March 20, 1973 H. C. BIERWIRTH ET AL 3,721,106

MOUNTING FOR ROOF TOP AIR CONDITIONER

Filed Aug. 18, 1971 2 Sheets-Sheet 1

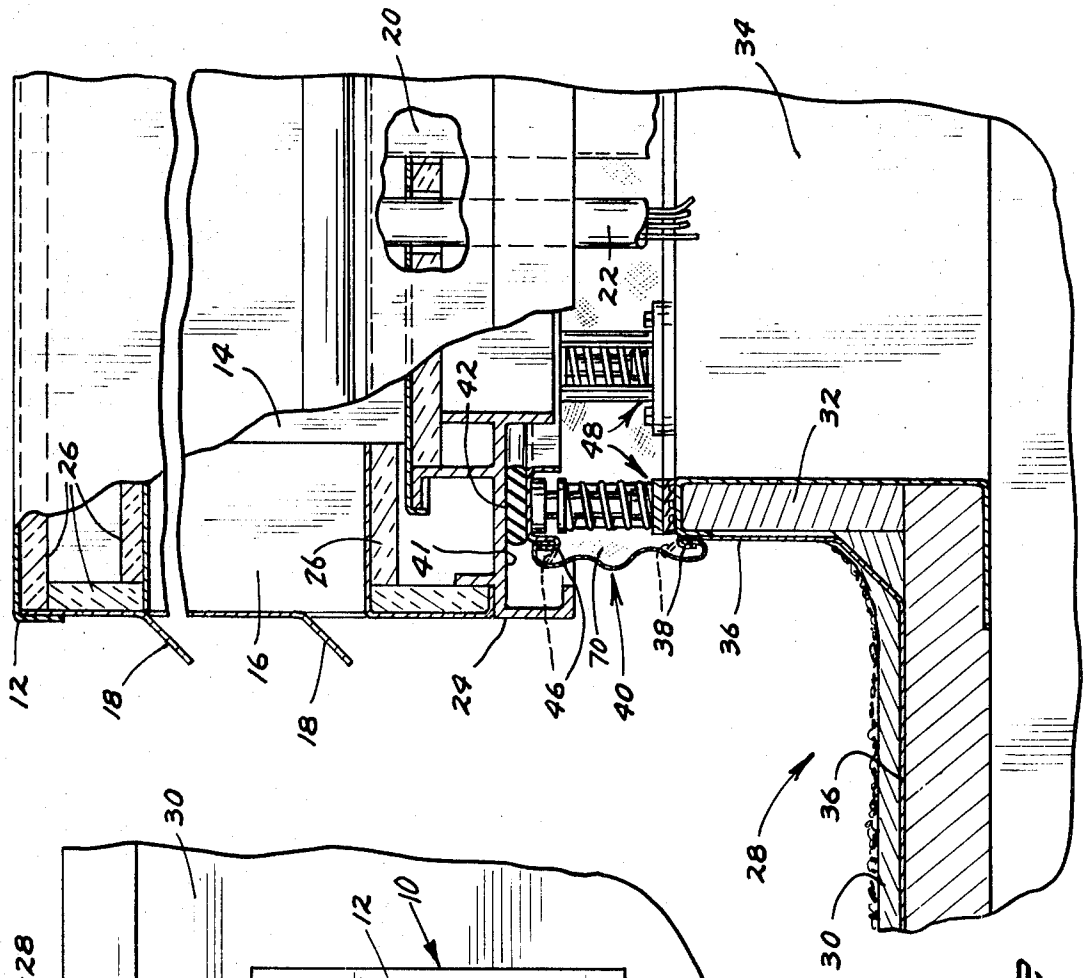

