

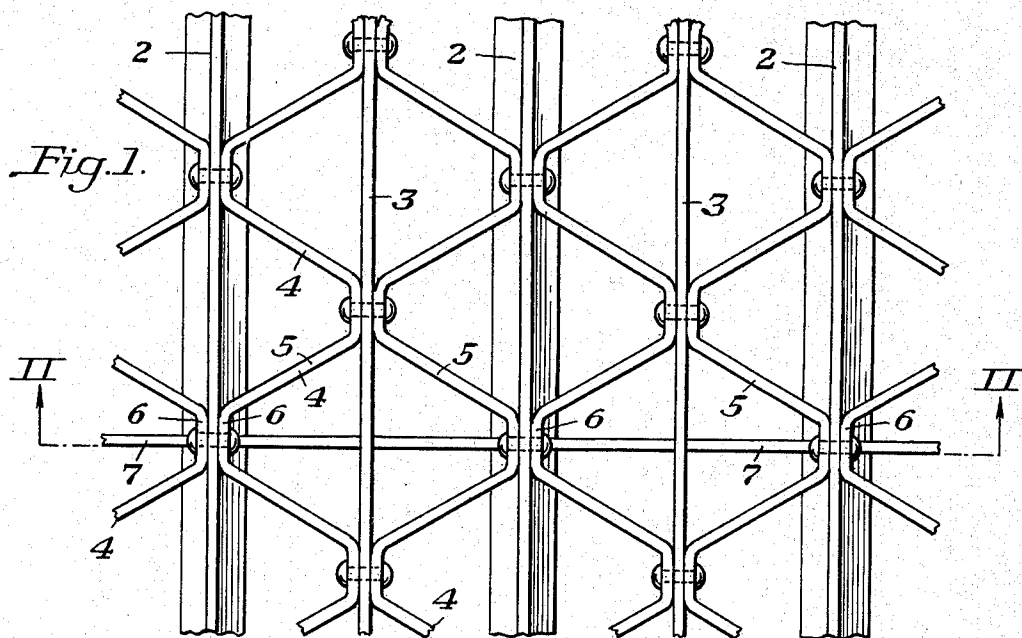
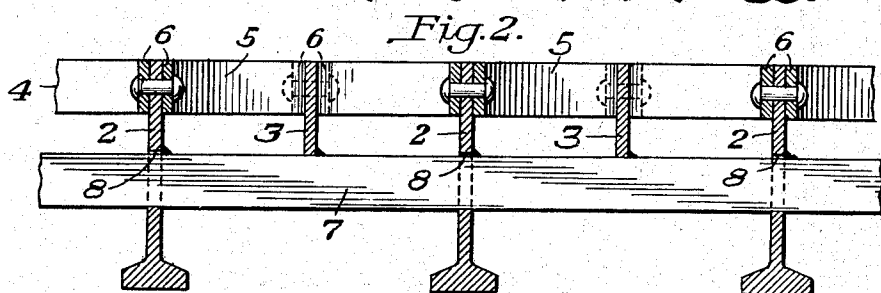
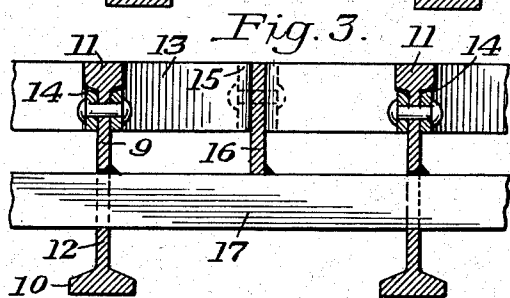
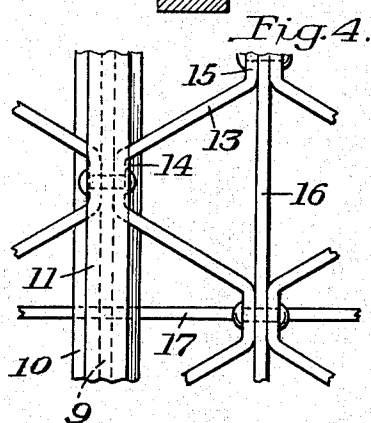
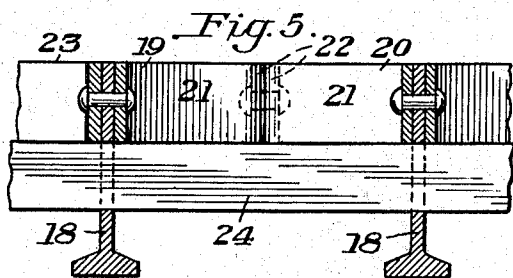
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2,190,215

