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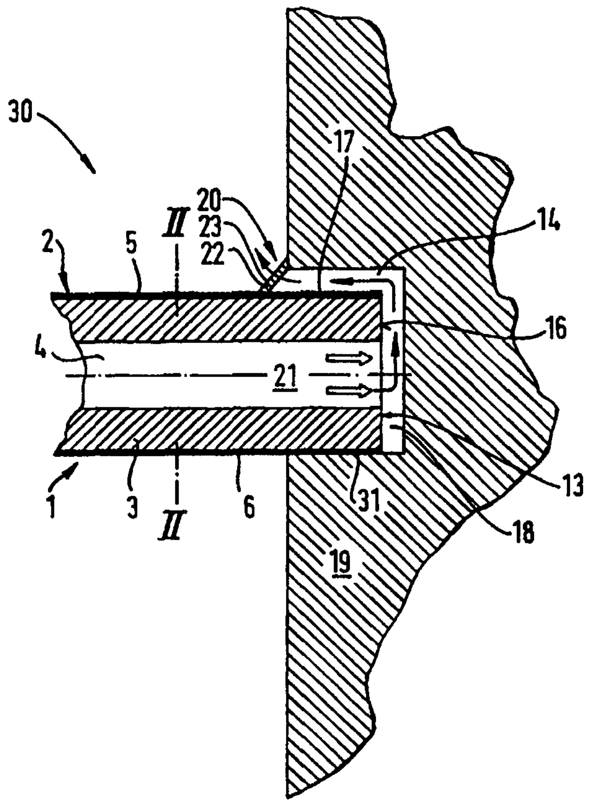
(54) Title: DEVICE FOR THE TEMPERATURE CONTROL OF BUILDINGS

(57) Abstract

The invention relates to a device for the temperature control of buildings, comprising a duct system (4) which is integrated into a storey ceiling (1) and through which a temperature-controlled fluid (21) is to flow, the fluid temperature being delivered to a surface of the storey ceiling (1). The device according to the invention achieves the object of providing cost-effective and agreeable temperature control of a building in that the fluid temperature is also delivered to the other surface of the storey ceiling (1), and in that essentially the same surface temperature is established on both surfaces (5, 6) of the storey ceiling (1).



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TITLE OF THE INVENTION

Device for the Temperature Control of Buildings

DESCRIPTION

TECHNICAL FIELD

The invention relates to a device for the temperature control of buildings according to the pre-characterizing clause of Claim 1, comprising a duct system which is integrated into a storey ceiling and through which a temperature-controlled fluid is to flow, the fluid temperature being delivered to a surface of the storey ceiling.

STATE OF THE ART

In floor heating known from practice, pipes carrying hot water as fluid are usually laid under the screed in the ceiling, a so-called heat distribution sheet in the form of a foil being additionally laid over the heating surface region for better heat distribution. In floor heating, only the room above the ceiling is heated because of the type of installation. The heat transmission of this heating system takes place solely by upward heat radiation. This form of heating is installed only after the completion of the ceiling and is therefore labour- and cost-intensive.

In ceiling heating likewise known from practice, the fluid-carrying pipes are usually not concreted into the ceiling, but are exposed in an interspace under a suspended heating ceiling, on heating pipes which are equipped with fins and by means of which heat is transmitted from the ceiling to the room below it. Despite the possible high surface temperatures, the heating capacity is relatively unfavourable on account of the low convective heat transmission. Also, this heating system is intended only for the downward radiation of heat.

A special form of ceiling heating known from practice is radiant-panel heating, which can be employed only in large halls or high rooms and in which a radiant heating surface is arranged below the ceiling. As in ceiling heating, here too, it is necessary to have very high surface temperatures on the radiant panel. Furthermore, considerable outlay is necessarily involved in installing this type of heating. Such a heating system is unsuitable for the residential sector.

Another device for the temperature control of buildings, which is known from practice, is air heating, which, in contrast to the systems referred to above, not only allows the heating of a building, but also its air-conditioning. In this device, the temperature-controlled air is carried to corresponding outlet ports in a pipeline system which is arranged in a cavity between a ceiling and a suspended intermediate ceiling. These ports cause the air either to flow down from the intermediate ceiling into a room or to rise upwards through ports in the floor. The pipeline system is insulated against radiation in the cavity. The temperature of a building is controlled solely by ventilation and convection. In temperature controls based purely on ventilation and convection, high air circulation is necessary, which is not always desirable for physiological reasons and, because of draughts, may cause illnesses or cause these to be transmitted. Operating a device for temperature control solely on the basis of the air supplied is unfavourable in energy terms and is difficult to control when there is to be a reaction to outside temperature fluctuations.

Devices which discharge heat with the aid of a cooling medium are known from the aircraft or automobile industry. These are designed as panel-shaped structural elements in sandwich form with honeycomb bodies arranged on the inside. A cooling medium, which discharges heat occurring, for example, on the engines, flows within the honeycomb body.

DE-C-33 31 619 shows a small-area evaporator with a heat exchanger, in which a pipeline system is pressed in between two honeycomb panels.

DE-A-36 11 659 shows a device for the temperature control of buildings, wherein warm air is fed through ducts provided in the floor and might flow out throuh openings into a room to be heated. In this known device, the ducts are integrated into the floor. The heating of the rooms is effected only by the fluid stream taken into the room and only so far as the room located above the duct system where the fluid emerges is temperature controlled. A temperature control on the other side of the same storey ceiling is not provided.

