

Feb. 13, 1940.

H. S. NAGIN

2,190,214

GRATING AND LIKE STRUCTURE

Filed Oct. 23, 1937

2 Sheets-Sheet 1

Fig. 1.

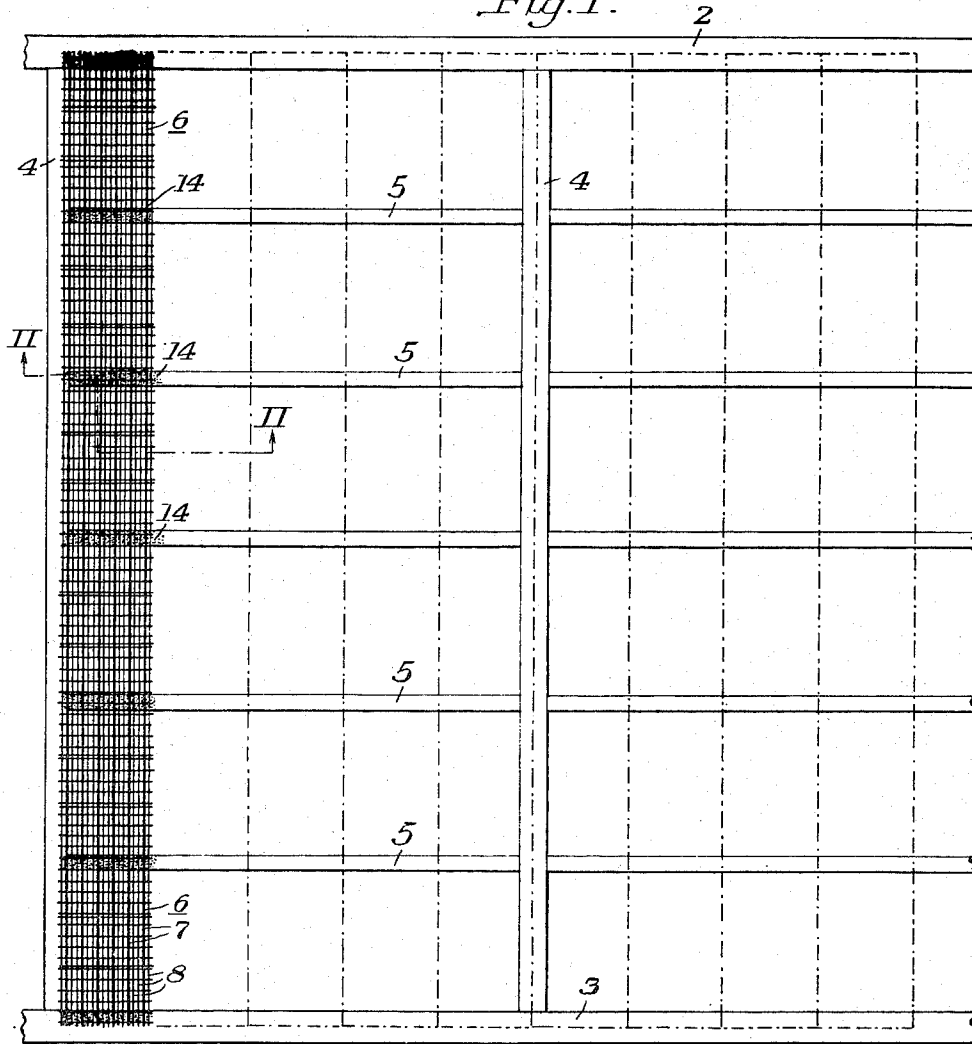
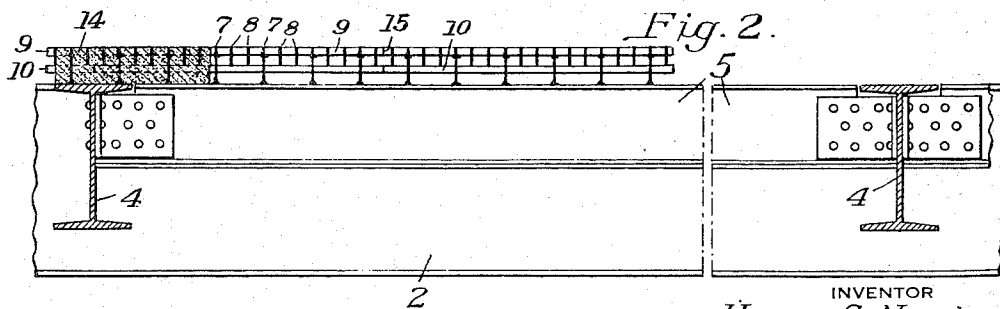


Fig. 2.

