April 21, 1942. H. P. SEUBERLING 2,280,455

ROAD JOINT

Filed May 10, 1940 4 Sheets-Sheet 1

Fig. 1.

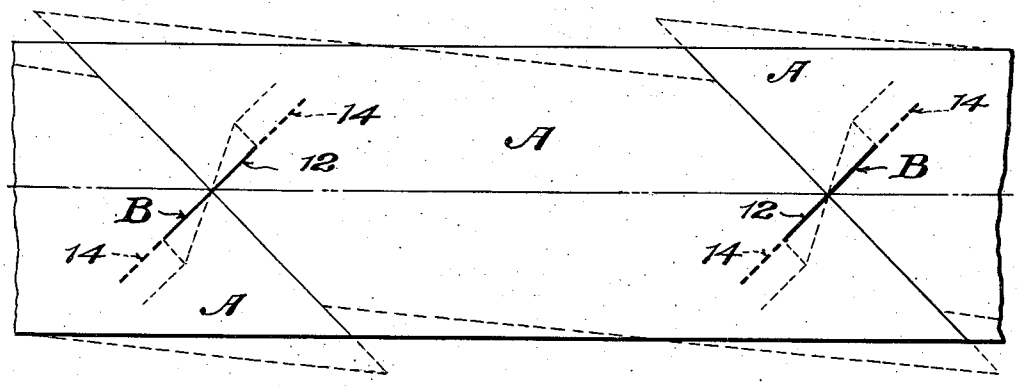


Fig. 2.

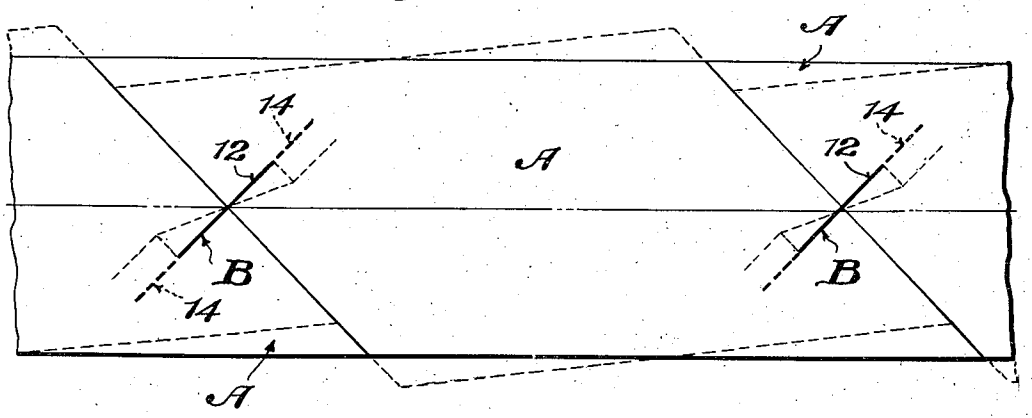
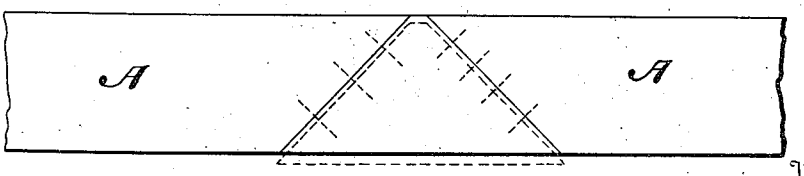


Fig. 3.



Inventors

Harry P. Seuberling,

By Wolhaupter & Groff,

Attorneys

April 21, 1942. H. P. SEUBERLING 2,280,455

ROAD JOINT

Filed May 10, 1940 4 Sheets-Sheet 2

Fig. 4.

