June 24, 1958 J. N. HELTZEL 2,839,973

CONCRETE EXPANSION JOINTS

Filed Jan. 3, 1955 2 Sheets-Sheet 1

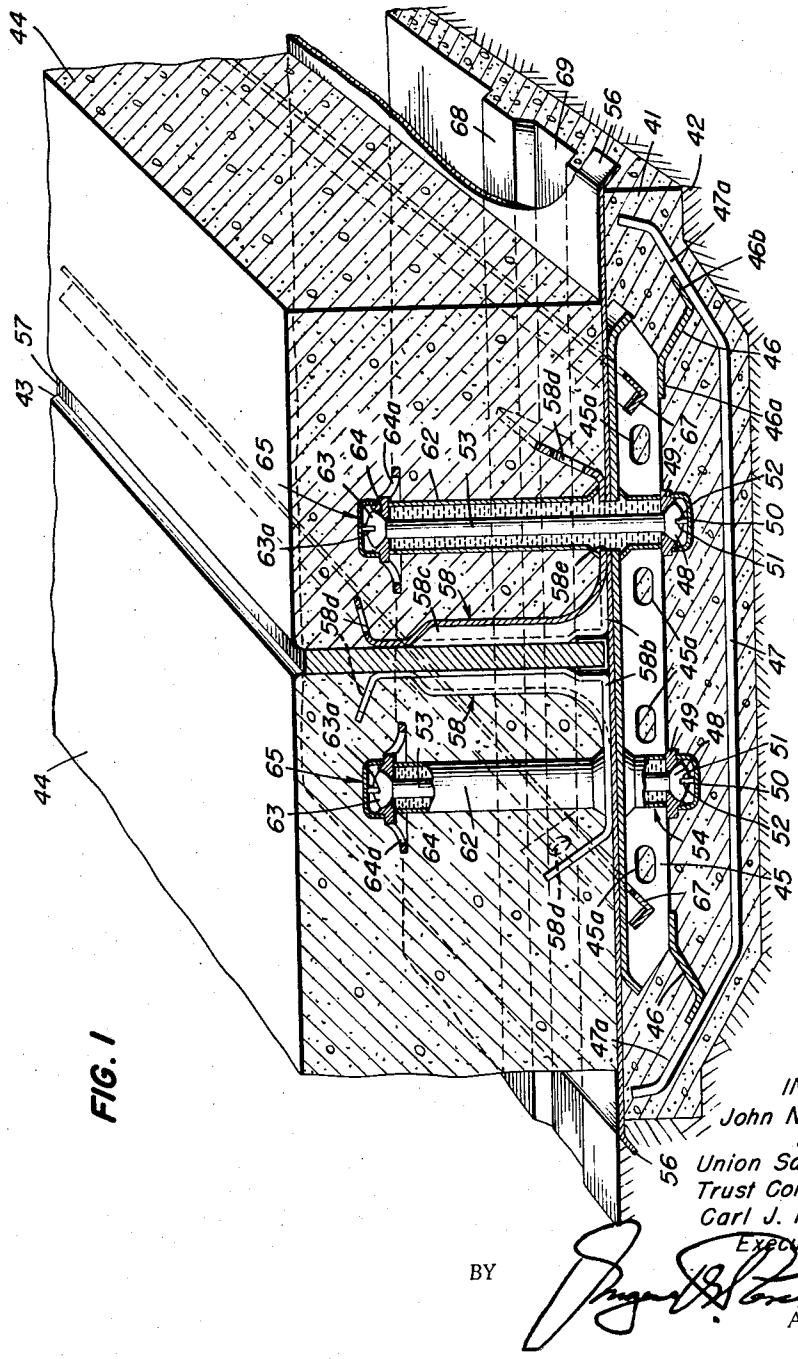


FIG. 1

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FIG. 4

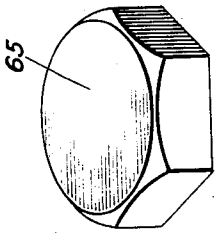


FIG. 5

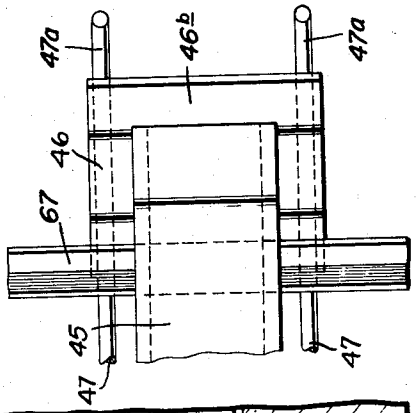


FIG. 2

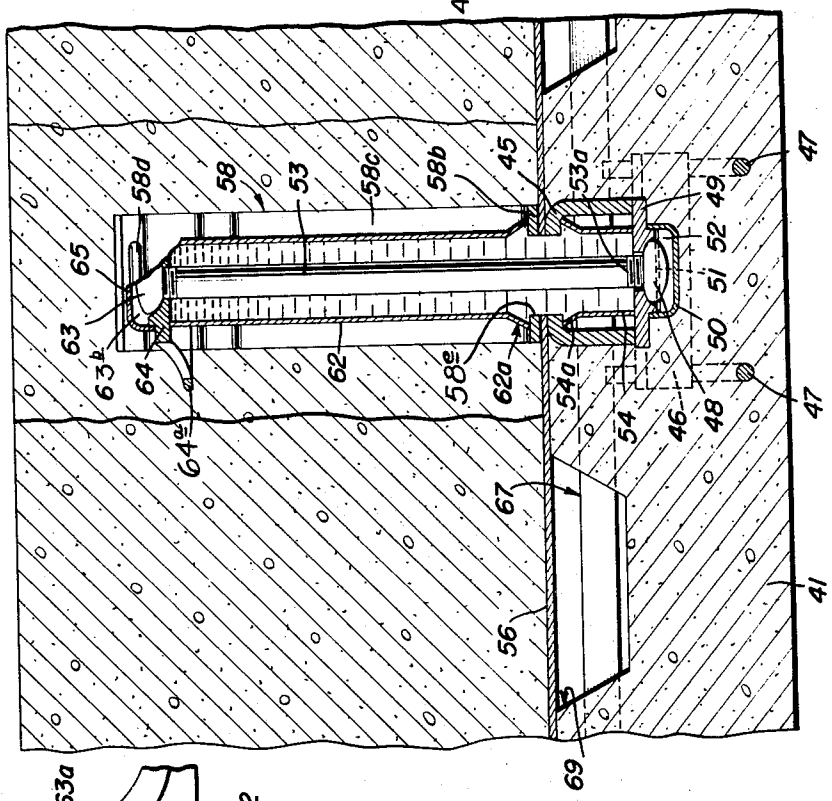
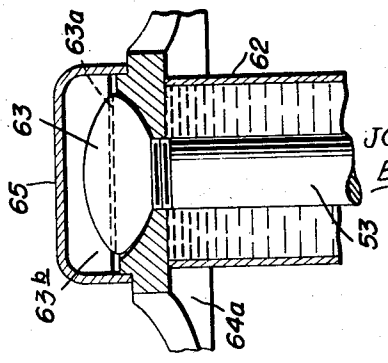


FIG. 3



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CONCRETE EXPANSION JOINTS

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Application January 3, 1955, Serial No. 479,529

7 Claims. (Cl. 94—18)

This present invention is a continuation in part of that disclosed in Patent No. 2,698,560, dated January 4, 1955 (application filed March 4, 1947), and relates to improvements in the so-called beamed expansion joint. According to this joint construction a sill or beam of suitable material, such as concrete, is embedded in the subgrade of a road or airport runway at a point predetermined by its location beneath a proposed expansion or contraction joint to be produced between a pair of concrete slabs. The same are to be poured later or are to be placed over the beam.

The principal object of the invention is to provide a construction of the type characterized and including tension means connecting the beam to the slabs and permitting the latter to expand or contract in any direction but preventing the slab ends from moving up and down.

Another object of the invention is to provide a construction as contemplated by the stated principal object, and further characterized by tension means stressed during the expansion of the slabs and by virtue of such stress contributing towards the relief of the tension developing in the slabs during the contraction.

With these and other objects in view which will become apparent as the invention is fully comprehended, the same resides in the novelty of construction, combination and arrangement of elements and method of constructing the combination of elements. Both the combination of elements and the method of constructing the combination will hereinafter be described in their specific details and are claimed in the subjoined claims.

