Oct. 29, 1957 H. F. LATHROP 2,811,022

ROOM AIR CONDITIONER

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Fig. 1

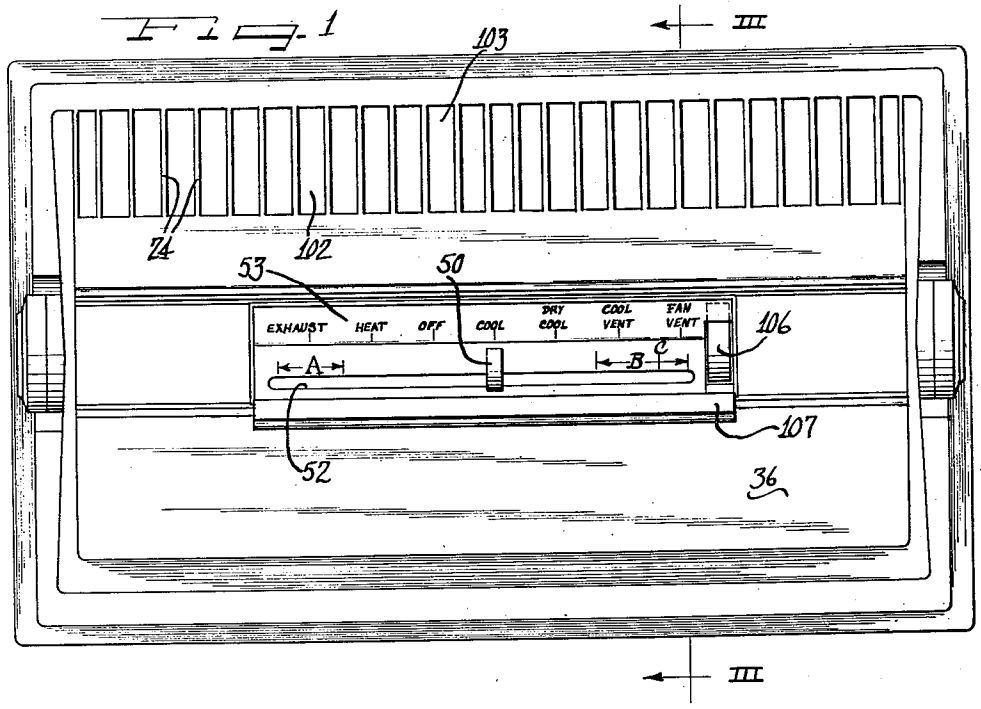
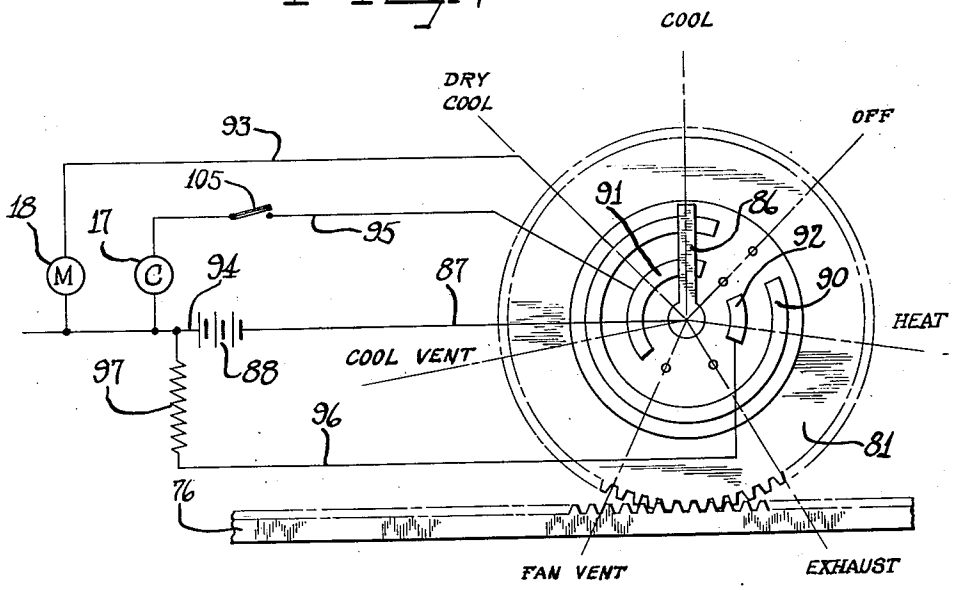


Fig. 7



Inventor

Harold F. Lathrop

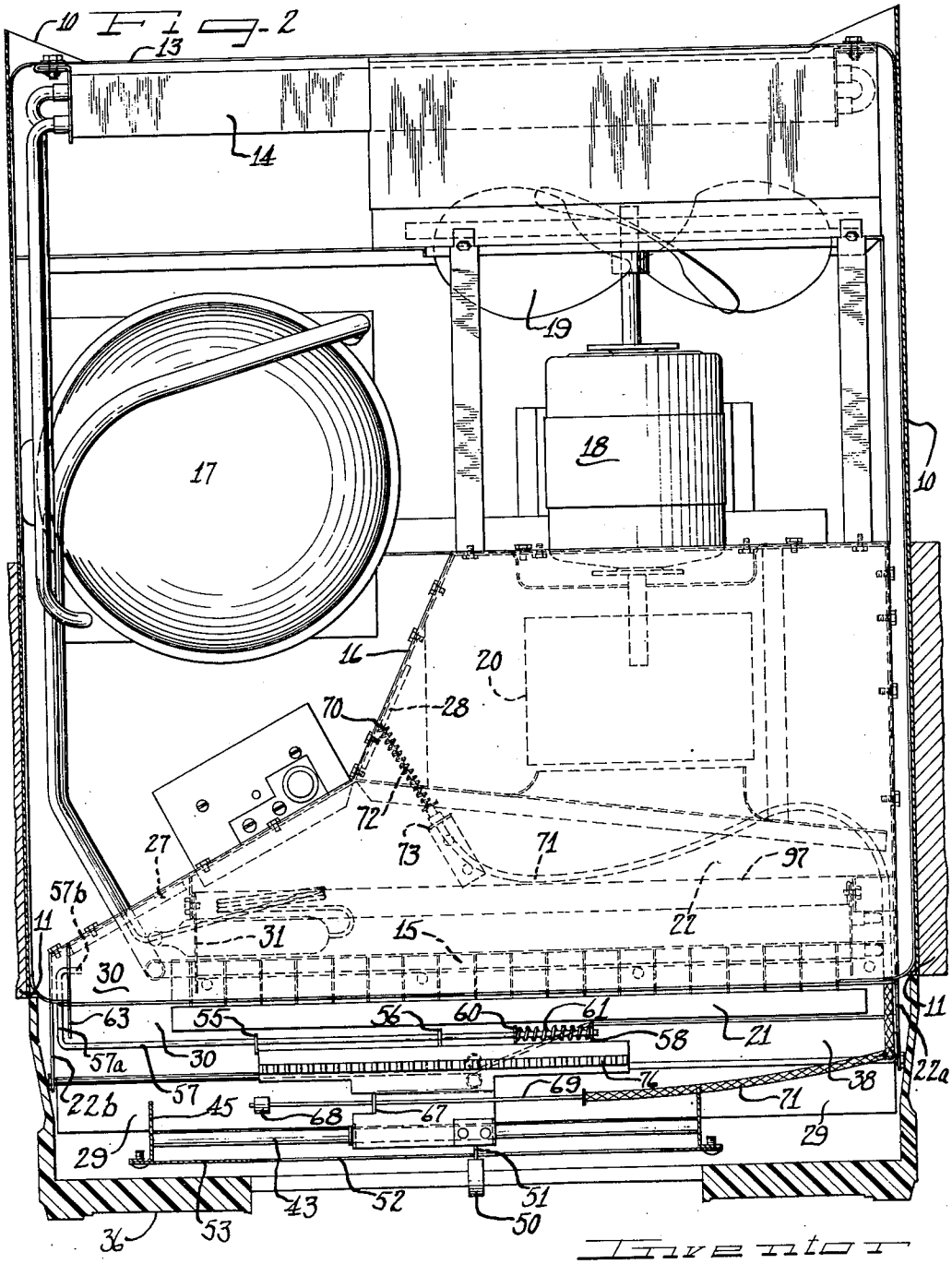
by Kiel, Thomas, Mecca, Gravelle & Attys

