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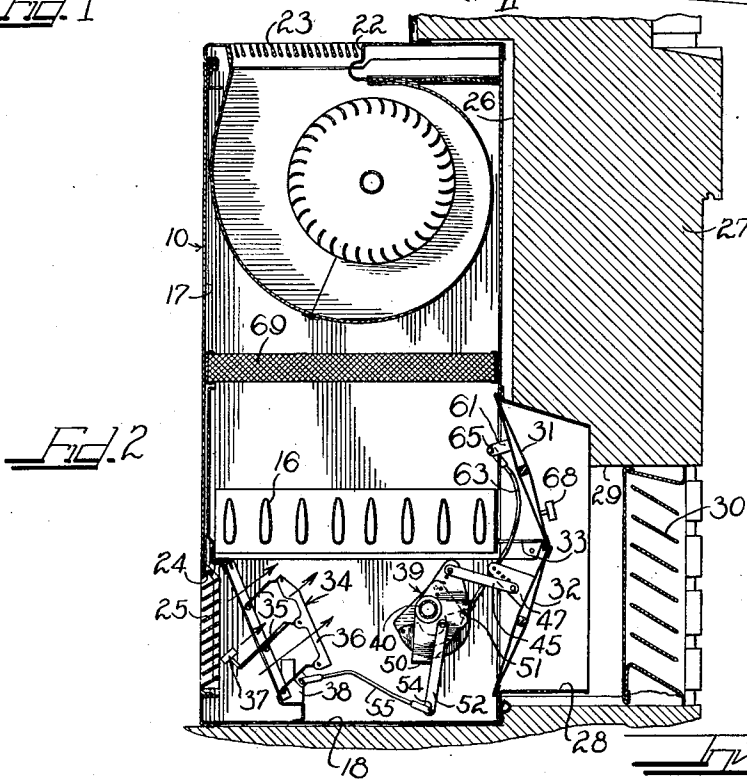
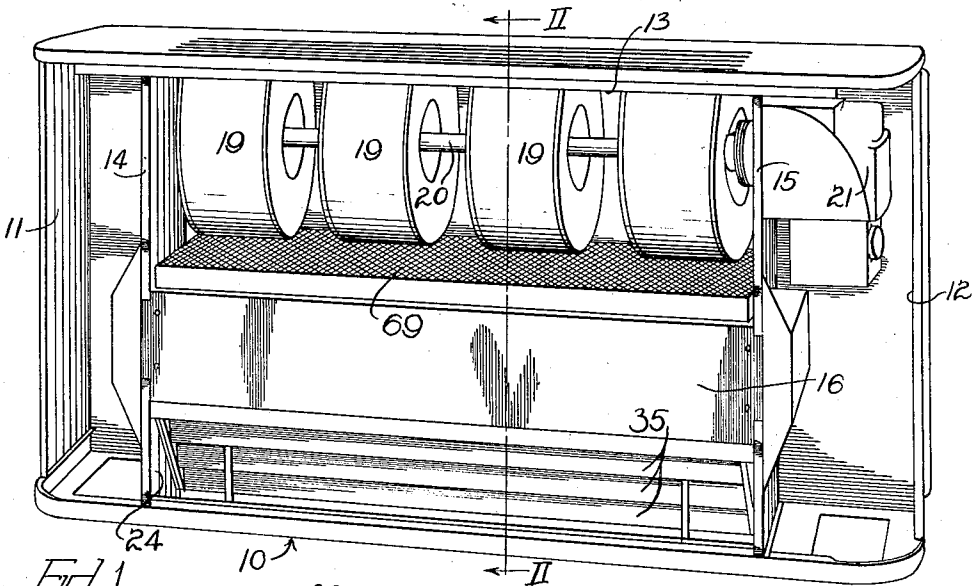
W. SHURTLEFF

