Sept. 28, 1943.

J. N. HELTZEL

2,330,214

JOINT AND JOINT INSTALLING APPARATUS FOR CONCRETE ROADS AND THE LIKE

Original Filed Jan. 9, 1940

2 Sheets-Sheet 1

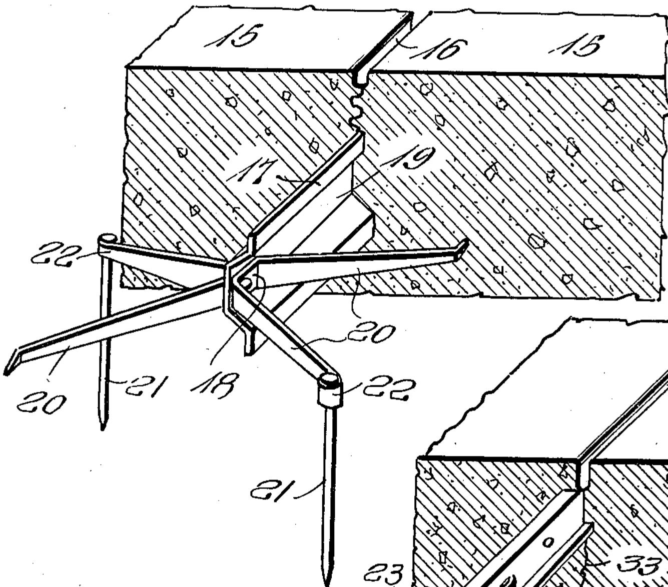

FIG. 1

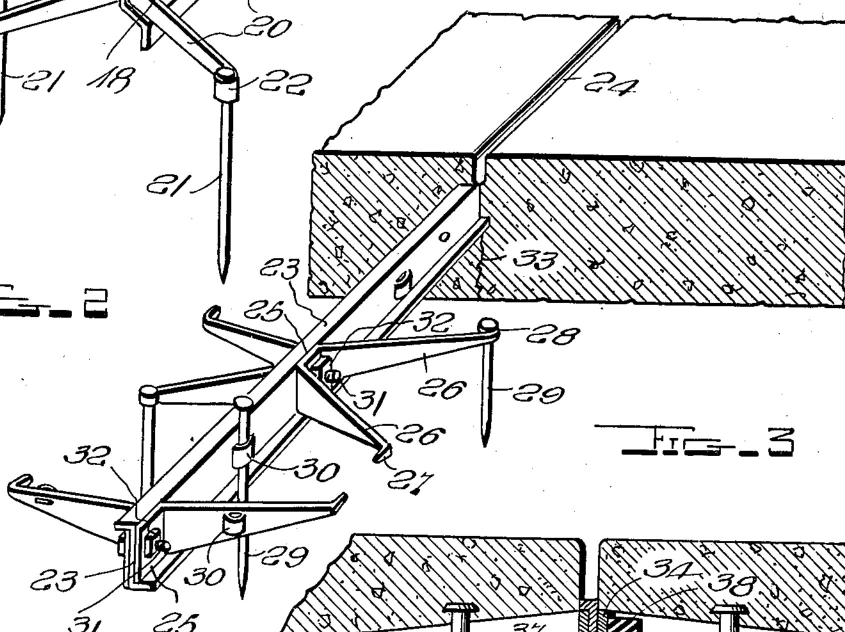

FIG. 2

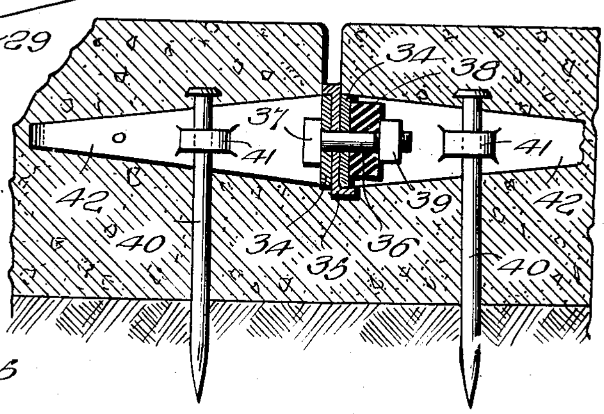

FIG. 3

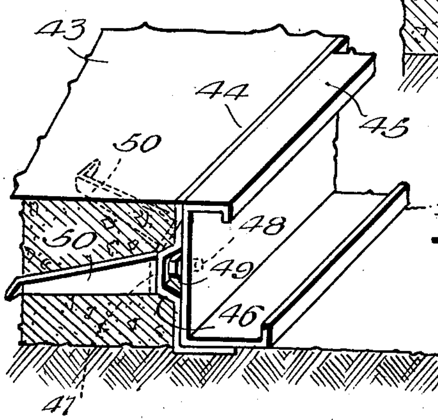

FIG. 4

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FOR CONCRETE ROADS AND THE LIKE