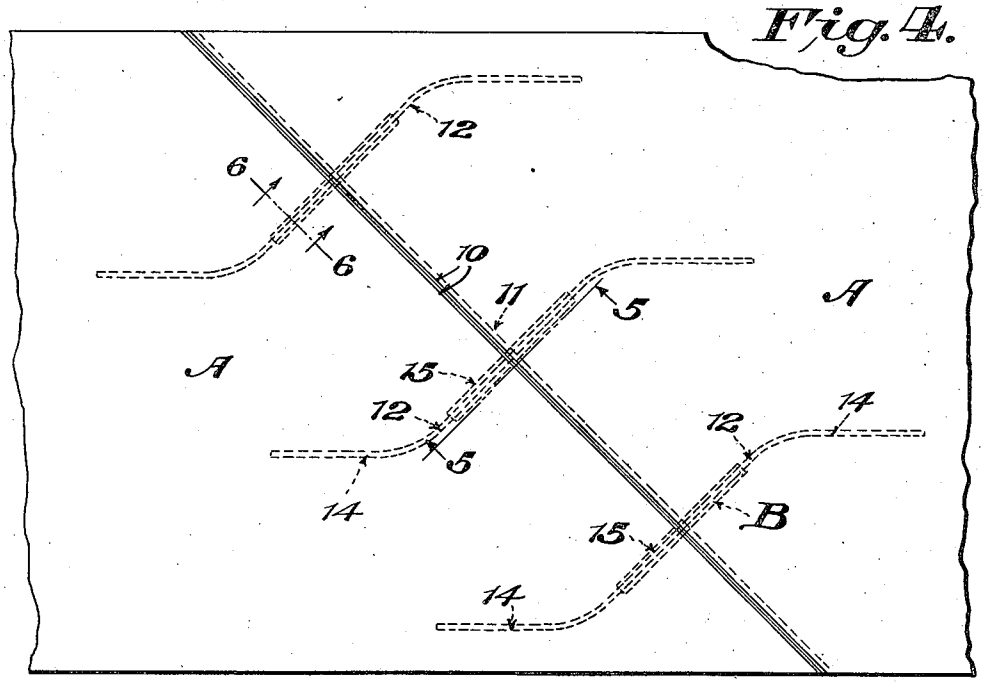


Fig. 5.

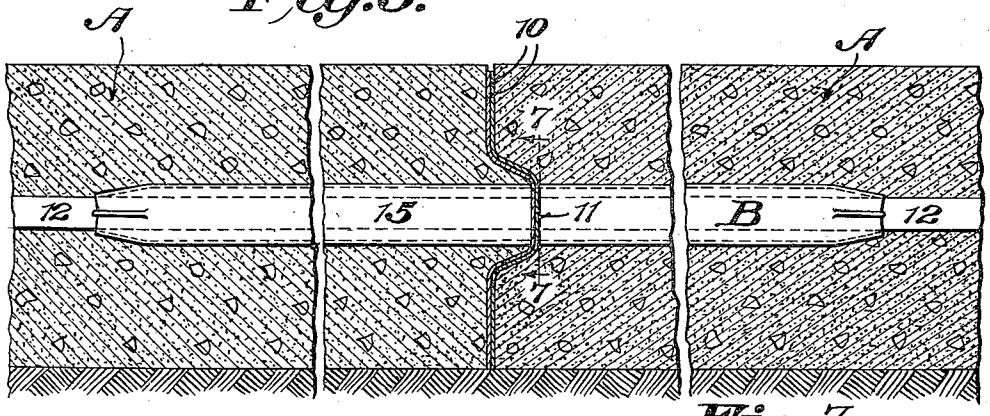


Fig. 6.

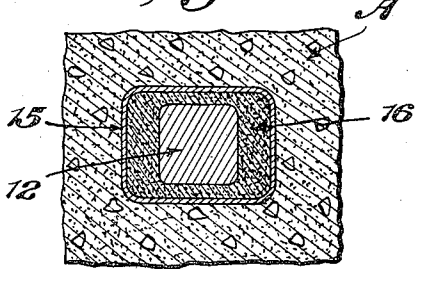
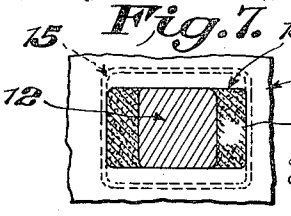


Fig. 7.



Inventors

Harry P. Seuberling,

By Wolhaupter & Groff

Attorneys

April 21, 1942. H. P. SEUBERLING 2,280,455

ROAD JOINT

Filed May 10, 1940 4 Sheets-Sheet 3

Fig. 8.

