Oct. 18, 1927. 1,645,622

B. A. PRINCE

METAL AND CONCRETE STRUCTURE FOR FLOORING AND SIMILAR PURPOSES

Filed Feb. 21, 1927 2 Sheets-Sheet 1

FIG. 1.

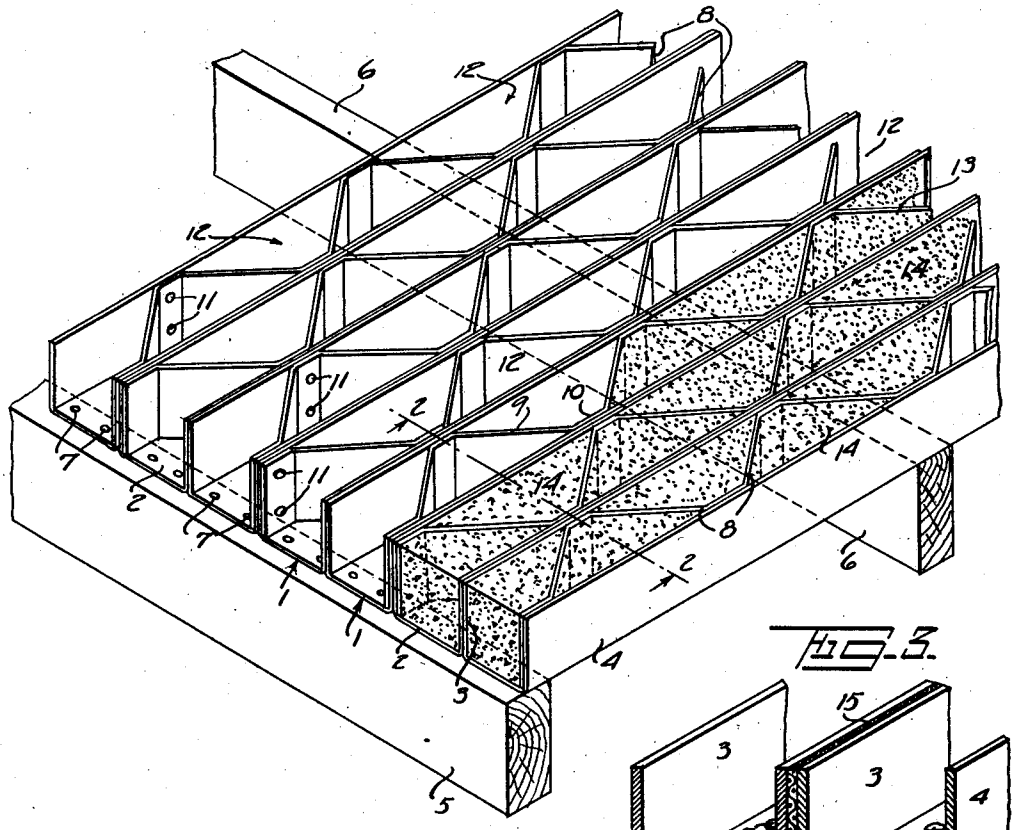



FIG. 3.

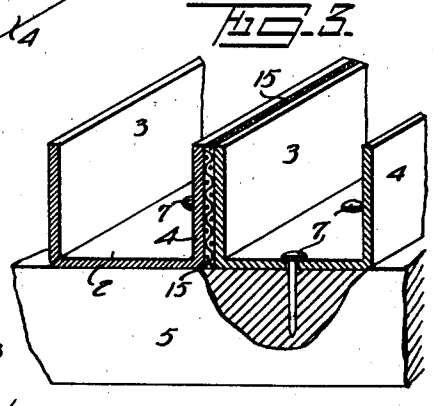
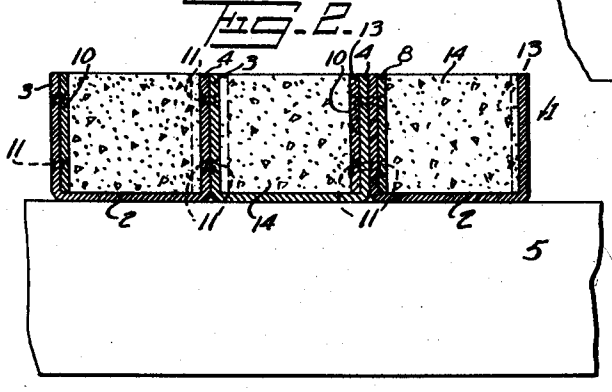



FIG. 2.




