Feb. 12, 1935. W. E. IRVING 1,991,154

BRIDGE

Filed May 10, 1933

Fig. 1.

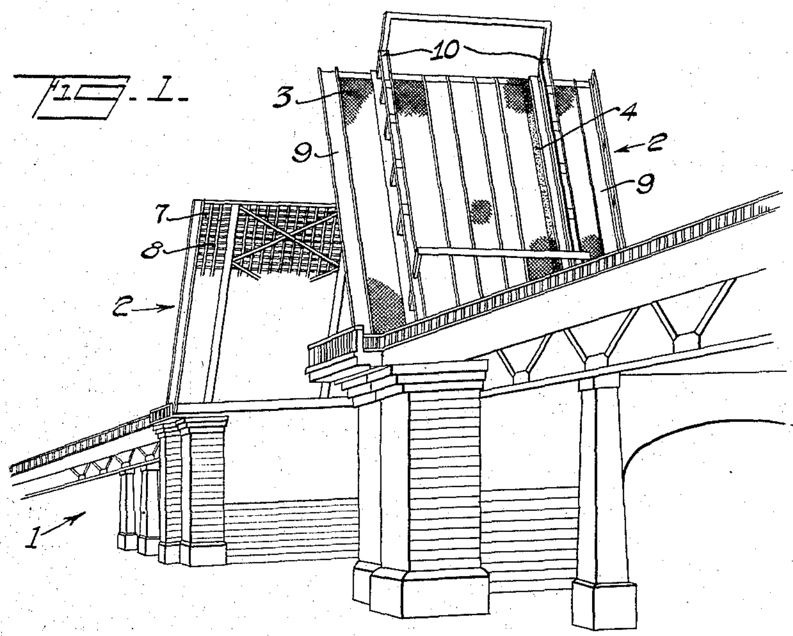


Fig. 2.

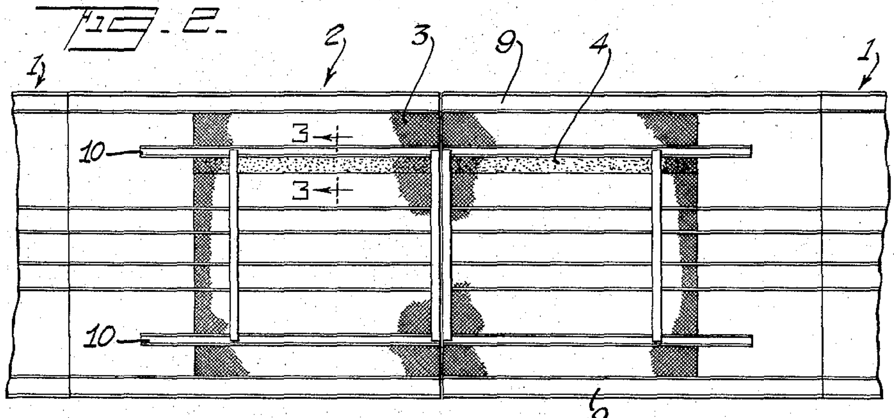


Fig. 3.

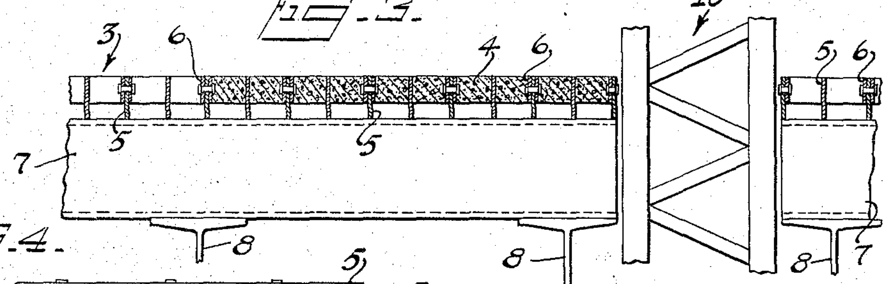
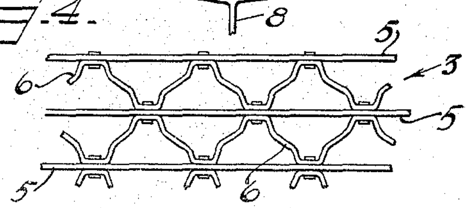


Fig. 4.