2,229,304

AIR CONDITIONING APPARATUS

Filed Jan. 12, 1938

3 Sheets-Sheet 1



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2,229,304

AIR CONDITIONING APPARATUS

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Fig. 3

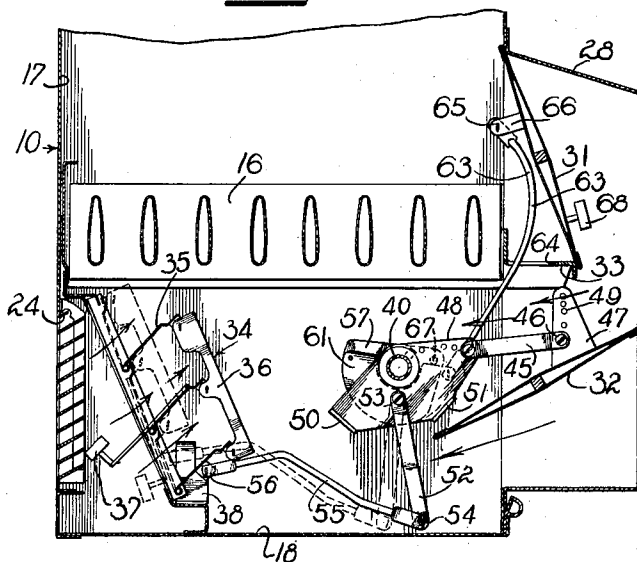
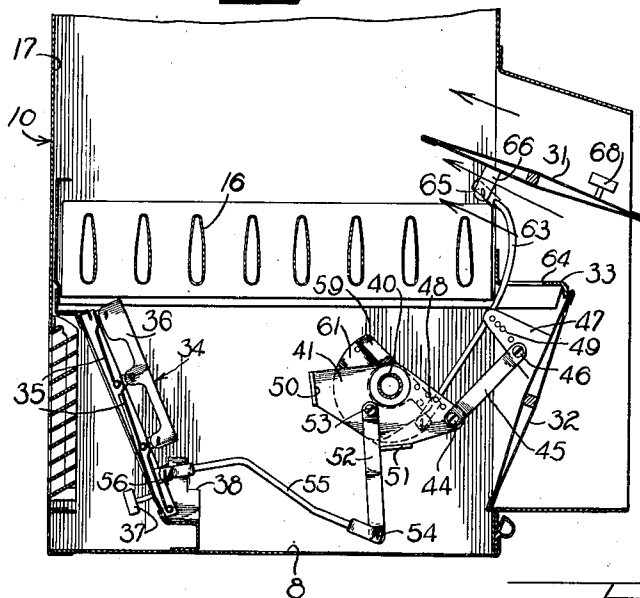


Fig. 4



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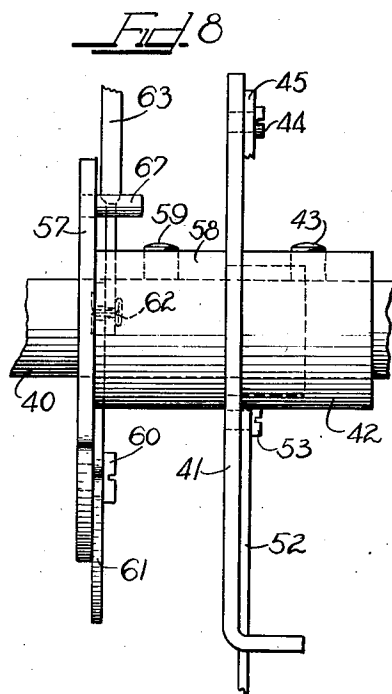
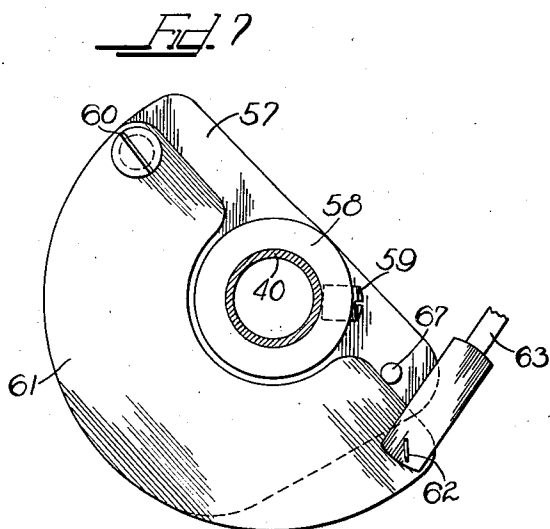
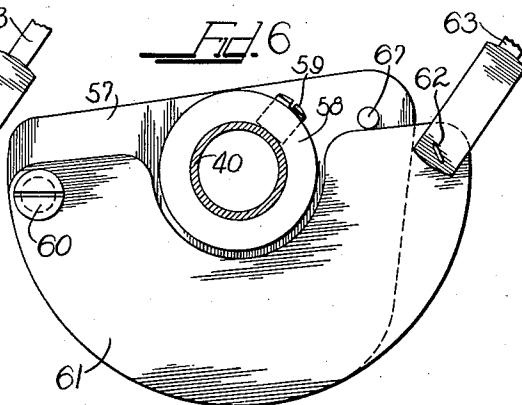
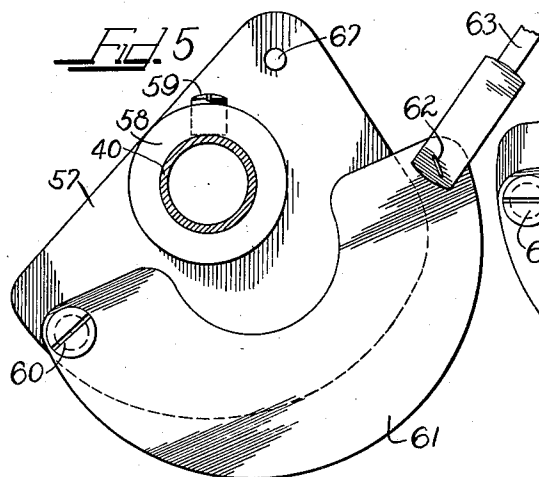
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AIR CONDITIONING APPARATUS