INVENTOR
Burton A. Prince
BY
ATTORNEY

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FIG. 5.

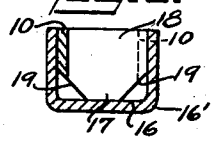



FIG. 4.

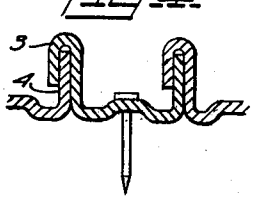



FIG. 6.

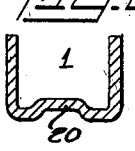



FIG. 6A.

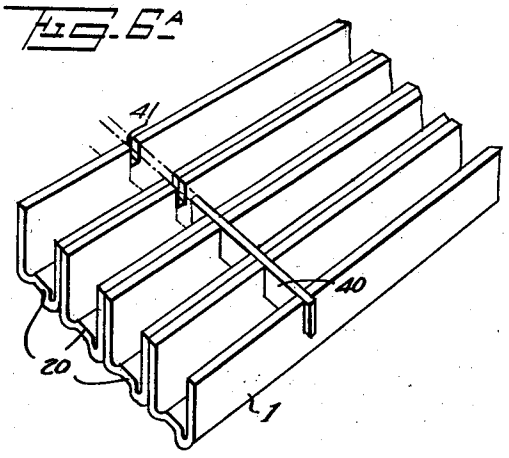



FIG. 7.

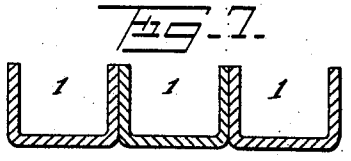



FIG. 8.

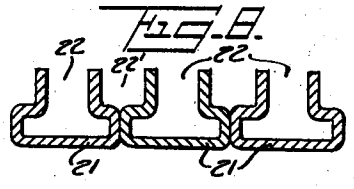



FIG. 9.

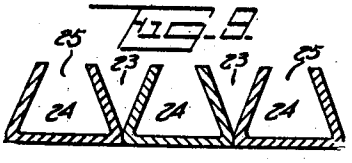



FIG. 10.

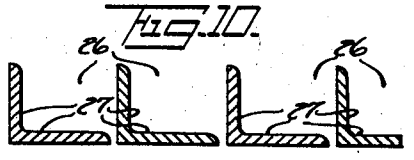



FIG. 11.

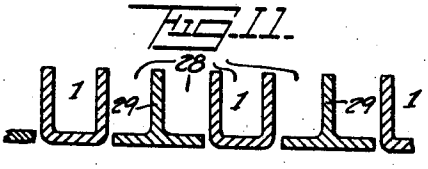



FIG. 12.

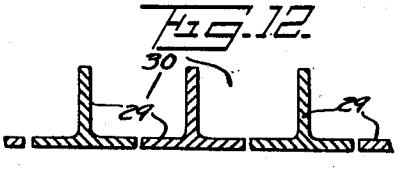
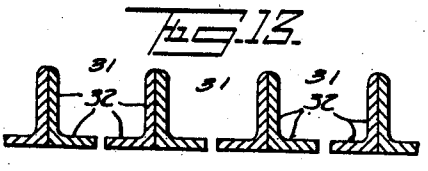



FIG. 13.




INVENTOR
Burton A. Prince
BY
ATTORNEY

Patented Oct. 18, 1927. 1,645,622

# UNITED STATES PATENT OFFICE.

BURTON A. PRINCE, OF WESTFIELD, MASSACHUSETTS, ASSIGNOR TO IRVING IRON WORKS COMPANY, A CORPORATION OF NEW YORK.

## METAL AND CONCRETE STRUCTURE FOR FLOORING AND SIMILAR PURPOSES.

Application filed February 21, 1927. Serial No. 169,770.

This invention relates to improvements in a structural unit that is essentially a slab. This unit lends itself particularly to use as a bridge flooring and in this specification its application to that type of use will be discussed and disclosed. It will be apparent, however, that many other fields for, and applications of, this type of construction exist and in describing the application of this structural unit to bridge flooring I do not wish to limit myself to that use alone.

