

[54] **AIR CONDITIONER**
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Primary Examiner—William J. Wye

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62/298, 62/297, 62/237, 62/302, 62/427
[51] Int. Cl. **F25d 23/12**
[58] Field of Search 62/263, 237, 262, 297,
62/298, 302, 427, 77, 248, 249, 250; 165/53,
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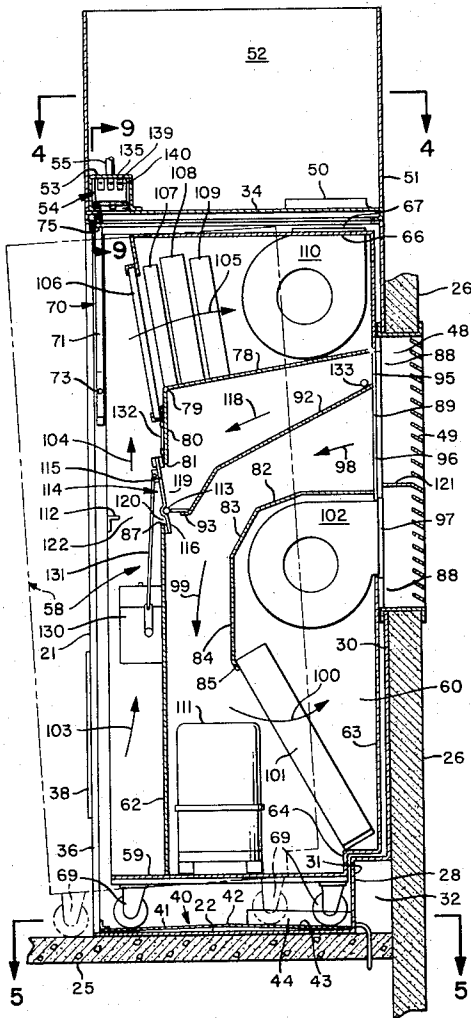
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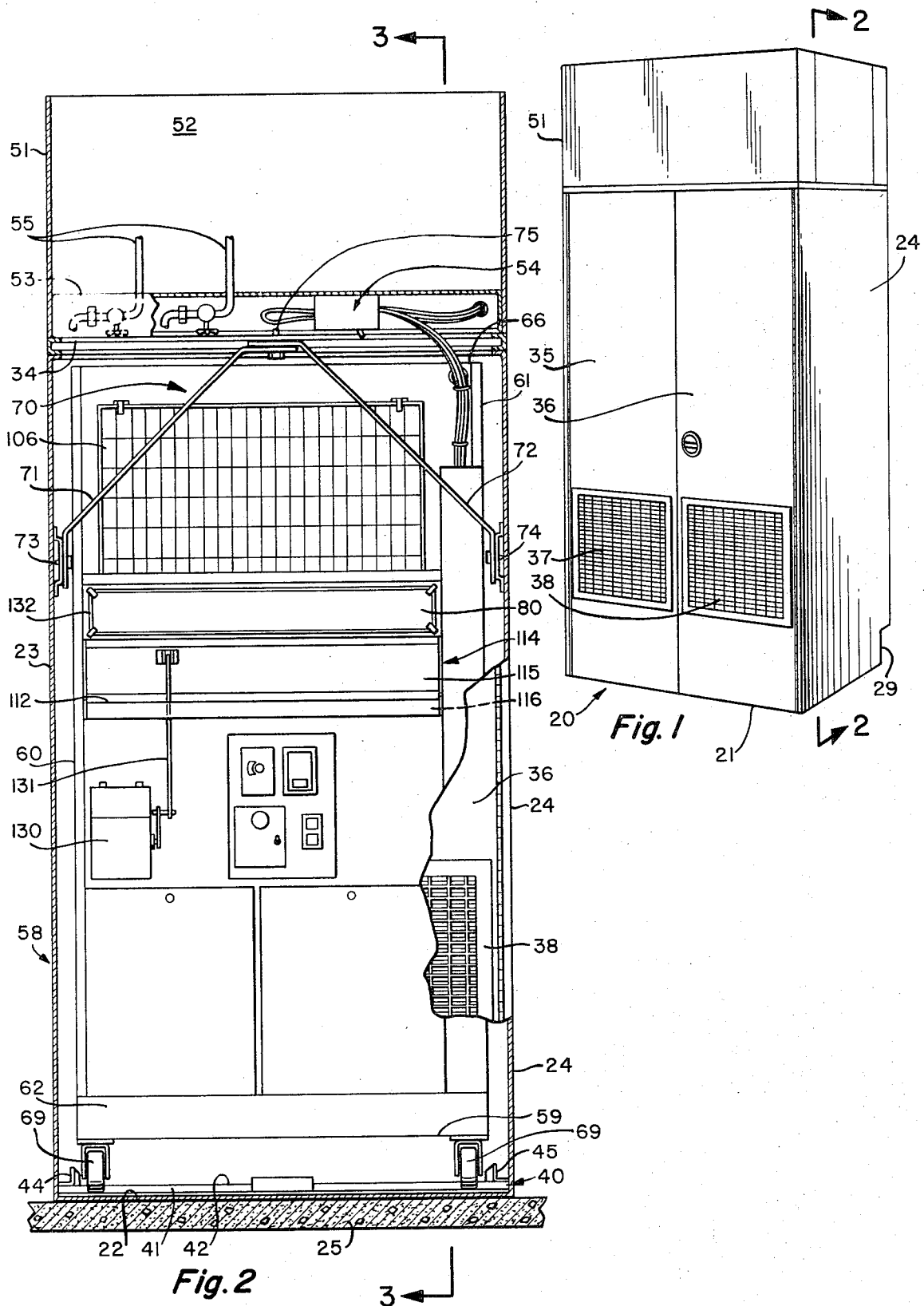
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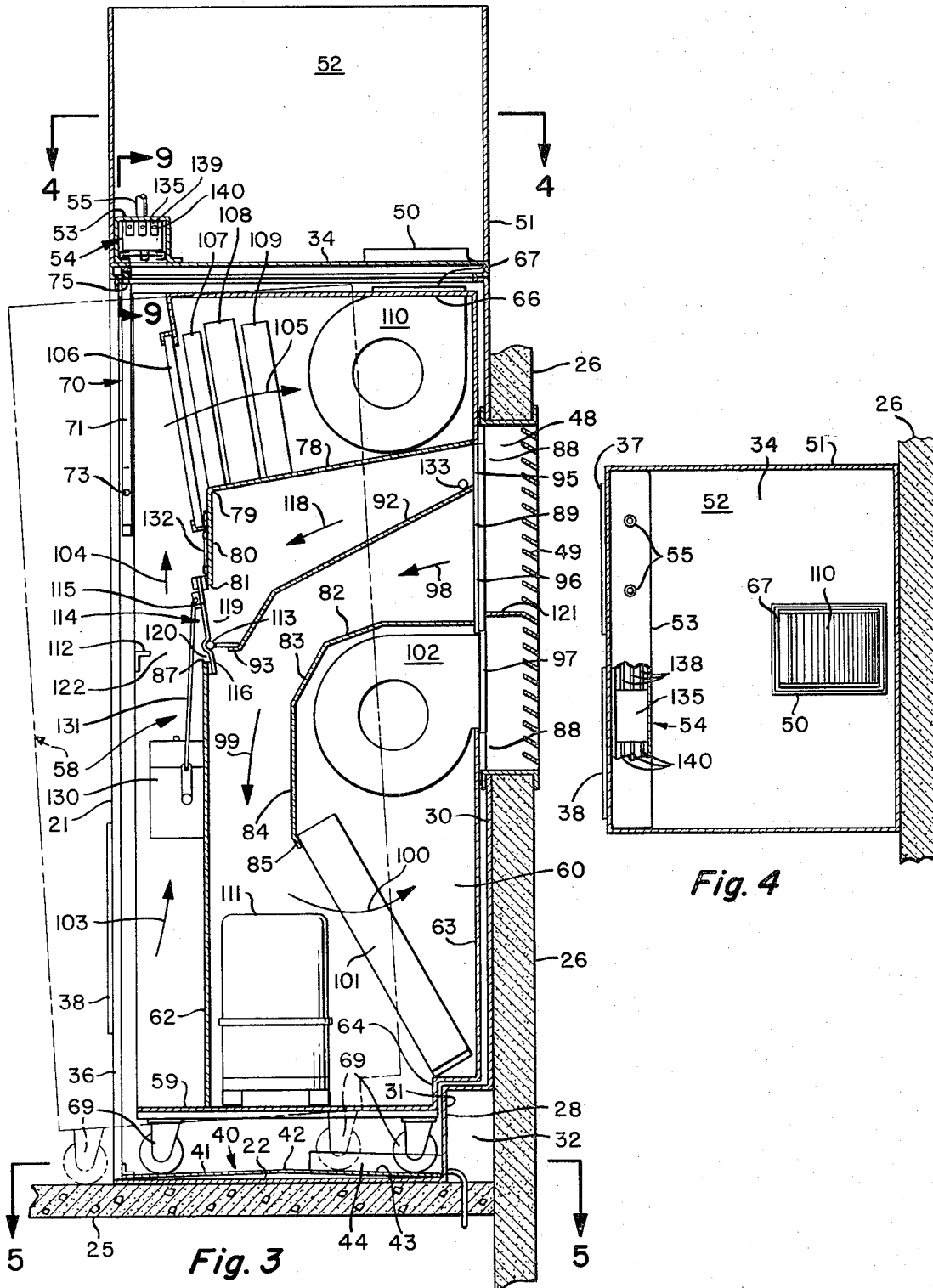
[57] **ABSTRACT**

