Sept. 18, 1934. R. C. BOSTWICK 1,974,327

EXPANSION JOINT FOR ROADS, FLOORS, AND LIKE STRUCTURES

Filed Dec. 3, 1931

Fig. 1.

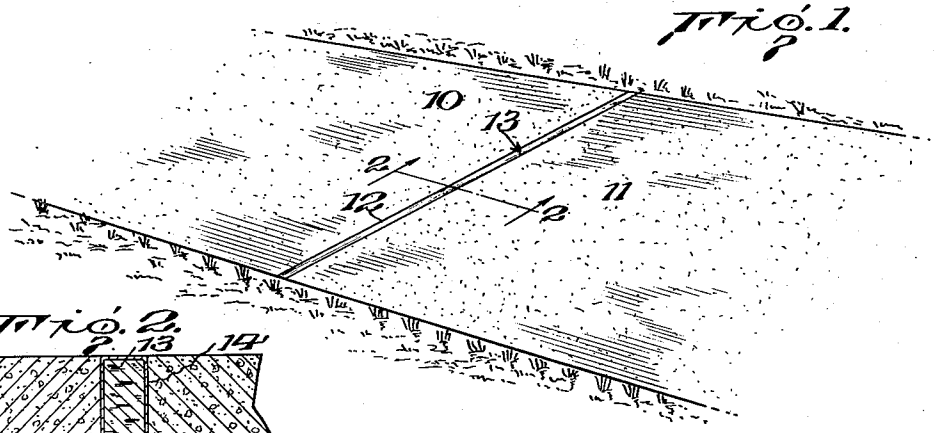


Fig. 2.

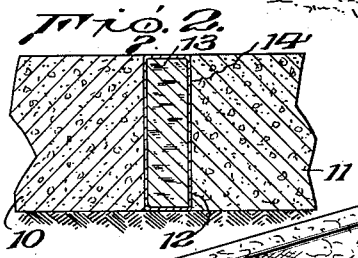


Fig. 3.

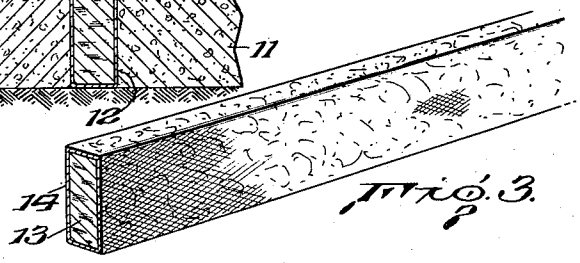
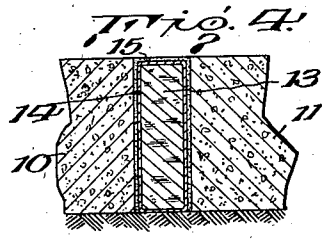


Fig. 4.



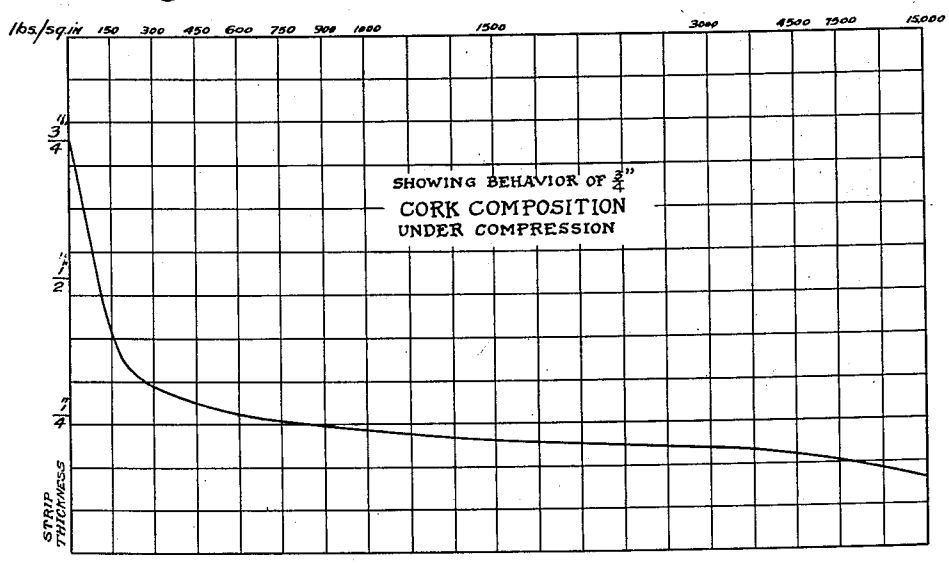


Fig. 5.

