

Nov. 25, 1947.

A. C. FISCHER

2,431,385

POROUS BODY EXPANSION JOINT

Filed March 1, 1945

2 Sheets-Sheet 1

Fig. 1

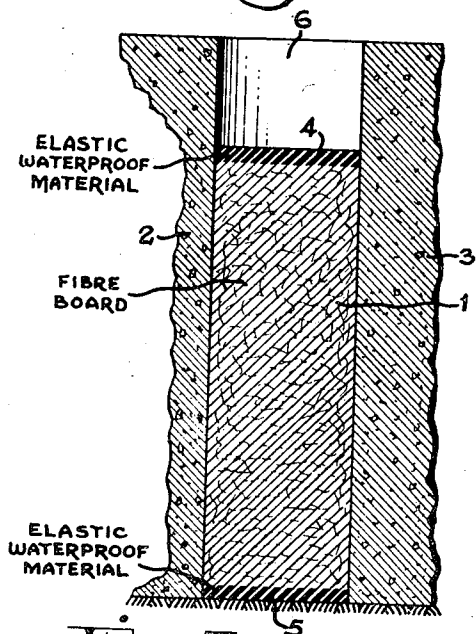


Fig. 2

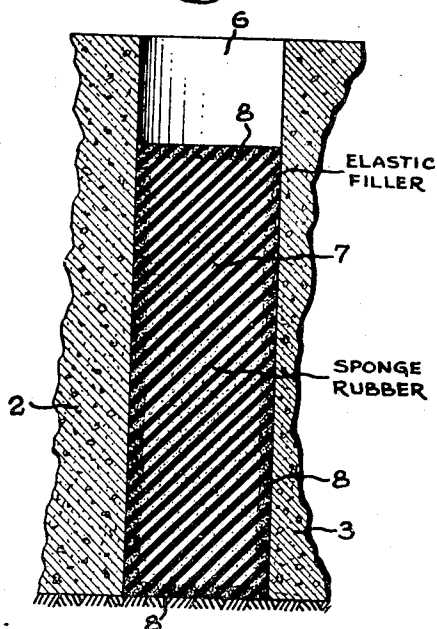


Fig. 3

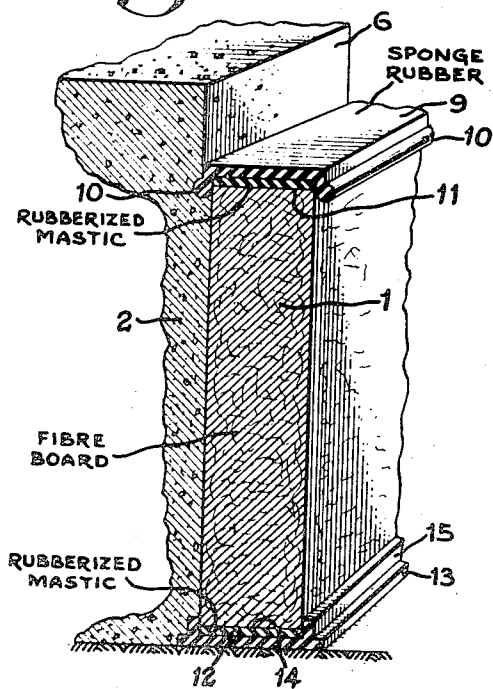
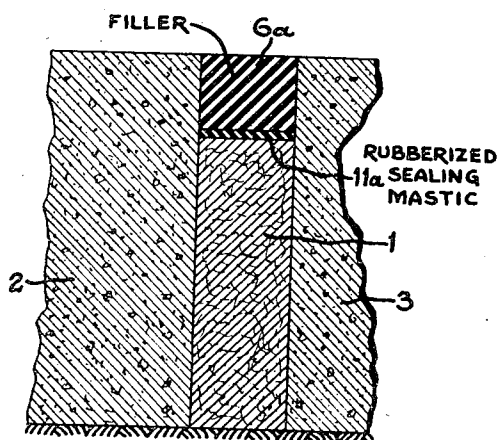