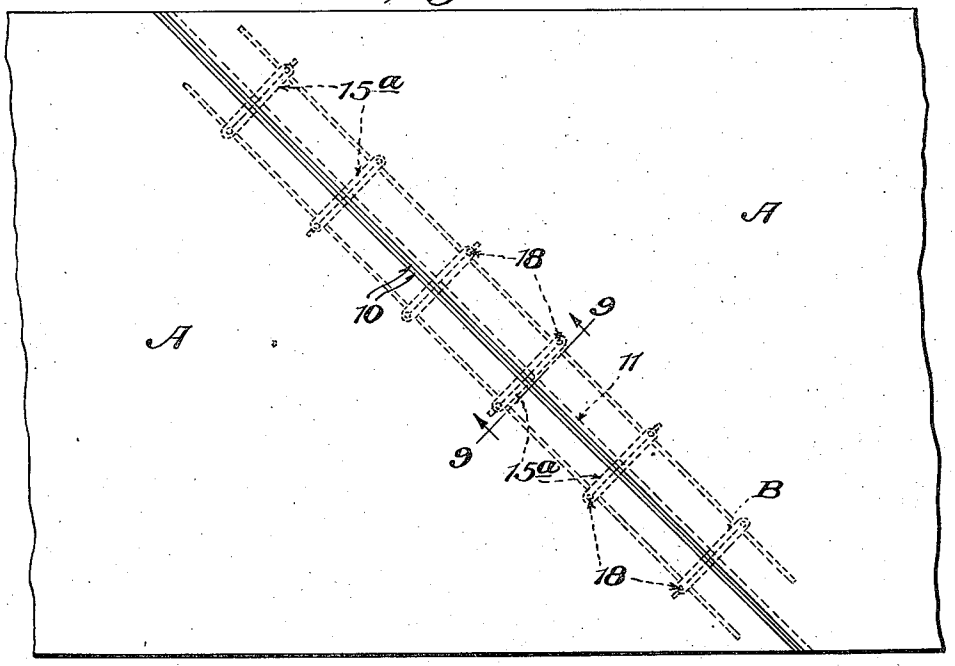


Fig. 9.

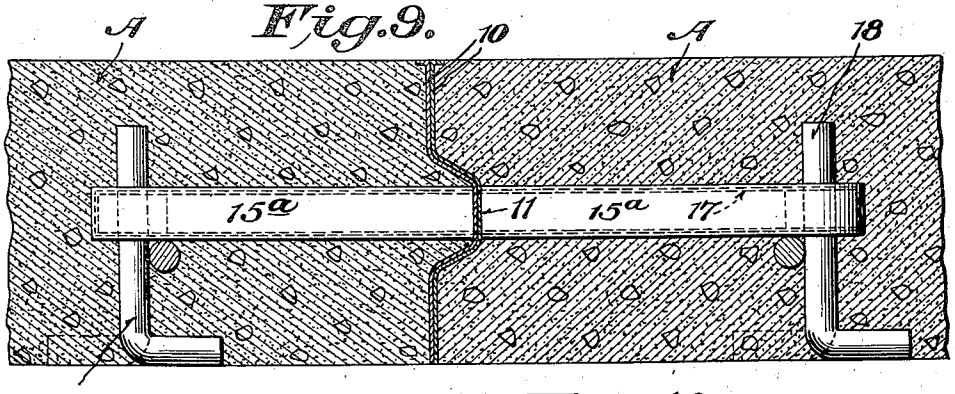
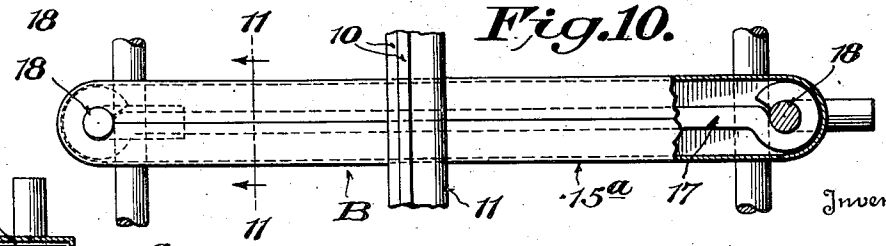


Fig. 10.



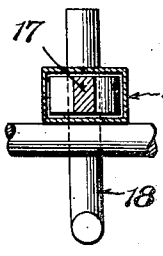


Fig. 11.

Inventors

Harry P. Seuberling,

By Wolhaupter & Groff.

Attorneys

April 21, 1942. H. P. SEUBERLING 2,280,455

ROAD JOINT

Filed May 10, 1940 4 Sheets-Sheet 4

Fig. 12.

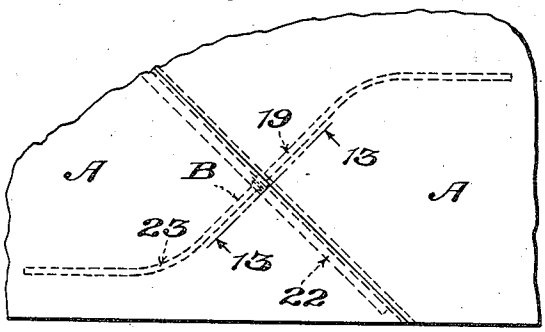


Fig. 13.

