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AIR CONDITIONING ARRANGEMENT FOR RELATIVELY
HIGH ROOFED BUILDING STRUCTURES
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FIG. 1

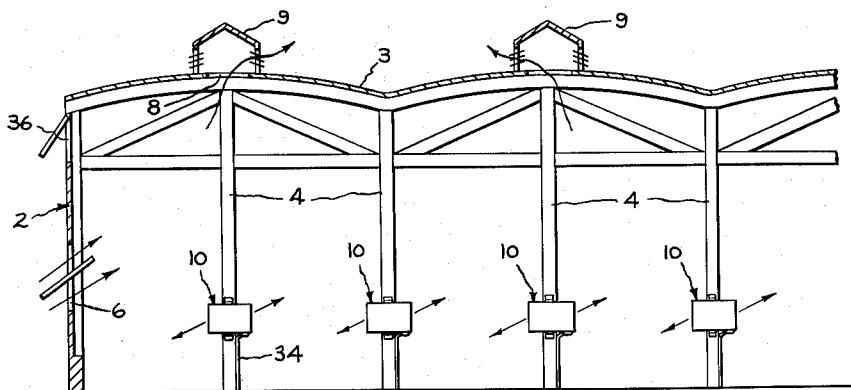
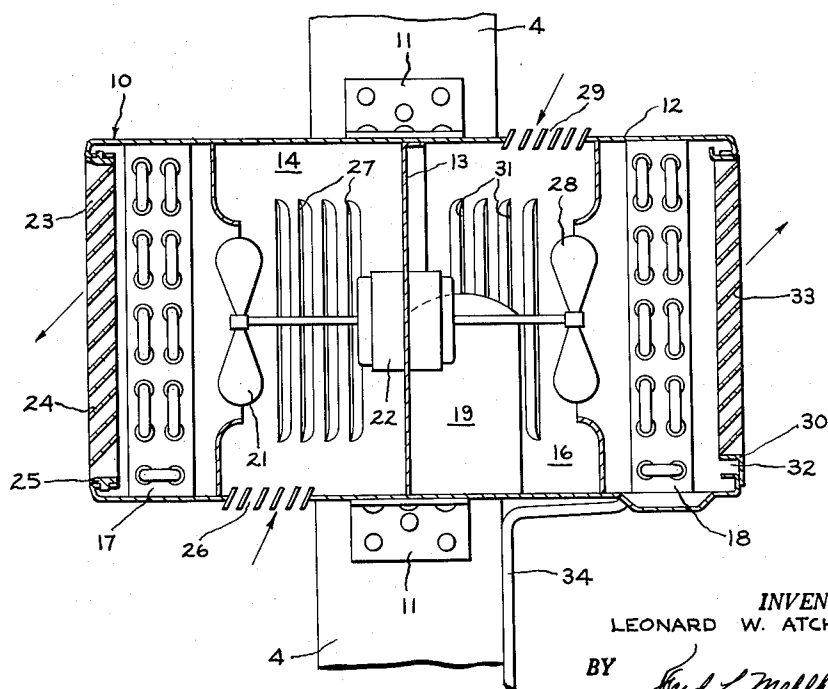


FIG. 2



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1

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AIR CONDITIONING ARRANGEMENT FOR RELATIVELY HIGH ROOFED BUILDING STRUCTURES

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2 Claims. (Cl. 62-263)

The present invention relates to an air conditioning arrangement for a building and is more particularly directed to an improved arrangement for cooling the air within the lower or occupied portions of a single story building structure of the type having a relatively high roof.

It is an object of the present invention to provide an air conditioning arrangement for a building structure having a relatively high roof by utilizing a plurality of air conditioning units of the type commonly referred to as room air conditioners or window type air conditioners which are mounted totally within the building structure and consequently cannot be cooled by passing outside air over the condensing unit thereof.

