Dec. 8, 1936. L. J. MENSCH 2,063,552

EXPANSION AND CONTRACTION JOINT FOR CONCRETE STRUCTURES

Filed Nov. 9, 1934

Fig. 1

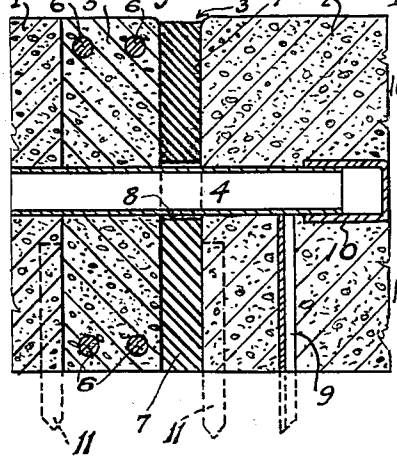


Fig. 2

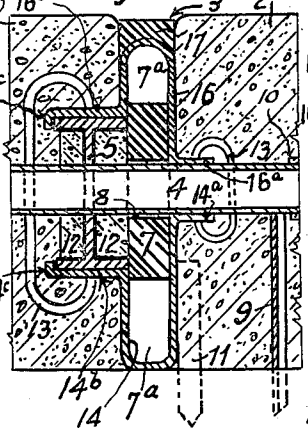


Fig. 3

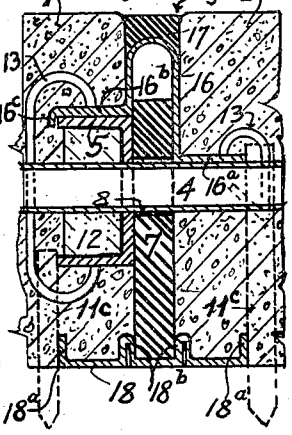


Fig. 4

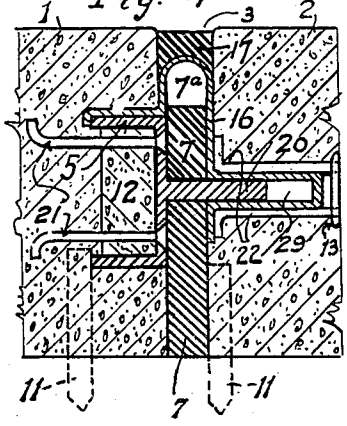


Fig. 5

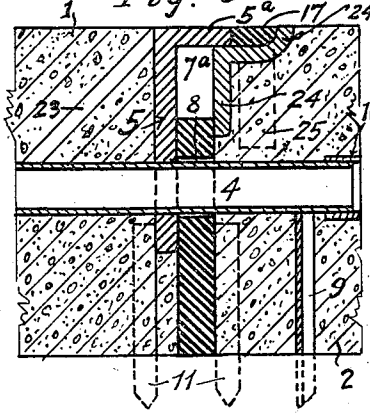


Fig. 6.

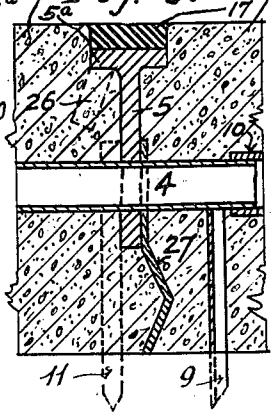


Fig. 7

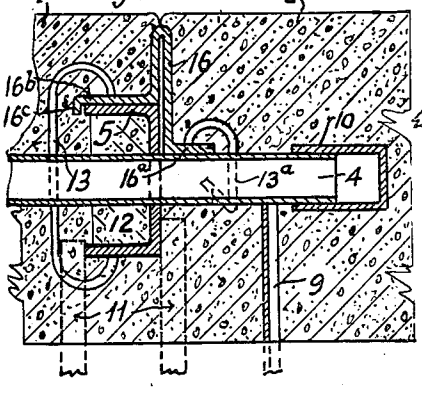
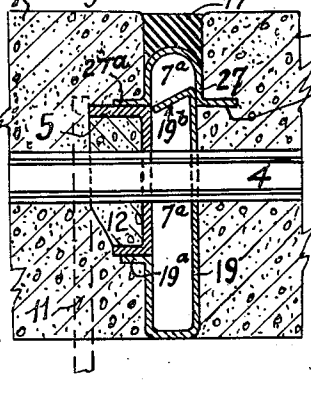


