(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 145 247**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **84307598.7**

(51) Int. Cl.⁴: **E 04 F 15/024**

(22) Date of filing: **02.11.84**

(30) Priority: **04.11.83 CA 440454**

(43) Date of publication of application:
19.06.85 Bulletin 85/25

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: **CONSTRUCTION SPECIALTIES LIMITED**
895 Thermal Road
Mississauga Ontario L5E 2C2(CA)

(72) Inventor: **Morris, Richard Paul**
2121 Rathburn Road, No. 703
Mississauga Ontario L4W 2X3(CA)

(72) Inventor: **Betts, Kenneth Herbert**
819 Duchess Drive
Mississauga Ontario L4Y 1R9(CA)

(74) Representative: **Cheyne, John Robert Alexander**
Mackenzie et al,
HASELTINE LAKE & CO. 28 Southampton Buildings
Chancery Lane
London WC2A 1AT(GB)

(54) Concrete floor panel and floor system.

(57) A thin lightweight, strong cementitious floor panel (10) has a flat upper surface (12) and a ribbed lower surface (14). Reinforcing rods (32,34) extend through the ribs (16) near the bottom of the panel and are arranged one (32) along each side of the panel and two (34) in a crossed configuration in the centre. The ends of the crossed bars (34) rest on the side bars (32) and the side bars (32) extend to regions adjacent corners of the panel at which the panel can be supported in a floor so that the bars tend to transfer loads imposed on the panel to the panel support regions.

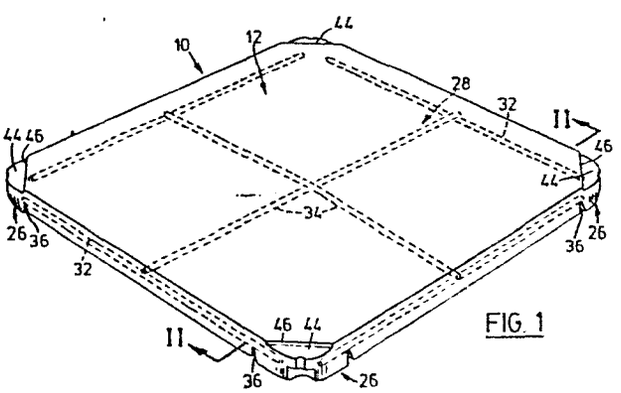

FIG. 1

EP 0 145 247 A2

CONCRETE FLOOR PANEL AND FLOOR SYSTEM

This invention relates to a lightweight floor panel made of a cementitious material.

Floor panels are commonly used in computer rooms and other areas where it is convenient to raise the floor on pedestals and to place wiring and other mechanism beneath the floor for convenient access for service. Such floor panels have commonly in the past consisted of materials such as pressed wood or chipboard encased in metal sheets or two part welded steel panels. The chipboard and metal panels, although relatively light in weight, have proven expensive to manufacture and also are not entirely fireproof. The applicant therefore has conceived a concrete floor panel. However, a major difficulty with concrete floor panels has been that in order to ahcieve sufficient strength (typically 1,500 pounds per square inch is required), the panels have been so heavy that they could not be handled, installed, and removed for access to the space below them without special machinery.

Accordingly, it is an object of the invention to provide a lightweight reinforced concrete floor panel which has strength sufficient to serve as a raised floor in many areas (e.g. computer rooms) and yet which is sufficiently light in weight that individual panels can be handled by one or two workmen. To this end the invention provides in its broadest aspect a lightweight floor panel comprising: a body of a cementitious mater-

ial, the body being of generally thin and flat rectangular shape with a substantially planar upper surface and a lower surface with ribs formed therein, said ribs providing strength and reducing the amount of material in the panel. The body also defines corner regions at which the panel can be supported in use. A set of reinforcing bars is provided in the body and the bars are disposed substantially parallel to the upper surface of the body. The set includes two bars arranged in a crossed configuration generally centrally of and extending generally parallel to sides of the panel, and four bars arranged one along each side of the panel within the body and terminating at said corner regions. Each of the crossed bars is arranged with respective end portions thereof resting on the bars at respectively opposite sides of the panel considering the panel oriented as in use so that loads imposed on the panel tend to be transferred by said bars to said corner regions. The panel also includes a reinforcing mesh sheet member extending in said body parallel to said upper surface and covering at least a substantial portion of the panel area inwardly of said side reinforcing bars.