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ROOM AIR CONDITIONER

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FIG. 2



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ROOM AIR CONDITIONER

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Fig. 3

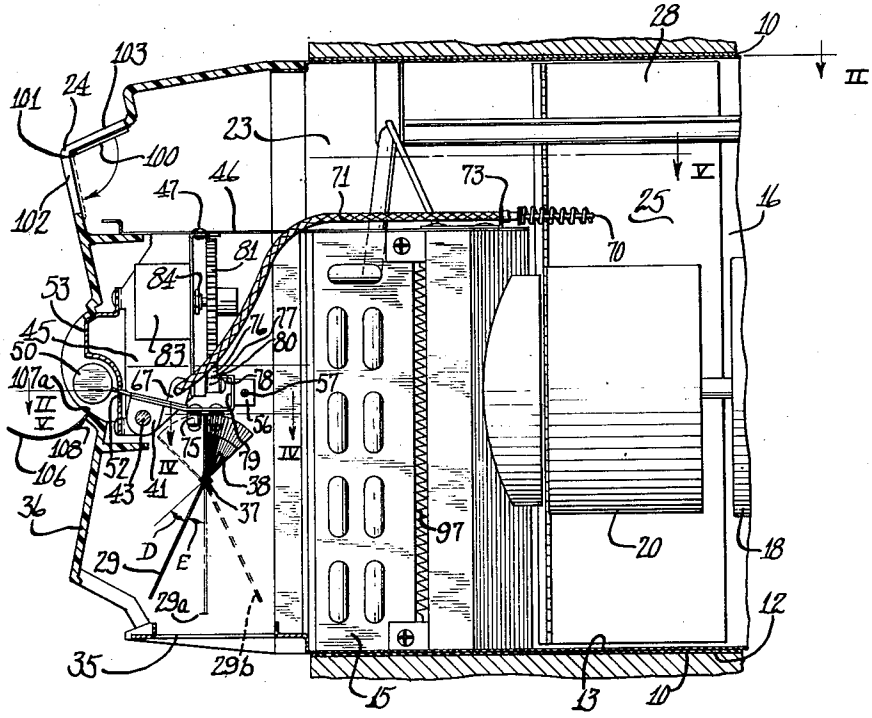
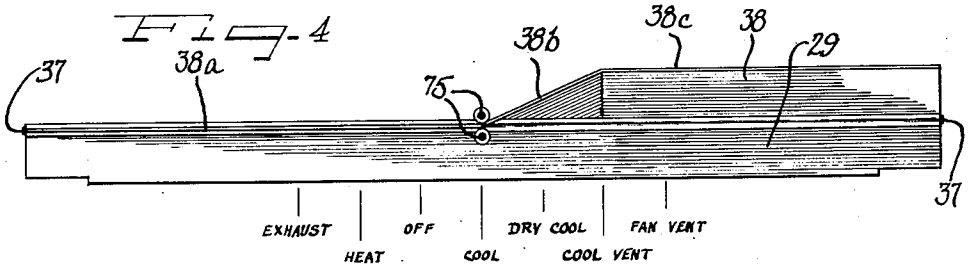


Fig. 4



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ROOM AIR CONDITIONER

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Fig. 5

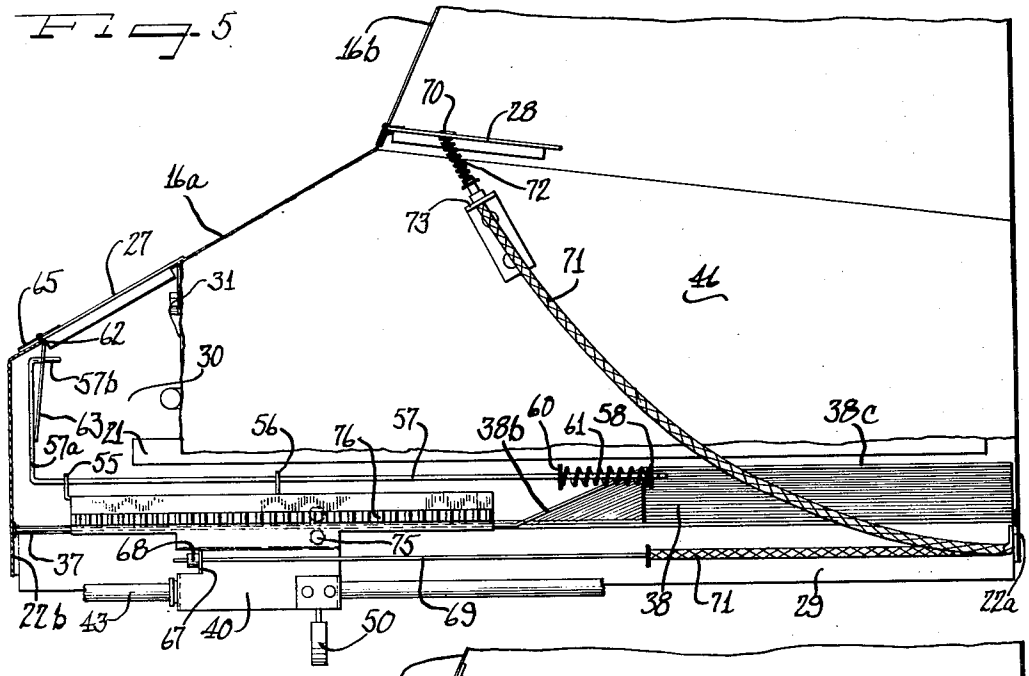
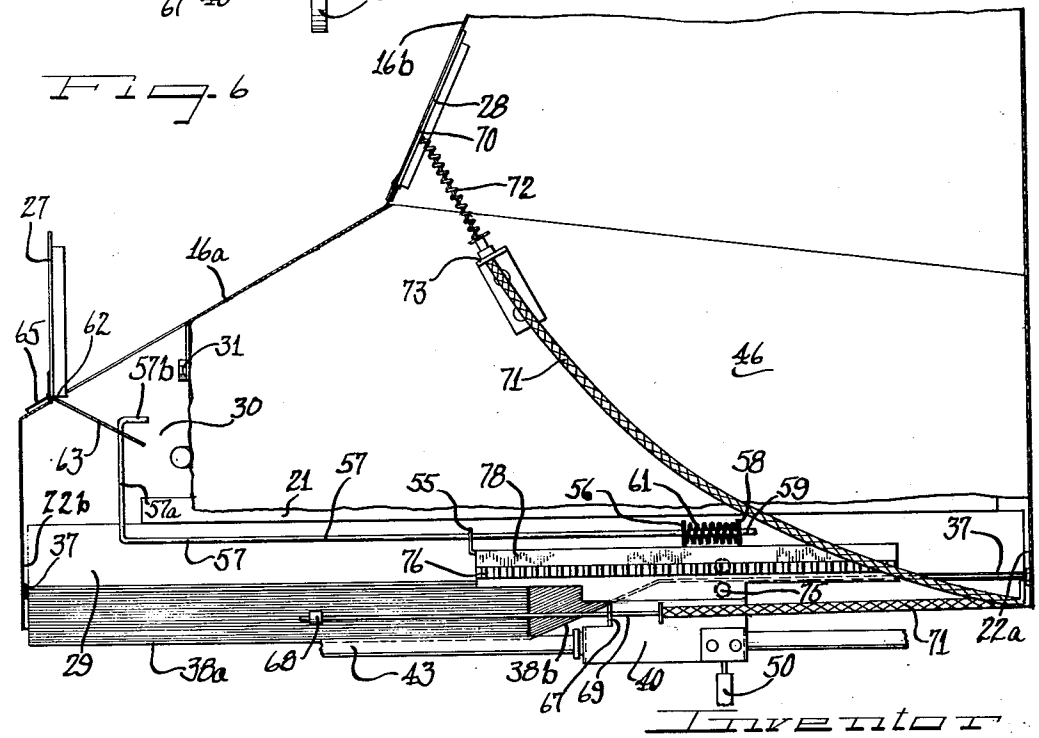


