June 8, 1943. J. H. JACOBSON 2,321,087

MEANS OF REINFORCING VERTICAL FACES OF ROAD SLABS

Filed April 2, 1942 2 Sheets-Sheet 1

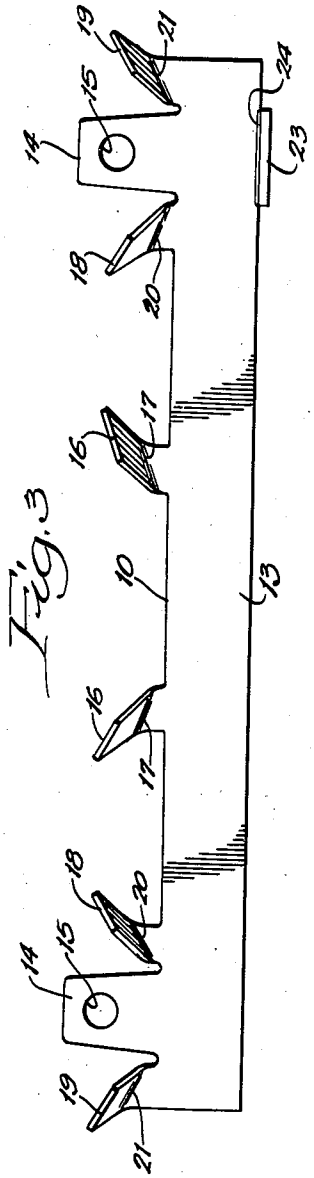


Fig. 3

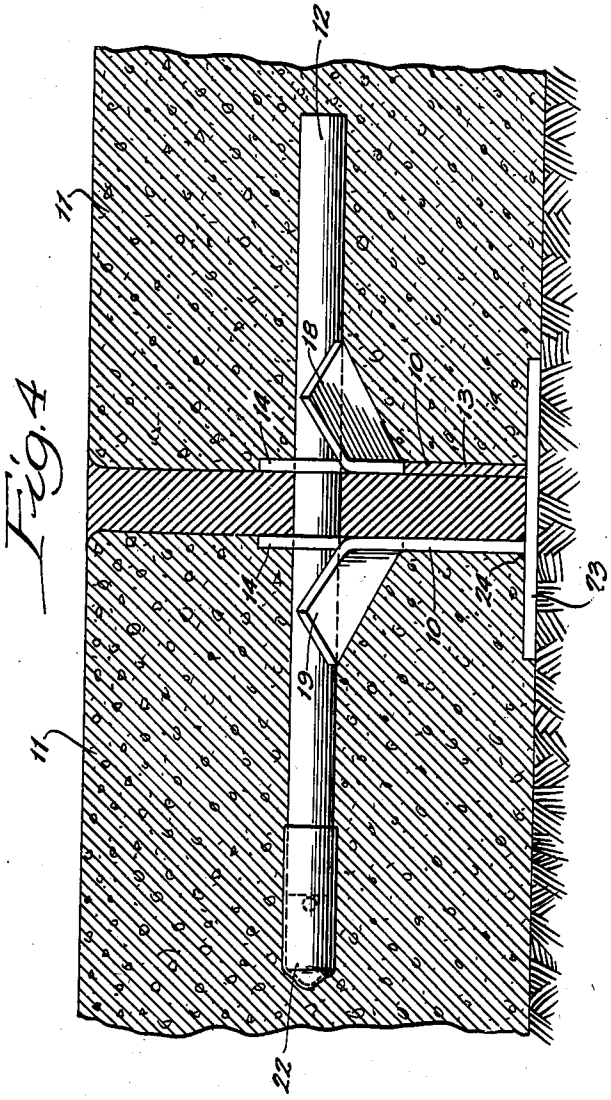


Fig. 4

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MEANS OF REINFORCING VERTICAL FACES OF ROAD SLABS

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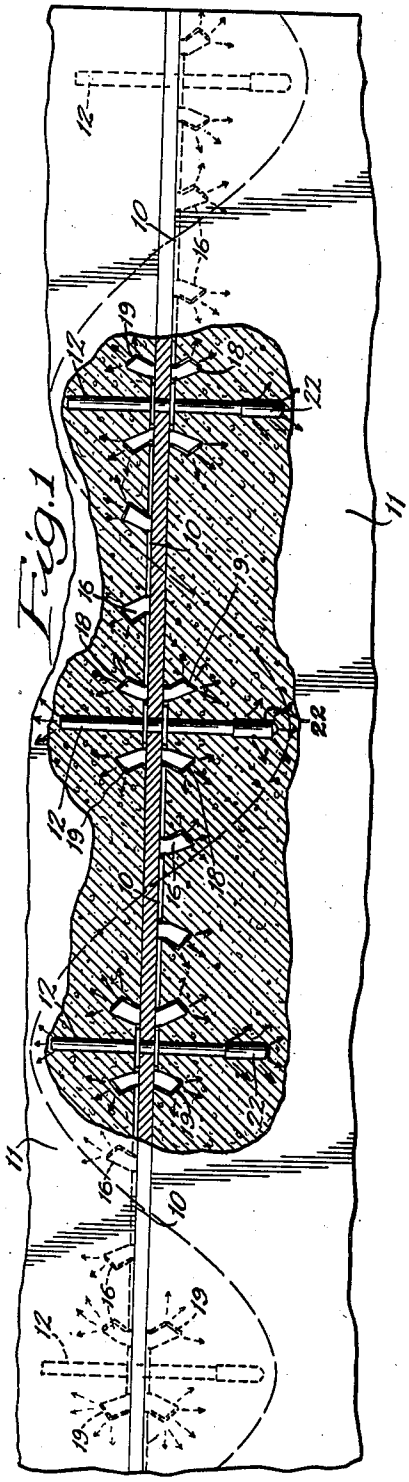


Fig. 1

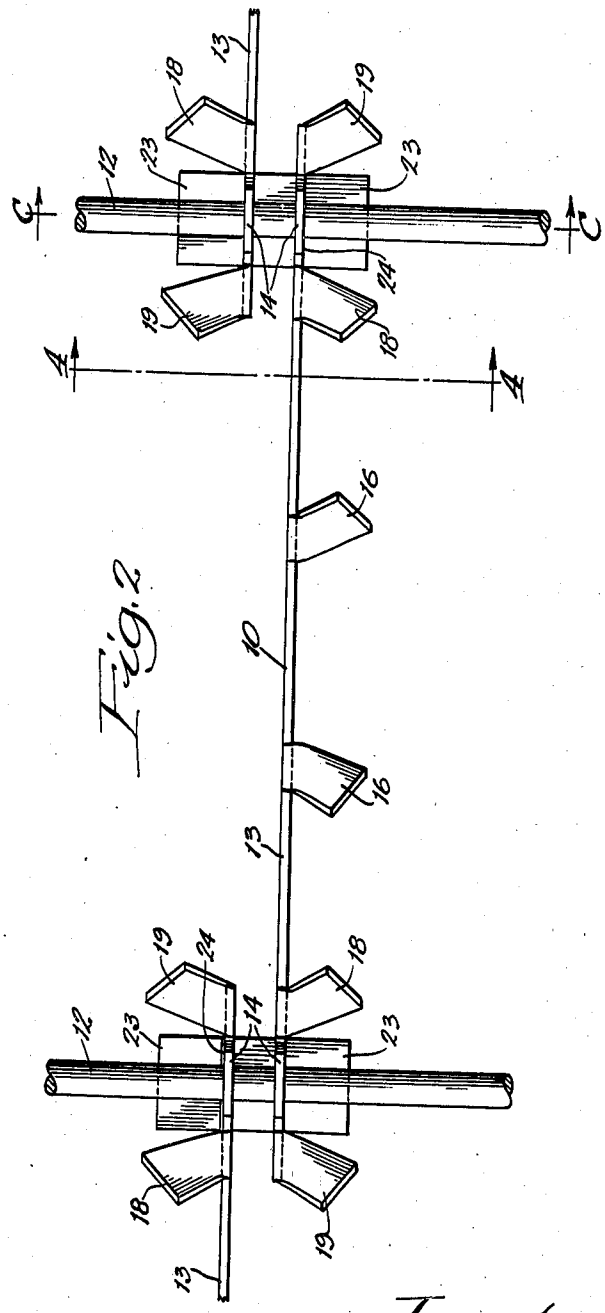


Fig. 2

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UNITED STATES PATENT OFFICE

2,321,087

MEANS OF REINFORCING VERTICAL FACES OF ROAD SLABS

James H. Jacobson, Chicago, Ill.

Application April 2, 1942, Serial No. 437,308

11 Claims. (Cl. 94—18)

The present invention is designed to afford reinforcement for the vertical edge faces of abutting concrete road slabs, and at the same time to provide for the transfer of load stresses across the joint gap and to distribute the vibrational stresses occasioned by rolling loads from the immediate point of impact into widely adjacent portions to the road structure on opposite sides of the gap.

With these purposes in view, the structure is designed to extend in the form of hingedly connected sections from side to side of a road or traffic lane, so that a continuous connection will be afforded throughout in contradistinction to conventional types of road joints which are introduced at spaced intervals without additional connection save that afforded by the concrete itself.

