

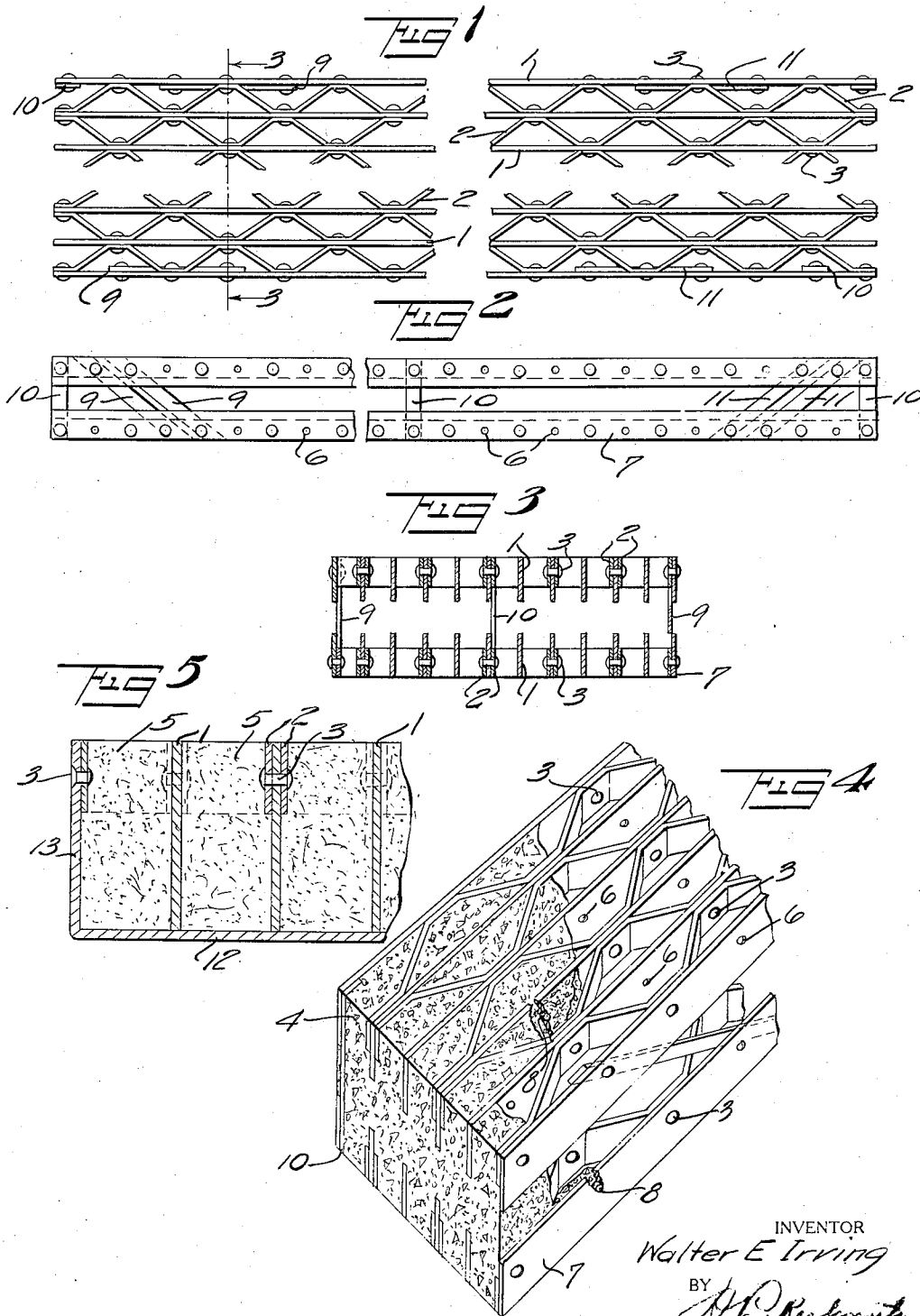
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REINFORCED CONCRETE SLAB

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REINFORCED-CONCRETE SLAB.

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To all whom it may concern:

Be it known that I, WALTER E. IRVING, a citizen of the United States of America, residing at Glenbrook, county of Fairfield, State of Connecticut, have invented certain new and useful Improvements in Reenforced-Concrete Slabs, of which the following is a specification.