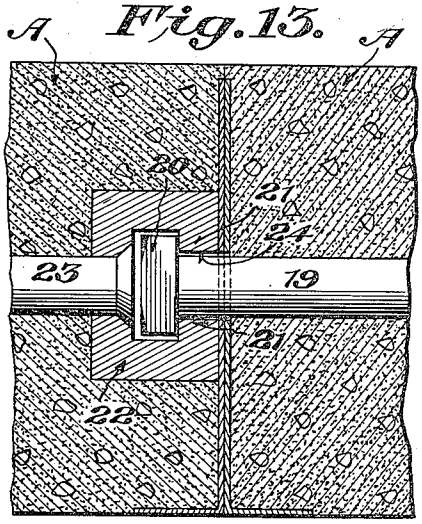


Fig. 14.

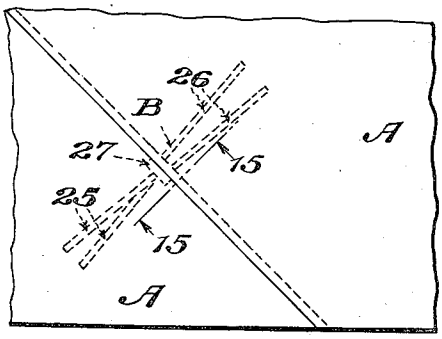


Fig. 15.

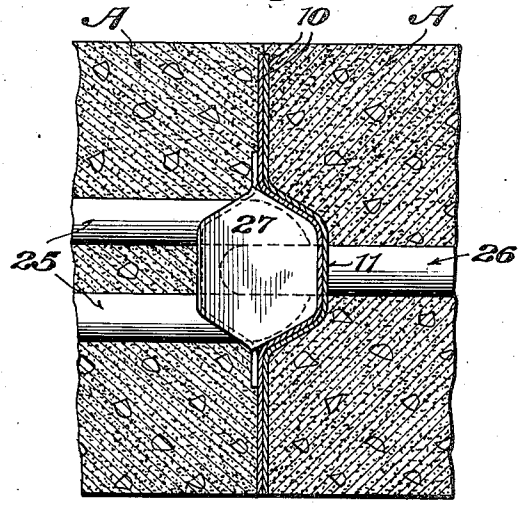
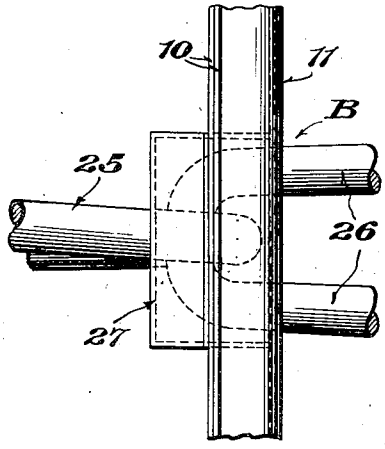


Fig. 16.



Inventors

Harry P. Seuberling,

By Wolhaupter & Groff

Attorneys

Patented Apr. 21, 1942

2,280,455

UNITED STATES PATENT OFFICE

2,280,455

ROAD JOINT

Harry P. Seuberling, Cincinnati, Ohio

Application May 10, 1940, Serial No. 334,438

11 Claims. (Cl. 94—18)

This invention relates to concrete roadways of the type comprising separate slabs or sections disposed in end to end relationship, and has particular reference to improvements in the joints between the ends of the slabs of such roadways.

Heretofore, the general practice in constructing concrete roadways of the type mentioned has been to dispose the ends of the slabs at right angles to the roadway and to provide expansion and contraction joints between the slab ends, leaving spaces of appreciable width between the slab ends at the joints and filling these spaces with a suitable mastic. A roadway of this type is advantageous from the standpoint of reducing tendency of the slabs to heave and crack under expansion, but it is disadvantageous for a number of different reasons. For example, when the slabs expand, the mastic filler between the slab ends is squeezed and caused to bulge upwardly above the surface of the roadway, resulting in ridges across the surface of the roadway at spaced intervals therealong which are both an annoyance and a hazard to traffic. Moreover, when the mastic is bulged into ridges, traffic not only wears it away rapidly, but pushes and spreads it sidewise over the tops of the slabs adjacent to their ends, with the result that when the slabs subsequently contract the ridges are replaced by depressions which are equally as annoying and hazardous to traffic as the ridges. Proper maintenance requires frequent replenishing of the mastic, but this usually only aggravates the undesirable conditions stated. Furthermore, any appreciable spacing apart of the top portions of the slabs at their ends renders these portions of the slabs extremely susceptible to rapid chipping by traffic.

