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(54) Air-conditioner

(57) The base (9) and side walls (5,6,7,8) of a ceiling-mounted ("cassette") air conditioner are fabricated as a one-piece moulding in an expanded, thermally insulating plastics material such as polystyrene. Compared with known designs, mass production is thereby made simpler, as is installation because of the relatively lighter weight of the air conditioner.

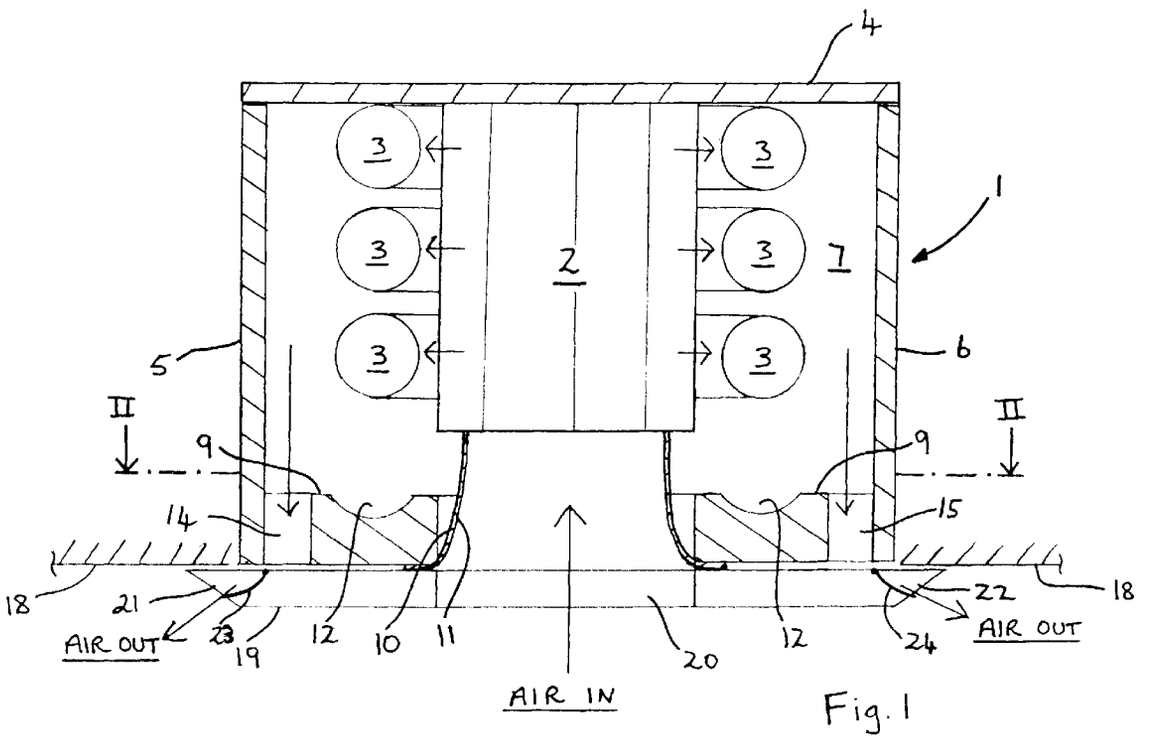

Fig. 1

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Description

This invention relates to air conditioners and more particularly to ceiling-mounted, or so-called "cassette", air conditioners.

Cassette air conditioners comprise a casing that houses a heat exchanger, usually in the form of coiled metal, eg copper, tube, and a fan. The heat exchanger is typically the evaporator of a refrigeration unit, the condenser of which is usually remotely located, typically on an outside wall. However, the heat exchanger could be connected to a remotely located refrigeration unit that serves to supply chilled water to the heat exchanger. In use, the fan sucks in air from the room which passes over the heat exchanger and the cooled air is discharged back into the room. During that process, condensation forms on the external surface of the heat exchanger and drips into a drip tray from which it drains or is periodically pumped away. Often, such air conditioners also include a heating function whereby, especially in the winter, the air may be heated instead of being cooled.

