Aug. 18, 1959 S. P. TAUBER ET AL 2,899,876

SEALERS FOR JOINTS

Filed Oct. 24, 1957

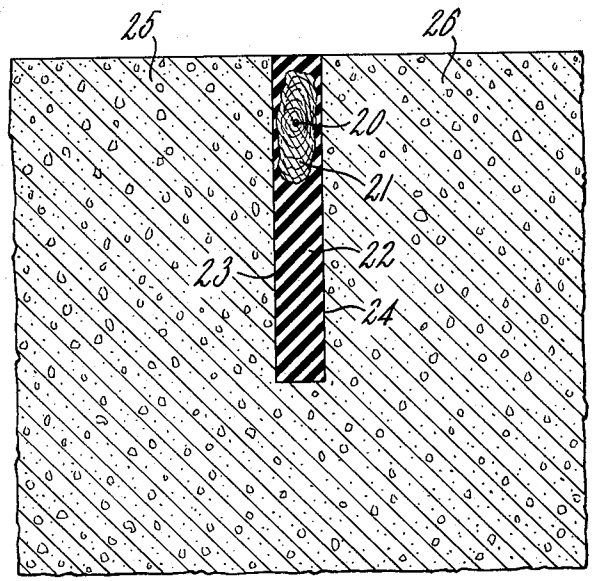


Fig. 1



Fig. 2

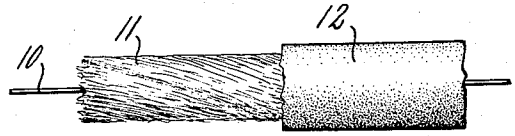


Fig. 3

United States Patent Office 2,899,876
Patented Aug. 18, 1959

2,899,876

SEALERS FOR JOINTS

Samuel P. Tauber, New York, N.Y., and George J. Stinnett, San Antonio, Tex., assignors to United States Rubber Company, New York, N.Y., a corporation of New Jersey

Application October 24, 1957, Serial No. 692,228

3 Claims. (Cl. 94—18)

This invention relates to sealers for joints between adjacent sections of concrete constructions, for example expansion joints, contraction or dummy joints, and construction joints in airfield pavements and highways.

Joint filling compositions that are used to fill the expansion space between adjacent concrete sections must be able to expand and contract with the contraction and expansion of the concrete sections and yet maintain an effective seal in the expansion joint by adhesion to the faces of the adjacent concrete sections to prevent infiltration of surface water. In such concrete pavements in airfields for jet aircraft, the joint sealer must also be resistant to the high heat impinging on the paving surface and to the solvating action of jet fuel, and must withstand the tail-pipe blast without being displaced from the expansion space. Various thermoplastic joint filling compositions that may be poured hot and which solidify on cooling, and other thermoplastic compositions that may be poured cold or otherwise placed in the joint at ambient temperatures and which set on standing, are well known. Such joint filling compositions heretofore used for filling the joints in concrete pavements in airfields for jet aircraft operations have been unsatisfactory in that they have been displaced by the heat and blast expelled from the tail-pipe of both fighter type and bomber type jet aircraft currently in use.

According to the present invention, we have provided a joint sealer between adjacent sections of concrete pavements that will expand and contract with the contraction and expansion of the adjacent concrete sections, that will give excellent adhesion to the faces of the concrete sections and prevent infiltration of surface water, and that will not be displaced by the heat and blast effect from the tail-pipe of jet aircraft. The present invention is applicable to sealing the joints in all kinds of concrete paving constructions, as in the runways, taxi ways and aprons, and warm-up areas in airfields, including those for jet aircraft, and in conventional automobile highway constructions.