Accordingly, the general object of the present invention is to provide, in a concrete roadway composed of slabs disposed in end to end relationship, novel tie or bonding means connecting the slabs together at their ends, in combination with a novel relationship to each other of the slab ends, whereby the top portions of the slabs at their ends may be maintained constantly in abutting or practically abutting relationship to each other to afford a roadway having at all times a smooth, continuous top surface devoid of the mentioned disadvantages of prior roadways constructed as stated, and whereby, despite this advantageous abutting or practically abutting relationship of their top end portions, said slabs are free to expand and contract without the setting up of heaving pressures or dangerous stresses therein.

According to the invention the ends of the slabs extend diagonally across the roadway, whereby expansion or contraction of the slabs results in their lateral displacement relative to each other without the setting up of heaving pressures or dangerous stresses therein, and in this connection a special object of the invention is to provide novel tie or bonding means between the slabs which act not only to maintain the slabs at all times in end to end abutting relationship and in longitudinal alinement with each other under normal temperature conditions, but to permit them freely to shift laterally relative to each other whereby they are returned to positions in longitudinal alinement with each other whenever they may have become disalined due to a change in temperature and the temperature subsequently returns to normal.

Another object of the invention is to provide a roadway of the type mentioned having simple, effective means for the transfer of traffic loads from one to another of the slabs.

Another object of the invention is to provide a roadway possessing the features and advantages of the invention and in which the joint forming elements at the ends of the slabs are of simple, practical, inexpensive construction.

With the foregoing and other objects in view, which will become more fully apparent as the nature of the invention is better understood, the same consists in the novel construction, combination and arrangement of features and elements as will be hereinafter more fully described, illustrated in the accompanying drawings and defined in the appended claims.

In the accompanying drawings, wherein like characters of reference denote corresponding parts in related views, and wherein the relative motions of the parts are greatly exaggerated for the purpose of easy understanding:

Figure 1 is a top plan view of a portion of a roadway constructed in accordance with the invention and illustrating diagrammatically and by dotted lines the movement of the slabs thereof relative to each other and the action of the slab connecting elements upon expansion of the slabs.

Figure 2 is a view similar to Fig. 1 illustrating the movement of the slabs relative to each other and the action of the slab connecting elements upon contraction of the slabs.

Figure 3 is a top plan view of a portion of a roadway constructed in accordance with an alternative embodiment of the invention.

Figure 4 is a detail top plan view of the adja-

cent end portions of an adjacent pair of the slabs of a roadway constructed in accordance with the Figs. 1 and 2 illustrations.

Figure 5 is an enlarged section on the line 5—5 of Fig. 4.

Figure 6 is an enlarged section on the line 6—6 of Fig. 4.

Figure 7 is a detail section on the line 7—7 of Fig. 5.

Figure 8 is a view similar to Fig. 4 illustrating another alternative embodiment of the invention.

Figure 9 is an enlarged section on the line 9—9 of Fig. 8.

Figure 10 is a plan view of one of the slab connecting units of the Fig. 8 embodiment of the invention.

Figure 11 is a cross section on the line 11—11 of Fig. 10.

Figure 12 is a fragmentary view similar to Fig. 4 illustrating another alternative embodiment of the invention.

Figure 13 is an enlarged section on the line 13—13 of Fig. 12.

Figure 14 is a view similar to Fig. 12 illustrating another alternative embodiment of the invention.

Figure 15 is an enlarged section on the line 15—15 of Fig. 14; and

Figure 16 is an enlarged plan view of the slab connecting elements of the Fig. 14 embodiment of the invention.

Referring to the drawings in detail, it will be observed that a roadway constructed in accordance with the invention is composed fundamentally of a succession of slabs disposed in end to end relationship to each other with their ends extending diagonally across the roadway. In the drawings these slabs are designated as A and in accordance with the invention they may be formed from concrete or other suitable material and may be of either rhomboidal form, as illustrated in Figs. 1 and 2, or of trapezoidal form as illustrated in Fig. 3. In either case they may be of equal or unequal lengths. Also, in either case, the ends of the individual slabs may have equal or unequal amounts of angular or diagonal relationship to the longitudinal axes of the slabs. Preferably, however, the ends of the slabs have equal amounts of angular or diagonal relationship to the longitudinal axes of the slabs whether the slabs are of rhomboidal or trapezoidal form. Preferably, too, this angularity is forty-five degrees, although it may be greater or less.