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FIG. 5

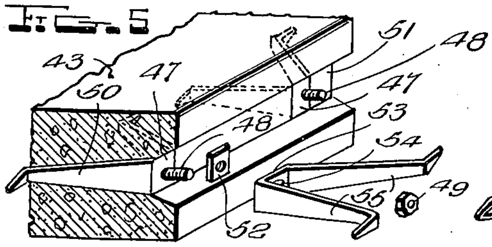


FIG. 6

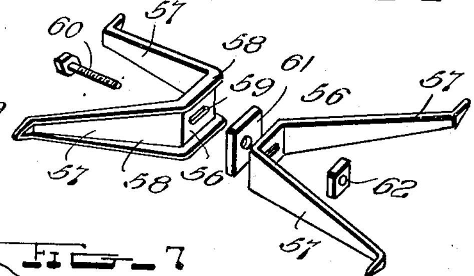


FIG. 7

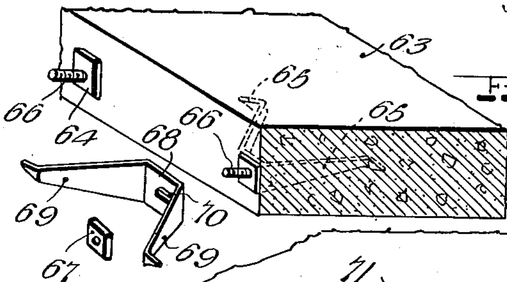


FIG. 8

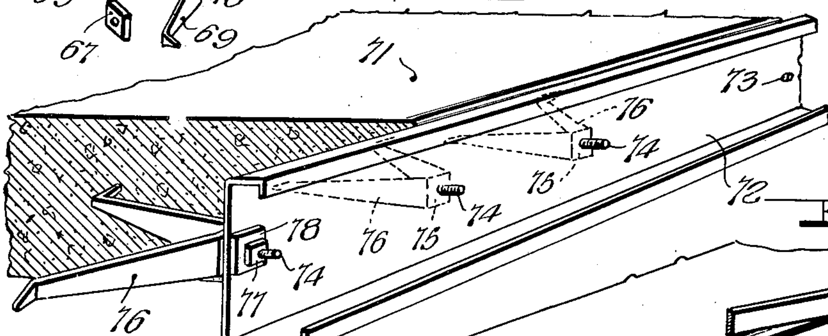


FIG. 9

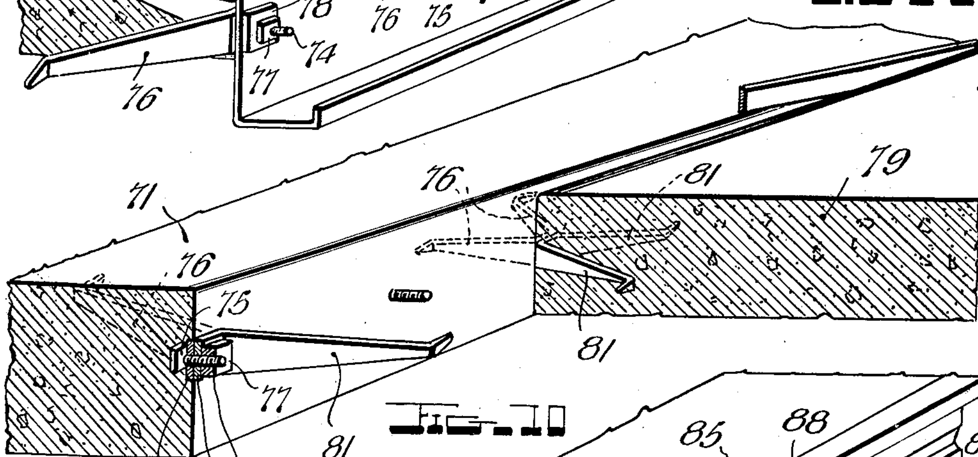


FIG. 10

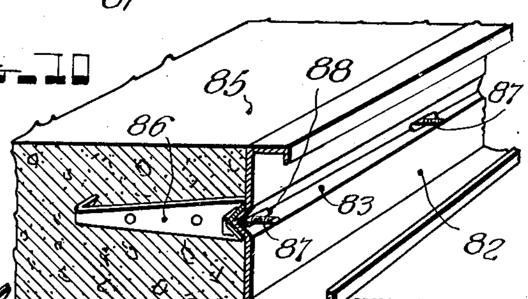
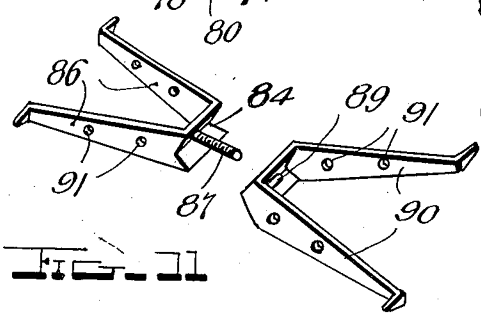


FIG. 11



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Patented Sept. 28, 1943 2,330,214

UNITED STATES PATENT OFFICE

2,330,214

JOINT AND JOINT INSTALLING APPARATUS FOR CONCRETE ROADS AND THE LIKE

John N. Heltzel, Warren, Ohio

Original application January 9, 1940, Serial No. 313,128. Divided and this application November 3, 1942, Serial No. 464,372

12 Claims. (Cl. 94—8)

The present invention relates to improvements in joints and joint installing apparatus for concrete roads and the like. This application is a division of my prior application Serial No. 313,128, filed January 9, 1940.

An object of the present invention is to provide improved means for producing joints, particularly longitudinal or center line joints, in concrete roads and the like.

Another object is to provide an improved joint and load transfer means for half width road sections that are laid at different times, with means to accommodate longitudinal shifting of one section relative to the other.

Another object is to provide an improved means for creating an artificial joint in concrete, with means for transferring loads between adjacent sections.

Another object is to provide in a road joint means to eliminate tension in the concrete itself and to confine such tension directly to the load transfer elements of the joint.

Other objects will be apparent from the description.

In the drawings:

Figure 1 is a perspective view, with adjacent concrete slabs shown in section, illustrating an application of the invention to a longitudinal contraction joint for roadways and the like.

Figure 2 is a perspective view of another application of the invention to a longitudinal contraction joint.

Figure 3 is substantially a vertical section through a road joint, illustrating a further embodiment of the invention as employed in connection with a dummy joint.

Figure 4 is a perspective view illustrating a further application of the invention to a method of building roadways by the half-width built-up system, in which one half of a section is formed and at a later period the other half is formed and tied to the first.

Figure 5 is a group perspective view of the joint installation shown in Figure 4.

Figure 6 is a group perspective view of an alternative assembly of shear plate and load transfer elements.