Fig. 8



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UNITED STATES PATENT OFFICE

2,063,552

EXPANSION AND CONTRACTION JOINT FOR CONCRETE STRUCTURES

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Application November 9, 1934, Serial No. 752,272

11 Claims. (Cl. 94—18)

This invention relates to improvements in expansion and contraction joints for concrete structures and is particularly adapted, though not necessarily limited in its use, for concrete roads, bridges, buildings and the like, and one of the objects of the invention is to provide for insertion between proximate edges of adjacent sections of the concrete structure, a joint embodying a definite, expansible and compressible medium of any desired or suitable width, varying approximately from one-half to two inches in width. The medium will in its operation permit movement of the sections of concrete structure, due to temperature changes and their moisture contents, in directions at substantially right angles to the joint, without damaging the ends of the concrete sections, and at the same time will always fill the entire width of the expansion space, irrespective of the degree of contraction of the concrete and the width of such space.

A further object of the invention is to provide in a joint of this character improved means for permitting relative movements of the proximate ends of adjacent sections, and at the same time provide an improved joint capable of transferring a least one-half of the load which is exerted at the end of one road section from traffic or otherwise, to the adjacent road section across the joint.

A further object is to provide in a joint of this character improved means for preventing sand, dirt, water or foreign matter from entering the space between ends of adjacent sections, which foreign matter would be compressed into a highly resisting body, eventually filling the space between the road sections, and which would defeat the object and purpose of the expansion joint. Furthermore, water entering the joint will weaken many clay soils which form the foundation of the road, and in cold climates ice would be formed in the joint, resulting in a cracking of the road.

The separating medium may be provided in any suitable form, preferably as a sheet of premolded plastic material, such as specially prepared asphalt, cork, sponge rubber, compressible fiber of any desired thickness and size, or in the form of collapsible boxes of thin wood, sheet metal and like materials.

In order to prevent relative vertical movements of the proximate ends of adjacent slab or concrete sections, there are preferably employed anchor pins or dowels of any desired configuration or construction, but preferably circular in cross section, and may be either tubular or solid, of any desired diameter and length, any number of which may be employed and spaced apart for any suitable distance. It has been found that round dowels of approximately three-fourths of an inch in diameter and approximately two to four feet long and spaced about twelve inches apart, will produce very good results.

One end of each dowel for approximately one-half the length thereof is preferably oiled, painted or greased to permit free movements of the concrete or slab section, and if desired, there may be provided adjacent the lubricated end of each of the dowels or anchors a socket which is embedded in the adjacent concrete section or slab, and into which sockets the respective ends of the dowels move when the section expands and contracts.

It is obvious that a free and easy sliding of the adjacent sections or slabs in the desired direction, due to temperature changes and the moisture content variation, will occur only when the dowels or anchors are parallel with the movement of the slab or section, therefore it is necessary that all of the dowels or anchors should be maintained parallel both in vertical and horizontal directions substantially at right angles to the joint.

It has heretofore been attempted to produce this result by supporting the dowels or anchors in the center by the plastic or expansion element and by means of light metal supports, driven into the ground near each of the dowel ends, but it has been found that the dowels become displaced or bent by the workmen stepping upon them, or by large masses of concrete falling upon them from the concrete construction chutes, or by being hit with the shovels, tampers, etc., resulting in the formation of steps at the joints and caused by the bending of the dowels or anchors when the slabs or concrete sections expand and contract, with the further result that the dowels as ordinarily installed damage the ends of the slabs or sections and are themselves deformed and lose their ability to transfer loads. Furthermore, it is manifest that a joint composed of many loose members, each of which must be accurately set and carefully held in place, is not only undesirable but is expensive to install and maintain.