My invention relates generally to flooring, stair treads, paving and the like structures which are to be subjected to excessive amounts of wear and heavy stresses, and more specifically is designed to produce plates, slabs or panels of concrete or mastic material which can be manufactured in standardized form, and which, in addition to armored wearing or tread surfaces, will also contain metallic reinforcing elements, and be relatively light in weight as compared with other reenforced concrete slabs of even inferior strength and wear resisting qualities.

A typical use to which my invention may be advantageously applied is in the flooring of bridges subjected to heavy traffic conditions, in which very thick slabs of ordinary reenforced concrete are now often used. Such old forms of concrete slab have to be made of excessive thickness (8 to 10 inches or more) to successfully resist the applied bending stresses, so that they add an unnecessary weight to the dead load which the supporting bridge structure has to carry, and, at the same time, are unsatisfactory because of constant liability to fracture under impact, or from seasonal changes of temperature. They are also subject to rapid erosion of their tread surfaces by heavy vehicles. My invention overcomes these difficulties, and produces slabs of such greater strength that they can be made much thinner and yet be self-supporting under given loads, and which present armored wearing surfaces to the traffic that will last practically indefinitely, and which have excellent holding qualities against the tractive thrust of motor driven vehicles.

The best form of structure, at present known to me, embodying my invention, and one of sundry possible modifications thereof, is illustrated in the accompanying sheet of drawings in which:

Fig. 1 is a plan view of the metallic skeleton for a panel embodying my invention, parts being broken away.

Fig. 2 is a side elevation and Fig. 3 is a cross section of the same drawn to different scales.

Fig. 4 is a perspective, illustrative view of a completed panel with parts broken and,

Fig. 5 is a cross section of a modified form with parts broken away.

Throughout the drawings like reference characters indicate like parts. The preferred form of grating here shown is that described and claimed in U. S. patent to Keller No. 1,045,795, granted November 26, 1912, though other forms might be used. This preferred form of grating is composed of a series of straight bars 1, 1, spaced apart and held together by a series of intermediate bent, or reticulated, strips of metal, 2, 2, of less depth, all said parts being fastened thereto by rivets 3, 3, or equivalent means. In the simplest form of the invention the grating is embedded in a plastic mass of concrete 4 (Fig. 4) or other mastic 5, (Fig. 5) with that surface of the grating in which the adjacent edges of bars 1, 1, and strips 2, 2, are in the same plane, located substantially in the plane of the upper surface of the completed slab so formed. Such grating then helps to form an armored tread surface for the slab which is highly resistant to the wearing effect of the feet of pedestrians, or of the wheels of vehicles, passing over it. Also the grating gives strength to the completed structure for resisting bending stresses, when the panels so formed are supported only at their ends or at intermediate points, and great rigidity against distorting forces of any kind is assured.

Some or all of the bars or strips may have holes in them to receive portions of the mastic. Thus the straight bars 1, 1, may have an extra series of rivet holes 6, 6, punched in them and the concrete or mastic may be forced through these and, on hardening, will then form keys or fins passing through these holes and firmly uniting the otherwise partially separated bodies of said concrete or mastic, thus keying the whole mass to the grating, as shown at 8 in Fig. 4.

Panels thus constructed, without additional elements in the combination, may be used for stair treads and in other situations, with or without a complete underlying foundation or support, where the production of durable, non-slipping tread surfaces is the main consideration.

Where slabs of greater thickness or depth are required to act as trusses, supported only at their ends, and to then support heavy loads particularly moving loads, as in traffic bridges, it is desirable to additionally strengthen the slab by a bottom member which will both serve to further assist in holding the mastic in place in the meshes of the tread surface forming grating, and also serve as the lower, tension member of the truss so formed.

This may best be done by also embedding, in or near the bottom surface of the slab, a second panel of grating 7, as shown in Figs. 2, 3, and 4. If the preferred form of grating shown in the Keller patent is used for this purpose, such second and lower grating 7 may best be reversed in position, as shown, so that the reticulated strips 2, 2, will then be in the lowest possible position in the slab and have the greatest possible bending moment with reference to the upper grating which, of course, serves as the compression member of the truss and center of any bending moment produced by loads superposed thereon. This also has the advantage that two armored surfaces are then formed on the slab, and the same can consequently be used with either side up.