FIG. 2

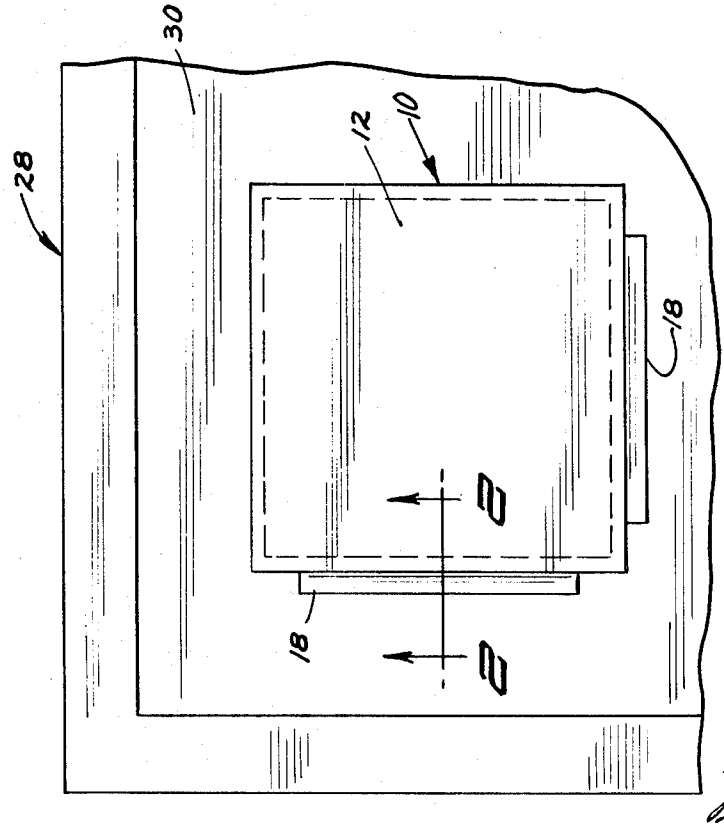

FIG. 1

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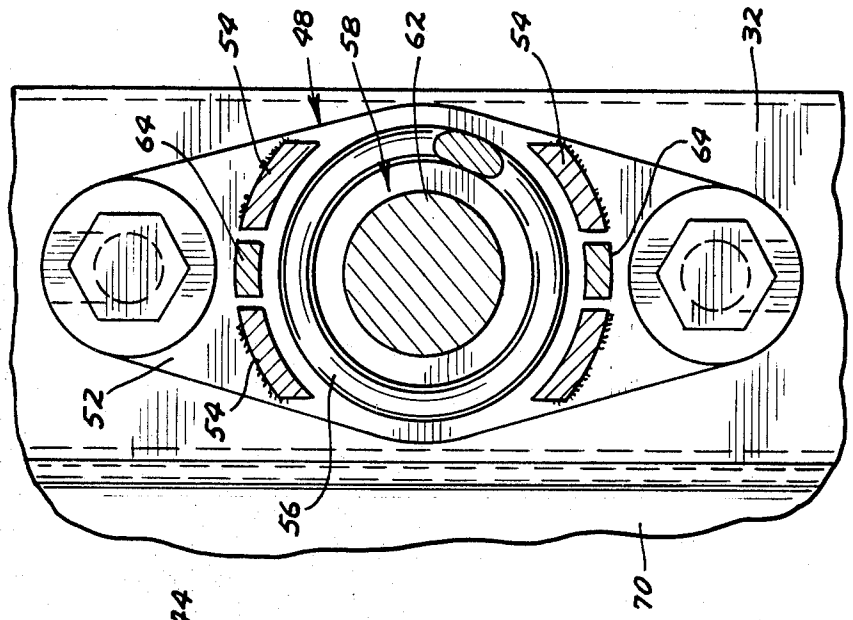