It is one of the objects of the present invention to overcome all of these difficulties and objections and to provide an improved joint of this character in which there is employed at

least one stiff or substantially rigid structural member to which the dowels or anchors are permanently and securely fastened, by welding or in any other suitable manner, in correct relative positions and direction and fabricated at the plant or factory.

Such a structure is preferably of a width substantially equal to the width of the road bed, and if only one-half is constructed at a time, is of a width substantially equal to the distance of the side frames of the slabs or concrete sections from approximately the center of the road, and is provided with special supports at the ends, so that the section, with the dowels and eventually the entire joint assembled, may be picked up from the side of the road and placed into the proper position with respect to the slab or section forms.

When the rigid structure member is once in place and securely held, all of the dowels and anchors will be maintained in their proper positions for easy movements of the slabs and sections.

To the attainment of these ends and the accomplishment of other new and useful objects as will appear, the invention consists in the features of novelty in substantially the construction, combination and arrangement of the several parts hereinafter more fully described and claimed and shown in the accompanying drawing illustrating this invention, and in which

Figure 1 is a vertical, cross-sectional view through a joint of this character constructed in accordance with the principles of this invention.

Figures 2, 3, 4, 5, 6, 7 and 8, are views similar to Figure 1, of modified forms of the invention.

In the drawing the same reference numerals designate corresponding parts in the various forms of the invention.

Referring to the form of the invention shown in Figure 1, the numerals 1 and 2 designate adjacent concrete sections or slabs which are spaced from each other a suitable distance to provide an expansion space 3 of any desired width.

The numeral 4 designates a dowel or anchor member, any number of which may be provided and which may also be of any desired construction in cross section. These dowels may be constructed of any suitable material and may be either solid or tubular and are securely fastened, intermediate their ends to a substantially rigid structural element 5.

In this form of the invention this structural element is in the form of a reinforced structure provided with reinforcing bars 6 and is of a height that the upper end thereof will terminate substantially flush with the upper faces of the sections 1 and 2.

This structural element 5 is preferably placed in position so that one of its lateral faces will abut the proximate face of one of the concrete sections, and within the space formed between the other face of the element 5 and the proximate face of the adjacent concrete section, there is provided a resilient element 7 constructed of any suitable material such as elastic or the like and may be provided in the form of strips, normally of a width to fill the space between the structure 5 and the section 2. The upper end of the strip 7 is substantially flush with the upper faces of the sections 1 and 2, and the strip 7 is provided with openings 8 through which the dowels or anchors 4 freely pass.

The openings 8 may be of any desired configuration to compensate the shape of the cross sectional configuration of the dowels or anchors. Preferably one of the openings 8 is provided for each of the dowels or anchors.

The numeral 9 designates a suitable support which may be employed, if desired and may be arranged in any position, within the concrete section 2 to serve as a means for constituting an additional support for the dowels or anchors 4.

Within either one or both of the sections 1 and 2, there may be provided a socket 10 formed in any desired or suitable manner and of any suitable material, and is adapted to receive the end of the dowel or anchor 4, and which end, in the normal position of the parts, terminates a considerable distance short of the bottom of the socket so as to permit the dowel 4 to move lengthwise, due to contraction and expansion of the parts.

The ends of the dowels or anchors which enter the socket 10 may be lubricated in any suitable manner, such as by means of a coating of any suitable lubricating material so as to permit of a free and easy movement of the dowels within the sockets.

If desired, stakes or members 11 may be provided in proximity to certain of the faces of the strip 7 and the structural element 5 so as to hold the joint assembly in place against violent shocks during construction.

In the form of the invention shown in Figure 2, the structural element 5 is shown in the form of an I-beam of metal, and if desired this element may be stiffened by concrete or other cementing material 12 filling the spaces on opposite sides of the web or body portion of the element, to be fabricated at the factory. The dowels 4 pass through the web or body portion of the element 5 and are secured thereto by welding or in any other desired or suitable manner, so that they will project for a considerable distance beyond the lateral faces of the element 5 and into the sections 1 and 2.