Fig. 4



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Fig. 5

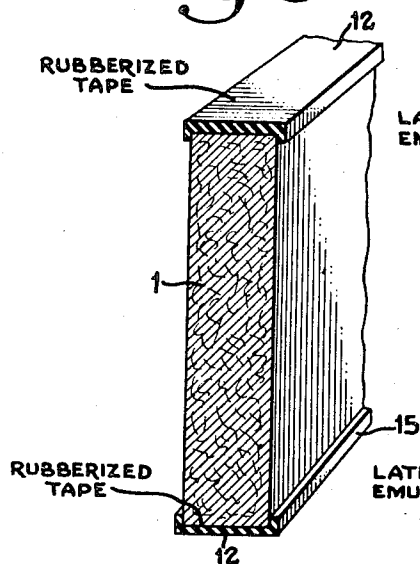


Fig. 6

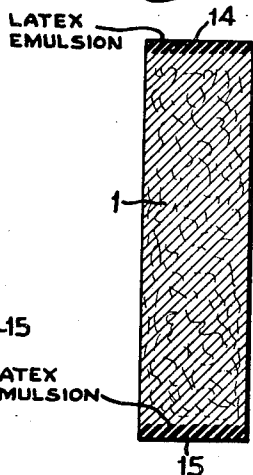


Fig. 7

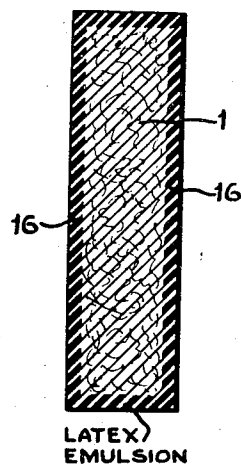


Fig. 8

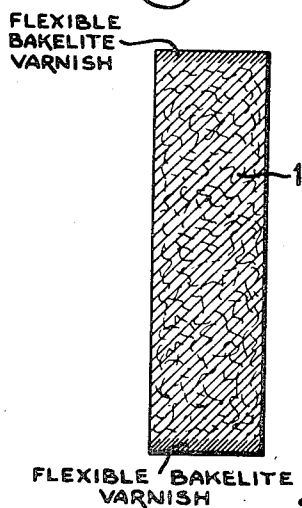


Fig. 9

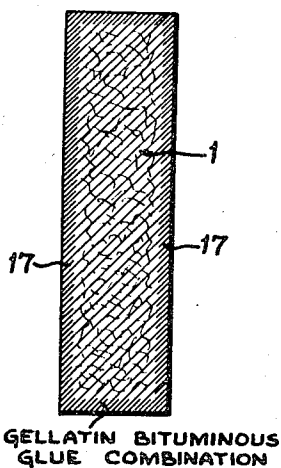


Fig. 10

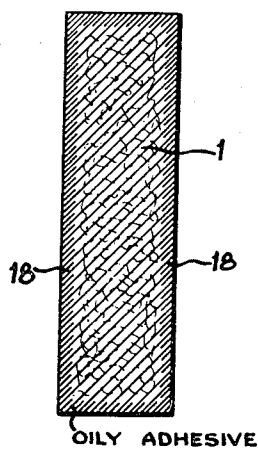
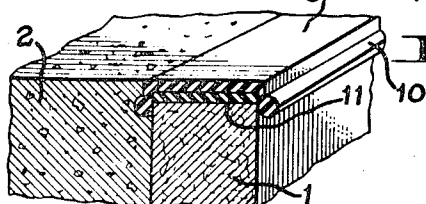


Fig. 11



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POROUS BODY EXPANSION JOINT

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Application March 1, 1945, Serial No. 580,323

7 Claims. (Cl. 94-18)

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This invention constitutes a structural improvement upon the flat slab-like strips of material commonly used for the purpose (among other purposes) of defining the lines of subdivision in the pouring of cement pavements, and which, being made of deformable material, remain permanently in position in the finished pavement to serve as weather-proof fillers, conventionally called "expansion joints" in the spaces that must be left between the sections of pavement to permit thermal expansion of the sections while in use.

