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(54) **CEILING WITH STABILIZING FRAME**

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(57) **ABSTRACT**

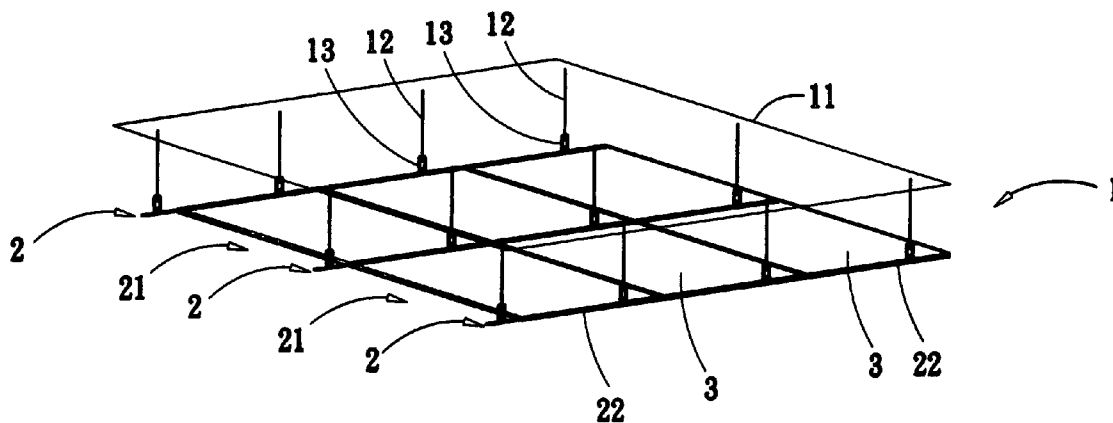
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A ceiling with stabilizing frame 1 comprises a frame, a plurality of ceiling plates, and a plurality of fastening devices. Each of the fastening devices is placed at an inner side of one of the side plates of one of the ceiling plates and has a threaded hole. The frame has a plurality of mounting bars, which are connected with cover plates of the ceiling plates on upper sides thereof by holding screws, which are respectively engaged with the threaded holes of the fastening devices. Thereby load on the ceiling plates is spatially distributed, so that an increased maximum load and an enhanced lifetime of the ceiling is achieved.

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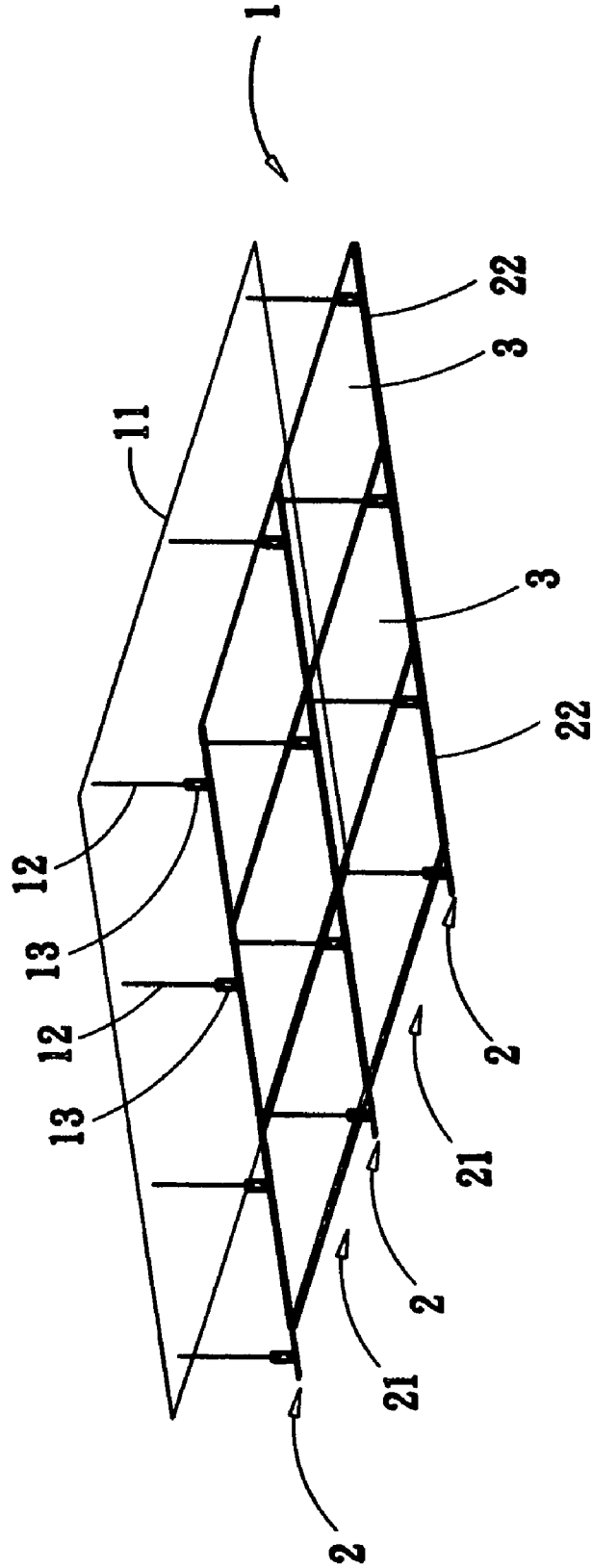