Conventionally, the aforesaid casing consists of a multiplicity of separately formed parts secured together by screws and/or nuts and bolts. More particularly, it will typically comprise a rigid rectangular top made of sheet metal from which the fan and the heat exchanger are suspended, and four separately formed rectangular side walls, again made of sheet metal. The base of the casing is defined largely by the drip tray which is usually moulded in a plastics material. Underlying the drip tray is a rectangular grille which is designed to be visually attractive. The grille, which nowadays usually comprises a plastics moulding, has a central air inlet section and peripheral air outlets. Each outlet has a separately moulded, elongate baffle associated with it which is mounted on the grille and can be rotated about a longitudinal axis, either manually or by means of a remotely controlled electric motor, so as to vary as desired the direction of flow of the conditioned air into the room.

The aforementioned sheet metal components of the casing need to be internally or externally thermally insulated in order to prevent the formation of condensation on their external surfaces. This is usually achieved by sticking sheets of insulating material to the internal or external surfaces of the sheet metal components.

As will be apparent from the above, assembly of conventional cassette air conditioners is, because of the number of components involved, very labour intensive. Also, the extensive use of a sheet metal parts adds to their weight which renders ceiling-mounting more onerous for the installer. The present invention proposes a simple but nevertheless elegant solution to those problems in which, unusually, structural parts are made of an expanded plastics material.

According to the present invention, therefore, there is provided a cassette air conditioner including a casing housing a fan and a heat exchanger, the casing having a top, side walls and a base defining a drip tray for collecting condensation formed, in use, on the external surface of the heat exchanger, characterised in that the side walls and the base are formed as a one-piece moulding in an expanded, thermally insulating plastics material.

As in the case of prior cassette air conditioners, the casing will usually be generally cuboid in shape with the top, base and side walls being substantially rectangular. However, the invention affords the ready possibility of adopting other shapes, for example generally cylindrical ones.

Preferably, the plastics material is an expanded, relatively rigid polystyrene, but any other suitable expanded plastics material may be used. Such materials are easy to mould in relatively complex shapes using relatively low-cost tooling by, for example, steam-treating granular raw plastics material in situ in the mould.

Thus, and as will be self-evident, the invention affords a cassette air conditioner having a casing which dispenses with many of the separate sheet metal components hitherto conventionally used, which is relatively lightweight and to which thermally insulating material does not need to be separately applied. In particular, the invention significantly simplifies the assembly operation and, therefore, considerably reduces assembly costs.

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic side elevation, partly in section, of a cassette air conditioner constructed in accordance with the invention shown installed in a false ceiling; and

Figure 2 is a section on the line II - II of the one-piece, expanded plastics portion of the casing shown in Figure 1.

Referring to the drawings, the cassette air conditioner comprises a casing designated generally 1 which houses an electrically powered centrifugal fan 2 and an annular heat exchanger coil 3 comprising coiled copper tube. The fan 2 and coil 3 are both securely suspended from a rigid, rectangular top 4 of the casing 1. The top 4 may be made principally of thin sheet metal, such as steel, strengthened to render it rigid.

The rest of the casing 1 is moulded in one-piece, using known techniques, in a relatively high density, expanded polystyrene such as 80g/ltr CARIL (Trade Mark). This one-piece moulding comprises four rectangular side walls 5, 6, 7 and 8 and a rectangular base 9. The one-piece moulding is secured to the top 4 by appropriate fasteners (not shown).

The base 9 has a central opening 10 in which is secured a cowl 11. The cowl 11 may be made of metal or a plastics material and serves the function described later. Radially outwards from the opening 10, there is a generally annular channel 12 formed in the base 9. As can be seen from Figure 1, the channel 12 is located

vertically below the heat exchange coil 3 such that condensation which forms on the external surfaces of the latter during operation of the air conditioner will continually drip into the channel 12. As in conventional designs, condensation collected in the channel 12 flows into a sump 13 located below the level of the channel 12 from where the condensation drains under the action of gravity or is periodically pumped away, in either case to an external location.