In this form of the invention there is provided the space 3 between the sections 1 and 2 substantially U shaped flexible plate members 14—16 which are arranged respectively above and below the dowels 4 and may be of any desired height, and these members may be held in position by means of suitable clips or anchor devices 13 clamping flanges 14^a and 16^a, which partially encircle the dowels 4, against the dowels, and which flanges are arranged on one side of the members 14 and 16.

Flanges 14^b and 16^b are also provided on the opposite side of the respective members 14 and 16 to engage and rest respectively against the upper and lower faces of the element 5, the extremities of the respective flanges being bent as at 14^c and 16^c over the edges of the element 5, so as to hold the elements 14 and 16 against bodily lateral displacement with respect to the element 5.

Similar clips 13 may be provided, if desired, for clamping the flanges 14^b and 16^b against the bottom and top of the element 5.

Within the space formed by the walls of the members 14 and 16 is arranged the elastic or resilient element 7, through which the dowels 4 pass and by means of which dowels the element 7 is supported. This element 7 is of a height to terminate considerably short of the top and bottom of the chamber formed by the elements 14 and 16 to provide air spaces 7^a above and below the element 7.

The element 14 terminates substantially flush with the bottom of the sections 1 and 2, while the element 16 terminates for a substantial distance short of the upper faces of the sections 1 and 2, and the space above the element 16 and between the sections 1 and 2 may be closed by material 17 such as asphalt or the like poured or otherwise placed in position. The provision of this space and the filling material 17 will maintain the elements 14 and 16 against the pressure of the concrete sections 1 and 2.

In the form of the invention shown in Figure 3, the stiff structural element 5 is in the form of a channel iron stiffened by means of concrete 12, and the dowels or anchors 4 are secured to the element 5 by welding or in any other suitable manner, the dowels extending through the element 5 and projecting a substantial distance on both sides thereof. The pre-molded strip of plastic or resilient material 7 between the sections 1 and 2 extends to substantially the bottom of the space or foundation and to a point for a substantial distance above the element 5, but terminates short of the top of the space 3 between the sections 1 and 2. The flexible element 16 of a substantially inverted U shaped form is disposed within the space 3 and is provided with a flange 16^a which projects laterally from one face of the element 16, rests upon and partially encompasses a portion of the dowel or anchor 4, a clip 13 being provided for clamping the flange to the dowel. A laterally projecting flange 16^b is also provided on the element 16 and projects from the outside face of the element in contact with the top of the element 5, a depending lip or flange 16^c being provided at the edge of the flange 16^b to engage over the edge of the element 5. A clamp 13 serves to secure the flange 16^b to the element 5. The element 16 terminates short of the top surface of the sections 1 and 2, and the space above the element 16 may be filled with poured asphalt or a pre-molded plastic strip 17.

It has been found that when the sections 1 and 2 contract, there is formed a space between the element 7 and the ends of the slabs or sections 1 and 2, and where insufficient drainage and poor soil conditions are encountered, the passing traffic exerts a pumping action on the water and soil mixture at the joints and water mixed with soil may be driven into the vacant space. After several years enough material may possibly accumulate in the space to greatly diminish the compressible space originally occupied by the element 7.

In order to avoid such an occurrence and to overcome such a difficulty, there may be provided at the bottom of the sections 1 and 2, a flexible strip or member 18, which will prevent the entrance of water and dirt, and besides hold the strip or element 7 in place.

This strip 18 is preferably bent up at its sides as at 18^a where there is danger that the water and dirt may enter from the sides of the road and the central portion of the strip may be bent up as at 18^b to form a channel or seat to receive the lower edge of the strip or element 7.

When strip 18 is not necessary or desired, a plurality of clips of the same shape may be placed at the bottom of the element 7, and in order to hold the strip or the clips in position, stakes 11^c may be provided, which engage the outer faces of the upturned portions 18^a.

In the form of the invention shown in Figure 4, the stiff structural member 5 is in the shape of a special rolled section, preferably of channel formation, with a rib 20 integral therewith projecting laterally from one face thereof. This rib 20 may be employed in lieu of the dowels or anchors disclosed in the other forms of the invention. The element 5 may be secured in position, if desired, by means of suitable anchors 21 which may be fastened or secured to the element in any suitable manner, such as by welding, riveting, or the web of the element 5 may be sheared to provide the necessary projecting anchorage, and are provided for the purpose of securely holding the element 5 in the concrete section 1.