Further objects and advantages of the invention will appear from the following description, taken together with the accompanying drdawings which show a preferred embodiment of the invention, and in which:

Fig. 1 is a perspective view from above of a panel according to the invention;

Fig. 2 is a sectional view taken along lines II-II of Fig. 1;

Fig. 3 is a perspective view from below of the floor panel of Fig. 1; and,

Fig. 4 is a perspective view of a raised flooring system utilizing the panels of Fig. 1.

Reference is now made to the drawings, which show a floor panel 10 according to the invention. The panel 10 is essentially square and comprises a body of fiber reinforced concrete. Fiber reinforced concrete is now well known and may consist of cement, sand, glass fibers, water; it may also include a plasticizer and polymers to strengthen the product. Pearlite or other lightweight aggregates may also be included to reduce the weight of the mix. The invention is not concerned with the particular formulation but rather with the physical design of the panel.

As shown, the panel 10 has a substantially planar upper surface 12 and a lower surface 14 having ribs generally indicated at 16 formed therein. The panel 10 is very thin in relation to its length and width. The length and width of the panel are typically 610 mm, while the overall thickness of the panel (dimension t) is typically only about 43 mm except at the corner regions (see later). The ribs 16 are thus provided to increase the strength of the panel while reducing the weight thereof.

The ribs 16 include four side ribs 18 one extending along each lower side of the panel 10, and two

major ribs 20 arranged at right angles to each other and dividing the lower surface of the panel into four quadrants 22. The height of each side rib and major rib 18, 20 (dimension d1) is about 20 mm; the width of each side rib 18 (dimension d2) is about 38 mm at its base, and the width of each major rib 20 (dimension d3) is about 30 mm at its base.

Each quadrant 22 has formed therein a pair of minor ribs 24 (Fig. 3) which extend parallel to one another and parallel to the minor ribs in the other quadrants. The minor ribs 24 are much smaller than the major ribs 20, being only about 3 mm in height and 12 mm in width.

The panel is also shaped to define corner regions which are generally denoted 26 in Fig. 3 and which extend below the major ribs 80, 20 for example by about 5 mm. These regions are designed to act as support areas at which the panel can rest on pedestals or other supports in an assembled floor system as will be described in more detail later, primarily with reference to Fig. 4.

Panel 10 further includes a set of steel reinforcing rods 28 (Figs. 1 and 2) all extending generally parallel to the upper surface 12 of the panel. There are six reinforcing rods 28, one extending along each side of the panel through each side rib 18 and two disposed in a crossed configuration in the centre of the panel, and ex-

tending through the respective major ribs 20. In Fig. 1, the rods at the sides of the panel are individually denoted 32 while the crossed rods are denoted 34. Typically, rods 32 will be say, 10 mm in diameter while rods 34 will be 7-8 mm in diameter. The rods are spaced slightly above the bottom of the panel, typically about 5 mm above the bottoms of the side ribs 18 and the major ribs 20. This spacing is achieved as follows. The mould in which the panel is made (not shown) includes raised supports, two for each reinforcing rod 28, one at each end of each rod 28. The reinforcing rods 28 are placed on the raised supports before the concrete is poured. When the panel is removed from the mould, the raised supports leave small pockets 36 (Fig. 3) in the panel and through which the rods 28 are exposed (although in practice, a thin "skin" of concrete tends to form over the exposed surface of the rod). The pockets 36 are not visible when the panel is installed and have a negligible effect on the strength of the panel. It will be noted that pockets 36 are provided at the ends of the major ribs 18 and 20. Thus, the pockets 36 in the side ribs 18 terminate adjacent and effectively define the corner regions 26 while the pockets in the ribs 20 are located where those ribs meet the side ribs 80.

As best seen in fig. 1, the reinforcing rods 32 at the sides of the panel terminate within the corner regions 26 and the crossed rods 34 rest at their ends on

the side rods 32. Thus, loads imposed on the upper surface of the panel in use will tend to be transferred by way of the rods 34 to the rods 32 and, from those rods, to corner regions 26 of the panel where the panel can be supported. The two crossed rods 34 are arranged in contact with one another approximately at their mid points and may be wired together. The lower of the two rods 34 as seen in Fig. 1 is straight while the other rod 34 is bent slightly at its mid point to define two rectilinear sections and pass over the straight rod. The extent of the bend is just sufficient that all four ends of both rods 24 lie substantially in a common plane.