FIG 1

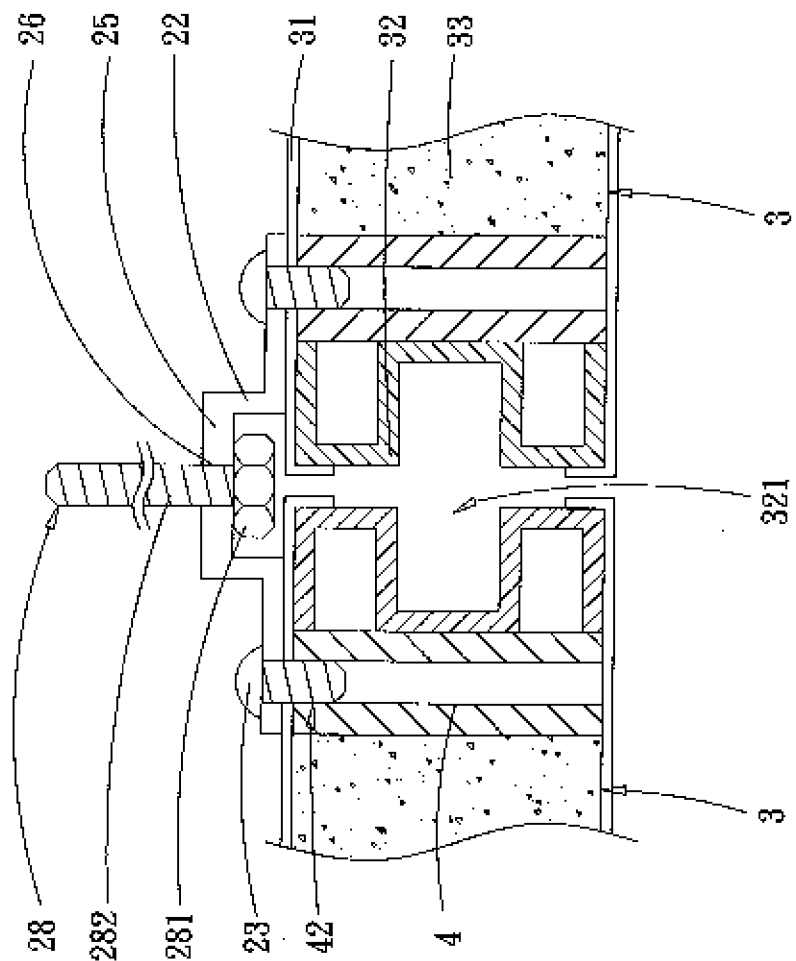


FIG 2

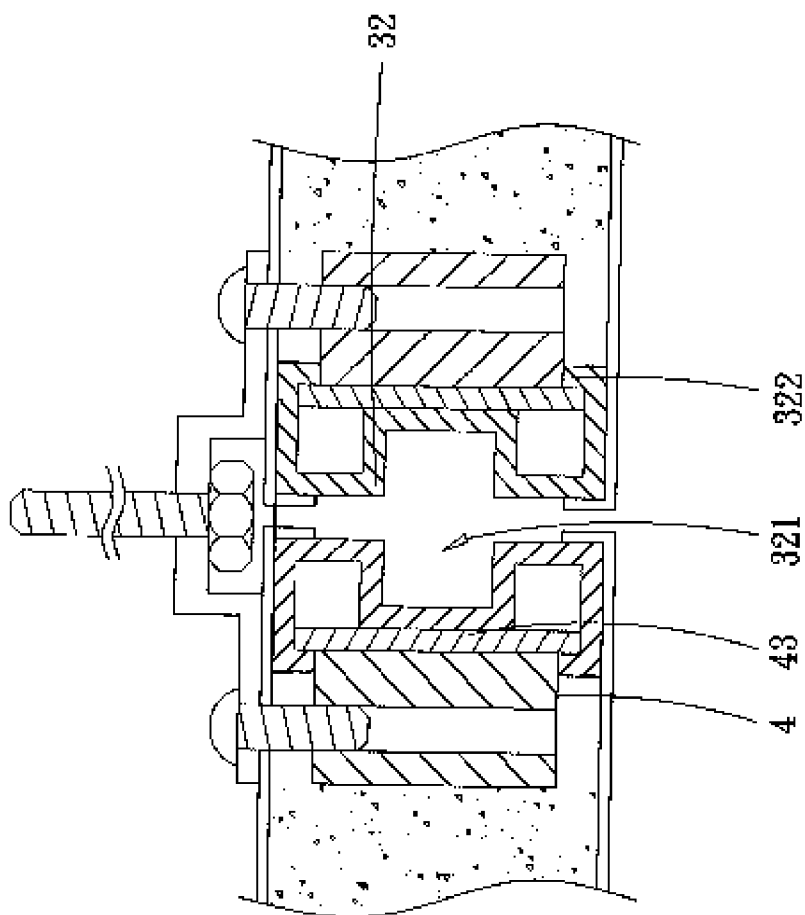


FIG 3

