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(54) **DEVICE FOR FIXING A TILE TO A STRUCTURE, FOR EXAMPLE A SUPPORTING STRUCTURE OR AN INTERMEDIATE STRUCTURE OF A BUILDING, AND CEILING SUSPENDED FROM A STRUCTURE**

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(71) Applicant: **Dominique Firinga**, Macon (FR)

(72) Inventor: **Dominique Firinga**, Macon (FR)

(73) Assignee: **OBER**, Bar Le Duc (FR)

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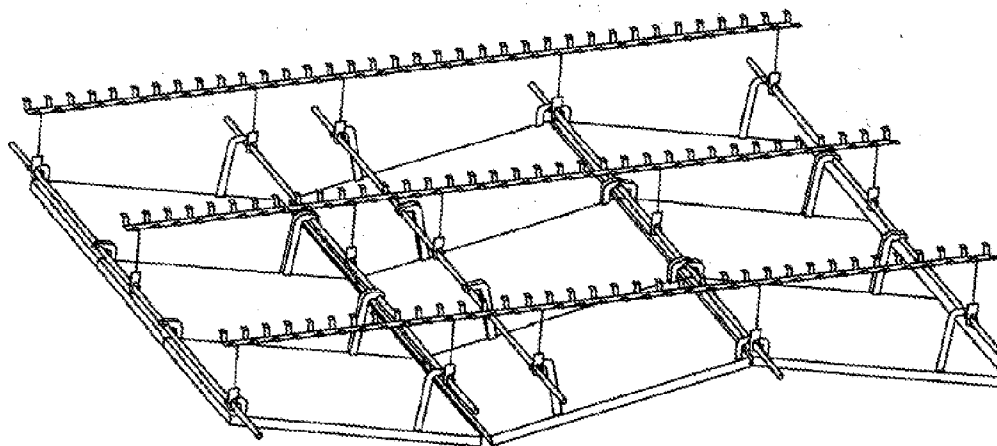
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(57) **ABSTRACT**

A device for fixing a tile to a structure, for example a supporting structure or an intermediate structure of a building, the fixing device having a suspension comprised of a threaded rod and a safety hook, a first end of the threaded rod being arranged so as to be connected to the structure, the safety hook being made integral with a second end of the threaded rod by a nut system; a tube retained in the safety hook, and a fastening hook fixed by a rigid connection on a platelet, the platelet arranged so as to be fixed to one main face of the tile, the fastening hook extending in a direction substantially perpendicular to the platelet, a free end of said fastening hook being shaped so as to be placed resting on the tube. The invention also relates to an associated suspended ceiling and to making non-planar suspended ceilings.



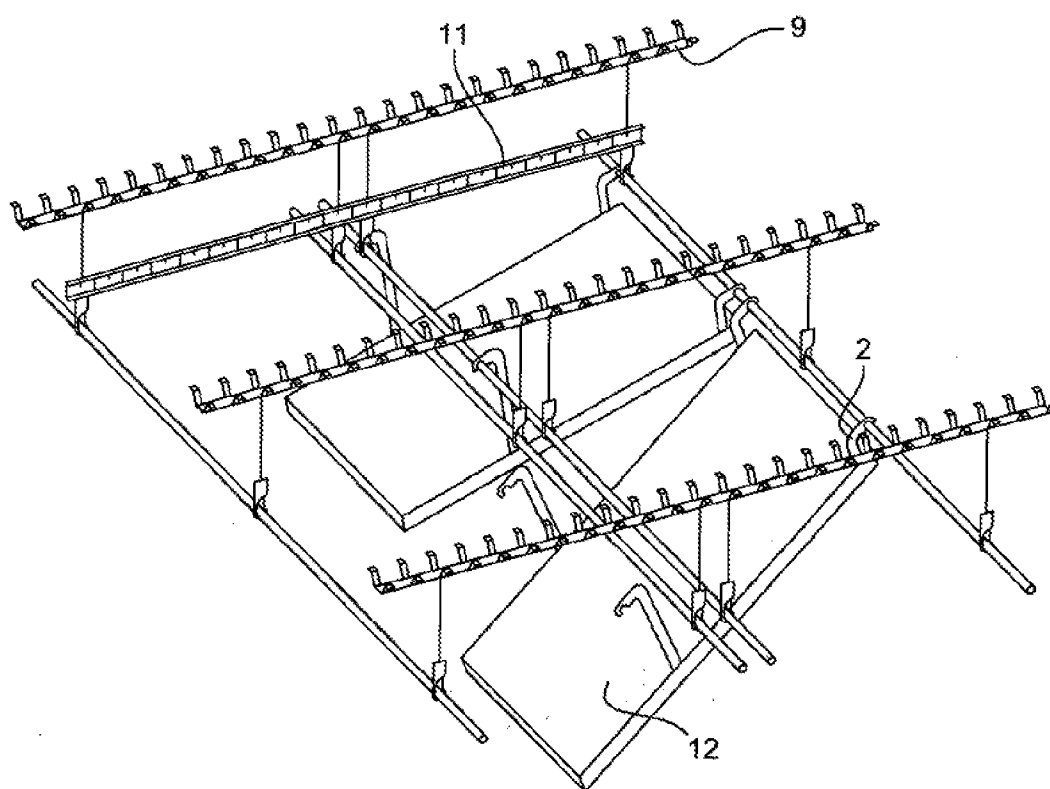
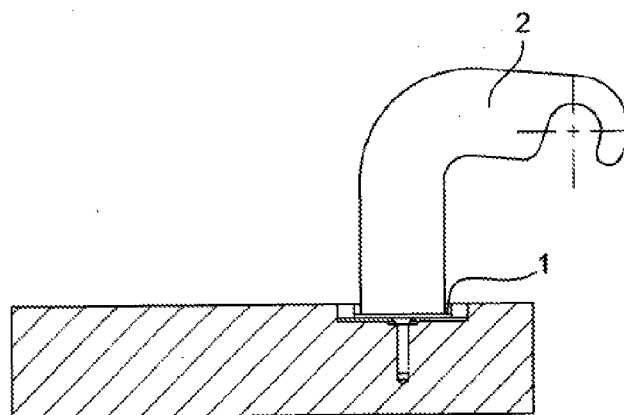
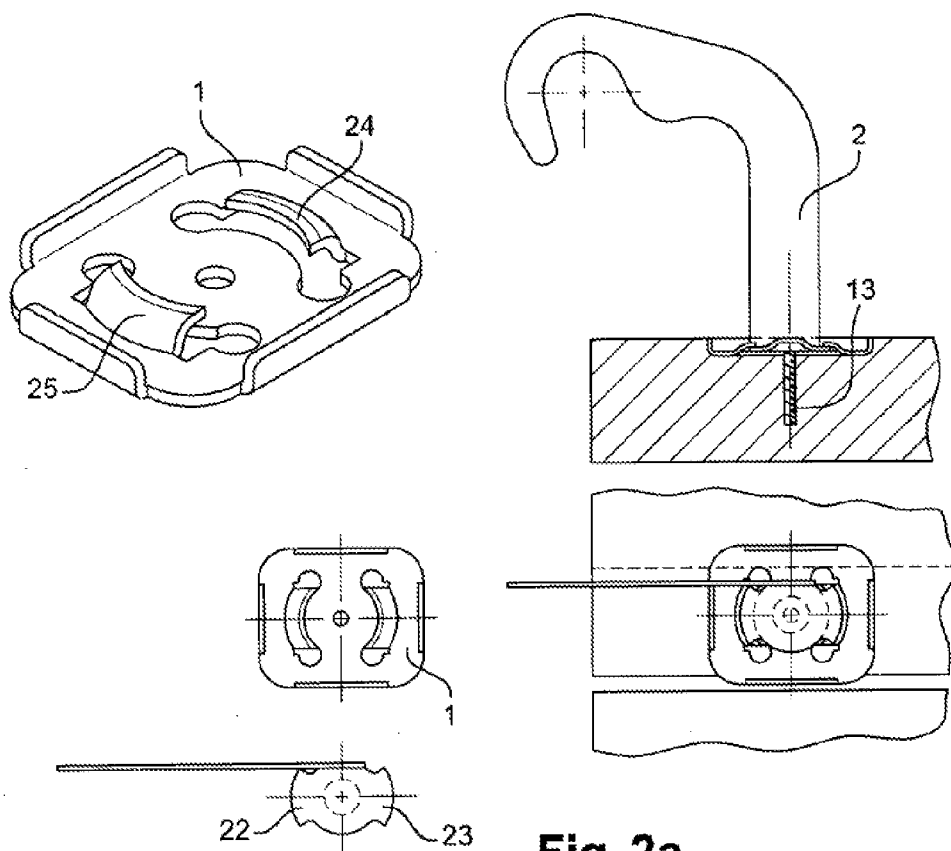


