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JOINT SEAL STRIP AND METHOD OF APPLYING SAME

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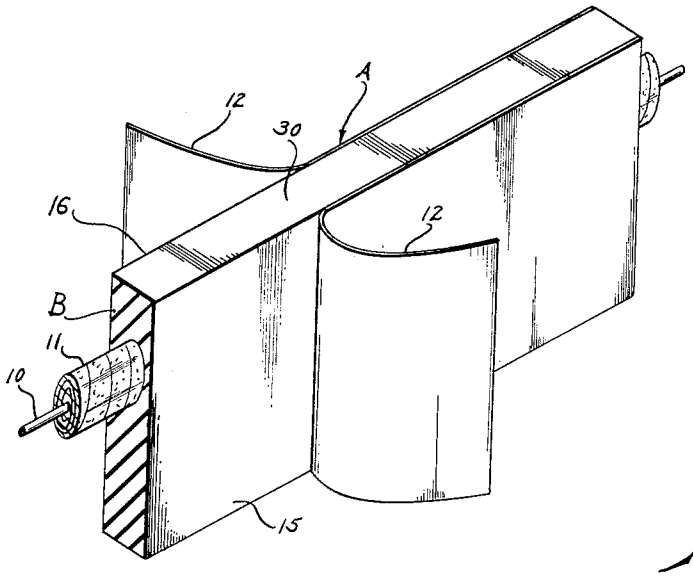


Fig. 1

Fig. 2

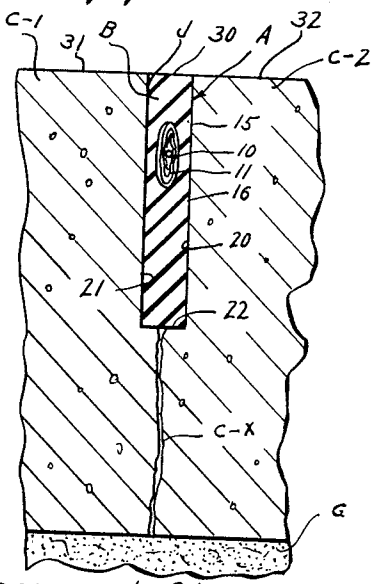
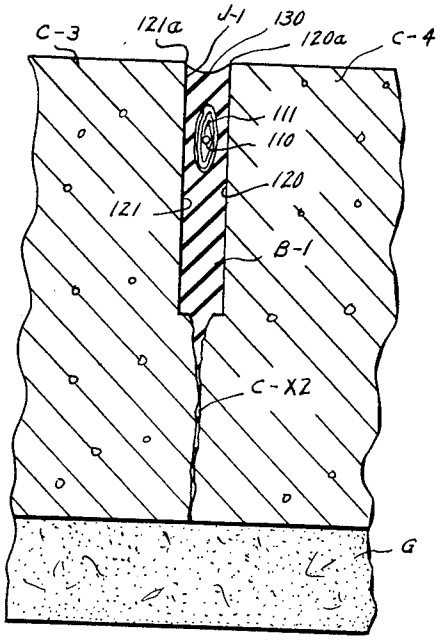


Fig. 3
PRIOR ART



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JOINT SEAL STRIP AND METHOD OF APPLYING SAME

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This invention relates to new and useful improvements in joint seal strips and methods of applying same, and particularly to thermoplastic joint seal strips adapted to be positioned in joints between concrete sections for sealing contact therewith.

Heretofore, in the forming of joints between adjacent concrete sections, boards of wood or other materials have been placed in the concrete during the pouring of the concrete or while the concrete was still wet and soft enough to receive the boards. Such boards have been subsequently removed and then various sealing strips or expansion joint materials have been positioned in the joints between the concrete sections for the intended purpose of maintaining a seal at such joints during the contraction and/or expansion of adjacent concrete sections.

In U.S. Patent No. 2,899,876, a sealing material for joints is disclosed in which an electrical wire is positioned so that heat may be applied to the sealer to soften same. This invention is an improvement on the subject matter of said Patent No. 2,899,876.

An object of this invention is to provide a new and improved joint seal strip and method of applying same which has all of the advantages of the joint sealer of said Patent No. 2,899,876, but which is an improvement over such joint sealer.

An important object of this invention is to provide a new and improved joint sealer and method of applying same wherein the joint sealer is positioned to form a joint between adjacent concrete sections prior to the hardening or setting of the concrete, and wherein the same joint sealer is left in such position after the concrete hardens and is internally heated to effect a seal between the joint sealer and the adjacent concrete surfaces.

Another important object of this invention is to provide a new and improved sealing strip which is rigid enough to serve as a divider member in wet concrete between concrete sections and which has an internal heating element therein for internally heating said strip to render same effective for sealing with the concrete without flowing from the joint through cracks or other defects in the concrete adjacent the sealing strip.