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Fig. 3.

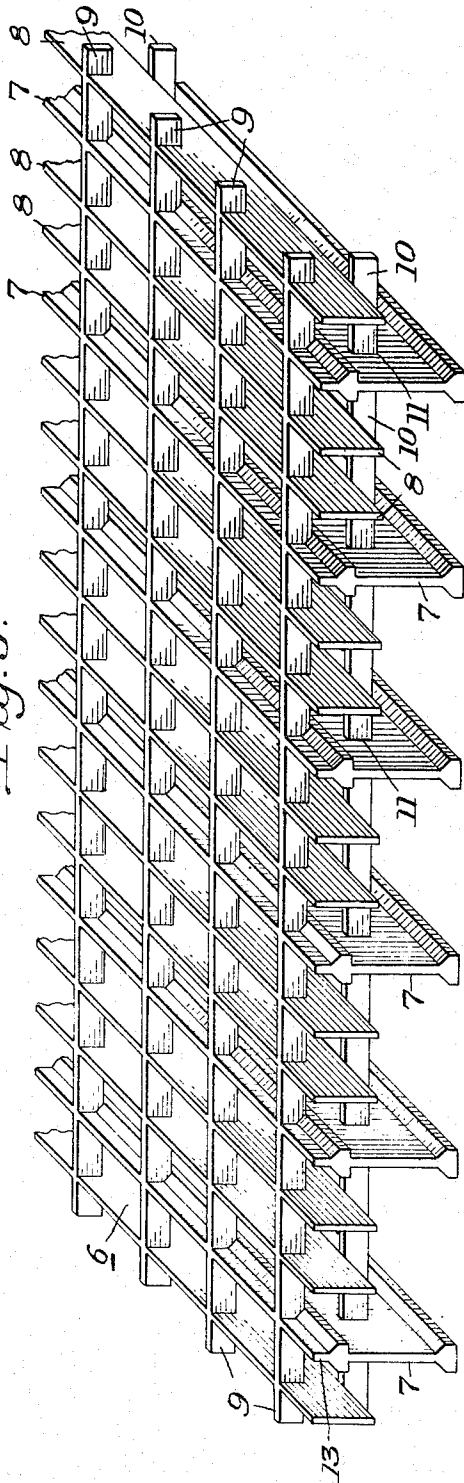


Fig. 4.

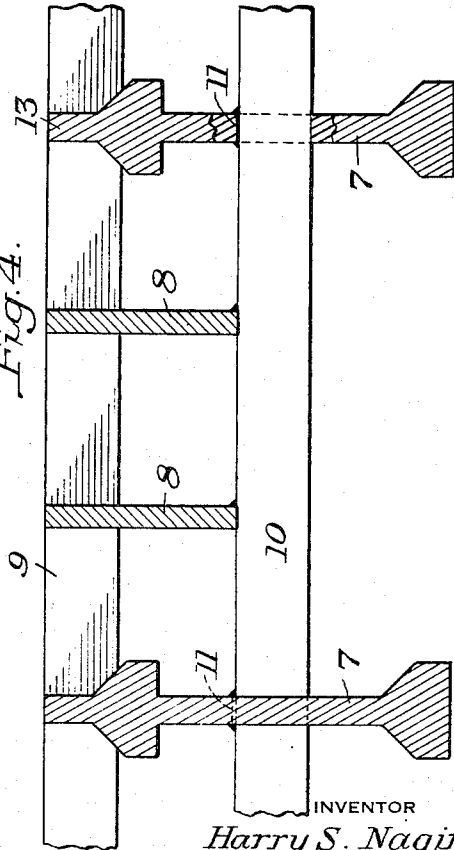
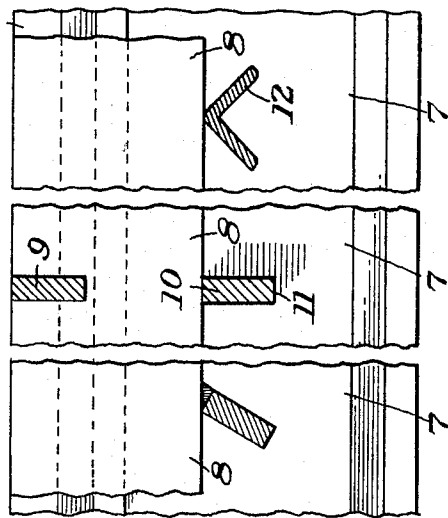


Fig. 5. Fig. 6. Fig. 7. 13



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UNITED STATES PATENT OFFICE

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GRATING AND LIKE STRUCTURE

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Application October 23, 1937, Serial No. 170,587

6 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 traffic without the aid of a reinforcing filling or a continuous substructure.