Filed Jan. 12, 1938

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,229,304

AIR CONDITIONING APPARATUS

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Application January 12, 1938, Serial No. 184,518

17 Claims. (Cl. 98—38)

The present invention relates in general to air conditioning apparatus, and is particularly concerned with improved means therein for controlling the circulation and temperature of air in large, densely occupied spaces such as school rooms, and the like, whereby predetermined temperature in the room where the apparatus is installed may be maintained exact at all times.

There are in general use in schools three standard cycles of operation for apparatus of the herein described type, namely:

(1) The full ventilation cycle. This cycle demands 100% circulation of outdoor air during room occupancy, but permits the use of 100% recirculation of air before and after school hours.

(2) The compromise cycle. This cycle demands a minimum variation of from 10% to 50% (as specified) of outdoor air during school hours and 100% recirculation is permitted before and after school hours.

(3) The fuel saving cycle. This cycle allows 100% of the air to be recirculated at all times until the room overheats, then outdoor air is mixed with room air as required to cool the room after all heat is shut off, air leakage being depended upon to overcome body odors and humidity. This cycle is particularly adapted for dry climates.

Having in mind that the laws of the different states may vary as to which of the above cycles may be required, and also that future laws might permit the use of other cycles of operation, it is a primary object of the present invention to provide a single apparatus of the type described herein which may be readily and easily adapted either before or after installation for operation according to any of the foregoing cycles, and which be readily adjusted to meet the varying specified amounts of outdoor air requirements in different installations.

A further object of the invention is to provide apparatus of the type described herein, which is so constructed that the entire space from the front to the back of the cabinet may be utilized for an air conditioning element, such as a radiator.

It is a further object of the invention to provide in such apparatus improved means whereby air may be discharged from the apparatus in a plurality of streams which may be independently varied as to their direction.

Another object of the invention is to provide air conditioning apparatus having an improved damper control for variably proportioning the

amount of inlet air taken from different sources to meet different operating conditions.

Still another object is to provide air conditioning apparatus having novel damper control means whereby a constant volume of inlet air may be maintained to said apparatus and varied with respect to the proportion thereof subjected to an air conditioning element.

A still further object is to provide air conditioning apparatus wherein all the inlet air, regardless of its source, will be filtered before being conducted to the air circulating device and discharge from the apparatus.

Other objects and features of the invention will more fully appear from the following detailed description taken in connection with the accompanying drawings which illustrate a single embodiment thereof, and in which:

Figure 1 is an elevational view of an air conditioning cabinet embodying the principles of the present invention, the front of the cabinet being removed to disclose the operative relationship of the internal parts thereof;

Figure 2 is a vertical sectional view taken through the cabinet and the wall of the room with which the cabinet is associated, showing the cooperative relationship of the cabinet with the wall and the manner of bringing in the outdoor inlet supply air through the wall, taken substantially on line II—II of Figure 1;

Figure 3 is an enlarged fragmentary sectional view taken through the lower part of the cabinet to show the operative connections between the inlet dampers and the position of the mechanism when the lower outdoor inlet damper is opened and the upper outdoor inlet damper is closed;

Figure 4 is a similar view showing the position of the operating mechanism when the inlet air damper and lower outdoor air damper are closed and the upper outdoor air damper is opened;

Figures 5, 6 and 7 are enlarged fragmentary detail views of the crank mechanism for actuating the upper outdoor inlet damper, the various views showing the relative positions of the parts for different settings of the damper;

Figure 8 is an enlarged fragmentary detail view in elevation showing the cooperative relationship of the operating cranks for the two outdoor inlet dampers.

As shown on the drawings:

One form of the present invention is shown in the drawings as being embodied in a casing or cabinet 10, preferably of metal, and of generally rectangular configuration. The cabinet is ar-

ranged to be supported directly on the floor of a room in which the air is to be conditioned.

