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G. BARBIER ET AL
HEATING OR COOLING SYSTEMS

3,072,183

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2 Sheets-Sheet 1

FIG. 1

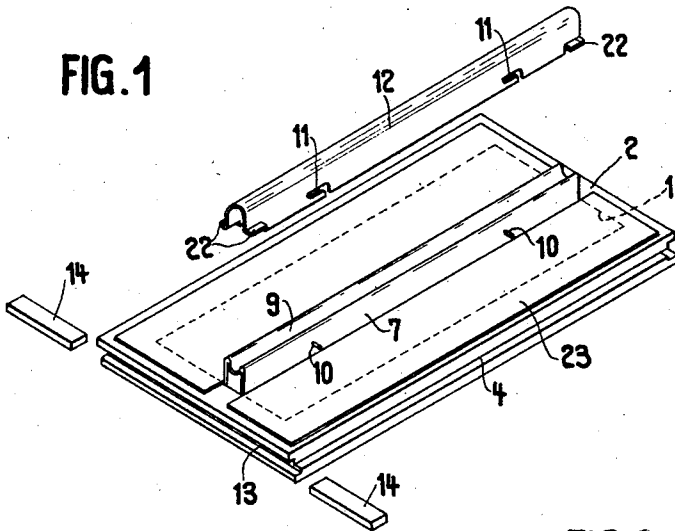


FIG. 2

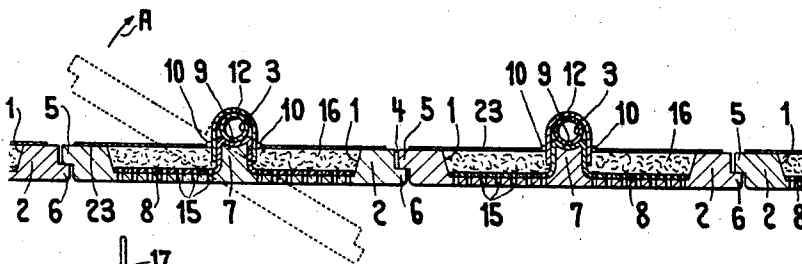
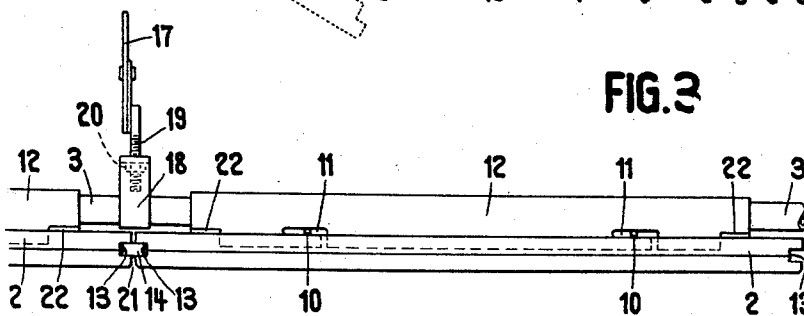