Panel 10 also includes a square expanded steel mesh sheet 40 (Fig. 2), the overall dimensions of which are approximately one or two centimeters smaller than the length and width of the panel, placed just below the upper surface 12. The expanded metal sheet 40 serves to prevent cracking of the upper surface of the panel should an impact occur such as when a heavy piece of equipment is dropped on the panel. Also, sheet 40 helps to resist shrinkage stresses on curing of the concrete in manufacture.

In fabrication of the panel, the rods 28 are placed in the mould on the raised supports referred to above and an appropriate fiber reinforced concrete mixture is poured. When the level of the concrete almost reaches the required finished surface, the mesh sheet 40

is placed on the concrete. Pouring is then completed and the upper surface is finished.

The panel shown weighs only about 40 pounds and yet could support a load of at least 1,500 pounds without cracking.

For installation as part of an elevated flooring system (see Fig. 4), each panel 10 includes a recess 42 in its upper surface at each corner region 26 (see also Fig. 1). Each recess includes a planar upper surface 44 and an edge 46 perpendicular to the surface 44 and extending at 45° to each of the adjacent sides of the panel. When four panels 10 are assembled together in a square, the four adjacent recesses 42 define a square composite recess 48 (Fig. 4) to accept a square hold down plate 50 for coupling to a pedestal 51 below the panels. Thus hold down plate 50 is secured by a screw 52 to a lower support plate 54 having a threaded hole 56 therein. Corners of plate 54 are turned up as indicated at 54a to engage behind the corner regions 26 of the panels and assist in locating the same during installation. Plate 54 is in turn welded to a tube 60. The tube 60 receives in its bottom a threaded post 62 welded to a base plate 64. A levelling nut 66 or post 62 serves to adjust the height of the support plate 54.

The lower surface of the panel also includes recesses (denoted 70) below each of the recesses 42 in the upper panel surface. These recesses 70 in effect

define ledges at the corners of the panel which can be engaged by mechanical lifting equipment for raising and lowering the panels during installation. A notch 72 in the extreme corner of the panel above recess 70 is also provided to accommodate the lifting equipment.

It will of course be appreciated that the preceding description relates to a particular preferred embodiment of the invention only and that many modifications are possible within the broad scope of the invention. For example, while a panel having a single set of reinforcing bars has been shown, it would be possible to provide a second similar set of bars above the bars 28. Also, mesh reinforcement can be provided along the edges of the panel using narrow mesh sheets inserted perpendicular to the upper surface of the panel. The particular form of mesh used for sheet 40 is not believed to be critical. For example, welded wire rod mesh or plastic mesh could be used in place of expanded metal sheets.

Finally, it should be noted that the particular dimensions and materials referred to herein are given by way of example only and may vary. For example, while a square panel has been shown, panels of other rectangular shapes are of course possible.

CLAIMS

1. A lightweight floor panel comprising: a body of a cementitious material, the body being of generally thin and flat rectangular shape with a planar upper surface and a lower surface with ribs formed therein, said ribs providing strength and reducing the amount of material in said panel, and said body defining corner regions at which the panel can be supported in use; a set of reinforcing bars in said body disposed substantially parallel to said upper surface and comprising two bars arranged in a crossed configuration generally centrally of and extending generally parallel to sides of the panel, and four bars arranged on along each side of the panel within the body and terminating at said corner regions, each of said crossed bars being arranged with respective end portions thereof resting on said bars at respectively opposite sides of the panel, whereby loads imposed on the upper surface of the panel in use tend to be transferred by the bars to said corner regions; and a reinforcing mesh sheet extending in said body substantially parallel to said upper surface thereof and covering at least substantially the entire area of the panel within said side reinforcing bars.

2. A panel as claimed in claim 1, wherein said crossed bars are arranged in contact with one another approximately at their mid points.

3. A panel as claimed in claim 2, wherein one of said bars is straight and the other is bent slightly to define two rectilinear sections angled about the mid point of the bar, the extent of the bend being such that the end portions of all four bars lie substantially iin a common plane.

