United States Patent

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[54] **CONCRETE JOINT LOAD TRANSFER DEVICE**
16 Claims, 4 Drawing Figs.

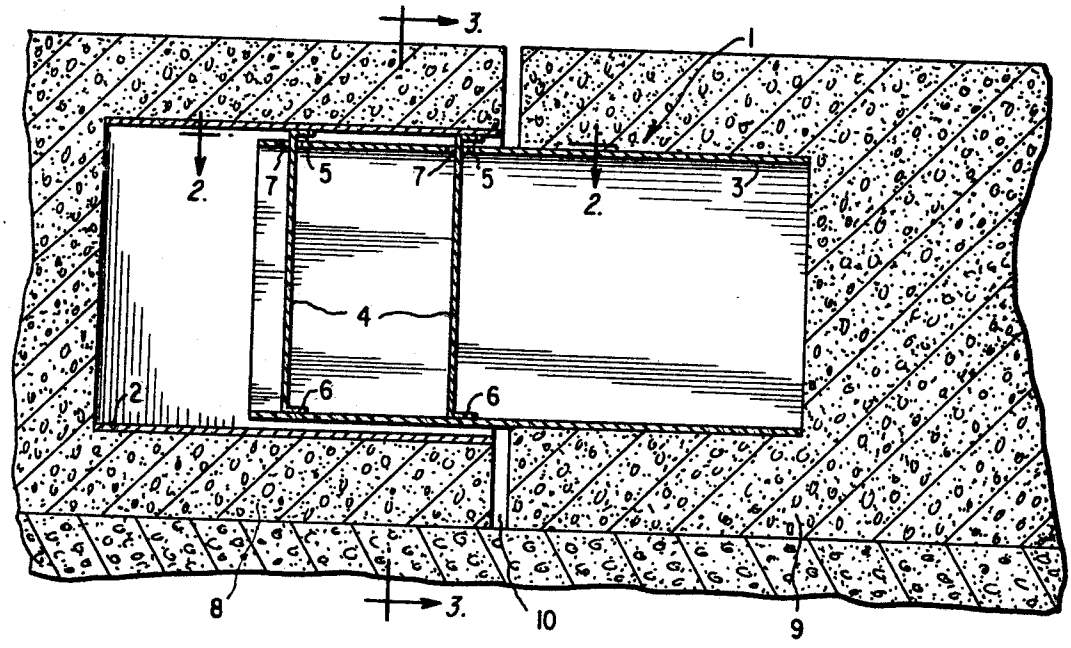
[52] **U.S. Cl.** 94/8, 94/18
[51] **Int. Cl.** **E01c 11/10**
[50] **Field of Search** 94/8, 18

[56] **References Cited**
UNITED STATES PATENTS

2,213,725	9/1940	White	94/18
2,351,255	6/1944	Fischer	94/18

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ABSTRACT: Disclosed herein is a concrete joint load transfer device including a first rectangular member, a second rectangular member telescopically positioned within the first member and at least one suspension element connected to opposite walls of said first and second members respectively, with the first and second members set in concrete slabs separated by an expansion joint.



