March 1, 1955 W. F. BORGERD 2,702,994

AIR CONDITIONING APPARATUS FOR BUILDINGS

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Fig. 1.

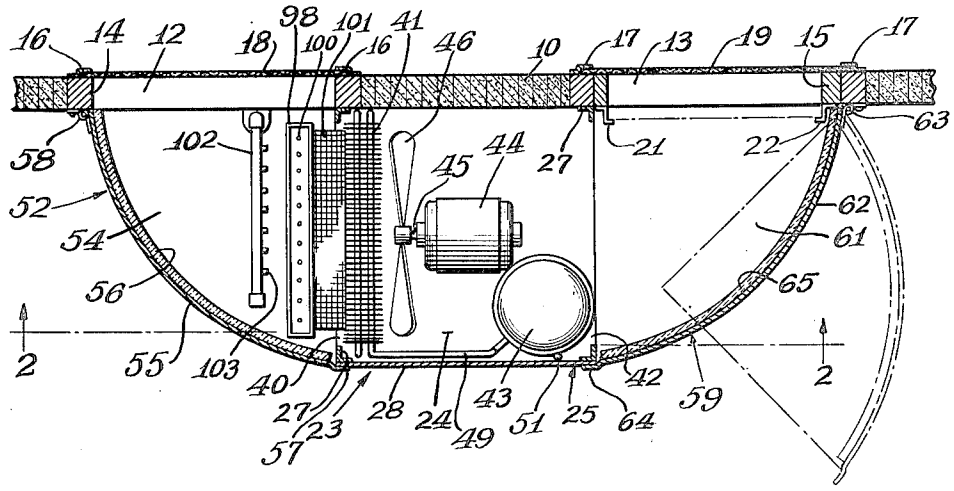
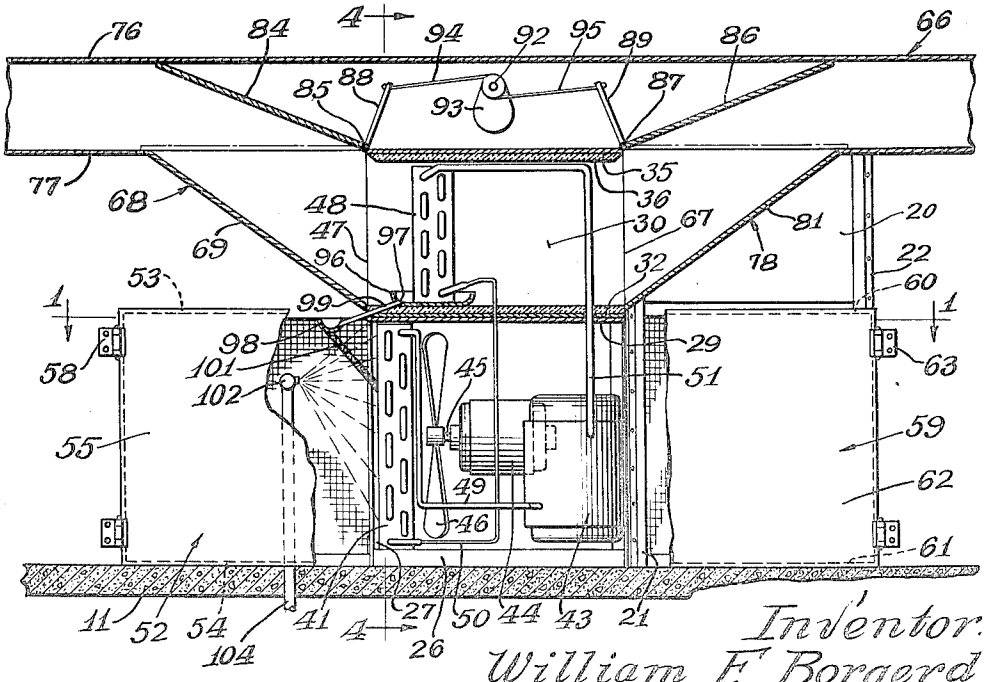


Fig. 2.



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AIR CONDITIONING APPARATUS FOR BUILDINGS

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7 Claims. (Cl. 62—140)

This invention relates generally to air conditioning apparatus and more particularly to an air conditioning unit adapted to be positioned in the basement or utility room of a building and to cool and dehumidify the air in the rooms of the building.