Inventor

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His Attorneys

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UNITED STATES PATENT OFFICE

1,974,327

EXPANSION JOINT FOR ROADS, FLOORS, AND LIKE STRUCTURES

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Application December 3, 1931, Serial No. 578,816

2 Claims. (Cl. 94—18)

My invention relates to improvements in expansion joints for roads, floors and like structures and has to do, more particularly, with an improved expansion joint construction which is particularly useful in the construction of concrete roads, and the like, which are subjected to considerable strains due to expansion and contraction with variations in temperature.

In the construction of concrete roads, and like structures, it has been the practice to form the structure in spaced sections, and to position in the intervening space between sections a filler strip, or a deposit of filler material, which may yield under the strain imposed thereon by the expansion of the material forming the sections. So far as I am aware, such expansion joints have commonly been constructed with the use of a plastic filler material, a portion of which, under the strain of expansion, is displaced from the space between the sections. For instance, in constructing concrete roadways, the space between adjacent sections has sometimes been filled with asphalt or a paper-like material soaked with asphalt. This filler material is not substantially compressible but is plastic, with the result that, when expansion forces the end walls of the sections toward each other, and diminishes the space between them, a portion of this plastic material is displaced and flows out above the normal road surface, thus creating a raised zone at the expansion joint, which is objectionable. Frequently, it has been found necessary to go over roads of this character and remove some of the plastic filler material which has been forced out at the joint. When contraction occurs with colder weather, and the space between adjacent sections is increased, the material which has been forced out of the joint does not return, as there is no force acting to restore it to its original position, with the result that, under contraction, a partial gap may be left between adjacent sections of the roadway. The result of the use of such expansion joints is to impair the even level surface of the roadway. The raised surfaces at the expansion joints, formed by the flow of the plastic material under expansion pressure, are objectionable and cause unpleasant vibration as automobile traffic rolls over the successive raised joints. Furthermore, some filler materials employed, while theoretically plastic under comparatively great pressure at ordinary temperatures, when in use as a part of a roadway become so intermixed with dirt and dust as to lose their plasticity, with the result that, since very great pressure is required to cause a flow of the filler material, the sections of the concrete roadway tend to rise, heave up or crack under pressure less than that which will cause a flow of the filler material. It is the principal object of my invention, therefore, to provide an improved expansion joint for roads, floors and the like, which, while yielding to absorb the stresses of expansion, will not create inequalities in the road surface.

A further object of my invention is to provide an expansion joint which will yield under relatively low pressure, so as to prevent the rising, heaving up or cracking of the roadway under expansion pressure.

It is a further object of my invention to provide an expansion joint for roads, floors and the like, in which the space between adjoining sections of the structure is maintained filled with a compressible and non-plastic filler, so that the expansion of such sections compresses the filler and does not displace portions thereof above the normal surface of the structure to create inequalities therein. Thus, it is an object of my invention to provide an improved expansion joint for roads, floors and the like, which is resilient and will yield under expansion pressure, which will return to normal and completely fill when the expansion pressure is relieved and contraction takes place, and which will not, under any circumstances, impair the normal level or surface of the structure.

It is a further object of my invention to provide an expansion joint for roads, floors and the like, using, as a filler material for the space between adjacent sections, a strip of cork composition which has been treated with a permanent plasticizer, rendering the cork particles softer and more flexible, so that the strip will compress under comparatively light pressure, but retains its resiliency and returns to normal dimensions when the expansion pressure has been removed and contraction takes place.

It is a further object of my invention to provide an expansion joint, embodying such a filler strip, which has been coated with a water-proofing composition to prevent the entry of water to the strip and the consequent deterioration or destruction thereof.

It is a further object of my invention to provide an expansion joint embodying such a filler strip, in which the material has been treated with an agent for preventing moulding, so that the material will not deteriorate and lose its compressible qualities under exposure to the weather.

Further objects, and objects relating to details and economies of construction and operation, will definitely appear from the detailed description to follow. In one instance, I accomplish the objects of my invention by the devices and means set forth in the following specification. My invention is clearly defined and pointed out in the appended claims.

A structure, constituting a preferred embodiment of my invention, is illustrated in the accom-

panying drawing, forming a part of this specification, in which:

Figure 1 is a fragmentary perspective view of an expansion joint in a concrete road, which joint is constructed in accordance with my invention;

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

Fig. 3 is a fragmentary, perspective view of a filler strip for use in the expansion joint of my invention, one end of the strip being shown in section;

Fig. 4 is a sectional view corresponding to Fig. 2, but illustrating an expansion joint embodying a modified form of my invention; and

Fig. 5 is a graphic diagram showing the compressibility under varying pressures of a strip of cork composition of the sort that I consider satisfactory for use as the filler strip in an expansion joint embodying my invention.

In the drawing, the same reference numerals refer to the same parts throughout the several views and the sectional view is taken looking in the direction of the arrows at the ends of the section line.