Figure 7 is a group perspective view of an alternative embodiment of half-width joint installation.

Figure 8 is a perspective view of a further alternative embodiment of joint installation utilizing a somewhat different type of shear plate and stress reducing elements in association with load transfer means.

Figure 9 is a perspective view of the assembly shown in Figure 8 and illustrates the manner of connecting the adjacent slabs from which the joint is formed.

Figure 10 is a perspective view of an installation of the type shown in Figures 8 and 9 but illustrating a somewhat modified structure of stress reducing element and load transfer connection.

Figure 11 is a group perspective view illustrating the structural elements which form the completed joint assembly utilizing the principle disclosed in Figure 10.

Concrete roads are usually constructed with a contraction joint running longitudinally the full length of the roadway. One such is illustrated in Figure 1, where the joint extends longitudinally between concrete sections 15 at the center of a roadway or the like. In this embodiment the concrete slab is provided with a dummy joint formed as a shallow surface groove 16 above a longitudinal division plate 17 which is embedded in the concrete along the center line of the slab. This plate is spaced above the subgrade and beneath the top surface of the concrete so that when the concrete dries out a fracture line develops immediately above and below the division plate, with the result that the slab is separated into sections having an interengaged relation by virtue of the irregular fracture and cross sectional shape of the division plate.

Modern traffic conditions necessitates the provision of adequate load transfer means extending transversely of longitudinal contraction joints. In order to meet these requirements in this type of joint, I provide a means having the functions of shear plates, stress reducing elements and load transfer means. Such means comprises an assembly of a pair of horizontally disposed substantially V-shaped members oppositely directed and having each a flat vertical apex portion 18 which serves as a shear plate and which seats against the face of the flat dished medial portion 19 with which the division plate is provided throughout its longitudinal extent. Oppositely angled arms 20 extend laterally from the flat shear plate portion 18 for embedding in the concrete of the road slab, and these arms extend sufficiently far to provide stress relieving elements by which strains remote from the joint are transferred directly to the shear plate portion. The assembly is completed by riveting the shear plate portions together through the central web of the division plate. This provides a rigid unitary assembly in which the rivet means additionally acts as a load transfer member by which loads are transmitted transversely across the joint. The assembly is maintained in position on the sub-grade during pouring of the concrete by stakes 21 engaged with sockets 22 on the arms 20, preferably at their ends. The stakes have sufficient frictional engagement with the sockets to support the weight of the entire assembly properly spaced above the sub-grade.

Figure 2 illustrates the invention as applied to a longitudinal contraction joint. In this embodiment a substantially Z-shaped division plate 23 is embedded vertically in the center line of the roadway beneath a dummy joint groove, with the upper and lower flanges of the strip disposed, respectively, beneath the top surface of the roadway and above the subgrade. The plate 23 has attached thereto at suitably spaced intervals a plurality of combined shear plate and stress reducing elements generally similar to those of Figure 1. These elements each have a flat central shear plate portion 25 formed with divergent lateral arms 26 extending from one face thereof, with one arm having an angled terminal portion 27 formed for anchoring engagement in the associated body of concrete while the other is provided with a terminal loop socket 28 which frictionally holds a retaining stake 29 by which the assembly is properly positioned on the subgrade. If desired, the arms 26 and division plate 23 may have struckout keepers 30 to receive the retaining stakes.

The elements are arranged in pairs at opposite sides of the division strip with their shear plate portions 25 transversely aligned and secured in clamped relation at opposite sides of the strip by means of bolts 31 passed therethrough and on which nuts 32 are threaded to effect the connection. In this embodiment, as the concrete dries out a crack 33 will form beneath the division strip in vertical alignment with the groove 24, whereby the concrete will be divided into slabs connected transversely of the roadway by load transfer elements which are the bolts 31. The arms 26 extend transversely of the roadway well into the concrete and provide a stress transferring means which transfers the load directly to the shear plate portions 25, in addition to serving as reinforcing members.