A further object of the invention is to so construct the appliance that the constituent sections may be of uniform shape and formed from plate metal stampings, requiring no additional fabrication, which are used in cooperation with dowel bars of conventional type formed from metal rods which not only serve to transfer load stresses across the gap but also serve to connect the constituent sections and to transfer vibrational stresses thereto for distribution throughout the structure.

Further objects and details will appear from the description of the invention in conjunction with the accompanying drawings, wherein—

Figure 1 is a plan view of a portion of a roadway embodying the structure of the present invention and indicating in dotted lines the method of distributing vibrational stresses;

Fig. 2 is a plan view of a plurality of the joint bars interconnected by dowel bars;

Fig. 3 is a rear elevation of one of the joint bars; and

Fig. 4 is a sectional view taken in part on line 4—4 of Fig. 2, with the concrete of the road slabs cut back to the line c—c.

The joint appliance as a whole comprises a plurality of facing joint bars 10 which have their ends overlapped, and with the bars standing edgewise in staggered relation and alternately embedded within the opposed joint faces of the concrete slabs 11 on opposite sides of the joint gap. The arrangement is one in which each slab face will provide separated portions which are faced by the joint bars on the same side of the gap with intervening portions where the bare surface of the concrete face is exposed. That is to say, each portion of the gap will be faced on one side only save at the points where the ends of the bars overlap one another.

As shown in Fig. 4, the joint bars are of overall height slightly greater than one-half the depth of the joint gap, and it will be understood that in the completed joint the upper portion of the gap will be bridged or filled by some suitable form of joint seal, metallic or fibrous, but the means provided for sealing the gap form no portion of the present invention and need not be described in detail. It will also be understood that in the pouring of the concrete the joint bars will be supplemented by suitable forms for temporarily confining the wet concrete in those portions of the joint which are not faced by the joint bars, or otherwise confined, but due to the peculiarity of the design of the face plates of the two halves through which the dowel bar is placed, it is possible and practical to use a board or other means for producing a definite resisting wall for the wet immature concrete mixture before and during the hardening process.

The length or height of the units will be determined by the design of the slab which they tend to join and hold in alignment with the next abutting slab of similar design. In an ordinary roadway or traffic lane, eight of the bars of uniform length, with their ends overlapped, will be employed, with the understanding, however, that the main reinforcing structure may be supplemented at its ends by shorter bars of special shape or dimension to afford curve or gutter sections which may be required by local conditions.

Each of the bars is formed of a stiff metal plate configured to afford an elongated body portion 13 which near each end is provided with an upstanding ear 14 having formed therein an aperture 15 of a size to receive a dowel bar when the ends of the joint bars are overlapped to bring the apertures 15 into register.

Between the upstanding ears, the body of the bar along its upper edge is provided with a pair of obliquely disposed backwardly and upwardly sloping intermediate wings 16, which are bent to present their upper sloping faces in inwardly convergent relation to one another, and which are deeply embedded within the concrete slab to which the bar is attached.

The wings are bent obliquely backwardly and upwardly along oblique bending lines 17 which converge toward the center, which arrangement presents the sloping flat faces of the wings in convergent relation to one another and with the broad surface exposure to resist vertical thrust, and being deeply embedded in the concrete they serve to firmly anchor the center portion of the joint bar.

The intermediate wings 16 are supplemented by inner and outer end wings 18 and 19 located on each side of the ears 14, which end wings are bent backwardly along oblique inwardly convergent bending lines 20 and 21, which configuration of the end wings affords a firm anchorage against longitudinal displacement of the bar in either direction and presents the extended faces of the wings to resist vertical thrust. Thus all of the wings in conjunction being deeply embedded

serve to anchor the plate of which they are a part in such a way that the plates become in effect a part of the concrete slab itself and thus afford a definite support for the dowel bar, while the oblique disposition of all of the wings permits the concrete to easily flow beneath the wings and become firmly and closely packed so that the formation of gaps or pockets in the concrete is avoided.

In order to provide for expansion and contraction, one end of each of the dowel bars is provided with a tubular cap or sheath **22** of the usual character, which provides a void or gap to permit free movement of the end of the dowel bar, and in order to prevent bonding of the concrete to the exposed portions of the dowel and adjacent the cap, it is preferred to grease the same prior to the pouring of the concrete. In preparation for the pouring of the concrete, the joint bars are spaced apart from one another to afford a gap of the intended width, the bars being supplemented by temporary forms to exclude the concrete throughout the length and depth of the intended gap, after which the concrete is poured, which embeds the joint bars in staggered relation on opposite sides of the gap, and with their inner sides exposed to afford on each side an interrupted metallic facing which confronts the bare concrete on the other side, after the joint has been completed and the temporary form members removed, it being understood that a suitable filling of fiber or other acceptable material will thereafter be provided to prevent the intrusion of foreign materials into the gap.

