

June 21, 1960

H. NAGIN

2,941,455

COMPOSITE GRATING STRUCTURE

Filed Nov. 29, 1954

Fig.1.

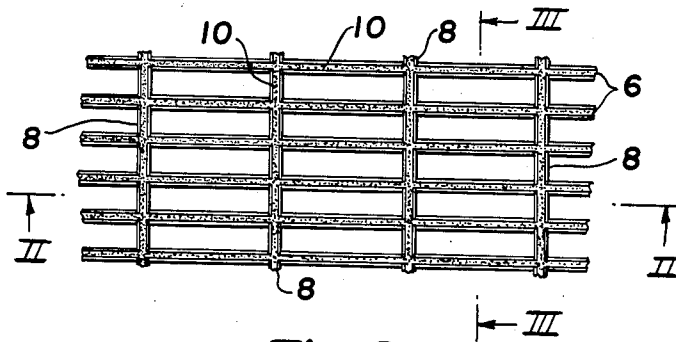


Fig.2.

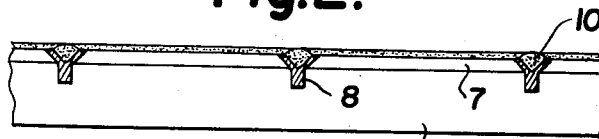


Fig.3.

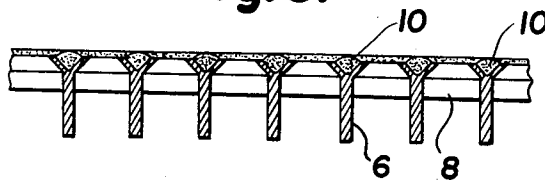


Fig.4.

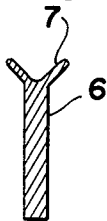
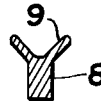


Fig.5.



INVENTOR.

Harold Nagin

BY

Christy, Parmelee, Stuppeland

ATTORNEYS

1

2,941,455

COMPOSITE GRATING STRUCTURE

Harold Nagin, Pittsburgh, Pa., assignor to Reliance Steel Products Company, McKeesport, Pa., a corporation of Pennsylvania

Filed Nov. 29, 1954, Ser. No. 471,666

2 Claims. (Cl. 94-5)

This invention is for a new composite grating such as those used in bridge floors and other traffic bearing surfaces, as well as platforms, sidewalks and elsewhere.

Gratings of the type referred to are generally comprised of one set of parallel main bars or sections of metal called bearer bars, and another set of transversely extending bars, called cross bars. The cross bars are pressure welded or otherwise secured to the bearer bars and the tops of the two sets of bars are in the same plane.

One objection to gratings of this character, especially when used for vehicular traffic, is that skidding may occur, due to the metal having a low coefficient of friction when wet, and another is that the edges of the metal bars provide a relatively small surface on which the wheel of the vehicle rests, causing excessive vibration.

In my copending application Serial No. 456,380, filed September 16, 1954, now Patent No. 2,895,389, I have shown a grating designed to provide an improved traction surface by having a relatively thin coating of abrasive grains secured over the tread surface by an epoxy resin. Such a mixture will adhere firmly to the metal, even under heavy traffic.

An object of the present invention is to provide an improved grating in which both sets of bars has the top edge of each bar provided with a trough-like formation into which a filling of resin and abrasive mix is placed, the filling preferably being heaped to a level above the tops of the troughs. This provides a greater mass of the resin abrasive material to resist wear than does the grating of my copending application above referred to. It further provides a grating which presents wider traction surfaces to the wheels of vehicles, or in the case of sidewalk gratings, to the shoes of the wearer.

A further object of the invention is to provide a new form of composite grating formed principally of metal, but having the wearing surface provided of firmly anchored abrasive and resin material having a high coefficient of friction.

My invention may be more fully understood by reference to the accompanying drawings, in which:

Fig. 1 is a plan view of a grating embodying my invention;

Fig. 2 is a longitudinal section in the plane of line II-II of Fig. 1;

Fig. 3 is a transverse section in the plane of line III-III of Fig. 1;

Figs. 4 and 5 are transverse sections on a larger scale through the individual bearer and cross bars respectively of the grating shown in Fig. 1.

The grating as disclosed in the drawings is comprised of main bearer bars 6 and transversely-extending cross bars 8. The main bearer bars 6 are of substantially deeper section than the cross bars 8, and except at the top they are of solid section as is common in gratings of this type. The top edges of the main bearer bars are rolled in such manner as to provide upwardly-diverging flanges, forming between them a trough 7. The cross bars 8 have their top edges similarly formed to provide troughs 9. As

2

shown in the drawings, the main bearer bars and the cross bars intersect, the main bearer bars being cut away to receive the cross bars which are then welded in place, the top edges of the cross bars and the main bearer bars being in substantially the same plane.

After the grating has been formed, the troughs 7 and 9 of the respective bars are filled with a resin-abrasive composition to a level extending above the level of the edges of the trough so that the resin-abrasive composition extends continuously throughout the full length of the grooves of both the cross bars and the main bearer bars, and this condition exists at the intersections of the cross bars and the main bearer bars as well as elsewhere in the length of the bars, as is clearly shown in the drawings.

The filling extends upwardly above the edges of the troughs in both sets of bars to a substantially common level and provides the entire traffic-bearing surface of the grating. The resin-abrasive mix provides a tough wear-resistant surface having a high coefficient of friction and the resin used has a strong adhesion to metal under all temperature conditions to which a grating of this character would be normally subjected, and will not creep or flow.