The adjacent ends of adjacent slabs are disposed entirely or in part in direct or indirect abutting relationship to each other and are maintained in this relationship by the tie or bonding elements B which permit the slabs to shift laterally relative to each other. Under a normal or mean atmospheric temperature the slabs A are disposed in longitudinal alinement with each other, as shown by full lines in Figs. 1 to 3. Thus, a rise in the temperature with consequent expansion of the slabs will produce a wedging action between the abutting, diagonally disposed ends of the slabs which will result in outward lateral displacement of the slabs relative to each other while a fall in the temperature with consequent contraction of the slabs will result in inward displacement of the slabs relative to each other. If the slabs are of rhomboidal form as illustrated in Figs. 1 and 2, the respective ends of the individual slabs will shift laterally in opposite directions, as illustrated by dotted lines in Figs. 1 and 2, or, in other words, each slab will partake of a rotary motion. If, on the other hand, the slabs are of trapezoidal form as illustrated in Fig. 3, some or all of the slabs will shift bodily in a direction at right angles to the roadway. Thus, due to the slabs being maintained by the bonding elements B in end to end abutting relationship, they will be returned to positions in longitudinal alinement with each other by said bonding elements or by wedging action whenever the temperature, following a rise or fall thereof, returns to its normal or mean degree. Accordingly, it will be apparent that the top portions of the slabs at their ends may be disposed either in abutting, or practically abutting relationship, whereby the roadway will have at all times a continuous, or practically continuous, smooth, top surface devoid of transverse joint ridges or depressions with all attendant advantages as compared with prior roadways in which the slabs move endwise toward and away from each other.

In order to provide for free sliding movement of the abutting end faces of the slabs A relative to each other, that portion of the end face of each slab which abuts the adjacent end of the adjacent slab may be defined by a metal plate of any suitable thickness and depth extending preferably from side to side of the slab. Alternatively, there may be only a single metal plate between adjacent slab ends fixed with respect to one of the slabs and having the adjacent end face of the adjacent slab slidably engaged thereagainst.

Whether there is a plate at each end of each slab or only a single plate between adjacent ends of adjacent slabs, such plates may be and preferably are used as end forms in constructing the slabs. Preferably, too, said plates, in either case, are of suitable cross sectional shape to provide at adjacent ends of the slabs horizontally disposed, interfitting rib and channel formations extending preferably from side to side of the slabs to hold the slab ends against vertical displacement relative to each other and to permit the slabs to partake of slight hinge movements vertically relative to each other in the event of warpage of the slabs or any slight elevation or depression of their ends for any reason.

According to each of the different embodiments of the invention illustrated in the drawings, there is provided a plate 10 at each end of each slab A extending from side to side and practically from top to bottom of the slab, and said plates are laterally offset in cross section approximately midway between their top and bottom edges, as indicated at 11, to provide the aforesaid interfitting, horizontally disposed, rib and channel formations for the purposes stated.

Of course, the provision of even a single plate 10 between the slab ends is not essential, but at least one such plate preferably is provided to reduce sliding friction. It will be understood, therefore, that the term "slab" as used herein is to be constructed as meaning a slab either devoid of end plates 10 or a slab provided at either or both ends with a plate 10.

According to the Figs. 4 to 7 embodiment of the invention the tie or bonding elements B are in the form of steel rods 12 extending through horizontally elongated openings 13 in the offset portions 11 of the plates 10 and anchored at their ends to the slabs at points spaced from the slab ends, as indicated at 14. In order that the slabs A may be free to shift laterally with respect to each other it is necessary that the medial por-

tions of the rods B, that is to say, the portions of said rods between their anchored ends, be freely movable laterally relative to the slabs, and any suitable provision for this purpose may be made For example, the slabs may simply have recesses of greater width than the tie rods B accommodating the medial portions of said tie rods. Preferably, however, the slabs are provided with metal sleeves 15 of greater width than the tie rods 12 encasing the medial portions of said tie rods and affording spaces within the slabs in which the medial portions of said rods may move laterally relative to the slabs. If desired, said sleeves may be filled with a suitable tie rod protecting mastic 16. The said sleeves may be held in place in any suitable manner during pouring of the slabs and serve, of course, as forms to provide in the finished slabs the necessary clearances at the sides of the medial portions of the tie rods 12 to permit said portions of said rods to shift laterally relative to the slabs when the slabs shift laterally relative to each other.