The sides of the rectangular base 9 are, adjacent to the side walls 5, 6, 7 and 8, formed with respective elongate openings, 14, 15, 16 and 17 through which the cooled air is discharged into the room, as will be described in more detail later.

Usually, and as shown in Figure 1, the casing will be located by suitable fixings (not shown) in the cavity above a false ceiling 18 and, surface-mounted on the ceiling 18, is a rectangular grille 19 secured by appropriate fasteners (not shown) to the base 9 of the casing 1. Preferably, the grille 19 is in the form of a visually attractive plastics moulding and comprises one or more central openings 20 and four peripheral elongate openings, two of which 21 and 22 can be seen in Figure 1.

As usual, each opening 21, 22 etc has a curved, elongate baffle associated with it, two of which, 23, 24 can be seen in Figure 1. Each baffle 23, 24 etc is pivotally mounted so that it can be moved manually or, by means of an electric motor, remotely in order to vary the discharge direction of the cooled air into the room. Conventionally, the baffles 23, 24 etc are pivotally mounted on the grille 19 itself which increases the complexity, and tooling costs, of the grille moulding. Such an arrangement may be used in an air conditioner of the present invention, but the invention affords the possibility of readily providing mountings for the baffles 23, 24 etc in the base 9 of the casing 1 instead, whereby the grille 19 moulding may be considerably simplified. Thus, mounting inserts (not shown) for the baffles 23, 24 etc could easily be securely incorporated into the base 9 during the expanded plastics moulding process. Equally, appropriate inserts (again not shown) could be incorporated into the expanded plastics moulding at any desired location to receive requisite fasteners, such as screws. For example, the base 9 could have appropriate inserts incorporated into it for receiving fasteners that fasten the grille 19 to the base 9 of the casing 1.

Whilst the mode of operation of the air conditioner shown in the drawings is conventional and so will be readily apparent to those skilled in the art, this will now be briefly described. Air is drawn in axially by the fan 2 from the room through the central opening(s) 20 in the grille 19 and the cowl 11. The air is discharged radially by the fan 2 through openings in its side wall and then passes over the heat exchange coil 3. As noted earlier, cold refrigerant or chilled water is circulated through the coil 3 and thus, by virtue of heat exchange therewith, the air becomes cooled. As is conventional, the external surface of the coil 3 may have fins attached to it in order to improve the heat exchange efficiency. The cooled air is then constrained by the top 4 and the side walls 5, 6, 7 and 8 of the casing 1 and by the external surface of the cowl 11 to flow in a downwards direction towards the elongate openings 14, 15, 16 and 17 in the base 9 of the casing 1. The cooled air is then discharged into the room via the baffled openings 21, 22 etc in the grille 19. The above-described air flow path is indicated by arrows in Figure 1.

As indicated earlier, the air conditioner may, if desired, be used to heat the air rather than to cool it. As is conventional, this may be achieved, where the coil 3 is cooled directly by refrigerant, by reversing the cycle of the refrigeration unit whereby the coil 3 acts as the condenser instead of the evaporator, or, where the coil 3 is chilled by water, by circulating hot water through it. Alternatively, electric heating elements may be provided adjacent to the coil 3. The desired degree of cooling or heating, as the case may be, will be controlled by a room thermostat and associated control circuitry.

Claims

1. A cassette air conditioner including a casing (1) housing a fan (2) and a heat exchanger (3), the casing (1) having a top (4), side walls (5,6,7,8) and a base (9) defining a drip tray for collecting condensation formed, in use, on the external surface of the heat exchanger (3), characterised in that the side walls (5,6,7,8) and the base (9) are formed as a one-piece moulding in an expanded, thermally insulating plastics material.

2. A cassette air conditioner according to claim 1 wherein said plastics material is a relatively rigid, high density polystyrene.

3. A cassette air conditioner according to claim 1 or claim 2 wherein the base (9) has a channel (12) moulded in it for collecting the condensation.