An air conditioner including a cabinet located in a building space to be conditioned adjacent to a building wall having an opening, the cabinet having a pair of outside air inlets and an outlet communicating through the wall opening, and inferiorly located condenser in the cabinet in a path of cooling air between one inlet and the outlet, the cabinet having a room air inlet and a conditioned air outlet, and a superiorly located evaporator interposed in the path of fluid movement between the room air inlet and conditioned air outlet. The installation is uniquely advantageous for use in existing buildings without altering structure.

13 Claims, 13 Drawing Figures







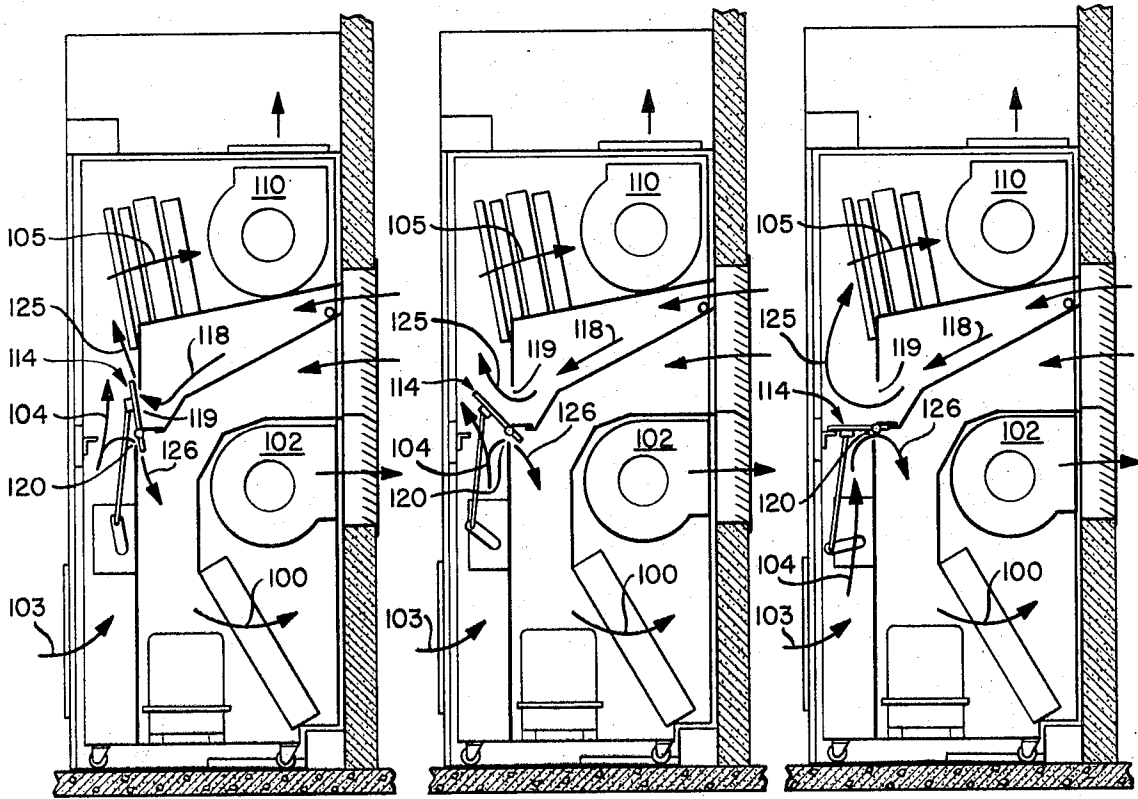


Fig. 6

Fig. 7

Fig. 8

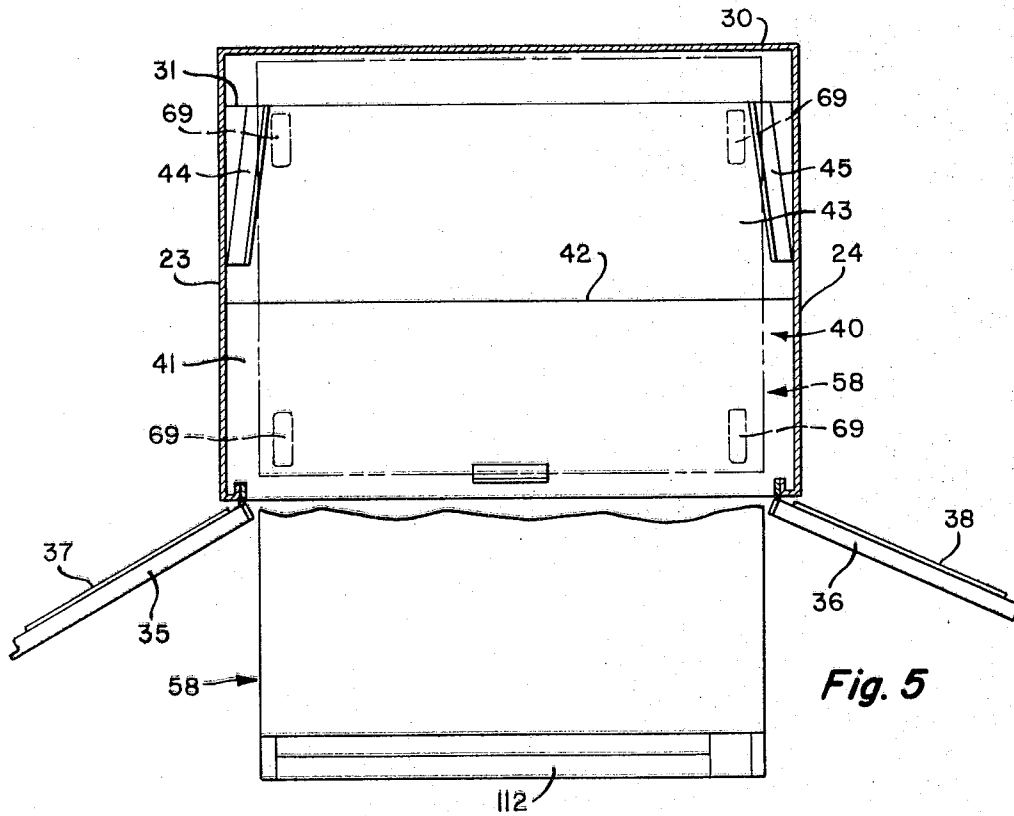


Fig. 5

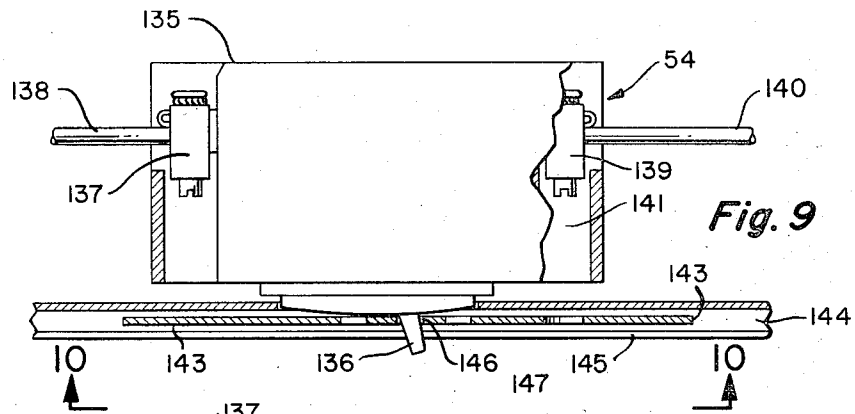


Fig. 9

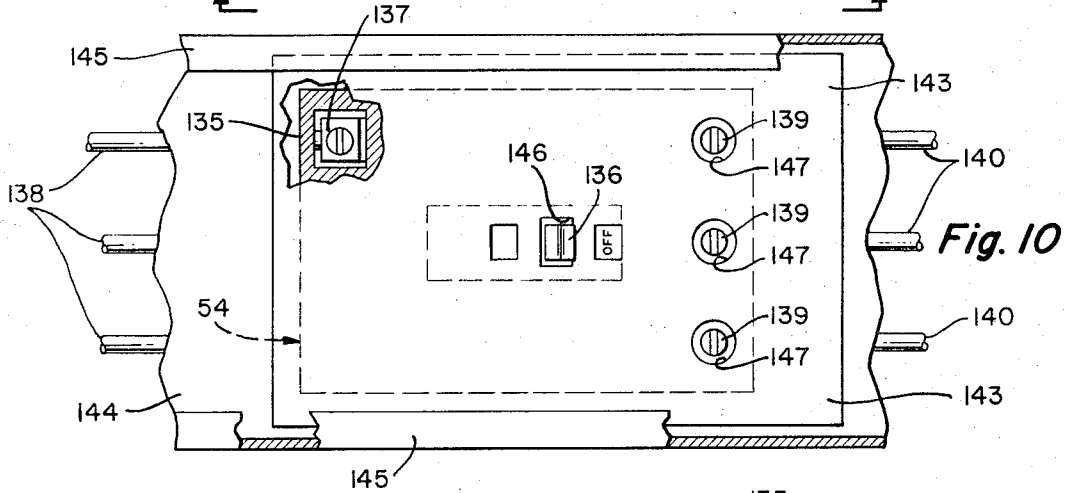


Fig. 10

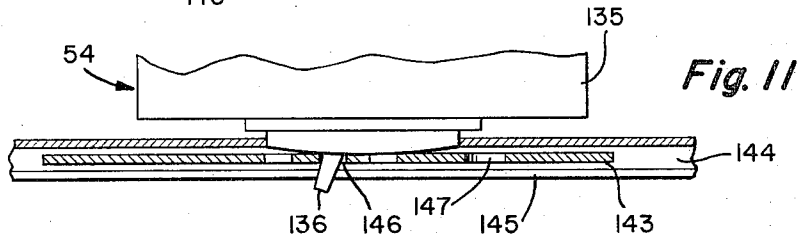