Assuming that the slabs A are disposed in longitudinal alinement with each other and in end to end abutting relationship, and that said slabs and the tie rods 12 are unstressed because of the existence of a normal or mean atmospheric temperature, it is apparent that since the tie rods 12 hold the slabs at all times in end to end abutting relationship, a rise or fall in the temperature with consequent expansion or contraction of the slabs will necessarily result in the end portions of the slabs shifting laterally relative to each other and in lateral shifting of the medial portions of the tie rods 12 relative to said slabs. This is illustrated diagrammatically in Figs. 1 and 2, wherein the heavy dash lines indicate the anchored ends of the rods 12 and the heavy full lines indicate the intermediate portions of said rods under normal or mean atmospheric temperature conditions in which the slabs are alined and are unstressed and said tie rods are unstressed, while the lighter dash lines indicate in a very exaggerated manner the positions assumed by the anchored ends and the intermediate portions of said tie rods when the end portions of the slabs shift laterally relative to each other due to expansion or contraction of the slabs.

The tie rods 12 may be slightly tensioned due to lateral shifting of the slabs A relative to each other, but any such tensioning is negligible and well within the elastic limits of said rods.

Since the end portions of the slabs A may, according to the invention, be maintained in end to end abutting relationship without danger of the setting up of heaving pressures or dangerous stresses therein, it is apparent that the top surface of a roadway constructed in accordance with the invention may, as aforesaid, have at all times a continuous, or practically continuous, smooth, top surface devoid of transverse joint ridges or depressions with all attendant advantages as compared with prior roadways in which the ends of the slabs move toward and away from each other.

According to the embodiment of the invention illustrated in Figs. 8 to 11 of the drawings the tie or bonding elements B are in the form of rods 17 pivoted at their ends to pin members 18 embedded in the slabs A, and are encased throughout their lengths by sleeves 15a serving the same purpose as the sleeves 15, that is, to provide spaces in the slabs to permit the rods 17 to partake freely of lateral movements relative to the slabs when the slabs shift laterally relative to each other. According to this embodiment of the invention the tie rods B simply pivot and do not bend when the slabs A shift laterally relative to each other; whereas, according to the Figs. 4 to 7 embodiment of the invention, lateral shifting of the slabs relative to each other results in slight bending of the tie rods 12 in the vicinity of the points of junction of their free, intermediate portions with their embedded or anchored end portions. Otherwise, the mode of operation of the Figs. 8 to 11 embodiment of the invention is the same as the mode of operation of the Figs. 4 to 7 embodiment of the invention.

According to the Figs. 12 and 13 embodiment of the invention adjacent ends of adjacent slabs A are connected together and held in end to end abutting relationship by means which neither bend nor pivot, but which permit the end portions of the slabs to shift laterally relative to each other. The specific means for this purpose comprises studs 19 projecting from the end of one of the slabs and having heads 20 disposed behind flanges 21 of a channel member 22 carried by the other slab and extending along the end thereof. The studs 19 may be comprised by the outer end portions of rods extending well into the first mentioned slab and suitably anchored therein, or they may be carried by a cross member in the nature of the channel member 22 which in turn may be anchored in the first mentioned slab in any suitable manner. Similarly, the channel member 22 may be anchored in the second mentioned slab in any suitable manner, as for example, by means of anchor rods 23 fixed thereto and embedded in said second mentioned slab.

Between the flanges 21 of the channel member 22 is a horizontal slot 24 corresponding in width to the cross sectional depth of the studs 19 and through which the studs 19 extend, whereby said studs are free to shift longitudinally along said channel member. Thus, the slabs are held in end to end abutting relationship and also against vertical displacement relative to each other and yet are free to shift laterally with respect to each other to compensate for contraction and expansion due to atmospheric temperature changes. Obviously, since the slabs are held in end to end abutting relationship to each other and are longitudinally alined under a normal or mean atmospheric temperature, they necessarily will shift laterally relative to each other when expanded or contracted due to a rise or fall in the temperature and will return to positions in longitudinal alinement with each other when the temperature returns to its normal or mean degree.

According to the Figs. 14 to 16 embodiment of the invention adjacent ends of adjacent slabs are connected together and held in end to end relationship by interfitting link members 25 and 26 which permit the slabs to shift laterally relative to each other. Each of said link members 25 and 26 is in the form of a U-shaped rod having its legs embedded in its related slabs A and its bight portion exposed at the end of its related slab, but the bight portion of the link 25 is disposed vertically whereas the bight portion of the link 26 is disposed horizontally. The bight portions of the links 25, 26 extend through one another whereby the slabs are linked together in end to end abutting relationship, and the bight portion of the link 26 is amply wide to permit the bight portion of the link 25 to shift laterally therein. Thus the slabs, while linked together in end to end abutting relationship, are permitted to shift

laterally with respect to each other when they contract or expand. This form of the invention therefore has the same mode of operation as set forth in connection with the other embodiments of the invention. Figs. 15 and 16 further illustrate that the bight portions of the links 25, 26 may be disposed in housings formed in part by the offset portions 11 of the plates 10 and by cooperating oppositely offset plates 27.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