In carrying out the present invention, a wire, which acts as a resistance element and will heat up on passage of an electric current therethrough, and which has a covering thereon of loose mineral fibrous material, is placed in the expansion space with the joint filling composition and an electric current is passed through the wire to heat the wire and the joint filling composition surrounding the fibrous covering. Such heating of the joint filling composition will soften it as in the case of conventional thermoplastic joint filling compositions and give a firm adhesive bond to the faces of the concrete sections after the heating operation when the softened filling composition has become cool. The heating of the joint filling composition will also cause impregnation of the joint filling composition into the outer portions of the loose fibrous covering to give a firm bond of the fibrous material to the joint filling composition. The fibrous material, thus anchored to the joint filling composition, will not

be blown out of the expansion joint by the tail-pipe blast from jet aircraft. One or more wires with fibrous coverings may be placed in the joint with the joint filling composition. One such wire with mineral fiber covering should be placed near the top of the joint adjacent the surface of the pavement in the case of jet aircraft pavements since the mineral fibers are resistant to the heat of the tail-pipe blast and even if some of the joint filling composition on top of the fibrous material, i.e. at the top surface of the joint, is melted by the heat of the fuel gases and blown out of the joint by the tail-pipe blast, the fibrous material embedded in the remainder of the joint filling composition will withstand the heat and blast from the tail-pipe and not become dislodged. When it is desired to heat the wire, leads from a portable generator are connected to the ends of the wire or to any two points of a wire between which heating is to be effected, and sufficient current passed through to give the desired amount of heat for softening the filling composition surrounding the fibrous covering. Where more than one wire with separate fibrous coverings, or more than one wire covered with a single covering, is placed in the joint, the corresponding ends of the wires may be twisted together and the two thus twisted ends connected to the leads from the generator to simultaneously heat the plurality of wires.

In the accompanying drawing which illustrates the invention:

Figure 1 is a cross-sectional view through a dummy or contraction joint in the runway of an airfield for jet aircraft with a joint sealer in accordance with the present invention,

Figure 2 illustrates one form of covered wire to be placed in the joint, and

Figure 3 illustrates a second form of covered wire to be placed in the joint.

The covering of mineral fibrous material on the wire is preferably a loose asbestos fiber covering which is made by lightly twisting a number of asbestos rovings around the wire. This is illustrated in Figure 2 of the drawing in which **10** is a No. 19 hard drawn copper wire which will become heated on passage of an electric current therethrough, and **11** is a covering of 21 strands of 7 cut rovings of asbestos fibers lightly twisted around the wire with one twist about every 2½ inches and having an overall diameter of about ½ inch. Other mineral fibrous material may be used, to cover the wire, e.g. glass fibers, ceramic fibers, mineral wool fibers. Such fibrous materials are not destroyed at temperatures up to 400° F. The loose mineral fibrous covering provides means in the joint for taking up the contraction and expansion of the joint sealer by virtue of the contraction and expansion of the adjacent concrete sections. The loose mineral fibrous covering is also readily impregnated at its outer surface with the joint filling composition to give a firm bond and prevent dislodgement from the joint.

Joint filling compositions are well known per se but do not form part of the present invention. The joint filling composition may be a thermoplastic material that is poured hot in the joint and which solidifies on cooling. Such thermoplastic materials are well known, for example, compositions comprising a major proportion of a bituminous material such as asphalt or coal tar pitch and a minor proportion of a rubber, natural or synthetic. Such a thermoplastic composition that is resistant to jet aircraft fuels, hydraulic fluids, engine cleaning compounds and the like that spill over the pavements in airfields comprises a major proportion of coal tar pitch and a minor proportion of butadiene-acrylonitrile copolymer oil-resistant synthetic rubber in which the butadiene is in major proportion and the acrylonitrile is in minor proportion.