Another object of this invention is to provide a new and improved sealing strip and method of applying same wherein a sealing strip for sealing a joint between concrete sections is made from a bituminous composition having fibrous material and an elastomer therewith which can be applied as a pliable strip and which has an electrical wire extending longitudinally therein for connection to a source of electrical energy to provide heat for softening such material of the strip when it is desired to adhere such strip to the concrete in contact therewith.

A further object of this invention is to provide a new and improved sealing strip which is adapted to be positioned between concrete sections with the upper surface thereof flush with the adjacent upper surfaces of the adjacent concrete sections and which is adapted to be heated to cause the side surfaces thereof to adhesively contact the adjacent side surfaces of the adjacent concrete sections while still maintaining the upper surface of the sealing strip flush with the upper surfaces of the adjacent concrete sections.

The preferred embodiment of this invention will be described hereinafter, together with other features thereof,

and additional objects will become evident from such description.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

FIG. 1 is an isometric view of the sealing strip of this invention, with releasable protective sheets partially adhered thereto;

FIG. 2 is a sectional view illustrating the final position of the sealing strip of this invention between adjacent concrete sections; and

FIG. 3 is a cross-sectional view similar to FIG. 2, but illustrating the deficiencies of the prior methods and materials.

In the drawings, the letter A designates generally the sealing strip of this invention. Such sealing strip A includes a solid bituminous composition B in which is positioned a heating element or wire **10** which is surrounded by an insulation covering **11**. For the purpose of protecting the external surface of the sealing strip A from adhering to adjacent strips A or other surfaces, releasable protective sheets **12** are preferably provided on each of the side surfaces **15** and **16** of the bituminous solid B. In FIG. 1, such protective strips **12** are shown partially stripped back from the solid B. Briefly, in carrying out the method of this invention, the sealing strip A is positioned with respect to concrete sections so that it divides the concrete into sections and such strip A may be inserted in the concrete prior to the hardening or setting of such concrete. In such case, the strip A is not removed from the concrete after the concrete hardens, but instead the material or composition of the solid body B of the strip A is heated by passing an electrical current through the wire or element **10** to soften the external surfaces **15** and **16** sufficiently to obtain an adherence or sealing with the adjacent surfaces of the concrete, as will be more fully explained hereinafter. The sealing strip A of this invention is therefore both a joint forming and sealing member. Considering the invention more in detail, the wire **10** may be any suitable electrical conductor such as a copper alloy wire, preferably of the No. 17 size and preferably of such a length that it extends outwardly from the ends of the body or composition B. As shown in FIG. 1, the wire **10**, the fiber insulation **11**, and the composition or body B are shown as a section or a fragment of a complete sealing strip A since the length thereof may be varied to accommodate different lengths of concrete joints. However, the ends of the wire **10** should extend beyond the ends of the body or composition B so that such wire **10** may be connected to a source of electrical current. In the usual case, an electrical voltage from a portable 110–120 volt generator which is capable of delivering 5700 watts is connected to the ends of the wire **10** in the portion of the joint being treated. Sufficient current is passed through the wire at the 110–120 volts to soften the external surface of the composition or body B sufficiently to render it adhesive to concrete but without causing a flowing of such body or composition B. In the usual case, the material of the body B is heated to at least 225° F. and preferably to about 275° F., at which temperatures bonding of the sides **15** and **16** of the body B with the adjacent sections of the concrete is obtained without any visible flow of the body B.

The insulation **11** is preferably formed of asbestos rovings, but other insulation material may be employed such as glass fiber, kraft paper, hemp, jute, magnesia rope, ceramic fibers, and mineral wool fibers. Such insulation material should be capable of withstanding temperatures up to about 275° F., and preferably up to about 400° F. By reason of such insulation, the heat from the wire **10** is transmitted to the composition or body B substantially

uniformly without burning the composition or body B so that the external surfaces of the body B, and particularly the side surfaces 15 and 16 are substantially uniformly heated for thereby rendering them substantially uniformly adhesive.

The composition or body B is a thermoplastic material which is a solid at normal ambient temperatures, is pliable and adhesive at temperatures as low as 0° F. and should have not more than 0.5 centimeter flow at 140° F. for a period of five hours when positioned at a 75° inclination to the horizontal in accordance with the tests set forth in the Federal Specification SS–R–406c. Also, the composition or body B has a cone penetration at 77° F. (Federal Specification test SS–R–406c) between about 25 and about 100. At 32° F., the material of the body B has a cone penetration (Federal Specification test SS–R–406c) of from about 10 to about 50.

In the preferred form of the invention, the composition or body B includes a combination of bituminous material and an elastomer. The bituminous material is preferably asphalt and the elastomer is preferably polybutene. The elastomer such as the polybutene is present in a percentage weight range of from about 0.5% to about 10%, but the specific preferred amount of the polybutene or other elastomer is 5% by weight. Other elastomer such as polyurethan, latex, polyalkylene ether-polyureurethane, isocyanate base elastomers, and isoölefin polymers.

