April 5, 1949. C. S. CODY 2,466,383

AIR CONDITIONING APPARATUS FOR COOLING OR HEATING

Filed Aug. 13, 1946 4 Sheets-Sheet 1

FIG. 1

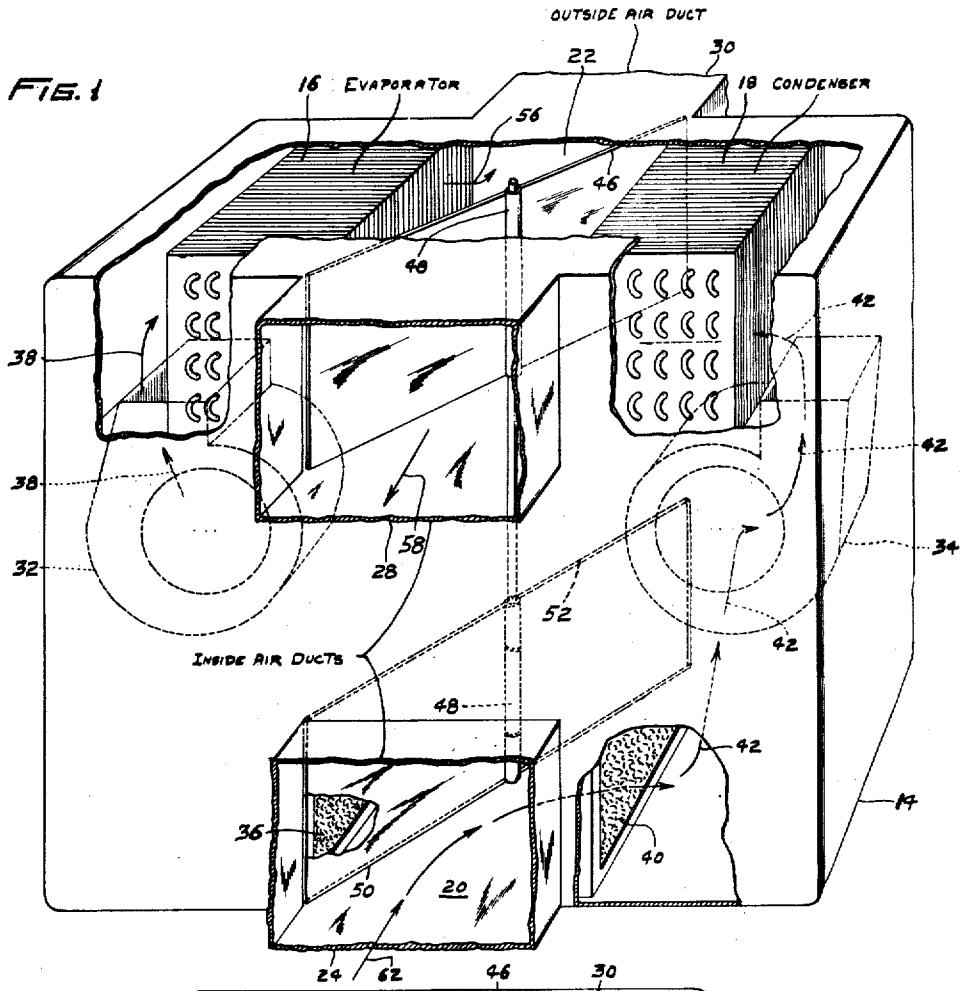
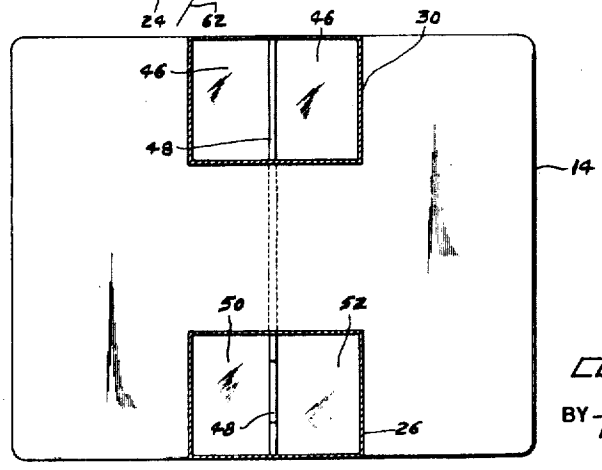


FIG. 2.