In recent years air conditioning units have been installed in many homes and office buildings, and as the public becomes better acquainted with the comfort realized from air conditioning, a far greater number of units will no doubt be in demand. The most satisfactory type of air conditioning system for a building is one in which conditioned air is supplied from a single refrigeration unit to the various rooms by means of air ducts. Since many buildings are not equipped with suitable air ducts for such a system, the cost of installing a duct system is so great that many buildings have been equipped with the room type air conditioner. This type has been found to be generally unsatisfactory because the unit usually obstructs a window opening or a portion of the floor and is of such limited capacity that only one room can be effectively cooled. Another type of system which requires no air ducts is one in which several evaporators, one positioned in each room of the building, are connected to common refrigerant compressing and condensing means. This system has proved to be quite expensive because considerable plumbing is required and the path of refrigerant flow is long. Since many of the newer buildings are constructed with an air duct system which connects the rooms with a forced draft hot air furnace, it would be advantageous to utilize this duct system for cooling the rooms. The present invention provides an air conditioning unit adapted to be connected to a furnace duct system so that separate ducts are not required and the above mentioned disadvantages are overcome.

One object of the present invention is to provide an air conditioning unit which is adapted to be completely assembled by the manufacturer before shipment to the place of installation.

Another object of the invention is to provide an air conditioning unit which is adapted to be positioned within a building to be cooled between spaced apart openings provided in an outer wall of the building through which cooling air is circulated.

Another object of the invention is to provide an air conditioning unit which is adapted to be inserted through one of the outer wall openings into the basement or utility room of the building.

Another object of the invention is to provide an air conditioning unit which is adapted to be connected into the duct system between the hot air furnace and the rooms of the building.

Another object of the invention is to provide damper means for controlling the flow of air from the duct system over the evaporator of the air conditioning unit.

Another object of the invention is to provide means for closing one of the outer wall openings so that fresh air can be circulated into the building by fan means provided in the high side compartment of the air conditioning unit.

Another object of the invention is to provide means for removing condensate from the evaporator of the air conditioning unit and distributing it over the condenser thereof.

Another object is to provide means for spraying cooling water over the condenser of the air conditioning unit during overload periods.

With the above and other objects and advantages in view, the invention consists of the novel details of construction, arrangement and combination of parts more fully hereinafter described, claimed and illustrated in the accompanying drawings in which:

Figure 1 is a horizontal sectional view of an air conditioning unit embodying the invention taken on line 1—1 of Figure 2.

Figure 2 is a vertical sectional view taken on line 2—2 of Figure 1.

Figure 3 is a plan view of the unit of Figure 2 with some parts broken away.

Figure 4 is a vertical sectional view taken along line 4—4 of Figure 2.

The air conditioning unit shown in the drawings is adapted to be mounted in the utility room of a building with the low side compartment connected into a hot air duct system. However, it is to be understood that the invention could be mounted in some other portion of the building, such as a basement or storage room, with the low side compartment connected into a duct system built especially for the air conditioning unit.

Referring particularly to the drawings, a portion of an outer wall of a building is indicated by reference numeral **10** and a portion of the floor of a utility room is indicated by reference numeral **11**. Wall **10** is provided with two spaced apart openings **12** and **13** which are encased by frames **14** and **15** respectively. Secured over the openings **12** and **13** by clamps **16** and **17** are screens **18** and **19** which prevent foreign matter from entering the openings and protect the utility room from unauthorized personnel. A door **20** is slidably secured against the inner surface of wall **10** by vertically extending channels **21** and **22** so that the door may be lowered to cover opening **13** or raised above the opening. In the drawings the door **20** is shown in raised position above opening **13** and means for locking it in this position (not shown) may be provided.

The air conditioning unit is indicated generally by reference numeral **23**. The unit **23** is positioned within the utility room adjacent outer wall **10** between openings **12** and **13**. A high side compartment **24** is enclosed by a lower casing **25** comprising a base frame **26**, vertically extending corner channels **27**, front wall **28** and top wall **29**. A low side compartment **30** is enclosed by upper casing **31** comprising bottom wall **32**, side walls **33** and **34**, and top wall **35**, the inner surfaces of which are covered by an insulating material **36**. Upper casing **31** is removably secured to lower casing **25** by screws **39** which fasten the extended edge portions **37** and **38** of the bottom wall **32** of the upper casing to the top wall **29** of the lower casing.