There are a number of different types of expansion joints made to serve the purpose of yieldingly filling the spaces referred to and varying, structurally, from material formed in situ by pouring hot asphaltic or equivalent material into the spaces, to slab-like strips extruded or otherwise preformed at the place of production. Most of these types, while readily yielding to the cement pavement sections in the direction of thermal expansion, will not react satisfactorily in the sense of keeping the spaces filled and weather-proof as the spaces are enlarged by contraction of the pavement sections under falling temperatures.

Attempts made to render expansion joints properly reactive to contraction of pavement sections and the resultant enlargement of the spaces between them, have been either along the line of complicating the joint structure in a manner to set up counterflow of ductile asphalt during contraction, from spaces into which the asphalt escaped during expansion of the sections or else incorporating a fibrous or other resilient filler in the joint structure or producing the joint structure from a fabricated body of fiber impregnated with asphalt. Both of these remedies were failures and did not render the joint body reactive because the fibrous matter was saturated beyond the possibility of resiliency.

The present invention solves the problem by constructing the preformed expansion joint slab or strip with not only sufficient mass integrity to permit it to be manipulated as a dividing wall in the manner conventional in the art of pouring sectional cement pavements, but with the novel condition of having a degree of inherent mass resiliency that permits it to yield by compression as distinguished from flowing under the pressure of the thermally expanding pavement sections; and by such compression, storing in the resilient expansion joint body, energy that causes said body to return by expansion to approximately its original dimension, as distinguished from back

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flow, in order to fill the enlarging space between sections when the pavement sections contract under lowering temperatures, these phenomena being achieved, according to the invention, by incorporating in the expansion joint a slab or strip formed of material having a highly porous or cellular structure and inherent body resiliency; for instance, the qualities possessed by a body of sponge rubber (preferably with its cells ruptured), or by an inherently resilient body of fibers, felted or otherwise fabricated into self retaining form with mass integrity and inherent body resiliency; or some material equivalent to these; said bodies being rendered proof against seepage of water on any or all of its faces that are liable to encounter moisture in service; their moisture proofing elements being applied as a shallow surface infiltrate entering into and anchoring itself to and capable of sealing the outer pores of the body, but leaving unfilled and unobstructed the pores of the main mass of body material, of which the joint is made; and leaving the individual elements that define the pores of the main portion of the body without interadhesion and free to exercise their individual resiliency; and the said moisture-proofing element having when set, an inherent elasticity that prevents its rupture or impairment of its pore-sealing and moisture-proofing capacity when it partakes of the alternate compression and distension of the porous body in service.

In the accompanying drawings:

Fig. 1 is a fragmentary view in vertical transverse section, of opposed ends of two pavement sections and the porous fiber-board body of an interposed expansion joint; said fiber-board body being proofed against water seepage at top and bottom and the tread surface filler used above the joint being omitted;

Fig. 2 is a view similar to Fig. 1 in which the main body portion of the expansion joint is made of sponge rubber and the seepage proofing element is applied as an elastic surface filler completely around said body;

Fig. 3 is a fragmentary view in perspective, showing a body portion of an expansion joint similar to that of Fig. 1, with seepage proofing elements of special materials at top and bottom, fashioned at the sides to cause them to be embedded in the paving sections;

Fig. 4 is a view similar to Fig. 1, on a somewhat smaller scale, showing the tread-surface filler element in position;

Fig. 5 is a view partly in vertical transverse section and partly in perspective showing the ex-

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pansion joint body with still another embodiment of the seepage proofing element;

Figs. 6 and 8 are vertical transverse sections of fiber-board expansion joint bodies, rendered seepage-proof by shallow surface fillers of special materials at the ends thereof;

Figs. 7, 9 and 10, are vertical transverse sections of fiber-board expansion joint bodies rendered seepage proof by shallow surface fillers of special materials on all four surfaces of the body; and

Fig. 11 is a fragmentary view in perspective of one paving section and the adjacent fiber board body of the expansion joint having a seepage proofing cap similar to that of Fig. 3, but located to also serve as the expansion joint tread surface flush with the wheel surface of the pavement.