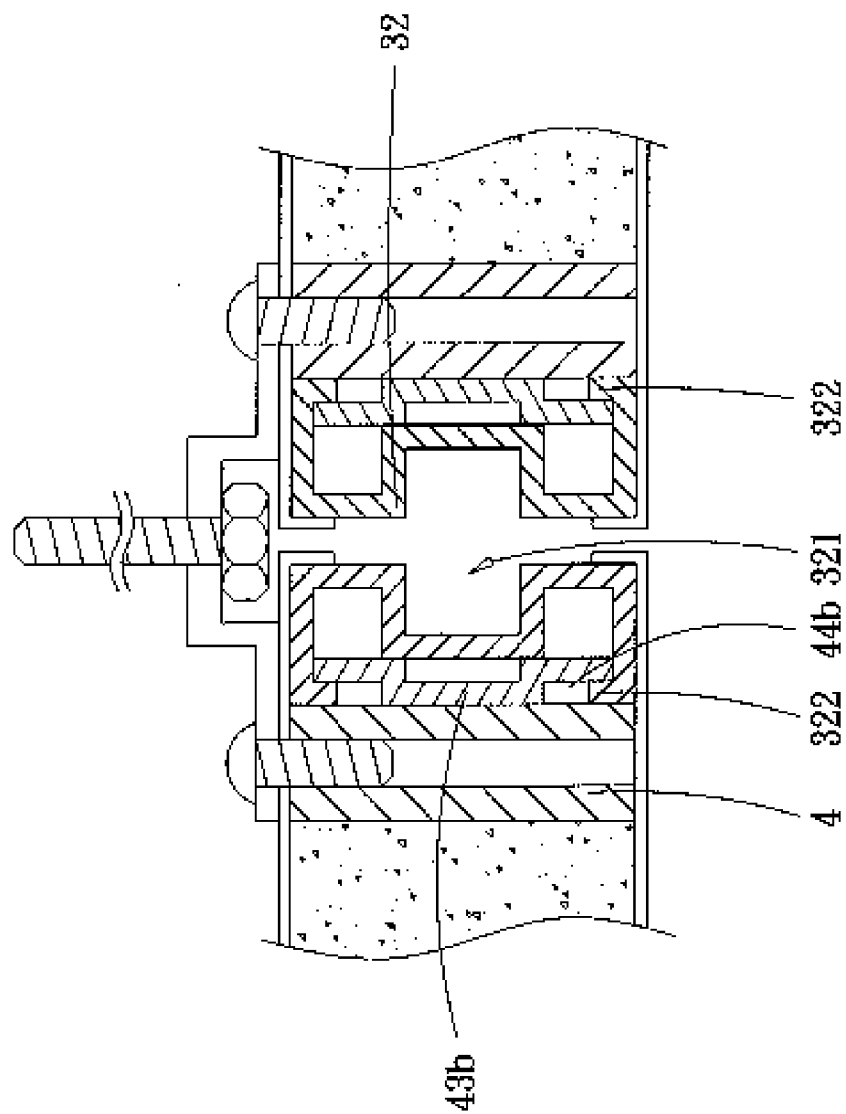


FIG 4

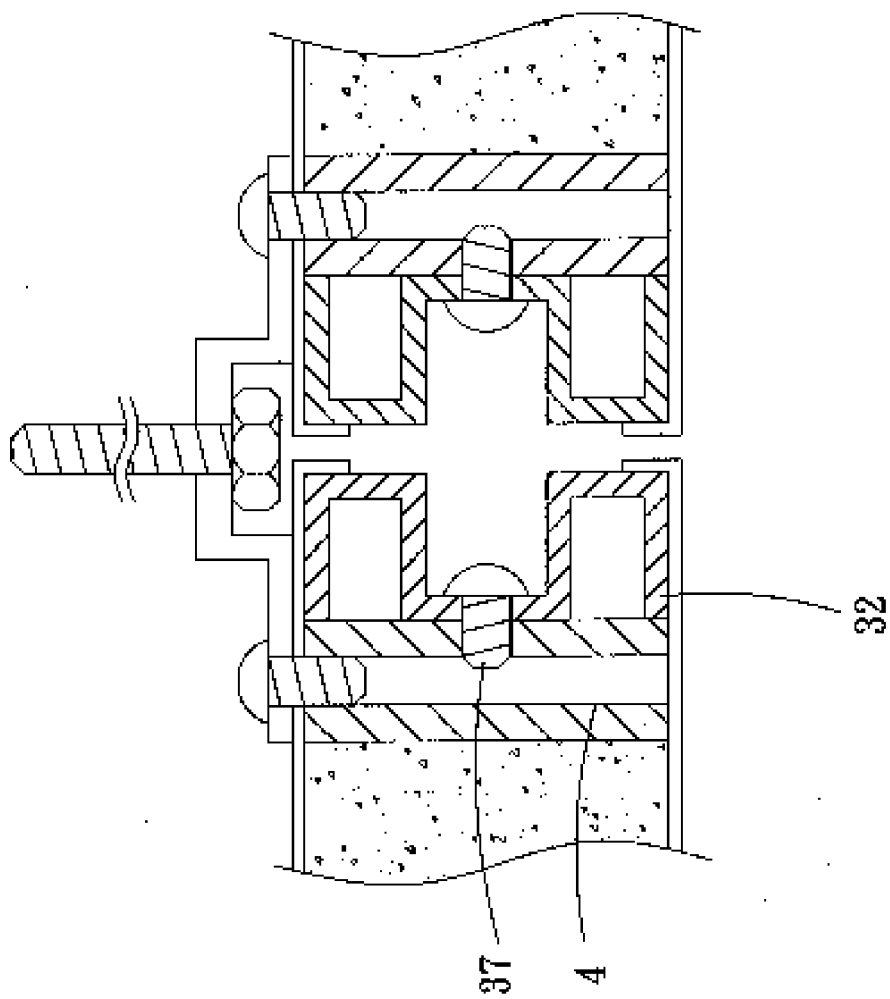


FIG 5

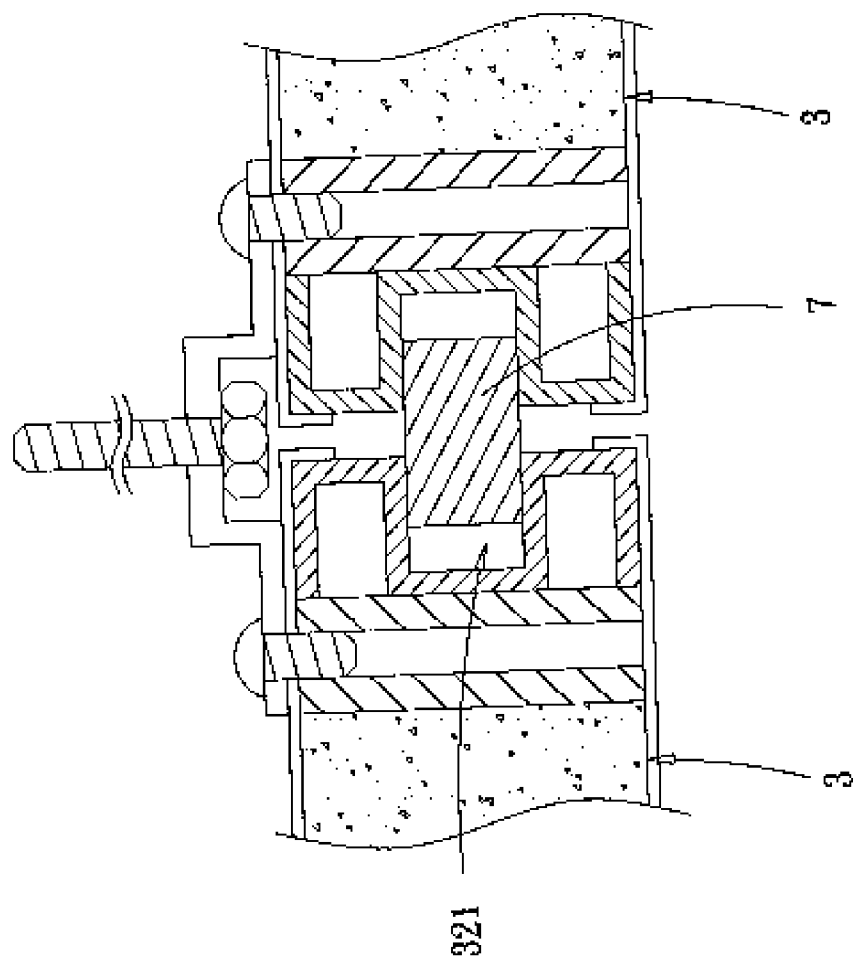