The thermoplastic joint filling material may be a so-called cold pouring joint filling material which is poured into the joint cold and which sets hard on standing. Such materials are well known, for example, fresh mixtures of a dry component of asbestos fibers and mineral filler, e.g. cement or clay and rubber vulcanizing agents with a liquid component of coal tar oil and oil-resistant synthetic rubber may be cold poured in a joint and will set on standing. The joint filler may be a rubber composition such as solid rubber softened by solvents or oils, or by heat or by mastication, or may be a rubber latex composition. Such rubber compositions may contain vulcanizing ingredients that will cure the rubber at the elevated temperatures to which the joint filling composition is subjected on heating the wire. The heating of the joint filling composition will also remove water from the joint such as water that may have seeped in the joint or that may be retained at the faces of the concrete sections or water introduced with the joint filling composition as in the case of latex. The wire with the loose mineral fibrous covering may have a coating over the fibrous covering of joint filling composition or of a composition compatible with the joint filling composition. For example, as shown in Figure 3, the wire **10**, with the covering **11** of asbestos rovings as in Figure 2 may have a coating **12** of joint filling composition over the covering **11** applied as by passing the fiber covered wire through a bath of the melted coating composition and cooling. For example, a thermoplastic composition comprising 60 to 90 parts of coal tar pitch and 40 to 10 parts of a synthetic rubber copolymer of a major proportion of butadiene and a minor proportion of acrylonitrile is an excellent thermoplastic joint filling composition for joints in paving for airfields for jet engines and may be used to coat the asbestos covered wire. Such coating of the fibrous covered wire may be done on the job or at the factory. The coating of joint filling composition on the asbestos covering may be such as to supply all the joint filling composition needed when one or more of the thus coated fibrous covered wires are caulked into the joint. The heating of the wire or wires will soften or melt the coating composition and seal the joint. The coating of joint filling composition on the asbestos covering may be thinner so that the coated fibrous covered wire or wires will be introduced in the joint with the joint filling composition similarly to the fibrous covered wire without a coating over the fibrous covering. The wire covered with the mineral fibrous material with or without a coating of joint filling composition may be wrapped for shipping where the fibrous covering may be damaged or the coating material may become sticky or contaminated in shipping or handling or in storage, and such wrapping material may be removed when the wire is ready for use. An example of such wrapping material is wettable cellophane, which may be spirally wrapped around the covered wire.

There are various methods of placing the wire with the fibrous covering and the joint filling composition in the joint. These will be illustrated with a hot pouring joint filling composition. If the joint filling composition is precoated on the fibrous covering in sufficient amount, all that is necessary is to caulk the coated fibrous covered wire, or a plurality thereof, in the joint. If uncoated fibrous covered wire or a fibrous covered wire with an insufficient coating of joint filling composition is used, such coated or uncoated fibrous covered wire may be passed through a hot bath of the joint filling composition and removed and caulked into the joint. Also, in the case of uncoated fibrous covered wire or fibrous covered wire coated with insufficient joint filling composition to fill the joint, the coated or uncoated fibrous covered wire may be placed in the joint simultaneously with the pouring of the hot joint sealing composition to fill the joint. Again in the case of uncoated fibrous covered wire or fibrous covered wire coated with insufficient joint filling composition to fill the joint, the hot joint sealing composition may be poured into the joint to the desired height and the uncoated or coated fibrous covered wire or wires introduced into the joint forcing the hot sealing composition around the fibrous covered wire or wires, particularly in the case of uncoated fibrous covered wires. If desired the coated or uncoated fibrous covered wires may be placed in the joint alternately with poured increments on layers of the hot joint filling material until the joint is filled. Other methods will readily occur.