The description should be read in connection with the accompanying drawings, forming part of the application and wherein:

Fig. 1 is a fragmentary perspective view of a novel slab and support-provided expansion joint wherein the slabs have an improved shiftable connection with a novel subgrade embedded supporting beam or sill, which latter is shown partly in perspective and partly in cross section;

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged sectional detail of one of the upper tension rod bearings and related parts;

Fig. 4 is a perspective view of an upper tension rod bearing cover; and

Fig. 5 is a fragmentary plan view of a portion of the skeletal beam frame.

Referring specifically to the drawings and having particular reference to Fig. 1, it is seen to disclose a sill or beam 41 submerged in the subgrade 42. Preferably, this beam extends completely across the roadway and below the joint space 43 between adjacent ends of the slabs 44. A beam extending completely across a multiple slab width roadway would undoubtedly, as a practical proposition, have to be poured on the job. However, a plurality of sills or beams laid end to end and possibly precast and hauled to the place, could replace the single beam.

Instead of relying on the structural rigidity of a concrete sill or beam 41 to carry a load, it has been reinforced by rigid steel members 45 of U-shaped cross-section embedded therein and extending transversely thereof or longitudinally of the roadway. The sides of members 45 have spaced holes 45*a* through which the concrete extends and which thus provide an anchorage in the beam 41. Although members 45 have have specified as U-shaped or channel form, other cross-sectional shapes can be used.

The rigid channel form members 45 are reinforced and supported at their ends by diagonally depending and somewhat Z-shaped spacer members 46. Said spacer members 46 have their upper foot portions 46*a* welded to the bottom edges of channel 45 while their lower foot portions 46*b* are welded to the adjacent upturned end portions 47*a* of the laterally spaced and subjacent reinforcing bars or members 47 which are disposed transversely of the joint 43.

Tension bars or members 53 connect the slabs 44, 44 and beam 41 at opposite sides of the joint 43 to admit of relative horizontal shifting of same and are supported by anchorage terminal members 48 and 63 as shown.

Anchorage terminal members 48 are each seated in beam-carried sockets 49 which are welded to the superposed lower edges of U-member 45 and covered by covers 50. Each of said terminal members 48 have in their lower portion a notch 51 receiving a rib 52 formed on the interior of the cover 50 and holding the terminal member 48 against rotation. In this connection it is to be understood that covers 50 are initially frictioned onto socket-provided collars and are subsequently held fast by the poured concrete. The covers 50 are water-tight and are filled with a supply of lubricant. The terminal members 48 are threaded at their upper ends projecting through the sockets 49 for engagement by threaded end parts of the related tension members 53.

The lower part of each tension member 53 is surrounded by a tube 54 bearing with its lower end against the upper side of the adjacent socket 49 and with its upper flared end against the upper or bight portion of the beam-reinforcing channel or U-member 45, which latter is oversizedly apertured for the free passage of the tension members 53.

The members of the disclosure so far described form part of the beam 41 structure and may be encased with either concrete or bituminous material. If the rigidity of member 45 is ample, the same may be encased in bituminous material for protection against rust.

The use of bituminous material as a rust-induced deterioration preventer, as stated for member 45, makes it possible in many instances to dispense with the spacing and reinforcing means 46 and 47. Such would be the case where means 46 and 47 were used in conjunction with 45 to supply strength to supplement that of 45 when partially rusted away. However, similar means could be used for supporting members 45 in position during the application of the bituminous material. The use of concrete in the formation of beam 41 will make it possible to use lighter members 45 than would be the case otherwise.

It may prove practical to position the beam 41 elements so far described on the subgrade, and to then pour the concrete and surface it so that the resulting beam has a top bearing portion flush with the subgrade. Care should be taken to prevent the infiltration of any concrete into a tubular member 54, since such concrete might interfere with the insertion and proper subsequent swinging operation of the tension member 53 upon expansion and contraction of slabs 44.

After the beam 41 has been placed in proper position, an asphalt or other cover strip 56 is placed over the

structure to promote relative freedom of movement of slabs 44 on beam 41.

Then the expansion or joint strip 57 and the supporting members 58 are mounted on the cover strip 56 so that the vertical portions of the former hold the joint strip 57 in a vertical position during the pouring of the slabs. The bottom portions 58*b* of members 58 function as slides or skids during the expansion or contraction of the slabs 44.