Positioned within high side compartment **24** adjacent the open end **40** thereof is a finned tube refrigerant condenser **41**. A motor-compressor unit **43** is secured adjacent open end **42** and an electric motor **44** is positioned between the motor-compressor unit and condenser **41**. Fastened to the armature shaft **45** of motor **44** is a propeller type fan **46** which operates to force cooling air through the compartment **24** as hereinafter described. Secured within low side compartment **30** adjacent open end **47** is a finned tube refrigerant evaporator **48** over which air to be cooled will be passed in the manner explained hereinafter. The above mentioned members of the refrigerating system are connected by conduits, and with a suitable charge of refrigerant, the system will operate in the conventional manner. After the refrigerant has been compressed by motor-compressor unit **43**, it is forwarded through conduit **49** to the condenser **41** where it will be cooled and condensed by the cooling air passing thereover. The cooled refrigerant then flows through restrictor capillary tube **50** into evaporator **48** where it absorbs heat from the air being circulated thereover. The refrigerant is returned to the motor-compressor unit **43** by conduit **51** which completes the refrigeration cycle. Suitable controls for automatically controlling the operation of motor-compressor unit **43** and motor **44** are contemplated but are not shown since they are not important to the invention.

Pivotally connected to frame **14** of opening **12** by

hinges 58 is an elbow duct 52 comprising a top wall 53, bottom wall 54 and curved front wall 55. The duct 52 connects open end 40 of lower casing 25 to opening 12 and provides a free path for outside air. The inner surfaces of the duct 52 are covered with a sound deadening material 56 and front wall 55 is provided with flange 57 which engages lower casing 25. The opposite open end 42 of lower casing 25 is connected to opening 13 by duct 59 comprising top wall 60, bottom wall 61 and curved front wall 62. One edge of the duct 59 is connected to frame 15 by hinges 63 whereas the opposite edge is provided with a flange 64 which fastens to front wall 28 of lower casing 25. The inner surfaces of the duct 59 are covered with a sound deadening material 65 to prevent the noise of the refrigeration machinery and air circulating therethrough from being projected into the building. The lower casing 25 is positioned proximate to outer wall 10 so that the top wall 29, front wall 28, floor 11 and outer wall 10 enclose the compartment on four sides. With fan 46 operating, cooling air is pulled through opening 12, circulated through duct 52, high side compartment 24 and duct 59, then discharged outside through opening 13. The ducts 52 and 59 offer only a slight resistance to the movement of air therethrough so that the condenser 42 and motor-compressor 43 are properly cooled by the large volume of cooling air passing thereover.

In the illustrated embodiment the upper casing 31 is positioned directly below a horizontally extending duct 66 which comprises side walls 74 and 75, top wall 76 and bottom wall 77. In the instant case it is contemplated that the duct 66 is connected to a forced air draft furnace having a conventional fan (not shown) for circulating air therethrough, but it is to be understood that it could be a separate duct system installed between the rooms and unit 23. The side walls 33 and 34, top wall 35 and bottom wall 32 of upper casing 31 cooperate to enclose the low side compartment 30 with oppositely disposed ends 47 and 67 remaining open. End 47 is connected to duct 66 by a tapering duct 68 comprising bottom wall 69, vertical side walls 70 and 71, and top walls 72 and 73 which connect the side walls 70 and 71 to the side walls 74 and 75 of horizontal duct 66. The opposite open end 67 of compartment 30 is joined to the horizontal duct 66 by a second tapering duct 78 having vertical side walls 79 and 80, bottom wall 81 and short top walls 82 and 83 which connect the side walls 79 and 80 to the side walls 74 and 75 of the horizontal duct.

A damper 84 is connected to top wall 35 of upper casing 31 over open end 47 by hinges 85, whereas a similar damper 86 is connected to top wall 35 over open end 67 by hinges 87. Levers 88 and 89 are fixedly secured to dampers 84 and 86 in order to provide means for rotating the dampers. When the dampers are rotated to the position shown by solid lines in Figure 2, the air circulating through horizontal duct 66 will be by-passed over evaporator 48. By rotating the dampers to the position shown by dotted lines in Figure 2, the ducts 68 and 78 will be closed from horizontal duct 66 and the air will not be circulated through compartment 30. Although any means could be used to operate the dampers, the illustrated embodiment shows a small electric motor 90 which is back-geared to pulleys 91 and 92 through gear box 93. Pulley 91 is connected to damper 84 by means of a cord 94 which is fastened to lever 88. Lever 89 of damper 86 is connected to pulley 92 by cord 95. By providing a thermostatic control (not shown) to control the motor 90, the dampers will be slowly raised by the motor when the air is to be cooled and slowly lowered when the air is to be heated.