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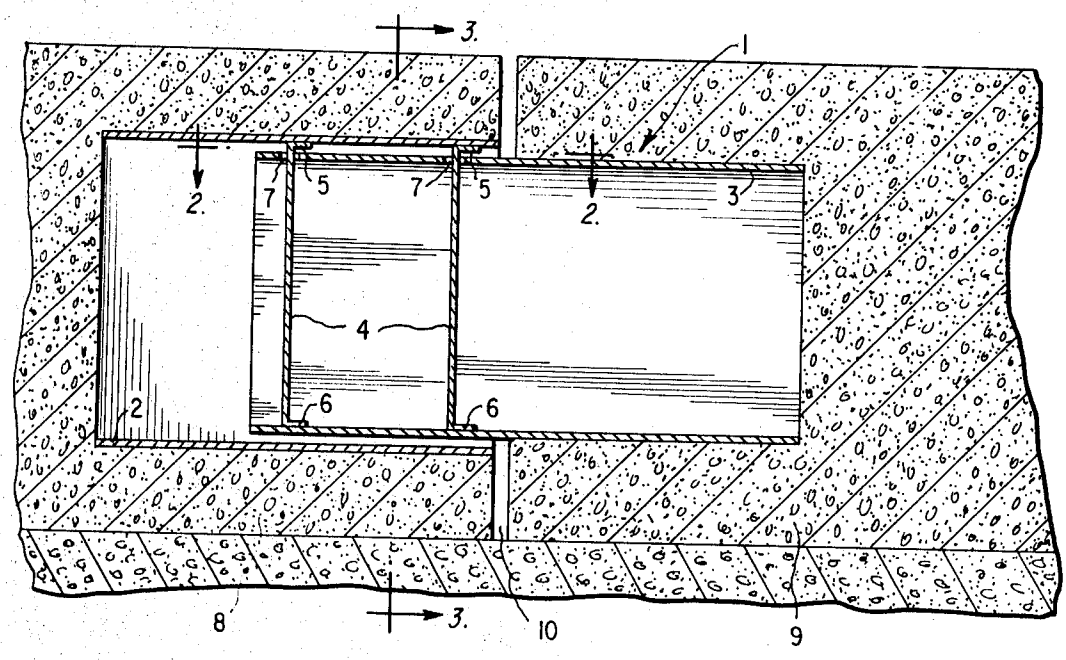


FIG. 1

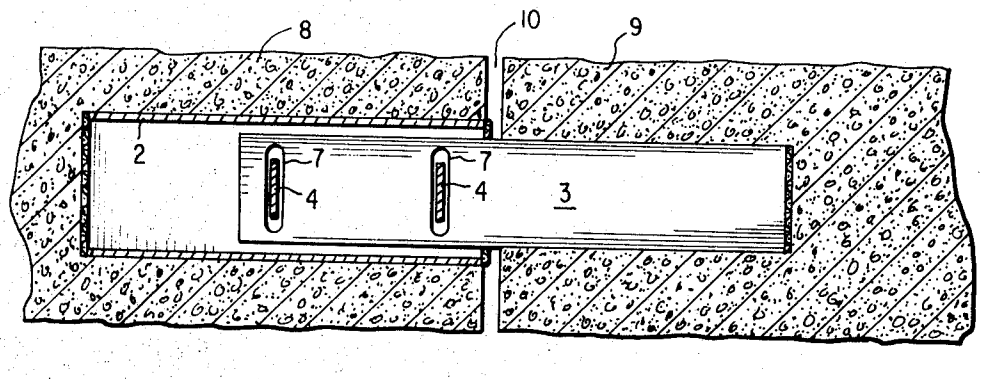


FIG. 2

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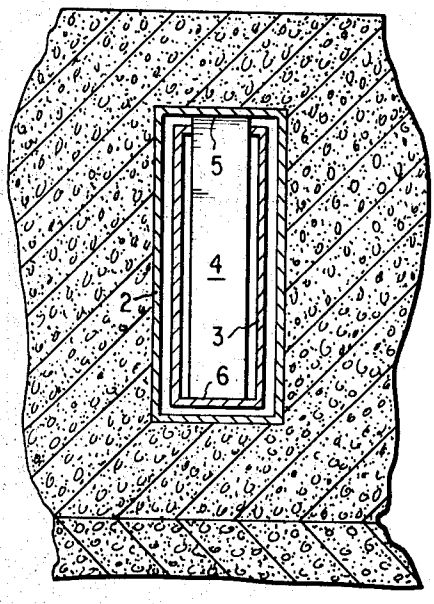