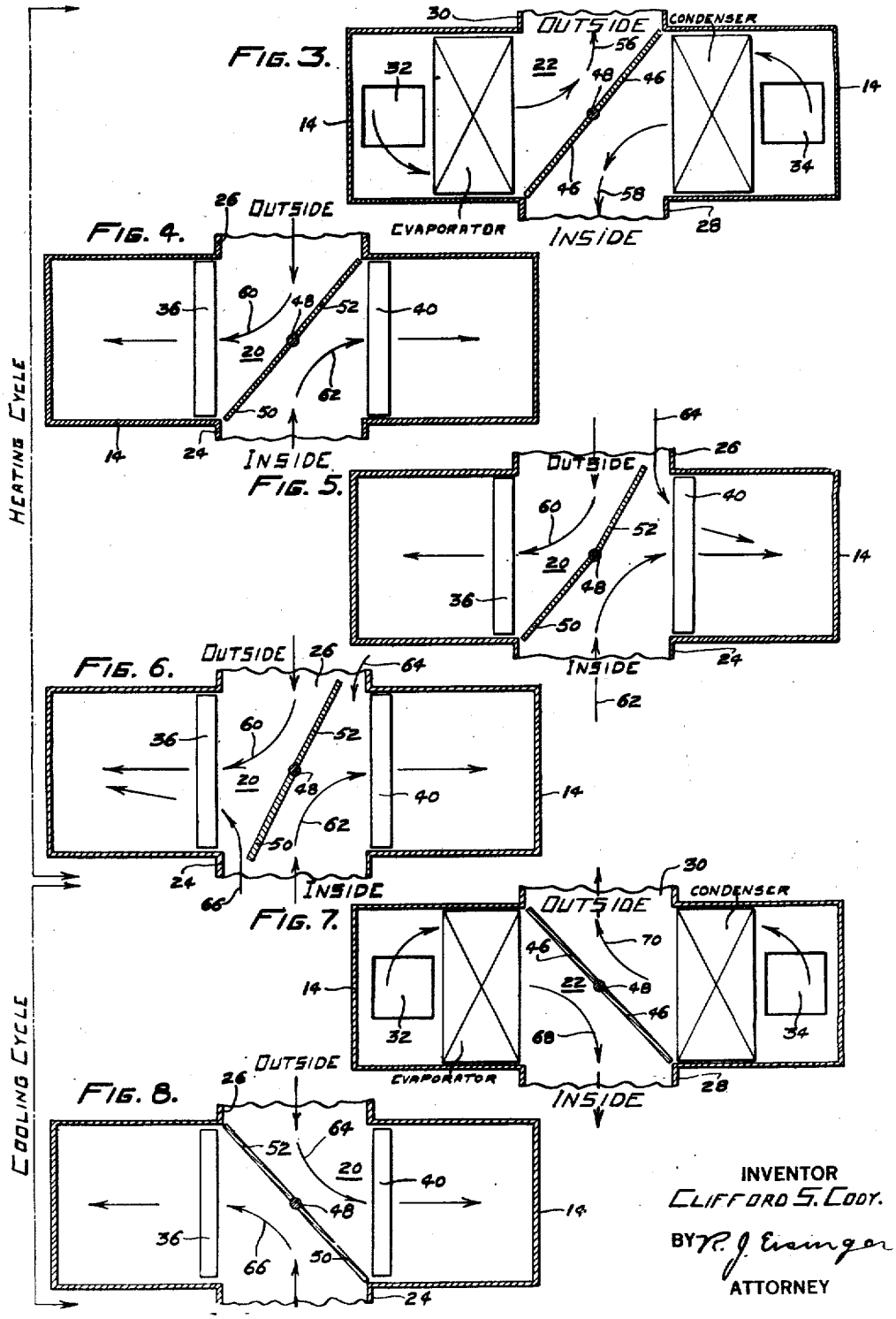
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April 5, 1949. C. S. CODY 2,466,383

AIR CONDITIONING APPARATUS FOR COOLING OR HEATING

Filed Aug. 13, 1946 4 Sheets-Sheet 2



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AIR CONDITIONING APPARATUS FOR COOLING OR HEATING

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FIG. 9.

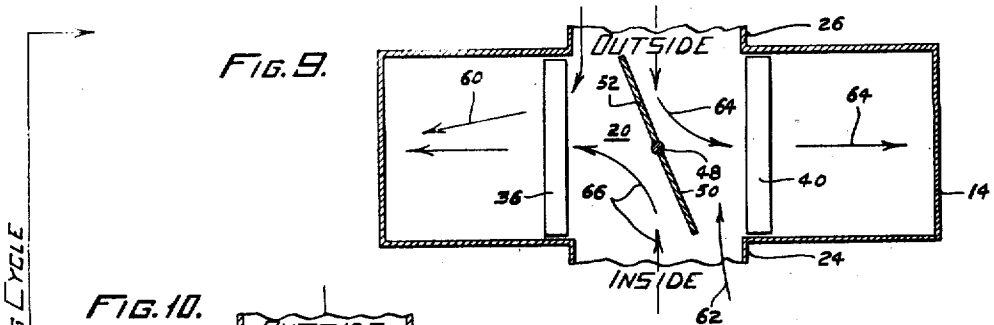


FIG. 10.