Fig. 6



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by Kerr, Akerman, Merriam, Gould & Pettis

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Patented Oct. 29, 1957

2,811,022

ROOM AIR CONDITIONER

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Application November 13, 1953, Serial No. 391,863

18 Claims. (Cl. 62—129)

The present invention relates to air conditioning equipment, and more particularly is concerned with the provision of a novel and more effective apparatus for controlling the various interrelated motors and air flow dampers thereof.

With the advent of widespread ownership of air conditioning units, and especially of the type which is positioned in a room window for conditioning a single room, the need for improved controls has increased. In view of the fact that air conditioners of this type are positioned for ready adjustment by the user, and further in view of the fact that many of the users are women or other persons unskilled in the operation of mechanical devices, it has been desired that a control system be provided which is capable of operation through a single, simple, control lever.

I am of course aware of the fact that interrelated controls have been used in the prior art of air conditioning. However, to my knowledge, the prior art control structures have been limited to rotary type control levers and have failed to provide the completeness of control available in the simplified, reciprocating, structure herein provided.

In order to provide a control system which is extremely rugged, compact, and simple to operate, the present invention utilizes a pair of oppositely reciprocatable control rods for actuating fresh air and room air exhaust dampers, a directly actuated room air recirculation damper at the inlet to the refrigeration evaporator and a multiple position rotary switch capable of actuation simultaneously with the reciprocation of the damper controls for selectively energizing the refrigerant compressor motor, the fan motor, or an electric heater, or a combination thereof, as may be desired. By operatively associating the switch or energizing means, with the reciprocating controls, the control system herein shown provides a complete range of operation for winter or summer use by means of a single reciprocating knob having a plurality of positions along a horizontally disposed dial.

It is, therefore, an object of the present invention to provide a novel master control system for air conditioning apparatus.

A further object of the present invention is to provide a simplified master control system for air conditioning units while at the same time providing a substantially rigidified structure.

Yet a further object of the present invention is to provide an automatically interrelated damper control system for room air conditioners in which dampers controlling fresh air inlet, room air exhaust, or room air recirculation may be controlled and proportioned by means of a single sliding lever.

A feature of the present invention is the interrelationship of a pair of reciprocating transmitting cables having lost motion in opposite directions.

Another feature of the present invention is the provision of a reciprocating control platform which alternatively actuates one or the other of a pair of reciprocating

transmission cables and simultaneously actuates a recirculation damper in a positively driven manner.

Another object of the present invention is to provide a rotary control switch for the interrelated energization of an air conditioner motor and fan, which switch is actuated in a predetermined relationship with the air distribution dampers of the conditioning unit.

Another object of the present invention is to provide a novel air distribution damper arrangement for distributing air from the evaporator chamber of the air conditioner to the room.

A further object of the present invention is to provide an interrelated damper control system for proportioning a desired amount of fresh air with recirculated air at the inlet to the evaporator of an air conditioning unit.

Another feature of the present invention is the interrelationship of an inlet damper controlling the flow of room air to the evaporator chamber of an air conditioning unit to reduce the air flow to said evaporator and thereby increase the dehumidification of recirculated air.

Yet another feature of the invention is a full length room air recirculation control damper positioned upstream in the air flow to the evaporator chamber whereby the condensation of moisture from the air by the evaporator may be varied.

Still other and further objects and features of the present invention will at once become apparent to those skilled in the art from a consideration of the attached drawings which illustrate a preferred embodiment of the present invention and in which:

Figure 1 is a front elevational view of an air conditioning unit constructed according to the present invention and illustrating my control panel;

Figure 2 is a plan view in cross-section taken along the line II—II of Figure 3;

Figure 3 is a partial, side elevational view in cross-section taken along the line III—III of Figure 1;

Figure 4 is a cross-sectional view taken along the line IV—IV of Figure 3 and illustrating the positioning of the recirculation damper;

Figure 5 is a plan view in cross-section taken along the line V—V of Figure 3 but showing the controls in the extreme left hand operating position;

Figure 6 is a plan view in cross-section taken along the line V—V of Figure 3 but having the parts in the extreme right hand operating position as viewed in Figure 1;

Figure 7 is a schematic view illustrating the electrical connections forming a portion of the present control system.

As shown on the drawings:

As may be seen from a consideration of Figures 1 and 2, the control apparatus of the present invention is utilized in a generally rectangularly shaped air conditioning unit positioned in an opening in the wall of a room to be air conditioned. The conditioning unit comprises an outer housng **10** which is preferably semi-permanently secured in the window opening **11** by any conventional mounting means. The housing **10** is preferably constructed of sheet metal and is adapted to cover the sides and top of the air conditioning apparatus and, further, is constructed to provide supporting means **12** along its lower edges for supporting a base pan **13**.

The base pan **13** is preferably of conventional design and is provided with an upstanding peripheral flange, thereby making it dish-shaped for the collection of condensate. A condenser **14** and an evaporator **15** are secured to the base pan **13** at opposite ends thereof and are separated from each other by an intermediate insulated partition **16** thereby providing an evaporator compartment and a condenser compartment. The ends of the sheet metal housing **10** are open, and hence the condenser **14** faces outdoor atmosphere while the evaporator **15**

faces into the room. Thus, the condenser compartment is open to air flow from the outside and the evaporator compartment is open to air flow from within the room.

The conventional refrigeration compressor **17** is provided in the condenser compartment and a fan motor **18** is mounted in the condenser chamber, preferably by securing it to the partition **16** or the base pan **13**. The fan motor **18** carries a condenser fan **19** which moves air inwardly through the condenser **14**, over the motor **18** and the compressor **17**. The motor also drives a centrifugal fan **20** which draws air through the filter **21**, through the evaporator **15** into the lower chamber **22** through the centrifugal fan **20** which forces the air upwardly through the overhead outlet chamber **23** past the outlet grill **24** into the room.

The above described air circulatory paths are those defined by the enclosure walls **10** and **16** without regard to modification of the air flow resulting from damper controls. The air conditioning unit operating under the above described air flow would provide what is generally termed "recirculation" of the room air with cooling and dehumidification only. No provision is made, in the above described air flow for either exhausting stale air from the room or for the introduction of fresh air into the room from the outside. Also, no controls are provided for varying the rate of flow over the evaporator apparatus, and as a result, a constant rate of dehumidification is provided.

While the above outlined apparatus provides a large amount of refrigeration, it has been found inadequate in most homes since it is usually desired that fresh, filtered air be available from the outside and also that room air be exhausted or heated on occasion. Further, it is often desired to increase the rate of dehumidification of the air within the room. Additional controls for accomplishing these functions are provided by the present invention and are correlated with each other so that the positioning of a single control knob will automatically provide different types and varying degrees of refrigeration or heating.