FIG. 3

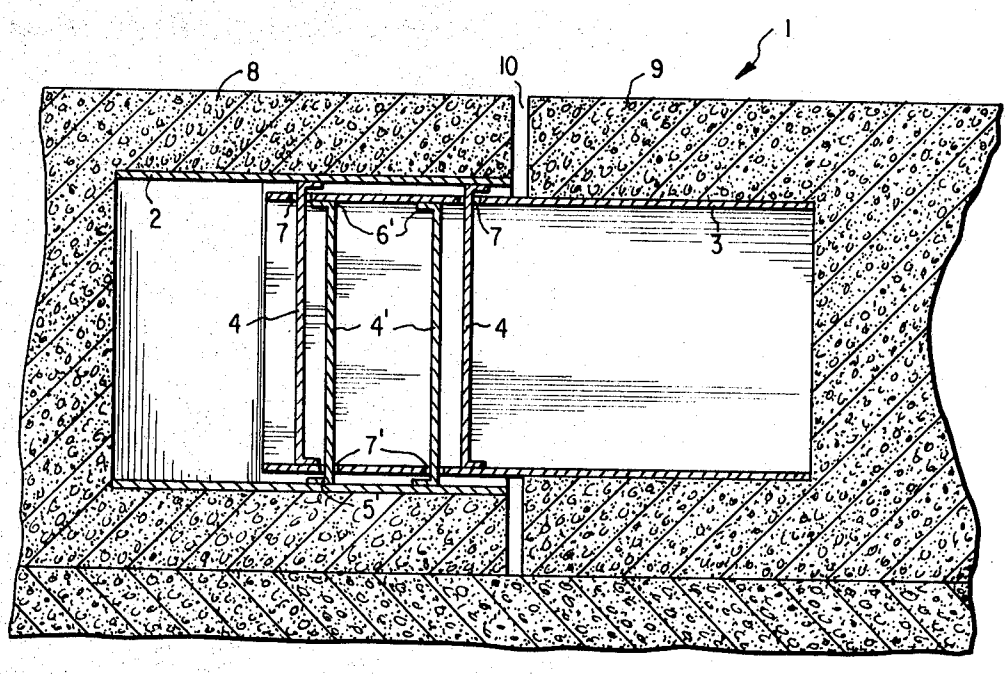


FIG. 4

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CONCRETE JOINT LOAD TRANSFER DEVICE

This invention is directed to an improvement in expansion joints in concrete pavement and other structures employing concrete slabs and is concerned more particularly with load transfer devices connecting such concrete slabs while permitting essentially complete freedom of expansion and contraction of the concrete slabs.

The provision of expansion and control joints in concrete road beds and other extended concrete structures is well known to compensate for the expansion and contraction of such concrete structures in response to temperature change and variation in moisture content. Ideally, such expansion joints should remain in a horizontal plane or in any desired plane during the course of such expansion and contraction and regardless of loads applied to the separated concrete slabs. To this end, it is well known to provide structural connections between the individual slabs of a concrete structure in order to transfer the loads applied to one slab to an adjacent slab and assure the maintenance of contiguous slabs of concrete in the same plane regardless of the expanded or contracted condition of the slabs and the load forces applied to one or the other or both of such slabs. Particularly, this maintenance of uniform planar relation between adjacent concrete slabs is necessary in the construction of road beds in order to avoid unnecessary roughness in the construction of concrete roads. However, the maintenance of adjacent concrete slabs, provided with expansion joints between them, in the same plane is desired in most all applications.

Many attempts have been made to provide effective load transfer devices for assuring that adjacent concrete slabs are maintained in the same and the present invention is the produce of a continuing effort to improve on such load transfer devices.

All prior devices suffer from certain drawbacks, some of which include the high cost of constructing such load transfer devices, the high cost of installing such devices, the complicated nature of installation of such devices resulting in high labor costs and other economical drawbacks. Consequently, there is a continuous effort in the industry to provide a simple and highly economical load transfer device that can be easily constructed at a minimum of cost and installed by relatively unskilled labor in a minimum amount of time. The production of such device is the primary object of this invention.