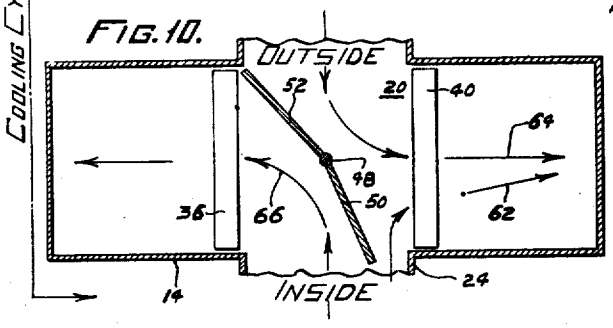
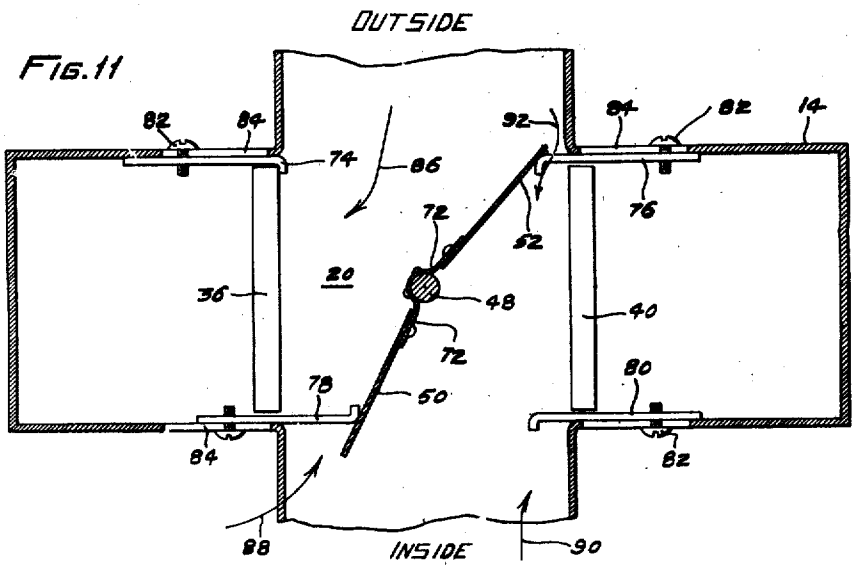


FIG. 11



WITNESSES:
E. H. Lutz
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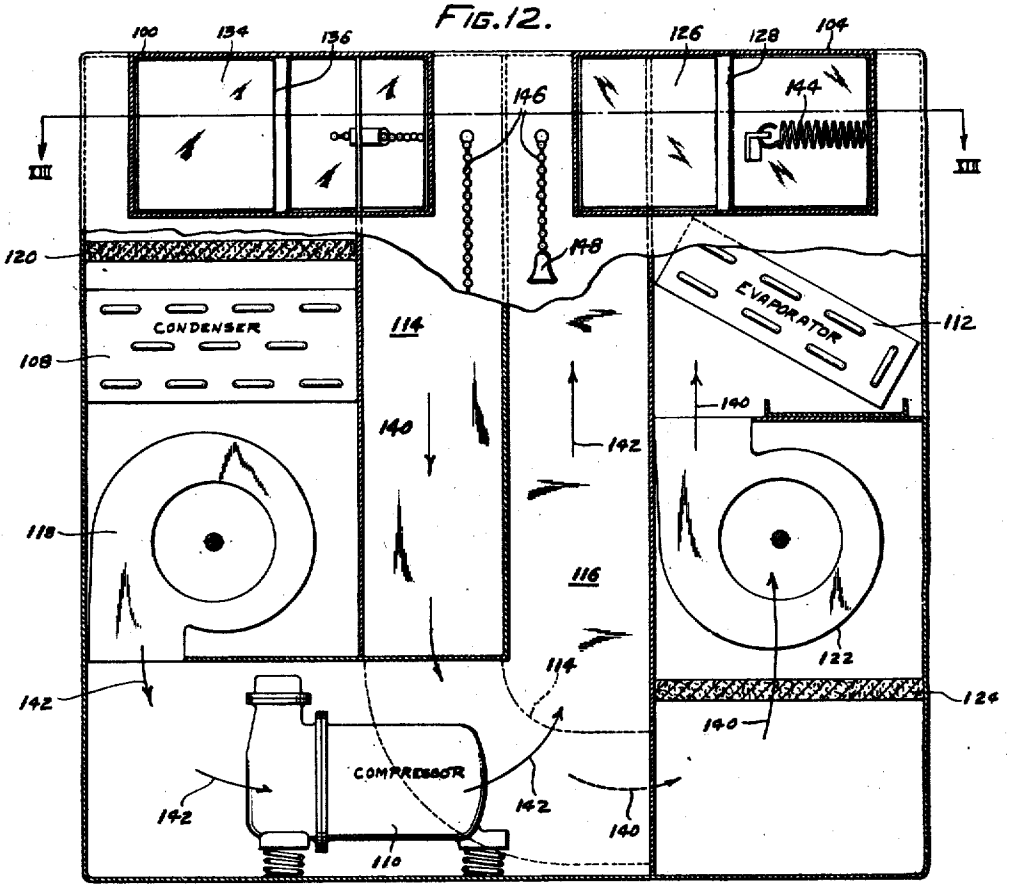
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April 5, 1949. C. S. CODY 2,466,383

AIR CONDITIONING APPARATUS FOR COOLING OR HEATING

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FIG. 12.