FIG. 4

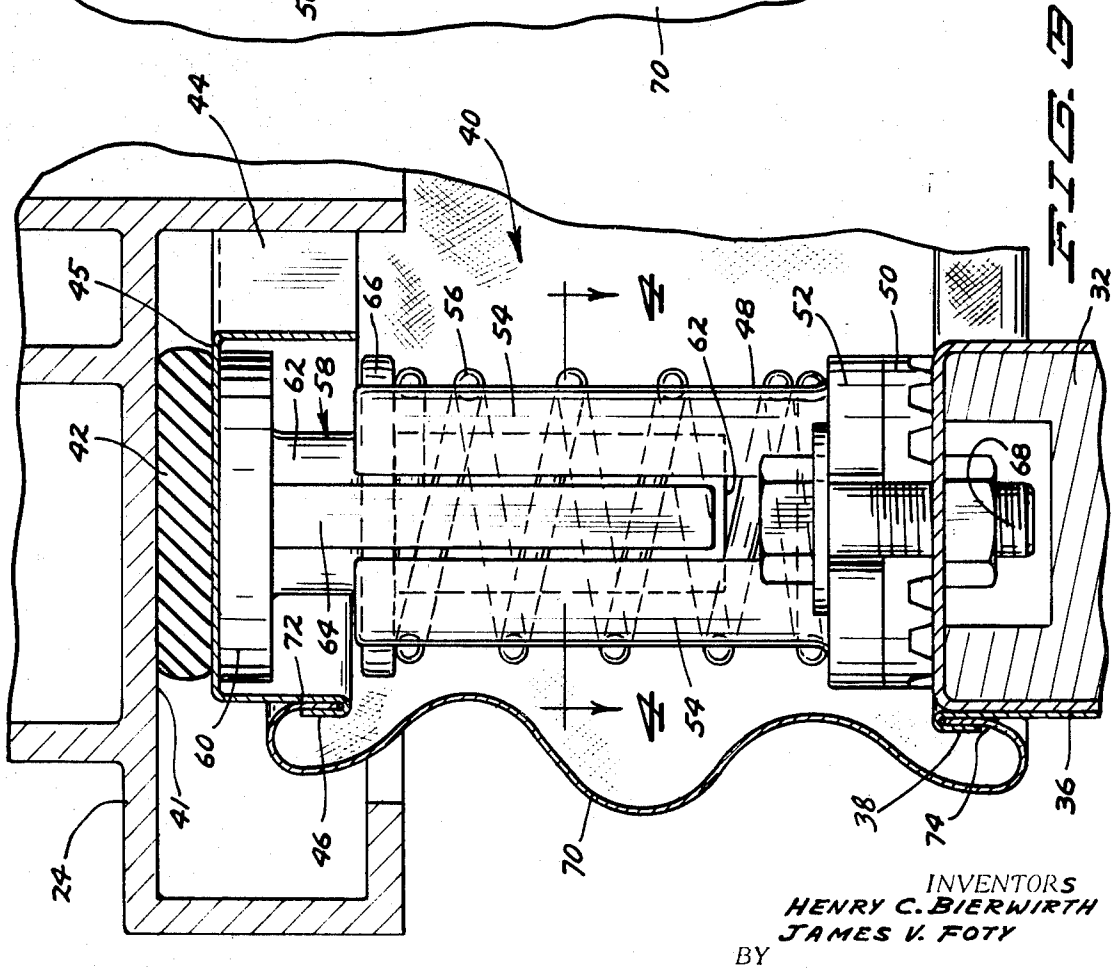

FIG. 3

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MOUNTING FOR ROOF TOP AIR CONDITIONER

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Int. Cl. F25d 19/00
U.S. Cl. 62—297 4 Claims

ABSTRACT OF THE DISCLOSURE

A rectilinear upstanding, continuous, rigid curb on a flat roof top defines an opening through the roof. Vibration isolation means are supported on top of the periphery of this curb and, in turn, support the main frame of a complete air conditioning unit. The vibration isolation means includes a continuous sheet of flexible material in sealing relationship to both the entire lower outer periphery of the air conditioning unit frame and the entire upper outer periphery of the curb, and loosely disposed between the curb and frame. This sheet isolates the inside of the air conditioning unit and building from the outside thereof; and insulates the space within the curb and the unit from the temperature and weather conditions outside.