The overlapped ends of adjacent joint bars are supported upon a flat foot **23** which is preferably a section of the plate which is stamped out of the stock in the formation of the wings and which is welded to one of the bar ends along the weld line **24**, which provides a support to prevent toppling of the joint structure prior to the pouring of the concrete.

In positioning the bars, the two ends are overlapped and the dowels entered through the registering apertures, which affords a hinge connection for the adjacent joint bars, and in view of the fact that each dowel bar is entered through two overlapped bars, each of which is firmly anchored into the slab with which it is associated, it will be seen that the dowel bars afford a degree of flexibility equal to the elasticity or plasticity of the concrete itself which unifies the structure throughout.

With the joint bars thus embedded and having their ends connected by the dowel bars, a continuous hinged reinforcement will be provided from end to end of the gap and transversely of the roadway.

In the distribution of stresses occasioned by a rolling load, as for instance by the two laterally spaced wheels of a truck, the resistance against vertical displacement of the slabs will be that afforded by the dowel bars, which in turn are supplemented by the support afforded by the overlapped ends of the joining bars between dowels which are firmly and deeply anchored into the faces of the road slabs. The more distant ends of the joint bars are likewise supported by other of the dowel bars, so that the structure throughout is tied together in such a way that every portion of the structure will cooperate and assist in resisting displacement, irrespective of the particular points which receive the full impact of the wheels.

The vibrational stresses set up by repeated impact of a wheel load which normally causes disintegration of the concrete at points immediately surrounding the dowel bar and at the face of the vertical plane are prevented from causing funneling, due to the fact that the apertures through the vertical plates of the ends of adjoining bars are a steel reinforcement which within itself is properly and firmly embedded into the face of the vertical plane. Thus the stresses are distributed in diminishing degree and in undulatory or wave-like lines of progression from the points of impact, and in diminishing height as indicated by the dotted lines in Fig. 1. It will also be noted that there is a radial distribution of stresses through the ends of the anchoring wings and through the dowel bars, so that every portion of the structure coacts in resisting the effects of impact wheresoever applied.

In view of the fact that the joint bars are set in staggered relation on opposite sides of the joint gap, and are anchored to the concrete alternately on opposite sides, the vibrational stresses will flow back and forth across the gap in diminishing degree as indicated, and will tend to diminish out or become absorbed as they advance away from the points of impact. This damping out action is promoted by reason of the fact that the lines of vibration, traveling in opposite directions, will tend to neutralize or extinguish one another.

The hinging of the joint bars on the dowels also affords a limited degree of flexibility, which is highly desirable, while the entire structure is tied together from end to end so that there is no break in the continuity of the connections through which stresses applied at any particular point are distributed and absorbed. Each dowel bar therefore contributes in varying degree in a cooperative action which extends through the entire series.

The simplicity of the structure offers few problems of installation and is adaptable to the various cross sections desired by highway engineers in various States. The design is also one which simplifies the making of additions, such as in widening sections of curves. The resultant diffusion of stresses across a number of dowel bars indicates the feasibility of engagement of more than one dowel bar across the abutting slabs and permits calculation of the transference of load from each individual axis point of the dowel bar in correlation one with the other.

Although the invention has been described with particular detail, it will be understood that the shape and dimensions of the joint bars and the location and arrangement of the anchoring wings may be varied without departing from the principles of the invention.

I claim:

1. In road joint reinforcing means of the character described, a plurality of joint bars arranged in spaced staggered relation to one another and having their ends in overlapping relation, and a load transference member entered through the overlapped ends of the bars and bridging the spaced bars and forming a hinge connection therefor and projecting outwardly in each direction from the bars and in position to have the projecting ends entered through the opposed faces of road slabs and into the interior of the slabs.

2. In road joint reinforcing means of the character described, a plurality of joint bars arranged in spaced staggered relation to one another and

having their ends in overlapping relation, and a load transference member entered through the overlapped ends of the bars and bridging the spaced bars and forming a hinge connection therefor and projecting outwardly in each direction from the bars and in position to have the projecting ends entered through the opposed faces of road slabs and into the interior of the slabs, each of the bars being provided with anchoring members extending backwardly from the bar and in position to be embedded within the associated road slab.