Longitudinally, the cabinet is divided into end compartments 11 and 12 and an intermediate compartment 13 by means of partitions 14 and 15 which extend vertically and are inwardly spaced from the ends of the cabinet.

The intermediate compartment 13 forms a channel for the flow of air which is to be conditioned and is vertically separated by an air conditioning element 16 into an upper collecting compartment 17 and a lower mixing or inlet compartment 18. In the present instance, the air conditioning element comprises a radiator, and it will be noted that in my novel construction, the radiator extends from the forward wall of the cabinet to the rear wall of the cabinet, so that large quantities of air may be readily handled.

The collecting compartment has mounted therein a plurality of circulating devices such as fans 19 having their rotors all mounted on a common drive shaft 20 which extends longitudinally of the compartment and is supported in suitable bearings in the partitions 14 and 15. This driving shaft is connected to suitable power means, in this instance, an electric motor 21, which is mounted in end compartment 12 so as to be outside of the air stream flowing in the intermediate compartment. Since it is a common characteristic of electric motors to heat up during operation, the mounting of the motor outside of the air stream materially increases the efficiency of the conditioning apparatus.

The individual casings or housings of the fans are respectively connected to an outlet opening 22 at the top of the casings. The discharge opening 22 is provided with a grille 23 having inclined vanes which may at each fan discharge have such inclination as to deflect the air being discharged from a particular fan, in any desired direction. As shown in Figure 2, the vanes of the grille are forwardly inclined so that the stream of air issuing from the fan will be deflected in a forward direction from the cabinet.

It has been found that improved ventilation is obtained when the air is discharged from the cabinet in a plurality of individual streams. Moreover, by being able to adjust the direction of these streams, the direction of the streams may be adjusted to give the most efficient operation of the unit for a particular location in the room in which it is being utilized. For example, if the unit were located at the center of a side wall of the room, the two central discharges might be directed upwardly and forwardly, and the end discharge streams toward the ends of the room. On the other hand, with the unit placed near one end of a side wall of a room, the discharge adjacent the near end of the room might be directed forwardly, and the other three discharge streams directed toward the other end of the room at an angle of substantially 45°. It will therefore be evident that the unit may be readily accommodated for different locations to give the most efficient distribution of air in the room.

On the front of the cabinet at its bottom, there is provided an inlet opening 24 having louvers 25 permitting the entrance of room air into the mixing or inlet air chamber 18 below the radiator.

As will be seen in Figure 2, the unit is preferably mounted so as to partially extend at its rear portion into a recess 26 of an associated wall 27, the unit being sealed around its periphery.

At the rear of the cabinet adjacent its bottom,

there is provided an inlet duct 28 which is adapted to cooperate with an inlet opening 29 in the associated wall to form an inlet passage for outdoor air. The wall opening, at its outer end, is provided with louvers 30 for keeping out rain, snow and the like.

The duct 28 at its upper end communicates with the collecting compartment 17 and at its lower end communicates with the mixing air inlet compartment 18 below the radiator.

The flow of inlet outdoor air to either of these compartments is controlled by a pair of cooperatively associated damper vanes 31 and 32 which extend across the duct and are pivoted in the side walls of the duct at their center lines for rotative movement. The inner edges of these damper vanes are adapted to engage, when in closed position, with a horizontally disposed baffle 33. It will be evident, therefore, that by actuating the damper vane 31 to open and closed position the inlet of outdoor air into the collecting chamber above the radiator may be controlled. On the other hand, if this damper is closed and the lower damper 32 is opened, the inlet outdoor air may be directed into the mixing compartment so as to be drawn through the radiator 16. Moreover, these dampers may be operated as a unit to admit a portion of the inlet air above the radiator and a portion below the radiator.

The admission of room air to the mixing chamber is controlled by a damper, generally indicated at 34, which is of the gravity closing type. This damper comprises a plurality of vanes 35 which are similarly pivoted along corresponding edges for swinging movement into open and closed position. The vanes are connected by a bridge member 36 for simultaneous operation. The damper is biased by a weight 37 which acts under the influence of gravity to actuate the damper to closed position, or partially closed position as desired, depending upon the relative position of the weight 37, when no air is being taken in through the damper or whenever there is a back draft. When this damper is free to open and close, or when it is not forcibly held in closed or open position, the damper will be forced open by the flow of inlet air therethrough, the amount of opening depending upon the amount of air being taken in. In fully opened position, the rotational movement of the vanes is limited by a stop member 38.

The dampers 31, 32 and 34 are actuated from a unitary control mechanism, generally indicated at 39, and connections are made to the respective dampers in such manner that as the control is actuated through a control movement in one direction, the dampers will operate in a predetermined order to give a predetermined cycle of operation.