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1,991,154

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1,991,154

BRIDGE

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9 Claims. (Cl. 14—73)

This invention relates to highway bridges generally but is more specifically designed to produce a bridge of the bascule type or of the vertical lift type in which the lifting span or spans shall be exceptionally light in weight and shall present little resistance to wind pressure, so as to save in the expenditure of power in opening the draw, and reduce the strains to which the structure as a whole is subjected when and while the draw is opened or being opened and strong winds are blowing.

I have found that all the requirements for a useful bridge for both vehicular and pedestrian traffic are fully met, and many unexpected advantages realized, if the bridge deck or floor is mainly composed of an openwork metal grating.

Especially is this true if such deck, or long sections thereof, is or are formed of a practically continuous grating such as is disclosed in Patent No. 1,629,134 to W. A. Van Hoffen, dated May 17, 1927.

Among the advantages resulting from such improvement may be mentioned the following:

When a bascule span of that type is being operated it presents very little resistance to wind pressure, and so reduces the amount of power required in lifting or lowering the bascule section, as well as the strains to which it and the supporting structure are subjected while elevated entirely or partially.

The weight of said section is substantiallly reduced below present requirements, thereby contributing to the same beneficial results. Also the entire deck structure is open to the atmosphere and for painting and does not collect and hold the moisture which seeps through ordinary paving to the supporting structure beneath.

The usual accumulations of snow and dirt are prevented, thus reducing the dead load and costs of cleaning, even ordinary dust being drawn out of the grating mesh by wind suction.

Frequent and costly repaintings of the under surfaces to prevent rusting are rendered unnecessary.

The usual costs of frequent repairs to pavement are much reduced, the grating surface being practically indestructible and maintaining always a perfectly plane surface.

Finally, and perhaps most important of all, the particular preferred form of grating used prevents skidding of motor cars.

The best form of apparatus at present known to me embodying my invention is illustrated in the accompanying sheet of drawing in which

Fig. 1 is a perspective view of a portion of a bascule bridge with my invention applied thereto, the draw being open.

Fig. 2 is a plan view of same with parts broken away, the draw being closed.

Fig. 3 is a detail cross section on an enlarged scale taken on line 3—3 of Fig. 2 showing the runway for animals, and

Fig. 4 is a detail plan view showing the preferred form of grating mesh.

Throughout the drawing like reference characters indicate like parts. 1 represents generally the main bridge structure, and 2, 2, the upwardly swinging sections or bascules forming the draw. 3 represents the grating forming the deck or floor of each bascule section, and 4 is a strip of cement filling running preferably along one edge of the roadway over which sheep, hogs and other animals having small hoofs may safely be driven.

Preferably I employ a grating having its mesh formed by a series of parallel straight bars 5, 5, between which the bent strips 6, 6, are fastened by riveting or other convenient means in the well known way. Preferably also these strips are of less depth than the straight bars, the parts being assembled so that the upper edges of both strips and bars shall be in the same plane, thus obtaining the advantages described in Patent No. 1,045,795 to G. A. Keller, dated November 26, 1912. The grating is supported on any suitable sills 7, and stringers 8, 8. The usual foot paths are shown at 9, 9, Fig. 2. Overhead trusses 10, 10, extend lengthwise of the swinging sections or bascules 2, 2, for stiffening the same.

In operation, when the bascule sections are in lowered position shown in Fig. 2, a particularly smooth roadway is produced over which motor cars can be driven rapidly without vibration. Snow, rain, oil and dirt fall through the open mesh of the floor into the water beneath. The clean upper surface of the grating so maintained furnishes a good traction base, and one to which rubber tires will closely adhere when brakes are sharply applied. Also the straight bars 5, 5, present an additional resistance to side-skidding when brakes are thus used, or the car swerves sharply to either side in avoiding an obstacle in its path. The bent strips 6 aid this action and also present a resistance to forward skidding, when brakes are sharply applied, thus enabling cars to be stopped more quickly, and in less space than is required on an ordinary pavement, especially when the latter is covered with the usual film of oil drippings.

When the bascule sections are entirely or partly raised the wind blows freely through the open mesh of the grating so that very little wind pressure is developed on the raised sections of the draw and a cheaper operating power plant can be used, consuming less power than that which would be required if a brick or cement flooring were used, with its added load of dirt and possibly ice and snow.

The same flooring can also be used for the fixed spans of the bridge and many of the above outlined advantages would also be realized there.

Of course other forms of open mesh grating could be substituted for that shown and described without losing all of the advantages above pointed out, so long as the general principles of construction here explained are retained and the resulting structure is within the definitions of the appended claims.