BACKGROUND OF THE INVENTION

This invention relates to the mounting of complete air conditioning packages on building roof tops in such a manner as to insulate the roof and the remainder of the building from the audible and other vibrations naturally set up within the air conditioning package during normal operation thereof.

Increasingly it has become desirable to mount complete air conditioning units on the top of flat-roofed industrial, commercial and institutional buildings. Customarily this has been done in the past by completing the top roof of the building, providing a special charatcer roofing in the area where the air conditioning unit is to be set, and then building up the air conditioning package on the roof top. An overall housing or cover is provided for the unit, and the air ducts work and power energy conduits are connected between the unit and the interior of the building through the roof.

A considerable amount of vibration is associated with the operation of the motors, fans, compressors and the like of a roof top air conditioning unit, and the transmission of noise and other vibrations from the unit to the interior of the building poses a severe problem. For example, where areas in the interior of the building immediately adjacent to the roof are designed for such uses as classroom instruction or the like, arbitrary restrictions are placed on the location of the air conditioning unit on the roof top often at the sacrifice of a good design practice occasioned by losses in operating efficiency and including increases in installation and operating expense.

Attempts have been made to isolate the individual pieces of the equipment causing the vibration problems by mounting such units on springs or resilient cushions or the like, but such attempts have proved prohibitively costly and/or substantially ineffective to eliminate the unwanted vibrations.

Other methods of accomplishing vibration isolation include the supporting of the entire air conditioning package on steel rails which are in turn supported on the roof. A plurality of vibration isolation pads are then mounted between the air conditioning unit and the rails. This structure is unduly costly and raises the unit height to an unacceptable level. Also, this system requires special roofing under the rails, and requires a considerable amount of field labor. The vibration isolation pads are subject to

weathering and wear from temperature changes because they must stand in the weather. Noises generated within the unit are transmitted into the building using the roof as a sounding board.

It is known to mount ventilating and air conditioning apparatus in an opening in a roof top. See FIG. 3 of U.S. Pat. No. 2,134,142, and U.S. Pat. No. 2,882,810, for example.

Mounting equipment on a floor or roof and to attempt to isolate that equipment from the floor or roof by vibration isolation units is seen in U.S. Pats. Nos. 1,066,209; 2,359,941; and 1,089,748.

It is known to use a pad of resilient material between the top of a curb or wall and transparent skylight panels. See U.S. Pat. No. 3,405,487.

Before the present invention, however, no structure has been shown or suggested by the prior art which will permit the installation of an air conditioning unit on the roof of a building at any desired location, will isolate the interior of the building from the vibrations created in the air conditioning unit, and simultaneously isolate and insulate the interiors of the building, the air conditioning unit, and the vibration isolation means from weather conditions outside the building.

BRIEF SUMMARY OF THE INVENTION

The flat roof of a building designed to accommodate a rooftop air conditioning unit is provided with a rigid, upstanding curb which defines an opening through the roof in underlying relationship to the chosen location of the air conditioning unit. The air conditioning unit consists of a complete package mounted on a unitary horizontal main air conditioning unit frame. A plurality of vibration isolation stantions are supported on the upper edge of the curb and, in turn, support the lower edge of the unitary air conditioning unit frame. A continuous, loosely disposed layer of material is situated in sealing relationship to the entire upper periphery of the curb and the entire lower periphery of the air conditioning frame. Separate means, forming no part of the invention, are to be provided to isolate against vibrations, the air supply and return ducts and the gas, electrical, and/or other energy and control conduits extending through the roof opening to the interior of the building.