The control mechanism comprises a shaft 40 which extends longitudinally of the mixing compartment 18 and is pivoted in the partitions 14 and 15 for rotative movement.

Secured to the shaft 40 is a plate member 41 having a hub portion 42 which surrounds the shaft and is provided with a set screw 43 by means of which the plate may be fixedly secured to the shaft for rotation therewith. This plate in effect forms a crank which is pivotally connected as at 44 to one end of a link 45. The other end of this link is pivotally connected as at 46 to an arm 47 which is spaced outwardly a slight amount from the center of rotation of the vane 32 and

fixedly supported thereon in any appropriate manner.

drawn therethrough from the inside of the room, or close under the influence of gravity at any time air ceases to move therethrough or when there is a back draft against the same.

The damper vane 31 is also actuated in response to movements of control shaft 40, and for this purpose the shaft has mounted thereon a disk 57 having an integrally formed hub 58 which surrounds the shaft and is secured for rotation therewith by means of a set screw 59. This disk 10 forms in effect a crank member which is provided with a crank pin 60 which forms a pivot for one end of a segmental link member 61.

The link 61 is pivotally connected at a point 62, which is diametrically disposed across from 15 the pivot pin 60, to one end of a curved rod-like link 63. This link is arranged to extend through a slot 64 in the baffle 33 and have its other end pivotally connected as at 65 to a lug 66 carried by the vane 31 and laterally spaced from its cen- 20 ter line of rotation.

On the opposite side of the hub 58 from the pin 60, the plate is provided with a pin 67 which is adapted during a portion of the rotative movement of the shaft 40 to engage against the free 25 end of the segmental plate 61 and carry the plate with it through a portion of its rotative movement.

The plates 57 and 41 are relatively so disposed on the shaft 40 that when the plate 41 is at one 30 limit of its movement, the relative positions of plate 57 and segmental ring 61 will be as shown in Figure 5, and the damper vane 31 will be in closed position.

As the shaft 40 is rotated in a clockwise direction, the pin 67 will engage the free end of segmental link 61, as shown in Figure 6, this position corresponding to a dead center position of the operating crank for damper 32 at which time 40 the damper 32 is open. It will be noted that during the movement of plate 57 from the position shown in Figure 5 to the position shown in Figure 6, the damper 31 will remain closed.

As the shaft is further rotated, the operating crank for damper 32 will reach its other limit 45 and this damper will be again closed. During this continued movement, the plate 57 will move to the position shown in Figure 7, carrying the segmental link 61 with it through a rotative movement. This rotative movement acts through 50 connecting link 63 to open the damper 31. Upon reverse movement of the shaft, damper 32 will again be moved to open position, in which position damper 31 will have moved to closed position, and then as damper 32 again closes, damper 55 31 will continue to remain closed due to the movement of pin 67 away from the free end of segmental link 61. Closing of damper 31 will be aided if it is provided with a suitable counterweight 68 on the opposite side of the center line 60 of rotation of the damper from lug 66.

From the foregoing, it will be apparent that the dampers 31 and 32 are operated according to a predetermined cycle. All the outdoor air may be directed into the mixing chamber, it may be 65 proportionally divided between the mixing chamber and the collecting chamber so that a portion of it is heated and the remaining portion is not heated, or all the outdoor air may be admitted to the collecting chamber above the radiator. 70 The variation in the settings of all the dampers is accomplished through a single control medium, the shaft 40 which may be manually actuated or actuated by suitable power means controlled, if desired, by thermostat. 75

With the connection to the vane 32 just described, it will be noted that when the radius of the crank which passes through the pivotal connection 44 is in alignment with the link 45, the crank will be on dead center position and the vane 32 will be swung to open position. On the other hand, movement of the crank to a limit position of either side of its dead center position will actuate the vane 32 to closed position. In other words, starting with the vane 32 in closed position, as shown in Figure 2, movement of the crank in a clockwise direction will bring it to dead center position as shown in Figure 3, at which position the vane 32 is opened. Continued movement of the crank in a clockwise direction will again bring the vane 32 back to closed position as shown in Figure 4.