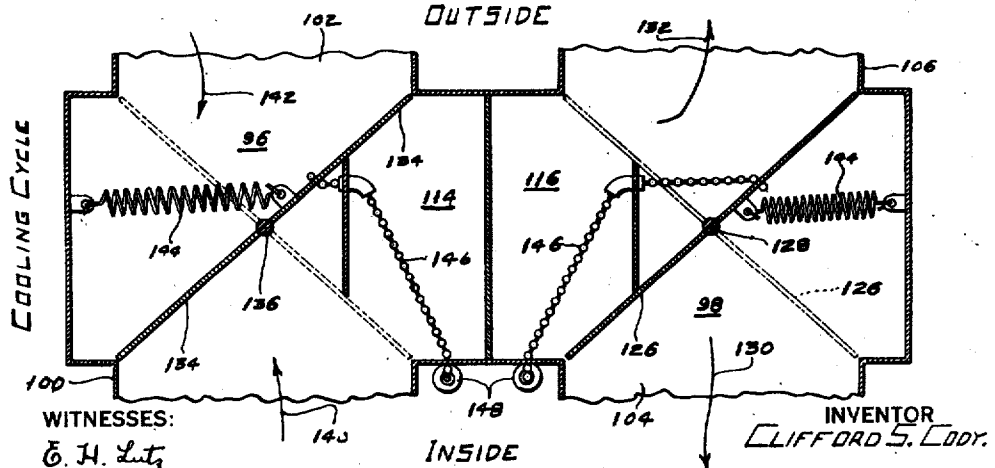


FIG. 13.

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Patented Apr. 5, 1949

2,466,383

UNITED STATES PATENT OFFICE

2,466,383

AIR-CONDITIONING APPARATUS FOR COOLING OR HEATING

Clifford S. Cody, Springfield, Mass., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application August 13, 1946, Serial No. 690,267

5 Claims. (Cl. 62—129)

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My invention relates to air conditioning apparatus of the type adapted to be selectively used for heating or for cooling the air of a room or other enclosure.

One object of my invention is to produce an improved apparatus of the type set forth.

A further object of the invention is to produce an improved air conditioning apparatus by means of which room air, exclusively, may be conditioned and recirculated, by means of which variable amounts of outside air may be added to the room air being conditioned and recirculated, by means of which variable amounts of room air may be exhausted to the outside atmosphere, and by means of which room air may be exhausted from, and outside air may be conditioned and introduced into, the room simultaneously.

A still further object of the invention is to produce an improved apparatus for carrying out the foregoing objects which will be inexpensive, compact and easy to operate.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a diagrammatic, perspective view of an air conditioning apparatus embodying my invention, the apparatus being shown adjusted for heating, and certain parts being omitted;

Fig. 2 is a reduced, rear elevational view of the apparatus shown in Fig. 1;

Fig. 3 is a reduced diagrammatic top plan view of the air conditioning apparatus showing the damper controlling flow of air from the apparatus, as adjusted for heating;

Figs. 4 to 6, inclusive, are reduced diagrammatic views, illustrating some of the positions to which the dampers controlling the admission of air into the apparatus may be adjusted when the apparatus is used for heating;

Fig. 7 is a view similar to Fig. 3, showing the damper adjusted for cooling;

Figs. 8 to 10, inclusive, are views similar to Figs. 4 to 6, illustrating corresponding positions of the dampers controlling admission of air into the apparatus when the apparatus is usd for cooling;

Fig. 11 is a diagrammatic, horizontal sectional view, illustrating one form of mechanism by means of which the dampers shown in Figs. 4 to 6 and 8 to 10, both inclusive, may be adjusted;

Fig. 12 is a diagrammatic, front elevational view of another embodiment of the invention showing the apparatus adjusted for cooling; and

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Fig. 13 is a fragmentary top plan view of the apparatus shown in Fig. 12.

In the embodiment illustrated in Fig. 1, the air conditioning apparatus is enclosed in a casing 14 which is internally partitioned to form an evaporator compartment for housing an evaporator 16, a condenser compartment for housing a condenser 18 and a compressor compartment for housing a compressor, not shown. The evaporator and condenser are connected in refrigerant flow relation to each other and to the compressor in any well-known manner, not shown, whereby compressed refrigerant gas flows from the compressor to the condenser where it is cooled and liquefied, and whereby the liquefied refrigerant flows from the condenser to the evaporator where the refrigerant is vaporized, the vaporized refrigerant being withdrawn from the evaporator by the compressor to complete the cycle.

The casing 14 is provided with a lower air intake chamber 20 and an upper air discharge chamber 22. The air intake chamber communicates with the lower portions of the evaporator and condenser compartments and is connected to the room by a duct 24 and to the outside atmosphere by a duct 26. The air discharge chamber 22 communicates with the upper portions of the evaporator and condenser compartments and is connected to the room by means of a duct 28 and to the outside atmosphere by means of a duct 30.