GRATING AND LIKE STRUCTURE

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2,190,215

GRATING AND LIKE STRUCTURE

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9 Claims. (Cl. 189—82)

This invention relates to gratings and like structures and is particularly applicable to gratings of the so-called open mesh type which are used for flooring in bridges, runways and in other locations and which directly support the traffic without the aid of a reinforcing filling or a continuous substructure. If desired, however, the structure can be used in a reenforced concrete structure. This application is a modification of my co-pending application, Serial No. 170,587, for Gratings and like structures, filed October 23, 1937.

In certain installations of traffic supporting roadways, such as are employed in bridges, the floor or deck on which the traffic is borne is constructed of metal open mesh gratings or grids which are supported directly on a skeleton supporting structure, such as the sills or stringers of the bridge. Such floors are in general constructed from sectional units or slabs which are usually later welded or riveted, in the field, together to form a continuous structure. Each unit is, in general, made of spaced apart bearer bars which span the space between the stringers or sills, the bearer bars in turn being secured together at their tops by transverse bars. The tops of the cross bars and bearer bars are usually in the same plane. The grating or flooring presents a cell-like surface to the traffic and this reticulated traffic sustaining floor has proved to be quite successful in use. It is substantially skid-proof and highly wear-resistant and at the same time it forms a structure which is much lighter than any known continuous surface structure, such as a reenforced flooring, and this permits the bridge or structure to be economically designed and fabricated, due to the greatly lessened dead load of the floor. Due to the mesh-like structure, the flooring is self-cleaning, and there is but little likelihood of snow and ice accumulating on the floor to increase the dead load, or to cause skidding.

It is apparent that any lessening of the weight of the floor and the dead loads imposed thereon will enable a lighter supporting structure to be employed without any sacrifice in the strength of the structure, thus serving to reduce the cost of the completed structure without in any degree impairing the ability of the floor and structure to carry the loads imposed thereon.

The openings in an open type grating preferably should not be too large, as vehicles, particularly those with smaller wheels, will not smoothly pass over large openings. Where the stringers run longitudinally of the bridge and

the open mesh flooring rests directly on the stringers, it is obvious that the bearer bars must run transverse to the roadway and for the reasons which I have given, the bearer bars must not be too widely spaced from one another. Furthermore, it is essential that the structure be strong and the deflection of the flooring be at a minimum. The deflection is inversely proportional to the cube of the depth, and it is evident that it is desirable to have the main bearer bars as deep as possible. A certain minimum thickness of metal is necessary to allow for corrosion and in many instances if the bearer bars are of an economical size and properly spaced, the structure will be unduly heavy and unnecessarily strong. Such a structure is costly and uneconomical. If sufficient bearer bars of the necessary strength and stiffness are employed to carry the load, and intermediate bars are included to enable the size of the openings to be of a desirable size, and means are employed to transmit the load from the intermediate bearer bars to the main bearer bars, the resulting structure will be free from the aforementioned objections.

One of the objects of my invention is to provide an open mesh flooring which will embody a maximum strength and a minimum of metal and provide cell-like openings of a desirable size. I accomplish this by using a number of spaced apart main bearer bars of a size sufficient to carry the load to the supporting structure and a number of intermediate bearer bars of less depth parallel to and placed between the main bearer bars, the intermediate bearer bars and the main bearer bars being secured at their top portions in substantially the same plane by cross bars which serve to space apart the said bearer bars and to distribute the load, while the bottom portions of the intermediate bars rest on carrier bars which, in turn, are secured to the main bearer bars below the cross bars. Stresses imposed on the intermediate bearer bars are transmitted to the carrier bars and through them to the main bearer bars and thence to the supporting structure.

In one form of my invention I use main bearer bars connected by interposed zigzag bars which are connected to each other and to the main bearer bars preferably by riveting. The strains imposed on the bent bars are transmitted largely to a carrier bar which is arranged transversely to the main bearer bars. In all forms of the modifications shown in this application, bent bars are employed and they are preferably se-

cured by riveting, as this form of construction is desired by some engineers.

By the use of structures made according to my invention, it is possible to advantageously design the floor so that it rests directly on fairly widely spaced supporting members. For example, the floor may rest on the stringers of a bridge, without the use of sills or substringers interposed between the stringers and the floor. This enables a simpler design to be utilized, as well as worthwhile reductions to be made in the weight of the bridge, and consequently in the cost thereof.