FIG 6

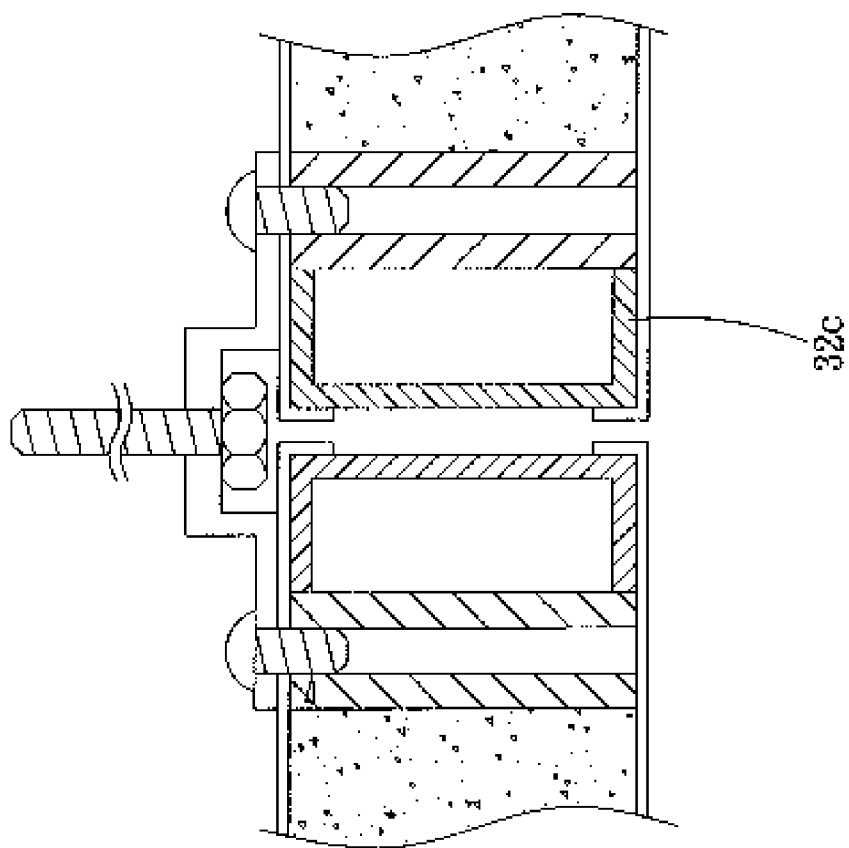


FIG 7

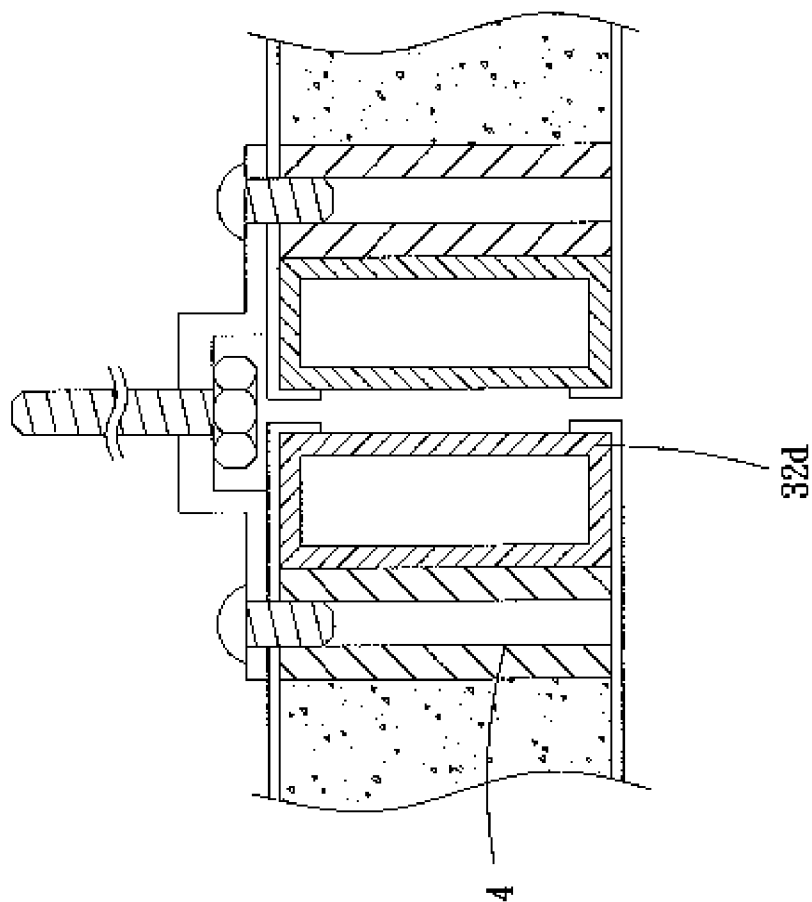