Fig. 1



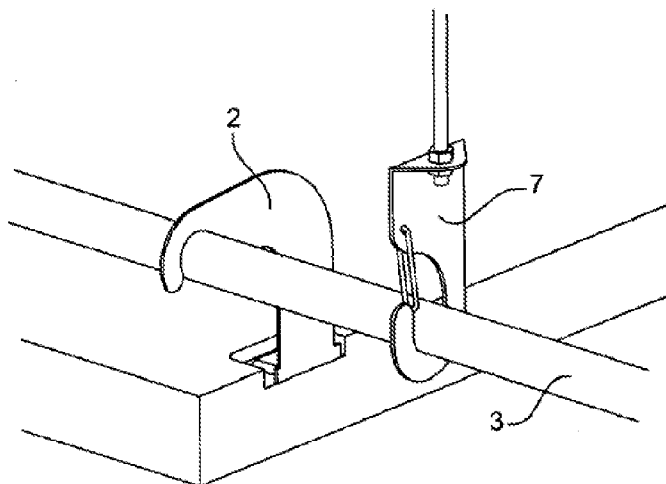


Fig. 3a

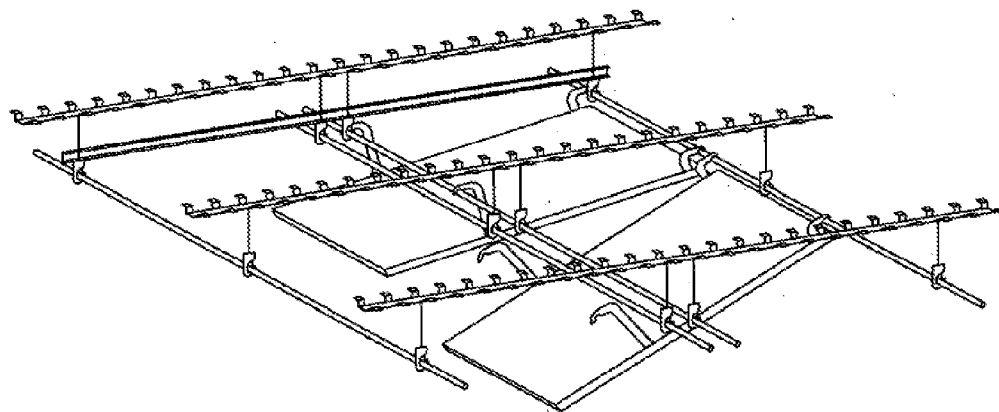


Fig. 3b

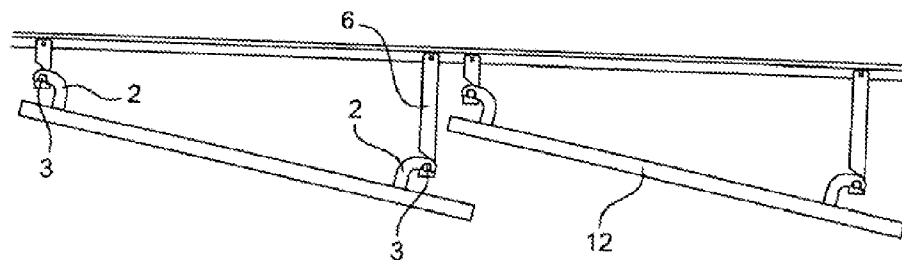


Fig. 4

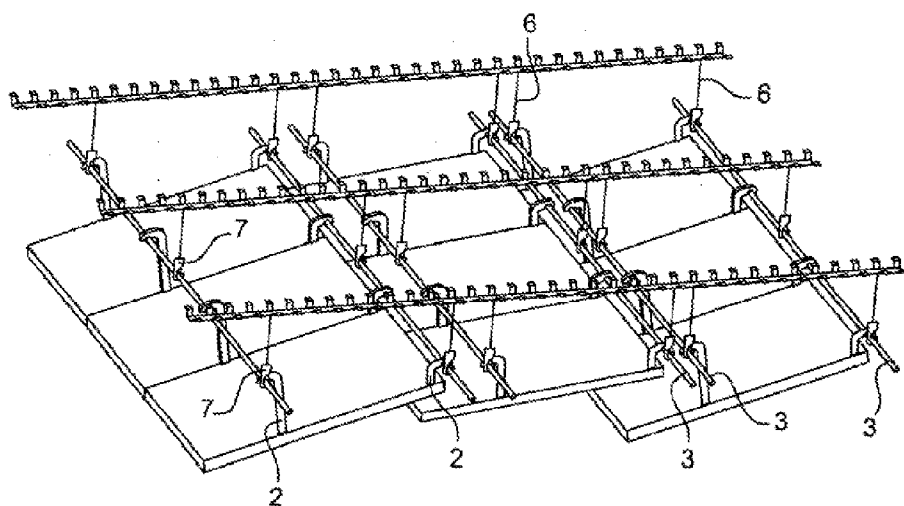


Fig. 5

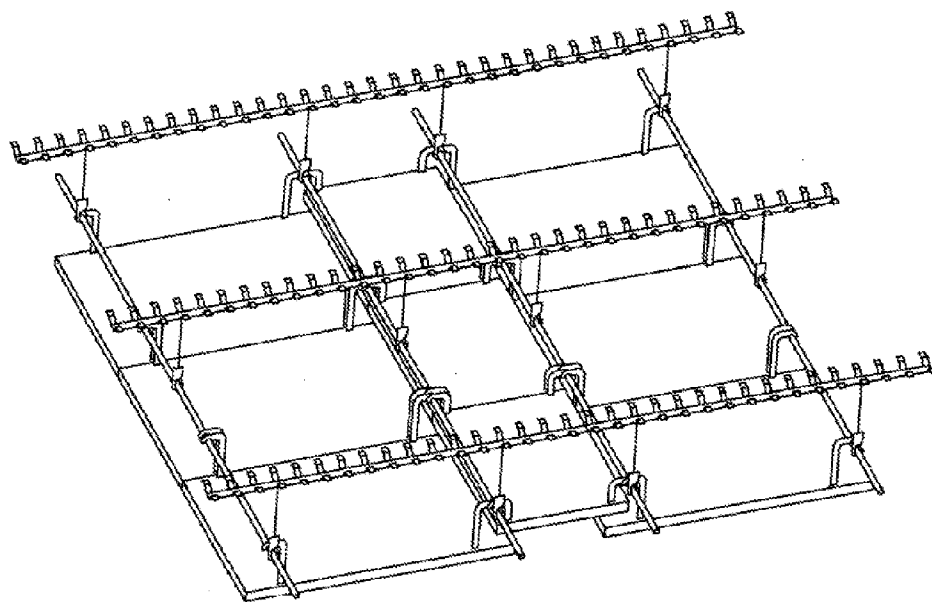


Fig. 6

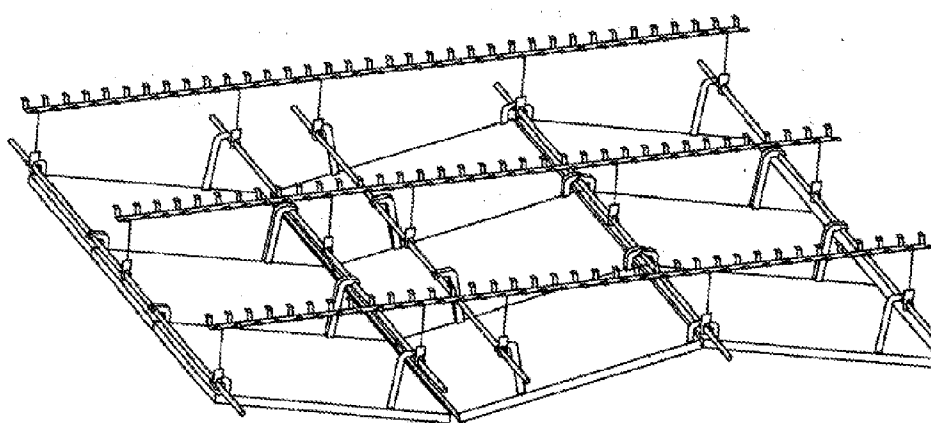


Fig. 7

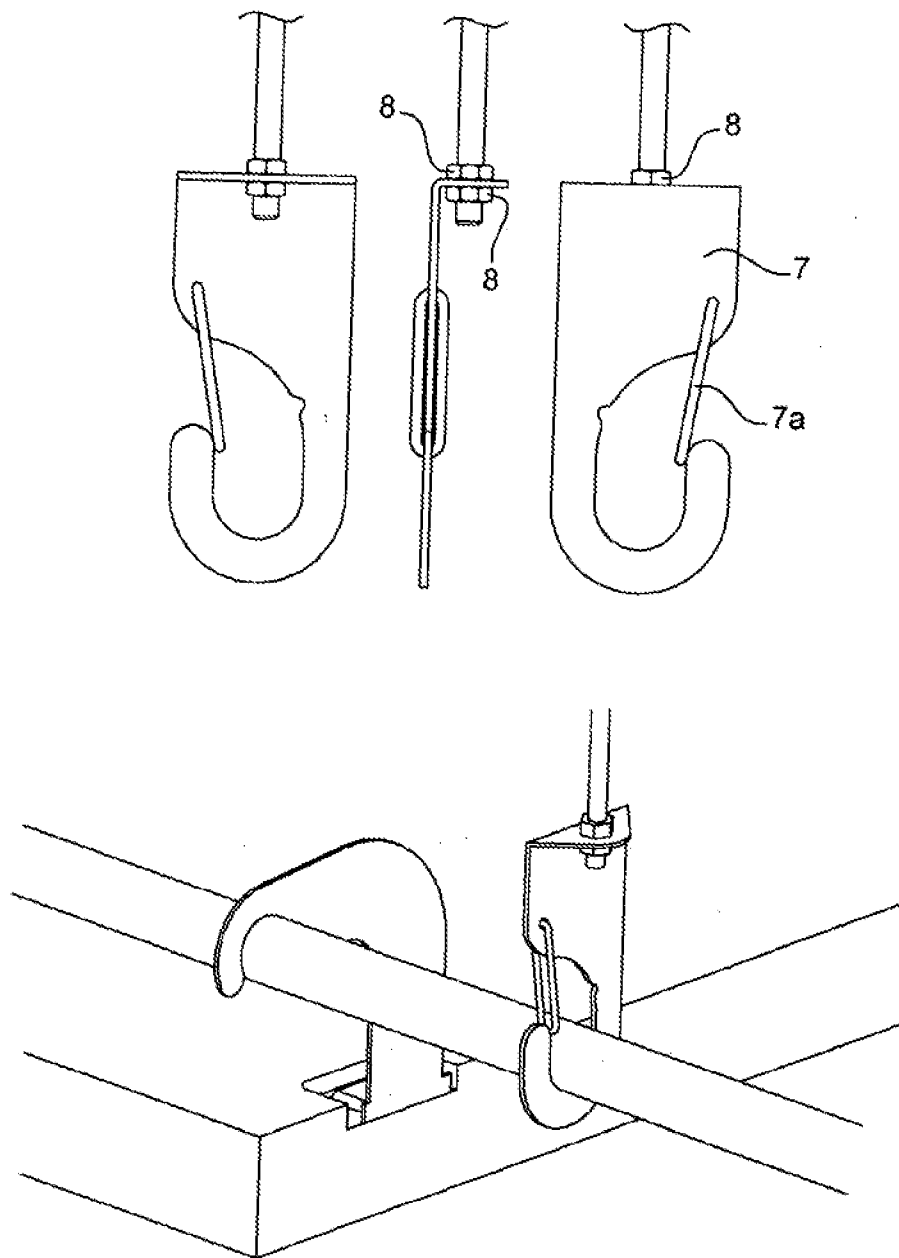


Fig. 8

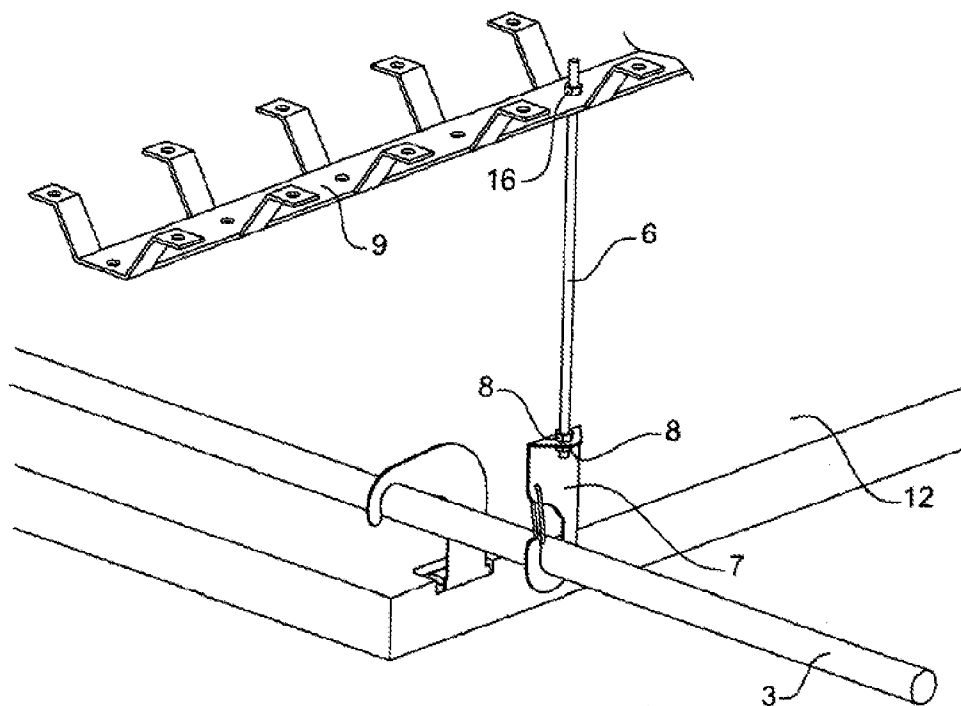


Fig. 9a

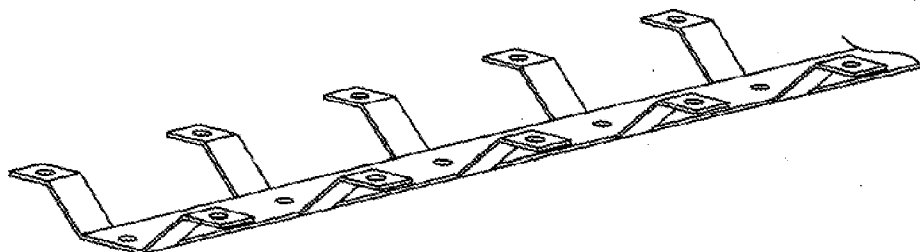


Fig. 9b

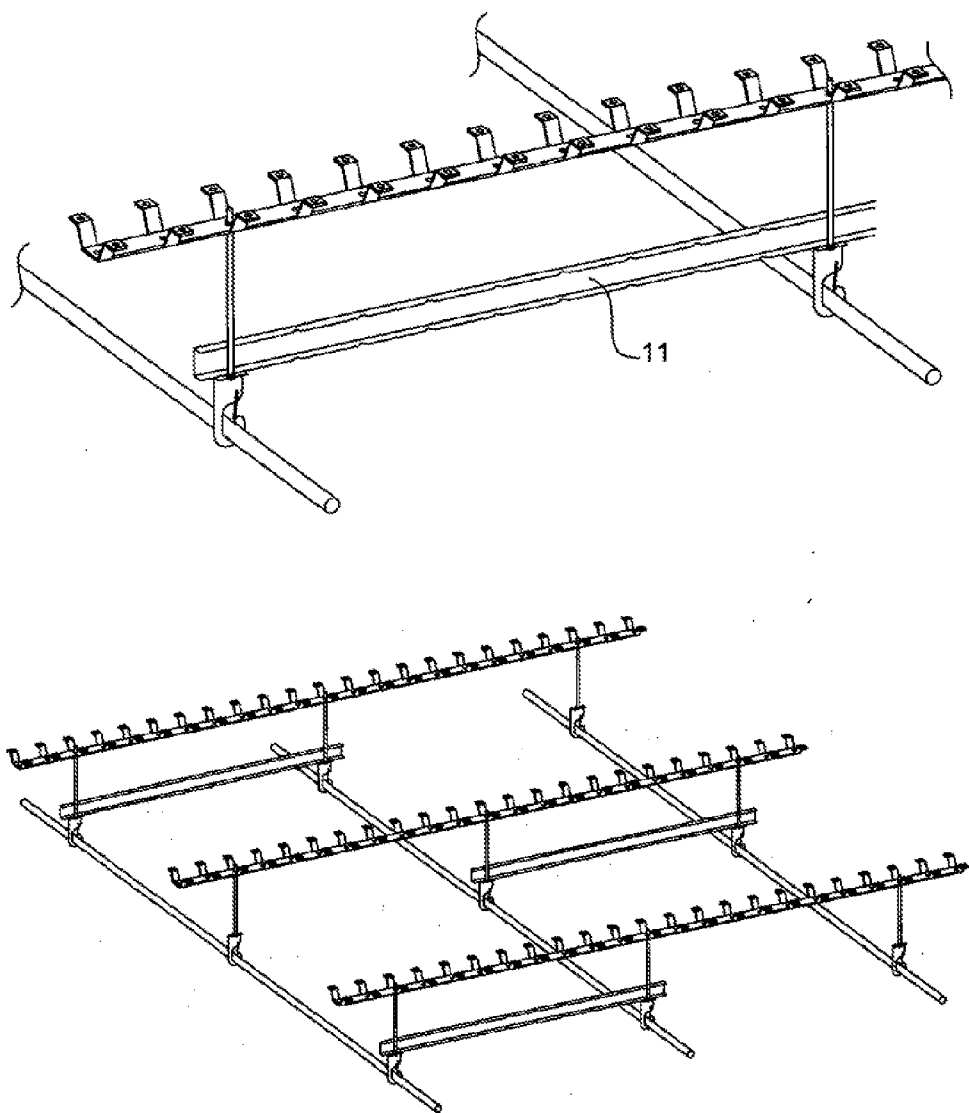


Fig. 10

**DEVICE FOR FIXING A TILE TO A
STRUCTURE, FOR EXAMPLE A
SUPPORTING STRUCTURE OR AN
INTERMEDIATE STRUCTURE OF A
BUILDING, AND CEILING SUSPENDED
FROM A STRUCTURE**

CROSS-REFERENCE TO RELATED U.S.
APPLICATIONS

[0001] Not applicable.

STATEMENT REGARDING FEDERALLY
SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

NAMES OF PARTIES TO A JOINT RESEARCH
AGREEMENT

[0003] Not applicable.

REFERENCE TO AN APPENDIX SUBMITTED
ON COMPACT DISC

[0004] Not applicable.

BACKGROUND OF THE INVENTION

[0005] 1. Field of the Invention