4. A panel as claimed in claim 1, wherein said ribs comprise a side rib along each side edge of the panel and two major cross ribs arranged at right angles to each other and together with said side ribs dividing said bottom surface into four quadrants.

5. A panel as claimed in claim 4, wherein said side reinforcing bars are disposed in said side ribs and wherein said crossed reinforcing bars are disposed in said cross ribs.

6. A panel as claimed in claim 4 or 5, and including two pockets in each of said side ribs and major cross ribs, said reinforcing bars being exposed through said pockets, said pockets being formed by supports for said reinforcing bars during moulding of the panel.

7. A panel as claimed in claim 1, wherein said reinforcing mesh sheet is disposed just below said upper surface of the panel.

8. A panel as claimed in claim 1, wherein said reinforcing mesh sheet is an expanded sheet.

9. A panel as claimed in claim 1, 4 or 5, wherein said upper surface is recessed at each corner therof to receive a hold-down plate.

10. A panel as claimed in claim 1, 4 or 5, wherein said upper surface includes a recess therein at each corner of the panel, each said recess having a planar upper surface and an edge extending at 45° to each of the adjacent sides of the panel so that when four of said panels are assembled together said recesses together form a composite square recess to receive a square hold-down plate.

11. A panel as claimed in claim 1, 4 or 5, wherein said upper surface is recessed at each corner thereof to receive a hold-down plate, and wherein said lower surface is shaped to define a pocket below each said recess for receiving panel lifting means.

12. A panel according to claim 1, 4 or 5 wherein said cementitious material is a fibre reinforced concrete.

13. A panel as claimed in claim 1, 4 or 5 , wherein said cementitious material is a fibre reinforced concrete having lightweight aggregate therein.

14. A floor system comprising an assembly of floor panels of the form claimed in claim 1, and a plurality of pedestals supporting said panels above an underlying sur-

face, wherein said panels are square in shape, wherein the upper surface of each panel includes a recess at each corner of the panel, said recess having a planar upper surface and an edge extending at 45° to each of the adjacent sides of the panel, and wherein the panels are assembled together in groups of four for defining a floor surface so that the said recesses form respective composite square recesses between the panels, and wherein the pedestals are positioned below said composite recesses, and wherein there is provided in association with each pedestal a hold-down plate received in the associated composite recess and coupled to the pedestal.