Preferably, however, I employ the type and size of grating mesh indicated in the drawing, Fig. 3 of which shows the grating and supporting sill 7 and stringers 8 of the relative size and proportions actually used in the University Bridge at Seattle, Washington, which has been recently rebuilt with my invention in use thereon. Fig. 4 which shows a detail of the particular type of grating mesh is on a slightly larger scale than that of Fig. 3, for greater clearness. It being obvious to those skilled in the art that the sills 7 for a highway bridge of this type would be formed of I-beams of about six inches depth, it will be seen by comparison in Fig. 3 that the straight bars 5 of the grating are spaced apart about two and one-half inches from center line to center line so that each one of the meshes or loops formed by the bent strips 6, as shown in Fig. 4, will be a little less than five inches in vertical dimension. As also shown in Fig. 4 the successive rivets in each straight bar 5 are spaced apart a distance substantially equal to that between the rivets at the top and bottom of each grating mesh when looking at this figure. The general result is that the grating meshes form series of geometrical figures each substantially square in contour but with reversed curved border lines and with a straight bar forming a diagonal of each such substantially square figure, all rivets throughout the gratings being spaced apart both lengthwise and crosswise thereof at a uniform distance somewhat less than the distance between centers employed in standard close mesh ventilated flooring, which latter, as is well known to those skilled in the art, for many years has been substantially seven inches. It also results from the use of the above specified dimensions in designing grating mesh that each two adjacent bars or straight members 5 are spaced apart a distance (2½ inches from center line to center line) which is about one-half the wave-length of the bent or reticuline strips 6, said wave-length of course extending from the center of one rivet to the center of the next rivet lengthwise of the grating.

The resultant design approximates quite closely that shown in design patent to Paul L. Price, No. 73,440, for "Floor grating", granted September 13, 1927, but the wavelength of the grating there shown is slightly more than twice the distance crosswise between two adjacent bars, the Price design having evidently been based upon the previous standard wave length for floor gratings, which is seven inches, while the spacing apart of the straight bars was less than one-half that, being approximately 2½ inches, in said patented design.

While the difference to the eye between the Price design and that shown in Fig. 4 of the present application is not marked, I have preferably shown the square mesh layout first above described for the reason that I have found the slightly greater number of strip sections extending diagonally crossways of the grating in every unit length thereof is more effective in presenting just the required degree of resistance to the action of rubber tires tending to slide lengthwise of the bridge when the passing car is sharply checked in its movement by its brake or is sharply accelerated by the driver stepping on the accelerator.

As indicated in Figs. 1 and 2, I preferably make this decking substantially continuous and integral in character from side to side of the roadway and along the entire length of very considerable sections thereof which preferably are continued from one expansion joint of the supporting bridge structure to another. For this purpose I preferably employ a continuous grating structure such as is shown and described in patent to W. A. Van Hoffen, No. 1,629,134, dated May 17, 1927. This is most important, as if separate smaller panels of the relatively light grating, such as can alone be fabricated in the shop out of commercial lengths of iron bars and strips of the character here required were used, the surface of the roadway would be composed of a large number of separate panels which could only be held in position under heavy traffic with very great difficulty and the abutting ends and sides of which would create irregularities in the road surface besides presenting innumerable steel points and edges, each exerting its cutting action upon the rubber tires pressed down upon it by the weight of the overrunning car or truck, and also jolting the vehicle.

Another particular advantage of the grating decking results from the fact that being absolutely self-draining, no crowning of the surface of the roadway such as is necessary with all other pavements is required when it is used, it being therefore possible to lay the grating absolutely flat upon the sills or purlins 7, as well shown in Fig. 3. This reduces the cost of installation of the decking considerably and permits all the bars 5 and strips 6 to be installed in absolutely vertical position instead of being tipped slightly to one side as is the case with ordinary paving blocks.

Another novel and unexpected function of any open mesh bridge decking made according to my invention which has developed in practical use thereof, is its cooperation with motor cars moving rapidly over it in automatically cleansing, not only the grating itself, but also the subjacent supporting structure through a vacuum cleaner action. It has been shown that the air compressed before every rapidly moving car is forced downward through the grating meshes and sucked upward again behind the car. This has been visually demonstrated by scattering light wood ashes on the grating and on the sills and beams beneath. After a few cars have thereafter passed over the bridge, the ashes are found to have been completely blown away, upward or downward. This vacuum cleaner action prevents any dust collecting on the decking or on its subjacent supporting structure to absorb and retain moisture, thus initiating and maintaining a continuous rusting of the metal, such as occurs when such collections of moisture-absorbing dirt are protected from the sun's rays and the air currents by the imperforate, roof-like deckings of the prior art.

