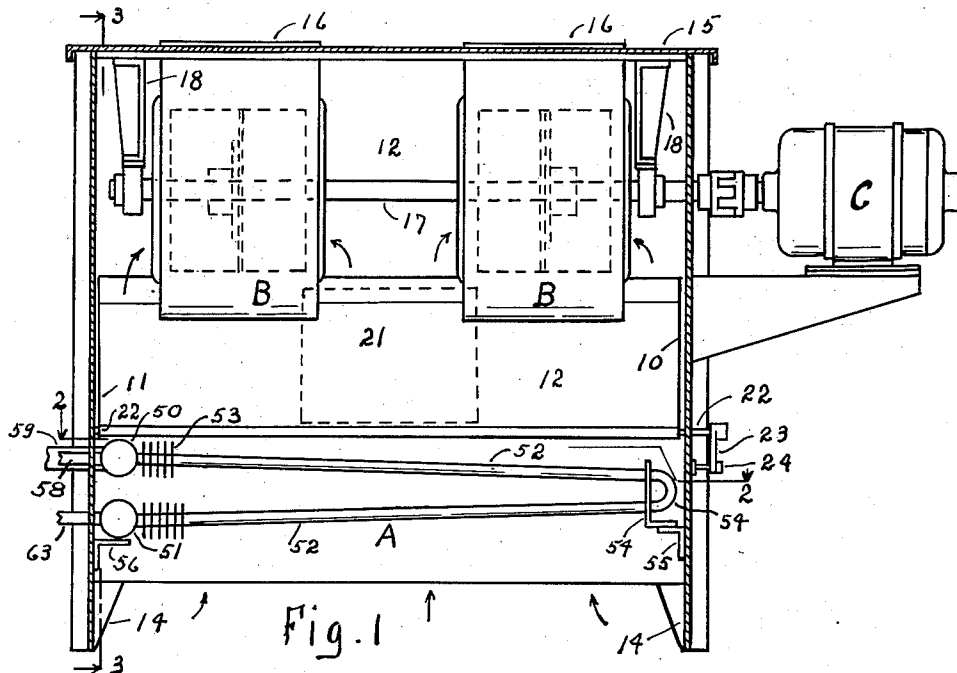
F. M. YOUNG

2,040,118

AIR CIRCULATING AND CONDITIONING DEVICE

Filed July 19, 1935

2 Sheets-Sheet 1



Inventor  
Fred M. Young  
By A.S. Knotz  
attorney

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F. M. YOUNG

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AIR CIRCULATING AND CONDITIONING DEVICE

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2 Sheets-Sheet 2

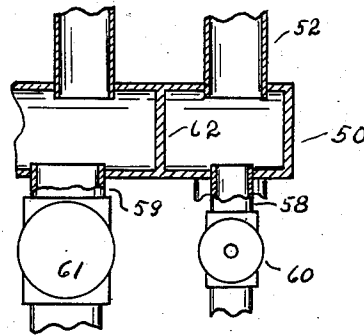
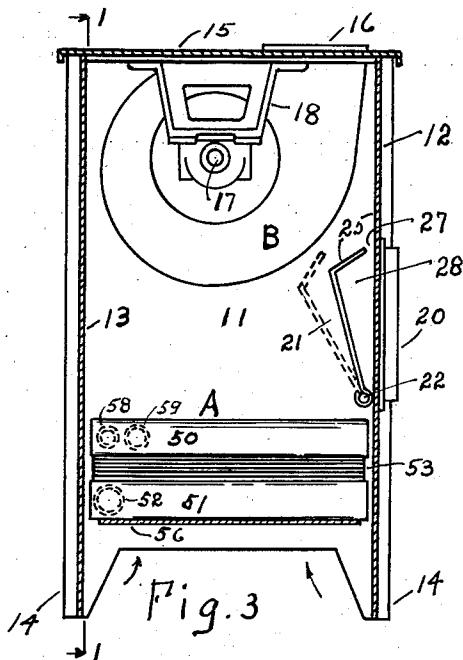