A more specific example is here given for a joint sealer for pavements for aircraft. As stated above, in joints in airfield pavings for jet aircraft, it is desired to have a mineral fiber covered wire embedded in the joint filling composition near the top surface of the pavement. This is illustrated in Figure 1 which represents a sealer of the present invention in a contraction or dummy joint in a runway for jet aircraft. Such contraction or dummy joints are cut in the concrete surface or molded with a removable form. The joint was ⅜ inch wide and 2½ inches deep and made 20 foot squares lengthwise and widthwise of the runway. A number 19 hard drawn copper wire covered with 45 strands of 7 cut rovings of asbestos fibers lightly twisted with seven and one-half turns per foot and having an overall diameter of about ⅝ inch was used. A hot melt of commercial joint filling composition of a major proportion of coal tar pitch and a minor proportion of butadiene-acrylonitrile copolymer synthetic rubber was used as the joint filling composition. The hot joint filling material was poured in the joint. The wire with the fibrous covering was coated with the same hot joint filling composition and this was inserted in the joint on top of the hot poured joint filling composition. The joint filling composition was cooled by the concrete. Leads from a portable 110–120 volt generator capable of delivering 5700 watts were connected to the ends of the wire in the portion of the joint being treated. Sufficient current was passed through the wire at 110 volts to soften the joint filling material in the joint and firmly adhere it to the faces of the adjacent concrete sections and to firmly anchor the fibrous covering in the joint sealing material. Referring particularly to Figure 1 of the drawing which shows a completed joint, the wire **20** with the covering **21** of loosely twisted asbestos rovings is firmly embedded in the joint filling composition **22** which is adhered to the faces **23** and **24** of adjacent sections **25** and **26** of the concrete pavement. The joints in a 100 foot square section in the center of the width of the runway about 500 feet in from one end of the runway were sealed in this manner according to the present invention. The effectiveness of the thus sealed joints was tested by impinging the tail-pipe blast from an air force jet aircraft Type T–33 onto the treated section of the runway with the engine running 5 minutes at 20% power, 5 minutes at 40% power and 3½ minutes at 100% power. No deterioration of the joint sealer showed at the end of the test. In another test, four transverse joints 200 feet in length and three longitudinal joints 150 feet in length were sealed in the above manner according to the present invention. The joints were tested by impinging the tail-pipe blast from an air force jet aircraft Type T–33 onto the longitudinal joints for 4½ minutes at 40% power followed by 3 minutes at 80% power and onto the transverse joints for 5½ minutes at 40% power followed by 5½ minutes at 80% power. No deterioration of the joint sealer showed at the end of the test. Other joint sealers as, for example, in expansion joints between sections in automobile roadways, and construction joints where a new concrete section is added to a finished concrete section leaving a keyed joint to be sealed between the sections, may be formed similarly to the contraction or dummy joints described in detail herein or with the various modifications discussed above. Also the joints of the present invention permit heating sub-

sequent to the initial sealing of the joint, as for example annually or semi-annually to improve adhesion of joint filling composition to the faces of the adjacent paving sections or improve anchoring of the fibrous covering of the wire in the joint filling composition or to otherwise rejuvenate the joint seal, making it unnecessary to remove old material from the expansion space, clean the joint and again fill the joint with joint filling composition.

In view of the many changes and modifications that may be made without departing from the principles underlying the invention, reference should be made to the appended claims for an understanding of the scope of the protection afforded the invention.

Having thus described our invention, what we claim and desire to protect by Letters Patent is:

1. A joint sealer between opposed faces of adjacent sections of concrete paving construction comprising a thermoplastic joint filling material having embedded therein adjacent the surface of the pavement a wire with a covering thereon of loose mineral fibrous material, said covering substantially filling the space between the opposed faces of the concrete sections adjacent the surface of the pavement, said wire acting as a resistance element and heating up on passage of an electric current therethrough.

2. A joint sealer between opposed faces of adjacent sections of concrete paving construction comprising a thermoplastic joint filling material having embedded therein adjacent the surface of the pavement a wire with

a covering thereon of a plurality of rovings of asbestos fibers, said covering substantially filling the space between the opposed faces of the concrete sections adjacent the surface of the pavement, said wire acting as a resistance element and heating up on passage of an electric current therethrough.

3. A joint sealer between opposed faces of adjacent sections of concrete paving construction comprising a joint filling material having embedded therein adjacent the surface of the pavement a wire with a covering thereon of a plurality of rovings of asbestos fibers, said covering substantially filling the space between the opposed faces of the concrete sections adjacent the surface of the pavement, said wire acting as a resistance element and heating up on passage of an electric current therethrough, said joint filling material being a thermoplastic composition comprising a major proportion of coal tar pitch and a minor proportion of butadiene-acrylonitrile copolymer synthetic rubber.

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