I provide a structure wherein the amount of material employed is at a minimum, while at the same time the strength and stiffness of the structure is unimpaired. The structure is strong and stiff and of lighter weight than any similar structure of like strength and stiffness that I know of. My structure is relatively simple and inexpensive to build, may be fabricated and placed in position with ease, and provides an excellent traffic surface.

In the accompanying drawing, where I have shown for purposes of illustration the present preferred embodiment of my invention:

Figure 1 is a fragmentary plan view of a portion of a unit;

Figure 2 is a vertical sectional view along the line II-II of Figure 1;

Figure 3 is a vertical sectional view of another form of a unit;

Figure 4 is a plan view of a portion of the unit shown in Figure 3; and

Figure 5 is a vertical section of still another form of a unit.

For ease in fabrication and erection I prefer to construct my gratings of metal in units of a convenient size, which units are later placed in position on the supporting structure in the field and if an area larger than an individual unit is to be covered, a desired number of units are employed and the adjoining units are welded to each other and to the supporting structure, which may well be the stringers or the sills of a bridge or floor beams in other structures.

In the drawing, I have shown in Figures 1 and 2 a fragmentary view of a unit made up of metallic elements which comprises a number of parallel and spaced apart longitudinally extending main bearer bars 2 of generally inverted T-section, the web of which extends vertically. The bars are of sufficient area to resist the stresses which will be imposed thereon. Between the main bearer bars 2 and parallel thereto are rectangular intermediate bearer bars 3 of considerably less depth than the main bearer bars and disposed edge up. The main bearer bars 2 and the intermediate bearer bars 3 are connected adjoining their tops to form a grating of the desired mesh by zigzag bars or bent bars 4 having diagonal portions 5 which extend between the main bearer bars and the intermediate bearer bars, and flat portions 6 which bear against the sides of the said bars 2 and 3. The flat portions 6 of adjacent zigzag bars overlap the opposite sides of the main bars 2 and the intermediate bars 3 in the same region. The zigzag bars 4 are of less depth than the intermediate bearer bars 3. The tops of the main bearer bars 2, the intermediate bearer bars 3 and the zigzag bars 4 are in substantially the same plane. The arrangement of the bars and connecting zigzag bars facilitate their assembly and joinder in the overlapping regions, preferably by riveting to form an integral structure. It is, of course, under-

stood that other means of fastening may be employed, such as spot welding.

The intermediate bearer bars 3, which are of less depth than the main bearer bars 2, extend to and are supported on the carrier bars 7 which pass through slots 8 in the webs of the main bearer bars 2. The intermediate bearer bars are welded to the carrier bars 7 and the carrier bars 7 are welded to the webs of the main bearer bars 2.

In the form of the invention shown in Figures 3 and 4, the main bearer bars 9 are of modified railroad rail section and have a bottom flange 10 and a head portion 11 connected by a web 12. When main bearer bars of this shape are employed, it is essential that the flat portions of the zigzag or bent bars 13, which fit against the main bearer bars, be reduced in vertical section from the top at 14 so as to fit under the head portion 11. The flat portions 15 which fit against the intermediate bearer bars 16 are uninterrupted in section. The intermediate bearer bars are of rectangular section, are of considerably less depth than the main bearer bars and are placed edgewise in the structure. Of course the intermediate bearer bars could have a section other than rectangular. The tops of the main bearer bars, the intermediate bearer bars and the unreduced portions of the zigzag bars are in the same plane. The zigzag bars 13 are connected to the main bearer bars 9 and the intermediate bearer bars 16 preferably by riveting. Through the webs 12 of the main bearer bars a carrier bar 17 is passed through appropriate slots. The intermediate bearer bars 16 which are of less depth than the main bearer bars 9 rest on the carrier bar 17 and are preferably welded thereto. The bottom of the carrier bar 17 is above the bottom portion of the main bearer bars 9.