IN THE DRAWINGS

FIG. 1 is a fragmentary top plan view of a flat roof-top and of a roof-top air conditioning unit mounted thereon;

FIG. 2 is an enlarged, fragmentary vertical sectional view of the portion of the air conditioning unit and roof-top taken on the line 2—2 in FIG. 1;

FIG. 3 is a further enlarged fragmentary view also taken substantially on the line 2—2 in FIG. 1, and showing further details of a specific vibration isolation structure between the air conditioning unit frame and the curb; and

FIG. 4 is a horizontal sectional view taken on the line 4—4 in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the form of the invention as shown, a complete air conditioning unit package 10 includes an outer casing 12, an air conditioner 14, air ducts including intake air duct 16, intake and discharge louvers 18, conditioned air supply and return ducts 20, and electrical, gas, and/or other energy and control lines such as that represented by energy and control cable 22. The makeup of the particular packaged air conditioning unit is not important to the principle of this invention per se, except that each such unit develops sound and other unwanted vibrations. A packaged air conditioning unit of the invention will be mounted upon and will include a continuous main air con-

ditioning unit frame 24, having a continuous outer periphery, the outer casing 12 of the air conditioning unit being in sealing relationship to this entire outer periphery of the main frame 24. Appropriate layers of insulating material 26 are associated with the outer casing 12 of the package to provide vibration and temperature insulation between the outside and the inside of the unit outer casing 12.

A building 28 on which the packaged air conditioning unit 10 is installed includes a flat-top roof 30 on which a rectilinear, upstanding, continuous rigid curb 32 is mounted to define an opening 34 through the roof.

As shown, a metal flashing 36 extends from the roof, and up the outside surface of the curb. This flashing has an upper edge portion 38 which initially extends outwardly from the top of the curb (as seen in dotted lines) and which can be deformed downwardly for a purpose to be described, as seen in full lines.

The vibration isolation means 40, as shown, includes a resilient continuous pad 42 which extends in sealing relation to the entire periphery of a bottom support surface 41 of the main air conditioning unit frame 24. A continuous inverted channel member 44 provides an upper surface 45 in contact with the pad 42, and is provided with an initially outwardly positioned flange 46 (illustrated in dotted lines), which can be deformed inwardly during the installation of the unit and the vibration isolation means for a purpose to be described and to position as illustrated in full lines.

The channel member 44 and the pad 42 are supported with respect to the curb 32 by a plurality of vibration isolation stantions 48. It is to be understood that these stantions will be spaced sufficiently close to each other to easily bear the weight of the air conditioning unit and that the channel members 44 will be sufficiently rigid so that the stantions will support this channel member and the pad 42 in sealing relationship with each other and with the bottom support surface 41 of the main frame 26 of the air conditioning unit.

While a particular form of vibration isolation stantion or upright isolation device is shown, it is to be understood that such a device could take any one of a number of different forms and still come within the concept of the invention. As shown, then, each stantion includes a resilient, disc-like footing member 50 supported on the curb 32; an elongated slotted plate 52 having a central portion of size and shape to completely overlie the footing member 50; four arcuate, parallel vertical legs integral with and extending upwardly from the upper surface of the plate 52, two of such legs being at each end of the elongated plate; and a compression coil spring 56 resting on plate 52 inside the space defined by the upwardly extending legs 54.

On this curb-supported, upwardly extending assembly is placed a rigid head member 58 which includes a support plate 60, a downwardly extending head shaft 62 integral with the support plate 60, two parallel, downwardly extending, arcuate legs 64 also integral with the plate 60 and a spring support collar 66 extending integrally outwardly from shaft 62 and of configuration to lie within the space provided by the arcuate legs 54 and 64 to be in bearing relationship to the top of the compression coil spring 56.

In order to fixedly position the stantions 48, bolts 68 are provided to fit into the slotted openings of the plates 52. As best seen in FIG. 3, these bolts can be anchored in the curb in any convenient or preferred manner.

When the stantions have been fixed in their preferred locations, the inverted channel member 44 is then put in place to come into bearing relationship with each of the upper support plates 60 of the stantions 48, and the continuous resilient pad 42 is placed on top of the channel member.