This unit, which is essentially a slab, finds application in the following general types of construction: bridge flooring; flooring; ceilings; roofs, walls; partitions; road surfacing; overhead passageways, etc.

This invention involves the employment, in a floor structure, of a plurality of associated units, each of which comprises a supporting element, preferably of U-shaped cross section or of some cross section adapted to cooperate with others in the formation of a channel member, for holding a zigzag or transverse bar or bars to form with it a flooring surface, with or without a suitable body of filling material, such as concrete, in which said bar or bars may be embedded.

There is a need for a substitute for planking and ordinary reenforced concrete for use as bridge and other flooring. This need has resulted from traffic changes both with respect to the number of vehicles and to their type. Many existing bridges must be replanked at frequent intervals. Ordinary reenforced concrete slabs are very heavy. Many bridges were originally designed for lighter loads than are now commonly applied to them. In addition, many of the existing structures will not carry the dead load which would result from the use of a concrete type of bridge flooring.

I am well aware that heretofore bridge flooring has been armored with iron or steel plate but the use of this type of surface does not embody many of the advantages that are to be found in the invention which I here describe.

One type of construction that finds application to bridge flooring and which I particularly wish to claim is as follows: A structural unit consisting of a series of U-shaped sections, or channel irons, which are placed side by side with their vertical webs in contact with each other, the bottoms of the channel irons resting directly on the supporting members of the bridge structure, in the case of wooden bridges on the timbers or bridge joists, or on the I beams if of iron work.

These U-shaped sections are suitably fastened to the supporting members as by nailing, riveting, or bolting. Located in the channel irons are zigzag shaped bars. For the purpose of preventing rust, the metal portions may be coated with asphalt, tarvia, or other common corrosion preventers or the sections may be separated by a strip of tarred paper or similar material which will prevent the entrance of moisture between them. It is evident that a structure of this latter sort will also allow for expansion and contraction due to temperature changes.

An important feature of this invention is that no forms such as are commonly used in reenforced concrete constructions are necessary for its installation, the channel members serving this purpose and remaining as an integral part of the construction.

The best form of apparatus embodying my invention at present known to me, with certain modifications thereof, are illustrated in the accompanying two sheets of drawings in which:

Fig. 1 is a schematic perspective view showing a portion of the bridge flooring assembled and resting directly on two of the floor beams of a wooden bridge. This figure also shows the reticulated or zigzag bars inserted in the channel-shaped sections, parts being broken away.

Fig. 2 is a detail vertical sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a detail view of a modification showing the insertion of tarred paper or felt between the vertical webs of the channel irons.

Fig. 4 shows a view of a modified channel iron that is so designed as to prevent the entrance of water or moisture between the vertical adjacent webs.

Fig. 5 is a cross section of a unit showing a modified form of reticulated bar.

Fig. 6 is a cross section of a modified channel member.

Fig. 6ª is a detail view showing a modified fastening and tread-forming means.

Fig. 7 is a view of several U-shaped members assembled without any filler bars or composition.

Fig. 8 is a view of a modification of the channel member having an enlarged base part.

Fig. 9 is a further modification showing a V-shaped groove between truncated trapezoidal-shaped channel members.

Fig. 10 is a view showing U-shaped channels formed by angle irons laid side by side.

Fig. 11 is a view showing channels composed of alternately arranged U- and inverted T-shaped metal strips.

Fig. 12 shows channels composed of inverted T-shaped bars alone, and

Fig. 13 shows channels produced by arranging angle iron, or L-shaped bars, back to back.

Throughout the drawings like reference characters indicate like parts. 1 designates a series of channel or U-shaped metal members each having the horizontal web portion 2 and the vertical web portions 3 and 4. These members, in constructing the bridge or other flooring, may be placed side by side so that their vertical web portions 3 and 4 are directly in contact as shown in Figs. 1, 2, 4, 6 and 7. The horizontal webs are placed directly on the wooden bridge joists or girders 5 and 6, two of which are shown in Fig. 1, and are secured in place by means of the spikes which are passed through the openings 7 into the wooden joists below, of the floor supporting structures. Located within each of the U-shaped or channel members is a zigzag-shaped bar 8 having the flat vertical portions 9 and 10, the portions 10 engaging the vertical inner surfaces of the channel member. These portions 10 may be secured to the vertical webs 3 and 4 of the channel members by rivets, or by electric spot welding as indicated in Figs. 1 and 2 at 11, or by other fastening means, or the bars may be allowed to lie loosely in said members. The bars 8 may be termed reticular bars since they divide or separate the space in the U-shaped channel members into reticulated or cellular spaces.