The expansive element in this form of the invention consists preferably of two pre-molded strips 7 and a flexible inverted U shaped member 16 which is shaped around the rib 20 to be in tight contact therewith and to provide a recess or socket 29 into which the rib 20 projects. The end of the rib 20 terminates, in the normal position of the parts, short of the bottom of the recess 21 so as to permit the rib 20 to move within the recess or socket 21 during contraction and expansion of the parts.

Reinforcing rods 22 may be provided and are fastened together by means of suitable clips 13 and by means of the rods 22 and clips 13, the portion of the element 16 which is shaped around the rib 20 will be strengthened and will hold the same in contact with the rib 20, thereby strengthening the portion of the end of the slab which might be weakened by the formation of the recess or socket 21 therein.

In the form of the invention shown in Figure 5, the rigid structural element 5 is provided with a horizontal flange 7^a at the top thereof, the upper surface of which flange is substantially flush with the upper surface of the concrete section 1. The dowels or anchors 4 are secured to the element 5 in any suitable manner, such as by means of welding or the like in the shop, and if desired braces 23 may be provided and may be welded to the dowels or anchors 4 and to the upper part of the vertical leg of the element 5, and thereby serve to tie the structural member 5 to the section 1. The expansible element 7 is preferably in the form of a plastic strip through which the dowels pass by means of openings 8 in the strip, and the strip 7 terminates short of the lower face of the flange 5^a to provide an air cushion 7^a.

An angle member 24 may be provided which is fastened to the section 2 in any suitable manner, such as by means of anchors 25, sheared from the angle member 24. The member 24 is provided with a flange 24^a which is preferably of a somewhat cup shaped formation, the upper edge of the flange terminating substantially flush with the top face of the section 2, and a filler 17 of poured asphalt or any other suitable material is provided in the space formed by the cup shaped portion of the element 24.

In the form of the invention shown in Figure 6, there is disclosed a contraction joint in which the stiff structural member 5 is in the form of a T beam with a short horizontal flange 5^a. The dowels 4 are welded or otherwise secured to the element 5, at the factory, and the flange 5^a on the side adjacent the slab or concrete section 1 is provided with anchors 26 sheared therefrom and embedded into the section 1 to hold the member 5 securely to the section.

The slab or section 2 in this form of the in-

vention, is free to contract once the lower part of the slab is cracked, due to temperature and moisture influences. Where a definitely located crack is desired, in the lower portion of the slab, a sheet metal separator 27 may be inserted and may be of any desired configuration. A portion of the separator 27 is so arranged that the dowel or anchor 4 will pass therethrough and project therebeyond so as to enter the socket or recess 10 in the section 2.

Thus it will be seen that by reason of the element 27 a definite crack may be assured in the structure.

In Figure 7 there is also disclosed a structure of contraction joint which prevents water from the top surface from passing through the joint opening to the sub-grade.

In this form of the invention the rigid element 5 is of channel formation, being filled with concrete or cement 12 and through which element 5 the dowels or anchors pass.

A flexible folded sheet 16 is provided between the sections 1 and 2. This sheet 16 is folded intermediate its ends back upon itself, so that the folded portions will be in close proximity. One end of the folded portion is shaped to form a flange 16^b which rests against the top of the element 5, and the extremity of the flange 16^b is bent as at 16^c over the edge of the element 5. A clip 13 may be provided for clamping the flange 16^b against the element 5.

The other end of the folded portion of the sheet 16 is shaped to form a laterally projecting flange 16^a which rests against and partially encompasses the dowel 4. A spring clip 13^a is provided which engages the flange 16^a and the lower portion of the dowel or anchor 4, the end of the lower portion of the clip 13^a being shaped as at 13^b to partially encompass the lower part of the dowel 4.

In the form of the invention shown in Figure 8, the rigid element 5 is substantially in the form of a channel through which the dowel or anchor 4 passes, and to which the dowel is secured by welding or otherwise, and the element 5 is filled with reinforcing cement or concrete 12.