Fig. 4

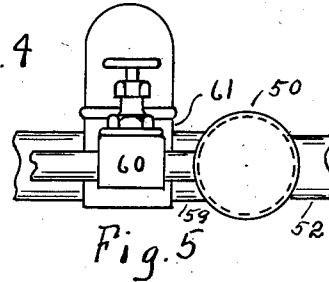


Fig. 5

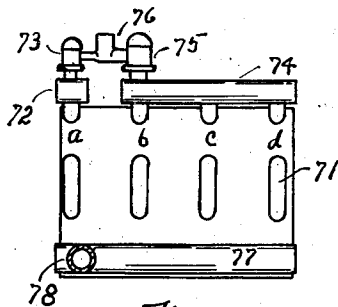


Fig. 6

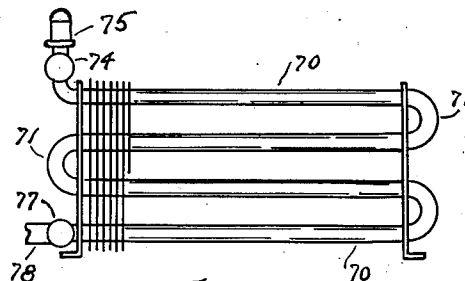


Fig. 7

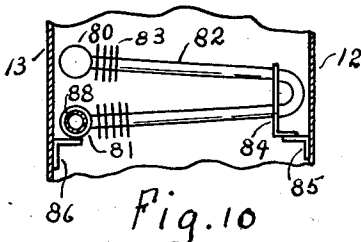


Fig. 10

Inventor  
Fred M. Young  
By A. S. Krotz  
attorney

## UNITED STATES PATENT OFFICE

2,040,118

AIR CIRCULATING AND CONDITIONING  
DEVICEFred M. Young, Racine, Wis., assignor to Young  
Radiator Company, Racine, Wis.

Application July 19, 1935, Serial No. 32,179

6 Claims. (Cl. 257—137)

My invention relates to air conditioners wherein the room air is re-circulated and heated or cooled for comfort and wherein a predetermined quantity of outside air may be admitted and evenly mixed with the circulated air.

It further relates to means whereby the air circulating fan may be operated at full capacity at all times, regardless of the amount of bypassed or fresh air or the amount of heating or cooling needed.

I accomplish the foregoing results by providing fixed capacity air moving fans and a heating or cooling core having means for changing its active area zone-like, the active area extending parallel to the axis of the fans and for the full width of the cabinet.

To these and other useful ends, this invention consists in matter hereinafter set forth and claimed and shown in the accompanying drawings in which:

Figure 1 is a front sectional elevation of my device taken on line 1—1 of Figure 3.

Figure 2 is a transverse section of the device shown in Figure 1, taken on line 2—2 of Figure 1.

Figure 3 is an end sectional elevation of the device shown in Figures 1 and 2, as viewed from lines 3—3 of Figure 1.

Figure 4 is an enlarged fractional section of the core shown in Figures 1, 2 and 3, showing the regulating valves.

Figure 5 is an enlarged fractional end view of the core as shown in Figure 4.

Figure 6 is a fractional front view of a modification wherein the core is especially adapted to use brine or a refrigerant for cooling the circulated air.

Figure 7 is a side elevation of the device shown in Figure 6.

Figure 8 is a top view of a modified form of the core showing the housing in section.

Figure 9 is a side elevation of the core shown in Figure 8.

Figure 10 is an end elevation of the core shown in Figures 8 and 9.

As thus illustrated in Figures 1 to 5, the device shown is especially adapted to heat the circulated air by means of steam or hot water. The end walls of the cabinet or container are designated by numerals 10 and 11, the rear wall by numeral 12 and the front wall by numeral 13, thus forming a cabinet, rectangular in cross section and having preferably supporting legs 14, so as to provide means for the air to pass into

the bottom of the cabinet as indicated by arrows in Figures 1 and 3.

I provide a heating core which is, in its entirety designated by reference character A. This core is preferably positioned near the bottom of the cabinet as illustrated.