US-A-2 988 980 shows a panel-shaped device for the temperature control which can be disposed inside rooms in front of ceilings and walls. The panel comprises perforations in the face directed to the inside of the room for the outflow of air. The room is air-conditioned by the air streaming in. The ducts that transport the air to the perforations are not integrated in the storey ceiling, but can be advantageously affixed to in a predetermined clearance from the heavyweight storey ceiling. This is a clasical air-conditioning that provides falling air from the top and where temperature control is effected by the intaken air. No success of temperature control is achieved on the opposite side of the storey ceiling.

US-A-2 559 871 shows a device for temperature control of a building where a pipe system disposed in the hollow walls and ceilings of the building is perforated to let emerge air into individual rooms through openings in the walls. The walls and ceilings of the building are insulated outwardly. Some portions of the hollow walls can be separated from the complete system by shutting members. A central heat exchanger unit in the global system allows to remove or to add heat from or to externally fed surrounding air in the manner of a heat pump. The temperature control of the rooms occurs exclusively by the temperature of the air intaken into the building. Due to the insulation of the walls of the rooms, a discontinuous temperature course results at the surface of the storey ceiling. In the area of the emerging openings, the temperature of the air is achieved, while in the other areas, due to the good insulation between pipe system and the surfaces, only a slow adaption to the air temperature in the pipe system is achieved. Particularly, the fluid temperature is not established to one or several surfaces of the storey ceiling, but to the opposite, such contact is hindered. Finally, the fact is that a single air heating is established in the rooms, with the known drawbacks.

German journal sbz, issue No. 2, 1996, pages 60 to 63, shows a device for the temperature control of a building via a ceiling heating. The ceiling radiation heating comprises pipes being solidly concreted in the ceiling of the room, and recirculating water, wherein the aim is to achieve a homogenous ceiling temperature. This is achieved by additional cooling and heating devices, respectively, connected with the pipes. Furthermore, there is provided in addition to the ceiling radiation heating temperature controlled with warm water, a source airing system separated therefrom, the air outflow openings in the floor level thereof being fed through air ducts provided in the concrete ceiling, too. This ceiling radiation heating establishes a completly different temperature in the area of the ceiling than on the opposite side of the storey ceiling. This is already effected in that a second airing system being completely separated from the water pipe system, comprising pipelines and the like, is disposed between the upper side of the storey ceiling and the water pipes and thus effects a thermal insulation of the pipes from the upper side of the storey ceiling. Due to the aeration, the air emerges into the room in the area of the floor and the rooms located above the storey ceilings are temperature controlled in the manner of an air heating.

DISCLOSURE OF THE INVENTION

The object of the invention is to provide a device according to the pre-characterizing clause of Claim 1, which allows more cost-effective operation and makes it possible to have optimum temperature control of a building.

This object is achieved in said device by means of the characterizing features of Claim 1, in that the fluid temperature is also delivered to the other surface of the storey ceiling, and that essentially the same surface temperature is established on both surfaces of the storey ceiling.

The temperature control device according to the invention advantageously makes it possible to control the temperature of multi-storey buildings in such a way that a predeterminable room temperature is delivered simultaneously to the rooms above the storey ceiling and below the latter. The energy used for temperature control is thereby converted with favourable efficiency. The costs of producing a temperature control device according to the invention are low, since it can be produced in one piece with the storey ceiling and there is, therefore, no need for the device to be mounted. In spite of providing the device according to the invention, the storey ceiling can still be thin, with the result that the overall height of the building can be reduced, whilst at the same time considerable costs are saved. The production costs of the storey ceiling provided with the device according to the invention are also favourable, as compared with retrofitting solutions. The heated rooms are temperature-controlled from above and from below, thereby effectively avoiding the formation of air layers of differing temperature. Altogether, the installation costs and energy costs are kept low by virtue of the temperature control device according to the invention.

The room above the storey ceiling is maintained at a predeterminable constant temperature by temperature control in the manner of floor heating. This type of temperature control is felt to be agreeable physiologically. At the same time, the device acts in the manner of ceiling heating for the space below the storey ceiling, but without the room-height losses otherwise accompanying this.

The ceiling or floor of the building is in no way different from conventional smooth surfaces.

The temperature control device according to the invention preferably provides means for the outflow of a fluid, then gaseous, into the rooms adjoining the storey ceiling, the fluid expediently being air or treated air. The introduction of the temperature-control fluid into the building causes an additional swirling of the air layers, the air introduced being at the predeterminable temperature and therefore not being felt to be disagreeable. The particular advantage of this solution is that the duct system performs a synergetic double function, in which, on the one hand, the temperature of the fluid is delivered to the surfaces of the storey ceiling and, on the other hand, the fluid is introduced at essentially the same temperature into the spaces already temperature-controlled via the surfaces of the storey ceiling, so that no undesirable temperature gradients occur. A predeterminable temperature is established uniformly in the buildings temperature-controlled in this way, so that the continuous temperature-control operation takes place advantageously in energy terms. Since a low flow is established in the duct system, there are no temperature fluctuations over the course of the duct system. Another advantage of this combination is to be seen in that spent air is replaced by introducing fresh air, without separate ventilations, for example by opening the windows, having to be provided for this purpose. Temperature control may advantageously mean both heating and cooling, depending on the outside temperature and the predetermined room temperature. Particularly in the case of cooling, the introduction of air has an especially advantageous effect, since the energy radiated from the surfaces fluctuates with the selected temperature and falls at lower temperatures.