Fig. 11

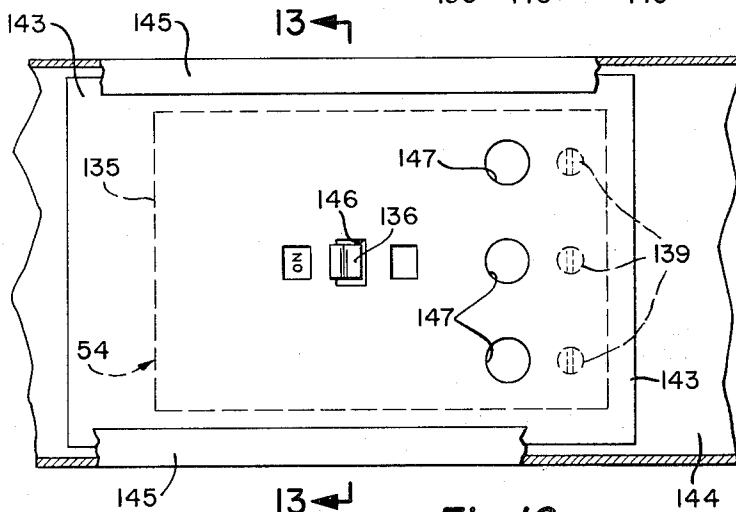


Fig. 12

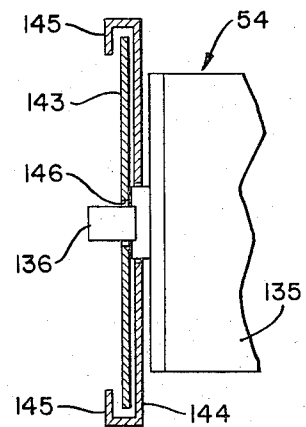


Fig. 13

AIR CONDITIONER

BACKGROUND OF THE INVENTION

While the field of air conditioners for location in the space to be conditioned, including room air conditioners, has been highly developed, there have persisted a wide number of difficulties in connection with the larger of such units, especially in certain installations having more stringent requirements. For example, in the air conditioning of existing educational plants, particularly school rooms, existing air conditioning units have not been entirely satisfactory, as often requiring substantial alteration to the building, difficulty and consequent loss of classroom time in installation and maintenance, distraction and discomfort by operating noises, and requirements of undue floor space necessarily withdrawn from teaching use.