The resin-abrasive composition may be any of the various compounds described in my application Serial No. 456,380, filed September 16, 1954, now Patent No. 2,895,389, of which the present application is an improvement, or disclosed in the application of Harry S. Nagin and Donald H. Russell, Serial No. 427,873, filed May 5, 1954, in both of which the resin is comprised in substantial part or entirely of an epoxy resin and the abrasive is a particulate or granular material such as grains of aluminum oxide or other abrasive, sand, or an abrasive in conjunction with sand, or sand with hydraulic cement. Epoxy resins, when cured with a suitable catalyst, may be cured in situ at room temperature. They adhere tenaciously to metal over all temperature conditions to which a grating is normally subjected in use, neither becoming excessively brittle when very cold, nor softening when exposed to hot sunshine. They are the reaction products of epichlorohydrin and diphenylolpropane, and are available as liquids, semi-liquids, and solids. In the practice of the present invention I prefer to use an epoxy resin having a light syrupy consistency at room temperatures. To cure these resins, it is necessary to use a catalyst which is introduced at the time that the resin-abrasive composition is prepared, and which remains in the cured resin. Catalysts for the resin are in the class of polyamines, as diethylene triamine, ethylene diamine, dimethyl-propyl amine, diethylamino-propyl amine, piperidine and pyridine, and are well known in the art. Different catalysts may affect the temperature required to cure the resin, and the amount of catalyst will also vary the curing time. I have found diethylene triamine to be satisfactory in the ratio of about 10% by weight of catalyst to resin. Some resiliency without loss of adhesive qualities may be imparted to the epoxy resins and some economy effected by adding thereto natural or synthetic rubber, either in the granulated form or the latex form. Thus polyvinyl acetate latex, natural rubber latex, and latex or emulsion forms of synthetic rubbers may be added to the mix. For instance, a mixture in the approximate proportion by weight of one pound of commercial epoxy resin of a light syrup like consistency to 2.5 ounces of catalyst to 3.5 ounces of rubber or latex as above described may be used. When polyvinyl acetate latex is used, it is one commercially available having a resin content of about 50% to 50% of water.

Another example is one part by volume of Epon No. 828 resin plus 10% by weight of catalyst with 10 parts by volume of sand or harder abrasive grains such as aluminum oxide, silicon carbide, or crushed natural rock

particles. The mix used should be a relatively stiff mix which is capable of being heaped into the trough and retaining its form, although it need not have exactly the percentages above indicated. Also various mixes including epoxy resin with or without polyvinyl acetate with hydraulic cement and abrasive grains as disclosed in the aforementioned application of Nagin and Russell may be employed with not less than about 50% of the total resin being an epoxy resin. For example I may prepare an emulsion of epoxy resin of the character described and polyvinyl acetate latex with about equal weights of the two resin solids, and mix with it diethylene triamine as a catalyst, using about 10% by weight of catalyst to epoxy resin content. I add one part of quick-setting cement or Portland cement to .1 to .15 part by weight of resin solids. To this mix is added sand or other aggregate or combinations of sand and other aggregate, such as abrasive grains to form a stiff mix, there being from 3 to 5 parts of sand and/or aggregate to 1 part of cement. Water may be added as needed. The same formula may be followed using only epoxy resin emulsion instead of the two resins. A substantial proportion of the resin must be an epoxy resin in order to secure high adhesion of the mix to the metal when it solidifies.

The composition per se forms no part of my invention which is directed to a grating having trough-like surfaces in some or all portions of the tread surface thereof into which the resin-abrasive composition having the desired characteristics is filled and hardened or cured.

I claim:

1. A composite metal grating comprised of a series of parallel main bearer bars of solid section, a series of cross bars of solid section intersecting the main bearer bars and set into the top edges of the main bearer bars and of less depth than the main bearer bars, the top edges of both series of bars being in a common plane, the top edges of both series of bars having oppositely flared sides defining a V-shaped trough and having an overall width greater than the transverse thickness of the bars, and a

filling in the aforesaid troughs, the filling being comprised of a thermosetting epoxy resin and hard abrasive grains cured in situ in the trough whereby the resin is bonded to the metal and to the grains, said filling projecting above the upper edges of said troughs and covering the intersections, the filling constituting the entire traffic bearing surface of the grating.

2. A composite metal grating comprised of a series of parallel main bearer bars, a series of cross bars intersecting the main bearer bars and set into the top edges of the main bearer bars and of less depth than the main bearer bars, the top edges of both series of bars being in a common plane, the top edges of both series of bars having oppositely flared sides defining a V-shaped trough, and a filling in the aforesaid troughs, the filling being composed of a thermosetting epoxy resin and hard abrasive grains cured in situ in the troughs whereby the resin is bonded to the metal and to the grains, said filling projecting above the upper edges of said troughs and covering the intersections, the filling constituting the entire traffic-bearing surface of the grating.

References Cited in the file of this patent

UNITED STATES PATENTS

25	1,665,846	Denni	Apr. 10, 1928
	2,077,749	Fischer	Apr. 20, 1937
	2,246,898	Sayre	June 24, 1941
	2,265,735	Lambert	Dec. 9, 1941
30	2,319,468	Nagin	May 18, 1943
	2,512,996	Bixler	June 27, 1950
	2,670,060	Fenske	Feb. 23, 1954
	2,718,829	Seymour et al.	Sept. 27, 1955
	2,735,829	Wiles et al.	Feb. 21, 1956
35	2,747,474	Nagin	May 29, 1956

FOREIGN PATENTS

	519,055	France	Jan. 17, 1921
	455,470	Great Britain	Oct. 21, 1936
40	513,453	Great Britain	Oct. 12, 1939