4. A cassette air conditioner according to any one of claims 1 to 3 wherein the moulding incorporates inserts that securely receive fasteners that join other elements, such as the top (4), a decorative grille (19) and air-directing baffles (23,24), thereto.

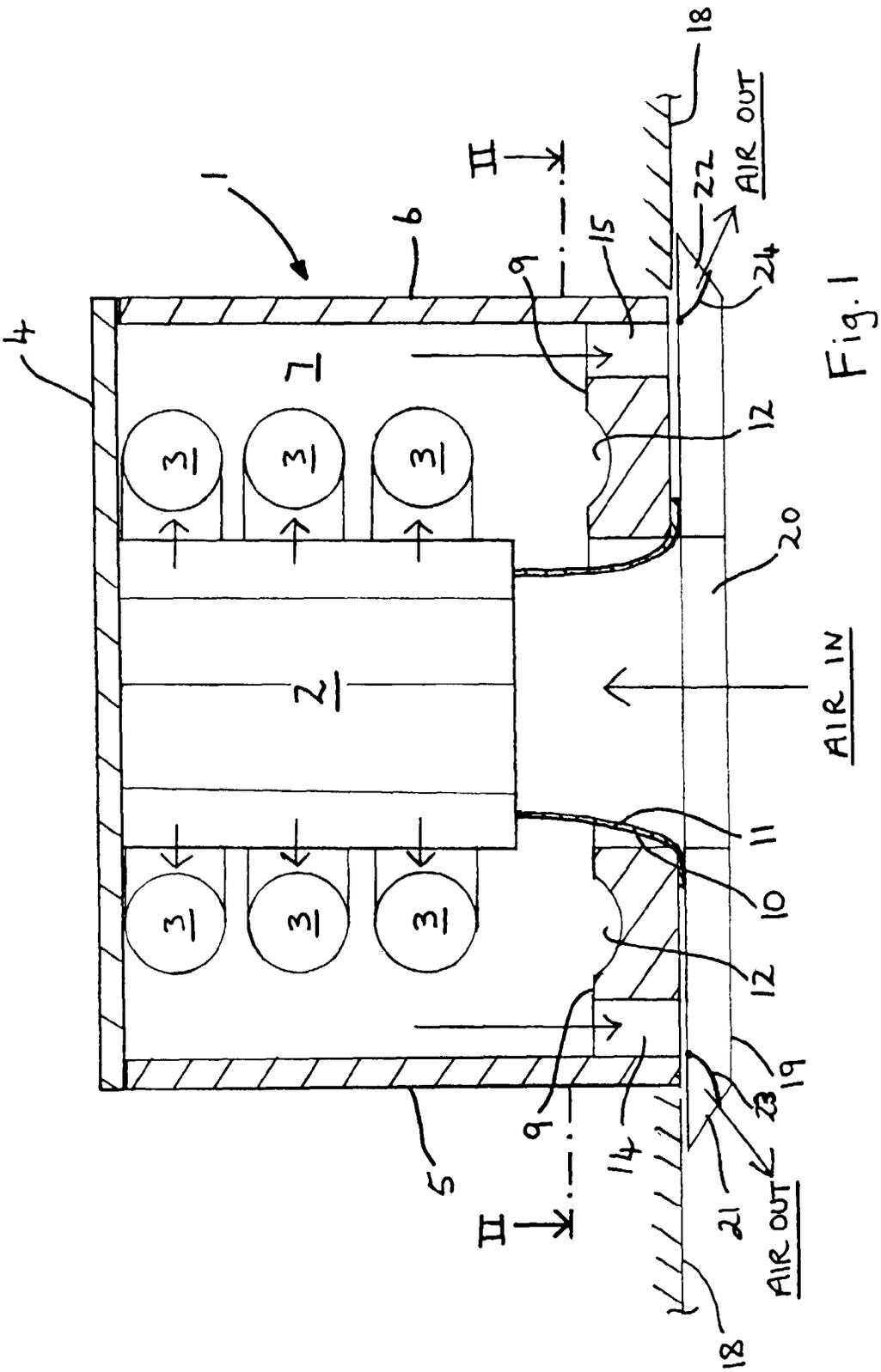
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Fig. 1