The asphalt which is used is preferably the catalytic blown asphalt with the P_2O_5 which has therewith diatomaceous earth or a similar material in a percentage by volume of about 5 to about 25%, and specifically in the preferred composition, such diatomaceous earth is present in an amount of about 8% by weight.

A fiber such as asbestos, magnesium carbonate, glass fibers, hemp, cotton, kraft paper and bagasses is incorporated and is homogeneously mixed with the asphalt and the elastomer in the preferred composition or body B forming the sealing strip A of this invention. Such fiber is present in a range from 0% to about 35% by weight. In the specific preferred example of the composition or body B of this invention, the fiber would be asbestos and would be present in the amount of about 15% by weight. Several examples of the composition or body B of this invention are set forth below with the cone penetration characteristics thereof to indicate the scope of the invention, but without intending to limit same to such examples.

Percent Asbestos (by weight)	Cone Penetration at 77° F. (Total Weight, 150 grams)	Cone Penetration at 32° F. (Total Weight, 200 grams)
0	69	35
5	52	30
10	41	25
15	35	22
20	29	15

In each of the foregoing examples, the flow of the sealing strip A was to more than 0.5 of a centimeter when such material was subjected to 140° F. for five hours when positioned at a 75 degree angle of inclination in accordance with Federal Specification test SS–R–406c. Additionally, each of the foregoing examples was subjected to the bond and extension test for five cycles at 0° F. in accordance with the Federal Specification test SS–R–406c and no failure occurred.

Insofar as the protective sheets 12 are concerned, they may be formed of numerous materials such as kraft paper which may have pressure sensitive adhesive on the inner surfaces thereof, cellophane, or vinyl plastics, Other protective covers or sheets may also be utilized, but are not necessary.

In carrying out the method of this invention, the sealing strip A is shipped to the point of use in the condition

shown in FIG. 1 with the protective strips 12 preferably in contact with the surfaces 15 and 16 to protect same against adherence to adjacent strips or other surfaces. Then, at the time of use, the protective strips 12 are readily stripped by hand from the sealing strip A to expose the surfaces 15 and 16. Such surfaces 15 and 16 of the composition or body B when made in accordance with this invention, are capable of being rendered adhesive to concrete when heated to a temperature of about 225° F. with the internal heating element 10, and preferably to a temperature of about 275° F.

The sealing strip A, after having the protective sheets 12 removed therefrom, is ready for use and is either positioned in a pre-cut joint in between concrete sections C–1 and C–2 or, the sealing strip A is positioned in the wet concrete to form a divider between concrete sections C–1 and C–2. Such type of dummy joint J is illustrated in FIG. 2 between such section C–1 and C–2. It will be appreciated that the joint J may extend to the bottom of the area between the sections C–1 and C–2, but preferably it is formed for only a portion of such distance. The joint J has side walls 20 and 21 and a bottom wall 22. A crack C–X is indicated in FIG. 2 below the joint J because a crack generally develops below a joint J due to the fact that the presence of the joint J itself is a crack initiating structure which is desirable since the crack is thereby controlled at a point which is below the joint J and therefore is not visible at the surface of the concrete.

When the sealing strip A is positioned in the wet concrete prior to the hardening or setting of same, the sealing strip A actually serves as the divider member to form the joint J between the adjacent concrete sections such as the sections C–1 and C–2 shown in FIG. 2. In such case, the upper surface 30 of the body or composition B is placed in the concrete when it is wet or while it is being poured so that such surface 30 is flush with the upper surfaces 31 and 32 of the concrete sections C–1 and C–2, respectively. After the concrete has hardened or has set, the sealing strip A is heated by passing the current previously described through the electrical wire or element 10. The heat from the wire 10 substantially uniformly heats the external surfaces 15 and 16 of the sealing strip A to render them adhesive and to cause them to bond to the adjacent surfaces 20 and 21, respectively, of the joint J. With this method, the sealing strip A is softened only enough to render such external surfaces 15 and 16 adhesive to the concrete adjacent thereto and is not softened enough to cause any visible flow of the material or body B. In the usual case the temperature of the material or body B will reach about 270° F. when the surfaces 15 and 16 become adhesive to the concrete surfaces 20 and 21. The material or body B does not flow into the crack C–X in view of the fact that it is of such a composition that it does not flow at the temperature at which surfaces 15 and 16 become adhesive. Also, since the sealing strip A is a solid when placed in the concrete, there is no flow of the asphalt or other components of the body B into the crack C–X. For that reason, the upper surface 30 of the body B remains flush or in alignment with the upper surfaces 31 and 32 as shown in FIG. 2. This is particularly important in connection with joints which are subjected to traffic from automobiles and airplanes. By maintaining the upper surface 30 of the body B flush with the surfaces 31 and 32, the upper corners of the concrete adjacent to the joint J are prevented from being subjected to excessive chipping action which is commonly experienced with the prior known sealing strips. As the concrete chips away, the joint becomes less and less effective and water and other undesirable materials are permitted to leak between the sealing material and the joint surfaces of the concrete.

