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3,052,945

MEANS FOR CONSTRUCTING JOINTS IN CONCRETE ROADS

Filed June 16, 1959

2 Sheets-Sheet 1

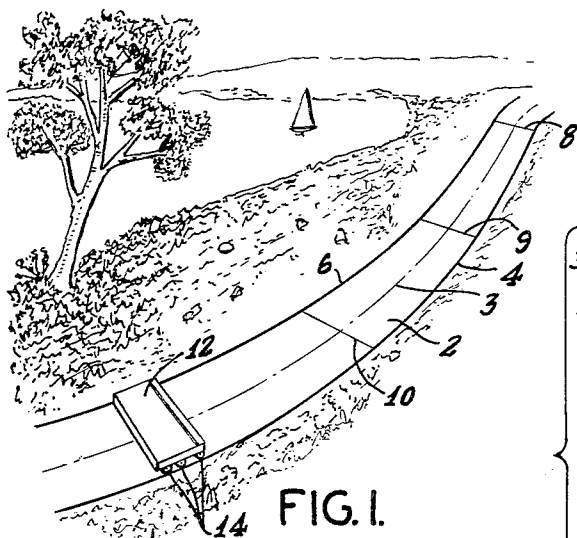


FIG. 2.

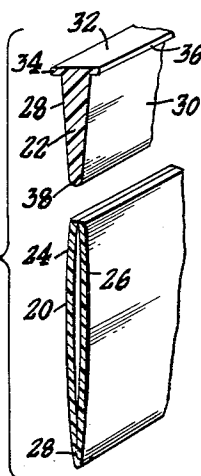


FIG. 3.

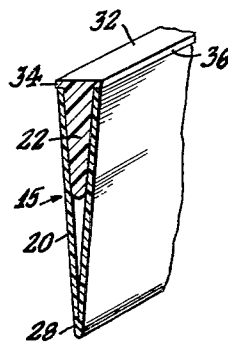


FIG. 4.

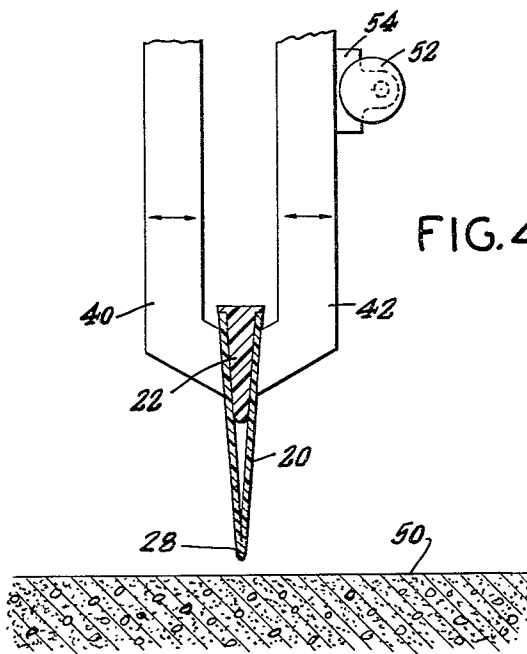
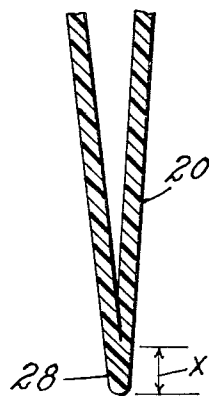


FIG. 3a

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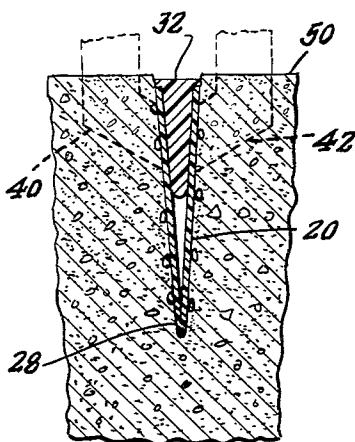


FIG. 5.