FIG 8

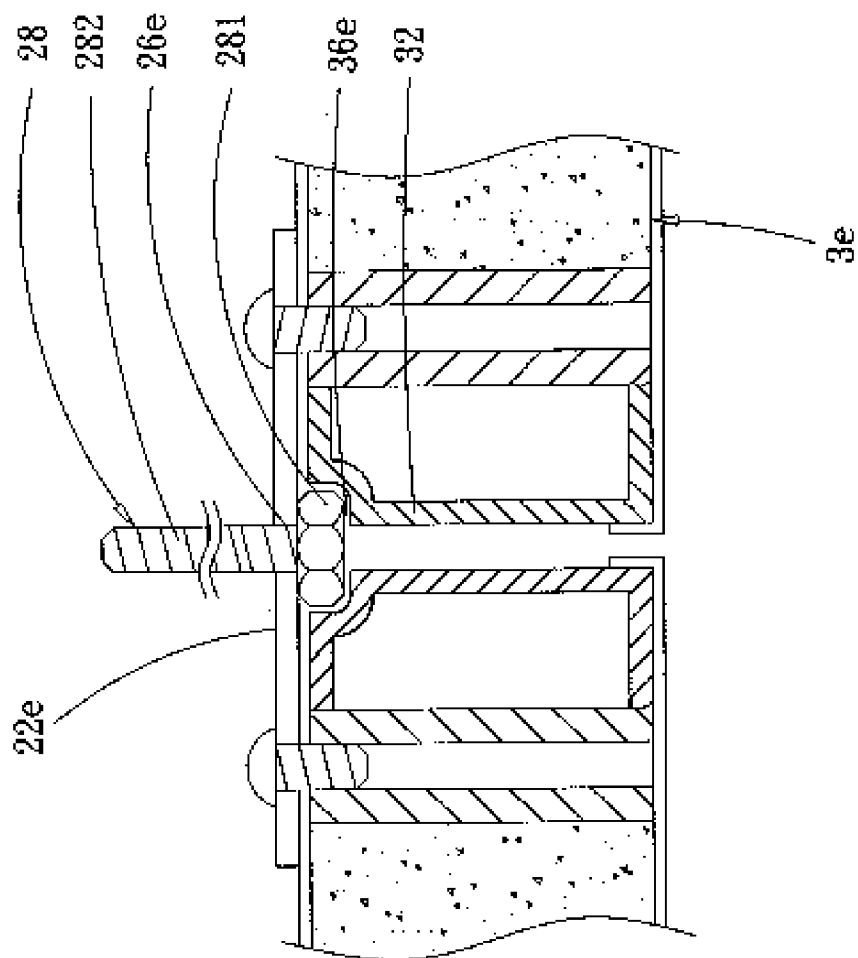


FIG 9

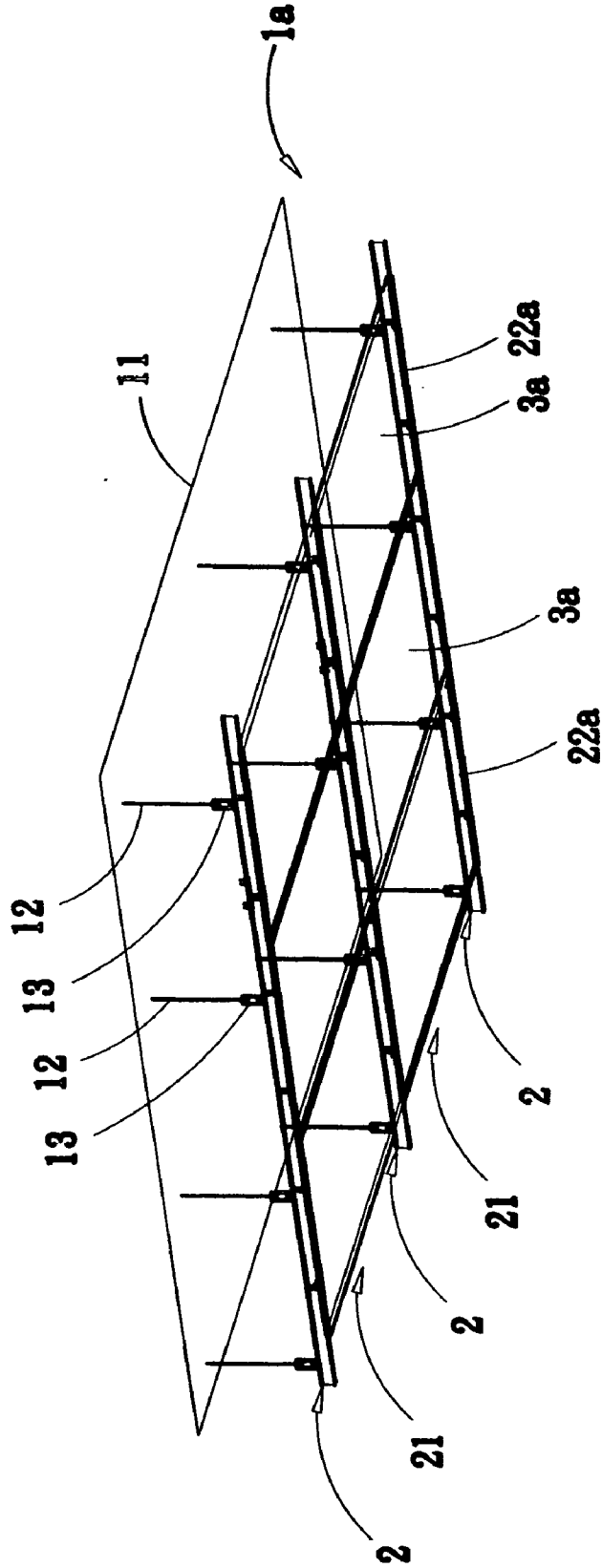


FIG 10
(PRIOR ART)

