Feb. 11, 1969 F. W. FORK 3,426,492

METAL CELLULAR FLOORING SECTION AND METHOD OF MAKING THE SAME

Filed Oct. 18, 1966 Sheet 1 of 2

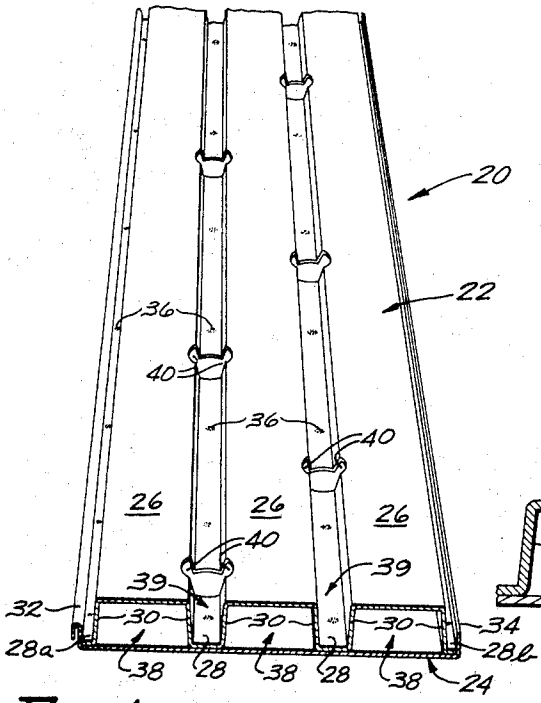


Fig. 1

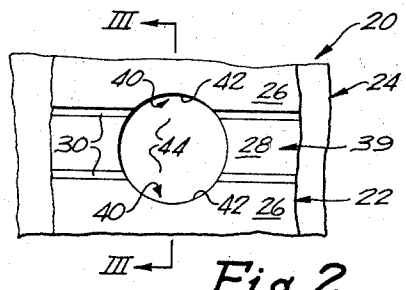


Fig. 2

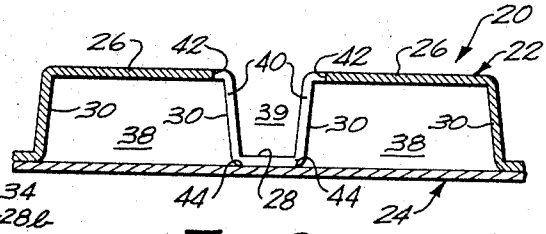


Fig. 3

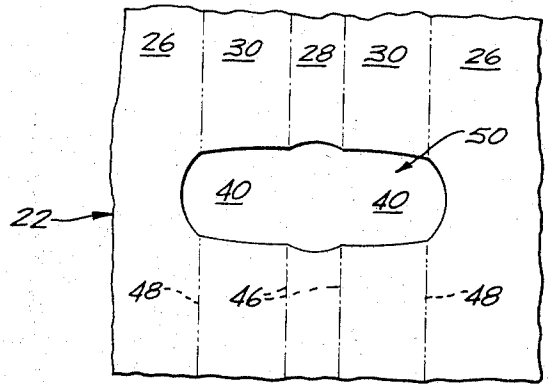


Fig. 4

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METAL CELLULAR FLOORING SECTION AND METHOD OF MAKING THE SAME

Filed Oct. 18, 1966 Sheet 2 of 2

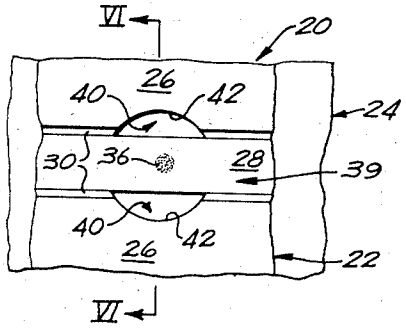


Fig. 5

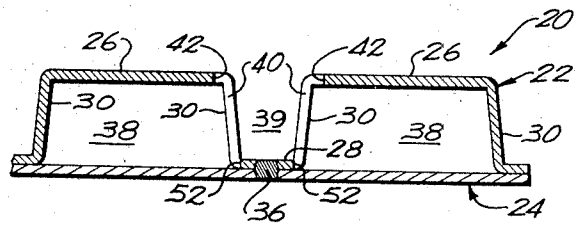


Fig. 6

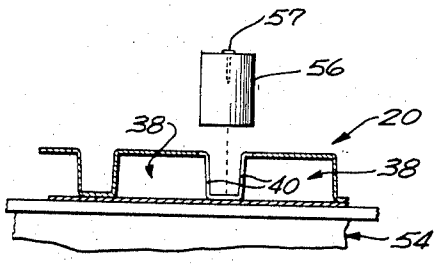


Fig. 8

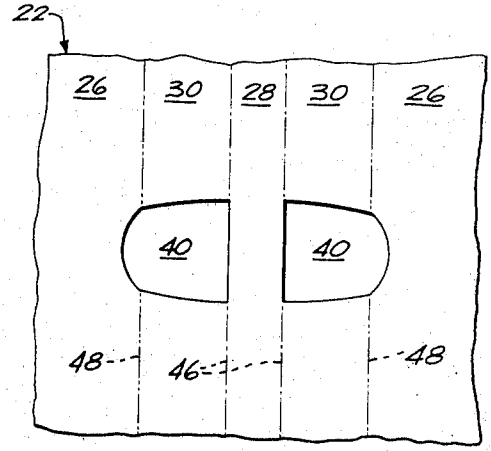


Fig. 7

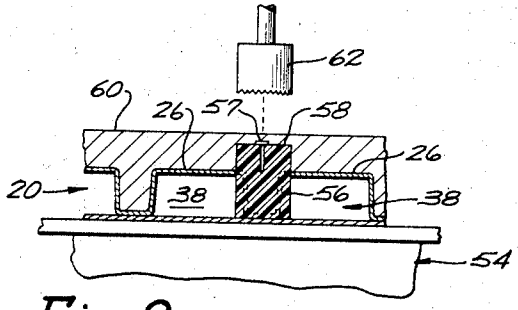


Fig. 9

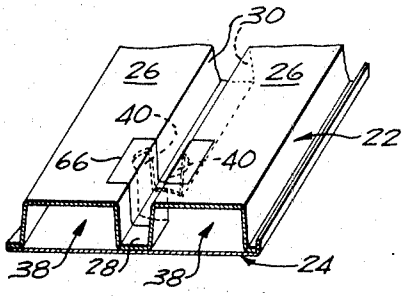


Fig. 11

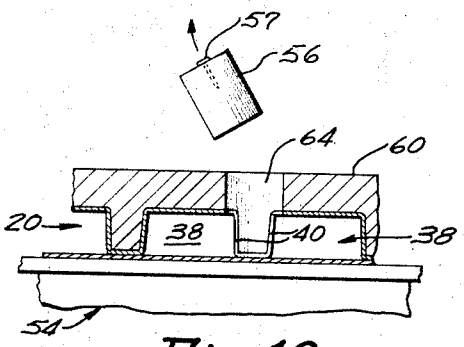


Fig. 10

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METAL CELLULAR FLOORING SECTION AND METHOD OF MAKING THE SAME

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Filed Oct. 18, 1966, Ser. No. 587,509
U.S. Cl. 52—221 8 Claims
Int. Cl. E04b 5/48, 5/10

ABSTRACT OF THE DISCLOSURE

A metal cellular flooring section providing a plurality of spaced, generally parallel cells, each pair of adjacent cells presenting spaced crests, confronting side walls, and an intermediate valley disposed between the confronting side walls. Opposed openings, one in each of the confronting side walls, provide communication at one location in the flooring section, between the interiors of the adjacent cells and the space above the intermediate valley.

This invention relates to metal celluar flooring sections of the type adapted to be supported horizontally and thereafter to receive and support a layer of concrete, and more particularly to an improved metal cellular flooring section of the type described, having prepunched openings therein which provide relatively easy access to selected cells of said flooring section and a method of making said section.

Metal cellular flooring sections of the type described are well known in the prior art. See, for example, U.S. Patent Nos. 2,041,965, 2,125,366 and 3,102,610. The metal cellular flooring section normally comprises an upper corrugated sheet having crests and valleys and inclined side walls connecting adjacent ones of the crests and valleys, and a lower metal sheet secured thereto and cooperating with the crests and the inclined side walls thereof to form a plurality of spaced, generally parallel enclosed cells or channels.