SUMMARY OF THE INVENTION

It is, therefore, an important object of the present invention to provide an air conditioner which overcomes the above-mentioned difficulties, being highly advantageous for installation in both new and existing educational buildings, with little or no alteration to the latter, and which can usually be installed in one day or less, so as to cause no disruption or loss of classroom time, even though the work be done during winter months when construction labor is readily available.

It is another object of the present invention to provide an air conditioner of the type described which is extremely economical to manufacture and install, resulting in substantial savings in initial cost, and which effects substantial economies both in operation and maintenance. For example, the instant apparatus affords savings in permitting cooling by outside air under certain weather conditions, affording supplemental heat without boiler operation in relatively mild weather, enabling central automatic clock control and permitting incremental or unit installation without high-cost penalty.

It is a more particular object of the present invention to provide an air conditioner which includes unique structure isolating vibration and noise for extremely quiet operation, and which further permits of quick and easy removal and replacement of operating unit as a whole, so that maintenance and repair may be performed most economically and outside of the school-room.

Another advantage resides in the ability to install relatively large units of the instant invention in existing buildings without changing the building structure, and without even cutting floors as utilities may be fed from overhead.

It is still another object of the present invention to provide an air conditioner having the advantageous characteristics mentioned in the preceding paragraphs, which incorporates a unique internal arrangement of component parts resulting in an upright or vertical arrangement requiring a minimum of floor space, specifically as little as thirty-three inches by forty-two inches in an otherwise unused and inactive corner of the room.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front perspective view showing an air conditioner constructed in accordance with the present invention.

FIG. 2 is a sectional elevational view taken generally along the line 2—2 of FIG. 1.

FIG. 3 is a sectional side elevational view taken generally along the line 3—3 of FIG. 2.

FIG. 4 is a horizontal sectional view taken generally along the line 4—4 of FIG. 3.

FIG. 5 is a horizontal sectional view taken generally along the line 5—5 of FIG. 3.

FIG. 6 is a sectional view similar to FIG. 3 but illustrating a normal condition of operation with minimal outside air.

FIG. 7 is a sectional elevational view similar to FIG. 6, but illustrating an operating condition utilizing mixed inside and outside air.

FIG. 8 is a sectional elevational view similar to FIG. 7, but illustrating a condition using substantially all outside air.

FIG. 9 is an enlarged partial sectional elevational view taken generally along the line 9—9 of FIG. 3.

FIG. 10 is a view taken generally along the line 10—10 of FIG. 9.

FIG. 11 is a view similar to FIG. 9, but showing another condition of use.

FIG. 12 is a view similar to FIG. 10, but illustrating the condition of use shown in FIG. 11.

FIG. 13 is a sectional view taken generally along the line 13—13 of FIG. 12.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, and specifically to FIGS. 1—3 thereof, the air conditioning device is there generally designated 20, and includes an outer enclosure or cabinet 21 which may be suitably fixed in position within a building space being air conditioned. More specifically, the outer enclosure or cabinet 21 may include a generally horizontal bottom wall or base 22, and a pair of laterally spaced, generally parallel, facing side walls 23 and 24 upstanding from opposite sides of bottom wall 22. The opposite side walls 23 and 24 are both seen in FIGS. 2 and 5, while the bottom wall 22 may be seen in FIGS. 2 and 3, and there illustrated as resting generally horizontally on a supporting floor 25. It will also be seen, as in FIG. 3, that the bottom wall 22 terminates at its rear or outer edge short of the adjacent upstanding building wall 26. Further, the side walls 23 and 24 have their lower rear or outer corner regions cut away, as at 28 and 29 in FIGS. 1 and 3.

The cabinet 21 further includes an upstanding outer or rear wall 30 which extends laterally between the rear edges of the side walls 23 and 24, and has its lower region 31, see FIG. 3, recessed or offset forwardly away from the building wall 26. That is, the rear or outer cabinet wall 30 may be disposed in generally facing relation with the building wall 26, except at the lower recessed rear wall region 31, which region combines with

the adjacent spaced building wall 30 to provide a laterally extending, open ended through passageway 32, say for existing utilities or to accommodate future requirements.

An upper or top wall 34 may extend across and between the upper edges of side walls 23 and 24 and rear wall 30, to effectively close the upper end of the cabinet 21. Openable closures or front doors 35 and 36, say having air passageways or grills 37 and 38 in their respective lower regions, may be suitably hinged to respective side walls 23 and 24 for swinging movement between the closed condition of FIG. 1 and an open condition, as in FIG. 5.

The bottom wall or base 22 of the cabinet 21 may be provided on its upper surface with ramp means 40, say including an inwardly or rearwardly inclining plane 41 which extends generally from the forward edge of base 22 rearwardly or inwardly and slopes upwardly to a ridge or crest 42 spaced medially between the front and rear regions of the bottom wall. Extending from the crest or ridge 42, the ramp means 40 includes an inner plane 43 declining rearwardly toward the rearward edge of the base 22. In addition, on the rearwardly declining plane 43, adjacent to opposite side walls 23 and 24, are a pair of rearwardly or outwardly convergent guide members or rails 44 and 45. The ramp means 40 serves a purpose appearing presently in detail.