I provide one or more fans in the top of the cabinets which are, in their entirety, designated by reference character B.

It will be noted that I provide considerable space between the core A and the fans B. The reason for this will hereinafter appear.

In Figures 1 and 3 I illustrate two fans B, having a single motor driving means C. In some installations I provide a single fan and in others I provide 3 or even 4 fans. Thus the cabinet is generally considerably longer than its width and the fans are always positioned in spaced apart, end-to-end relation as shown in Figure 1.

The fans B are preferably of the cage type, as illustrated and are supported preferably from the top or lid 15, of the cabinet, through which I provide air outlets 16, one for each fan. The fan rotors are carried by means of shaft 17 which in turn is carried by bearing brackets 18. When the fans are in motion, air will enter the fans as indicated by arrows and will be discharged through outlets 16. Thus air will enter the bottom of the cabinet and pass upward through the cabinet and be discharged at 16, the object being to circulate the room air and condition it as it passes through the cabinet.

I provide a bypass or outside air inlet having an air filter 20, an outline of which is illustrated in Figure 3 by dotted lines. I provide a damper 21 having preferably the shape illustrated in Figure 3. This damper extends the full width of the cabinet and is hingedly supported as at 22, having a lever 23, by means of which the damper may be moved automatically or manually to any desired position and held by means of a spring-latch knob 24.

It will be noted that the filter 20 is considerably shorter than the width of the cabinet. I provide means whereby the incoming fresh air will be equally distributed to each fan in the following manner:

The free edge of the damper 21 is provided with an angled extension 25, as illustrated. Thus when the damper is nearly closed, as illustrated, an opening 27, for the full length of the cabinet, and a transverse air duct 28 are provided, whereby the incoming fresh air will be equally distributed from the opening 27 for the entire length of the cabinet. When the damper 21 is wide

open, as illustrated by dotted lines in Figure 3, the opening is sufficient to provide area about equal to the area of the inlet at 20. Inlet 20 is preferably large enough to provide fresh air for comfort during moderate weather during which time the core A may, under some conditions, be made inoperative.

One of the requirements of a device of this class is that the fan operate at full capacity at all times. It is therefore, necessary to heat or cool at least a fraction of the air for the full width of the cabinet, thus to insure discharging the air from each of the outlets at a uniform temperature.

It would be difficult to control the full area of an ordinary core, especially during moderate weather, so the air for the width of the cabinet, is heated or cooled to a uniform temperature by an on-and-off or metered valve. Certain portions of the core would heat earlier or reach a higher temperature at times, than other portions. Therefore the air reaching one fan might be of a different temperature than the air reaching another fan. Particularly might this be true when three or four fans are used in a single housing.

I provide novel means for controlling the temperature wherein a narrow longitudinal portion of the core may receive a full supply of steam or coolant and the remainder of the core be supplied by means of the on-and-off valve system or otherwise, the arrangement being such as will cause certain portions of the passing air, for the width of the cabinet, to be heated or cooled uniformly.

Referring to the design shown in Figures 1, 2, 3, 4 and 5: I provide an inlet header 50 and an outlet header 51. These headers are connected by means of tube loops 52 having the usual closely spaced fins 53 and a supporting header plate 54. Thus the assembly may be supported at one end by means of bracket 55 and at the other end by means of bracket 56. I provide a primary inlet connection 58 for header 50 which is positioned adjacent the end of the header as illustrated. I provide a secondary inlet connection 59.

I provide an inlet valve 60 for connection 58 and a secondary inlet valve 61 for connection 59. These valves may be adapted to be operated manually or otherwise. I prefer, however, to operate valve 60 manually and provide for operating valve 61 by means of a room thermostat. Valve 60 is preferably relatively small whereby it may be left wide open at all times; thus normally temperature control will rest largely in valve 61.

A partition 62 is preferably provided, whereby one row of tubes only is served by valve 60. This valve is of a suitable capacity whereby during any cool weather, it may be left wide open and the first rows of tubes will be heated for their entire length; thus a narrow zone of passing air for the entire length of the cabinet, will be heated or cooled at a uniform temperature.