Another object of this invention is the provision of a load transfer device for the expansion joints connecting adjacent concrete slabs which device can be easily and completely constructed remote from the point of its installation in the expansion joint.

Still another object of this invention is the provision of a load transfer device for the expansion joint of adjacent concrete slabs wherein the supporting structure transferring such load is positioned prior to placement of concrete with a suitable temporary support which becomes embedded in concrete; the temporary support may be placed on either or both sides of the expansion joint and at some distance from it, and the material forming the expansion joint proper is not called upon to support the load transfer device during the placement of concrete.

A further object of this invention is the provision of a load transfer device for expansion joints of adjacent concrete slabs wherein the load transferring structure of such device is completely embedded within the concrete slabs and it is not necessary to arrange the load transferring structure within the expansion joint.

Still a further object of this invention is to provide a load transfer joint device for the expansion joint of adjacent concrete slabs which can be installed at a minimum expenditure of time and effort.

Another object of this invention is to provide a load transfer device for the expansion joint between contiguous concrete slabs which permits free and easy expansion and contraction of said slabs while effectively and consistently transferring the loads applied to one slab to the adjacent slab.

Yet another object of this invention is to provide a load transfer device for the expansion joints of adjacent concrete slabs which permits expansion of the concrete slabs in any direction caused by heat and moisture change in the slabs.

A more specific object of this invention is to provide a load transfer device for the expansion joints of concrete slabs which includes a first rectangular member, a second rectangular member partially telescoping within said first member, said first member completely embedded within one concrete slab, the portion of said second member extending outside said first member being embedded in a second concrete slab with an expansion joint between said slabs, and means for transferring the load applied to one rectangular member to the other rectangular member.

Still another specific object of this invention is to provide a device as described in the immediately preceding object, wherein said second member has a suspension element connected to one side thereof and extending through the opposite side thereof to connect to an inside portion of said first member.

Still a further specific object of this invention is to provide a load transfer device as immediately preceding wherein alternate suspension elements extend through opposite sides of said second member and are connected to said second member at opposed portions of said opposite sides with the terminal portions of said suspension elements connected to said first member.

These and other objects of the invention will become readily apparent to those skilled in the art, when consideration is given to the following detailed description of preferred embodiments of the invention which is set forth by way of example, said description taken in conjunction with the accompanying drawings wherein:

FIG. 1 illustrates in elevation, a device according to the invention in its simplest form;

FIG. 2 illustrates a plan view of the device of FIG. 1 taken along the line 2–2 of FIG. 1;

FIG. 3 illustrates a cross section of the device of FIG. 1 taken along the line of 3–3 of FIG. 1; and

FIG. 4 illustrates in elevation a second embodiment of the invention.

Referring now to FIGS. 1 to 3, the details of the invention in its simplest form will be described. The load transfer device of the present invention is illustrated generally at 1. The device includes a first rectangular member 2 and a second rectangular member 3. The second rectangular member extends partially within the first member in a telescoping fashion with a portion of the member 3 extending outside the member 2. Of course it will be understood that when referring to members 2 and 3 as rectangular members, one should bear in mind that many other hollow members would be substantially equivalent to the rectangular members 2 and 3 and are equally acceptable in practicing the invention. Examples of additional configurations for the members 2 and 3, which is by no means exhaustive of the range of equivalents that will become apparent to those skilled in the art, include square members, circular members, elliptical members, channel shaped members, rectangular members with perforations, reinforced rectangular or other shaped members, including substantially any shaped hollow member which may have solid portions for reinforcements, etc. It is important, however, that the first member 2 be hollow over the portion thereof receiving the portion of the second member having the suspension elements to be described hereinafter, and that the second member be hollow for at least substantially a major portion of the second member extending within the first hollow member. The significance of the first and second members being hollow will be more clearly understood from the following description, but briefly a significant advantage of the present load transfer device is that the load transferring structure may be positioned within the concrete slabs due to the hollow nature of the first and second members and it is not necessary to provide the load transferring elements which must also permit the expan-