As may be seen from Figures 2, 5 and 6 the air conditioner of the present invention is provided with three correlated air control dampers, namely a fresh air damper **27**, an exhaust damper **28** and a recirculation air damper **29**. A consideration of the air pressures resulting from operation of the fans **19** and **20** indicates that the condenser compartment will be under a positive pressure caused by the operation of the fan **19** to draw outside air into the condenser compartment, while the lower evaporator compartment **22** is under a reduced pressure since it provides the source for the fan **20**. The high pressure chamber **25**, which constitutes the exhaust or high pressure side of the centrifugal fan **20** is in direct connection with the outlet chamber **23** as may be seen from Figure 3.

From the above, it will be apparent that the condenser chamber and the chamber **25**, which lie on opposite sides of the right hand portion of the separating wall **16** as viewed in Figure 2 will be under a positive pressure. However, due to the design of the fans **19** and **20**, the pressure built up in the chamber **25** will be of a substantially greater degree. Thus, while fans **19** and **20** are in effect pumping against each other, air will flow in an exhausting direction through the partition **16** when the exhaust damper **28** is open.

On the other hand, when the fresh air vent damper **27** is in its open position, shown in Figure 6, the positive pressure found in the condenser compartment as a result of the fan **19**, coupled with the reduced pressure found in the chamber **22**, will cause a strong flow of outside air through the damper opening **27**, through the side channel **30**, around the end wall **31** of the chamber **22**, through the filter **21**, the evaporator **15** and out through the fan **20** to the exhaust chamber **23** and from thence to the room.

By passing all of the fresh air entering through the vent **27** over the filter **21** and the evaporator **15** prior to releasing it from the air conditioning cabinet enclosure, all of the fresh air will be filtered and cooled before entry into the conditioned space. Further, even if the compressor is not in operation, all of the fresh air entering the air conditioning cabinet evaporator chamber through the damper **27** will be filtered prior to its distribution to the room. This is of course, an important matter in industrial areas where ventilation is practically impossible without filtering the air being brought in from the outside atmosphere.

Recirculation of room air through the evaporator **15** is accomplished through the room air inlet **35** in the bottom of the front cover **36**. This opening is controlled by means of the damper **29** which comprises a rectangular sheet of material pivoted about the rod **37** to the side walls **22***a* and **22***b* of the main evaporator enclosure as may be seen from Figures 2, 4, 5, and 6. The damper **29** is provided with an upstanding cam extension **38**, which is preferably integral with the damper portion **29** but may, of course, be constructed of sheet metal or deformed bar stock rigidly secured to the damper **29** by any conventional means. In either construction, the cam surface is arranged to follow a line composed of points lying a constant distance from the pivot **37** but positioned on radius lines lying at varying angles to the plane of the damper **29**.

As may be seen from Figure 3, when the damper **29** is positioned in the dotted line position **29***b* adjacent the filter **21**, the air flow through the opening **35** is effectively blocked from passing through the filter to the evaporator **22** and through the fan **20**.

It is to be noted however, that the damper **29** in no way interferes with the passage of fresh air from the vent **27**, through the side channel **30** and from thence through the filter **21** and the evaporator **15**. This is true since the chamber **30** extends from the base pan **13** upwardly the entire height of the filter **21** and the evaporator **15**. Thus, air passing through the passage **30** may flow behind the damper **29** very readily, even though it is in the closed, or dotted line position shown in Figure 3. It is thus evident that the damper **29** and the damper **27** may be controlled to provide selectively, fresh air from the outside, or recirculated air from the room, or varying proportions of the two, to the evaporator **15**, upon the utilization of interrelated controls. Of course, it is to be understood that when the damper **29** is positioned in the solid line position indicated in Figure 3, air will pass directly through the aperture **35** through the filter **21**, the evaporator **15** and on through the evaporator fan **20**.

Having thus described the positioning of the dampers utilized for purposes of air control, the interrelationship provided by the structure of the present invention will now be described. Since the fresh air inlet damper **27** leads fresh air directly to the evaporator fan **20**, and since the evaporator fan **20** pumps air under pressure into the area **25** adjacent the exhaust opening **28**, it is clear that in order to provide effective fresh air supply to the room, the exhaust damper **28** must be in the closed position when the fresh air vent **27** is open. Therefore, apparatus is provided for alternatively opening the dampers **27** and **28**.

The above mentioned alternative operation is provided in the present invention by means of a reciprocating platform **40** which is preferably constructed of sheet metal. Ears **41** are turned downwardly from the platform **40** and are provided with apertures for the passage of a fixed mounting rod **43**. The mounting rod **43** is rigidly secured to the base structure **13** of the air conditioning unit, preferably through a mounting bracket **45** which is secured to the bottom closure wall **46** of the chamber **23** by means of any conventional fastening structure, such as rivets **47**. In this connection, it is noted that the

bottom closure plate **46** provides a cover plate for the evaporator compartment and shrouds the evaporator and filter **21** to prevent air from passing upwardly and over the filter **21** and the evaporator **15** into the fan inlet chamber **22**. The plate **46** may of course be secured to the evaporator **25** or to the walls **22***a*, **22***b* whichever is desired. In any event, it is necessary that the rod **43** be firmly fixed relative to the base structure of the air conditioning unit.

The platform **40** is moved laterally along the rod **43** by means of a single actuating knob **50** which is secured to the plate **40** by means of a riveted, or otherwise secured, extension **51** which extends through a slot **52** in the indicator plate **53**. As may be seen from a consideration of Figure 1, the slot **52** extends substantially the entire length of the indicator plate **63** and permits the movement of the actuating knob **50** between extreme positions of "exhaust" and "fan-vent." The indicator plate **53** is secured to the fixed support **45**, or the hood **36**, whichever is preferred and thus remains in a constant position relative to the rod **43**.

Actuation of the fresh air and exhaust dampers respectively is accomplished by means of lost motion connections between the plate **40** and the respective dampers **27** and **28**. As may be seen from Figures 5 and 6, the plate **40** is provided with a pair of bent over lips **55** and **56** which slidably support the fresh air damper actuating rod **57**. The rod **57** carries, at the right end thereof as viewed in Figures 5 and 6, an abutment washer **58** maintained in position on the rod **57** by means of a cotter key **59** or similar conventional means. A second abutment washer **60** is slidably mounted upon the rod **57** at the left end of a normally uncompressed take-up spring **61**.

The ear **56** and the washer **60** are constructed so that upon movement of the ear **56** to the right, the washer **60** will abut the ear **56** and further movement of the ear **56** can be accomplished only through compression of the spring **61** or movement of rod **57**. The damper **27** is provided with a hinge **62** by which it is pivoted to the portion **16***a* of the dividing wall **16** and further carries an extension **63** rigidly secured thereto and extending into the path of the bent over arm **57***a* carried by the actuating rod **57**.

In order to prevent undesired rotation of the loosely mounted rod **57**, an aperture is provided in the extension **63** and a portion **57***b* of the arm **57***a* is positioned in the aperture, thereby preventing the arm **57***a* from turning about the axis of shaft **57** and into a position out of contact with the damper actuating extension **63**.

As may be seen in Figure 5, the shaft **57** is in an inactive, or non-actuated position when the actuating knob **50** is in its extreme left hand position. Sufficient lost motion is provided between the abutment **56** and the washer **60** so that the fresh air damper **27** is not actuated in the counterclockwise direction, or into the open position until the actuating knob **50** has moved to the right, as viewed in Figure 1, to the position entitled "cool vent." In the cool vent position, the damper **27** is in a partially open position intermediate between that shown in Figures 5 and 6.