I provide a common outlet 63 in header 51 and position it adjacent inlet 58, thus the flow of heating or cooling medium will tend to favor the inlet side of the core; therefore when valve 61 is opened, the portion of the core adjacent that served by valve 60, will first be heated or cooled for the entire length of the cabinet. Thus as the volume of heating or cooling medium is increased the core will be heated or cooled for a greater width, transverse to the axis of the fans, thereby to insure a uniform temperature at outlet 16.

Referring now to the design shown in Figures

6 and 7, the operation is similar to that shown in Figures 1 to 5 except the design is especially adapted for cooling by means of brine, cold water or refrigerant. The core is preferably made in the form of a conventional evaporator core except in the manner of supplying the coolant. The object of this design, as in the others, is to control the cooling by zones or at least insure variable temperatures transverse to the axis of the fans and provide a uniform temperature in any zone parallel to the axis of the fans and for the full length of the cabinet. In this design, for convenience, I illustrate four vertically positioned coils comprising four tubes each, which coils are designated by reference numeral 70. These tubes are connected at their ends by means of loops 71. Clearly each coil may consist of any number of tubes and the cores may consist of any number of coils. I provide preferably a header 72 for the first coil which coil, in its entirety, is designated by reference character *a*. I provide an expansion valve 73 for coil *a*. The three remaining coils are designated in their entirety by reference characters *b*, *c* and *d*. I provide a header 74 for coils *b*, *c* and *d* and an expansion valve 75, having a connection to header 74 adjacent coil *b*. Valves 73 and 75 are provided with a common inlet 76. Valve 73 may be adapted for continuous service and valve 75 may be thermally controlled and when positioned as shown, will tend to first supply coil *b*, coils *c* and *d* receiving the heating or cooling medium in the order shown. When valve 75 is only partially opened, coil *b* will receive the major portion of the medium and if the valve 75 is wide open for an extended period, each coil will be about equally supplied. The coils each terminate into a common outlet header 77 having a common outlet 78 which is positioned adjacent coil *a*. Thus the tendency of the heating or cooling medium will be to favor first coil *b* and then coil *c* whereby the passing air will be equally heated or cooled in zones which are parallel to the axis of the fans.

In Figures 8, 9 and 10 I illustrate a very simple core which will operate automatically to provide the desired heat control as in the other designs. An inlet header 80 and an outlet header 81 are spaced apart and extend the full length of the cabinet. Tube loops 82 connect these headers as clearly illustrated in Figure 10. I provide the usual closely spaced fins 83 and a tube plate 84 which is adapted to rest on bracket 85 as a support for one side of the core. A bracket 86 is adapted to support the header side of the core, it being understood that the headers 80 and 81 are anchored together in a suitable manner.

It will be observed that this core is adapted to fill the entire air path and that the headers 80 and 81 are positioned parallel to the fan axis. An inlet connection 87 is provided at one end of header 80 and an outlet 88 is positioned at the opposite end of header 81; thus the flow of heating or cooling medium will tend to pass through the tube loops equally. I provide an inlet valve 89. This valve may be of the metering or on-and-off type and adapted to be controlled manually or by means of a room thermostat. It will be understood that I may elect to make use of two valves in this design as illustrated in Figures 4 and 5. The operation of this core will be as follows: Assuming that steam is the heating medium, a very small quantity of steam would barely heat the header 80 and possibly the tube loops for a short distance from the header; the tem-

perature of the loops varying as more or less steam is admitted into the header 80.

Under all conditions the highest temperature will be in header 80 and the lowest will be in header 81, the tube loops having a varying temperature which will be graduated between the temperatures of the two headers. Thus all of the passing air will be heated more or less, the least rise in temperature being on the side opposite the headers and the greatest rise being adjacent the headers for the entire length of the cabinet. Thus the air will, when it is mixed and discharged from the fan outlet, have a uniform temperature, the fans may operate at full capacity at all times and the temperature of the air will be controlled by simply controlling the quantity of heating or cooling medium passing through the core.