The plate 41 is provided with a series of threaded openings 48 having different radial spacings from the center of rotation of the plate, and the arm 47 is likewise provided with a series of threaded openings 49. The openings 48 and 25 49 permit variation of the crank throw and also the throw of the vane 32 simply by connecting the link 45 between different threaded openings on the plate 41 and the arm 47. Depending upon the manner in which the link 45 is connected, the vane 32 will always close at the limit of movement of the crank, but the amount that the vane 32 will be opened will be governed by the link connection. For example, with the link connected as shown in Figure 4, with its one end 30 pivoted at the outermost point of the plate 41, and its other end at the innermost point on the arm 47, the maximum opening of the vane will be secured, whereas, if the innermost connection on the plate 41 is used and the outermost opening on the arm 47, the minimum opening of the vane 40 32 will be secured. With this arrangement, the opening of vane 32 may be adjusted to provide different amounts of inlet air to the mixing chamber as may be specified to meet different requirements in various installations. This change may be easily accomplished before or after installation, and all that is necessary is to remove the screw pivots on the link with a screw driver and reconnect the link in the proper holes 50 for the particular opening desired.

For operating the gravity closing damper 34, the plate 41 is provided with a pair of angularly disposed lugs 50 and 51 between which a link member 52 is mounted for swinging movement, one end of this link member being pivoted as at 53 to the plate 41. The free end of the link 52 is pivoted as at 54 to one end of a connecting link 55, the other end of the link 55 being connected as at 56 to one of the vanes 35 of the gravity closing damper. 60

With the connection just described, it will be noted that the lug 50 at one limit of movement of the plate 41 will abut the link 52 and actuate the damper 34 to fully opened position, in which position it is locked against closing by gravity. 65 This is clearly shown in Figure 2. At the other limit of movement of plate 41, the link 52 is abutted by lug 51, which acts to close the damper 34 and lock it in closed position, as shown in Figure 4. At the intermediate positions of the plate 41, for example, as shown in Figure 3, the link 52 is not engaged by either of the lugs and is free for swinging movement therebetween. Under these conditions, the damper 34 is adapted to 70 open in proportion to the amount of air being

Referring to Figure 2, a filter 69 may be disposed between the radiator and the fans in the collecting compartment, this radiator being also disposed above the outdoor air inlet to the collecting compartment. With this arrangement, all the inlet air, regardless of its source, will have to pass through the filter before entering the circulating fan. This filter will remove dust and lint and prevent accumulations forming on the fan rotor blades and interior of the fan casing and will assure that only clean air is discharged into the room.

Air conditioning apparatus embodying my improved damper arrangement is particularly adapted for cyclic operation.

At night time, it is desirable to entirely shut off the admittance of outside air and force the control damper for inlet room air wide open so that the air in the room may aspirate and circulate by convection currents. The position of the dampers for this operating condition is shown in Figure 2. This setting of the dampers may also be used when it is desired to utilize 100% recirculated air for quickly heating the room to normal temperature before admitting outdoor air.

Should the specified cycle of heating require varying outdoor air according to a specified minimum during school hours, all that is necessary is to further move the control shaft to actuate damper 32 to the desired opening, as shown in Figure 3. In this position all the outside air passes into the mixing chamber, and it will be noted that the lugs 50 and 51 do not at this portion of the cycle engage link 52. The damper 34 is therefore free to adjust itself, depending upon the amount of air being drawn in, and may close under the action of gravity when the suction in the mixing chamber is decreased sufficiently.

Should the room still continue to overheat, when the radiator is all the way on, further movement of the shaft 40 will close the dampers 32 and 34 and entirely open the damper 31 so that 100% outdoor air passes directly into the collecting compartment without having to pass through the radiator.

My improved damper arrangement permits regulating room temperature with full steam heat in the radiator until outdoor weather temperatures are approximately 50° (F.), before it becomes necessary to require valve control. In this way the usual hazards attending valve control of radiators is eliminated.

From the foregoing description, it will be apparent that the herein described invention provides improved air conditioning apparatus which may readily and easily be adapted either before or after installation for operation in a manner to meet the requirements of variously specified operating cycles; which is so constructed that the entire space from the front to the back of the cabinet may be utilized for an air conditioning element, such as a radiator; in which the discharged air is divided into a plurality of streams which may be independently varied as to their directions; which contains novel damper control means for variably proportioning the amounts of inlet air taken from different sources to meet different operating conditions; which permits the maintenance of a constant volume of inlet air to the apparatus and enables variation thereof with respect to the proportions thereof subjected to an air conditioning element; and which embodies a filter so placed as to assure that all the

inlet air will be filtered, regardless of its source, before it is discharged from the apparatus.

The invention has been described herein more or less precisely as to details, yet it is to be understood that the invention is not to be limited thereby, as changes may be made in the arrangement and proportion of parts, and equivalents may be substituted, without departing from the spirit and scope of the invention.