Positioned beneath evaporator 48 is a shallow pan 96 having an outlet 97 connected to tray 98 by tube 99 which extends through top wall 53 of duct 52. Tray 98 is positioned slightly forwardly of condenser 41 and is provided with a series of small holes 100 in the bottom thereof. A slightly tilted screen 101 is secured under tray 98 with the upper edge under holes 100 and the lower edge adjacent the finned surface of condenser 41. As is well known in the art, the surface temperature of a refrigerant evaporator will be low enough to condense moisture from the air passing thereover. In the present invention, any water which condenses on evaporator 48 will drip into pan 96 from where it will gravitate through tube 99 into trough 98. This condensate will drip slowly through holes 100 and will be distributed over screen 101 from where most of it will be removed by the air being circulated by fan 46. Any that is not so removed will drain onto the hot surfaces of the condenser 41 and be evaporated. In this manner the condensate will be effectively removed and will be utilized in cooling the condenser 41 since considerable heat will be removed from the condenser during the evaporation of the condensate.

Secured below trough 98 is a header 102 having a series of nozzles 103 directed toward condenser 41. The header 102 is connected to a suitable water supply (not shown) by tube 104. If the refrigerating system is subjected to overload conditions, the temperature and pressure of the refrigerant will be raised and the air circulating over condenser 41 will not remove the excessive heat therefrom. When this occurs, by supplying water to header 102, a fine mist will be sprayed over condenser 41. As this mist contacts the hot surfaces of the condenser, it will be evaporated with a resultant cooling of the condenser. Since water absorbs a large amount of heat during vaporization, only a small amount of water will be required to quickly cool the condenser. It is contemplated that suitable controls (not shown) be provided for automatically controlling the supply of water to header 102.

The air conditioning unit 23 is completely assembled at the fractory before shipment to the building in which it is to be installed. By swinging the elbow duct 52 or 59 away from outer wall 12, the unit 23 can be turned to a horizontal position and inserted through either opening 12 or 13. It is then positioned between the openings and low side compartment 30 is connected to horizontal duct 66 by tapering ducts 68 and 78. With dampers 84 and 86 in lowered position, the low side compartment 30 is shut off from duct 66 and this duct may be used to circulate warm air from a furnace to the rooms of the building. When the air to the rooms is to be cooled, dampers 84 and 86 are raised by motor 90 and the furnace is shut off. The room air will then be circulated over evaporator 48 where it will lose heat and be cooled to a predetermined temperature. Any condensate collected by pan 96 from evaporator 48 will be drained through tube 99 into trough 98 from where it will drip onto screen 101 and be removed by the air circulating through high side compartment 24. Fan 46 will circulate outside air through high side compartment 24 by way of openings 12 and 13 and header 102 will operate to spray water over condenser 41 during overload conditions in the manner described heretofore.

Elbow ducts 52 and 59 are adapted to be rotated away from lower casing 25 in order to provide access to the high side machinery for servicing thereof. When the unit 23 is being used to cool the air, door 20 is secured in the raised position as shown in Figure 2 of the drawing. If it is desired to circulate fresh air into the building without cooling it, elbow duct 59 is rotated away from casing 25 as shown by the dotted lines in Fig. 1 and the door 20 is lowered so that it closes opening 13. With the refrigeration system shut off electric motor 44 is then operated and fresh air is drawn through opening 12 by fan 46 and discharged into the building through open end 42 of compartment 24.

From the foregoing it is apparent that a novel air conditioning unit is provided which will operate to cool the rooms of a building. It is adapted to be positioned in a utility room or similar storage space of a building so that valuable floor space in the living quarters of the building is not obstructed. A separate duct system is not required if a hot air duct system to a furnace is available in the building. The unit can be installed in the building without the necessity of carrying parts through the doorways or rooms of the building and convenient access to the refrigeration machinery is available for servicing thereof after the unit is installed. A sufficient amount of outside air is provided for the cooling of the high side members during normal operating conditions and water spray means is provided for quickly cooling the condenser during overload periods. Condensate is removed from the evaporator by simple and effective means and disposed over the condenser so that it will be evaporated and carried outside the building by the cooling air.