It will be understood that under all conditions some change of temperature may be caused in all of the air as it passes through the core but since there is little or no difference in temperature in any zone parallel to the axis of the fans, the discharged air will represent the combined results of the various temperature changes brought about by the core. Clearly various changes may be made in the cores, the object at all times being to provide uniform temperatures parallel to the fan axis and varying temperatures transversely, whereby the device will operate successfully with any number of fans.

It will be further understood that I may elect to place the cabinet in a horizontal position by making some slight changes in the cores; for example, in the case of the core shown in Figures 1 to 5, the valve side of the core would be positioned at the bottom and in case of the core shown in Figures 8, 9 and 10, the headers would be positioned at the bottom, having means whereby condensate may pass directly from manifold 80 to manifold 81.

Having thus shown and described my invention I claim:

1. An air circulating and conditioning device of the class described, comprising a housing having means for moving an air current therethrough and a heat transfer core positioned in the entire path of the air current, said core having a common outlet and a narrow independent section for its length and an inlet valve therefore, whereby a certain portion of the passing air will be heated for the entire length of said core, the remainder of said core having an inlet connection adjacent said narrow section and having means whereby the entering heating or cooling medium will tend to first heat or cool said core adjacent said section for its entire length and then extend transversely as said medium is increased in quantity.

2. An air circulating and conditioning device of the class described, comprising an enclosure having means at one end to force air therethrough and a heat exchange core at the other end occupying the entire path of the air, a fresh air inlet positioned between said air moving means and said core, having a damper for the width of said cabinet and means whereby a predetermined quantity of fresh air may be admitted and dis-

charged over the entire length of said damper, said core having means whereby a narrow portion thereof, parallel to said damper, will first be affected by the heating or cooling medium and said affected portion will be gradually widened to thereby regulate the extent of heat transfer, as the medium is increased.

3. A heat transfer core of the class described, comprising a relatively small primary inlet and means whereby a portion only of said core, for its length, is served by said primary inlet, a common outlet for said core and a secondary inlet adjacent said primary inlet, a valve for said primary inlet and a valve for said secondary inlet whereby said primary valve may be used permanently and said secondary valve may be used intermittently.

4. An air circulating and conditioning device of the class described, comprising a housing, rectangular in cross section, having two or more fans positioned in a row therein, whereby an air current is moved therethrough, a heat transfer core positioned in said housing across the entire path of the air current, said core having inlet and outlet headers at one side thereof and positioned parallel to the axis of said fans, means whereby said core is first heated or cooled for its length at said inlet side and as the supply of heating or cooling medium is increased, the heated or cooled portion is widened in a transverse direction to the axis of said fans.

5. A heat transfer device comprising a cabinet having an air inlet at one end and one or more cage type exhaust fans forming the outlet at the other end, said fans having air inlets at opposite ends thereof, a heat transfer core in said cabinet positioned between said inlet and fans and having means whereby heating or cooling will, under minimum capacity, be confined to a narrow strip the length of said core and parallel to the axis of said fans and means whereby additional heating or cooling medium will cause said heated strip to widen and remain parallel to the axis of said fans.

6. An air circulating and conditioning device comprising a housing, an exhaust fan having two or more spaced apart inlets positioned at one end of said cabinet and a recirculated air inlet at the other end, a heat transfer core in said housing positioned adjacent said inlet whereby recirculated air passing through said housing, will be treated by said core, an untreated air inlet in the side wall of said housing positioned between said core and said fan having a width considerably less than the width of said housing, a hinged damper positioned parallel to the axis of said fan and occupying the entire width of said housing, said damper being curved longitudinally and positioned to thereby provide an enclosing chamber over said last named inlet for the length of said housing and whereby an opening for said last named inlet for the full width of the cabinet may be provided when said damper is wholly or partially opened, means whereby the recirculated air is at all times equally treated for the width of said cabinet.

FRED M. YOUNG.