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 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 cross 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 reinforced 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.

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 must not be too large, as traffic will not smoothly pass over openings which are large in both directions, and it is particularly desirable that the dimension of the opening parallel to the line of travel be of small size. It has been found desirable to decrease the spacing of the bearer bars, rather than the spacing of the cross-bars, as the slab strength gained in proportion to the added weight incurred is considerably larger for a decrease in bearer bar spacing than for a decrease in the

spacing of cross-bars. 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 for smooth passage of traffic, 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 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.

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 and the openings presented to the traffic are of a desirable size. The structure is strong 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 drawings, where I have shown for purposes of illustration the present preferred embodiment of my invention:

Figure 1 is a plan view of a unit or slab in position over a supporting structure;

Figure 2 is a cross-section along the line II—II of Figure 1, but on an enlarged scale;

Figure 3 is a view in perspective of a portion of a unit or slab;

Figure 4 is a sectional end view of a part of a slab; and

Figures 5, 6 and 7 are partial sectional side views of a portion of a slab showing various modifications of the carrier bar.

In the drawings, Figures 1 and 2 show a supporting structure which may be a bridge or other traffic bearing structure having side girders or trusses 2 and 3, spaced apart floor beams 4 between and secured to the girders, and spaced apart stringers 5 between and secured to the floor beams. The tops of the floor beams, the stringers and the parts of the girders upon which the flooring rests are in substantially the same plane.

Resting on the supporting structure and secured thereto as by welding at appropriate points is an open mesh flooring. For ease in fabrication and erection, the flooring is generally formed from a number of units or slabs of convenient size, secured side by side on the structure. One of the units or slabs is shown in Figure 1 and designated by the numeral 6. The slab is preferably constructed so as to extend from one side girder 2 to the other side girder 3 and is welded at appropriate points to the stringers and the side girders, and in some cases to the floor beams. The desired number of units or slabs are placed side by side and welded together at appropriate contacting points to form the complete flooring.

The unit includes a desired number of parallel spaced apart main bearer bars 7 of a cross sectional area sufficient to carry the loads which will be imposed. Arranged in spaced apart relation between the main bearer bars and parallel thereto are intermediate bearer bars 8 of less depth than the main bearer bars. The main bearer bars and the intermediate bearer bars are connected at their tops by cross bars 9 secured thereto, preferably by electric pressure welding. The tops of all of said bars are in substantially the same plane. The intermediate bearer bars 8 are of less depth than the main bearer bars and are supported on and are preferably welded to carrier bars 10 which pass through slots 11 in the webs of the main bearer bars. The carrier bars 10 may be secured to the main bearer bars 7 by welding. Preferably the carrier bars 10 are more widely spaced apart than the cross bars 9.

The carrier bars 10 may pass through vertical slots 11 in the webs of the main bearer bars 7 as shown in Figure 6, or the slots may be inclined as shown in Figure 5. Where the slots are inclined, I prefer to make each alternative slot in each member of opposite angularity. This has a tendency to add longitudinal stiffness to the intermediate bars 8. It is not necessary

that the carrier bars be of rectangle section, as other sections may be employed, for example an angle member 12, as shown in Figure 7. The cross bars 9 and intermediate bearer bars 8 are preferably of rectangular section, although other shapes may be employed. The main bearer bars may have a cross section of the shape shown in Figures 3 and 4, which show a modified railroad rail section with an upstanding rib 13 to facilitate welding thereto of the cross bars 9 or may be of any other suitable shape.

In order to stiffen the structure and particularly the intermediate bearer bars, and at the same time prevent the deposition and collection of dirt and various kinds of refuse on top of the stringers 5, I prefer to fill the space over the stringers to the top of the flooring unit with a cementitious material or a plastic mass 14, as described and claimed in my co-pending application, Serial No. 143,278, filed May 18, 1937. If desired, the complete flooring may have a plastic material incorporated with it, over the whole or any part of the surface and to any depth.

For ease in fabrication, the floor units of a convenient size are prepared at the factory and assembled in place on the supporting structure. Preferably the units are placed so as to extend transversely of the roadway and across the stringers of the bridge, as shown in Figure 1. The required number of units are placed side by side and the projecting bars of each unit are welded to the corresponding bars of the adjacent unit as shown at 15 in Figure 2. The main bearer bars 7 may extend longitudinally of the roadway or even at an angle to the longitudinal axis of the roadway, and instead of being supported on stringers, which are fairly widely spaced apart in the usual bridge structure, the unit may rest on sills which extend transversely of the stringers and which are much less widely spaced apart than the stringers. The flooring structure may also rest on the stringers and the sills, in which case the sills would have to be at the same height as the stringers.