58*c* denotes lineally extending reinforcing ribs pressed into members 58 intermediate its ends to rigidify the same and enable me to use lighter gauge material than would otherwise be possible. The upper and lower angularly directed ends of members 58 are provided with holes 58*d* for anchoring purposes.

The slide or base portion 58*b* of each member 58 is provided with an opening 58*e* registering with an opening in the horizontal flange or web of member 45. Each tension member 53 is inserted through these openings in the members 45 and 58 and is surrounded by a tubular member 62 preventing the infiltration of foreign matter.

The upper end of each tension member 53 is formed by a knob-like terminal member 63 capable of universal movement in socket 64 resting on top of the tube 62 and covered by cap or cover 65. The terminal member 63 has on its upper side a notch 63*a* for the insertion of the flange of a wrench-like implement whereby the tension rod 53 may be turned and threaded into or out of the part 48. Or cap 65 can be of hex form and have a key flange 63*b* engaging in notch 63*a* so that the tension member 53 can be unscrewed from member 48 by simply applying a wrench to the cap 65. Also, the terminal member 63 can be threaded onto the upper end of the tension member 53 employing opposite threads to those which connect the lower end of 53 to 48. The insertion of the wrench when used, must, of course, be preceded by the removal of the cap 65 which, in its operative position, prevents the entry of foreign matter.

In order to properly space rigid members 45 prior to pouring of beam 41, spacers 67 extending longitudinally of the beams 41 are provided and secured to the former by welding or otherwise. Thus in Fig. 1 such members are seen to be V-shaped in cross-section and to extend through the sides of channel members 45 adjacent the bight portions thereof.

Drainage and friction are important factors in expansion joints. In order to reduce the friction on the top surface of the sill or beam 41 on which the slabs 44, 44 bear, and at the same time to provide for drainage, the top of the beam or sill 41 is provided with corrugations 68 spaced from one another by drain channels 69 sloping downward from the bottom of the expansion joint 43.

The asphalt cover 56 is positioned between the top surfaces of the corrugations 68 and the bottom surfaces of the slabs 44 and facilitates the shifting of the latter on the former. In addition, a lubricant may be applied to the asphalt cover 56.

Moisture, having infiltrated through the expansion joint or otherwise, will be diverted to the drain channels 69. This drainage also relieves the tension members 53 of excessive strains otherwise imposed on them by the freezing of the moisture.

The top surfaces of the corrugations 68 are level and lie flush, or in plane with, the subgrade of the roadway. The tension members 53 are anchored in the corrugations 68 and do not project through the drain channels 69.

It should be understood that the corrugated (68) base or beam 41 proposition with the drainage channels 69 may be used in connection with contraction joints, also called dummy-type joints.

As will be understood from the foregoing read in connection with the drawings, the members 45, 46, 47 constitute a functionally integral skeletal frame for the beam or sill 41. Also, the member 67 which is supported in frame member 45 reinforces the beam or sill in a lengthwise direction by being anchored in the raised load-supporting portion 68 beyond drainage channel 69. The bearing-providing cross members 49 serve also to strengthen the U-member 45 of the beam frame while the bight portion of U-member 45 provides the beam 41 with a hard load-supporting top portion.

Since the tension bars 53 can be unscrewed from the lower terminal members 48 the beam 41 and adjoining subgrade 42 can be rolled with the beam in place preparatory to the pouring of the slabs 44.

What is claimed is:

1. In a slab-formed roadway or runway construction, a subgrade embedded load-transfer member extending across an expansion joint from beneath adjacent slabs and comprising functionally integral top and bottom bar members and intermediate connecting members, said connecting members located at least adjacent opposite ends of the bar members, said top bar member having a vertical hole at opposite sides of the joint space between slabs, upwardly extending tension bars diametrically smaller than said holes and extending therethrough for anchoring connection in and to the related slabs, a bearing head secured to the lower end of each tension bar, head-retaining bearing means at the lower face of said top bar member, sleeve-like members extending upwardly and downwardly, respectively, from the top and bottom of said top bar member spacedly surrounding said tension bars, the upper ones of said sleeves removably supported by said top bar member, an upper bearing head on each of said tension rods, and supporting bearings carried by the top ends of the upper sleeves and receiving the respective upper bearing heads, said supporting bearings being embedded in the related slabs.