Referring to the drawings, 1 represents highly cellular or porous and inherently resilient bodies of fiber-board or like material, (of which there are several different makes upon the market), usually made for heat insulating purposes but here used to constitute the principal body masses of expansion joints.

Bodies 1 are installed between opposed ends 2, 3 of adjacent paving sections, in conventional manner, and having sufficient resiliency to not only enable them to yield and assume reduced transverse dimension and increased density under pressure of the ends 2, 3, when the pavement sections expand under rising temperatures, but to store up sufficient energy in so doing, to cause the bodies to expand toward their original transverse dimensions and continue to fill the enlarging space between the sections when the sections contract under falling temperatures.

In Fig. 1, the top and bottom edges of body 1 have their adjacent cells filled with an elastic compressible material 4, 5, water-proof at least to the extent that it will cause the porous body to resist seepage of water when its outer cells are filled with said material. By shallow impregnation of pores or cells of body 1 near its outer surfaces, the waterproofing material is anchored to the cellular body; and when set its elasticity enables it to partake of the alternate compression and distention that occur in the resilient body under expansion and contraction of the paving sections, without impairment of its water-proofing relation to the body. Numeral 6 in Fig. 1 indicates a space left for introduction of a filling (6a, Fig. 4) such as asphalt or the like, conventionally introduced by pouring in molten state for providing tread surface on the expansion joint flush with the wheel surface of the pavement.

In Fig. 2, the cellular or porous body 7 is sponge rubber, and its shallow impregnation that moisture-proofs it is an elastic filler 8 preferably applied to all four faces of the body in substantially the same relation as described in connection with the fillers 4 and 5 of Fig. 1.

In Fig. 3 the porous or cellular body 1 of fabricated fiber has a crowning strip 9 of rubber, preferably sponge rubber, fashioned with longitudinal beads 10 at its sides, which become embedded in the poured pavement sections 2, 3 so that the rubber strip cannot be drawn away from its place by disturbances of traffic, whether exerted through the medium of the filler to be poured into space 6 (Fig. 3), or exerted upon the crowning strip direct, when, as shown in Fig. 11, this rubber crowning strip is flush with the wheel surface of the pavement. Beneath the rubber crowning strip in both Fig. 3 and Fig. 11 there is a rubberized mastic water-proofing member 11, prepared so as to

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retain its elasticity and expansibility, said member 11 being applied to the edge of the cellular body 1 by shallow impregnation, or filling of outer cells and consequent anchorage as described in connection with Fig. 1. As shown in Fig. 3, when the expansion joint is set upon damp subsoil, the rubberized mastic water-proofing element 14 and laterally beaded rubber apron 12, 13, substantial duplicates of elements 9, 10 and 11, are preferably used at the bottom of the joint. Rubber apron 12, 13 may include a facing flange 15.

The waterproofing member 11 is preferably of a rubberized bituminous composition having a high degree of adhesive tenacity, plasticity and distendability or stretch, with recuperative capabilities, which properties remain effective even at sub-freezing temperatures ranging to 0° F. The adhesive powers of this material are such that it retains an effective bond with different materials such as concrete, asphaltic expansion joint bodies, either pre-formed or poured, capping strips of sponge rubber or of plastic bodies, so that any joint of which the same constitutes a part is effective in excluding the entry of foreign matter therein. The mode of preparing this rubberized bituminous composition and the ingredients thereof are fully disclosed in copending applications, Serial No. 471,503, filed January 6, 1943, and Serial No. 575,935, filed February 2, 1945. In the latter application a preferred embodiment of the composition is specified as formed of the following ingredients:

	Per cent
Kempol #54 (polymerized oil) ---	32.6 (26 to 35)
Asphalt B-----	38.0 (35 to 45)
Residual or flux oil-----	21.6 (16 to 25)
Clay-----	4.0 (3 to 5)
Asbestos-----	1.1 (0.5 to 1.5)
Exfoliated Vermiculite-----	2.7 (1.5 to 3.5)

Kempol #54 is a polymerized linseed oil, and is representative of any of the various polymerized oils which are commonly used as rubber substitutes.