A more specific object of the present invention is to use window type air conditioners to provide a layer of relatively cold air from the floor of a building structure to a height slightly above the heads of the occupants of the building.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of the specification.

In accordance with the present invention there is provided, in combination with a building structure having a comparatively high roof or ceiling structure, a plurality of self-contained air conditioning units each mounted entirely within the building at a height slightly above the heads of the occupants of the building. Each of these air conditioning units contains the normal refrigeration system including an air cooling unit and an air cooled condensing unit for supplying condensed refrigerant to the cooling unit. In order to cool the condensing unit, means are provided in each of the air conditioning units for circulating an air stream from within the building over the condensing unit and for discharging this air stream in an upward direction from the air conditioning unit. Means are also provided in each of the air conditioners for circulating an air stream from the building over the cooling unit and for discharging this air stream in a downward direction from the air conditioning unit so that a layer of relatively cold air, as compared with the air in the upper portion of the building, is built up on the floor of the building up to a height slightly above the heads of the occupants.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

Fig. 1 is a somewhat schematic view of a cross section of a building structure having the air conditioning arrangement of the present invention; and

Fig. 2 is a cross-sectional view of one of the self-contained, window-type air conditioning units adapted to maintain a layer of relatively cool air in the lower portion of the building structure.

Referring now to Fig. 1, there is shown a building 2 of the type commonly used for manufacturing, warehousing, for a garage or other type of operation requiring a

2

large space. Many of the recently erected buildings for these operations are of the one story type having a relatively high roof and ceiling. In this specification and claims annexed hereto, the terms "relatively high roof" or "relatively high ceiling" are meant to apply to a structure having a roof height of approximately twelve feet or more, as compared to the height of a ceiling in a house or dwelling which is normally about eight feet or less. In the illustrated building, the roof 3 is supported by a plurality of columns 4 which may be of steel, concrete or other type of building structure. Means are provided in the building for ventilating the upper portions thereof including windows or openings 6 around the sides of the building and preferably openings 8 in the roof 3 of the building. Ventilation of the air in the portion of the building above the openings 6 occurs through natural convection or may be aided by fans positioned in the openings 8 to withdraw air from the building. Cupolas or sheds 9 cover the openings 8 in the roof and prevent rain or snow from entering these openings. In manufacturing buildings of the above type, most of the occupants perform their operations and are stationed in the space between the floor and eight feet above the floor level, which is generally below the level of the openings 6. The upper areas of the manufacturing building above the level of the openings 6 are generally reserved for heating ovens and conveying equipment, and normally there are very few, if any, occupants stationed in the upper portions of the building.

In order to provide a layer of cool air in this space occupied by the working force within the building, a plurality of self-contained or window-type air conditioning units 10 are mounted within the building at a height slightly above the heads of the occupants of the building.

In the embodiment of the invention shown, as may be more easily seen in Fig. 2, each of the air conditioning units 10 is mounted on a support column 4 or other support means and is held in place against the column by a mounting means such as the bracket plates 11 to which the housing 12 of the air conditioning unit 10 is securely attached. It should be noted that each of the air conditioners is mounted entirely within the building, as compared with the normal arrangement for room air conditioners in which a portion of the air conditioner is always exposed to the outside so that outdoor air may be circulated therethrough for cooling the condensing unit of the conditioner. These air conditioners are arranged in a manner to be hereinafter explained to cool only the lower portion of the building while the condensing unit of the air conditioner is itself cooled by the air from the upper portions of the building.