For many years, the metal cellular flowering sections have been employed in building construction to provide versatility in electrical service. For example, a plurality of the metal cellular flooring sections are supported by beams and girders in a building frame and are positioned in side-by-side interlocking relation and end-to-end abutting relation such that a plurality of the enclosed channels are provided throughout the floor area. Concrete is applied on top of the metal cellular sections to form the floors in the resulting building. The enclosed channels, beneath the floor covering, remain available throughout the life of the building as passageways for electrical wiring.

Heretofore, access to the electrical wiring beneath the concrete has been accomplished by penetrating the concrete and the sheet metal crest of a cell to introduce or withdraw electrical cables. Many electrical codes have required that the power conductors be maintained in a separate cell apart from the low voltage signal, communications, telephone wiring. Hence, it has been necessary to provide an individual floor outlet for power utilization and a separate floor outlet for telephone installations. Signal equipment has demanded a third floor outlet.

In my earlier filed copending application Ser. No. 535,282, filed Feb. 14, 1966 which is assigned to the assignee of the present invention, I have described a novel electrical distribution system wherein a single access opening is provided between a pair of underfloor cells to allow a single floor outlet to accommodate two types of service which are required by electrical codes to be delivered separately to the point of access.

Objects

The principal object of the present invention is to provide a metal cellular flooring section having factory installed openings in the side walls of the electrical cells to accommodate availability of two types of electrical service at a single access location.

Another object of this invention is to provide readily removable closure means for the openings provided with the present flooring section.

A further object of this invention is to provide a method for making the present metal cellular flooring sections.

Summary of the invention

The present invention provides improvements in a metal cellular flooring section of the type described and wherein each pair of adjacent cells presents spaced crests, confronting generally vertical side walls and an intermediate valley disposed between the confronting side walls.

In accordance with the present invention, pairs of opposed openings are provided in the corrugated metal sheet at a plurality of locations thereon. Specifically, one of the opposed openings is formed in each of the confronting side walls such that each of the openings has an upper peripheral edge portion residing substantially at the level of the crest and a lower peripheral edge portion residing substantially at the level of the intermediate valley. The opposed openings provide communication between the interiors of the adjacent cells and the space above the intermediate valley.

In accordance with the present method of making the metal cellular flooring sections, the opposed openings may be formed by piercing a single opening in the upper metal sheet before it is corrugated. The opposed openings are placed in those regions of the upper metal sheet which will subsequently comprise the confronting generally vertical side walls and the intermediate valley. Alternatively, the opposed openings may be formed by piercing two separate and spaced-apart openings in the upper metal sheet prior to its being corrugated in those regions of the upper metal sheet which will subsequently comprise the confronting generally vertical side walls.

Further in accordance with the present invention, readily removable closure elements are provided for temporarily closing the opposed openings, whereby concrete may be poured over the flooring section without entering the cells thereof. The closure elements permit easy entry into the adjacent cells after the concrete has hardened.

The above and other objects and advantages of the present invention will become apparent from the following detailed description by reference to the accompanying drawings, in which:

FIGURE 1 is an isometric view of a metal cellular flooring section formed in accordance with the present invention;

FIG. 2 is a fragmentary plan view of a portion of the flooring section of FIG. 1, illustrating opposed openings provided in adjacent cells thereof;

FIG. 3 is a cross-sectional view taken along the line III—III of FIG. 2;

FIG. 4 is a fragmentary plan view of a metal sheet having a single opening pierced therein and which will subseqently be corrugated to form the upper sheet of the present metal cellular flooring section;

FIG. 5 is a fragmentary plan view similar to FIG. 2, illustrating an alternative embodiment of the present flooring section;

FIG.6 is a cross-sectional view taken along the line VI—VI of FIG. 5;

FIG. 7 is a fragmentary plan view of a metal sheet having a pair of spaced-apart openings pierced therein and which will subsequently be corrugated to form the upper sheet of the present flooring section;

FIG. 8 is a fragmentary cross-sectional view, similar to FIG. 3, illustrating readily removable means for closing the opposed openings of the present flooring section;

FIGS. 9 and 10 are cross-sectional views similar to FIG. 8 and illustrating successive steps employed in gaining access through the opposed openings into the adjacent cells; and

FIG. 11 is a fragmentary isometric view illustrating alternative readily removable means for closing the opposed openings.

Flooring section—General description

Referring now to FIG. 1, there is illustrated a metal cellular flooring section **20** including an upper metal sheet **22** and a lower metal sheet **24**.