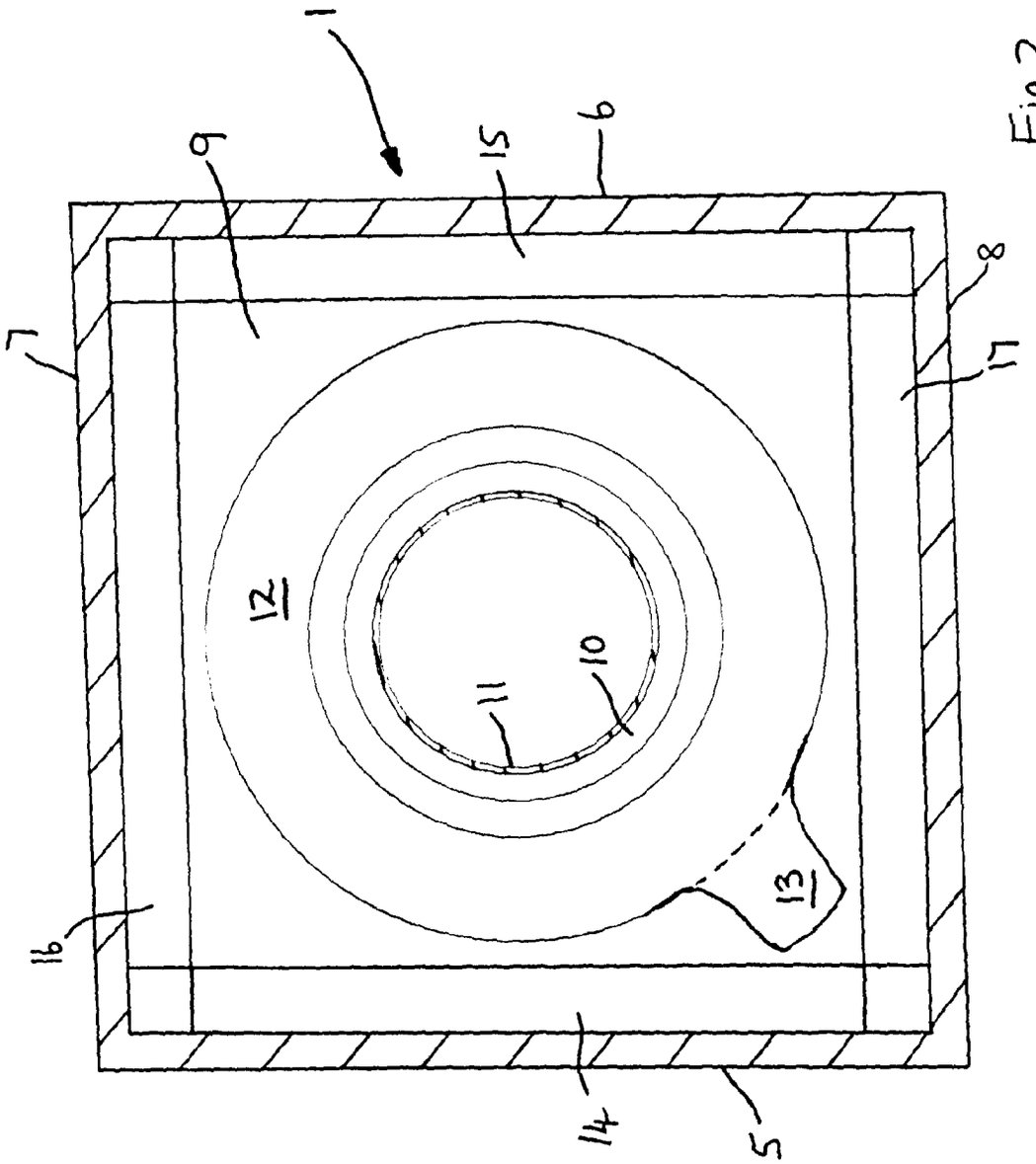

Fig.2