The building wall 26 includes a through opening or passageway 48 which may be louvered, as by outwardly declining louvers 49 for protection from the elements and other purposes appearing presently. Formed in the top wall 34 may be an opening or air passageway 50 defining a conditioned air outlet. Upstanding peripherally about the top wall 34 may be a plenum wall 51 defining therewithin a plenum space 52 for distribution therefrom of conditioned air as to suitable ductwork, or directly into the space being conditioned. Within the plenum 52, as along the front or inner wall thereof, there may extend an inverted channel 53 defining a laterally extending utility connection enclosure into which electricity, water and the like may be conducted. At one location in the enclosure 53 is a circuit breaker 54, while water or other conduit means 55 are illustrated at another location in the enclosure.

A housing is generally designated 58 and of generally rectangular overall outline configuration sized for location in conforming spaced relation within the cabinet 21. In particular, the housing 58 includes a generally rectangular, horizontal bottom wall 59 spaced over the bottom cabinet wall 22 and ramp means 40. A pair of generally vertical, laterally spaced side walls 60 and 61 upstand from opposite side edges of the bottom wall 59, while a pair of generally vertical, parallel spaced front and rear walls 62 and 63 upstand from respective front and rear regions of the bottom wall 59, extending laterally between the side walls 60 and 61. The lower region of rear housing wall 63 is recessed inwardly or forwardly, as at 64 for spaced conforming reception of the forwardly or rearwardly recessed cabinet wall region, and the front housing wall 62 is spaced rearwardly from the front cabinet doors 35 and 36.

Extending across the upper ends of housing side walls 60 and 61, and front and rear walls 62 and 63 is a housing top wall 66 provided with a conditioned air opening 67 located for general registry with the cabinet top wall opening 50.

It will now be appreciated, as from FIGS. 2, 3 and 5 that the inner housing or enclosure 58 is located within and completely spaced from the outer cabinet, there being essentially no rigid or metal connection therebetween. Maintaining the enclosure or housing spaced above the cabinet bottom wall 22 and ramp means 40 are a plurality of ground engageable rolling elements or wheels 69 depending from the housing bottom wall 59 into rolling engagement with the ramp means 40, as in solid lines in FIGS. 2, 3 and 5.

The wheels 60 thus provide running gear supporting the housing or enclosure 58 for movement from its position entirely within the cabinet 21 to a position entirely exteriorly of the cabinet as by rolling movement between the open doors 35 and 36, as shown in FIG. 5. It will now be understood that the ramp means 40 serves to properly locate the housing 5 in position within the cabinet 21, the rear wheels 60 moving rearwardly over the crest 42 and gravitationally rolling rearwardly to an equilibrium position, as guided by the rails 44 and 45 with the housing in its spaced relation within the cabinet. If desired, the wheels 69 may be braked, or chocked.

In addition, retaining brace means, as at 70, may employ a pair of elongate elements or strips 71 and 72 extending diagonally upwardly and inwardly between respective cabinet side walls 23 and 24 and the cabinet top wall 34. Thus, each of the elongate members 71 and 72 may have its lower end suitably secured, as by fasteners 73 and 74 to respective cabinet side walls 23 and 24 at the forward or inner edge region thereof. From the fasteners 73 and 74 the elongate retainers or tie members 71 and 72 may extend obliquely upwardly toward each other to a common laterally medial location at a forward region of the top wall 34, being detachably fixed thereto by a common fastener 75. Thus, the retainer strips or tie members 71 and 72 serve both to rigidify the cabinet 21, and prevent removal of the enclosure or housing 58 from the cabinet without prior disconnection of the retainer members.

Internally within the housing or enclosure 58, there is provided an upper internal wall 78 which extends laterally between the side walls 60 and 61, and forwardly or inwardly from the outer wall 63 toward and terminating short of the front cabinet doors 35, 36 at a location 79, from which the upper internal wall depends, as at 80, to a lower edge 81.

A lower internal wall 82 extends laterally between the housing side walls 60 and 61, being spaced below the internal wall 78 and extends from the rearward or outward housing wall 63 forward or inward beneath the wall 78, extending thence downwardly and inwardly as at 83, and thence merging into a generally vertically depending wall region 84 which terminates, as at 85 spaced over the bottom wall 59 and rearwardly or outwardly of the upper internal wall region 80. The front housing wall 62 extends upwardly from the bottom wall 59 generally coplanar with and toward but terminating short of the internal wall region 80, as at an upper edge 87.

The rear or outer cabinet wall 30 is provided with an opening 88 located in general alignment with the building wall opening 48, and similarly the rear or outer housing wall 63 is formed with an opening 89 generally in registry with the opening 88.

An intermediate internal housing wall 92 extends laterally between opposite housing side walls 60 and 61,

being spaced vertically between the upper internal housing wall 78 and lower internal housing wall 82, and extends forwardly or inwardly from the plane of the rear wall 63 toward a terminal region or laterally extending closure plate 93 located vertically between the edge 81 of the internal wall 80 and the upper edge 87 of vertical wall 62. By this internal housing construction, the housing opening 89, and corresponding cabinet opening 88 and wall opening 48 are effectively subdivided. Thus, an upper opening 95 is provided between the upper internal wall 87 and the intermediate internal wall 92, while an intermediate opening 96 is provided between the intermediate internal wall 92 and the lower internal wall 82. Further, a lower opening 97 is provided between the lower internal wall 82 and the lower edge regions of openings 89, 88 and 48. The intermediate opening communicates between the exterior of the building wall 26 to afford an inlet for outside air passing inwardly between the intermediate and lower internal walls 92 and 82, thence downwardly between the vertical wall 62 and lower region 84 of the lower internal wall 82, as along the path of arrows 98 and 99. The outside air may pass thence along the path of arrow 100, downwardly and upwardly toward the opening 97 for exit through the building wall 26. Exiting air is separated from the entering air by a guide or divider 121 in wall opening 88. Thus, along the direction of arrows 98, 99 and 100 is defined a path for outside air or fluid movement into the housing 58 and outwardly therefrom. Interposed across the path 98, 99 and 100, in a lowermost region thereof, may be a condenser or condensing coil 101, so that outside air passing through the path 98, 99 and 100 serves to cool the condenser. Also in the path 98, 99 and 100, say adjacent to the outlet opening 97, may be air movement means 102, such as a blower or fan for effecting movement of cooling air through the condenser 101. Additionally located in the lower region of housing 58 may be a compressor 111, which together with the condenser 101 are of considerable weight, and afford the housing substantial upright stability.