Next, a continuous sheet of flexible material 70 will be positioned around the entire outer periphery of the vibration isolation means. An upper edge portion 72 thereof will be placed between the flange 46 and its adjacent leg of the inverted channel member 44, and the flange will be forced back on the edge portion 72 to fixedly clamp it in sealing relation to the entire periphery of the channel member 44. A lower edge portion 44 of the continuous sheet of flexible material 70 will likewise be positioned between the edge portion 38 of the flashing 36, and this portion 38 will be forced back against the flashing 36 to fixedly position the lower edge portion 74 of the material in sealing relation with the entire upper outer edge portion of the curb 32.

Many kinds of flexible materials will be satisfactory in structure in accordance with the invention. Such material can be made of rubber, plastic, or woven fibrous material, or metallic bellows-shaped strips having flutes that run longitudinally around the curb. Laminates of several materials can also be used. The material is disposed loosely between the curb and the unit frame. The attributes for the flexible material include inability to transmit vibration from the upper edge portion to the lower edge portion thereof and ability to prevent any wind from passing therethrough. Other desirable attributes can include sound-deadening properties and/or temperature insulation properties.

When the vibration isolation means has been built up as described above, the air conditioning unit main frame 24 can be lowered into position so that the bottom support surface thereof comes into sealing relationship with the continuous resilient pad 42. This can be done by lowering the entire package unit into place at once, or the main frame can be positioned first and then the conditioning unit built up thereon.

Means forming no part of the present invention will be provided to isolate against transmissions of vibrations along energy and control cables such as 22 or conduits and along conditioned air ducts such as illustrated at 20.

When the air conditioning unit is put into operation, the vertical components of the vibration will be absorbed by the compression coil spring 56 as the metallic head member 58 vibrates harmlessly and noiselessly up and down with respect to the footing member 50. The horizontal components of vibration tend to be absorbed by the resilient pad 42 and cannot be transmitted between the head member 58 and the slotted plate 52 because there is no direct contact between them.

Because the flexible material 70 prevents the ambient weather conditions from having any effect beneath the surface of the suspended air conditioning unit, there is no need for a roof under the unit, and the expense of such construction is eliminated. Also eliminated, therefore, is the need for special roofing under the air conditioning unit as has been necessary when the units of the prior art have been set on roof surfaces which can no longer be properly maintained, repaired and replaced without moving the entire air conditioning unit. The stantions themselves will not deteriorate either because they are also out of the weather. The only field installation necessary after the roof, curb and stantions have been prepared is the crimping of the flange 46 and the upper edge portion 38 of the flashing 36 on the upper and lower portions of the flexible material 70, respectively; and the lowering of the air conditioning packaged unit into place.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A structure for mounting an air conditioning unit having a unitary main frame which provides a continous peripheral support surface, said structure including:

(a) a flat roof surface;

(b) a rigid continuous curb extending upwardly from said flat roof surface and defining an opening in the roof;

(c) a vibration isolation support supported with respect to said curb around the periphery of the roof opening and supporting said main air conditioning unit frame; and

(d) a continuous sheet of flexible material extending loosely between said air conditioning unit and said curb, said material being in sealing relation with the bottom periphery of said air conditioning unit and with the upper periphery of said curb and isolating the inside of said building and unit from the outside thereof.

2. The combination of claim 1 wherein the curb is rectilinear in configuration, and the roof top and the curb top each lie in spaced apart horizontal planes; and the main frame of the air conditioning unit is of configuration to overlie and slightly overhang the vibration isolation support when the support is supported with respect to the curb.

3. The combination of claim 1 wherein the vibration isolation support includes a plurality of vibration isolation stantions in which an upper main frame supporting member is isolated from a lower curb supported member by upright resilient means capable of reciprocating vertical movement in response to the vertical components of vibrations in said unit.

4. The combination of claim 3 wherein said upright resilient means is a coil spring located in load bearing relation to said upper and lower members.

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62—295; 259