0145247

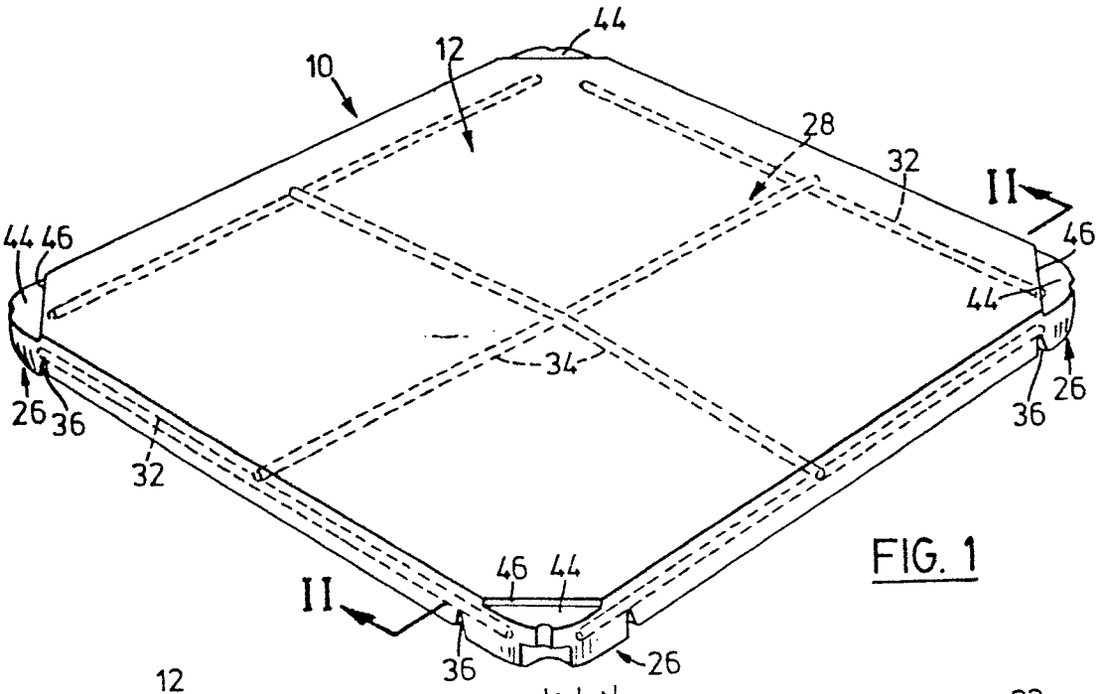

FIG. 1

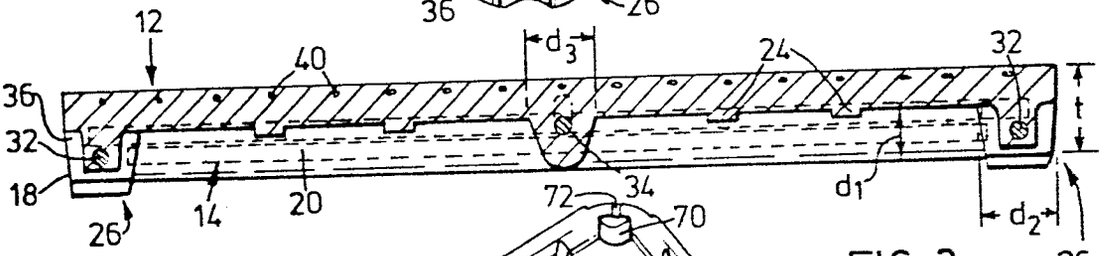

FIG. 2