The apparatus further includes a blower 32 disposed in the evaporator compartment and a blower 34 disposed in the condenser compartment. The blower 32 is adapted to draw air from one side of the air intake chamber 20 through a filter 36 and to blow said air into contact with the evaporator and into the adjacent side of the air discharge chamber 22. This is illustrated by the arrows 38. The blower 34 is adapted to draw air from the adjacent side of the air intake chamber 20, through a filter 40, and to blow said air over the condenser and into the adjacent side of the air discharge chamber 22. This is indicated by the arrows 42. The blowers 32 and 34 thus discharge separate streams of conditioned air into opposite portions of the air discharge opening 22. The streams of air delivered into the air discharge chamber are separated by means of a damper 46 fixedly mounted on the upper portion of a shaft 48 and bisecting the air discharge chamber 22, as clearly shown at the top of Fig. 1.

When the apparatus is to be used for heating, shaft 48 is rotated to move the damper 46 to the

position shown in Figs. 1 and 3 in which position air heated by contact with the condenser is discharged into the room through the duct **28** while the air used for evaporating the refrigerant in the evaporator is discharged to the outside atmosphere through the duct **30**.

When the apparatus is to be used for cooling, the position of the damper **46** is reversed and the air cooled by the evaporator is discharged into the room while the air used for condensing the refrigerant is discharged to the outside atmosphere. Suitable means, not shown, will be provided at a point accessible from the room for moving shaft **48**, and hence the damper **46**, to either position.

In order to regulate admission of air into the apparatus, the air intake chamber **20** is provided with means for selectively connecting the low pressure sides of each of the blowers **32** and **34** with the room, with the outside atmosphere, or with both, so as to permit either or both of the blowers to draw outside air, or room air, exclusively, or a variable mixture of room air and outside air, and to discharge such air into contact with the evaporator or condenser, respectively.

The means for controlling the admission of air into the intake chamber **20** may be in the nature of a one-piece damper rotatable with the shaft **48** and moved to various positions with reference to the duct **24** leading to the room and the duct **26** leading to the outside atmosphere. As shown, however, the heating chamber **20** is provided with two dampers **50** and **52** which are fastened to the lower portion of the shaft **48** and adapted to be adjusted to various positions by rotation of the shaft.

Operation

When the apparatus is to be used for heating, the shaft **48** is turned so as to bring damper **46** to the position shown in Figs. 1 and 3 in which the upper room duct **28** communicates exclusively with the portion of the discharge chamber **22** which is adjacent the condenser, and the upper outside duct **30** communicates exclusively with that portion of the air discharge chamber **22** which is adjacent the evaporator. In this position of the damper, the air moved by the blower **32** will be discharged to the outside atmosphere through the duct **30**, as indicated by the arrow **56**, and the air moved by the blower **34** is discharged into the room through the duct **28**, as indicated by the arrow **58**.

If it is desired to heat and recirculate room air exclusively, the dampers **50** and **52** are adjusted to the position shown in Figs. 1 and 4. In this position of the dampers, the evaporator blower **32** is cut off from the room duct **24** and will, therefore, draw air only through the outside lower duct **26**, as indicated by the arrows **60**. As stated, the air drawn by the blower **32** will, after giving up its heat to the evaporator, be discharged to the atmosphere through the duct **30**. Conversely, the condenser blower **34** is cut off from the outside atmosphere so that it can draw room air, exclusively, through the lower duct **24**, as indicated by the arrows **62**. The air heated by contact with the condenser will be discharged into the room through the upper duct **28**.

When it is desired to recirculate and heat the room air while simultaneously introducing some outside air and mixing it with the room air, the dampers **50** and **52** are adjusted to the position shown in Fig. 5, in which the damper **52** is spaced

from the adjacent wall of the duct **26** so that the condenser blower draws room air, as indicated by the arrows **62**, and a certain amount of outside air, as indicated by the arrows **64**. In this position, the evaporator blower continues to draw outside air exclusively.

When it is desired to exhaust some of the room air to the outside atmosphere while simultaneously heating some outside air and admitting it into the room, the dampers **50** and **52** are adjusted to the position shown in Fig. 6, in which the evaporator blower draws air from the outside, as indicated by the arrows **60**, and from the room, as indicated by the arrow **66**. Likewise, the condenser blower **34** now draws room air, as indicated by the arrows **62**, and outside air, as indicated by the arrow **64**.

In Figs. 4, 5 and 6, only some of the positions to which the dampers **50** and **52** are adjusted while the apparatus is used for heating, have been shown, but it will be understood that these dampers are capable of being adjusted to other intermediate positions. For example, if the dampers **50** and **52** are moved to a position at a right angle to the position indicated in Fig. 4, the evaporator blower will draw room air exclusively and discharge it to the outside atmosphere, while the condenser blower will draw outside air exclusively and discharge it into the room. It will also be noted that the upper damper, once adjusted to the heating position as shown in Fig. 1, remains fixed until the apparatus is to be used for cooling and that the air admitted into the apparatus is regulated solely by adjustment of the lower dampers **50** and **52**.

When it is desired to use the apparatus for cooling, the shaft **48** is moved so that the damper **46** is adjusted to the position shown in Fig. 7, in which the evaporator compartment and the adjacent portion of the air discharge chamber **22** communicate with the room, as indicated by the arrows **68**, and the condenser compartment and the adjacent portion of the air discharge chamber communicate with the outside atmosphere, as indicated by the arrows **70**.