To further strengthen the structure the two gratings may be spaced apart and held together by metal struts, 9, 10 and 11, some of which, as shown at 9 and 11, are oppositely inclined one to another and to the gratings to produce an effective bracing action, while others, as 10, are placed at right angles to the gratings to ensure accurate spacing of the same, and also to produce a composite bracing system, by cooperation with the inclined struts 9 and 11. These struts may be conveniently fastened to the respective gratings by rivets placed in properly selected holes of the extra series 6, 6; provided in the straight bars 1, 1, as above explained.

As indicated in Fig. 4 the originally plastic, subsequently hardened body of the slab is preferably formed of a good quality of concrete (such as is usually made of hydraulic cement mixed with sand and other mineral aggregate) where great strength and wear resisting qualities are required, but in some other cases I may use a softer mastic (an asphaltic compound, perhaps) such as shown in Fig. 5. This latter may be advisable where sound deadening qualities or a semi-elastic tread surface is desirable.

Under any of these conditions the lower grating 7 may be replaced or supplemented by some other form of retaining member. For this purpose I may use a sheet of metal 12, shown in Fig. 5 and this may be made of metal thick enough so that its outer edges (one of which is shown at 13 in Fig. 5) may be bent up to serve as the outer mem-

bers of the series of straight bars 1, 1, of the grating, thus saving material, as well as labor in riveting.

In constructing a slab or plate according to my invention the metal skeleton, such as shown in Figs. 2, 3, and 4, or other form of metal frame or container such as shown in Fig. 5, or the upper grating alone, is first riveted together, and the spaces thereafter filled in with the plastic material and the same allowed to set before use. In the form shown in Fig. 5 this filling operation may be performed after the metal structure is installed in its position of use.

The gratings can be cheaply manufactured in standard units by quantity production in properly equipped plants and then shipped on order in "knocked down" condition to the location of use, where they may be assembled and the bracing struts 9, 10 and 11 riveted in position, if it is important to economize bulk in transportation; or the complete skeleton may be riveted together at the production plant, if the resultant saving in labor exceeds the alternative saving in freight. In either case the filling mastic will usually be mixed and added on the job to save freight.

It should be understood that the accompanying drawings are illustrative, only, and are not supposed to show exact dimensions or proportions. Thus the structures shown in Figs. 3 and 4 are much narrower in proportion to their depth than the actual structures would usually be in good practice. In general it may be said, however, that slabs or plates of my improved construction can usually be made of about half the thickness of the ordinary reinforced concrete slabs now in use for any given purpose, and develop the same or greater strength under bending stresses and far greater lasting qualities, and that, while the metal gratings have a greater specific gravity than the concrete, which they displace, they weigh but little more than the old form of reinforcing rods usually employed, and that they occupy such a small proportion of the total mass of the slab that a large net saving in weight results. Consequently a heavy traffic bridge structure may be redesigned when my invention is used and enough metal saved in the supporting structure (whether of the cantilever, girder or suspension type) to more than compensate for the additional cost of my improved armored floor plates or slabs, and to this saving in first cost is added still greater savings in upkeep and replacement of the roadway surface under use, and longer life.

It is also to be understood that my invention is not limited to the particular form or outline of grating shown in the drawings but that gratings of any desired design or structure may be substituted for that shown,

that other forms and arrangement of bracing struts may be employed, and that other forms of fastening means may be substituted for the rivets shown.

strips of less depth riveted to the straight bars in position such that the upper edges of both are in the same plane.

2. A new article of manufacture, such as is set out in claim 1, in which said grating is keyed in said slab by fins of the hardened material passing through openings in certain elements of the grating.

3. As a new article of manufacture, an armored slab or plate suitable for use as flooring, treads or paving, which slab or plate comprises a body of originally plastic but subsequently hardened material with a metallic grating set in said hardened material, which grating is composed of bars and strips of different depths with the upper edges of all bars in the plane of the upper surface of said slab or plate, together with a metal sheet extending and held under the bottom edges of the deeper bars of said grating.