I claim as my invention:

1. In apparatus of the character described, a cabinet having a collecting compartment at its upper part opening into the room, a mixing compartment at the lower part of the cabinet having an inlet opening for room air, a conditioning compartment between and communicating with the collecting and mixing compartments, air conditioning means in the conditioning compartment, a fresh air inlet communicating at its upper end with the collecting compartment and at its lower end with the mixing compartment, current creating means in the collecting compartment, and control means operable to proportionally control the relative amounts of fresh air flow into the collecting and mixing compartments and the flow of room air into the mixing compartment, said control means comprising damper means in each of the aforesaid inlets and a link mechanism interconnecting said damper means, said link mechanism including a lost motion connection therein.

2. In apparatus of the character described, a cabinet having a collecting compartment at its upper part opening into the room, a mixing compartment at the lower part of the cabinet, a conditioning compartment between and communicating with the collecting and mixing compartments, said conditioning compartment extending from front to back of the cabinet, air conditioning means in the conditioning compartment, two fresh air inlets respectively communicating with the collecting and mixing compartments, a room air inlet to said mixing compartment, current creating means in the collecting compartment, dampers for respectively controlling the flow of air through said inlets, and common actuating means for said dampers including a lost motion connection with at least one of said dampers.

3. In apparatus of the character described, a cabinet defining an air discharge opening and a pair of inlet air openings, air circulating means for taking air in through the inlet openings and discharging it at the discharge opening, dampers for respectively controlling the admission of air through the inlet openings, unitary actuating means for said dampers operable between predetermined limits of movement, and connections between the dampers and actuating means, said connections being arranged to close both dampers at one of the limits of the actuating means, progressively open and close the dampers alternately as the actuating means is moved towards its other limit, and close only one of said dampers at the other limit of movement of the actuating means.

4. In apparatus of the character described, a cabinet defining an air discharge opening and three air inlet openings, air circulating means adapted to take air in through the inlet openings and discharge it at the discharge opening, dampers for respectively controlling the admission of air through the inlet openings, unitary actuating means for said dampers, means connecting the actuating means with two of said dampers arranged to close both of said two dampers, progressively open and close said two dampers alter-

nately, and open only one of said two dampers, and means connecting the actuating means with the third damper, arranged to open and close it in timed relation to the actuation of said two dampers.

5. In apparatus of the character described, a cabinet defining an air discharge opening and three air inlet openings, air circulating means adapted to take air in through the inlet openings and discharge it at the discharge opening, dampers for respectively controlling the admission of air through the inlet openings, unitary actuating means for said dampers, means connecting the actuating means with two of said dampers arranged to close both of said two dampers, progressively open and close the said two dampers alternately, and open only one of said two dampers, and connections between the actuating means and the third damper arranged upon operation of the actuating means to force the third damper to closed position when one of said two dampers is closed, and force the third damper to opened position when both of said two dampers are closed.

6. In apparatus of the character described, a cabinet defining an air discharge opening, a pair of fresh air inlets and a recirculation air inlet, air circulating means in said cabinet adapted to take air in through the air inlets and discharge it through the discharge opening, a pair of dampers respectively controlling the fresh air inlets, a third gravity closing damper controlling the recirculation air inlet, and unitary actuating means for said dampers arranged in one position to open one of said pair when the other of the pair is closed, and in another position to reverse the same, said actuating means including a lost motion connection with said third damper rendering it free to close by gravity in said one of said positions of the actuating means, but forcibly retaining the same closed in the other position of said actuating means.

7. In apparatus of the character described, a cabinet defining an air discharge opening, a pair of fresh air inlets and a recirculation air inlet, air circulating means in said cabinet adapted to take air in through the air inlets and discharge it through the discharge opening, a pair of dampers respectively controlling the fresh air inlets, a third gravity closing damper controlling the recirculation air inlet, unitary actuating means for said dampers, connections from the actuating means to said pair of dampers arranged in one position of the actuating means to open one of said pair when the other of the pair is closed, and in another position to close both of said pair, and a lost motion connection between said actuating means and said third damper for rendering it free to close by gravity in said one of said positions of the actuating means, but forcibly retaining said third damper open in the other position of said actuating means.

8. In air conditioning apparatus, a cabinet having a pair of air inlet openings, a pair of dampers respectively controlling the admission of inlet air through said openings, a common rotatable actuating member for said dampers, a crank and link connection between said member and one of said dampers arranged for successively moving said one of said dampers from closed, to open and to closed positions as said member is actuated through successive partial movements of rotation in the same direction, and a lost motion connection between said actuating member and the other damper arranged to remain inop-

erative to move said other damper during the first partial movement of said member, and arranged operative to open the said other damper during the next partial movement of said member.