[0006] The invention relates to a device for fixing a tile to a structure, e.g. a supporting structure or an intermediate structure of a building and a ceiling suspended from such a structure. More specifically, the present invention relates to a complete system for installing and maintaining a suspended ceiling, which ensures an inclined positioning of the ceiling tiles and/or a positioning at different levels with respect to the horizontal plane, thereby providing a suspended ceiling that is not flat, but is volumetric, and that possesses an acoustic correction. This device permits to make a multitude of ceilings of different shapes and reliefs.

[0007] 2. Description of Related Art Including Information Disclosed Under 37 CFR 1.97 and 37 CFR 1.98.

[0008] A suspended ceiling has no structural function in a building. It has the following functions:

[0009] hiding the technical elements for supplying the room and/or the building, namely the various electrical cables, air conditioning ducts, water, air pipes, . . .

[0010] being easily fitted and removed, in order to permit the maintenance of these various technical elements

[0011] absorbing the noise, or more generally correcting the acoustics of a space by sound absorption or reflection, thanks to acoustic qualities specific to the materials used or to perforations or thanks to the shapes

[0012] reducing the ceiling height, in order to meet constraints of heating saving or aesthetical constraints

[0013] reflecting light

[0014] accepting accessories (lights, ventilation grids, fire-protection systems, smoke detectors, . . .)

[0015] A suspended ceiling (or false ceiling) is, according to the usual definition in the field of the building industry, a ceiling suspended by means of a suspension system or a frame or an edge profile fixed directly to a structure of a building (supporting structure such as a roof, beam or wall, or an intermediate fixing structure or also a true ceiling fixed to the supporting structure).

[0016] Concretely, a false ceiling is generally made of a plurality of flat tiles of small thickness (in the range of 1 to 3 cm) compared to the dimensions of their main faces (length, width in the range of a few dozen centimeters to a few meters), which tiles are positioned in one and the same plane in a grid-shaped supporting structure fixed to the supporting structure of the building.

[0017] So far, all existing installation systems permit to make flat false ceilings parallel to the horizontal surface of the floor. By way of an example, FR 1 424 561 discloses such a system for fixing tiles. The system comprises a plurality of rails having an inverted T-shaped cross-section. A foot of the T-shaped rail is aimed at being fixed to the supporting structure. The two legs of the T are aimed at receiving the edges of the tiles resting on them, which are then immobilized on the rail by leaf springs. Since the two legs of the T are flat and parallel, the false ceiling obtained is perfectly flat.

[0018] Many horizontal suspended ceilings also provide acoustic sound-absorption characteristics. Acoustic correction consists in changing the sound rendering of a room, in order to adapt it to its use. An acoustic absorption rate α_w (Alpha Sabine) between 0 and 1 is the value characterizing the performance of this sound absorption (1 being the optimal value). The most common solutions are the use of:

[0019] a porous material, which avoids the sound reflection; but such a material generates a non-negligible additional cost

[0020] perforations in the tiles, which allow noise not to be reflected towards the volume of the room; but such perforations do not allow any total or partial acoustic correction by reflection of sounds in one or more privileged directions.