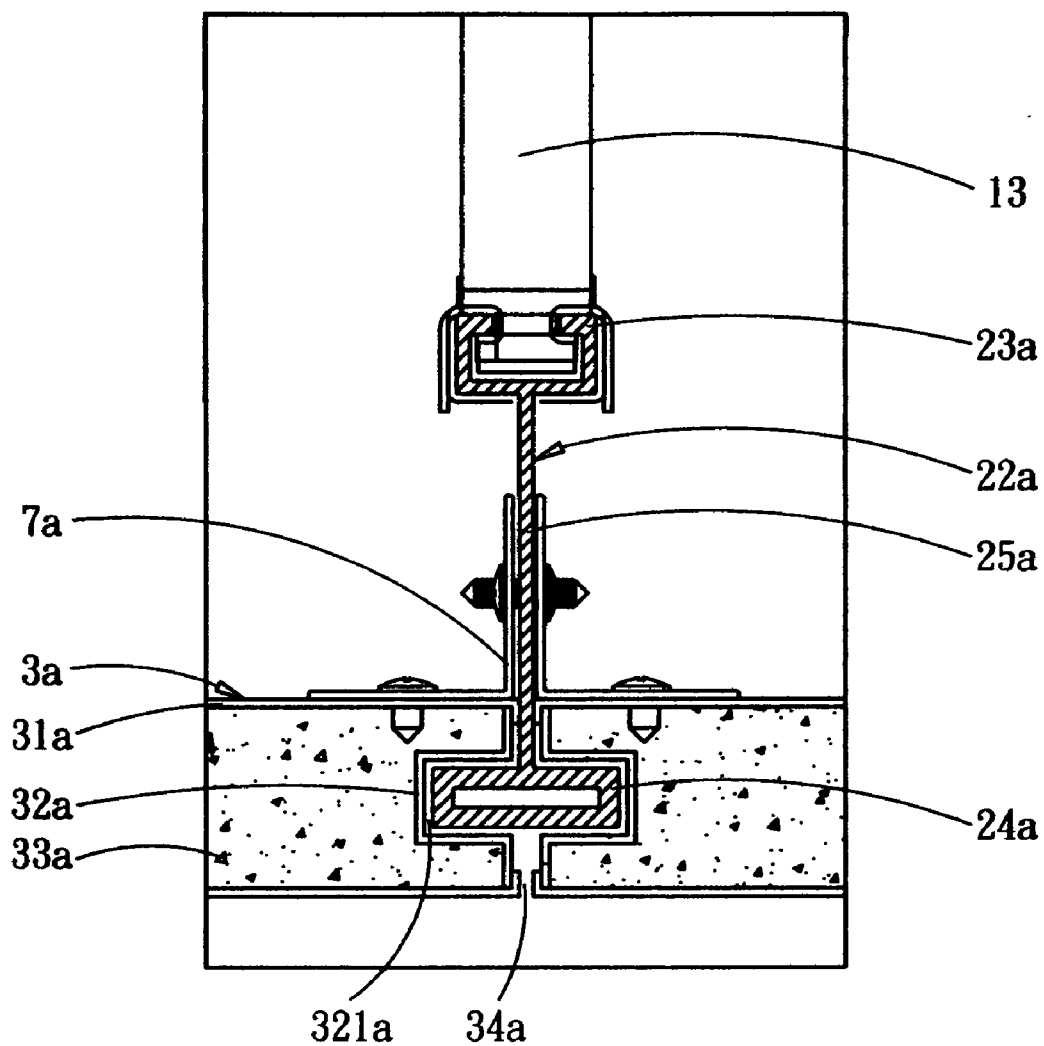


FIG 11
(PRIOR ART)

CEILING WITH STABILIZING FRAME

FIELD OF THE INVENTION

[0001] The present invention relates to a ceiling with a stabilizing frame, particularly to a ceiling with a stabilizing frame that is invisible and assembled using bolts.

BACKGROUND OF THE INVENTION

[0002] In a clean room, commonly a ceiling is used which has ceiling plates mounted on a frame. Since the frame is exposed, dust and dirt easily gather thereon, creating a hygienic problem.

[0003] As shown in FIGS. 10 and 11, for solving above problem, a ceiling 1a with a frame that is assembled using bolts has been constructed, comprising an upper structure 11, a frame 2, a plurality of ceiling plates 3a, and a plurality of mounting plates 7a. The upper structure 11 is mounted on structural parts of a building, e.g., a concrete floor or a steel plate, and has a plurality of suspension rods 12 and a plurality of height-adjusting devices 13 having height-adjustable lower ends. The frame 2 is suspended on the upper structure 11, having a plurality of horizontal mounting bars 22a, with spaces 21 left between neighboring mounting bars 22a. Each mounting bar 22a has a cross-section of the shape of a wine glass and has an upper edge, of a cross-section like the letter C, which is fastened to lower ends 23a of the height-adjusting devices 13, a lower edge 24a and a connecting plate 25a. Each of the ceiling plates 3a has two cover plates 31a, at least two side plates 32a and filling material 33a, inserted between the cover plates 31a and the side plates 32a. Neighboring ceiling plates 3a are mounted at mutual distances 34a. Each ceiling plate 3a occupies one of the spaces 21 between the mounting bars 22a. Each of the side plates 32a has a groove 321a that fits on one side of the lower edge 24a of one of the mounting bars 22a. Each of the mounting plates 7a is shaped like the letter L and fastened to one of the mounting bars 22a as well as to one of the ceiling plates 3a on an upper side thereof. Thereby, the ceiling plates 33a are mounted at roughly equal heights, so that hygienic problems are largely avoided.