Extending generally vertically within the housing 58, between the front housing wall 62 and cabinet doors 35 and 36 may be a fluid path or passageway, as along the direction of arrows 103 and 104, extending thence rearwardly or outwardly in the direction of arrow 105 between upper internal wall 78 and housing top wall 66. Thus, inside air or fluid may enter the housing 58 through lower front grilles 37 and 38, passing along path 103, 104 and 105, and exiting upwardly through conditioned air outlet or opening 50.

Interposed in and extending across fluid path 103, 104 and 105 may be an air filter 106, a cooling coil or evaporator 107, a heating coil or heater 108, and a humidifier 109. Adjacent to the conditioned air outlet 50 may be located suitable air movement means 110, such as a fan or blower effective to move air along path 103, 104 and 105.

It will further be seen, for example in FIG. 3, that the lower edge 81 of internal wall 78 terminates spaced above the upper edge 87 of internal wall 62, while the forward edge or closure 93 of internal wall 92 terminates horizontally spaced rearwardly or outwardly from the front cabinet doors 35 and 36, and a stop member or ledge 112 fixed between side walls 60 and 61 generally horizontally aligned with the edge 93. At a location generally vertically aligned between the wall edges 81

and 87, and generally horizontally aligned between the wall edge 93 and stop ledge 112, there may extend laterally, generally horizontally across the housing 58 between the housing side walls 60 and 61 a pivot 113 carrying a valve member or damper 114. The valve member or damper 114 may be of the butterfly type, and may have one portion or wing 115 relatively large for swinging movement between closing engagement with the relatively distant upper internal wall edge 81 and stop ledge 112, as well as a smaller or lesser valve portion or wing 116 swingable between closing engagement with the relatively closer internal wall 87. The pivot 113 may be located proximate to the closure edge 93, so as to effectively occlude any space therebetween.

There is defined an air passageway, path or duct means between the upper internal housing wall 78 and the intermediate internal housing wall 92, the opening 95 defining an outside air inlet for passage of air along the path of arrow 118. The space or opening 119 between wall edge 81 and pivot 113 defines a port or passageway for communicating outside air through path or duct means 118 and port or opening 119 to path or duct means 103, 104 and 105.

The upper edge 87 of vertical wall 86 is spaced below the pivot 113, the space therebetween defining an exhaust passageway or port 120 for communication between the path or duct means 103, 104 and 105, and the path or duct means 98, 99 and 100. In the position of damper 114 shown in FIG. 3, the ports or passageways 119 and 120 are closed by the damper, but may be opened upon damper movement in the counterclockwise direction.

The intermediate internal housing wall 92 terminates in a closure plate 93 extending in closing relation to pivot 113. The space 122 between pivot 113 and stop ledge 112 may provide an opening or port in the path or duct means 103, 104 and 105. As the wings 115 and 116 of the damper means 114 extend generally diametrically oppositely from pivot 113, the damper is swingable counterclockwise to open the ports 119 and 120, approximately 90° to a limiting position closing the port or passageway 122.

Certain conditions of operation are shown in the damper positions of FIGS. 6, 7 and 8. Normal operation is illustrated in FIG. 6, with the damper 114 just slightly opening outside air duct means 118 through port 119 to inside air duct means 103, 104 and 105, as along arrow 125. This normal damper position also permits slight exhaust movement of air, as along arrow 126 through exhaust passageway 120, which air aids in cooling the condenser and is exhausted to the outside.

An intermediate damper position is shown in FIG. 7, wherein a controlled portion of the warmer return air is reused.

An extreme condition is shown in FIG. 8, which effects substantial economy and saves power by utilizing outside air for cooling when weather conditions permit. Thus, the damper means 114 is swung to its limiting counterclockwise position, fully opening outside air duct means 118 to the air movement means 110, while room air is all passed through exhaust passageway 120 for movement to the outside.

The opposite extreme position is shown in FIG. 3, wherein all of the room air is reconditioned through path or duct means 103, 104 and 105, and outside air

is all exhausted through air movement means 102, the damper means 114 closing both the ports 119 and 120.

Automatically controlling the hereinbefore described damper means may be a damper motor 130, say mounted in the duct means 103, 104 and connected to the damper by a suitable operating arm 131. The damper motor may be actuated by suitable temperature sensing means, say a mixed air sensor 132 located in the duct means 103, 104, 105 upstream of the filter, and an outside air temperature sensor, as at 133, located in the outside air duct 118. The sensors 132 and 133 are suitably connected to the damper motor 130, as well as the compressor 111 and air movement means 102.