Figure 3 illustrates a modification of the joint shown in Figure 2, particularly as employed in connection with dummy joints disposed transversely of the roadway or the like. In this embodiment the shear plate portions 34 are clamped against opposite faces of the division strip 35 by means of a securing bolt 36 passed therethrough with its head 37 welded to one side of the strip. In this embodiment it is necessary to provide a resilient cushioning means to permit a limited separating movement of the shear plates with respect to one another and with respect to the division strip during the expansion and contraction of the concrete sections. This means comprises a resilient member 38, which preferably is a rubber block or which may be a spring or the like arranged over the shank of the bolt, between the securing nut 39 and the adjacent shear plate. As in the preceding forms, the assembly is maintained in proper position on the subgrade by means of retaining stakes 40 driven through keeper sockets 41 struck from stress reducing and reinforcing arms 42 which are integral with the respective shear plates 34 and which diverge laterally therefrom as do the corresponding arms of the preceding forms.

Figures 4 and 5 illustrate the manner of using the shear plates in the building of so-called half width highways. In this type of highway construction, a single lane, usually a ten foot width, indicated by the slab 43 is laid along one side of a roadway and after the concrete has dried, or at some later period, a similar section is laid along the other half of the road and is tied in to the first section. In preparing an installation of this character a grooving plate 44 is secured upon the subgrade against a conventional side form 45 at the center line of the roadway with its central longitudinal grooved portion 46 projected laterally in the direction of the section which is to be built. Shear plate members 47 are secured at the desired intervals longitudinally along the flat face of the grooved portion 46 by means of bolts 48 having their heads welded or otherwise suitably secured to the rear face of the shear plate 47. Nuts 49 are threaded on the bolt stems in the channel provided by the groove. Each shear plate has laterally extended divergent arms 50 adapted to extend into the body of the concrete to provide reinforcing means and stress reducing elements by which strains remote from the joint are transferred directly to the shear plates. The arms 50 are preferably integral with the shear plate so that the unit is generally of V-shaped form having a flat bight portion which provides the shear plate proper.

After the concrete slab 43 has dried sufficiently the side form and groove plate may be removed. This leaves the slab as shown in Figure 5, with a longitudinal groove 51 in its joint face. The stems of the bolts 48 project into the groove and are housed therein.

When the adjoining section is to be built, washers 52, preferably of yieldable or resilient material, are applied over the bolt stems and seated against the shear plates 47 that are embedded flush with the bottom of the groove, and substantially identical but oppositely directed shear plates 53 are engaged over the bolt stems which pass through apertures 54 provided therefor in the shear plates. The nuts 49 are then threaded onto the bolt stems whereby the shear plates will be clamped together at opposite sides of the intermediate washer members 52, and with the arms 55 extending from the shear plates laterally across the area which is to be filled with concrete in forming the companion section of the roadway. Concrete is then poured, and after it has set the two sections will be tied firmly together by means of the bolts 48 which act as load transfer elements across the space between the abutting shear plates. The joint is strengthened by the tongue and groove arrangement effected by the groove 51.

Figure 6 illustrates an embodiment of shear plate and load transfer means particularly adapted to road construction by the half width method. In this form each opposed shear plate comprises a substantially V-shaped member having a flat vertical bight portion 56 and a pair of integral divergent arms 57 extending therefrom. One shear plate element is provided throughout its extent with a laterally directed horizontal edge flange 58, which gives the plate a channel form in cross section. This channel construction is applied only to one plate of each opposed pair. One plate is centrally formed with an oblong horizontal slot 59 which receives loosely therethrough the stem of a bolt 60 that is passed through the respective shear plates and through an intermediate spacer member 61 therebetween. Member 61 is preferably a washer and may be of resilient or yieldable material. The assembly is secured by a nut 62 threaded home upon the bolt stem.