The spacing of the main bearer members, the intermediate bearer members, the cross bars and the carrier bars depends on the conditions to be met and on the design employed. It must be borne in mind, however, that the cells formed by the tops of the various members must be of such size as to be suitable for the traffic to be carried.

By the use of my invention, it is possible to accomplish worthwhile economies 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 transmitted to the carrier bars 10, thence to the main bearer bars 7 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. In a structural assembly, main bearer bars each formed of a rolled section of substantially I-beam form having base flanges and a bulbous head connected by a vertical web, an upstanding rib on the bulbous head, intermediate bearer bars of rectangular section of less depth than the main bearer bars lying between and spaced apart from the main bearer bars, cross-bars of con-

siderably less depth than the intermediate bearer bars and press welded at spaced intervals into said ribs and the tops of said intermediate bearer bars, and carrier bars extending through
 5 aligned slots in the main bearer bar webs and secured thereto, the tops of said carrier bars being in contact with the bottoms of and supporting the intermediate bearer bars.

2. A structural assembly composed of units
 10 joined together to form a continuous structure, each unit comprising at least three spaced-apart main bearer bars, at least one intermediate bearer bar of less depth than the main bearer bars disposed between each pair of main bearer bars
 15 and extending generally parallel thereto and spaced apart therefrom, cross-bars of less depth than the intermediate bearer bars extending generally transversely of the main bearer bars and connecting the tops of the main bearer bars and the tops of the intermediate bearer bars, the tops
 20 of all the bearer bars and the cross-bars lying in substantially the same plane, and carrier bars extending substantially transversely through the main bearer bars intermediate the top and bottom of the main bearer bars, the top edges of
 25 said carrier bars being in contact with the lower edges of the intermediate bearer bars.

3. A structural assembly composed of units joined together to form a continuous structure,
 30 each unit comprising at least three spaced-apart main bearer bars of greater depth than width, at least one intermediate bearer bar of less depth than the main bearer bars disposed between each pair of main bearer bars and extending generally
 35 parallel thereto and spaced apart therefrom, cross-bars of less depth than the intermediate bearer bars extending generally transversely of the main bearer bars and connecting the tops of the main bearer bars and the tops of the intermediate bearer bars, the tops of all the bearer
 40 bars and the cross-bars lying in substantially the same plane, and carrier bars extending substantially transversely between each pair of main bearer bars and secured thereto intermediate the top and bottom of each main bearer bar, the top
 45 edges of said carrier bars being in contact with the lower edges of the intermediate bearer bars.

4. A structural assembly composed of units joined together to form a continuous structure,
 50 each unit comprising at least three spaced-apart main bearer bars, at least one intermediate bearer bar of less depth than the main bearer bars

disposed between each pair of main bearer bars and extending generally parallel thereto and spaced apart therefrom, cross-bars of less depth than the intermediate bearer bars extending generally transversely of the main bearer bars and
 5 connecting the tops of the main bearer bars and the tops of the intermediate bearer bars, said main bearer bars having aligned slots intermediate their top and bottom edges, and continuous carrier bars extending through said slots, the top
 10 edges of the carrier bars being in contact with the bottom edges of the intermediate bearer bars.

5. A structural assembly composed of units joined together to form a continuous structure,
 15 each unit comprising at least three main bearer bars of greater depth than width spaced apart and extending substantially parallel to each other, intermediate bearer bars of less depth than the main bearer bars disposed between the main
 20 bearer bars and substantially parallel thereto, there being at least one intermediate bearer bar between each pair of main bearer bars, cross bars of less depth than the intermediate bearer bars extending between and connecting the tops of the
 25 main bearer bars and the tops of the intermediate bearer bars, and carrier bars extending between and secured to the main bearer bars, the top edges of the carrier bars being in contact with the bottom edges of the intermediate bearer bars, the bottom edges of the carrier bars lying in a
 30 plane which is above the plane of the bottoms of the main bearer bars.

6. A structural assembly composed of units joined together to form a continuous structure,
 35 each unit comprising at least three main bearer bars of greater depth than width spaced apart and extending substantially parallel to each other, intermediate bearer bars of less depth than the main bearer bars disposed between the main
 40 bearer bars and substantially parallel thereto, there being at least one intermediate bearer bar between each pair of main bearer bars, cross bars extending between and connecting the tops of the main bearer bars and the tops of the intermediate bearer bars, and carrier bars extending
 45 between and secured to the main bearer bars, the top edges of the carrier bars being in contact with the bottom edges of the intermediate bearer bars, the bottom edges of the carrier bars lying in a plane which is above the plane of the
 50 bottoms of the main bearer bars.

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