FIG. 3



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FIG. 4

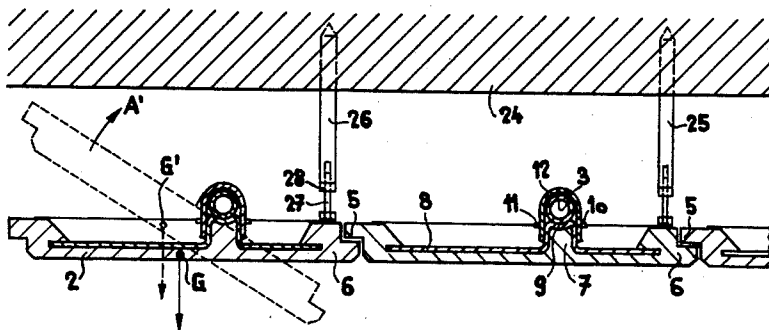


FIG. 5

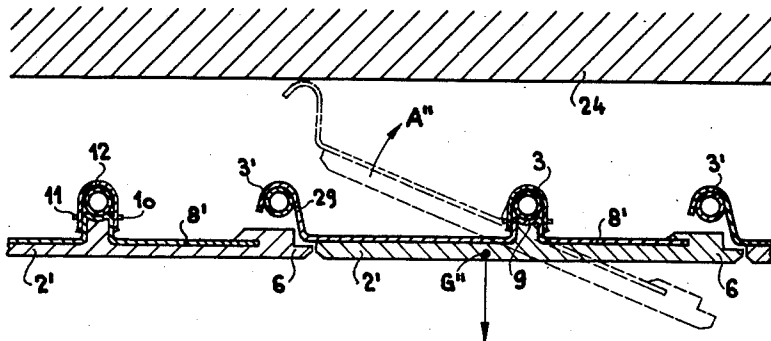
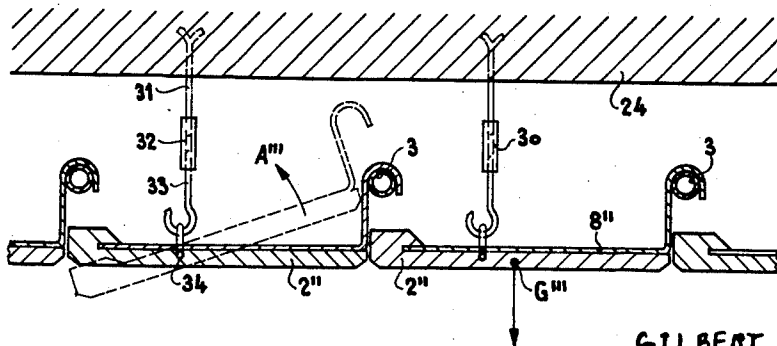


FIG. 6



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HEATING OR COOLING SYSTEMS

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3 Claims. (Cl. 165—55)

This invention relates to systems for heating or cooling rooms by radiation. Such systems preferably comprise tubes or conduits for the heating or cooling medium arranged in a space between the raw ceiling and a suspended ceiling and a plurality of radiating panels or plates mounted on these tubes or conduits.

Known systems of this type especially those having plates of plaster of Paris, have the disadvantage that it is not possible to take one arbitrary plate out of the formation of plates of the finished ceiling assembly. It is however common practice to install piping for water or gas and electric wiring between the raw ceiling and the suspended ceiling and these installations should be easily accessible for maintenance or service without involving expert workmanship.

It is an object of this invention to overcome these disadvantages by providing pivotal suspension means for the radiating plates, allowing the plates to be tilted so that any arbitrary plate may be taken out of the finished ceiling assembly. By tilting the plates out of the formation of plates into an inclined position, the suspension means of the plates and the space between the raw and the suspended ceiling are accessible from below. It is a further object of the invention to provide securing means such as slidable keys, stops or catches preventing the plates from unintentional tilting.

The attached drawings illustrate by way of example some embodiments of a heating or cooling system.

FIG. 1 is a perspective exploded view of a radiant plate with a grooved rib, the cap of the suspension bearing being lifted off and two slidable keys being slid out of a keyway in the side of the plate.

FIG. 2 is a cross section of a formation of plates forming an assembled suspended ceiling, the view being taken perpendicular to the tubes, and

FIG. 3 is a side view of a part of the same system parallel to the tubes.

FIG. 4 is a cross section of another system in which the tubes are arranged beside the center of gravity of the plates, the view being taken perpendicular to the tubes.

FIG. 5 is a similar cross section of a third system, and

FIG. 6 is a similar section of a system with plates where the suspension means are placed beside the tube.

The FIGURES 1, 2 and 3 show plate elements 2 of plaster of Paris, stucco, mortar or any other synthetic material which may be reinforced by fibrous material. The plates have a recessed portion 1. The side faces of the plates parallel to the tubes 3 have projecting ledges 5 and 6. Ledge 5 is flush with the upper side of the plate element 2 and is arranged on a higher level than ledge 6, which is flush with the under side of plate 2 exposed to the room to be heated or cooled. A rib 7 running parallel to the edges 5 and 6 is arranged in the center of plate 2. The bottom of the recess 1 and rib 7 is covered with a heat conducting sheet 8 of e.g. aluminum.

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The sheet 8 may be fixed by tongues (not shown) stamped out of the sheet, which tongues will anchor in the plaster of Paris when the plate is poured. In the top of the rib 7 the sheet has a channel-like trough 9 accommodating a tube 3. Projecting pins 10 are arranged in the sides of rib 7 which engage bayonet-slits 11 a U-shaped aluminum cap 12 when the heating or cooling system is assembled. The cross section of the cap 12 and trough 9 are formed to fit snugly about a tube 3. Lobes 22 of cap 12 rest upon the rim of the plate 2. The trough 9 and the cap 12 together form a suspension bearing allowing the plate 2 to be tilted on the tube. For this purpose the seat of the tube in trough 9 and cap 12 have been chosen in such a way, that the plates 2 may be tilted on the tubes 3. The rims of the plates 2 perpendicular to the ribs 7 and to the tubes 3 have grooves 13 in which slidable keys 14 may be placed in a position to prevent the plates 2 from unintentional tilting. In the present embodiment the bottom of recess 1 comprising both the sheet 8 and part of the plaster of Paris body of the plate has been provided with sound absorbing perforations 15. The recess 1 is filled with sound absorbing material 16, such as glass wool, and is covered by a layer 23 e.g. a sheet of kraft paper. The sound absorbing perforations, the recess and the layer 23 however may be omitted.