The arms 57 of each element extend well back into their respective concrete sections to provide stress reducing members which transfer strains remote from the joint directly to the shear plates. It is apparent that the channelled construction of one shear plate provides a socket in which the opposite shear plate is received; this gives to the joint the effect of a tongue and groove connection.

Figure 7 illustrates a preferred manner of using assemblies of the general type shown in Figure 6 when constructing roads by the half width method. In this embodiment the first half section 63 is laid with the shear plates 64 flush with the joint face. Each plate has a pair of integral diverging arms 65 extending laterally therefrom into the body of the slab, and has also a threaded bolt stem 66 passed therethrough and projecting transversely therefrom into the joint space. The bolt is rigidly attached to the plate, preferably by welding the bolt head to the rear face thereof. When the adjoining section is to be laid similar shear plate elements are attached to the exposed bolt stems 66 and secured by nuts 67 threaded thereover. Each shear plate element corresponds to its opposed embedded element and has a flat vertical bight portion 68 and lateral divergent arms 69 integral therewith. The bight 68 is, however, provided with a horizontal oblong slot 70 which takes over its companion bolt 66 and allows the sections to shift relative to one another longitudinally of the roadway.

This permissive relative axial movement between the old and new sections is of great importance. The two sections, being constructed at different times, contrast and expand differently; and furthermore, while the freshly poured section is drying out, the axial shifting of the older section continues. Without some provision for compensating the relative movement between the sections the shear plates and stress reducing arms 68 and 69 would be torn loose from the green concrete, and the efficacy of the joint would be utterly destroyed. The oblong slots provide an efficient means for permitting the necessary movement because the firmly anchored bolt stems can shift laterally freely in the slots and form their own housing sockets in the green concrete without in any way adversely affecting the load transfer function of the bolts or their dowel useage.

Figure 8 illustrates still another embodiment of the shear plate element construction as applied to half width road building. In this embodiment a concrete slab 71 is formed along one half the width of the road behind a side form 72. The side form is provided with a longitudinally spaced series of bolt receiving apertures 73 which receive therethrough the stems of bolts 74. Each bolt 74 is passed through the center of a flat vertical shear plate 75 that bears against the inside face of the side form. The bolt head is preferably welded to the inner face of the shear plate. Each shear plate 75 is formed with a pair of integral arms 76 diverging laterally from its inner face and extending well back into the concrete to receive load strains remote from the joint and transfer them directly to the shear plate. Nuts 77 cooperate with steel washer members 78 in securing the shear plates and side form together.

After the material of the slab 71 has hardened sufficiently the side form 72 is removed, leaving the shear plates exposed in flush relationship in the slab face with the bolt stems 74 projected therefrom. When the companion slab 79 is to be laid, as shown in Figure 9, other shear plate members 80 identical with the plates 75 are secured over the bolt stems. The opposed plates are disposed in face to face contact or with a washer therebetween and are clamped together by means of the nuts 77 threaded onto the bolt stems. The plates 80 have stress receiving arms 81 extending therefrom which correspond in arrangement and function to the arms 76 of the opposed shear plates.

Figures 10 and 11 illustrate a modification of the embodiment of Figures 8 and 9. As shown, the side form 82 is formed with a V-shaped groove pressed laterally from one face to provide on the opposite face a V-shaped rib 83 running longitudinally of the form. A shear plate 84 is embedded in the slab 85. This plate is V-shaped in cross section complemental to the rib 83 of the side form, over and upon which it is adapted to seat.

The plate 84 has a pair of integral arms 86 diverging laterally from its rear face, and mounts a rigidly connected bolt 87 which projects laterally from its front face. The bolt is received through a slot 88 provided in the side form. When the form is removed for installation of the companion slab a complemental shear plate 89 is engaged over the bolt stem 87 in the channel formed in the joint face of the slab 85 by the rib 83. The parts are secured together by appropriate nut and washer means, not shown. The shear plate 89 also is formed with integral divergent arms 90 similar in purpose and arrangement to the arms 86. Where desired, the respective stress reducing arms may be provided with concrete bonding apertures 91.