In general, my invention consists in constructing an expansion joint for roads, floors and like surfaces subject to expansion and contraction, by filling the space left between adjacent sections of such structure with a strip of filler material which is compressible, resilient and non-plastic, so that, under expansion pressure, the material yields or compresses without causing any flow at all from the space between the sections and, when the expansion pressure is relieved and contraction takes place, the material resumes its normal volume, filling the space left between the sections. I contemplate the use of a filler material which not only compressible, but compressible under comparatively light pressure, so that compression of the filler material takes place under expansion pressure less than that which will cause the sections of the structure to rise, heave up or crack. I contemplate the use, as a filler material for my expansion joint, of a strip of cork composition made of particles of cork agglomerated by a suitable binder and treated with an enduring or lasting plasticizing agent to soften the cork particles and render them more flexible, so that the strip of composition cork thus formed is compressible under comparatively light pressure. The filler strip may, if desired, be made up of a plurality of sections arranged horizontally or vertically. I propose, further, to coat the exterior of such a cork composition filler strip with a waterproofing agent, such as asphalt, in order to prevent water from entering the filler strip and destroying or deteriorating the filler material by its action. I contemplate, further, impregnating the filler strip with an agent to prevent moulding, such as creosote, and thus further protecting the filler strip against destruction or deterioration due to exposure to the weather. If desired, after the filler strip has been positioned in the space between adjacent sections of the structure, a sealing coat of waterproofing material may be applied above the upper edge of the filler strip and between the strip and the adjacent sections of the structure, so that the strip is, in effect, embodied in the roadway and all joints are closed.

In Fig. 1, I have illustrated, in perspective, a portion of a concrete roadway including an expansion joint embodying my invention. The sections 10 and 11 of the roadway are spaced from each other, leaving a space 12, in which the filler strip 13 is located. The filler strip 13 is a strip of cork composition composed of particles of cork agglomerated by a suitable binder. The binder must be such that the resulting cork composition is compressible but not plastic or displaceable. This strip may be formed on the extruding machines in use in the art of making cork composition. I am aware that it has been proposed to use a composition composed of cork particles agglomerated by the use of asphalt as a binder. Such a composition is not satisfactory, however, since it is displaceable under pressure, due to the plasticity of the binder. A suitable formula, which I have found useful for the manufacture of a strip of cork composition of a nature satisfactory for use in this expansion joint, consists of 300 pounds of cork particles agglomerated by a thermal setting binder formed by the use of 26 pounds of phenol, 16¼ pounds of paraformaldehyde, and 12¼ pounds of a 14% solution of sodium hydroxide. This binder sets when heat is applied, for instance, in the extrusion machines, and the resulting composition is compressible but not plastic or displaceable under pressure. As an enduring plasticizing agent, I use, in this mixture, 60 pounds of diethylene glycol, which serves the function of softening the cork particles and rendering them more flexible, so that the resulting cork composition has greater compression under relatively light loads than it would without the use of this softening agent. To this mixture, there is added 20 pounds of any one of the numerous lubricants used in the cork composition art. The above formula produces a strip of cork composition which I have found to give excellent results as a filler strip for expansion joints. A satisfactory cork composition can be made from this formula by following the procedure hereinafter set forth; 26 parts by weight of phenol, 16¼ parts by weight of paraformaldehyde, and 60 parts by weight of diethylene glycol are mixed in a copper-jacketed kettle provided with suitable stirring apparatus and heated to about 210° F. When that temperature has been reached, 12¼ parts by weight of a 14% solution of sodium hydroxide is added as a catalyst. The heating of the mixture is continued, at a temperature of about 210° F., until a sample of the liquid taken off will set in ten minutes in boiling water. Then the reaction is interrupted and the intermediate product, which is a heavy liquid, is immediately mixed with cold ground cork in the proportion of about 160 pounds of the liquid and 300 pounds of cork particles. These proportions may be varied however. The comminuted cork, which has been thus treated, is then taken to the extrusion machines, for instance, such as are shown in United States Letters Patent, No. 1,453,617, issued May 1, 1923. In such machines, the comminuted cork thus treated is confined in a mold at a temperature of about 300° F., which completes the reaction and causes the comminuted cork to be agglomerated by the binder into a cohesive mass in the shape desired.

Instead of the binder mentioned in the above formula, any one of a number of other thermal setting binding agents may be used for agglomerating the cork particles, such as glue, casein or blood albumen. If glue, casein or blood albumen be used as the binder, however, the material will not prove as satisfactory as one in which the cork particles are agglomerated by the binder previously described, as it will not be as resistant to moulding and deterioration. As an enduring plasticizing agent, other materials may be used

in place of diethylene glycol, such as glycerine or ethylene glycol.