In this form of the invention the anchor 4 is preferably of an I beam construction.

A flexible member 19 of substantially U shaped configuration is provided with a flange 19^a projecting laterally from one side thereof and engaging the lower face of the element 5. The opposite wall of the element 19 projects upwardly for a substantial distance above the dowel 4 and through which the dowel freely passes. The upper extremity of this wall projects preferably a substantial distance above the upper face of the element 5 and the edge of the wall is bent inwardly and inclines downwardly towards the proximate face of the element 5. An inverted U shaped member 27 is provided in the upper portion of the space 3 between the sections 1 and 2 and is provided at its base with laterally projecting flanges 27^a—27^b. The flange 27^a rests upon the upper surface of the element 5, while the flange 27^b projects into the section 2 of the concrete structure. This element 27 terminates short of the upper faces of the sections 1 and 2, and the space thus formed above the element 27 may be filled by poured concrete or asphalt or a preformed resilient strip 17.

In this form of the invention, as well as in the forms of the invention shown in Figures 2, 3, 4 and 5, there will be formed air spaces between the proximate ends of adjacent slab or concrete sections, so as not to interfere with the contraction and expansion of the joint.

In all of the forms of the invention, it will be manifest that there is provided a form of joint in which the dowel or anchor pins are rigidly and firmly held in position, being secured firmly to the rigid or stiff structural member, thereby insuring a proper positioning and a maintaining of the alinement of the dowels or anchor pins at all times, preventing them from becoming displaced, bent or otherwise injured, which would interfere with the free sliding movements of the slab or concrete sections with respect to each other during contraction and expansion of the parts.

The resilient element as well as the air cushions or spaces between the sections will permit of such movement of the parts and the air spaces also serve as a means for permitting the flexible and resilient elements to be compressed.

It will also be manifest that with the present invention the dowels or anchors being held firmly or rigidly in position will not damage the ends of the concrete slabs or sections and will not themselves become deformed or lose their ability to transfer the loads from one slab or concrete section across the joint to the other section. Furthermore, all crushing of the concrete around the dowels or anchors will be avoided and as the dowels or anchors are well lubricated they will slide readily in the sockets or recesses which receive the ends of the dowels or anchors.

Furthermore, there is provided a structure which will prevent the entrance of water and foreign matter into the joints, so that there will be no pumping action or surging of water in the joints, the presence of which would tend to destroy the joints, and the entrance of foreign matter into the joints would tend to build up a formation which would interfere with the expansion action of the sections and contraction or compression of the resilient elements between the sections, and which form a portion of the expansion joint.

It will also be manifest that a greater portion of the joint, such as the stiff or rigid structural member with the dowels or anchor pins rigidly secured thereto, may be fabricated in the factory, and such a structure may be readily handled and readily placed in position for the building up of the road structure.

While the preferred forms of the invention have been herein shown and described, it is to be understood that various changes may be made in the details of construction and in the combination and arrangement of the several parts, within the scope of the claims, without departing from the spirit of this invention.

What is claimed as new is:

1. In a joint of the character described for concrete structures, a stiff structural girder, and dowels or anchor elements rigidly and permanently secured thereto and projecting laterally therefrom and adapted to project into and move within an adjacent concrete section, during contraction and expansion of said section.

2. In a joint of the character described for concrete structures, a stiff structural girder, dowels or anchor elements rigidly and permanently secured thereto and projecting laterally therefrom and adapted to project into and move within an adjacent concrete section, during contraction and expansion of said section, and laterally compressible means co-operating with said girder and disposed in a space between the proximate faces of adjacent concrete sections.

3. In a joint of the character described for concrete structures, a stiff structural girder, dowels or anchor elements rigidly and permanently secured thereto and projecting laterally therefrom and adapted to project into and move within an adjacent concrete section, during contraction and expansion of said section, and laterally compressible means co-operating with said girder, disposed within and closing a space between the proximate faces of adjacent concrete sections.