I claim:

1. A roadway structure comprising slabs disposed in end to end relationship and having their ends extending diagonally across the roadway in slidable straight-line engagement with each other, and means connecting said slabs together and holding them at all times in end to end abutting engagement with each other, said structure including space means adjacent to said connecting means to permit portions of said connecting means to move laterally relative to the slabs and thereby permit the ends of the slabs to move laterally relative to each other.

2. A roadway as set forth in claim 1 in which the means connecting adjacent ends of adjacent slabs together and holding them in end to end abutting engagement comprises a channel member carried by one of the slabs and studs carried by the other slab and having heads slidably disposed in the channel member of the first mentioned slab.

3. A roadway as set forth in claim 1 in which the means connecting adjacent ends of adjacent slabs together and holding them in end to end abutting engagement comprises interfitting links carried, respectively, by the slabs.

4. A roadway comprising slabs disposed in end to end relationship to each other and having their ends extending diagonally across the roadway in abutting, slidable straight-line engagement with each other from side to side of the slabs, rods connecting said slabs together and holding them in end to end abutting engagement with each other during the entire cycle of contraction and expansion thereof and acting to transpose any variation in size of the slabs due to change in temperature to a motion of the slabs relative to each other causing their ends to shift laterally relative to each other, said rods being anchored at their ends in the slabs at points spaced inwardly from the slab ends, and said slabs having spaces at opposite sides of the medial portions of said rods to permit the said medial portions thereof to move laterally relative to the slabs, thus to permit the slab ends to shift laterally relative to each other.

5. A roadway comprising slabs disposed in end to end relationship to each other and having their ends extending diagonally across the roadway in abutting, slidable straight-line engagement with each other from side to side of the slabs, rods connecting said slabs together and holding them in end to end abutting engagement with each other during the entire cycle of contraction and expansion thereof and acting to transpose any variation in size of the slabs due to change in temperature to a motion of the slabs relative to each other causing their ends to shift laterally relative to each other, and pivotal connections between said rods and said slabs at points spaced inwardly from the ends of the slabs, said slabs having spaces at the sides of said rods permitting them to move laterally relative to said slabs, thus to permit the slab ends to shift laterally relative to each other.

6. A roadway comprising slabs disposed in end to end relationship and having their ends extending diagonally across the roadway in abutting, slidable straight-line engagement with each other from side to side of the slabs, metal rods connecting said slabs together and holding them in end to end abutting engagement with each other during the entire cycle of contraction and expansion thereof and acting to transpose any variation in size of the slabs due to change in temperature to a motion of the slabs relative to each other causing their ends to shift laterally relative to each other, said rods being anchored in said slabs at points spaced inwardly from the ends of the slabs, said slabs having spaces at the sides of said rods between their anchored ends to permit them to move laterally relative to the slabs, thus to permit the slab ends to shift laterally relative to each other, said slabs being disposed in longitudinal alinement with each other and being unstressed at a mean temperature.

7. A roadway as set forth in claim 4 in which sleeves are embedded in the slabs and are of greater width than the rods and encase the portions of said rods between their anchored ends and define the spaces in the slabs at opposite sides of the medial portions of said rods.

8. A roadway as set forth in claim 5 in which sleeves are embedded in the slabs and are of greater width than the rods and encase the portions of said rods between their anchored ends and define the spaces in the slabs at opposite sides of the medial portions of said rods.

9. A roadway comprising slabs disposed in end to end relationship and having their ends extending diagonally across the roadway in straight-line abutting slidable engagement with each other from side to side of the slabs, and means connecting together each two adjacent ends of said slabs and holding them in end to end abutting engagement with each other during the entire cycle of contraction and expansion thereof, at least one of each two of the adjacent ends of said slabs having space means to permit movement of said connecting means laterally relative to at least one of each two of said slab ends and also movement of the slab ends laterally relative to each other, whereby any variation in length of the slabs due to change in temperature causes their ends to shift laterally relative to each other.

10. A roadway structure as set forth in claim 1 in which the slabs are of rhomboidal shape in plan.

11. A roadway structure as set forth in claim 1 in which the slabs are of trapezoidal shape in plan.

HARRY P. SEUBERLING.