It will be noticed that the bars 8 form pockets 12 or cellular spaces extending from the upper edges of channel members to the bottom webs 2 thereof and rest directly on the latter in the preferred form of the invention illustrated. This, however, is not always necessary. In these pockets is placed a suitable filling material as concrete, asphalt, tarvia, or nailcrete indicated by the numeral 14. By reason of the channel members 1 being placed closely together the pockets 12, when filled will form a continuous upper surface. The bars provide a non-skid surface at their upper edges.

If desired, the outer surfaces of the vertical webs 3 and 4 may first have applied thereto a rust resisting substance, such as asphalt. Also roofing paper, to form a water-tight joint, may be placed between the vertical webs as shown at 15 in Fig. 3. This last would also allow for lateral expansion of the channel members.

It is clear that this bridge flooring may be readily constructed by first assembling the U-shaped members 1 and the zigzag members 8 in the shop, if they are to be fastened together, then securing them to the wooden joists or I beams of the bridge structure as by means of the nails 7 if wooden supports are used. Other suitable fastening means would be used if an iron or steel supporting structure is employed. The concrete or other filling material in plastic condition is next inserted in the spaces 12, preferably on the job, and allowed to set flush with the upper edges 13 of the bars 8 and of flanges 3 and 4 (see Fig. 2). The use of forms is therefore entirely eliminated.

An important feature is in the use of U-shaped or channel members which are placed directly on the joists or I beams and side by side. These members in themselves, therefore, form a closed bottom or flooring for the filling material when inserted in the spaces 12.

In the modification shown in Fig. 4 the channel members are formed with one side 3 of each extended so as to overlap the upright side 4 of the adjacent section. This is for the purpose of making the joints between the channel sections or units waterproof. It also serves as a fastening means.

In the modification shown in Fig. 5 the special form of filler bar 18 is shown with lower portions cut away at 19 so that only downwardly projecting portions 17 of each bar bear on the bottom web 16 of the channel member. This permits the corners 16' of the U-shaped cross section of the channel member to be curved, more or less, without the bars 18 jamming against the inwardly inclined portions of the vertical webs so formed. This makes it easier to roll out the channel member and reduces the liability to fracture which might occur in trying to roll it out with sharp corners at the meeting of side and bottom webs.

In the modification shown in Fig. 6 the same results are obtained by rolling a slightly raised section 20 in the bottom of the channel member. A plain zigzag bar 8 may then be used, as in Fig. 1, but with no danger of its jammng more or less in the bottom of the channel member if the latter has rounded inner corners, as there shown.

Fig. 6a shows a modification in a perspective view which illustrates several of the channel members shown in Fig. 6 held together by means of cross bars, (one of which is shown at 40) notched to intermesh by means of slots 41 with the vertical webs of the channel members, which latter may be of any form, though that shown in Fig. 6 is illustrated. Bars 40 then take the place of

bars 8 in forming part of the tread surface of the unit.

Fig. 7 illustrates the idea of assembling several U-shaped or channel members 1 without any filler bars. In this construction the width of the sections preferably would be less than that shown in other figures of the drawing, where filler bars are used. The sections can be fastened together in any convenient manner and filled with concrete.

In Fig. 8 the channel members are shown as formed with enlarged base parts 21, placed side by side and narrow top openings 22. This leaves spaces 22′ between the upper edges of adjacent sections. This distributes the wearing surfaces more evenly so that filler bars may be omitted, if desired.

Fig. 9 shows a further modification of this form in which the grooves 23 that are formed between the adjacent channel members 24 are V-shaped and the channels proper are substantially trapezoidal in cross section. The lower webs of these members will, of course, rest directly on the joists or other supporting structure of the bridge. The channel members 24 may receive zigzag bars such as shown in Fig. 1, which will extend across their upper open spaces 25.

Fig. 10 shows the troughs 26 of the desired U-shaped cross section formed by adjacent L-shaped angle irons 27 which are substantially in contact, one with another.

In Fig. 11 the channels or troughs 28 are formed by arranging the U-shaped members 1 alternately with the inverted T-shaped members 29.

In Fig. 12 the channels 30 are formed by arranging a plurality of inverted T-shaped members 29 side by side.