4. As a new article of manufacture, an armored slab, or plate suitable for use for flooring, treads or paving, which slab or plate comprises a panel of grating having a series of parallel, straight bars of considerable depth connected together by a series of strips of less depth, the upper edges of said bars and strips being in the same plane, a body of hardened mastic filling all the spaces between said strips and bars, and a sheet of metal extending across the bottom of said series of straight bars and connected to the exterior members of said series.

5. As a new article of manufacture, an armored slab forming a composite plate and truss suitable for use as a flooring when resting on separated supports and subjected to heavy duty, which slab or plate comprises a panel of grating having a series of parallel, straight bars of considerable depth connected together by a series of strips of less depth, the upper edges of said bars and strips being in the same plane, a body of hardened mastic filling all the spaces between said strips and bars, and additional metallic reinforcing and retaining means for the lower portion of said mastic body.

6. As a new article of manufacture, an armored, reenforced slab forming a composite plate and truss suitable for use as a flooring when resting on separated supports and subjected to heavy duty, which slab or plate comprises a body of originally plastic but subsequently hardened material with two metallic gratings set in said hardened material, the upper surface of one of said gratings being substantially flush with the upper surface of said slab.

7. An article of manufacture, such as set out in claim 6, in which said second grating has its lower surface substantially flush with the lower surface of said slab.

8. An article of manufacture, such as set out in claim 6, in which said two gratings

5 A special advantage which the use of my invention produces, over old methods of building reenforced concrete slabs, results from the fact that in my invention the reinforcing metal is accurately spaced and securely held in the predetermined position in the slab by reason of the spacing action of the struts, 9, 10 and 11 or equivalent spacing means used, and because the elements of the grating are fixed in their relative positions. This is a decided improvement over the loose rods, etc., heretofore used, which are often displaced before the pouring of the concrete, or by the act of pouring it, so that they do not have the expected strengthening effect on the completed slab. Also my grating structure alone forms a sufficient flooring over which motor trucks or wheel barrows carrying the plastic concrete or other filling may be run to dump it into the metal skeletons after they have been placed in position to form the bridge or other flooring, any convenient retaining means, such as boards, metal lath, etc., being fastened against the under surface of the grating skeleton in the usual way to prevent the semi-liquid mass from falling entirely through the floor structure.

A saving in necessary thickness of slab, over ordinary reenforced concrete, also results from the added strength in resisting compression stresses given to the upper portion of each slab by the upper grating. While the rods of ordinary reenforced concrete slabs, collected in the bottom portions thereof, may make that portion strong enough to withstand the tensile strains produced by the bending moment, the unreinforced upper portions of such slabs may be crushed by the compression stresses there produced. In my invention the grating reinforcement at such upper portion of the slab supplies ample protection against any such failure under compressive stresses, and, as a result the slabs may be made thinner, and dead weight thereby saved.

All embodiments of my invention above described form plates or slabs of trusslike character that are self-supporting in the sense that they are capable of functioning as trusses and carrying relatively heavy loads when supported only at their ends.

Having described my invention, I claim:

1. As a new article of manufacture, an armored slab forming a composite plate and truss suitable for use as flooring under heavy duty, which slab comprises a body of originally plastic material hardened in position about the members of a metallic grating, said grating being composed of straight bars of considerable depth with intervening bent

are spaced apart and held together by metallic struts.

9. An article of manufacture, such as set out in claim 6, in which said two gratings are spaced apart and held together by metallic struts, some of which struts are inclined to said gratings and oppositely inclined one to the other.

10 10. An article of manufacture, such as set out in claim 6, in which said two gratings are spaced apart and held together by metallic struts which are fastened at either end to said gratings by certain rivets also serving to fasten together constituent elements of said respective gratings.

11. A metal skeleton adapted for use in armoring and reinforcing a slab designed for use in floors and for like purposes, which

skeleton comprises, in combination, two gratings placed one over the other and struts for spacing apart and holding together said gratings, the upper grating being a rigid structure capable of acting as a compression resisting member in any composite truss structure in which said skeleton may be incorporated. 25

12. A structure such as set out in claim 11 in which certain of said struts are inclined one to another and to the planes of the gratings. 30

13. A structure such as set out in claim 11 in which certain of said struts are inclined one to another and to the planes of the gratings, while others are placed at right angles to said planes.

WALTER E. IRVING.