While the invention has been shown and described in only one form, it will be obvious to those skilled in the

art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit thereof. It is desired that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. In combination with a building to be cooled, an air conditioning unit positioned between a first opening and a second opening provided in an outer wall of said building, said unit comprising a high side compartment having oppositely disposed open ends, one of said open ends being connected to said first opening by a first duct, the other open end being connected to said second opening by a second duct which is adapted to be moved away from the open end, said high side compartment being provided with a compressor, condenser and fan means for circulating outside air therethrough by way of said openings, a low side compartment having an evaporator secured therein over which air to be cooled is passed, and a door which is slidably secured in such a manner that it can be moved over said second opening when said second duct is rotated away from said open end so that fresh air will be circulated by said fan means through said first opening into said high side compartment and discharged therefrom into said building.

2. In combination with a building having a furnace duct system through which said building is to be cooled, an air conditioning unit positioned between spaced apart openings provided in an outer wall of said building and directly below a duct of said furnace duct system, said unit comprising a high side compartment connected to said openings through which outside air is circulated, a condenser and compressor positioned in said high side compartment, a low side compartment, a low side compartment duct system connectable to said duct of said furnace duct system positioned thereabove, damper means selectively operable to one position for effectively placing said low side compartment duct system within said furnace duct system and selectively operable to another position for effectively removing said low side compartment duct system from said furnace duct system, and an evaporator positioned in said low side compartment for cooling air passed therethrough.

3. In combination with a building to be cooled, an air conditioning unit positioned between a first opening and a second opening provided in an outer wall of said building, said unit comprising a high side compartment which is in communication with said openings, fan means for circulating outside air from said first opening through said high side compartment and discharging it through said second opening, a condenser and compressor positioned in said high side compartment, said condenser mounted between said first opening and said fan means, a low side compartment having an evaporator positioned therein over which air to be cooled is circulated, means for collecting condensate formed on said evaporator and distributing it into the circulating outside air immediately prior to its contact with said condenser between said first opening and said condenser, a header having nozzles therealong mounted between said first opening and said condenser whereby a fine spray of water is projected over said condenser when water is applied to said header and whereby said fan means draw said fine spray over said condenser.

4. In combination with a building having an outer wall which is provided with a first opening and a second opening, an air conditioning unit which is adapted to be inserted through one of said openings and installed between the openings, said unit comprising a lower casing and an upper casing, said lower casing having a first open end connected to said first opening by an elbow duct and a second open end connected to said second opening by another elbow duct, said ducts being hinged to said wall so that they can be rotated away from said unit, a condenser and compressor enclosed by said lower casing with fan means for circulating outside air thereover, and an evaporator enclosed by said upper casing over which air to be cooled is circulated.

5. In a combination as claimed in claim 4, a tray disposed beneath said evaporator, a screen disposed adjacent said condenser, a tube connecting said tray and said screen whereby any condensate collecting on said evaporator is drawn by gravity into said tray, through said tube, onto said screen and thereby distributed over said condenser.

6. In an air conditioning system for installation in a building having a furnace duct system and two spaced-apart openings in an outer wall thereof, an air conditioning unit comprising a high side compartment and a low side compartment, said low side compartment mounted above said high side compartment, a pair of ducts mounted on said low side compartment so that said low side compartment is connectable through said pair of ducts to said furnace duct system when disposed therebelow, selectively operable damper means associated with said pair of ducts whereby said low side compartment is effectively placed within said furnace duct system when said damper means are operated to one position and effectively removed from said furnace duct system when first damper means are operated to another position, said high side compartment having two oppositely disposed open ends, and means for connecting each of said open ends to one of said openings in said outer wall.

7. In a system as claimed in claim 6, said last means comprising a pair of elbow ducts, each of said elbow ducts pivotally mounted at one of said open ends whereby said elbow ducts are pivoted to include said openings and said open ends to permit outside air to be circulated through said high side compartment and whereby said elbow ducts are selectively pivoted away from said open ends and said openings to permit circulation between the outside and the inside air.

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