The residual or flux oil is that from which the heavy asphalts are blown. It is characterized by the following properties:

Ductility at 77° F., 5 cm. per min.
Penetration at 32° F., 200 gms. 60 sec.

The material is too soft to take a penetration at 77° F. with a standard needle, and is too soft to take a melting point reading with ring and ball.

Asphalt B has the following properties:

Melting point (A. S. T. M. ring and ball)-----°F--	175-190
Ductility (A. S. T. M. 77° F., 5 cm. per min.)-----cm--	4 to 8
Penetration:	
77° F., 100 gms. 5 secs. A. S. T. M.	cm-- 0.12-0.20
32° F., 200 gms. 60 secs. A. S. T. M.	cm-- 0.22-0.18

When the crowning strip 9, shown at a depressed portion of the expansion joint in Fig. 3 and flush with the pavement in Fig. 11, is made of the rubberized bituminous mixtures described in the preceding paragraph either integral with or separate from the water-proofing member 11, the beadings 10 enhance the adhesive effects with the concrete to assure a complete and effective seal despite extensive movement of the pavement sections.

In Fig. 4 the strip of rubberized sealing mastic

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11a, disposed above the core 1, and below the filler 6a, is effective in adhering to the faces of the pavement sections 2 and 3 when the same is of the character described in the preceding paragraphs. If desired, the filler 6a may be the rubberized bituminous mixture above, which may be poured into the joint in a flowing state.

In Figs. 5 to 10, inclusive, the basic ideas of Figs. 1 to 4 are substantially repeated though with varied detail. Fig. 5 substitutes upper pre-formed flanged rubberized capping apron 9 and lower apron 12, 13 as the upper and lower water-proofing elements. When this material is used it should be prepared with a surplus of sluggishly fluent rubberized cement that will enable it to partake of compression and distension of the expansion joint.

The rubberized tapes 12 and 13 may be formed of the special compositions described above to obtain a highly distendable and adhesive sealing layer.

Fig. 6 substitutes for the elastic water-proofing material 4 and 5 at top and bottom of Fig. 1, top and bottom impregnations of latex emulsion. Fig. 7 applies the same latex emulsion as impregnations 16 on all four sides of the cellular body. Latex emulsion may, with advantage, be subjected to vulcanization, especially when not protected by sealing compounds. It is preferably forced by pressure to flow into marginal pores of or impregnate the desired distance into the porous or cellular body.

Fig. 8, in a construction otherwise similar to Fig. 1, uses flexible Bakelite varnish as the top and bottom water-proofing impregnation.

Figs. 9 and 10 both show water-proofing impregnation on all four faces of this porous or cellular body; Fig. 9 using a gelatin-bituminous glue combination 17; and Fig. 10 an oily adhesive 18.

Generally from $\frac{1}{16}$ " to $\frac{1}{8}$ " will be found a sufficient depth of impregnation. Impregnation may be superinduced, in any instance, by either pressure over the fluid being applied, or by suction at the face of the porous body opposite that being impregnated.

Materials used herein, such as asphaltic material; rubberized tape, rubberized cement; latex emulsion, with or without heat treatment or vulcanization; asphaltic gelatinized mixture; asphaltic glue mixture; flexible Bakelite varnish; toughened sponge rubber capping; ruptured cell sponge rubber; are all terms well known in the art, identifying materials purchasable in the open market.

It is to be understood that the formulae of construction and types of joint mentioned in this specification, are only a few of the many in which the identifying structural and operative principles of the invention may be employed; and therefore, I do not wish to be limited to the particular forms shown, since they are selected for purposes of illustration rather than limitation.

This application is a continuation-in-part of my application Serial No. 330,770, filed April 20, 1940, Patent No. 2,370,647, March 6, 1945.