sion and contraction of the adjacent concrete slabs, to be positioned within the expansion joint between such slabs. Also shown is a pair of suspension elements 4 which are connected by any convenient arrangement to the inside of the first hollow member 2 as indicated at 5. The connection may be made by welding the suspension elements 4 to the member 2 or by any other known securing arrangement. The opposite ends of the suspension elements are connected to the rectangular member 3 as indicated at 6.

The suspension elements 4 extend through the openings 7 in the upper surface of the rectangular member 3. Thus, as can be clearly seen from the drawings, the suspension elements are connected to the inside of the rectangular members 2 and 3 at opposite wall portions.

Looking particularly at FIG. 3, the preferred arrangement of the load transfer device of this invention is shown wherein any pressure applied to the member 3 in a downward vertical direction will be transferred through the suspension element 4 to the member 2. Clearly, the rectangular structure is preferred since the elongated rectangular cross section for the hollow members will clearly provide greater strength in transferring applied loads than will many of the various other possible cross section configurations.

The rectangular members 2 and 3 are shown embedded in the concrete slabs 8 and 9, respectively, with the slabs 8 and 9 being separated by an expansion joint 10.

It will be readily recognized that the load transfer device of this invention may be completely constructed at a factory remote from the area of incorporation in the concrete structure. The device may be easily manufactured and is readily adaptable to high-speed manufacturing processes and modern machinery. When the complete load transfer device has been constructed, it is shipped to the area of ultimate use and may be easily incorporated in the adjacent concrete slabs as the slabs are being poured. To this end, it is important to provide an impervious screen over both extreme ends of the members 2 and 3, and also at section where member 3 enters member 2. This is clearly indicated in FIG. 2.

Other practical arrangements will be recognized for achieving the same end. For instance, the entire inner space of the two telescoping members 2 and 3 bounded by the screens shown in FIG. 2 can be filled with a lightweight foamed material such as foamed polyurethane which is sufficiently strong to keep concrete from occupying this space, and which offers only negligible resistance to the movements of the telescoping members 2 and 3 and the suspension elements 4 which might be expected in the normal operation of the device.

When incorporating the load transferring devices of the present invention in adjacent concrete slabs, a number of different arrangements may be employed to assure transfer of forces applied in either direction to one slab directly to the adjacent slab in order to maintain the effective plane of the slabs uniform at the expansion joints. One of the most practical ways of employing the load transfer device of the present invention for transferring the load in both directions is merely to provide a number of the devices in a line along the area of expansion joint with alternate devices being turned in an opposite direction. Thus, in looking at FIG. 2, a very convenient way of assuring the transfer of loads in both directions from one slab to the other would be to provide a second device adjacent the one shown with the larger hollow member 2 being embedded in the concrete slab 9 and the extended portion of the smaller hollow member 3 being embedded in the slab 8. Thus, the force applied to one slab is always transferred by tension on the suspension elements 4 of one of the devices to the adjacent slab.

Another arrangement for the number of devices used to assure that loads are transferred in both directions to the adjacent concrete slabs is merely to invert the alternate devices with respect to each other. Thus, looking at FIG. 3, if a device were placed adjacent in side-by-side relation to the one illustrated, except that the adjacent device be rotated 180° about the axis of the telescoping members 2 and 3, it will be evident that the load applied to one concrete slab, either vertically up, or vertically down, would be transferred to the adjacent concrete slabs through tension on one of the suspension elements 4.