As may be seen in Fig. 2, each of the air conditioners 10 include a housing or casing 12 and a barrier 13 dividing the housing into two separate compartments which are designated the cooling or evaporator compartment 14 and the condenser compartment 16. An evaporator or cooling unit 17 is positioned in the evaporator compartment in the end thereof remote from the barrier. A condenser is positioned in the condenser compartment across the end of the compartment remote from the barrier in a manner similar to the mounting of the evaporator. The condenser and evaporator are connected in refrigerant flow relationship, in any manner well known in the art, with a compressor 19 which is also located in the condenser compartment 16. Means are provided in the air conditioner for circulating a stream of air from within the building over the cooling unit of the evaporator compartment and for discharging this air stream from the air conditioner in a downward direction or toward the space occupied by the majority of the occupants of the building. More specifically, these means comprise a propeller type fan or blower 21 mounted in the evaporator

3

compartment 14 and driven by a shaft extending from the motor 22 mounted in the barrier. Air is drawn into the evaporator compartment 17 by the fan 21 through a plurality of openings 26 provided in the bottom of the casing 12, as well as through openings 27 provided in the sides of the casing. The air stream is then circulated over the evaporator 17 and flows through an outlet opening 23 in the end of the housing 12 in which is mounted a grille member 25 having a plurality of louvers slanting in the downward direction so that the air stream is diverted or forced to flow downwardly toward the lower portions of the building. In the illustrated and preferred embodiment, the louvers are arranged on an angle of 45° and impart a definite downward thrust to the air stream. Thus air is drawn from the building into the evaporator compartment and circulated over the evaporator or cooling unit 17 by the fan 21 and discharged in the downward direction from the air conditioner to cool the space below the air conditioning unit 10.

Means are provided within the air conditioning unit for circulating an air stream from the building through the condenser of the condenser compartment and for discharging this air stream in an upward direction from the air conditioning unit. These means include the condenser fan 28, also driven by a shaft from the motor 22, for circulating an air stream over the condenser 18 of the condenser compartment. Air from within the building enters the condenser compartment through the openings 29 in the top of the casing 12. The condenser compartment may also have openings in the sides of the case such as the openings 31 through which air from the building enters the condenser compartment. In order to direct the air stream being discharged through the opening 32 of the condenser compartment in the upward direction, a grille member 30 is provided having a plurality of relatively long (in the direction of air flow) louvers 33 slanted in the upward direction. The illustrated louvers 33 slant upwardly at an angle of no less than 45° and impart a definite upward thrust to the air stream. Thus, the condenser of the air conditioning unit is cooled by an air stream drawn from within the building itself and the relatively warm air carrying heat away from the condenser is discharged from the air conditioner in the upward direction to be carried away by the ventilation provided in the upper portions of the building. The warm air being discharged from the air conditioner continues to flow upwardly within the building and is exhausted through the outlets 8. There is, therefore, no extraordinary buildup of heat in the upper portions of the building and this, along with the natural tendency for cold air to collect in the lower portions of a building, makes it possible to buildup a layer of cool, dry air in the lower portions of the building occupied by the working force. This layer of air extends up to the level of the air conditioners which, as was stated previously, are mounted above the heads of the occupants. In a preferred embodiment of the invention air is circulated through the condenser compartment 16 from the upper portions of the building and through the evaporator compartment 14 from the lower portions of the building. Obviously it is not necessary to pass the air into the compartments from these specific directions, however, this is the most desirable arrangement and does help to maintain a definite dividing plane between the warm air and cold air. The one feature that is necessary, however, is to discharge the air from the condenser compartment in the upward direction while discharging the air from the evaporator or cooling compartment in the downward direction so that there is no appreciable amount of mixing of the cold discharge air with upper layers of relatively warm air and so that the discharged warm air from the condenser is immediately started on its path out of the building.

It is well known that moisture condenses on the evaporator or cooling unit of a room air conditioning unit. When these units are mounted for their usual type of

4

operation with a portion of the unit extending to the outside, it is a simple matter to drain the moisture collected on the evaporator to the outside. However, when they are mounted entirely within the building it is necessary to provide some drain means for disposing of the condensate water not eliminated during the operation of the unit, such as the conduit 34 which connects with the overflow drain of the air conditioning unit and carries the overflow condensate water down the column 4 to some suitable outlet or drain pipe within the building.