In opening the damper **27**, the spring **65**, which normally biases the damper **27** closed, must be overcome in order to provide a smoothly balanced opening operation. The spring **61** is constructed to collapse partially before the damper **27** begins to open. This compound resiliency provides a smooth damper action and also permits sufficient resiliency in the system to prevent possible jamming of the mechanism due to very slight misalignments caused by imperfect assembly. It has been found that the provision of the spring **61** and the washer **60** have substantially eliminated any problems of binding relative to the actuating shaft **57** and as a result, no expensive reaming operations or similar expensive operations or parts are necessary relative to the turned over lips or ears **55** and **56** to provide perfectly aligned bearings.

As shown in Figure 6, by movement of the actuating knob **50** to the extreme right hand position, or in other words, into the position of "fan-vent," the damper **27** is moved into its fully open position thereby admitting the maximum amount of fresh air through the partition **16***a* to the passageway **30**.

Actuation of the exhaust damper is accomplished in a manner similar to that above described relative to the fresh air damper **27**, except that the exhaust damper is actuated upon movement of the platform **40** in the left hand, or opposite direction. The lost motion for the exhaust damper is provided by means of the ear **67** turned upwardly from the plate **40** in combination with the abutment **68** which is rigidly secured to the actuating cable **69**, which is in turn connected at **70** to the exhaust damper **28**. The cable **69** is slidably mounted in the fixed cable housing **71** and movement of the abutment **68** toward the left will cause a pull at **70** upon the damper **28**. The damper **28** is normally biased into the closed position against the partition portion **16***b* by the spring **172** which is confined between the damper **28** and the fixed abutment **73** which carries the cable housing **71**. The fixed abutment **73** may, of course, be carried by any portion of the air conditioning apparatus which is secured to the base plate **13**, and is, preferably carried by a portion of the closure plate **46** in the compartment **23**.

Actuation of the damper may be clearly understood from a consideration of Figures 5 and 6. In Figure 6, the actuating knob, and hence the plate **40** are positioned in the extreme right hand, or fan-vent, position. In that position the abutment **68** on the actuating cable **69** is not in contact with the ear **67** on the plate **40**. This is true since the abutment **68** moves to the right only to the extent necessary in permitting the damper **28** to move to the closed position under the influence of the spring **72**. However, upon movement of the actuating knob **50** toward the left, the ear **67** intercepts the abutment **68** and moves the actuating cable **69** toward the left in opposition to the biasing spring **72**. Opening of the damper **28** is desired only in the position of "exhaust" and hence the abutment **68** is positioned on the cable **69** so that it will be intercepted by the ear **67** at a position only slightly to the right of the position "exhaust" on the indicator plate and will be moved to the point of maximum exhaust damper opening at the position immediately adjacent the left hand end of the slot **52**.

From the relationships above described, and shown in Figures 5 and 6, it will be apparent that a range of fresh air damper opening positions will be provided adjacent the right hand end of the indicator plate and a range of exhaust damper open positions will be provided at the left hand end of the damper plate. The extent of these ranges is indicated in Figure 1 wherein the range denoted A is the range of movement of the knob **50** corresponding to movement of the exhaust damper and the range B is the range of movement corresponding to movement of the fresh air damper.

In view of the resiliency of the fresh air damper hookup, provided by the spring **61**, the fresh air damper is permitted to reach its maximum open position at a point C between the "cool-vent" and the "fan-vent" positions. From the left end of range B to the point C, the fresh air damper is gradually opened, permitting a mixture of fresh air with that of the room. From the point C to the right, continued movement of the knob **50** will cause no further opening of the fresh air damper but will maintain the damper in its fully open position.

It is thus apparent, that the exhaust and fresh air dampers are alternatively operated and that an area is provided in which neither the fresh air nor exhaust damper is in the open position. This intermediate area is utilized as described below for the recirculation and cooling or heating of the room air.

Control of the recirculation of room air is provided by means of the damper **29**. As explained above, the damper **29** is provided with a cam surface **38**, an end view of which may be seen in Figure 3. The cam surface **38** is more clearly seen in Figure 4 wherein the damper **29** is viewed from above in its wide open, room air recirculation, position. As may there be seen, the cam surface **38** is deflected rearwardly along a portion **38***b* until it reaches an extreme position **38***c* in which the cam surface is positioned at an angle D relative to the damper **29**. As may be seen from Figures 3 and 4, a straight portion **38***a* provides the other extreme cam position and lies at an angle E relative to the damper **29**.

The cam surface **38** cooperates with a pair of rollers **75** which are rotatably mounted on the plate **40**. Since the support rod **43** and the recirculation damper pivot **37** are positioned on parallel axes, it will be clear that movement of the actuating knob **50** along the rod **43** will cause the rollers **75** to traverse a path directly over and parallel to the pivot **37**. Since the cam surface **38** is positioned between the rollers **75**, reciprocation of the rollers **75** will cause the damper **29** to be pivoted from a solid line, open, position shown in Figure 3 in which the rollers contact the portion **38***a* of the cam **38**, to a position in which the rollers **75** have moved to the right as viewed in Figure 1 to a position in which they cooperate with the portion **38***c* of the cam surface **38** to maintain the damper **29** closed. A plan view of the operation of the damper **29** by the rollers **75** may be seen in Figures 5 and 6 wherein the rollers **75** are in contact with the portions **38***a* and **38***c* of the cam **38** respectively.

Operation of the fan and compressor motor controls is also accomplished through reciprocation of the platform **40** by the control knob **50**. For this purpose, a toothed rack **76** is secured longitudinally along the member **40**. As shown in Figure 3, the rack **76** is integral with the sheet metal platform **40** and comprises the bent up flange **77** with the teeth **76** thereon. The flange **77** is in turn deformed from the horizontally projecting flange **78** and the upturned side **79** which carries the ears **55** and **56** associated with the fresh air damper control above described.

A backing roller **80** is rotatably mounted upon a fixed support **45** in contact with the guide flange **78**. This arrangement provides support for the platform **40** through the guide flange **78** as well as at the ears **41** riding upon the longitudinally extending rod **43**. This three point support prevents the platform **40** from dropping downwardly unto the cam **38** and also maintains the reciprocating control rods **57** and **69** in a bind-free, constant position.

The rack teeth **76** engage a gear **81** securely fixed to the switch shaft **82**. The shaft **82** is the operative member of a rotary switch **83** rigidly secured to the fixed housing **45** by means of a conventional center post fastening nut **84**. In constructing the apparatus, it is desired that the center post be mounted in a somewhat elongated vertical slot rather than a round hole. Thus, the switch **83**, with its shaft **82**, may be moved vertically somewhat to provide the desired engagement tension between the gear **81** and the rack teeth **76**.

In assembly, the gear **81** is mounted to fully engage the rack **76** and maintain the guide flange **78** in engagement with the rollers **80**. By thus positioning the switch **83**, all slack is taken out of the rack support, as well as the supports for the reciprocating damper controls, thereby preventing rattling and other annoying vibrations during operation of the controls. In this connection, it is to be understood that the rollers **75** and **80** may be of any suitable material, but it is preferred that they be coated with rubber, nylon, or similar resilient material capable of damping.

The control switch **83** may comprise any conventional type of multiple control type switch either of the rotary type or the type comprising a plurality of axially spaced switches actuated by cams on the reciprocating platform **50**, but preferably it takes the form shown in Figure 7. There, the shaft **82** carries a conducting wiper **86** which is electrically connected by means of a conductor **87** to a source of electricity **88**. Current is taken from the wiper **86** by means of a fan control segment **90**, a compressor motor segment **91**, and a heating coil segment **92**. While the switch **83** is a continuous one, seven operative positions are provided, corresponding to the positions indicated on the control dial panel shown in Figure 1. These positions are indicated by the radially extending center lines of Figure 7 bearing indicia corresponding to those found on the indicator plate.