When it is desired to cool and recirculate room air, exclusively, the dampers **50** and **52** are adjusted to the position shown in Fig. 8 in which the evaporator blower draws room air, exclusively, as indicated by the arrows **66**, while the condenser blower draws outside air, exclusively, in the direction indicated by the arrows **64**.

When it is desired to recirculate and cool room air and simultaneously to introduce cooled outside air, while at the same time exhausting some of the room air, the dampers **50** and **52** are adjusted to the position shown in Fig. 9, in which the evaporator blower draws outside air as indicated by the arrows **60**, and inside air as indicated by the arrows **66**, while the condenser blower draws room air as indicated by the arrow **62**, and outside air as indicated by the arrow **64**.

When it is desired to circulate and cool room air only, while at the same time exhausting some of the room air, the dampers **50** and **52** are adjusted as shown in the position of Fig. 10, in which the evaporator blower draws room air exclusively, as indicated by the arrows **66**, while the condenser blower draws room air and outside air as indicated by the arrows **62** and **64**.

As stated in conjunction with the heating cycle of the apparatus, the dampers **50** and **52** can be adjusted to other positions, not shown. For example, if the dampers **50** and **52** are adjusted to a position at a right angle to the position shown

in Fig. 8, the evaporator blower will draw outside air, exclusively, and the condenser blower will draw room air, exclusively.

In Fig. 11, I show, by way of example, means for connecting the dampers 50 and 52 for movement with shaft 48 and means for limiting the movement of the dampers so as to effect adjustment of the dampers in the manner set forth in connection with Figs. 4 to 6 and 8 to 10. As shown, the dampers 50 and 52 are secured to the lower portion of the shaft 48 by resilient strips 72, and stops 74, 76, 78 and 80 are provided for limiting the movement of the dampers upon rotation of the shaft. The resilient strips 72 are sufficiently strong to support the weight of the dampers and insure their movement with the shaft, but are sufficiently flexible so as to yield when the movement of either or both of the dampers is restricted by one or more of the stops. The stops may be movably mounted in any desired manner, as, for example, by means of bolts 82 slidable in slots 84 provided in adjacent walls of the casing.

By this construction illustrated, the stops may be selectively moved into or withdrawn from the lower air intake chamber 20 so as to be disposed in, or withdrawn from, the path of movement of the dampers 50 and 52. In Fig. 11, for example, the stop 74 is shown wholly withdrawn and the stops 76, 78 and 80 are shown as projecting somewhat into the lower air intake chamber. In this position, when the shaft 48 is rotated in clockwise direction, as shown in Fig. 11, the dampers 50 and 52 will rotate with the shaft until the damper 52 abuts the stop 76 and the damper 50 abuts the stop 78. In this position, the evaporator blower will draw a major portion of air from the outside atmosphere as indicated by the arrow 86, and a minor portion of air from the room as indicated by the arrow 88. Simultaneously, the condenser blower will draw a major portion of air from the room as indicated by the arrow 90, and a minor portion from the outside atmosphere as indicated by the arrow 92. Obviously, if the stop 76 is moved further into the air intake chamber 20, the amount of air drawn from the outside atmosphere by the condenser blower will be proportionately increased, and vice versa. When the shaft is rotated in counterclockwise direction as viewed in Fig. 1, the reverse situation will prevail and the position of the dampers 50 and 52 will be controlled by the position of the stops 74 and 80. The shaft 48 may be rotated by any suitable knob or handle, not shown, and the stops may likewise be adjusted by any suitable handle or other means, not shown.

Operation

Assuming that it is desired to use the unit for cooling by day and for heating by night, or assuming that the apparatus is to be used for cooling during the warm season and for heating during the cool season, the stops 74, 76, 78 and 80 are adjusted either at the time of the installation of the air conditioning unit or from time to time by the user thereof, so as to regulate the egress and ingress of outside air and room air, respectively, into the lower intake chamber. With the stops so adjusted, it is merely necessary for the user to turn the shaft 48 to move the upper damper 46 from the position shown in Fig. 1 to the position shown in Fig. 7 without the necessity of paying any attention to the dampers 50 and 52. In other words, the rotation of the shaft 48 to move the damper 46 to one or the other of its extreme positions, automatically moves the lower dampers 50 and 52 to predetermined positions so as to regulate the flow of air into or from the room, as desired. For example, as shown in Fig. 11, rotation of the shaft 48 will allow the damper 50 to move through the space between the stops 78 and 80, but will allow the damper 52 to move from the adjacent end of the stop 76 to the other side of the air intake chamber 20.

By this means, the control of the unit by the user is reduced to the simple rotation of the shaft 48 from one extreme position, indicated on an appropriate index (not shown), to another position on said index.

While the structure described is capable of being operated manually by the user of the apparatus, it is also contemplated to connect the shaft 48 to some conventional form of thermostatically-operated actuating mechanism (not shown) so that, when the temperature of the room falls below a predetermined value, the shaft 48 is automatically turned to the position in which the apparatus is used for heating, and vice versa.