[0004] For performing installations above the ceiling plates, it is occasionally necessary to have human workers to wall thereon, so that maximum allowed load thereof is important. In conventional art, however, as described above, the ceiling plates 3a are carried by the frame 2 via the mounting plates 7a only, which are relatively small, so that load is concentrated on small areas. Furthermore, the cover plates 31a and the side plates 32a are typically made of metal sheets of a thickness of only 0.5 mm, which limits maximum load. Hence accidents easily happen, furthermore, the ceiling 1a has a limited lifetime.

SUMMARY OF THE INVENTION

[0005] The main object of the present invention is to provide a ceiling with a stabilizing frame of increased maximum load and increased lifetime.

[0006] For achieving above objects, the present invention comprises a frame, a plurality of ceiling plates, and a plurality of fastening devices. Each of the fastening devices is placed at an inner side of one of the side plates of one of the ceiling plates and has a threaded hole. The frame has a plurality of mounting bars, which are connected with cover plates of the ceiling plates on upper sides thereof by holding screws, which are respectively engaged with the threaded holes of the fas-

tening devices. Thereby load on the ceiling plates is spatially distributed, so that an increased maximum load and an enhanced lifetime of the ceiling is achieved.

[0007] Other aspects and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a perspective view of the ceiling with stabilizing frame of the present invention in the first embodiment.

[0009] FIG. 2 is a cross-sectional schematic illustration of mounting of a pair of side plates 32 on the frame 2 of the present invention in the first embodiment.

[0010] FIG. 3 is a cross-sectional schematic illustration of mounting of a pair of side plates 32 with inward bent edges 322 on the frame 2 of the present invention in the second embodiment.

[0011] FIG. 4 is a cross-sectional schematic illustration of mounting of a pair of side plates 32 with inward bent edges 322 by movable plates 43 with elevated central plates 44 on the frame 2 of the present invention in the third embodiment.

[0012] FIG. 5 is a cross-sectional schematic illustration of mounting of a pair of side plates 32, using side screws 37, on the frame 2 of the present invention in the fourth embodiment.

[0013] FIG. 6 is a cross-sectional schematic illustration of mounting of a pair of side plates 32 on the frame 2, and stabilizing thereof by the insertion block 7, or the present invention in the fifth embodiment.

[0014] FIG. 7 is a cross-sectional schematic illustration of mounting of a pair of C-shaped side plates 32c on the frame 2 of the present invention in the sixth embodiment.

[0015] FIG. 8 is a cross-sectional schematic illustration of mounting of a pair of O-shaped side plates 32d on the frame 2 of the present invention in the seventh embodiment.

[0016] FIG. 9 is a cross-sectional schematic illustration of mounting of a pair of side plates 32, having depressions 36e at upper outer edges thereof, on the frame 2 of the present invention in the eighth embodiment.

[0017] FIG. 10 (prior art) is a perspective view of a conventional ceiling with stabilizing frame.

[0018] FIG. 11 (prior art) is a cross-sectional schematic illustration of mounting of a pair of conventional side plates 32a on the frame 2a of conventional art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] As shown in FIGS. 1 and 2, the present invention is a ceiling with stabilizing frame 1, comprising a frame 2; a plurality of ceiling plates 3; and a plurality of fastening devices 4. Each of the ceiling plates 3 has cover plates 31, side plates 32 and filling material 33 (numbers describing embodiments of the present invention correspond to numbers describing conventional art as shown in FIGS. 10 and 11). The fastening devices 4 pass completely through the ceiling plates 3, so that load on the ceiling plates is spatially more widely distributed, resulting in increased maximum load and enhanced lifetime thereof. Below a more detailed description is given.

[0020] Referring to FIG. 2, for every ceiling plate 3, each of the cover plates 31 has an edge that projects inwards at a right

angle for stably connecting to one of the side plates 32. Each of the side plates 32 has a cross section roughly like the letter M, with a central groove 321. The fastening devices 4 pass completely through the ceiling plates 3, having threaded holes 42, and are each welded to one of the side plates 32, so that a stable connection is made.

[0021] The frame 2 has a plurality of mounting bars 22, which are connected with cover plates 31 of the ceiling plates 3 on upper sides thereof by holding screws 23. The holding screws 23 are respectively inserted into the threaded holes 42 for fastening the ceiling plates 3. Each of the mounting bars 22 has a central elevated plate 25 with mounting holes 26, through which a mounting rod 28 passes. Each of the suspension rods 28 comprises a threaded rod 282, which passes through the hole 26, and a fastening element 281 at a lower end of the threaded rod 282. For each mounting rod 28, the threaded rod 282 at an upper end thereof is fastened to one of the height-adjusting devices 13 of the upper structure 11, and the fastening element 281 has a larger diameter than the mounting hole 26. Alternatively, the mounting rods 28 are welded to the lower plate 25 (not shown). Thus the fastening devices 4 are enabled to hold the ceiling plates 3 with distributed load, so that increased maximum load and enhanced lifetime are achieved.

[0022] Furthermore, the ceiling plates 3 are preferably respectively fixed at four corners thereof for stable connecting thereof.

[0023] Referring to FIGS. 3 and 4, the present invention in second and third embodiments thereof, for each ceiling plate 3, the side plates 32 thereof have inward bent edges 322 for holding one of the fastening devices 4. As shown in FIG. 3, each of the fastening devices 4 further has a movable plate 43, which is held to one of the side plates 32 by the inward bent edges 322 thereof. As shown in FIG. 4, for each of the fastening devices 4, the movable plate 43 thereof has elevated edge parts 44b to be held by the inward bent edges 322 of one of the side plates 32, so that the movable plates 43 and the rear edges 32 form a plane outer surface.

[0024] Referring to FIG. 5, the present invention in a fourth embodiment has the side plates 32 and the fastening devices 4 respectively connected by side screws 37 rather than by welding, which serves to distribute load spatially for increased maximum load and increased lifetime of the ceiling plates 3.

[0025] Referring to FIG. 6, the present invention in a fifth embodiment further comprises an insertion block 7, which is inserted between side plates 32 of neighboring ceiling plates 3, in space left by the central grooves 321 thereof. Thereby load on the ceiling plates is effectively distributed spatially.