According to a preferred development, it is possible for the fluid to be at least partially recirculated, so that there is the possibility of stopping the introduction of air into the rooms, without the fluid build-up generated at the same time leading to the duct system cooling off or heating up. Expediently, by appropriate means, such as an adjustable fluid switch or the like, a fluid flow ratio can be set between a fluid component to be introduced into the building and a fluid component to be recirculated. Thus, it is also possible to set a complete bypass mode, in which the entire fluid is recirculated, without impairing temperature control by means of the storey surfaces.

Expediently, a plurality of outflow ports are provided for the fluid to be introduced into the building, the said outflow ports being individually closable, so that the air flow can be set specifically according to a particular room. By adapting the effective outflow port cross-section, a throttle effect is triggered, which, for example, acts on a fluid control in such a way that the reduced fluid component to be introduced is then carried in the bypass mode and does not lead to an increase in the fluid stream introduced through the remaining outflow ports. Preferably, the outflow ports for the air to be introduced are arranged in the floor region of the rooms, with the result that they are easily accessible. Furthermore, even with the window open, the air introduced exercises its temperature-control effect.

It is advantageous if the duct system within the storey ceiling runs at an equal distance from the top side and under side of the storey ceiling. This expediently ensures that the fluid temperature is delivered simultaneously both to the top side - the floor of a room above the ceiling - and to the underside - the ceiling of a room below it. Such an arrangement may advantageously be integrated as early as when the storey ceiling is built. This avoids the need for subsequent additional installation work in a finished building. Thus, advantageously, a ready-to-instal storey ceiling with an integrated duct system, comprising the temperature control device according to the invention, can be produced and then only needs to be inserted into a building by the system-building method. Such a storey ceiling may advantageously be integrated into the building during the erection of the latter or may be inserted into the formwork even before the wall material has set.

When sometimes several coats or coverings influencing the upward heat-carrying capacity of the temperature control device are provided in the floor of the building, it is advantageous not to arrange the duct system within the storey ceiling at the same distance from the top side and under side of the latter, as described above, but to displace it an appropriate distance upwards or downwards in parallel according to the heat emission requirement, so that uniform setting of the surface temperature is achieved.

For the course and distribution of the duct system, it is expedient if the latter is led from a distribution point in a radiated manner to a plurality of outflow ports. For example, a distribution point or feedpoint may be arranged centrally in the middle of the storey ceiling or, alternatively, in the middle of the longitudinal side of the storey ceiling, so that the duct system extends from this point over the storey ceiling in a radiated manner. Another advantageous course for distributing the fluid in the duct system is afforded when the air in the duct system is led to a plurality of outflow ports in a grid-like, serpentine, meander-like or other manner. By virtue of this arrangement, the duct system is distributed uniformly over the surface of the storey ceiling. As a result, the air is initially, as in a closed system, carried within the storey ceiling, can deliver its temperature upwards or downwards there and can then emerge at the outflow ports. This arrangement makes it possible for the energy employed to be utilized advantageously in energy terms for obtaining heat or cold.

In a particularly advantageous development of the invention, the storey ceiling rests with a narrow edge region in a recess of the building wall. In this case, expediently, a gap is left between the lateral delimitation of the recess and the edge of the storey ceiling, the said gap advantageously being reserved as a compensating space for thermally induced expansion. Expediently, however, this gap is dimensioned larger, so that, even in the event of high thermal expansion, a predetermined minimum clearance remains. Supply lines or empty pipes can advantageously be accommodated in this clearance region. In this arrangement, it is appropriate also to use the channel system within the storey ceiling for such supply lines, for example for ceiling lighting or the like.

The edge of the storey ceiling is advantageously designed as a vertical edge which runs parallel to the elongate wall recess. This arrangement is advantageous when no special requirements are placed on the mounting of the ceiling. If, however, special arrangements are made with regard to support and thermal expansion, it is advantageous if the support in the recess is designed as stairs, either a vertical storey edge resting on the lower step or the edge being likewise stair-shaped as a counterpiece.

According to a particularly preferred development of the invention, the gap is utilized to allow the duct system to open into it level with the storey ceiling, so that the gap is utilized in the manner of a pre-compression space. Since the storey ceiling rests in the recess in an essentially leak-tight manner, the air is essentially deflected in the gap and led over the storey ceiling in the direction of the interior of the room located above it, with the result that the introduction of air into the room advantageously acquires a pronounced horizontal component. The outflow port is then arranged essentially in the extension of the wall, and the cross-section of the said port is obtained from the difference between the height of the recess and the thickness of the storey ceiling. The effective outflow port cross-section can expediently be reduced by providing floor strips which are advantageously pivotable in order to achieve the possibility of setting the effective cross-section.