I have found by practical experience that the best practice is to use a grating of the type shown in Figs. 3 and 4 which, together with the supporting sills 7 (made of standard 6" channels set on edge, or I-beams) placed 15 inches apart between centers, weighs only 22 lbs. per square foot of roadway surface.

Having described my invention, I claim:

1. In a bridge structure, a bridge decking for motorized traffic equipped with pneumatic tires, formed of a non-skid, self-cleaning, open-mesh grating comprising a plurality of metal strips all set on edge with their upper edge surfaces all lying in one and the same plane said grating resting on a skeleton supporting structure, and said strips being held together at all points of contact one with another with sufficient rigidity to form a unitary structure presenting a reticulated upper surface serving as a roadway for such traffic, the total area of the openings in which surface exceeds the total area of the exposed upper edge surfaces of all metal strips forming the same; whereby practically all finely divided or liquid material falling toward said decking passes through the open meshes thereof, and dust particles temporarily deposited on said strip-edge surface are soon forced off said meshes by the tires of successive motor vehicles crossing the bridge, while the vertical air currents set in motion through said open meshes by rapidly moving vehicles also keep the subjacent deck-supporting structure clean and dry.

2. A bridge floor structure defined in claim 1 in which approximately half of said strips are of uniform thickness, and are spaced apart laterally at uniform distances each many times greater than said thickness and extend along lines parallel to the line of direction of traffic, while considerable portions of the length of each remaining strip diverge from said traffic line.

3. A bascule bridge for motor traffic having its upwardly swinging section provided with a road surface such as defined in claim 1.

4. A bridge floor structure such as defined in claim 1 in which said metal strips are of two classes, the members of one of which classes are straight bars of uniform depth extending lengthwise of the bridge, while the members of the second class are bent into wavelike form and are of considerably less depth than are said bars.

5. A bridge floor structure such as defined in claim 1 in which said metal strips are of two classes, the members of one of which classes are straight bars of uniform depth extending lengthwise of the bridge, while the members of the second class are bent into wavelike form and are of considerably less depth than are said bars, said bent strips forming a uniform series of figures each substantially square in contour with one of said straight bars forming a diagonal thereof.

6. A bridge floor structure such as defined in claim 1 in which said metal strips are of two classes, the members of one of which classes are straight bars of uniform depth extending lengthwise of the bridge, while the members of the second class are bent into wavelike form and are of considerably less depth than are said bars, said bent strips forming a uniform series of figures each substantially square in contour with one of said straight bars forming a diagonal thereof, the distance between the center lines of said straight bars being about two and one-half inches.

7. A bridge floor structure such as defined in claim 1, which exists in the form of continuous, structurally integral sections of grating of the character described extending from one expansion joint to another of the supporting bridge structure longitudinally of the latter, and from side to side of said bridge roadway.

8. A highway bridge for use by motorized traffic equipped with pneumatic tires comprising the combination, with a skeleton supporting structure, of a decking for the traffic lanes thereof formed of a non-skid, self-cleaning, open-mesh grating comprising a plurality of metal strips all set on edge with their upper edge surfaces all lying in one and the same plane, and their lower edges supported along spaced-apart lines, said strips being held together at all points of contact one with another with sufficient rigidity to form a unitary structure presenting a reticulated upper surface serving as a roadway for such traffic, the total area of the openings in which surface exceeds the total area of the exposed upper edge surfaces of all metal strips forming the same; whereby practically all finely divided or liquid material falling toward said decking passes through the open mesh thereof, and dust particles temporarily deposited on said strip-edge surfaces are soon forced off said meshes by the tires of successive motor vehicles crossing the bridge, while the vertical air currents set in motion through said open meshes by rapidly moving vehicles also keep the subjacent deck-supporting structure clean and dry.

9. A combination such as defined in claim 8 in which said supporting structure includes a plurality of parallel sills extending transversely of the roadway and on which said grating may rest directly, and a plurality of stringers extending parallel to the roadway on which said sills rest; whereby a grating of sufficient lightness to permit commercial fabrication and insure free air circulation may be used, but still support the heavy wheel loadings of modern motor trucks.

WALTER EDWARD IRVING.