The tubes 3 (e.g. serpentine) carrying the heating or cooling medium are suspended from a raw ceiling (not shown) by help of strips 17 cemented into this ceiling. The tubes 3 are mounted in blocks 18 that are coupled to the straps 17 by means of adjustable bolts 19 and nuts 20. The bolts 19 and nuts 20 allow a correct leveling of the tubes.

The full lines in FIGURE 2 show a finished ceiling assembly of a heating or cooling system where the slidable keys 14 in the grooves 13 are slid to a position where four plates 2 meet. The ledges 5 of the plates 2 rest upon the ledges 6 of contiguous plates (seen from the side of the tubes). To take one plate 2 out of the assembly of plates forming a finished ceiling, the slidable keys must be slid out of contact with the plate to be taken out, so that this plate will be free to be tilted out of the assembly. To do this, a suitable tool, e.g. a blade, is inserted from below, that is from the side of the ceiling exposed to the room, into the slit 21 between adjacent plates 2 (FIGURE 3). By help of this tool the keys 14 can be slid in the grooves 13 until they are out of contact with the plate 2 which is to be taken out. Now this plate can be tilted as indicated by arrow A in FIGURE 2 in the position shown by dotted lines or even further. Now the cap 12 is accessible and can be slid parallel to the rib 7 and taken off from the pins 10, so that the suspension bearing can be opened and the plate taken away. To insert a plate in the suspended ceiling, these operations are carried out in reverse order. When the plate has been fitted into the formation, the corresponding keys are shifted by means of a tool inserted in slit 21 until they meet other adjoining plates.

FIG. 4 shows another system in which the tubes are secured to the plates by means located off-center on the plates. Corresponding parts have the same reference numbers. In contradistinction to the first embodiment, the rib 7 is displaced from the center of the plate and is

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located beside the center of gravity G of the plate. The rib 7 has a trough 9 corresponding with the radius of the tube 3 as in the system described above. The suspension bearing establishing the connection between the tube and the plate has pins 10 and a cap 12 with bayonet-slits 11 as before. The suspension of the tubes 3 from the raw ceiling 24 is not shown in FIGURE 4. This suspension may be of the same type as that shown in FIGURE 3. Since the bearing of plate 2 upon the tube 3 is beside the center of gravity, the plate has a tendency to tilt downwards in a direction opposite to that of arrow A'. To keep the plate on a horizontal plane, supports 25 are arranged in the raw ceiling. These supports comprise holders 26 secured to the raw ceiling 24, having an adjusting screw 27 with a lock-nut 28 in their lower parts. By means of these elements the length of the stops can be correctly adjusted. Instead of supports secured to the raw ceiling adjustable supports arranged upon the plate could be provided. The radiating plates shown in FIGURE 4 are simple heating or cooling plates in which the elements 15, 16 and 23 have been left out. To take such a plate out of the finished ceiling formation, the plate is tilted in the direction of arrow A' to the position indicated by dotted lines. Some effort is necessary, since the center of gravity of the plate rises from G to G' during this operation. The tilting of the plate makes the securing means 10, 11 and 12 accessible from the right side of tube 3. Now the cap 12 can be taken away and the plate removed. When inserting a plate, these actions are carried out in the reverse order.

FIGURE 5 shows a third system. Here a second tube 3' is arranged alongside each tube 3 carrying the pivotal plates 2, providing a stop for the plates. The plates 2 e.g. of plaster of Paris are covered by a heat conducting sheet 8'. These sheets 8' have a rib with a trough 9 arranged at some distance beside the center of gravity of the plate and are brought in heat conducting relationship with tube 3 by means of the parts 10, 11 and 12 forming a suspension bearing. On the left side, in FIGURE 5 the sheet has a hook-like bend 29. The radius of this bend has been adapted to fit the tube 3', so that the sheet can be brought in heat conducting contact with the tube 3'. It is of advantage to form the hook shaped bend so that it will fit snugly upon the tube. Thereby the heat-conducting connection will be assured not only by the weight of the plate but additionally by the clasping action of the bend. At the side of bend 29 the sheet protrudes over the plaster of Paris body of the plate 2'; the other side has a ledge 6, situated below the protruding sheet 8' of an adjoining plate 2'.

To take such a plate 2' out of the finished ceiling formation, the plate is tilted on the tube 3 in the direction of arrow A', so that the securing means 10, 11 and 12 will be accessible. Now cap 12 can be taken off and the plate taken out of the ceiling.