The fan motor **18** is connected by means of the conductor **93** to the segment **90**, and by the return conductor **94** to the source of electricity **88**. The segment **90** extends substantially around the periphery of the switch **83** but is provided with an interrupted portion at the "off" position. In all the remaining positions of the control knob **50**, the fan motor **18** is energized.

The compressor **17** is likewise electrically connected to the return **94**, and to its segment **91** by means of the connector **95**. However, the segment **91** is relatively short and as may be seen from Figure 7 provides an electrical connection between the wiper **86** and the conductor **95** only when the control knob **50** and hence the wiper **86** is in the cool-vent, dry-cool and cool positions. No cooling effect is provided in the fan-vent, exhaust, heat, or off positions.

Since the compressor **17** is not, for obvious reasons, in operation during the heating season the segment **92** is positioned in a vacant portion of the arc of the segment **91**. This placement permits a minimum space requirement of the switch **83** without curtailing the operation in any way. The segment **92** is connected by the conductor **96** to the heater resistance coil **97** which is in turn connected to the return **94**. The heater **97** is in operation only during the period when the knob **50**, and hence the wiper **86** is in the "heat" position.

While no switch position-maintaining detents have been shown, it is contemplated that conventional spring biased detents be provided to maintain the wiper **86** in its selected position. In view of the direct relationship between the switch **83** and the platform **40**, it will be understood that the switch detent will also provide the means for maintaining the knob **50** in its various selected positions.

Having thus described the component elements of my interrelated control mechanism, its operation as a unit will now be explained. After installation, and the connection of the unit to an electrical source, control of the fresh air damper, the exhaust damper, the recirculation damper, and the motor switches may all be accomplished through the single master control knob **50**. This control may best be described by the discussion of the separate, control knob positions.

Exhaust.—In the exhaust position, the control knob **50** is positioned at any desired point within the range A, indicating the exhaust damper opening, and positioned directly under the word "Exhaust" on the indicator panel. In this position, a plan view which may be seen in Figure 5, the exhaust damper **28** is in its open position and the fresh air damper **27** is closed. Likewise, the rollers **75** are in contact with the portion **38***a* of the cam **30***a* and the recirculation damper **29** is therefore also in the open position, permitting maximum air flow from the room to the air conditioning unit through the aperture **35**. Due to rotation of the gear **81** in response to movement of the control knob **50** to the exhaust position, the wiper **86** is rotated to the angular position marked "Exhaust" in Figure 7 in which the fan motor **18** alone is energized.

Thus, in the "Exhaust" position, room air is drawn in through the aperture **35** past the open damper **29**, through the filter **21**, the evaporator **25**, through the fan

20, out through the exhaust damper 28 and from thence to the outside atmosphere. As explained above, while the fan 19 provides a positive pressure in the condenser compartment, the fan 20 provides a higher pressure than the fan 19 and hence, air flow is directed outwardly through the partition 16 and the opening 28.

Heat.—During the winter months, the air conditioning unit of the present invention may be utilized for purposes of providing heat to the air of the room. Since it is not desired to heat fresh air directly from outdoors, it being more efficient to heat recirculated air, recirculation damper 29 is maintained in its opened position by contact of the rollers with the section 38*a* of the cam 38. Thus, the damper 29 is in the full line position shown in Figure 3. Likewise, it is desired that both the exhaust and fresh air dampers be closed. Therefore, movement to the heat position will cause disengagement between the abutment 68 and the ear 67 of the platform 40 and, likewise, the ear 56 will not be in contact with the abutment 60. In view of this, the biasing springs 65 and 72 will maintain the dampers 27 and 28 respectively in their closed positions. In order to circulate the heat generated by the heating element 97, the fan motor 18 is energized at the same time as the element 97. The electrical connections may be clearly seen from Figure 7 wherein, in the heat position, the wiper 86 extends horizontally to the right.

Off.—In the off position, the dampers remain in exactly the same position as in the heat position above described, with the exhaust and fresh air dampers closed and the recirculation damper open. However, no electrical contact whatever is provided between the wiper 86 and any of the electrical components 17, 18 or 97. Thus, no air is moved, nor is any electrical energy consumed.

Cool.—In the cool position, the control knob 50 is positioned directly under the portion marked "Cool" on the indicator panel and the controls are positioned as indicated in the solid lines of Figure 2. Thus, the fresh air, exhaust, and recirculation dampers, are in the same position as indicated above in connection with the heat and off positions. No fresh air is circulated and the entire cooling effect is performed upon recirculated air. In this position, both the compressor 17, and the fan motor 18 are energized and a maximum amount of recirculated air is permitted to pass through the fully open damper 29, through the filter 21, the evaporator 25, the fan 20 and out through the room air chamber 23 to the room.

Dry-cool.—The dry-cool position is provided in order to increase the dehumidification of the recirculated air. This is accomplished by partially closing the recirculation damper 29 without modifying the condition of any of the remaining elements. Thus, the rollers 75 move into contact with the cam surface 38*b*, and proceed along it approximately half the length of that surface. This causes the damper 29 to move into the position indicated by the dotted line 29*a* as shown in Figure 3, closing off approximately half of the recirculation air opening 35. As may be seen from Figure 7, in the dry-cool position both the compressor and the fans are in energized condition. Further, the fresh air damper control has not yet quite reached the opening position. Thus, the ear 56 and the abutment 60 are positioned immediately adjacent each other but are not in force transmitting position as yet.

Due to the restriction on the air flow to the evaporator through the opening 35, a smaller volume of air is passed over the evaporator 25, thereby more efficiently cooling the recirculated air. This results in the cooling of the recirculated air to a greater extent than that which would occur in the "Cool" position thereby removing a larger amount of moisture from the air. This air conditioning position is particularly effective in very moist weather in which the humidity level has become the determining factor in comfort.

Cool-vent.—In many cases it is desirable that a portion of the air cooled and circulated by the air conditioning unit be fresh air from outside the room. The present control system provides for the introduction of fresh air in varying proportions in combination with recirculated air. This is accomplished by movement of the control knob 52 to the range indicated at B, in Figure 1. Within that range, the fresh air damper 27 is progressively opened as the knob 50 is moved toward the right in Figure 1. In view of the angular relationship of the cam surface 38*b*, movement of the knob 50 toward the right also causes continued closing movement of the damper 29 simultaneously with the opening movement of the fresh air damper 27. Therefore, the control system automatically provides proportioning between recirculated air and fresh air such that as the amount of fresh air increases, the amount of room air recirculated decreases. As may be seen, from Figure 7, the "Cool-vent" position of the wiper 86 provides an electrical contact between the wiper 86 and the segments 90 and 91, thereby energizing both the compressor 17 and the pan 18.

Assuming that the knob 50 is substantially directly under the word Cool-vent as viewed in Figure 1, the fresh air damper will be substantially one-half way open and the damper 29 will be about three-fourths closed. In this position, fresh air will be drawn in through the damper 27, along the passageway 30, around and through the filter 21 the evaporator 25 to the fan 20. Likewise, a current of air will be drawn through the restricted opening 35, through the filter 21, the evaporator 25 and to the fan 20 which will force both the fresh air and recirculated air which has been filtered and cooled out through the chamber 23 to the room. As has already been explained above, movement of the recirculation damper 29 to a closed position does not block off or provide any restriction of the air flow from the passage 30 to the evaporator, since that passage extends above the axis of rotation of the damper 29.