2. In a slab-formed roadway or runway construction, a subgrade embedded load-transfer member extending across an expansion joint from beneath adjacent slabs and comprising functionally integral top and bottom bar members, and intermediate connecting members, said connecting members located at least adjacent opposite ends of the bar members, said top bar member having a vertical hole at opposite sides of the joint space between slabs, upwardly extending tension bars diametrically smaller than said holes and extending therethrough for anchoring connection in and to the slabs, a bearing head secured to the lower end of each tension bar, head-retaining bearing means at the lower face of said top bar member, sleeve-like members extending upwardly and downwardly, respectively, from the top and bottom of said top bar member and spacedly surrounding said tension bars, the upper ones of said sleeves removably supported by said top bar member, an upper bearing head on each of said tension rods, and supporting bearings carried by the top ends of the upper sleeves and receiving the respective upper bearing heads, anchoring means carried by said last-mentioned sleeve-carried bearings to be embedded in the slab when poured, and a removable upper bearing head-enclosing cap carried by said last-mentioned sleeve-carried bearings.

3. The combination set forth in claim 1 and said lower bearing heads detachably secured to said tension bars whereby the latter and the upper sleeves can be removed when the subgrade with the beam embedded therein is to be rolled prior to the pouring of the slabs.

4. The combination set forth in claim 2, and said top bar member being of inverted channel form and the lower head-retaining bearing means including a plate secured to and connecting the sides of said channel form bar.

5. In a roadway or runway construction wherein a pair of slabs provide a joint space therebetween, a subgrade-embedded beam extending lengthwise of the joint space and slidably supporting said slabs, a series of laterally spaced slab load-supporting ridges provided on the top surface of said beam and extending across the joint space, whereby to reduce the area of frictional engagement be-

tween the beam and slabs and to thus facilitate expansion and contraction-produced sliding movement of the slabs at opposite sides of the joint space, the spaces between said ridges constituting drainage channels for carrying away moisture from the joint space, and horizontal movement permitting tie means connecting said slabs to said beam, there being a yield-permitting relief area surrounding each of said tie means.

6. In a roadway or runway construction comprising adjacent slabs providing a joint space therebetween, a subgrade-embedded beam of substantial width extending lengthwise of said joint space and supporting the slabs at opposite sides of the latter, laterally spaced slab-supporting ridges rising from the top surface of said beam and extending crosswise of the joint space, said ridges providing drainage channels therebetween and reducing the area of frictional engagement between the slabs and beams so as to promote expansion and contraction-produced sliding movement of the slabs, an inverted channel form reinforcing member embedded in certain of said ridges and extending across the joint space with its bight wall at approximately the top surface of the related ridge, means supporting said channel members during the pouring of the concrete beam, and comprising longitudinally extending beam-reinforcing connector bars carried by and extending through the side walls of said channel-form reinforcing members at opposite sides of the joint space, horizontal movement-permitting tie means connecting said slabs to said beam, there being a yield-permitting relief area surrounding each of said tie means, and said tie means being secured to one of said beam-reinforcing members.

7. In a slab-formed roadway construction providing a joint space between adjacent slabs, a reinforced concrete subgrade-embedded beam supporting said slabs at opposie sides of the joint space for expansion and contraction-induced sliding movement, said beam extending lengthwise of the joint space, a beam-carried reinforcing member of inverted channel form and extending across said joint space, a second beam-reinforcing member spaced below said channel form member and also extending across said joint space, spacing members carried by said second reinforcing member and connected to the depending side flanges of the channel form member for supporting the latter adjacent the top surface of the beam to be formed during the pouring of the concrete and its subsequent setting stage, horizontal movement-permitting tie means connecting each of said slabs to the channel-form beam-reinforcing member beneath the bight wall of the latter, there being a yield-permitting relief area surrounding each of said tie means, and a separable connection between each tie means and the beam-carried channel-form member and in part provided by each of the latter, whereby the said tie means can be detached from the beam-carried channel-form member after the beam is embedded in the subgrade so as to permit rolling or packing of the latter preparatory to the pouring of the concrete slabs, said tie means to be re-attached to said channel-form member when the slabs are to be poured.

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