It will thus be seen that whether the shaft 48 is rotated manually or automatically, the upper damper 46 which determines whether the apparatus is to be used for cooling or heating, moves through its full range of movement, while the lower dampers 50 and 52, which regulate the flow of room air and outside air into or from the unit, are moved to positions which are predetermined by the setting of the stops so that the amount of room air or outside air, or a definite mixture of both, which is delivered to the room, can be maintained constant regardless of whether the apparatus is used for heating or for cooling.

In Figs. 12 and 13, there is shown another embodiment of the invention in which the air intake and air discharge passages are placed side by side in the upper portion of the casing, instead of near the bottom and top of the casing, as shown in Fig. 1. By this construction, all ducts will be overhead so as to leave the floor space around the unit unobstructed.

In this embodiment, the casing is provided with an air intake chamber 96 and an air discharge chamber 98. The air intake chamber communicates with the room through a duct 100 and with the outside atmosphere through a duct 102. Likewise, the air discharge chamber 98 communicates with the room through a duct 104 and with the outside atmosphere through a duct 106. The casing is further partitioned to provide a condenser compartment housing a condenser 108, a compressor compartment housing a compressor 110 and an evaporator compartment housing an evaporator 112. The casing is further provided with a duct or passage 114 leading from the air intake chamber 96 to the lower portion of the evaporator compartment and a duct or passage 116 leading from the condenser compartment to the air discharge chamber 98. In the condenser compartment, there is provided a blower 118, the low pressure side of which communicates with the air intake chamber 96 through the condenser compartment and a filter 120, and the high pressure side of which discharges into the compressor compartment. The blower 118 is thus adapted to draw air from the air intake chamber 96 and to propel the air to the air discharge chamber 98 through the compressor compartment and the passage 116. In the evaporator compartment is a blower 122 which is adapted to draw air from the air intake chamber 96 through the duct 114 and a filter 124, and to discharge the air over

the evaporator and into the air discharge chamber 98.

The air discharge chamber 98 is provided with a damper 126 mounted on a shaft 128 for rotation into the positions shown by solid and broken lines in Fig. 13. In the solid line position of this damper, the air moved by the blower 122 is delivered into the room in the direction of the arrow 130, while the air moved by the blower 118 is discharged to the outside atmosphere in the direction of the arrow 132. In this position of the damper 126, the apparatus is set for cooling the air of the room. Conversely, if the damper 126 is moved to the broken line position shown at the right-hand portion of Fig. 13, the air moved by the evaporator blower 122 through the passage 114 is discharged to the outside atmosphere, as indicated by the arrow 132, while the air moved by the condenser blower 118 through the duct 116 will be discharged into the room, as indicated by the arrow 130. In other words, the apparatus is converted from heating to cooling by mere transposition of the damper 126.

The air intake chamber 96 is likewise provided with means for controlling the admission of room air or outside air, or a mixture of both, from either or both of the ducts 100 and 102 into the apparatus. This means may be in the nature of a single damper 134 mounted on a shaft 136 for rotation to the positions shown in solid and broken lines in Fig. 13, or to intermediate positions (not shown). If desired, the damper 134 can be made in two pieces, after the fashion of the dampers 50 and 52.

Operation—Figs. 12 and 13

When the apparatus is to be used for cooling the room air, the damper 126 is adjusted as shown in solid lines in Fig. 13. If it is desired to cool and recirculate room air, exclusively, the damper 134 is adjusted to the position shown in solid lines in Fig. 13, in which position the upper end of the duct 114 is placed in communication with the room through the duct 100. The evaporator blower 122 now draws room air, exclusively, through the duct 114 and the portion of the air intake chamber 96 adjacent the duct 100. The air moved by the blower 122 is cooled by contact with the evaporator and is discharged into the room through the duct 104 and the adjacent portion of the upper air discharge chamber 98. The path of flow of the recirculated and cooled room air is indicated by the arrows 140 and 130. Simultaneously, the upper end of the condenser compartment is placed in communication with the outside atmosphere through the duct 102 and the adjacent portion of the air intake chamber 96, so that the blower 118 now draws outside air over the condenser, propels it into the compressor compartment to cool the latter, and discharges the air through the duct 116, through the portion of the air discharge chamber 98 adjacent the upper end of the duct 116, and through the outside duct 106. The path of flow of the outside air used for cooling the condenser and the compressor is indicated by the arrows 142 and 132.

When it is desired to cool outside air, exclusively, and admit it to the room, and simultaneously to exhaust room air to the outside atmosphere, the damper 134 is moved to the position shown in broken lines in Fig. 13. In this position, the upper end of the duct 114 is placed in communication with the outside air duct 102 and the upper end of the condenser compartment is placed in communication with the room duct 100. In this position, the evaporator blower draws outside air exclusively, while the condenser blower draws room air exclusively.

When it is desired to cool a mixture of outside air and room air and admit it to the room or when it is desired to exhaust room air with or without simultaneously introducing cooled outside air into the room, the damper 134 may be moved to other intermediate positions not specifically illustrated.