The switch means or circuit breaker 54 of the utility connection channel 53 may include a downwardly facing receptacle 135 enclosing a circuit breaker and having depending therefrom an operating lever or arm 136. Electrical terminals, say three in number, as at 137 may be located in the receptacle of box 135 for connection, as at 138 to an external source of power. A similar group of terminals, as at 139 may be mounted in the receptacle 135 for electrical connection to respective conductors 140 which pass to the air conditioning equipment in housing 58. The terminals 139 are accessible upwardly through passageways 141 which open downwardly through the receptacle or container 135.

Located directly beneath the receptacle or container 135 is a generally horizontally disposed plate or closure member 143 which is horizontally slidably mounted in a generally horizontal track 144. The track 144 may include a pair of spaced intumed edge portions or flanges 145 slidably supporting the closure member 143 for horizontal shifting movement longitudinally of movement of lever 136. Further, the closure member or plate 143 is provided with a central opening 146 receiving lever 136, so that the closure member is shiftable along track 144 upon movement of the lever between "on" and "off" positions. Further in the "off" position of lever 136, as shown in FIG. 10, the closure plate 143 affords access therethrough, as by means of a plurality of holes 147, to the several terminals 139. That is, the holes 147 of closure plate 143 align themselves with respective passageways 141 of the container 135 enabling a tool to be inserted therethrough for operation of the terminal means 139.

However, upon shifting movement of the operating lever 136 to the "on" position, as seen in FIGS. 11, 12 and 13, the closure member is shifted to place its access holes 147 out of alignment with the terminals 139, prohibiting access thereto. By this means, it will be appreciated that the power lines 140 may be connected to the switch means 54 only when the switch means is properly in its "off" position.

From the foregoing, it will now be understood that there is provided an air conditioning apparatus which is uniquely well adapted for use in educational plants and the like, and is otherwise well adapted to accomplish its intended objects.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

What is claimed is:

1. An air conditioner for location in a building space to be conditioned and comprising a cabinet for location adjacent to a building wall extending across a single wall opening, said cabinet having an upper pair of inlets for receiving outside air through said wall opening and a lower outlet adjacent to said inlets for discharge of condenser air through said wall opening, a condenser in a lower cabinet region interposed in the path of fluid flow between one of said inlets and said outlet, said cabinet having a lower inside air inlet and an upper conditioned air outlet, an evaporator in said cabinet interposed in the path of fluid flow between said inside air inlet and conditioned air outlet, and air movement means for moving air along said paths.

2. An air conditioner according to claim 1, in combination with a housing in spaced relation within said cabinet; said condenser, evaporator, and air movement means being mounted in said housing, for acoustic isolation from said cabinet.

3. An air conditioner according to claim 2, in combination with wheeled running gear mounting said housing for rolling movement into and out of said cabinet, said wheeled running gear including sound absorbing wheel material for acoustic isolation from said cabinet.

4. An air conditioner according to claim 1, said cabinet including an outer wall in proximate facing relation with said building wall, the lower region of said outer wall being recessed inwardly away from said building wall to provide a passageway between said building wall and lower outer wall region for utility lines and the like.

5. An air conditioner according to claim 3, said condenser being located in a lower region of said cabinet, said evaporator being located in an upper region of said cabinet, and a compressor in a lower region of said cabinet, for housing stability upon rolling movement thereof.

6. An air conditioner according to claim 1, said pair of outside air inlets and outlets being located in a vertically intermediate region of said cabinet, and fluid guide means directing outlet air away from said inlets.

7. An air conditioner according to claim 1, in combination with condenser duct means in said cabinet defining said fluid flow path between said one inlet and said one outlet, evaporator duct means in said cabinet defining said fluid flow path between said inside air inlet and conditioned air outlet, outside air duct means communicating between said other outside air inlet and an intermediate region of said evaporator duct means, damper means operative to control communication between said outside air and evaporator duct means, and exhaust passage means communicating between said evaporator duct means and condenser duct means for exhausting inside air.

8. An air conditioner according to claim 7, said damper means being located for simultaneous operative movement relative to all of said outside air and evaporator duct means and said exhaust passage means.

9. An air conditioner according to claim 8, said damper means comprising a pivoted valve element swingable to simultaneously open said outside air duct means and exhaust passage means while closing said evaporator duct means, and simultaneously closing said

evaporator duct means while opening said outside air duct means and exhaust passage means.

10. An air conditioner according to claim 9, in combination with shunt passage means communicating between said outside air and condenser duct means for increasing cooling air to said condenser.

11. An air conditioner for location in a building space to be conditioned and comprising a cabinet for location adjacent to a building wall extending across a wall opening, said cabinet having a pair of inlets for receiving outside air through said wall opening and an outlet for discharge of condenser air through said wall opening, a condenser in a lower cabinet region interposed in the path of fluid flow between one of said inlets and said outlet, said cabinet having a lower inside air inlet and an upper conditioned air outlet, an evaporator in said cabinet interposed in the path of fluid flow between said inside air inlet and conditioned air outlet, air movement means for moving air along said path, a housing in spaced relation within said cabinet; said condenser, evaporator and air movement means being

mounted in said housing for acoustic isolation from said cabinet, wheeled running gear mounting said housing for rolling movement into and out of said cabinet, and power switch means mounted in said cabinet and having terminals for detachable connection to conductors extending from said housing, and a closure member on said switch means in covering relation with said terminals and operatively connected to the switch means for shifting movement relative thereto upon actuation of the switch means, said closure member having openings shiftable to afford access to said terminals only when said switch means is off.

12. An air conditioner according to claim 3, in combination with ramp means beneath said running gear for guiding and locating said housing in its spaced relation within said cabinet.

13. An air conditioner according to claim 12, said ramp means including crest means for retaining said housing in proper position.

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