In Fig. 13 the channels 31 are formed by arranging the angle irons 32 in pairs, back to back, these various pairs being adjacent one to another.

In all of these forms a structural unit is obtained to support the load and at the same time to provide a form for the filling material of concrete, tarvia, etc.

Broadly stated, I have produced a steel flooring which is composed of units whose horizontal webs, or flanges or legs, when the units are assembled adjacent one to another, will form a continuous plate floor, which will act as a form or support for the filling material, such as concrete, which cooperates therewith to form a road, floor, or roofing, and will also act as a support for the reticulated bars or cross bars located in or on the channel members, while the vertical webs of said channel members afford strength to the flooring for carrying the load, and their upper edges take the wear and shock, and also have a non-skid effect. It may be noted that the exterior of the bottom of this flooring provides a continuous metal surface, which may serve as a steel ceiling of neat design.

Also, when these channels are filled with "nailcrete" or similar material, wooden flooring or roofing of any kind may be fastened directly to it, as by nailing, without the need of inserting screeds or nailing strips therein. In this last application, it would not be necessary to use the zigzag or cross bars.

The application of the filler bar is a particularly important part of the invention when no other covering material is used because without it, using just the troughs, one could not confine any of the softer materials for the filling 14 as they would roll up under traffic. Also the steel armoring would not be so well distributed nor have such good anti-skid effect. Furthermore, if the units were laid across the direction of traffic, the surface would be more bumpy, as the filling became hollowed out by wear and pressure, than would be the case if the filler bars are used.

Having described my invention, I claim:

1. A flooring structure comprising, in combination, a plurality of U-shaped members placed side by side and with their bottom webs designed to rest on a supporting structure, and means located in their interiors, for dividing said interiors into a plurality of spaces or pockets to receive a filling material.

2. A structure such as defined in claim 1 combined with layers of waterproof compressible material inserted between said members.

3. A flooring structure comprising in combination a plurality of channel-shaped members which are assembled side by side substantially in contact, and means for dividing the interior channel spaces into a series of pockets which means comprises bent bars placed in the channels.

4. A combination such as defined in claim 3 in which said bent bars are partly cut away so as to rest only on the middle portions of the bottom webs of said channel members.

5. A flooring structure comprising in combination a plurality of members which are assembled side by side in contact relation to form channel spaces, means for dividing the channel spaces into a series of pockets, said divided spaces being severally filled with concrete material to assist in providing a wearing upper surface, and means for securing the dividing means to said members.

6. A structure comprising in combination a plurality of channel-shaped members which are assembled side by side in contact relation, means for dividing the channel spaces into a series of pockets comprising bent bars placed therein, means for securing

the bent bars to the channel-shaped members, and filling material set in said channels to provide a road-wearing surface that is flush with the upper edges of the said members and bars.

7. The combination, with the supporting structure of a bridge, of a plurality of U-shaped members arranged side by side with their vertical webs in contact relation, said members having their horizontal webs resting directly on said bridge structure, and a zigzag bar located in each of said members adapted to divide the space in said member into a plurality of pockets for receiving a concrete filling, substantially as described.

8. A construction comprising, in combination, members which form parallel adjacent channels when assembled, means for dividing each of said channels into a plurality of spaces and an originally plastic material filling the spaces so formed.

9. A combination such as defined in claim 8 in which said dividing means comprises laterally bent metal strips deposited edgewise in said channels and resting on the bottoms thereof.

10. A combination such as defined in claim 8 in which the bottom webs of said channel members have their middle portions raised above the other portions, on which said raised portions said spacing members are supported.

11. A combination such as defined in claim 8 in which the bottom web of each channel member is perforated to receive a member adapted to fasten it to a supporting beam.

12. A structure such as defined in claim 8 in which one vertical web of each channel member is bent outwardly and downwardly to overlap the adjacent vertical web of the neighboring channel member.

13. A unit designed to be assembled with duplicates thereof to form a floor, which unit comprises the combination of a metallic channel member of approximately U-shaped cross section and a metal strip attached to the sides of said channel member and extending across the same, whereby said channel is divided into a plurality of individual spaces adapted to receive a plastic filling material in which said dividing strip will then be embedded.

14. A combination such as defined in claim 1 in which said dividing member is a zigzag strip of metal lying wholly in said channel.

BURTON A. PRINCE.