When it is desired to use the apparatus for heating the room air, the damper 126 is moved to the position shown in broken lines in Fig. 13 so as to place the duct 116 in communication with the room through the duct 104. This simultaneously places the upper end of the evaporator compartment in communication with the outside atmosphere through the duct 106.

To heat and recirculate room air exclusively, the damper 123 is adjusted to the position shown in broken lines, it being understood that for heating a mixture of outside air and room air with or without simultaneously exhausting room air, the damper 126 is retained in the broken line position and the damper 134 is adjusted to intermediate positions (not shown) in which the proportion of room air and outside air admitted to the intake chamber 96 may be varied at will.

The dampers 126 and 134 may be moved and positioned by any well-known means. For example, the dampers may be biased to the solid line positions by springs 144, and pull chains 146 may be used for pulling the dampers to the desired positions. The chains 146 terminate in accessible knobs 148 and suitable means, such as a keyhole slot arrangement (not shown) may be used detachably to engage the chains so as to retain the dampers in their adjusted positions against the bias of the springs.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What I claim is:

1. An air conditioning apparatus including a casing, an air cooling element in said casing, an air heating element in said casing, said casing having an air intake chamber arranged for receiving room air and outside atmosphere air to be conditioned by said cooling and heating elements and an outlet chamber arranged for receiving air conditioned by said elements and for discharging air to the room and to the outside atmosphere, means for propelling air from said intake chamber into contact with said cooling element and to said outlet chamber, means for propelling air into contact with said heating element and to said outlet chamber, a first damper means controlling the discharge of air from said outlet chamber, said damper means being movable to one position in which it directs the air cooled by said cooling element to the room and the air heated by said heating element to the outside atmosphere, and to another position in which it directs the air cooled by said cooling element to the outside atmosphere and the air heated by said heating element to the room, and a second damper means for controlling admission of room air and outside atmosphere air into said intake chamber, said second damper means being movable to one extreme position in which room air exclusively is directed to said cooling element and outside air exclusively is directed to said heating element and to another extreme position

in which outside air exclusively is directed to said cooling element and room air exclusively is directed to said heating element, and also being movable, while the first damper means is in one of its two mentioned positions, to a plurality of intermediate positions for directing variable mixtures of room air and outside atmosphere air to said cooling element and to said heating element.

2. An air conditioning apparatus including a casing, means dividing said casing into an evaporator compartment and a condenser compartment, an evaporator in said evaporator compartment, a condenser in said condenser compartment, said casing having a single intake chamber communicating with said evaporator and condenser compartments and arranged for receiving room air and outside atmosphere air to be conditioned by said evaporator and said condenser, and having a single outlet chamber communicating with said compartments for receiving the air conditioned by said evaporator and said condenser and arranged to discharge the conditioned air to the room and to the outside atmosphere, means for propelling air from said intake chamber into said evaporator compartment and to said outlet chamber, means for propelling air from said intake chamber to said condenser compartment and into said outlet chamber, a first damper means controlling the discharge of air from said outlet chamber, said damper means being movable to one position in which it directs air conditioned by said evaporator to the room and air conditioned by said condenser to the outside atmosphere, and to another position in which it directs the air conditioned by said evaporator to the outside atmosphere and the air conditioned by said condenser to the room, and a second damper means for controlling the admission of room air and outside air from said intake chamber into the evaporator and condenser compartments, said second damper means being movable to one extreme position in which room air exclusively is directed to said evaporator compartment and outside air exclusively is directed to the condenser compartment and to another extreme position in which outside air exclusively is directed to the evaporator compartment and room air exclusively is directed to the condenser compartment, and also being movable, while the first damper means is in one of its two mentioned positions, to a plurality of intermediate positions for directing variable mixtures of room air and outside air to said evaporator and condenser compartments.

3. An air conditioning apparatus as set forth in claim 1 and further including operating means for moving said first damper means from one to the other of its two mentioned positions, means yieldably connecting said operating means to said second damper means for moving the latter as far as it is free to move, and adjustable stop means for limiting the movement of said second damper means toward its extreme positions, whereby the second damper means is positioned to provide desired mixtures of room air and outside atmosphere air to said cooling element and to said heating element when the operating means moves the first damper means to its said one position and to provide different desired mixtures when the operating means moves the first damper means to its said other position.

4. The structure recited in claim 1 in which said intake and outlet chambers are disposed near the bottom and top of said casing, respectively, together with a rotatable shaft, means rigidly mounting said first damper means on the upper portion of said shaft so as to be rotatable therewith from one of its positions to the other, means yieldably connecting said second damper means to the lower portion of said shaft so as to be rotatable therewith in the absence of means limiting the movement of said second damper means, and adjustable limiting means adapted to be positioned in the path of movement of said second damper means for limiting the movement thereof and thus determining the plurality of intermediate positions to which said second damper means is to be set for regulating the mixture of room and outside air admitted to said intake chamber.

5. The structure recited in claim 1 in which said intake and outlet chambers are disposed side by side near the top of the casing, together with means for movably supporting each of said damper means, and means for moving said first and second damper means and for retaining them in various positions independently of each other.

CLIFFORD S. CODY.

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