In the modification shown in Figure 5, the main bearer bars 18 are of inverted T-shape standing on edge and are spaced apart in parallel relation. The main bars 18 are connected by two adjoining zigzag bars 19 and 20 of rectangular section and of less depth than the main bars. The zigzag bars have diagonal portions 21 and flat portions 22, as have the bars shown in Figure 1. The zigzag bars 19 and 20 contact at the alternate flat portions 21 and are secured together, for example, by riveting. The other alternate flat portions overlap the main bearer bars 18 and flat portions of adjacent zigzag bars 23 and are secured together by riveting. It will be observed that there are no intermediate bearer bars in this construction. Carrier bars 24 pass through slots in the webs of the main bearer bars 18 and are preferably welded to the main bearer bars. The carrier bars 24 contact the bottoms of the zigzag bars 19 and 20, and support them. The carrier bars are disposed at suitable intervals along the length of the main bearer bars 18. The bottom of the carrier bars is above the bottom of the main bearer bars 18. The tops of the main bearer bars and of the zigzag bars are in the same plane.

My invention provides novel reenforcing means by which bars of relatively shallow depth may be utilized to the maximum of their supporting capacity. While the structure which I have described is particularly applicable to flooring of the open mesh type, it can also be employed as a reenforcement for concrete slabs. I also contemplate that the unit may have incorporated with it a plastic filling material over the whole or any part of the surface and to any depth, as

described in my co-pending application, Serial No. 170,587, filed October 23, 1937.

The spacing and sections of the main bearer bars, intermediate bearer bars, zigzag bars and the carrier bars depend on the conditions to be met and on the design employed. The cells formed by the tops of the various members must be of a suitable size having regard to the traffic to be carried.

By the use of my invention, it is possible to accomplish worthwhile economy in the amount of material used to carry a given load under given conditions. In a structure made according to my invention the main bearer bars serve to transmit the loads to the supporting structure. The loads imposed on the intermediate bearer bars are naturally transmitted to the carrier bars and thence to the main bearer bars and from the main bearer bars to the supporting structure.

While I have illustrated and described the preferred embodiment of my invention, it will be understood that the invention is not limited thereto but may be otherwise embodied and practiced within the scope of the following claims.

I claim:

1. A grating structure of the class described composed of units joined together to form a continuous structure, each unit including at least three, longitudinally extending main bearer bars in spaced relation, zigzag bars having diagonal portions and flattened portions connecting said main bearer bars and of less depth than and disposed between each pair of the main bearer bars, the alternate flattened portions of the zigzag bars contacting the sides of the main bearer bars and being secured thereto, the tops of the zigzag bars and the main bearer bars lying in the same plane, and carrier bars transversely passing through said main bearer bars, the upper edges of the carrier bars being in contact with the lower edges of the zigzag bars and supporting the zigzag bars at intervals, the bottoms of the carrier bars being above the bottoms of the main bearer bars.

2. A grating structure of the class described composed of units joined together to form a continuous structure, each unit including at least three, longitudinally extending main bearer bars in spaced relation, zigzag bars having diagonal portions and flattened portions connecting said main bearer bars and of less depth than and disposed between each pair of the main bearer bars, the alternate flattened portions of the zigzag bars contacting the sides of the main bearer bars and secured thereto, the tops of the zigzag bars and the main bearer bars lying in the same plane, and transverse carrier bars extending between and connected to said main bearer bars, the upper edges of the carrier bars being in contact with the lower edges of the zigzag bars and supporting the zigzag bars at intervals, the bottoms of the carrier bars being above the bottoms of the main bearer bars.

3. A grating structure of the class described composed of units joined together to form a continuous structure, each unit including at least three, longitudinally extending main bearer bars in spaced relation, a plurality of zigzag bars having diagonal portions and flattened portions connecting said main bearer bars and of less depth than and disposed between each pair of the main bearer bars, certain of the flattened portions of one zigzag bar bearing against and being secured to the main bearer bar and certain of the other flattened portions being secured

to the flattened portions of the adjoining zigzag bar, and carrier bars extending between and secured to the said main bearer bars, the upper edges of the carrier bars being in contact with the lower edges of the zigzag bars at intervals, the bottoms of the carrier bars being above the bottoms of the main bearer bars.

4. A grating structure of the class described composed of units joined together to form a continuous structure, each unit including at least three, longitudinally extending main bearer bars in spaced relation, a plurality of zigzag bars having diagonal portions and flattened portions connecting said main bearer bars and of less depth than and disposed between each pair of the main bearer bars, certain of the flattened portions of one zigzag bar bearing against and being secured to the main bearer bar and certain of the other flattened portions being secured to the flattened portions of the adjoining zigzag bar, and carrier bars transversely passing through aligned slots in said main bearer bars, the upper edges of the carrier bars being in contact with the lower edges of and supporting the zigzag bars at intervals, the bottoms of the carrier bars being above the bottoms of the main bearer bars.