The upper metal sheet **22** is corrugated and includes crests **26**, valleys **28** and generally vertical side walls **30** which connect adjacent ones of the crests **26** and the valleys **28**. The upper metal sheet **22** also includes side valleys **28***a* and **28***b*. The lower metal sheet **24** is provided with a female lip **32** and a male lip **34** adjacent the side valleys **28***a* and **28***b*, respectively. The female and male lips **32**, **34** permit adjacent ones of the metal cellular flooring sections **20** to be interlocked.

The lower metal sheet **24** has a flat rectangular configuration and is secured to the valleys **28** of the upper metal sheet **22** preferably by means of a plurality of spot welds **36**. The lower metal sheet **24** cooperates with the crests **26** and the generally vertical side walls **30** to form a plurality of spaced, generally parallel enclosed cells **38**.

It will be noted that each pair of adjacent cells **38** presents spaced crests **26**, confronting side walls **30** and an intermediate valley **28**; and that the confronting side walls **30** and the intermediate valley **28** define a trough-like space **39**.

Present improvement

Reference is now directed to FIGS. 1–3, inclusive. In accordance with the present invention, the metal cellular flooring section is provided with a pair of opposed openings **40** at a plurality of locations along the length of the flooring section **20**. The opposed openings **40** are formed in the side walls **30** of adjacent ones of the cells **38**. The overall arrangement is such that the opposed openings **40** provide communication between two adjacent cells **38** and the intervening space **39** above the intermediate valley **28**, as best shown in FIG. 3. Each of the openings **40** has an upper peripheral edge portion **42** residing substantially at the level of one of the crests **26** and a lower peripheral edge portion **44** residing substantially at the level of the intermediate valley **28**. In this instance, the lower peripheral edge portion **44** is defined by the lower metal sheet **24**.

In FIG. 4, a portion of the upper metal sheet **22** is illustrated prior to corrugation. Bend lines **46** and **48** are illustrated and define regions of the upper metal sheet **22** which will subsequently comprise the intermediate valley **28**, the confronting generally vertical side walls **30**, and the crests **26**. The opposed openings **40** are preferably formed by piercing a single opening **50** in the sheet **22** prior to its being corrugated. The single opening **50** has a continuous edge extending through the crests **26**, the side walls **30** and the intermediate valley **28**. The configuration of the single opening **50** is such that when the upper sheet **22** is corrugated, the continuous edge resides substantially in the surface of a cylinder as shown in FIG. 2. This cylindrical configuration is preferred since the opposed openings **40** are now adapted to receive a cylindrical base cup such as that base cup disclosed in my copending application Ser. No. 535,282, filed Feb. 14, 1966, which is assigned to the assignee of the present invention.

An alternative embodiment of the present metal flooring section **20** is illustrated in FIGS. **5**, **6** and **7**. Corresponding numerals will be employed to identify corresponding parts heretofore described.

Referring now to FIGS. 5 and 6, the metal cellular flooring section **20** is provided with the opposed openings **40** each of which includes the upper edge portion **42** residing substantially at the level of the crests **26** and a lower edge portion **52** which, in this instance, comprises an edge of the intermediate valley **28**.

In FIG. 7, there is illustrated a portion of the upper metal sheet **22** prior to corrugation. The bend lines **46** and **48** are illustrated and define those regions of the upper metal sheet **22** which will subsequently comprise the crests **26**, the intermediate valley **28** and the confronting side walls **30**. In this embodiment, the opposed openings **40** are formed by piercing two separate and spaced-apart openings in those regions of the upper metal sheet **22** which will subsequently comprise the confronting side walls **30**. The configuration of the edge of the openings **40** is such that when the upper metal sheet **22** is corrugated, the opening edges will reside substantially in the surface of a cylinder as shown in FIG. **5**.

In this embodiment, the valleys **28** remain intact throughout their length. Consequently, the upper metal sheet **22** may be secured to the lower metal sheet **24** by means of a spot weld **36** placed on the valley **28** anywhere along its length. The spot weld **36** may be placed between the opposed openings **40**.

The opposed openings **40** have been described and illustrated as having a circular presentation when viewed in plan as in FIG. 2. It is to be understood, however, that the opposed openings **40** could, instead, have any other desired presentation, such as, a square, and a diamond.

Readily removable closure elements

Referring now to FIG. 8, a portion of the metal flooring section **20** is shown supported horizontally on a beam **54** preparatory to receive a layer of concrete. Prior to pouring the concrete, it is necessay to close the opposed openings **40** so as to prevent ingress of the concrete into the interior of the cells **38**.