Fan-vent.—As the control knob 50 is moved toward the right from the Cool-vent to the Fan-vent position, the fresh air damper is moved to the fully open position, as shown in the solid lines of Figure 6. In this position, the exhaust damper is closed and outside air is forced into the evaporator chamber under a slight positive pressure resulting from the operation of fan 19. Thus, air flows through the damper 27, into the chamber 30, around the filter 21, through the evaporator 15 the fan 20 and out into the room through the chamber 23. In view of the positioning of the filter 21, it is apparent that the fresh air which is admitted through the damper 27 will be filtered prior to its distribution to the room, thereby preventing the ingress of dirt and other undesirable material from the outside atmosphere. As may be seen from Figure 7, the compressor 17 is not energized in the Fan-vent position thereby preventing any cooling effect.

While the above outlined control system provides a simple and extremely rugged apparatus capable of providing varied control of fresh air room exhaust, recirculation, cooling and heating it is also desired that a control be placed over the direction of air flow from the chamber 23. This may be provided through an independently operated damper 100 which is pivoted about a support rod 101. The rod 101 is preferably secured at its ends to the end faces of the enclosure hood 36 and is positioned at the upper corner thereof. Vertically extending, parallel, slots are provided in the sides 102 and 103 of the hood 36 through which air leaving the chamber 23 may pass. Control of the direction of air flow is provided by pivoting the damper 100 about the axis 101 from positions which completely close the slots 102 to a position in which the slots 103 are covered. In the extreme portions of the range, air is respectively directed outwardly and upwardly at an angle of approximately 40° from the horizontal, and downward at an angle of 20° below horizontal. Throughout the intermediate por-

tions, the deflection of the air ranges between the lower angle position and the maximum upward deflection.

A separate automatic thermostat control may also be desired for turning off the apparatus upon the attainment of a predetermined low temperature. As may be seen in Figure 7, this control may comprise a conventional thermostatic switch **105** in the conductor **95** leading to the contact **91**. Upon the lowering of the room temperature to a point at which the thermostatic switch **105** is opened, the compressor will be temporarily shut down by deenergization of the motor **17**. The unit **105** may be mounted in any convenient position and preferably is mounted for operation by means of a knob **106** at the end of the indicator panel.

The indicator panel, with the control knob **50** and the control positions marked, may be uncovered, or on the other hand it may be hidden from view by a decorative bezel. This bezel may take the form shown in Figure 1 and 3 in which an arcuately contoured cover **106** is hinged as at **107** to the hood **36**. A conventional biasing spring **108** may be provided for maintaining the bezel **106** snugly against the arcuate surface **109** of the hood **36** thereby completely covering the entire control panel except when pulled downwardly to expose the controls, as in Figures 1 and 3. The bezel **106** may, of course, be utilized to provide space for the manufacturer's trade mark, or other similar informative or decorative material.

While the dampers **27** and **28** have been shown as rigid members, it is to be understood that flexible dampers are intended to be within the scope of the present invention. Thus, it is noted that each of the dampers **27** and **28** may be constructed of sheets of flexible vinyl plastic having a rigid plate secured to the central portion thereof. Using this material, the hinge may be completely eliminated and the edge of the vinyl secured to the partition **16**. In operation the edge of the vinyl projecting beyond the edge of the rigid central panel will act as a resilient seal for the damper opening and the secured edge will also act as a satisfactory hinge.

It will thus be seen, that I have provided a complete control system for room air conditioners which is capable of actuation of substantially all of the elements controlling refrigeration, heating, and air flow distribution through a single, easily operable master control knob. Since, of course, numerous modifications and variations may be made without departing from the scope of the novel concepts of the present invention it is therefore intended that the scope of the present invention be limited only by the appended claims.

I claim as my invention:

1. In a room air conditioning unit, an evaporator compartment and a condenser compartment, a first room air inlet chamber in said evaporator compartment, a second air outlet chamber in said evaporator compartment, an evaporator between said chambers and a fan between said evaporator and said second chamber for drawing air through said evaporator to said second chamber, first means for supplying outside air to said inlet chamber, second means for supplying air from said second chamber to said condenser compartment and a single reciprocating means for selectively actuating said first and second means, said reciprocating means comprising a first reciprocating element connected to said first means, a second reciprocating element connected to said second means, and a third reciprocating element slidably associated with said first and second reciprocating elements through oppositely acting lost motion connections.

2. In a room air conditioning apparatus having evaporator and condenser compartments, a first room air inlet chamber in said evaporator compartment, a second air outlet chamber in said evaporator compartment, an evaporator between said chambers and a fan between said evaporator and said second chamber for drawing air through said evaporator and transmitting it to said second chamber under a first positive pressure, a second fan in said condenser compartment drawing air inwardly through a condenser into said condenser compartment under a second lower positive pressure, first damper means for supplying air from said condenser compartment to said inlet chamber, second damper means for supplying air from said second chamber to said condenser compartment, biasing means urging both said first and second means into closed positions and a single reciprocating actuator for alternatively actuating said means into open positions.

3. In a room air conditioning apparatus having evaporator and condenser compartments, a first room air inlet chamber in said evaporator compartment, a second air outlet chamber in said evaporator compartment, an evaporator between said chambers and a fan between said evaporator and said second chamber for drawing air through said evaporator to said second chamber, first means for supplying air from said condenser compartment to said inlet chamber, second means for supplying air from said second chamber to said condenser compartment, biasing means urging both said first and second means into closed positions and a single reciprocating actuator for alternatively actuating said means into open positions, said reciprocating actuator comprising a first reciprocating element connected to said first means, a second reciprocating element connected to said second means, and a third reciprocating element slidably connected to said first and second reciprocating elements through oppositely acting lost motion connections.

4. In a room air conditioning unit, an evaporator compartment and a condenser compartment, a first room air inlet chamber in said evaporator compartment, a second air outlet chamber in said evaporator compartment, an evaporator between said chambers and a fan between said evaporator and said second chamber for drawing air through said evaporator to said second chmber, first means for supplying outside air to said inlet chamber, second means for supplying air from said second chamber to said condenser compartment and a single reciprocating means for selectively actuating said first and second means, said reciprocating means comprising a first reciprocating element connected to said first means, a second reciprocating element connected to said second means, and a third reciprocating element slidably associated with said first and second reciprocating elements through oppositely acting lost motion connections, said third reciprocating element having a cam guide thereon associated with a fourth means for supplying room air to said room air inlet chamber, whereby said fourth means is controlled simultaneously with said first and second means.

5. In a room air conditioning apparatus having evaporator and condenser compartments, a first room air inlet chamber in said evaporator compartment, a second air outlet chamber in said evaporator compartment, an evaporator between said chambers and a fan between said evaporator and said second chamber for drawing air through said evaporator to said second chamber, first means for supplying air from said condenser compartment to said inlet chamber, second means for supplying air from said second chamber to said condenser compartment, biasing means urging both said first and second means into closed positions and a single reciprocating actuator for alternatively actuating said means into open positions, said reciprocating actuator comprising a first reciprocating element connected to said first means, a second reciprocating element connected to said second means, and a third reciprocating element slidably connected to said first and second reciprocating elements through oppositely acting lost motion connections, said third reciprocating element having a cam guide thereon associated with a fourth means for supplying room air to said room air inlet chamber, whereby said fourth means is controlled simultaneously with said first and second means.