An intermediate layer, which consists, for example, of a fluid-tight elastomeric material, is preferably arranged between the (lower) supporting surface of the recess and the underside of the storey ceiling. The elastomeric material serves as a sliding bearing for the storey ceiling in the event of thermal expansion or contraction and uncouples the two parts, namely the storey ceiling and wall, vibrationally, so that it acts at the same time as a sound-insulating means. Favourable footfall sound insulation is obtained thereby. In addition, electronic sound invertors, e.g. acoustic converters, may be provided, which record acoustic signals and cancel them by means of the inverse sound signal, so that the cancelled signal is no longer perceived by a person standing outside. As a result, cost-effective additional footfall sound insulation becomes possible, and, furthermore, flow noises can also be suppressed in this way. Preferably, the acoustic detectors are accommodated in the duct system, so that sound transmission through the storey ceiling is inhibited, but sounds within the room delimited by the storey ceiling, for example a radio, are virtually not cancelled at all.

According to a preferred development of the invention, the storey ceiling is designed as a panel-shaped structural part in sandwich form which is delimited at the top and bottom by a plane layer, honeycomb bodies, for example made of aluminium, being arranged between the layers perpendicularly to these and passing through the distance between the layers. The duct system extends in the structural part essentially parallel to and, advantageously, at a mean distance from the layers. The duct system thus runs essentially transversely relative to the axial extent of the honeycomb bodies. Such a design advantageously has low weight and can be transported cost-effectively. Furthermore, the production of such a structural part entails little cost. Due to the fluid passing through the duct system, large-area convection takes place in the honeycomb body walls and is delivered advantageously to the layers. Expediently, the panel-shaped structural part consists of a material having high thermal conductivity above 10 W/mK, preferably even above 13 W/mK or even higher. Due to the modular organization of the multiplicity of honeycombs, the sandwich-like structural part can advantageously be adapted easily and flexibly to specific ground plans, both in terms of storey dimensions and in terms of the planned room division. The resulting storey ceiling is load-bearing and stable, since the sandwich design, in conjunction with the internal honeycomb design, forms a distortion-resistant hollow panel which is not inferior to the mechanical and acoustic properties of a concrete ceiling. It is possible, after the installation, for the honeycombs, which in the first place are empty, to be filled. Thus, according to an advantageous variant, it is possible to fill the storey ceiling with a gaseous medium under slight excess pressure, thereby likewise achieving improved sound insulation.

The sandwich-like structural part can be produced in a simple way: The individual honeycomb bodies are connected laterally to one another by adhesive bonding, welding or similar connection techniques so as to form a solid elongate body. The upper and lower layers of the structural part are applied as a covering, likewise by welding or adhesive bonding, to the longitudinal sides of the layer thus formed. Other production methods may also be used.

Footfall sound insulation and a floor covering may expediently be applied to the upper layer of the structural part. The lower layer of the structural part forms the underside of the storey ceiling, to which a conventional ceiling coat or fireproof coat can be applied.

According to an expedient version, a plurality of panel-shaped structural parts may be assembled to form a storey ceiling. In this case, it is advantageous to provide the duct system along the point of connection of the structural parts. Conventionally, in the case of a panel-shaped structural element, the honeycomb bodies are produced individually or in groups by adhesive bonding to the upper or lower covering layer. The absence of individual honeycomb bodies at the points of connection gives rise, in each panel-shaped structural part, to a recess at the points of connection of the structural parts which, when assembled in pairs, form a corresponding space for the duct system. In order to implement ceiling thicknesses which are as small as possible, it is also advantageous to install support elements as girders in the form of T-girders, double-T-girders or girders of another shape within the ceiling. In such a version, the girders advantageously run along the points of connection.

According to another expedient version, a one-piece panel-shaped structural element is produced as a storey ceiling. In such an arrangement, the duct system is produced together with the production of the panel-shaped structural part. For this purpose, when the honeycombed hollow body is being produced, individual honeycomb bodies are separated, punched or broken out of their connection to the other bodies at the points where the duct system is provided. The voids thus occurring within the honeycomb body determine the course of the duct. Alternatively, individual honeycomb bodies may also be arranged next to one another so as to be offset or staggered, thereby likewise defining the course of the duct system. The duct system is sealed off by subsequently applying the upper and lower layers.

However, the duct system within a one-piece panel-shaped structural part may also be produced by introducing a mandrel or a correspondingly designed driving tube perpendicularly to the orientation of the honeycomb bodies in accordance with the course of the ducts by the advance driving method, or by providing a corresponding pulling device. One of the methods described above may be used, depending on the thickness of the ceiling and the density and strength of the honeycomb bodies.

The temperature-controlled fluid in the storey ceiling is advantageously carried in a duct system designed in the form of a cylindrical pipe. Alternatively, it is possible to provide a pipe of triangular cross-section, in which a base side of the triangle runs parallel to the layers and preferably coincides with a layer. The room adjoining this layer will adapt more quickly to changes in the predetermined temperature. An arrangement of the duct system with this design is advantageous when several layers of a floor covering, screed or the like are provided on the floor.

It is possible, furthermore, to refrain from piping for the duct system and to provide the delimitations of the honeycombs for surrounding the duct system. Pipe weight is saved thereby.

Further advantageous embodiments of the invention are to be taken from the dependent claims and from the following description.

The invention will be explained in more detail below by means of exemplary embodiments with reference to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a truncated illustration of an embodiment of a temperature control device according to the invention.