In accordance with the present invention, the means for closing the opposed openings **40** preferably comprises a plug **56** which, in this instance, has a cylindrical configuration. A magnetically susceptible element **57**, such as a nail, may be positioned at the center of the plug **56** to assist in locating the plug **56**. Alternatively, the element **57** may comprise a magnet.

The plug **56** is inserted into the opposed openings **40** and, as shown in FIG. 9, has an upper surface **58** disposed at or above the level of the crests **26**. The plug **56** completely closes the opposed openings **40** and prevents ingress of concrete into the cells **38**. The plug **56** may be formed from any suitable material which will resist being crushed by the concrete poured thereover. Examples of suitable materials include foamed plastics, such as foamed polystyrene, foamed polyurethane, foamed polyethylene; thin gauge metals, cardboard, lightweight concrete, foamed glass and the like.

In FIG. 9, a layer of concrete **60** has been poured over the metal cellular flooring section **20**. In order to gain access to the adjacent cells **38**, a hole is drilled through the concrete **60**, for example, by means of a suitable hole saw **62** in a manner well known in the art. Positioning of the hole saw **62** directly over the plug **56** is facilitated by the element **57** in a manner also well known in the art. The plug **56** is then removed as shown in FIG. 10 and an opening **64** remains which permits access to the interiors of the adjacent cells **38**.

Referring now to FIG. 11, the opposed openings **40** could, instead, be closed by securing a sheet material **66** across the opposed openings **40** and to the crests **26**, the side walls **30** and the valley **28**. Suitable materials to be used include various cloths, stiff papers, thin gauge metal, tapes, films and the like.

Summary

From the foregoing detailed description, it should be readily apparent that the present invention provides an improved metal cellular flooring section wherein access to the interiors of the several cells may be readily achieved. Furthermore, the present metal cellular flooring section is provided with prepunched openings arranged to provide communication between the interiors of adjacent cells and the space between the adjacent cells at one location in the flooring section. Access to the adjacent cells is easily attainable after a layer of concrete has been poured over the flooring section and has hardened. This arrangement is exceedingly advantageous in that two adjacent cells may be activated simultaneously by drilling one hole in the concrete rather than by drilling two holes as heretofore required.

The present invention further provides readily removable closure elements which can be installed in the factory or in the field, as desired, to close the opposed openings. The closure elements prevent ingress of concrete into the cells and are readily removable when the cells of the flooring section are activated.

I claim as my invention:

1. In a metal cellular flooring section adapted to be supported horizontally and receive and support a layer of concrete, said flooring section comprising a corrugated upper metal sheet having crests and valleys and generally vertical side walls connecting adjacent ones of said crests and said valleys, and a lower metal sheet secured to said corrugated sheet and cooperating with said crests and said side walls to form a plurality of spaced, generally parallel cells, each pair of adjacent cells presenting spaced crests, confronting side walls and an intermediate valley disposed between said confronting side walls, the improvement comprising:

at least two opposed unobstructed openings, one formed in each of said confronting side walls, said opposed openings providing communication at one location in said floornig section, between the interiors of said adjacet cells and the space above said intermediate valley.

2. The improvement as defined in claim 1 wherein each of said opposed openings has an upper edge portion residing substantially at the level of a said crest and a lower edge portion residing substantially at the level of said intermediate valley.

3. The improvement as defined in claim 1 including readily removable closure means for closing each of said openings.

4. The improvement as defined in claim 3 wherein said readily removable closure means comprises a plug inserted between said adjacent cells into said openings and having an upper surface disposed at or above the level of said spaced crests.

5. The improvement as defined in claim 3 wherein said readily removable closure means comprises a sheet material applied over said openings and secured to the corrugated metal sheet.

6. The improvement as defined in claim 1 wherein said upper edge portion of each of said openings has an arcuate configuration and extends into one of said spaced crests.

7. The improvement as defined in claim 1 wherein said opposed openings are formed in said corrugated sheet by a single piercing operation such that a continuous edge is provided extending through the said spaced crests and the said confronting side walls of said adjacent cells and the said intermediate valley, said continuous edge residing substantially in the surface of a cylinder.

8. The improvement as defined in claim 1 wherein the generally vertical side wall at each of the opposite longitudinal sides of said flooring section, is imperforate.

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U.S. Cl. X.R.

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