[0021] There exist places where suspended ceilings with tile tilts, or ceilings with tiles arranged at different levels, have been installed in order to correct the acoustics of a space. They are implemented by specialists in the art, who use wire hanging systems, in which each tile is fitted separately and in which the lengths of the hooks are adjusted one by one (as in concert halls or movie theaters). But it is not common to mount this type of ceiling, because there is so far no standardized device ready for use to meet this kind of mounting for suspended ceilings. Yet there exists a real aesthetic and technical interest for such ceilings.

BRIEF SUMMARY OF THE INVENTION

[0022] The invention provides a novel device for fixing a tile to a structure, which novel device easily permits to fix tiles at varying heights and inclinations.

[0023] More specifically, the invention provides a device for fixing a tile to a structure, which device comprises:

[0024] a suspension means comprised of a threaded rod and a safety hook, a first end of the threaded rod being arranged so as to be connected to the structure, the safety hook being made integral with a second end of the threaded rod by means of a nut system,

[0025] a tube retained in the safety hook,

[0026] a fastening hook fixed to a rigid connection on a platelet, which platelet is arranged so as to be fixed to one main face of the tile, the fastening hook extending in a direction substantially perpendicular to the platelet, a free end of said fastening hook being shaped so as to be placed resting on the tube.

[0027] Under structure is understood herein a structure of a building such as a supporting structure (roof, framing, beam,

walls, etc. . . .), an intermediate structure secured to the supporting structure and aimed at bearing the false ceiling (namely in the case of a very high building), or even a real ceiling pre-existing in a building.

[0028] The main face of the tile is of course one of the large-size faces of the tile, the suspended ceiling tiles being generally flat, parallelepiped-shaped with a small thickness.

[0029] The use of a threaded rod to make the suspension means namely permits to easily adjust the height of the safety hook, and therefore of the tube. Moreover, each fastening hook is aimed at being fixed to one single tile, so that it is possible, namely by choosing fastening hooks of different lengths and/or by adjusting the height of each safety hook, to fix the tiles of the false ceiling fully independently from each other. Thus, by generating openings and original shapes, the device described herein permits, with tiles that are inclined and/or arranged at different levels, to trap the sound in these openings, in order to improve the acoustic absorption of the room and/or to return the sound in a privileged direction, in order to perform an acoustic correction.

[0030] Finally, as explained above, the tiles of a suspended ceiling should be removable, in order to permit the maintenance of the technical elements located at the back of the tiles. The fastening device presented also meets this requirement.

[0031] The invention thus provides a device for easy and standardized fixing of the tiles of a false ceiling independently from each other, namely with the following advantages:

[0032] ease of placing of each tile, independently from the adjacent tiles,

[0033] possibility of placing tiles of one and the same suspended ceiling independently from each other in different inclined positions and/or arranged at different levels with respect to the level of the floor, in order to generate an acoustic absorption and/or an acoustic reflection,

[0034] ease of removal of each tile, independently from the adjacent tiles.

[0035] According to one embodiment, the fastening hook has a flat main portion extending in a plane perpendicular to the platelet; the main portion of the fastening hook also extends in a plane substantially perpendicular to a longitudinal axis of the tube when the fastening hook is placed on the tube; and the end of the fastening hook has a notch having shapes and dimensions adjusted to the associated dimensions of a cross-section of the tube, in order to permit free rotation of the hook about the tube.

[0036] This specific shape of the hook has the advantage of being easy to make, by cutting the desired shape out of a flat material such as a metal sheet, for example. In addition, the specific shape of the notch of the free end of the fastening hook, in free rotation about the tube, facilitates the installation or removal of a tile, and also permits to position a tile easily according to a desired inclination.

[0037] According to one embodiment, the platelet comprises at least one through-recess permitting to fix the platelet to the main face of the tile by means of a screw. Thus, the platelet, which is flat by definition, can easily be fixed to the main flat surface of the tile. According to a variant, the main face of the tile can slightly be recessed locally, with a thickness at least equal to the thickness of the platelet, so that the platelet does not protrude with respect to the main face of the tile after its fixing.

[0038] The device according to the invention may also comprise a hooking rail formed so as to be made integral with

the structure, the hooking rail comprising at least one through-recess shaped so as to receive the first end of the threaded rod, the device also comprising a double nut for immobilizing the first end of the threaded rod in the recess of the hooking rail. The hooking rail facilitates the installation of the suspension means.

[0039] The device according to the invention may also comprise a spacer positioned above said safety hook and hooked directly to said threaded rod by friction, so as to permit to rigidify the whole of the fixing device, and impose a desired distance between the suspension means.

[0040] The invention also relates to a ceiling suspended from a structure, such as a supporting structure or an intermediate structure of a building, which suspended ceiling comprises a plurality of tiles suspended by one or several fixing devices as described above.

[0041] The advantages of the invention are essentially the ease and speed of installation (and dismantling) of such a ceiling, insofar as each tile is fixed independently from each other. Another advantage is the possibility of transforming very rapidly and easily a flat ceiling into a three-dimensional ceiling, by simply replacing one or several hooks, or inversely, transforming a three-dimensional ceiling into a flat ceiling, for example in order to punctually change the acoustics of a building.

[0042] The invention also relates to a ceiling suspended from a structure through fixing devices as described above. More specifically, the suspended ceiling comprises:

[0043] a plurality of suspension means, each suspension means being comprised of a threaded rod and a safety hook, a first end of the threaded rod of each suspension means being arranged so as to be connected to the structure, the safety hook of a suspension means being made integral with a second end of the threaded rod of said suspension means by means of a nut system,

[0044] a plurality of tubes comprising at least two tubes, each tube being maintained in a substantially horizontal position in the safety hook of at least two suspension means,

[0045] a plurality of tiles comprising at least two tiles,

[0046] a plurality of fastening hooks, at least two hooks per tile, a first free end of each fastening hook being placed on a tube and a second end of each fastening hook being fixed by means of a rigid connection to a main face of one single tile, each fastening hook extending in a direction substantially perpendicular to the main face of the tile, which it is fixed to,

[0047] at least two suspension means having different lengths and/or at least two fastening hooks having different lengths, so that at least two tiles extend in different planes.