9. In air conditioning apparatus, a cabinet having a pair of air inlet openings, a pair of dampers respectively controlling the admission of inlet air through said openings, a common rotatable actuating member for said dampers, a crank and link connection between said member and one of said dampers arranged for successively moving said one of said dampers from closed, to open and to closed positions as said member is actuated through successive partial movements of rotation in the same direction, a lost motion connection between said actuating member and the other damper arranged normally inoperative to move said other damper during the first partial movement of said member, and arranged operative to open the said other damper during the next partial movement of said member, and means for adjustably connecting said one damper with said member.

10. In combination, a damper pivoted for swinging movements to open and closed positions, a rotatable crank member, an elongate link pivotally connecting said crank and said damper in such a manner that the damper will be open when the crank and link are in dead center relation, and will be in closed position when the crank is rotated in either direction from dead center position.

11. In combination, a pair of dampers respectively pivoted for swinging movements to open and closed positions, a crank member mounted for rotation between limits on either side of a dead center position, an elongate link pivotally connecting said crank and one of said dampers in such a manner that the said damper will be open when the crank and link are in dead center relation, and the damper will be in closed position when the crank is at either of its limit positions, and means including a lost motion connection between the crank means and the other of said dampers effective to maintain the latter damper closed at one limit position of the crank, and open at the other limit position of the crank, said lost motion connection being ineffective relative to said latter damper at intervening positions of said crank.

12. In combination, a first damper, a second damper, said dampers being respectively pivoted for swinging movements to closed and open positions, actuating means including a crank mounted for rotation between limits on either side of a dead center position, a link pivotally connecting said crank and first damper in such a manner that the damper will be open when the crank and link are in dead center relation, and will be closed when the crank is at either of its limit positions, and a lost motion connection between said means and the second damper ineffective to actuate said second damper during movements of the crank in either direction between one of its limits and the dead center position thereof, but to progressively open the second damper when the crank moves from dead center position to its other limit, and progressively close the second damper upon reverse movement of the crank from its said other limit back to dead center.

13. In an air conditioning apparatus, a cabinet including air conditioning means and a collecting compartment, means in said cabinet for taking

air therefrom and discharging it to the exterior of the cabinet, means defining a first path for a supply of conditioned air to said compartment, a first damper means inserted in said first path, 5 means defining a second path for a supply of non-conditioned air to said compartment, a second damper means inserted in said second path, actuating means connected with said first and with said second damper means arranged operable to selectively move said first and said second 10 damper means for simultaneously increasing the volume of air supplied through one of said paths from zero to a maximum and decreasing the air supplied through the other path from a maximum to a minimum and for moving both of said damper 15 means to closed position, said actuating means including a movable member and link means operably connecting both of said damper means with said member, and said member having a lost motion connection with one of said damper 20 means.

14. In combination, a damper pivoted for swinging movements to open and closed positions, a rotatable crank member, an elongate link pivotally connecting said crank and said damper in 25 such manner that the damper will be open when the crank and link are in dead center relation, and will be in closed position when the crank is rotated in either direction from dead center, 30 and means for adjusting the link position in relation to said crank and damper for varying the amount of opening of the damper at the dead center position of the crank.

15. In combination, a damper pivoted for swinging movements to open and closed positions, a rotatable crank member, an elongated link pivotally connecting said crank and said damper in 35 such a manner that the damper will be open when the crank and link are in dead center relation, and will be in closed position when the crank 40

is rotated in either direction from dead center position, and pivotal connections respectively connecting the link ends with the crank and damper, said connections being respectively adjustable in a generally radial direction from the damper pivot 5 and the crank center, whereby the open position of the damper relative to the crank dead center position may be varied.

16. In combination, a damper pivoted for swinging movements to open and closed positions, 10 a rotatable crank, a curved link pivoted at one end to said crank on one side of its center of rotation, a second link pivoted at one end to said damper and having a pivot connection at its other end with the other end of the curved link, said 15 curved link upon rotation of the crank being swingable thereon in such a manner as to bring the pivotal connections at the ends of the curved link into and out of a diametrically disposed relation with the pivotal connections on opposite 20 sides of the center of rotation of the crank, and abutment means associated with said crank for engaging the curved link when its end pivotal connections are substantially in said diametric 25 relation, whereby the curved link and crank may be moved as a unit to actuate the damper through said second link.

17. In combination, a damper pivoted for swinging movements to open and closed positions, a first link having one end connected to said 30 damper, a double ended crank, a second link connected at one end to one of the crank ends, said other end of the second link being connected to the other end of the first link, and said other 35 crank end being arranged during rotation of the crank in one direction to engage the second link adjacent its connection with the first link for causing unitary movement of the crank, first link and second link.

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