I claim:

1. An expansion joint between two pavement sections comprising a layer of material bridging the gap between and adhesively bonded to said pavement sections, formed of a rubberized bituminous material, containing residual oil, comprising about 26 to 35% rubbery material, 35 to 40% asphalt, 16 to 25% residual oil, and 5 to 10% solid filling material, and characterized by a high

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degree of adhesive tenacity, distendability and recuperative power, which properties are retained at sub-freezing temperatures for maintaining the layer in adhesive bonded relation with the sections.

2. An expansion joint between two pavement sections comprising a compressible body of composition material, a layer of material adjacent to said body bridging the gap between and adhesively bonded to said pavement sections, said body being formed of a rubberized bituminous material, containing residual oil, comprising about 26 to 35% rubbery material, 35 to 40% asphalt, 16 to 25% residual oil, and 5 to 10% solid filling material, and characterized by a high degree of adhesive tenacity, distendability and recuperative power, which properties are retained at sub-freezing temperatures for maintaining the layer in adhesive bonded relation with the sections.

3. An expansion joint between two pavement sections comprising a compressible body of composition material, a layer of material above and below said body bridging the gap between and adhesively bonded to said pavement sections, said layers formed of a rubberized bituminous material, containing residual oil, comprising about 26 to 35% rubbery material, 35 to 40% asphalt, 16 to 25% residual oil, and 5 to 10% solid filling material, and characterized by a high degree of adhesive tenacity, distendability and recuperative power, which properties are retained at sub-freezing temperatures for maintaining the layers in adhesive bonded relation with the sections.

4. In an expansion joint the combination of a compressible body of inherently resilient fibers within an expansion space between two sections of masonry; said body having pores defined by its constituent fibers; said fibers, excepting those constituting outer surfaces of the body being non-adhering and freely movable one upon another and leaving the body freely deformable in said expansion space and a sealing apron superposed on the top of the body and in adhesive contact with the ends of the masonry sections, said sealing apron being formed of a rubberized bituminous material, containing residual oil, comprising about 26 to 35% rubbery material, 35 to 40% asphalt, 16 to 25% residual oil, and 5 to 10% solid filling material, and characterized by a high degree of adhesive tenacity, distendability and recuperative power, which properties are retained at sub-freezing temperatures.

5. An expansion joint between two pavement sections comprising a compressible composition in the gap between the sections and terminating a substantial distance below the paving surface, and a rubberized bituminous composition, containing residual oil, comprising about 26 to 35% rubbery material, 35 to 40% asphalt, 16 to 25% residual oil, and 5 to 10% solid filling material, and filling the gap above the compressible composition and adhesively bonded to the sections, said rubberized bituminous material characterized by a high degree of adhesive tenacity, distendability and recuperative power, which properties are retained at sub-freezing temperatures for maintaining the rubberized bituminous material in adhesive bonded relation with the sections.

6. An expansion joint between two pavement sections comprising a compressible composition in the gap between the sections and terminating a substantial distance below the paving surface, a non-metal strip bridging the gap between and adhered to said sections below the compressible

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composition material, containing flux oil, and a rubberized bituminous composition, containing residual oil, comprising about 26 to 35% rubbery material, 35 to 40% asphalt, 16 to 25% residual oil, and 5 to 10% solid filling material, and filling the gap above the compressible material and adhesively bonded to said sections.

7. An expansion joint between two pavement sections comprising a compressible composition in the gap between the sections and terminating a substantial distance below the paving surface, said composition containing on its exposed side surfaces rubberized bituminous material, containing residual oil, comprising about 26 to 35% rubbery material, 35 to 40% asphalt, 16 to 25% residual oil, and 5 to 10% solid filling material, and characterized by a high degree of adhesive tenacity, distendability and recuperative powers which properties are retained at sub-freezing temperatures for adhesively bonding with and maintaining an adhesive bond with the sections, and rubberized bituminous material of the same charac-

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ter as that on the side surfaces of the compressible composition filling the gap above the compressible composition and adhesively bonded with the sections.

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