[0048] Thus, by choosing appropriate lengths of the suspension means and/or appropriate lengths of the fastening hooks it is possible to make a multitude of different suspended ceilings, in particular a suspended ceiling with tiles in inclined positions or positioned at different levels.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] The invention will be better understood, and other features and advantages of the invention will become clear from the following description of exemplary fixing devices and suspended ceilings according to the invention. These

examples are given by way of non-restrictive examples. The description should be read in conjunction with the attached drawings, in which:

[0050] FIGS. 1 and 3*b* show different suspended ceilings according to the invention, in the phase of installation,
[0051] FIGS. 2*a*, 2*b*, 3*a*, 8-10 are detail views of the elements of the fixing device according to the invention,
[0052] FIGS. 4 to 7 show different suspended ceilings according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0053] As stated above, a tile-fixing device according to the invention essentially comprises:

[0054] a suspension means comprised of a threaded rod (6) and a safety hook (7), a first end of the threaded rod being arranged so as to be connected to the structure, the safety hook being made integral with a second end of the threaded rod (7) by means of a nut system (8),

[0055] a tube held in the safety hook (7),

[0056] a fastening hook fixed by means of a rigid connection to a platelet, which platelet is arranged so as to be fixed to a main face of the tile, the fastening hook extending in a direction substantially perpendicular to the platelet, a free end of said fastening hook being shaped so as to be placed resting on the tube.

[0057] In an improved embodiment, the tile-fixing device is comprised of a set of 5 families of parts that connect to each other and permits to meet the constraints for mounting a suspended ceiling with the above-described features (FIG. 1).

[0058] The platelet (1) and the fastening hook (2)

[0059] The tube (3), the stud (4) and the end supports (5)

[0060] The suspension means comprised of a threaded rod (6), a fastening hook (7) and nuts (8)

[0061] The hooking rail (9) and a double nut (10)

[0062] The spacer (11)

[0063] The fixing device is described below starting from the tile towards the ceiling.

[0064] Onto the ceiling tile (12) is hooked the family of platelet parts (1) and the fastening hook (2). The platelets are fixed to the tile by means of screws (13). A hook (2) is positioned by means of a rigid connection in each platelet and thus ensures the placing and maintaining in position of the hook (FIG. 2*a* and FIG. 2*b*).

[0065] The free end of the fastening hooks (2) is placed on the tubes (3) located above and on each side of the platelet (FIG. 3*b*), thus ensuring the placing and maintaining in position of the tile (12). This pivotal connection between the hooks and tubes permits to create the inclination of each tile (FIG. 3*a*). This inclination can be achieved by positioning identical fastening hooks (2) on the tubes (3) arranged on safety hooks (7) of different lengths, thus permitting to generate different heights on each side of the tile (FIG. 4) and/or by positioning on tubes located at a same height fastening hooks (2) of different dimensions (FIG. 5).

[0066] The tube (3) is a part that is absolutely necessary for the device and plays a major role in obtaining the inclinations of the tiles and in their ease of installation. Indeed, the rounded shape of the tube in connection with the rounded shape of the free end of the fastening hook (2) participates in the ease of installation of these tiles, because it allows to suspend first of all a first side of the tile by means of two hooks, then to raise the whole tile by rotating about the axis of the tube already stressed before placing the last two hooks on the tube in front of each other (FIG. 3*b*).

[0067] The suspended ceilings with tiles arranged at levels of different heights are made by positioning tubes at different heights thanks to threaded rods (6) of different heights or by using hooks of different heights for each tile (FIG. 6). The device also permits to combine these two principles of hooking

[0068] In order to make long lengths of tube, a connecting stud (4) can be added to the device and permit to connect two tubes together by means of a rigid connection. End supports (5) permit to place and fix these tubes at their ends to the walls. The stud (4) is not necessary if one tube is used to make the desired length of tube. Likewise, the end supports are not necessary in the absence of walls, or if the rigidity of the assembly is sufficient.

[0069] The suspension means comprised of a threaded rod (6), a safety hook (7) and nuts (8) permits to suspend the tubes (3). The safety hooks, each fixed to the ceiling by means of a threaded rod, receive the tubes. The connection between the hook and the threaded rod is made by a thread, which permits accurate adjustments through nuts during the placing of the tiles (alignment, flatness, . . .). The tube can slide slightly transversely on the hooks, in order to allow for adjustments. The non-return spring provided for on the hook (7) prevents the tube (3), after installation in the safety hook, from emerging during the various handlings of the tiles, in particular during a removal of these tiles (FIG. 8).

[0070] The threaded rod (6) is, in turn, suspended from the ceiling on the hooking rail (9) by a double-nut system or directly in the structure of the ceiling (concrete, wood, primary grid, . . .). The double nut permits to make coarse adjustments between the ceiling and the tiles (and to compensate for unevenness of the ceiling), the nuts (8) on the safety hook permitting to accurately finalize these settings (FIG. 9*a*).

[0071] The hooking rails (9) facilitate the placing of the suspension means. Indeed, in order to quickly fix the whole of the suspension means after the mounting of each ceiling, the hooking rail permits to arrange visual marks on the ceiling. They also serve as a guide for making the perforations that maintain them. They facilitate the visualization of difficult areas (lack of flatness, of material, . . .) by permitting to fix the threaded rod (6) of the suspension means directly to the structure of the building. They ensure maintaining as adequate as possible the distances required between the suspension means (FIG. 9*b*). The hooking rails are, however, not absolutely necessary; the suspension means can also be fixed directly to the structure.

[0072] The spacers (11) are positioned above the safety hooks. They include a series of notches distributed along the spacers, in which the threaded rods of the suspension means can be inserted by force. The spacers thus hook directly on the threaded rods by friction (FIG. 10). They permit to rigidify the whole of the fixing device creating a grid that definitely imposes the distances between the threaded rods (6), namely when they are long (at most 2 meters long, which limit is generally imposed by the safety standards in the building industry). They are fixed at their ends to the walls and can also be used as supports for light materials (insulation, . . .). The spacers are, however, not absolutely necessary, namely when the assembly of suspension means and tubes is sufficiently rigid for the application being contemplated.

[0073] FIG. 1 shows a general view of the device of the invention with all the parts in place. The hooking rails (9) are fixed to the ceiling of the building, the threaded rods (6) are

held by a double nut (10) on these rails. The safety hooks (7) fixed by two nuts (8) to the threaded rod (6) permit to position the tubes (3) in the plane of mounting of the ceiling. The tiles (12) are hooked to these tubes by means of hooks (2) that are, in turn, fixed to the tile by means of platelets (1).