Fig. 2 shows a cross-section through the temperature control device of Fig. 1, along the line II-II.

Fig. 3 shows a longitudinal section through the temperature control device of Fig. 2, along the line III-III.

Fig. 4 shows a cross-section through another embodiment of a temperature control device according to the invention.

Fig. 5 shows a cross-section through yet another embodiment of a temperature control device according to the invention.

Fig. 6 shows a cross-section through a elevational view of a further embodiment of a temperature control device according to the invention.

Fig. 7 shows a longitudinal section through an alternative embodiment of a temperature control device according to the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Fig. 1 shows a temperature control device according to the invention designated by the reference symbol 30. The temperature control device is integrated in a storey ceiling 1, the right hand side thereof being shown in cross-section in Fig. 1. The storey ceiling 1 is manufactured as panel-shaped structural part 2, wherein an upper surface 5 and a lower surface 6 of the ceiling 1 are formed as flat and thin sheet metals, respectively, which cover a honeycomb body 3 from both sides. The thickness of the honeycomb bodies 3 between the surfaces 5, 6 is several times the thickness of one layer 5 or 6. The honeycomb body 3 and the metal sheets 5, 6 consist of Aluminium because of its positive thermal coductivity properties. A duct system 4 is located betweeen the honeycomb bodies 3 parallel to the surfaces 5, 6, which duct system 4 might be sealed against the honeycomb bodies 3. The surface 5 which defines the upper side of the storey ceiling 1 can be covered by a footfall insulation as a carpet. The lower surface defining the underside 6 of the storey ceiling 1 can be provided with a ceiling coating.

In an apparatus not shown, air is regulated to a desired temperature and is introduced as hot or cold air 21 via suction-intake means into the duct system 4 of the ceiling storey 1. Therethrough, the ceiling storey 1 can be either used as heating system or as air-conditioning.

An edge region 13 of the storey ceiling 1 rests with its underside 6 in a recess 14 of a wall 19. A plastic intermediate layer 31 is provided between underside 6 and recess 14 to form a sliding bearing 31. This serves for adapting to the thermal expansion of the storey ceiling 1.

In the recess 14, the temperature controlled air 21 flows out at the peripheral portion 13 of the storey ceiling 1 at a vertical front face 16 of the storey ceiling 1 in the direction of the vertical wall section 19 located opposite thereof. A gap 18 is arranged between the front face 16 and the section of the recess 14. This gap 18 elongates in the manner of a right angle in the peripheral portion 13 above the surface 5 in an upper horizontal portion 17 of the storey ceiling 1 such that in the peripheral portion 13 of the ceiling 1, a distance corresponding to the gap 18 is set between wall 19 and surface 5. The gap 18 emerges at an opening 20 into a room being delimited downwardly by storey ceiling 1. The opening 20 is sealed off by a cover 22 which runs along the wall 19 and the upper side 5 of the ceiling 1. The cover 22 forms a skirting-board, moulding or the like for the room above the storey ceiling 1. Air outflow ports 23 are provided on the longitudinal side of the cover 22, with a flap or slit system, by means of which the hot und cold air 21 which had flowed into the room can be regulated or controlled by means of corresponding control and regulating devices.

The course of the duct system 4 within the storey ceiling 1 along line II-II is illustrated in Fig. 2. Within the honeycomb bodies 3, at the same distance from both surfaces 5, 6, is provided a pipe 8, in which the introduced hot and cold air 21 used for temperature control flows. The pipe 8 is a part of the duct system 4. This pipe 8 may be co-installed separately as a driving tube during the production of the panel-shaped structural part 2, or a tubular opening, which is leak-tight relative to its environment, may be formed in the honeycomb bodies 3 as a duct by bending out, punching out or any corresponding method.

Fig. 3 shows a longitudinal section of the storey ceiling of Fig. 2, a possible arrangement of how the duct system 4 is distributed in the ceiling surface becoming evident therefrom. The air 21 emerges from a distribution or feed device 24 vertically out of the plane drawing and distributes the air 21 in the plane drawing in a radiated 11 manner, with the aid of the duct system 4, in the storey ceiling 1, where the temperature is established on the two surfaces 5, 6.

In the following embodiments, the same reference signs as in Figs. 1 to 3 will designate the corresponding parts.

Fig. 4 shows an alternative embodiment which enables a simple arrangement of the duct system 4 within the honeycomb bodies 3. Individual honeycomb bodies 3 are connected to one another at their side portions to form a solid body. Subsequently, the covering with metal sheets which form the upper and the lower surfaces 5, 6 of the storey ceiling 1 is done. Individual honeycomb bodies 3 are removed, according to the necessary duct surface, at the locations where the duct system 4 is provided.

Fig. 5 shows a further embodiment for an arrangement of the duct system 4. The difference from the embodiment of Fig. 2 is that the pipe 9 of the duct system 4, in cross-section, corresponds to a triangle upside down, with a horizontal base line 10 and corresponding sides 32, which are sealed off relative to the honeycomb bodies 3 covering them. The base line 10 of the triangle is formed by the upper surface 5 of the storey ceiling 1. This construction is especially suitable for a heating system, because the heat that tends to move up is preferably established at the surface 5 forming the floor of the storey ceiling 1.