4. In a joint of the character described for concrete structures, a stiff structural girder, anchoring dowels rigidly and permanently secured thereto and projecting laterally therefrom and adapted to project into and move within an adjacent concrete section during contraction and expansion, said sections being spaced, and an inverted flexible substantially U shaped element within and adjacent the top of the space between said sections.

5. In a joint of the character described for concrete structures, a stiff structural girder, anchoring dowels rigidly and permanently secured thereto and projecting laterally therefrom and adapted to project into and move within an adjacent concrete section during contraction and expansion, said sections being spaced, and a flexible substantially U shaped element within and adjacent the bottom of the space between said sections.

6. In a joint of the character described for concrete structures, a stiff structural girder, dowel pins or anchor elements rigidly and permanently secured thereto and projecting laterally therefrom to project across a space between concrete sections and extending into and movable within an adjacent section during contraction and expansion of the said section, and a resilient element within and of a width to extend across said space and through which element said dowels freely pass.

7. In a joint of the character described for concrete structures, a stiff structural girder, dowel pins or anchor elements rigidly and permanently secured thereto and projecting laterally therefrom to project across a space between concrete sections and extending into and movable within an adjacent section during contraction and expansion of the said section, a resilient element within and of a width to extend across said space and through which element said dowels freely pass, and an inverted substantially U shaped flexible element within said space above said resilient element for closing said space to the entrance of foreign particles.

8. In a joint of the character described for concrete structures, a stiff structural girder, dowel pins or anchor elements rigidly and permanently secured thereto and projecting laterally therefrom to project across a space between concrete sections and extending into and movable within an adjacent section during contraction and expansion of the said section, a resilient element within and of a width to extend across said space and through which element said dowels freely pass, and a flexible element at the bottom and sides of said sections and below said resilient element to prevent water and foreign particles entering said space.

9. In a joint of the character described, a stiff structural member comprising a girder element and dowels rigidly and permanently secured to and projecting laterally from the girder for a substantial distance across a space between adjacent concrete sections and into and movable within one of said sections, said dowels serving as a support and guide for one of the sections, a resilient element within the space, and a flexible element adjacent the top of and closing said space, a portion of the last said element being fastened to the said girder on one side of the joint, and another portion of the last said element being secured to the dowels on the other side of the joint.

10. In a joint of the character described, a stiff structural member comprising a girder element and dowels rigidly and permanently secured to and projecting laterally from the girder for a substantial distance across a space between adjacent concrete sections and into and movable within one of said sections, said dowels serving as a support and guide for one of the sections, a resilient element within the space, a flexible element adjacent the top of and closing said space, a portion of the last said element being fastened to the said girder on one side of the joint and another portion of the last said element being secured to the dowels on the other side of the joint, and a comparatively thin sheet of material disposed at the lower part of the joint to form a definite surface of separation of adjacent concrete sections.

11. In a joint of the character described for concrete structures, a stiff structural girder, anchoring dowels rigidly and permanently secured thereto and projecting laterally therefrom and adapted to project into and move within an adjacent concrete section during contraction and expansion, said sections being spaced, a flexible element extending across the top of the space between said sections to form a closure therefor, and a flexible element forming a closure for the bottom of said space.

LEOPOLD J. MENSCH.

DISCLAIMER

2,063,552.—*Leopold J. Mensch*, Kenilworth, Ill. EXPANSION AND CONTRACTION JOINT FOR CONCRETE STRUCTURES. Patent dated December 8, 1936. Disclaimer filed June 18, 1938, by the patentee; the assignee, *Unit Dowel Joint Company*, consenting.

Hereby enters this disclaimer to that part of the disclosure of said patent which comprises figure numbered 4 and that part of the description describing the subject-matter of Fig. 4 of said patent, and particularly line 75, column 1, page 3, and lines 1 to 35, inclusive, column 2, page 3, of said patent.

Further enters this disclaimer with respect to all of the claims of said patent, as follows, to-wit: The patentee disclaims any interpretation or construction of the claims of said patent which would cover the subject-matter of Fig. 4 disclaimed herein or any interpretation or construction or scope of said claims other than that which covers the embodiments of Figs. 1 to 3 and 5 to 8 of said patent.

[*Official Gazette July 12, 1938.*]