In view of the fact that these expansion joints are exposed to the weather, and the entry of water into the filler strip may result in freezing and moulding, thus impairing its resilience and compressibility, I contemplate coating the filler strip with a water-proofing composition, such as asphalt, so as to form an exterior skin 14 to shed water and prevent it gaining access to the interior of the filler strip. This water-proofing composition may be applied to the filler strip either before or after it is inserted in place in the space between adjacent sections of the structure. However, when a phenolic condensation product, such as I have heretofore described, is used as the binder for the cork particles, a thin film of the binder is created in the extrusion machines upon the exterior of the strip which serves as an integral water-proofing coating, thus rendering unnecessary the application of a separate water-proofing coating of asphalt or the like. I propose further, as a means for preventing the impairment of the desirable qualities of the filler strip, due to exposure to weather, to impregnate the cork composition in its manufacture with an agent, such as creosote, which will prevent moulding of the filler strip, or other germicidal agents may be used if desired, to prevent attack by insects as well as mould.

I contemplate, further, after the cork composition filler strips have been inserted between sections of a concrete structure, applying between the ends of the walls of such structure sections and the filler strip, and over and around the filler strip, a sealing coat of water-proofing material which, when it sets, will form a practically continuous structure in which these compressible, non-plastic, cork composition filler strips are located to act as expansion joints. This added sealing coat is indicated at 15 in Fig. 4.

In Fig. 5, I have shown a graph which illustrates diagrammatically the compression characteristics of cork composition strips, of the sort which I deem desirable for use as a filler strip in my improved expansion joint. Referring to this graph, which shows the action of a strip normally ¾ inch thick, the horizontal ordinates indicate pounds per square inch, while the vertical ordinates indicate the thickness of the strip in fractions of an inch. From this graph it will be seen that the strip ¾ inch thick is compressed to ⅝ inch thickness under about 75 pounds per square inch pressure. It is compressed to about ½ inch thickness under approximately 100 pounds per square inch pressure. When subjected to a pressure of approximately 175 pounds the cork composition strip of this invention will be reduced to ⅜ of an inch or one-half its original thickness. Under 300 pounds per square inch pressure it has been compressed so that it is only a little more than ¼ inch in thickness and, from that point on, under increasing loads, up to 15,000 pounds per square inch, the subsequent decrease in thickness is relatively slight. This shows graphically that the composition is of such a nature as to be compressible under relatively light loads or pressures, so that this filler material will yield readily under a light expansion pressure and will yield before sufficient pressure has been generated by expansion to cause the sections of the structure to rise, heave up or crack.

The filler strip of cork composition, which I propose to use as the filler material of my expansion joint, is not plastic and hence none of this material will flow or be displaced from the space between adjacent sections by the expansion pressure. Consequently, there is no displacement of the filler material to cause the appearance of raised surfaces at the expansion joints and the normal evenness of the surface is maintained under expansion and contraction. Furthermore, the filler material is resilient and when the expansion pressure is relivered, or contraction takes place, the material resumes its normal volume so that the space between adjacent sections is filled thereby. This material can be economically manufactured and the expansion joint using it can be constructed at low cost, and hence, I have provided an expansion joint which possesses very desirable advantages over those heretofore in use, eliminates the defects of prior expansion joints for use in concrete roads, floors and the like, and still may be manufactured and installed at low cost.

I am aware that the particular embodiment of my invention herein disclosed may be changed considerably without departing from the spirit of my invention and, therefore, I claim my invention broadly, as indicated by the appended claims.

What I claim is:

1. An expansion joint for sectional roads and floors comprising a filler strip interposed between juxtaposed sections of such structure, said strip consisting of a body composed essentially of particles of comminuted cork agglomerated by a suitable binder, said binder having as one of its ingredients a softening agent for the cork capable of increasing and preserving the compressibility and resiliency of the cork, the softening agent being present in such quantity that said strip will compress without protruding beyond the surface of the structure to fully compensate for expansion of the structure sections at pressures less than those sufficient to cause buckling or breaking of said sections and will expand upon contraction of said sections to completely fill the space between said sections whereby the normal even level relationship of the sections is maintained irrespective of atmospheric conditions.

2. An expansion joint for sectional roads and floors comprising a filler strip interposed between contiguous sections of such structure, said strip being composed of a body consisting essentially of particles of comminuted cork agglomerated by a binder insoluble in water, said binder being present in such proportion as to form a film-like covering on said particles and cement them together, and said binder having as one ingredient a softening agent for the cork, said agent being present in sufficient quantity to appreciably reduce the compressibility and preserve the resiliency of the body of cork, the compressibility of said strip being such that pressures less than those sufficient to break or buckle the structure sections will compress said strip to fully compensate for expansion of said sections without protrusion of said strip above the surface of the structure, and the resiliency of said strip being such that it will expand upon contraction of the structure sections and completely compensate for such contraction, whereby the normal even level relationship of said adjacent sections is maintained irrespective of temperature conditions.

RICHARD C. BOSTWICK.