5. A grating structure of the class described composed of units joined together to form a continuous structure, each unit comprising at least three, longitudinally extending main bearer bars in spaced relation, at least one longitudinally extending intermediate bearer bar parallel to and spaced apart and of less vertical depth than the main bearer bars disposed between each pair of main bearer bars, zigzag bars connecting said main bearer bars and intermediate bearer bars and secured thereto, the tops of said main bearer bars, intermediate bearer bars and zigzag bars being in the same plane, and carrier bars passing transversely through said main bearer bars, the upper edges of the carrier bars being in contact with and supporting the lower edges of the intermediate bearer bars, the bottoms of the carrier bars being above the bottoms of the main bearer bars.

6. A grating structure of the class described composed of units joined together to form a continuous structure, each unit comprising at least three, longitudinally extending main bearer bars in spaced relation, at least one longitudinally extending intermediate bearer bar parallel to and spaced apart and of less vertical depth than the main bearer bars disposed between each pair of main bearer bars, zigzag bars connecting said main bearer bars and intermediate bearer bars and secured thereto and of less vertical depth than the intermediate bearer bars, the tops of said main bearer bars, intermediate bearer bars and zigzag bars being in the same plane, and carrier bars passing transversely through said main bearer bars below the top and above the bottom of each of the main bearer bars, the upper edges of the carrier bars being in contact with and supporting the lower edges of the intermediate bearer bars, the bottoms of the carrier bars being above the bottoms of the main bearer bars.

7. A grating structure of the class described composed of units joined together to form a continuous structure, each unit comprising at least three, longitudinally extending main bearer bars of inverted T-section arranged in parallel spaced relation, at least one longitudinally extending intermediate bearer bar parallel to and spaced apart and of less vertical depth than the main bearer bars disposed between each pair of main

5 bearer bars, zigzag bars disposed between said
 main bearer bars and intermediate bearer bars
 and secured thereto and of less vertical depth
 than the intermediate bearer bars, the tops of
 10 said main bearer bars, intermediate bearer bars
 and zigzag bars being in the same plane, and
 carrier bars passing transversely through said
 main bearer bars, the upper edges of the carrier
 bars being in contact with and supporting the
 15 lower edges of the intermediate bearer bars, the
 bottoms of the carrier bars being above the bot-
 toms of the main bearer bars.
 8. A grating structure of the class described
 composed of units joined together to form a con-
 20 tinuous structure, each unit comprising at least
 three, longitudinally extending main bearer bars
 having a head portion and a foot portion con-
 nected by vertical webs in spaced parallel rela-
 tion, at least one longitudinally extending inter-
 25 mediate bearer bar parallel to and spaced apart
 from and of less depth than the main bearer
 bars disposed between each pair of main bearer
 bars, zigzag bars disposed between said main
 bearer bars and said intermediate bearer bars
 30 and secured thereto, said zigzag bars having diag-
 onal portions and flattened portions, said flat-
 tened portions being of reduced vertical depth
 where the flattened portions of the zigzag bars
 adjoin the main bearer bars so as to accom-
 modate the head of the main bearer bars, the
 tops of said main bearer bars, the unreduced

portions of the zigzag bars and the tops of the
 intermediate bearer bars being in the same plane,
 and carrier bars passing transversely through
 said main bearer bars, the upper edges of the
 carrier bars being in contact with and supporting
 5 the lower edges of the intermediate bearer bars,
 the bottoms of the carrier bars being above the
 bottoms of the main bearer bars.

9. A grating structure of the class described
 composed of units joined together to form a con-
 10 tinuous structure, each unit comprising at least
 three, longitudinally extending main bearer bars
 in spaced parallel relation, zigzag bars having
 diagonal portions and flattened portions connect-
 ing the main bearer bars and of less depth than
 15 and disposed between each pair of the main
 bearer bars, the alternate flattened portions of
 the zigzag bars contacting the sides of the main
 bearer bars and secured thereto, the tops of the
 zigzag bars and the main bearer bars lying in
 20 the same plane, and means below the zigzag bars
 for transmitting stresses from the zigzag bars to
 the main bearer bars, said means including car-
 rier bars extending transversely between the main
 bearer bars and secured thereto, the bottoms of
 25 the carrier bars being above the bottoms of the
 main bearer bars and the tops of the carrier bars
 being in contact with the lower edges of the
 zigzag bars.

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