Fig. 6 shows a further embodiment of the invention in which the storey ceiling 1 consists of a plurality of adjacent elements like the above mentioned panel-shaped structural parts 2 which, when assembled together, form the storey ceiling 1. Some of the honeycomb bodies 3 have been broken out or omitted during production along the points of connection 7 of the individual structural parts, designated here with A and B, so that only the upper and lower covering panels 5, 6 form the point of connection 7 and, in between, there is a cavity which forms a duct system 4a. It is possible to flaten the honeycomb bodies 3 at 34.

Fig. 7 shows a longitudinal section through an alternative storey ceiling 1. The arrangement of the duct system 4 extends within the storey ceiling 1 in the form of a grid 12 as far as the edge region 13 of the ceiling. This uniform arrangement of the duct system 4 is advantageous when a uniform temperature profile is to be achieved over the ceiling surface 5, 6.

It has to be noted that the features of all described embodiments selectively can be combined to create other devices according to the invention for the temperature control of buildings.

CLAIMS

1. Device for the temperature control of buildings, comprising a duct system (4; 4a) which is integrated into a storey ceiling (1) and through which a temperature-controlled fluid (21) is to flow, the fluid temperature being delivered to a surface (5) of the storey ceiling,
characterized in
that the fluid temperature is also delivered to the other surface (6) of the storey ceiling (1), and
that essentially the same surface temperature is established on both surfaces (5, 6) of the storey ceiling (1).

2. Device according to Claim 1, characterized in that the fluid (21) is gaseous and that means for the outflow of the temperature-controlled fluid (21) into a building room delimited by the storey ceiling (1) are provided.

3. Device according to Claim 2, characterized by switch means for selectively setting the amount of fluid (21) to flow out or be recirculated.

4. Device according to Claim 2 or 3, characterized by closable outflow ports (23) where the fluid (21) can flow out.

5. Device according to Claim 4, characterized in that the outflow port (23) has throttle or valve means in the form of flaps, slits or shutters for controlling the fluid supply.

6. Device according to Claim 4 or 5, characterized in that the duct system (4; 4a) comprises a distribution point (24) and a plurality of outflow ports (23) provided in a radiated manner with respect to the distribution point (24).

7. Device according to one of Claims 1 to 6, characterized in that the duct system (4; 4a) within the storey ceiling (1) is arranged at the same distance from the top side (5) and underside (6) of the storey ceiling (1).

8. Device according to one of Claims 1 to 6, characterized in that the vertical distance of the duct system (4) from the top side (5) and the underside (6) of the storage ceiling (1) is different, the upward transition of heat being numerically approximately equal to or differing only slightly from the downward.

9. Device according to one of Claims 1 to 8, characterized in that the storey ceiling (1) rests with an edge region (13) in a recess (14) of a wall (19), a peripheral gap (18) being provided between the edge region (13) and the lateral delimitation of the recess (14).

10. Device according to Claim 9, characterized in that an intermediate layer (31) is arranged between the storey ceiling (1) and the supporting surface in the recess (14).

11. Device according to Claim 9 or 10, characterized in that the duct system (4; 4a) opens into the gap (18) in the direction of the wall (19), such that the fluid (21) is deflected in the gap (18) and is led over the storey ceiling (1).

12. Device according to Claim 11, characterized in that outflow ports (23) are arranged above the storey ceiling (1) in an extension of the wall (19), the outflow port cross-section being capable of being covered at least partially by coverings (22).

13. Device according to one of Claims 9 to 12, characterized in that a cable duct for power and/or communication lines is arranged in the gap (18).

14. Device according to one of Claims 1 to 13, characterized in that the storey ceiling (1) is designed as a panel-shaped structural part (2) in sandwich form, in which internally supporting or self-supporting honeycomb bodies (3) are arranged between the surfaces (5, 6) of the storey ceiling (1), and that the duct system (4a) is provided within the honeycomb bodies (3).

15. Device according to Claim 14, characterized in that the panel-shaped structural part (2) consists of a material having a thermal conductivity of more than 10 W/mK (coefficient of thermal conduction at 20°C).

16. Device according to Claim 14 or 15, characterized in that the panel-shaped structural part (2) consists of aluminium.

17. Device according to one of Claims 14 to 16, characterized in that a floor covering is applied to the top side (5) of the panel-shaped structural part (2) and a ceiling coat is applied to the lower side (6) of the latter.

18. Device according to one of Claims 14 to 17, characterized in that the storey ceiling (1) consists of a plurality of adjacent and assembled panel-shaped structural parts (A, B), in the region (7) of connection of which the duct system (4a) is arranged.

19. Device according to Claim 18, characterized in that the duct system (4a) provides connecting passages formed by breaking out or punching out honeycomb bodies (3).

20. Device according to Claim 18 or 19, characterized in that support elements, which carry the individual panel-shaped structural parts (A, B), are arranged along the region (7) of connection.

21. Device according to one of Claims 14 to 17, characterized in that the storey ceiling (1) consists of a one-piece panel-shaped structural part (2).

22. Device according to Claim 21, characterized in that continuous recesses (34) are designed, as part of the duct system (4), within the panel-shaped structural part (2) between the honeycomb bodies (3).

23. Device according to Claim 22, characterized in that the recesses (34) are lined with pipelines (8).

24. Device according to Claim 22, characterized in that the recesses (34) form a fluid-tight lining due to the metal forming of the walls of the honeycomb bodies (3).