6. An air conditioner having a fresh air inlet damper, a pivoted room air inlet damper, a room air exhaust

damper, fan means for moving air through said dampers when said dampers are in selected open positions, a compressor for supplying refrigerant to cool the air moving through said room air inlet and said fresh air inlet dampers, and a master control for simultaneously operating said dampers, fan, and compressor, said control comprising a reciprocating element movable in a direction parallel to the pivot axis of the room air inlet damper and in said movement causing pivotal movement thereof to control its position, a switch controlling said fan and said compressor, means on said reciprocating element for actuating said switch, and a pair of reciprocating rods connecting said reciprocating element to said fresh air and exhaust dampers, said rods being alternatively actuated by said reciprocating element at the extreme ends of the path of movement thereof.

7. An air conditioning apparatus comprising a housing having an evaporator compartment and a condenser compartment, a room air inlet chamber and a room air outlet chamber associated with said evaporator compartment an evaporator in said inlet chamber and extending substantially the full width of said apparatus, an evaporator fan between said evaporator and said second chamber, an outside air inlet associated with said condenser compartment and fan means associated with said condenser compartment for providing positive air pressure herein, a first damper connecting said outside air inlet to said room air inlet chamber, a second damper connecting said outside air inlet to said room air outlet chamber and a single reciprocating control for alternatively opening said dampers in opposite extreme positions against biasing means urging said dampers into closed position.

8. An air conditioning apparatus comprising a housing having an evaporator and condenser compartments, a room air inlet chamber and a room air outlet chamber associated with said evaporator compartment, and an outside air inlet to said condenser compartment, a first damper connecting said outside air inlet to said room air inlet chamber, a second damper connecting said outside air inlet to said room air outlet chamber, a third damper for varying the flow of air into the room air inlet chamber from a room and a single reciprocating control for alternatively opening said first and second dampers and simultaneously controlling the position of said third damper.

9. In an air conditioner, an air flow control damper having a pivotal axis intermediate its ends and a cam extending along one end in the direction of said axis, and reciprocating control means in sliding cooperating contact with said cam on said damper and movable along a path parallel to said axis for causing pivotal movement of said damper in response to variations in said cam.

10. In an air conditioner, an air flow control damper having a pivotal axis intermediate its ends, one of said ends having a cam edge associated therewith extending substantially a constant distance from said axis but having a varying lateral position relative to the plane of the other end, and reciprocating control means associated with said cam edge and movable along a path parallel to said axis for causing pivotal movement of said damper in response to the variations in lateral position of said cam edge relative to the plane of said other end.

11. An air conditioning apparatus comprising a housing having an evaporator and condenser compartments, a room air inlet chamber and a room air outlet chamber associated with said evaporator compartment, and an outside air inlet to said condenser compartment, a first damper connecting said outside air inlet to said room air inlet chamber, a second damper connecting said outside air inlet to said room air outlet chamber, a third damper for varying the flow of air into the room air inlet chamber from a room, a fourth damper controlling the direction of flow from said room air outlet chamber and having its pivot extending along the upper forward edge of said housing and having its damper surface selectively associated with air outlet apertures in the top and front surfaces of said housing and a single control for alternatively opening said first and second dampers and simultaneously controlling the position of said third damper.

12. In a room air conditioner, a room air circulation control comprising an air chamber containing conditioned air under pressure, an opening in the top of said chamber adjacent a side wall thereof, an opening in the side wall at a position adjacent said first opening and a damper pivotally mounted about an axis adjacent to and extending parallel to the line of junction between said wall and said top for movement into postions variably apportioning the flow of air through said openings, said damper extending substantially the entire width of said room air conditioner, said damper being of a size smaller than said opening whereby the flow of air may be directed as desired, said opening being only partially obstructed in any given position of adjustment.

13. In combination, a reciprocating control mechanism for simultaneously controlling a plurality of members each of which members is initially biased into a predetermined individual selected position comprising, a first reciprocating cable connected to one of said members for transmission of force in opposition to its respective biasing force, a second reciprocating cable connected to a second of said members for the transmission of force thereto in opposition to its respective biasing force, a reciprocating bar, lost motion connection means on said bar between said bar and each of said cables whereby movement of said bar from a neutral position in opposite directions will selectively reciprocate one only of said cables, and means for reciprocating said bar.

14. In combination, a reciprocating control mechanism for simultaneously controlling a plurality of members each of which members is initially biased into a predetermined individual selected position comprsing, a first reciprocating cable connected to one of said members for transmission of force in opposition to its respective biasing force, a second reciprocating cable connected to a second of said members for the transmission of force thereto in opposition to its respective biasing force, a reciprocating bar, lost motion connection means on said bar between said bar and each of said cables whereby movement of said bar from a neutral position in opposite directions will selectively reciprocate one only of said cables, a third member pivotally mounted for pivotal movement about an axis parallel to the path of reciprocation of said bar, a cam edge on said third member projecting a distance from said pivotal axis substantially equal to the distance between said pivotal axis and said reciprocating bar, and cam follower means on said bar for cooperation with said cam whereby reciprocation of said bar causes rotation of said third member, and means for reciprocating said bar.

15. In an air conditioning apparatus, an evaporator compartment, a first room air inlet chamber in said evaporator compartment, a second air outlet chamber in said evaporator compartment, a third chamber between said first and second chambers, an evaporator between said first and third chambers, a centrifugal fan between said third chamber and said second chamber for drawing air through said evaporator into said third chamber and thence through said fan into said second chamber under pressure, said fan having an axis of rotation substantially perpendicular to said evaporator and positioned eccentric thereof, the walls of said third chamber including a first perforate wall formed by said evaporator and a second wall lying in a plane between said evaporator and said fan, said second wall defining a plane lying at an acute angle to the plane of said evaporator and diverging therefrom in the direction of the center of the evaporator, said second wall having a short, generally circular, fan inlet duct therein leading to said fan, said duct having its central axis coaxial with said fan and terminating adjacent thereto.

16. In an air conditioning apparatus, an evaporator

compartment, a first room air inlet chamber in said evaporator compartment, a second air outlet chamber in said evaporator compartment, a third chamber between said first and second chambers, an evaporator between said first and third chambers, a centrifugal fan between said third chamber and said second chamber for drawing air through said evaporator into said third chamber and thence through said fan into said second chamber under pressure, said fan having an axis of rotation substantially perpendicular to said evaporator and positioned eccentric thereof, the walls of said third chamber including a first perforate wall formed by said evaporator and a second wall lying in a plane between said evaporator and said fan, said second wall defining a plane lying at an acute angle to the plane of said evaporator and diverging therefrom in the direction of the center of the evaporator, said second wall having a short, generally circular, fan inlet duct therein leading to said fan, said duct having its central axis coaxial with said fan and terminating adjacent thereto, and said second chamber having an opening at the top thereof expanding into a fourth chamber leading to said room.

17. In an air conditioning apparatus having an evaporator structure positioned in a first reference plane, a fan for drawing air through an inlet shroud inwardly along its axis and delivering it substantially peripherally, said fan having its axis generally perpendicular to said plane and intersecting said evaporator at a point eccentric thereof, said shroud comprising a planar surface diverging away from said first plane in the direction of the center of said evaporator relative to said fan axis, and a fan inlet duct having an inlet faired into said planar surface and extending coaxially of said fan to an outlet

parallel to said first plane and immediately adjacent to said fan whereby air is drawn evenly through said evaporator into said fan at an angle to the axis thereof.

18. In an air conditioning unit for enclosed rooms, an evaporator compartment and a condenser compartment, a first room air inlet chamber in said evaporator compartment, a second air outlet chamber in said evaporator compartment, an evaporator between said first room air inlet chamber and said second air outlet chamber, and a fan between said evaporator and said second chamber for drawing air through said evaporator to said second chamber under positive pressure, first means for supplying outside air at slightly lower positive pressure through said condenser compartment to said inlet chamber, second means for supplying air from said second chamber to said condenser compartment, and a single reciprocating actuator for selectively actuating said first and second means.

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