Where the grip of the hook-like bend is sufficiently strong, the tube 3 can be arranged in the center of the plate, which has the advantage that the tubes 3' can be arranged centrally between two tubes 3, and all tubes will be equidistant.

FIGURE 6 shows a system having heat radiating plates, where the pivotal suspension means are arranged beside the tube 3. These suspension means comprise a hook 30 cemented in the raw ceiling and an eye 34 incorporated in the plate 2''. This eye has shanks extending under the heat conducting sheet 8''. The hook 30 has a left-hand threaded bolt 31 cemented in the raw ceiling 24 and a lower part 33 having a right-hand thread. The long nut 32 has left-hand thread in its upper and a right-hand thread in its lower part. By turning the nut 32 the length of hook 30 can be adjusted. The right hand side of sheet 8'' has a hook-shaped bend which rests upon tube 3. Since the center of gravity G''' lies between the hook 30 and the tube 3, part of the weight of plate 2''

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will press the hook-shaped end of the sheet upon tube 3. To improve the heat conduction from the tube to the sheet and to the plate 2'', it is of advantage to form the hook-shaped bend so that it will grip the tube.

The adjustability of hook 30 allows for a correct alignment of the radiating plates 2'' so that all plates are on one plane. It is obviously on condition that all tubes 3 are arranged on the same plane. To this end the tubes are suspended in the same way as shown in FIGURE 3, but not shown in FIGURE 6 for the sake of clarity. If such a plate 2'' has to be taken out of a finished ceiling formation, it should be pushed from below on the right side of the plate (FIGURE 6). Thereby the hook-shaped end of the sheet is lifted clear off the tube and the plate will swing from the parts 33, 34. Now the space between the raw and the suspended ceiling is accessible so that nut 32 can be loosened and the plate taken away. When the hook 30 is turned 180° so that its opening faces to the right instead of to the left as shown in FIGURE 6, and provided that the space between the raw and the suspended ceiling is sufficiently large, the plate can be tilted further and can be taken from the hook without detaching same.

The pivotal suspension means may have other forms as shown in the drawings.

Instead of plaster of Paris plates with metallic heat distributing sheets, the plates may be self-supporting metallic plates which may have radiating surfaces with a thin layer of plaster, or the radiating surfaces may be painted.

What we claim is:

1. A radiation heating or cooling system for heating or cooling a room, comprising a radiant ceiling adapted to be spaced from the raw ceiling of the room, a plurality of conduits for carrying a heating or cooling medium located between said raw ceiling and radiant ceiling, said radiant ceiling comprising a plurality of pivotably mounted radiant plates, each of said radiant plates being in heat conducting connection with only one of said conduits, means on said plates preventing unintentional pivoting thereof, said pivotably mounted radiant plates having a central web arranged above the center of gravity of said plates and fixing means for swivelably mounting said central web on a conduit, said web and said fixing means providing both a hinge joint and a heat conducting connection between said plate and said conduit; the lateral faces of said plates, arranged perpendicularly to said conduit having grooves, slidable keys arranged in said grooves and said slidable keys interlocking said plate with adjacent plates in its working position.

2. A radiation heating or cooling system for heating or cooling a room, comprising a radiant ceiling adapted to be spaced from the raw ceiling of the room, a plurality of conduits for carrying a heating or cooling medium located between said raw ceiling and radiant ceiling, said radiant ceiling comprising a plurality of pivotably mounted radiant plates, each of said radiant plates being in heat conducting connection with only one of said conduits, means on said plates preventing unintentional pivoting thereof, said pivotably mounted radiant plates having a web located slightly off center, fixing means for swivelably mounting said web on a conduit, said web and said fixing means providing both a hinge joint and a heat conducting connection between said plate and said conduit, an adjustable stopper arranged in the raw ceiling and said stopper preventing the tilting of said radiant plate by gravity and keeping said plate in its working position.

3. A radiation heating or cooling system for heating or cooling a room, comprising a radiant ceiling adapted to be spaced from the raw ceiling of the room, a plurality of conduits for carrying a heating or cooling medium located between said raw ceiling and radiant ceiling, said radiant ceiling comprising a plurality of pivotably mounted radiant plates, each of said radiant plates being in heat conducting connection with only one of said con-

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duits, means on said plates preventing unintentional pivoting thereof, said pivotably mounted plates having an eye located slightly off center, an adjustable hook arranged in the raw ceiling engaging said eye, said eye and said hook forming a pivotable suspension of said plate, a resilient hook shaped part arranged on a lateral side of said plate, said hook shaped part being clamped over a conduit, thereby preventing the tilting of said plate and keeping said plate in working position and said hook shaped part establishing a heat conducting connection with said conduit.

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