[0026] Referring to FIG. 7, the present invention in a sixth embodiment has side plates 32c with C-shaped cross-sections, so that costs of material and production are reduced.

[0027] Referring to FIG. 8, the present invention in a seventh embodiment has side plates 32d with O-shaped cross-sections, so that stability is enhanced for increased maximum load and increased lifetime of the ceiling plates 3.

[0028] Referring to FIG. 9, the present invention in an eighth embodiment has mounting bars 22e, which are plane, without central elevated plates, and side plates 32e with depressions 36e at upper outer edges thereof, shown for C-shaped side plates of the sixth embodiment, but also applicable to other embodiments. Each of the mounting bars 22e has mounting holes 26e, through which the mounting rod 28

passes. The depressions 36e have widths that are suitable for accommodating the nuts 281. Thereby, manufacturing is simplified and cost is reduced.

[0029] While preferred embodiments of the invention have been set forth for the purpose of disclosure, modifications of the disclosed embodiments of the invention as well as other embodiments thereof may occur to those skilled in the art. Accordingly, the appended claims are intended to cover all embodiments which do not depart from the spirit and scope of the invention.

1. A ceiling with stabilizing frame, comprising:
 - a frame, having a plurality of mounting bars;
 - a plurality of ceiling plates, each having cover plates, side plates and filling material; and
 - a plurality of fastening devices, each being placed at an inner side of one of said side plates of one of said ceiling plates and having a threaded hole;
 wherein said mounting bars are connected with cover plates of the ceiling plates on upper sides thereof by holding screws, which are respectively engaged with the threaded holes of the fastening devices.
2. The ceiling with stabilizing frame of claim 1, wherein each of said side plates has a cross-section shaped like the letter M, having a central groove facing an outer side thereof.
3. The ceiling with stabilizing frame of claim 2, wherein each of said side plates has inward bent edges and each of said fastening devices has a movable plate, which is held by said inward bent edges of one of said side plates.
4. The ceiling with stabilizing frame of claim 3, wherein each of said movable plates has an outer side facing one of said side plates and an elevated central plate, which projects towards said outer side.
5. The ceiling with stabilizing frame of claim 2, wherein each of said plurality of mounting bars has mounting rods, each of which is fastened to a height-adjusting device at a lower end of a suspension rod of an upper structure.
6. The ceiling with stabilizing frame of claim 5, wherein each mounting bar has a central elevated plate with mounting holes and each of said mounting rods further comprises a threaded rod, which passes through one of said mounting holes and is fastened at an upper end thereof to one of said height-adjusting devices, and a fastening element, which is placed at a lower end of the threaded rod and has a larger diameter than said mounting holes.
7. The ceiling with stabilizing frame of claim 5, wherein each mounting bar has mounting holes, each of said mounting rods further comprises a threaded rod, which passes through one of said mounting holes and is fastened at an upper end thereof to one of said height-adjusting devices, and a fastening element, which is placed at a lower end of the threaded rod and has a larger diameter than said mounting holes, and each ceiling plate has depressions for accommodating said fastening elements.
8. The ceiling with stabilizing frame of claim 1, wherein each of said side plates has a cross-section that is shaped like the letter C.
9. The ceiling with stabilizing frame of claim 8, wherein each of said plurality of mounting bars has mounting rods, each of which is fastened to a height-adjusting device at a lower end of a suspension rod of an upper structure.
10. The ceiling with stabilizing frame of claim 9, wherein each mounting bar has a central elevated plate with mounting holes and each of said mounting rods further comprises a threaded rod, which passes through one of said mounting

holes and is fastened at an upper end thereof to one of said height-adjusting devices, and a fastening element, which is placed at a lower end of the threaded rod and has a larger diameter than said mounting holes.

11. The ceiling with stabilizing frame of claim **9**, wherein each mounting bar has mounting holes, each of said mounting rods further comprises a threaded rod, which passes through one of said mounting holes and is fastened at an upper end thereof to one of said height-adjusting devices, and a fastening element, which is placed at a lower end of the threaded rod and has a larger diameter than said mounting holes, and each ceiling plate has depressions for accommodating said fastening elements.

12. The ceiling with stabilizing frame of claim **1**, wherein each of said side plates has a cross-section that is shaped like the letter O.

13. The ceiling with stabilizing frame of claim **12**, wherein each of said plurality of mounting bars has mounting rods, each of which is fastened to a height-adjusting device at a lower end of a suspension rod of an upper structure.

14. The ceiling with stabilizing frame of claim **13**, wherein each mounting bar has a central elevated plate with mounting holes and each of said mounting rods further comprises a threaded rod, which passes through one of said mounting holes and is fastened at an upper end thereof to one of said height-adjusting devices, and a fastening element, which is

placed at a lower end of the threaded rod and has a larger diameter than said mounting holes.

15. The ceiling with stabilizing frame of claim **13**, wherein each mounting bar has mounting holes, each of said mounting rods further comprises a threaded rod, which passes through one of said mounting holes and is fastened at an upper end thereof to one of said height-adjusting devices, and a fastening element, which is placed at a lower end of the threaded rod and has a larger diameter than said mounting holes, and each ceiling plate has depressions for accommodating said fastening elements.

16. The ceiling with stabilizing frame of claim **1**, wherein connecting of said side plates and said fastening devices respectively is performed by welding.

17. The ceiling with stabilizing frame of claim **1**, wherein connecting of said side plates and said fastening devices respectively is achieved by screws.

18. The ceiling with stabilizing frame of claim **2**, wherein, for each pair of neighboring ceiling, an insertion block is inserted in a space left by said central grooves of mutually facing side plates of said neighboring ceiling plates.

19. The ceiling with stabilizing frame of claim **1**, wherein each of said cover plates is shaped like the letter L and on one edge thereof fastened to one of said side plates.

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