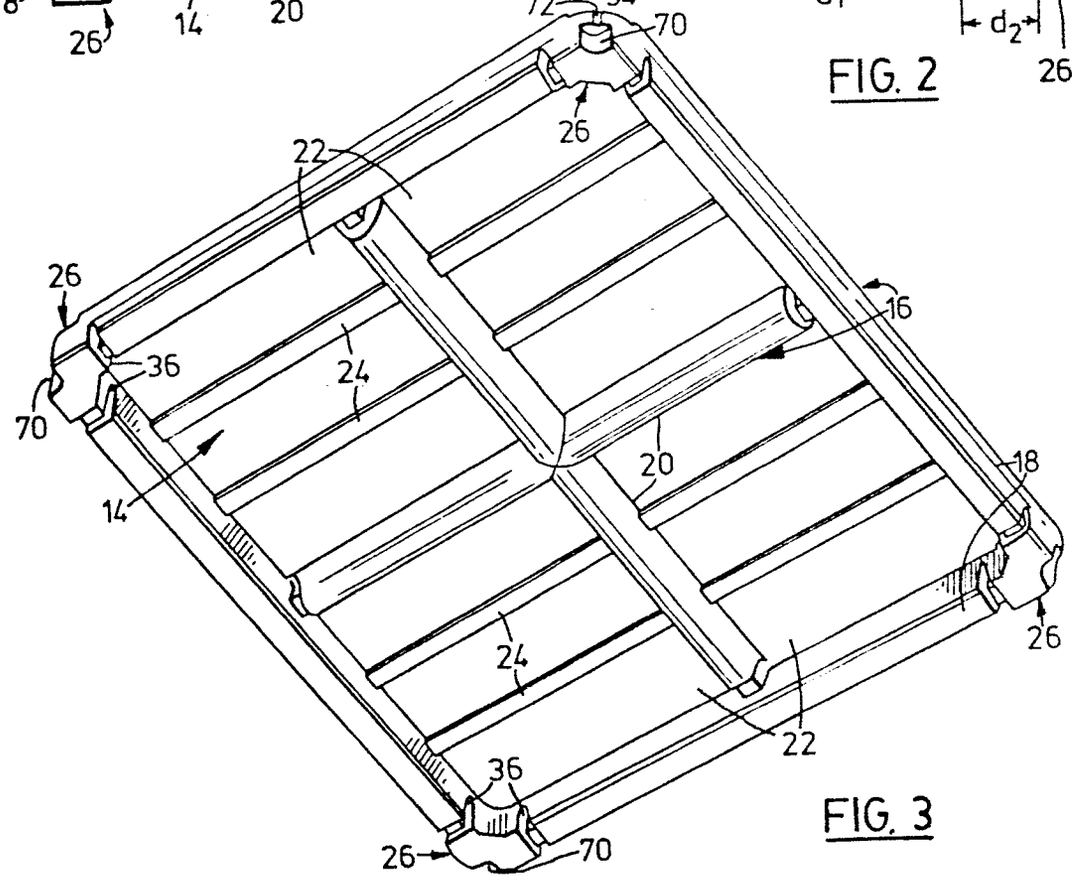

FIG. 3

0145247

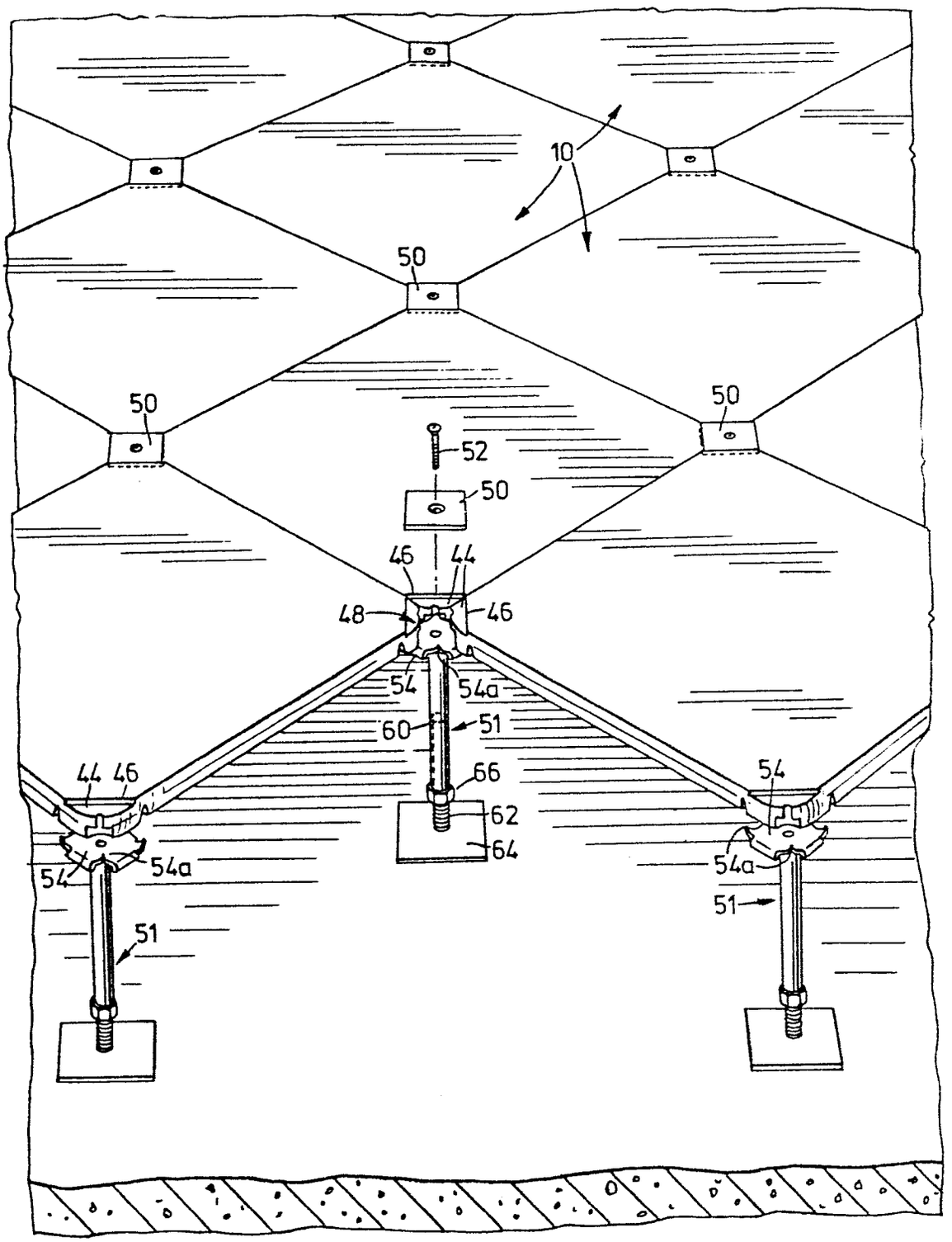

FIG. 4