Referring now to FIG. 4, a modification of the preferred embodiment, clearly within the scope of the present invention, is illustrated. The load transfer device is again illustrated generally at 1 and includes a large hollow member 2 having a smaller hollow member 3 telescopically positioned therein with a portion extending outside the member 2. The members 2 and 3 are again illustrated as embedded in the concrete slabs 8 and 9 respectively and the slabs being separated by the expansion joint 10. The suspension elements 4, as described in conjunction with the simpler form of the invention, are again illustrated as passing through the slots 7.

A second set of suspension elements 4' are also provided which extend through the slots 7' of the inner hollow member 3. In this manner, the device will transfer loads applied to either of the slabs to the other slab through tension on one of the suspension elements 4 or 4'. The suspension element 4' is connected to the outer member 2 at 5' and the inner member 3 at 6'.

By arranging the suspension elements 4 and 4' alternately for transferring loads between the concrete slabs 8 and 9, a greatly simplified and highly efficient device is available. In operation, if a downwardly vertical force is applied to the slab 8, that force is transferred to the hollow member 2 which in turn transfers the force to the inner member 3 through tension on the suspension element 4'. The downward force received by the inner member 3 is transferred to the slab 9 and thus the force is definitely and positively transferred to the slab 9 to maintain the effective plane of the slabs uniform at the joint. If a downward vertical force were applied to the slab 9, the force would be transferred to the member 3 which would in turn transfer the force to member 2 through tension on the suspension element 4. Force thus applied to the member 2 would be transferred to the concrete slab 8, thus maintaining the effective plane of the adjacent slabs uniform at the expansion joint.

I claim:

1. A load transfer device for concrete slabs connected by an expansion joint including:
   a. A first hollow member;
   b. A second hollow member telescopically extending at least partially within said first member; and
   c. At least one suspension element connected to the inside of said first member, extending through an opening in a wall portion of said second member and connected to a wall portion of said second member remote from said first named wall portion of said second member on the inside thereof.

2. A device according to claim 1 wherein at least said second member is rectangular in cross section and said opening containing wall portion and said remote wall portion are opposite walls of said rectangle.

3. A device according to claim 1 wherein both said hollow members are rectangular.

4. A device according to claim 1 wherein the ends of said hollow members furthest from each other are covered with a screen.

5. A device according to claim 1, wherein said suspension element is substantially perpendicular to the longitudinal axis of said hollow members.

6. A device according to claim 1 wherein said first member is embedded in one concrete slab and a portion of said second member extending out of said first member is embedded in a second concrete slab with said slabs spaced apart to form an expansion joint.

7. A device according to claim 1 wherein said second member does not extend completely through said first member in one direction, but does extend completely through said first member in the opposite direction.

8. A device according to claim 1 wherein said second member has a solid portion with the hollow part of said second member at least partially telescoping within said first member and said solid portion at least partially extending outside said first member.

9. A device according to claim 6 wherein there is a plurality of such load transfer devices between said concrete slabs and said one slab having embedded therein alternatively, said first member and said portion of said second member, said second slab having embedded therein the other of said first member and said portion of said second member alternatively.

10. A device according to claim 6 wherein there are a plurality of such load transfer devices between said concrete slabs with substantially all said first member embedded in said first slab with the vertical relation of the connection between said element and said first member and the connection between said element and said opposite wall of said second member being reversed in alternative devices.

11. A device according to claim 1 wherein there are a plurality of said suspension elements.

12. A device according to claim 11 wherein certain of said elements extend through opposite wall portions of said second member and are connected to opposite inside areas of said first member from other of said elements.

13. A device according to claim 12 wherein said members are rectangular in cross sections.

14. A device according to claim 12 wherein said elements are alternatively connected to one wall portion and extending through said one wall portion.

15. A device according to claim 14 wherein said second member is rectangular in cross section and certain of said elements are connected to one wall of the rectangular member and extend through openings in an opposite wall of said member and the remaining elements are connected to said opposite wall and extend through openings in said one wall.

16. A device according to claim 15 wherein said certain elements and said remaining elements are alternatively arranged and connected respectively to opposite inside portions of said first member.