25. Device according to one of Claims 14 to 24, characterized in that at least one surface (5) of the storey ceiling (1) at least partially delimits the duct system (4; 4a).

26. Device according to one of Claims 1 to 25, characterized in that the duct system (4) is designed with a circular cross-section (8).

27. Device according to one of Claims 1 to 26, characterized in that the duct system (4) is designed with a triangular cross-section (9), a base line (10) of the triangle being arranged parallel to a surface (5) of the storey ceiling (1).

28. Device according to one of Claims 1 to 27, characterized in that the fluid (21) is air.

29. Device according to one of Claims 1 to 28, characterized in that the storey ceiling (1) comprises means for sound insulation.

30. Device according to Claim 29, characterized in that the means for sound insulation comprise an electronic acoustic converter.

31. Device according to Claim 29 or 30, characterized in that the means for sound insulation are inserted into the duct system (4; 4a).

32. Device according to one of Claims 1 to 31, characterized in that lines or empty pipes for ceiling lighting are provided within the duct system (4; 4a).

33. Storey ceiling, comprising an integrated temperature control device (30) according to one of Claims 1 to 32.

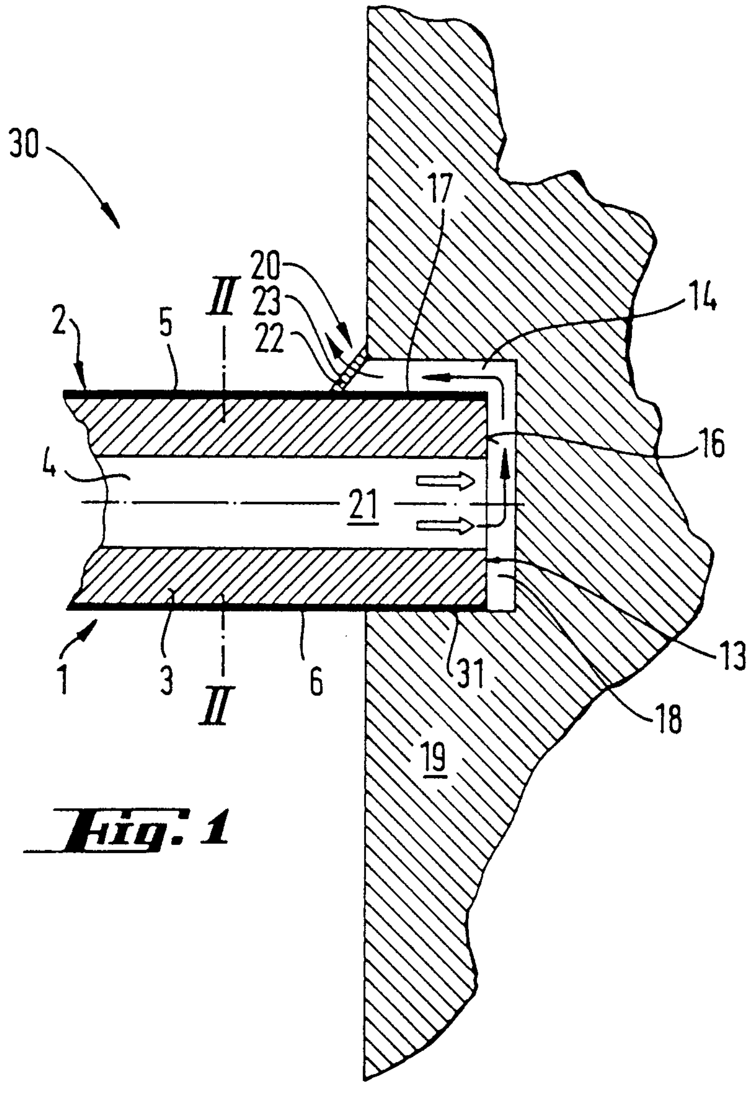


Fig. 1

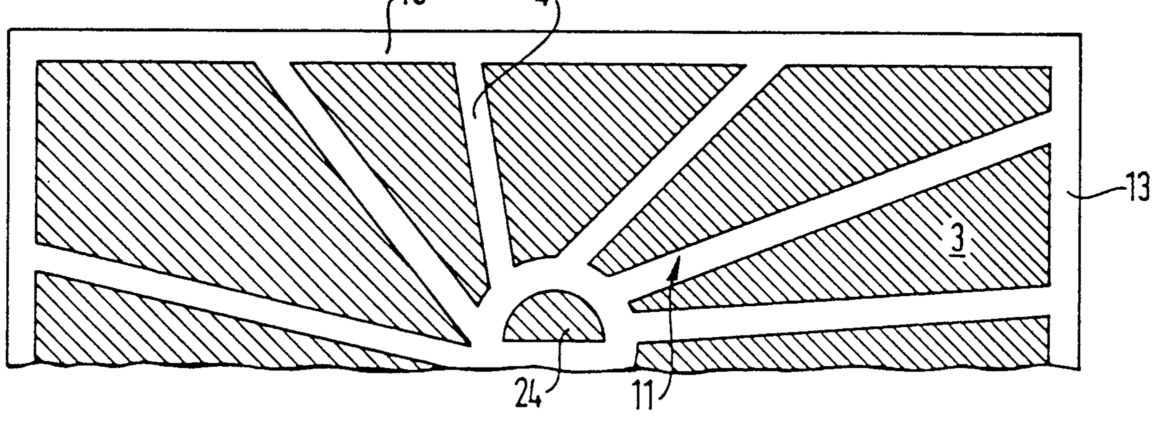


Fig. 3

Fig. 2

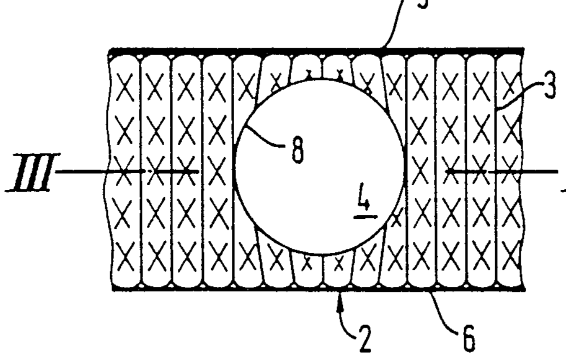
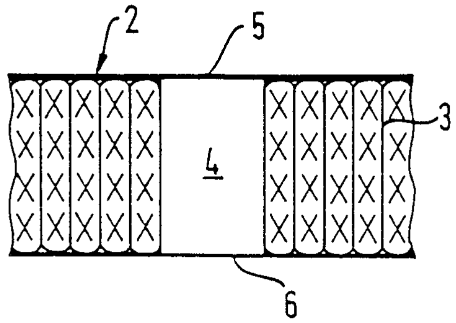


Fig. 4



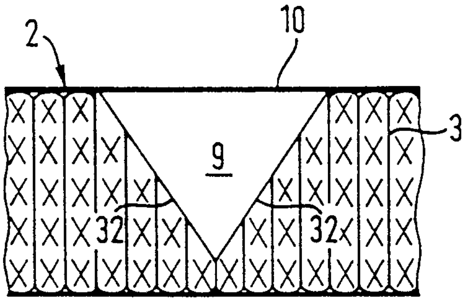


Fig. 5

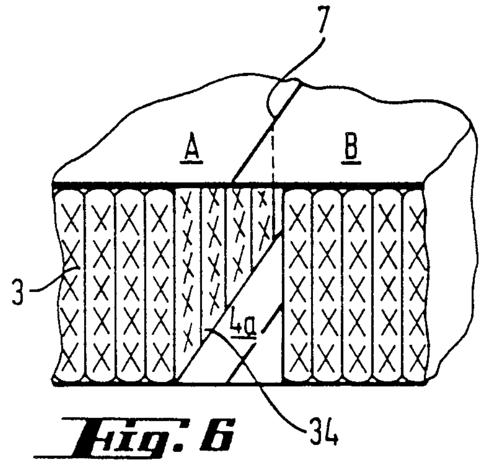


Fig. 6

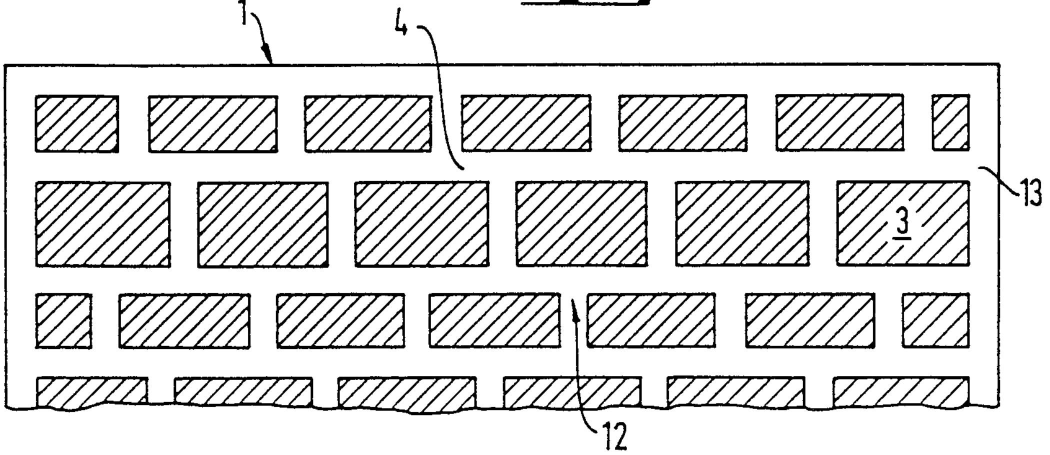


Fig. 7

INTERNATIONAL SEARCH REPORT

In. .ional Application No
PCT/EP 98/05225

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F24D5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F24D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 179 201 A (CARRIER ENGINEERING COMPANY LIMITED) 28 January 1970 see page 1, line 76 - page 2, line 5; figure 1 ---	1
A	FR 1 523 996 A (SIEMENS AG) 25 March 1968 see figures ---	1,4
A	EP 0 255 039 A (SCHMIDT REUTER) 3 February 1988 see figure 4 ---	1,3-5
A	US 2 669 393 A (SCHLEICHER) 16 February 1954 see figure 2 --- -/--	1,6

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search	Date of mailing of the international search report
4 January 1999	11/01/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 98/05225

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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