I claim:

1. In a concrete road or the like, a division plate for embedding in the concrete to establish sections, shear plates in face contact with the division plate on opposite sides thereof, said shear plates having stress transmitting arms extending into the sections, and rigid connector means passed through all said plates and securing them together against relative movement, said connector means providing load transfer means between the sections.

2. In a joint for concrete sections, a shear plate embedded in a section face, stress transmitting arms extending therefrom into the section, and a bolt extending through said plate and headed on the inner face of the plate with its stem projecting laterally from the outer face of the plate.

3. In a joint for concrete sections, a shear plate embedded in each opposed section face, a bolt headed rigidly on one plate with its stem slidable through the other, and a nut in threaded engagement with said stem behind said other plate for securing the assembly.

4. In a joint for concrete sections, a division plate, a shear plate embedded in each section face and abutting the opposite sides of the division plate, a bolt headed on the inner face of one shear plate with its stem extending through all said plates, a nut threaded on said bolt stem behind the other shear plate, and a resilient mem-

ber surrounding the bolt stem between the nut and the face of an adjacent shear plate.

5. In a joint for concrete road sections, a shear plate embedded in the face of one section, a second shear plate for embedding in the face of the other section, a rigid load transfer member passed through both plates in fixed connection with one, and the other plate having therein a slot disposed longitudinally of the joint and receiving said load transfer member slidably whereby to permit relative movement between said plates longitudinally of the joint.

6. In a joint for concrete road sections, a bearing member embedded in one section, a second bearing member for embedding in the other section, a rigid load transfer member passed through both bearing members in bearing engagement therewith, and one of said bearing members having an oblong slot disposed longitudinally of the joint and slidably receiving the load transfer member for movement longitudinally of the joint.

7. In a joint for concrete road sections, a bearing member anchored in one section, a second bearing member for the other section, a rigid load transfer member passed through both bearing members in bearing engagement therewith, said transfer member being fixed to one bearing member, the other bearing member having a slot disposed longitudinally of the joint and slidably receiving the transfer member for movement longitudinally of the joint, and securing means engageable with the transfer member behind said slotted bearing member.

8. In a longitudinal joint for half width method concrete road construction, a shear plate embedded in the face of the fabricated section, a threaded bolt rigidly secured thereto and projecting laterally therefrom, a second shear plate slotted to slide axially over said bolt and to shift thereon longitudinally of the joint, said slotted shear plate having stress transmitting anchor means extending laterally therefrom away from the fabricated section, and a nut adapted for threading on said bolt behind said slotted shear plate to retain same in assembled position.

9. In a joint for concrete road sections, a division plate, a shear plate at each side face thereof, a bolt passed transversely through all said plates and having a rigid connection with one shear plate, and a nut threaded on said bolt behind the other shear plate for securing said plates in assembled relation, said shear plates being adapted for embedding in the respective sections.

10. In a joint for concrete road sections, a division plate, a shear plate at each side face thereof, a bolt rigidly headed on one shear plate and passed through the division plate and the other shear plate, a nut on said bolt behind said other shear plate, and resilient means on said bolt between the division plate and nut.

11. In a joint for concrete road sections, a shear plate embedded in each opposed section face, stress transmitting arms integral with each plate and extending laterally therefrom away from the joint, a load transfer member comprising a bolt extending transversely across the joint and headed against one plate, and a nut threaded on the bolt and bearing against the other plate.

12. A concrete road section joint installation comprising a division plate adapted to extend longitudinally of a joint, said plate being longitudinally channelled, a pair of substantially V-shaped members disposed one at each side of the channel and having bight portions adjacent the channel bottom, the arms of said members being of a length to extend well into their respective concrete sections when formed, and rigid load transfer connecting means passed through said bight portions and division plate channel bottom and securing those parts in assembled relation.

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