3. In road joint reinforcing means of the character described, a plurality of joint bars arranged in spaced staggered relation to one another and having their ends in overlapping relation, and a load transference member entered through the overlapping ends of the bars and bridging the spaced bars and forming a hinge connection therefor and projecting outwardly in each direction from the bars and in position to have the projecting ends entered through the opposed faces of road slabs and into the interior of the slabs, each of the bars being provided with broadly surfaced anchoring wings extending backwardly and upwardly to present their broad faces in oblique relation to the surface of the road slabs.

4. In road joint reinforcing means of the character described, a plurality of joint bars arranged in spaced staggered relation to one another and having their ends in overlapping relation, and a load transference member entered through the overlapped ends of the bars and bridging the spaced bars and forming a hinge connection therefor and projecting outwardly in each direction from the bars and in position to have the projecting ends entered through the opposed faces of road slabs and into the interior of the slabs, each of the bars being provided with broadly surfaced anchoring wings extending backwardly and upwardly from the upper edge of the bar and in obliquely convergent relation to one another to present their broad faces in oblique relation to the surface of the road slabs.

5. In road joint reinforcing means of the character described, a plurality of joint bars arranged in spaced staggered relation to one another and having their ends in overlapping relation, and a load transference member entered through the overlapped ends of the bars and bridging the spaced bars and forming a hinge connection therefor and projecting outwardly in each direction from the bars and in position to have the projecting ends entered through the opposed faces of road slabs and into the interior of the slabs, each of the bars being provided in its medial region with a pair of broad surfaced anchoring wings extending backwardly and upwardly from the upper edge of the joint bar and presenting their broad surfaces in oblique convergent relation to one another, and each bar having at each end a pair of broad surfaced anchoring wings extending backwardly and upwardly from the upper edge of the bar and presenting their broad surfaces in obliquely convergent relation to one another.

6. In road joint reinforcing means of the character described, the combination of a plurality of joint bars standing vertically edgewise in staggered relation on opposite sides of the intended joint gap and with their ends in spaced overlapping relation to one another, and a dowel bar entered through each pair of overlapping ends to afford a hinge connection therewith and having the ends of the dowel bars projecting backwardly in position to be embedded within the road slabs on opposite sides of the intended joint, each of the joint bars having along its upper edge a plurality of backwardly and upwardly extending anchoring wings adapted to be embedded within the associated road slab, the wings comprising an intermediate pair located in the medial region of the bar and extending in obliquely convergent relation to one another and also comprising two end pairs, the wings of each pair standing in obliquely convergent relation to one another and on opposite sides of the proximate dowel bar.

7. A road joint reinforcing bar formed of plate material, having at each end an aperture adapted to receive a dowel bar and having a plurality of anchoring wings struck backwardly from the bar and adapted for embedment within a road slab.

8. A road joint reinforcing bar of elongated formation and formed of plate material, having at each end an upstanding ear provided with an aperture adapted to receive a dowel bar and having a plurality of anchoring wings projecting from the upper edge of the bar and extending backwardly and upwardly therefrom and tilted to present their faces in convergent relation to one another.

9. A road joint reinforcing bar formed of plate material, having an elongated body and having at each end an upstanding ear provided with an aperture adapted to receive a dowel bar and having formed on its upper edge an intermediate pair of backwardly and upwardly extending anchoring wings tilted to present their faces in convergent relation to one another and also having on opposite sides of each ear a pair of end wings extending backwardly and upwardly from the upper edge of the bar and tilted to present their faces in convergent relation to one another.

10. In a road joint, in combination with a pair of opposed concrete slabs separated by a gap, a road joint reinforcing structure comprising a plurality of joint bars alternately secured to the opposed slabs on opposite sides of the gap and with their ends standing in spaced overlapping relation, the overlapped bars being provided with anchoring means extending backwardly into the associated road slab to provide reinforcement alternately on opposite sides of the gap, leaving the intermediate portions of each slab unreinforced, and spaced dowel bars entered through the overlapped ends of adjacent joint bars, each dowel bar having its projecting ends entered into the road slabs on opposite sides of the gap, the reinforcing structure extending continuously throughout the length of the joint gap and affording a recurrently hinged reinforcement for the joint.

11. In road joint reinforcing means of the character described, a plurality of joint bars having their ends in contiguous relation to one another, and a load transference member entered through the contiguous ends of adjacent bars to afford a hinge connection therefor and having the ends of the load transference member projecting outwardly in each direction from the bars and in position to have the projecting ends entered through the opposed faces of road slabs and into the interior of the slabs, each of the bars being provided with anchoring members extending backwardly from the bar and in a position to be embedded within the associated road slab.

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