Obviously the ventilation of the building does not necessarily have to take place through openings in the roof or top of the building. It could for instance, flow out of openings in the sides of the building adjacent the top thereof. For example, a plurality of openings 36 (only one is shown) could be provided around the sides of the building adjacent the roof and, if no openings in the roof are provided, then the warm air in the upper portions of the building will move to the top of the building and flow out the openings 36. However, it is more desirable to provide openings in the roof section so that air from the central portions of the building will be easily and continually exhausted thereby assuring that there will be no build-up of warm air in any particular portion of the building.

By the present invention there is provided an arrangement for air conditioning the entire floor area of a building structure by means of self-contained air conditioning units of the window-type which are mounted completely within the building. This is a relatively inexpensive and easily adapted method for air conditioning a building structure having a relatively high roof and does not require the installation of air ducts or water cooling towers such as are required for many air conditioning arrangements. In fact, since most of these buildings are already provided with proper ventilation, the installation of air conditioning units in the manner previously set forth can be accomplished without any further cost of reconstruction. The present air conditioning arrangement is further advantageous in that the units mounted in one portion of the building may be of different capacity than those mounted in another portion of the building so that one particular portion of the building may be cooled to a greater extent than other portions to take care of greater heat loads in these particular portions of the building. It has a still further feature in that it takes advantage of natural convection to remove the warm air from the building and does not to any great extent continually recirculate the air in the upper portions of the building through the cooling portions of the conditioning apparatus and does not, therefore, remove unnecessary heat from this air.

While in accordance with the patent statutes there has been described what at present is considered to be the preferred embodiment of the present invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, the aim of the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination with a building having means for ventilating the upper portion thereof, a plurality of supporting columns for the roof of said building, means on said supporting columns slightly above the heads of the occupants of said building for mounting window-type air conditioning units, said units being mounted entirely within said building, each of said air conditioning units having a refrigeration unit mounted therein including an air cooling unit and a condensing unit for supplying liquid refrigerant to said air cooling unit, means in each of said air conditioning units for circulating an air stream from the upper portions of said building over said condensing unit and for discharging said air stream in an

5

upward direction from said air conditioning unit, means in each of said air conditioning units for circulating an air stream from the lower portion of said building over said air cooling unit and discharging said air stream in a downward direction from said air conditioning unit so that a layer of cool air is built up in said building from the floor thereof to a height slightly above the heads of the occupants therein.

2. In combination with a building having means for ventilating the upper portion thereof, a plurality of self-contained air conditioning units mounted entirely within said building at a height slightly above the heads of the occupants of said building, said air conditioning units each comprising a compressor, a housing, a barrier dividing said housing into an evaporator compartment and a condenser compartment, a compressor and a condenser mounted in said condenser compartment and an evaporator mounted in said evaporator compartment, said compressor, condenser and said evaporator being arranged in refrigerant flow relationship, a fan in each of said compartments for circulating separate air streams from within said building over said evaporator and said condenser respectively, an air inlet opening in the top of said condenser compartment for introducing air from the upper

6

portions of said building into said condenser compartment, a discharge opening in said condenser compartment, grille means in said outlet opening of said condenser compartment including a plurality of louvers for directing said discharge air in an upward direction into said upper portions of said building, inlet openings in at least the bottom of said evaporator compartment for introducing air from within said building into said evaporator compartment, an outlet opening in said evaporator compartment for discharging air therefrom, grille means in said outlet opening having a plurality of louvers for directing discharge air in the downward direction as said air is discharged from said evaporator compartment so that a layer of cool air is built up in said building from the floor thereof to a height slightly above the heads of the occupants therein.

References Cited in the file of this patent

UNITED STATES PATENTS

2,154,466	Morrison	Apr. 8, 1939
2,660,867	Borgerd	Dec. 1, 1953
2,682,757	Borgerd	July 6, 1954