[0074] The FIGS. 2a and 2b represent an example of platelet (1) held by means of a screw (13) on a tile, and an example of hook (2), which together permit to make the connection between the tile (12) and the tube (3), and which permit namely the inclination of the tile and/or the positioning in a plane different from the plane of an adjacent tile. The platelet 1 is a plate, for example cut out of a metal sheet of small thickness (1 to 3 millimeter, for example), fixed flat to the main face of the tiles by means of one or several screws (13). In the example shown, a recess of at least the same thickness is provided for in the main face of the tiles, so that the platelet does not protrude beyond the main face of the tile. This facilitates namely the stacking and the storage of the tiles against each other before being used. The hook 2 is also cut out of a plate of small thickness (1 to 3 millimeter, for example). The hook comprises a free end, the inner cut-out (21) is adapted to the diameter of the tubes (3) in order to permit a rotation about the tubes, but without excessive backlash. Thanks to its shape, the free end of the hook contributes to generating the pivotal connection with the tube (3) and to facilitating the installation, as well as the removal, if necessary. The hook also comprises a second, so-called locking end terminated by a foot bent at right angles with respect to the axis of the hook and having two fins (22, 23). The platelet comprises two hollow fins 24, 25, having the same diameters as the fins of the foot of the hook. The hook is made integral with the platelet as follows: the foot of the hook is inserted into the hollow fins of the platelet, then the fins of the foot of the hook are moved by a rotation of the hook towards the inside of the hollow fins 24, 25 of the platelet, where the fins 22, 23 of the foot of the hook are mechanically immobilized in the hollow fins 24, 25 of the platelet. The hook can be unlocked and removed simply through a reverse rotation. This embodiment of the platelet and the hook is advantageous because:

[0075] the platelets can be fixed to the tiles well upstream, for example at the factory during the manufacture of the tiles,

[0076] the tiles and the hooks can be stored independently from each other, and their flat shapes facilitate the storage,

[0077] the mounting of the hooks is very simple and fast, and can be performed at the last moment, when installing the false ceiling.

[0078] FIG. 3a shows the arrangement of the device at the level of the hook (2), the tube (3) and of the safety hook (7): the shape of the hook (2) permits a pivotal connection on the tube (3), which facilitates the mounting (and removal of the tiles), as it is done in two stages, as shown in FIG. 3b.

[0079] FIG. 4 and FIG. 5 show two possible models of possible mounting of a suspended ceiling with inclined tiles. FIG. 6 and FIG. 7 show two further possible models of mounting of a suspended ceiling with tiles this time arranged at different levels. FIGS. 4 to 7 highlight the multitude of mounting ways of a ceiling the device permits to make starting from our standardized device. FIG. 8 shows a model of a suspension means with its safety hook (7), non-return principle (7a), which ensures the maintaining of the tube in the hook, namely during the removal of the tiles, and the adjust-

ing nuts (8). FIG. 9a shows the device for hooking on the ceiling with its two-level adjusting systems. FIG. 9b is an example of a model of a hooking rail.

[0080] FIG. 10 shows the spacer (11), which permits to rigidify the whole of the device and can bear light equipment.

1. Device for fixing a tile to a structure, for example a supporting structure or an intermediate structure of a building, which fixing device is characterized in that it comprises:

- a suspension means comprised of a threaded rod and a safety hook, a first end of the threaded rod being arranged so as to be connected to the structure, the safety hook being made integral with a second end of the threaded rod by means of a nut system;

- a tube retained in the safety hook; and

- a fastening hook fixed by means of a rigid connection on a platelet, which platelet is arranged so as to be fixed to one main face of the tile, the fastening hook extending in a direction substantially perpendicular to the platelet, a free end of said fastening hook being shaped so as to be placed resting on the tube.

2. Device for fixing a tile according to claim 1, wherein the fastening hook has a flat main portion extending in a plane perpendicular to the platelet, the main portion of the fastening hook extending also in a plane substantially perpendicular to a longitudinal axis of the tube when the fastening hook is placed on the tube, and wherein the free end of the fastening hook has a notch having shapes and dimensions adjusted to associated dimensions of a cross-section of the tube, in order to permit a free rotation of the hook about the tube.

3. Device according to claim 1, wherein the platelet comprises at least one through-recess permitting to fix the platelet to the main face of the tile by means of a screw.

4. Device for fixing a tile according to claim 1, wherein said safety hook is provided with a non-return system capable of guaranteeing the maintaining of the tube in the safety hook.

5. Device for fixing a tile according to claim 1, comprising a stud shaped so as to connect two tubes by means of a rigid connection.

6. Device for fixing a tile according to claim 1, including end supports permitting the placement and fixing of said tube to walls at its ends.

7. Device for fixing a tile according to claim 1, including a hooking rail shaped so as to be made integral with the structure, the hooking rail comprising at least one through-recess shaped so as to receive the first end of the threaded rod, the device also comprising a double nut for immobilizing the first end of the threaded rod in the recess of the hooking rail.

8. Device for fixing a tile according to claim 1, including a spacer positioned above said safety hook and directly hooked to said threaded rod by friction, so as to permit to rigidify the whole of the fixing device.

9. Ceiling suspended from a structure, e.g. a supporting structure or an intermediate structure of a building, which suspended ceiling comprises a plurality of tiles suspended by means of a fixing device according to claim 1.

10. Ceiling suspended from a structure, e.g. a supporting structure or an intermediate structure of a building, which suspended ceiling comprises:

- a plurality of suspension means, each suspension means being comprised of a threaded rod and a safety hook, a first end of the threaded rod of each suspension means being arranged so as to be connected to the structure, the safety hook of a suspension means being made integral

with a second end of the threaded rod of said suspension means by means of a nut system (8);
a plurality of tubes comprising at least two tubes, each tube being maintained in a substantially horizontal position in the safety hook of at least two suspension means;
a plurality of tiles comprising at least two tiles;
a plurality of fastening hooks, at least two hooks per tile, a first free end of each fastening hook being placed on a tube and a second end of each fastening hook being fixed by a rigid connection to a main face of one single tile, each fastening hook extending in a direction substantially perpendicular to the main face of a single tile, which it is fixed to; and
at least two suspension means having different lengths and/or at least two fastening hooks having different lengths, so that the two tiles extend in different planes.

* * * * *