For example, in FIG. 3, a defective joint J–1 is illustrated wherein the upper surface 130 is cupped or

curved downwardly so as to expose the edges **120***a* and **121***a* of the surfaces **120** and **121**, respectively. When such condition occurs, wheels of airplanes and automobiles subject the edges **120***a* and **121***a* to the chipping previously referred to and in some instances such chips of concrete are sufficiently dangerous to even cause engine failure in jet airplane engines. The type of joint shown in FIG. 3 is caused by the running of the composition B–1 down into a crack C–X2 during the pouring of the liquid composition B–1 into the joint J–1 or during the heating of same with the electrical wire **110** which is surrounded by insulation **111**. In such case, a portion of the composition of the body B–1 flows down through the crack C–X2 to the sub-grade G below the concrete sections C–3 and C–4. In the form of the invention shown in FIG. 2, none of the material of the body B flows down through the crack C–X to the sub-grade G below the sections C–1 and C–2 because of the particular composition of the body B of the seal strip A of this invention. For that reason, the problem illustrated in FIG. 3 is not present with the sealing strip A of this invention.

With the method of this invention and the sealing strip A thereof, the sealing strip A may be applied at temperatures as low as 0° F. and therefore may be applied in the colder weather as well as in the hot weather, whereas the prior hot melt type of composition used for joints between concrete sections cannot be applied when the ambient temperature is below about 50° F. since condensation and lack of adhesion results below such temperature. Additionally, with the hot pour type of sealing joint composition, it must be poured at a controlled temperature which does not exceed a temperature which would destroy its effectiveness. Generally, the hot pour joint material is much hotter than the concrete sections adjacent the joints so that condensation of water occurs during the pouring of the joint material and such condensation prevents an adequate bond between the joint material and the concrete. Furthermore, with the sealing strip A of this invention, unskilled labor may be used in the installation of same and it may be machanically or manually installed.

Also, with the present invention, the use of separate initial boards formed of wood or other materials which are later removed is obviated. The same sealing strip A serves as the joint forming member and the joint sealing member. The economy of such a material as the sealing strip A of this invention is therefore believed evident. The present invention has use in connection with joints formed in concrete air strips, highways, driveways, and other types of concrete work such as the usual expansion joints. Various other uses of the present invention will occur to those skilled in the art.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. A method of applying a thermoplastic sealing strip having an insulated electrical wire therein between concrete sections, comprising the steps of, positioning the thermoplastic sealing strip with the insulated electrical wire therein in a position to form concrete sections prior to the hardening of the concrete, and applying a voltage across the electrical wire subsequently to the hardening of the concrete adjacent the strip to heat the sealing strip sufficiently to cause a sealing between the strip and the walls of the adjacent concrete sections and without causing any visible flow of said strip, whereby the same strip serves as the joint former and sealer between concrete sections said thermoplastic sealing strip including from about 0.5% to about 10% of an elastomer, from 0% to about 35% of a fibrous material, and asphalt, all of which are homogeneously mixed together to form a pliable material which is adhesive to concrete at temperatures as low as 0° F. and which is substantially non-flowing when heated to a temperature sufficient to render the external surface thereof adhesive to concrete.

2. The method set forth in claim 1, wherein said asphalt has a cone penetration at 32° F. of from about 10 to about 50, and which has no more than about 0.5 centimeter flow when placed at a 75 degree angle and when subjected to 140° F. for five hours.

3. A sealing strip adapted to seal in a joint between adjacent concrete sections, comprising a homogeneous solid mixture including a homogenous mixture of from about 0.5% to about 10% of an elastomer, from 0% to about 35% of a fibrous material, and asphalt, said strip being adhesive to concrete at temperatures as low as 0° F. and substantially non-flowing when heated to a temperature sufficient to render the external surface thereof adhesive to concrete, and an insulated heating element extending into said solid and adapted to be connected to a source of electrical voltage for heating said solid sufficiently to render the external surface thereof adhesive to concrete.

References Cited by the Examiner

UNITED STATES PATENTS

1,329,631	2/20	Riehle	94—18 X
1,817,933	8/31	Ross	94—18.2
1,952,706	3/34	Fischer	260—758
1,972,439	9/34	Dresser	20—7
2,334,184	8/43	Fischer	94—18.2
2,625,086	1/53	Ulrich	94—18 X
2,899,876	8/59	Tauber	94—18
2,910,922	11/59	Horning	94—18

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