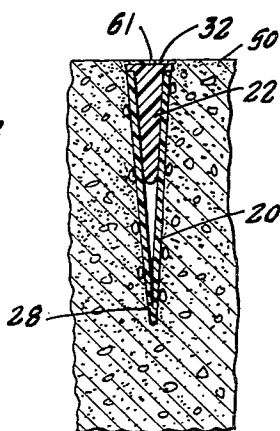


FIG. 6.

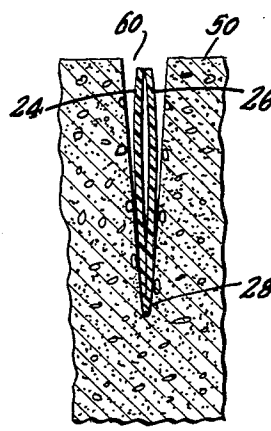


FIG. 7.

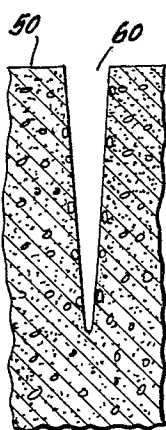


FIG. 8.

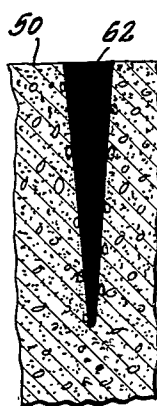


FIG. 9.

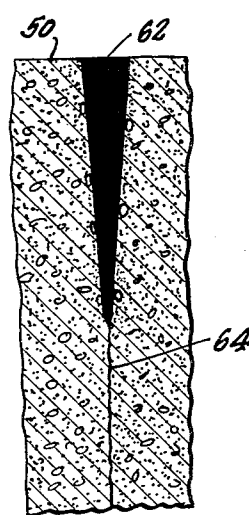


FIG. 10.

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MEANS FOR CONSTRUCTING JOINTS IN CONCRETE ROADS

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3 Claims. (Cl. 25—118)

This invention relates to the construction of concrete roads, airport landing strips and the like and particularly to methods and means for inducing the formation of cracks in the concrete at intervals to accommodate the dimensional changes in the strip either during setting or as the result of subsequent variations in atmospheric temperature.

It has been the common practice to induce the formation of cracks at intervals depthwise through concrete roadway strips for the purpose stated, by forming grooves transversely of the strip which extend depthwise for a fraction of the thickness of the concrete slab but which delineate predetermined vertical planes of weakness in or near which the slab is induced to crack through its remaining depth during the subsequent concrete setting process or during the subsequent temperature variations to which the road is exposed. One or more grooves extending longitudinally of the axis of the road are also usually provided for the same purpose and these grooves, whether transverse or longitudinal, are filled with a water proofing mastic, such as asphalt, to seal the base of the concrete slab against the infiltration of water and foreign materials.

The experience in the art has been that prior known methods and devices used and proposed for use for this purpose have certain practical deficiencies.

Attempts to mold the groove into the concrete by inserting a molding strip in the freshly poured mix to be removed after the concrete has become set have presented problems especially in the task of extracting the strip. The molding strip is left in place until the concrete is sufficiently set to prevent collapse of the groove upon removal of the strip, but its removal after the concrete is cured damages the concrete by disturbing the aggregate in the process of removal. Some molding strips have even had to be routed out which is a time consuming and expensive operation which does further damage to the concrete, in instances necessitating a subsequent costly hand edging operation. The expedient of sawing grooves in the set concrete involves a critical problem of timing of the sawing operation. If it is done too early in the curing phase the coarse aggregate will be displaced and its bond with the matrix broken; but if too late the concrete is apt to crack randomly which is just what the groove forming operation seeks to avoid. Sawing also is sometimes most impracticable because of the inability to avoid cutting through the coarse aggregate hidden within the concrete slab and which in some areas is extremely resistant to sawing.

Many of the prior art proposals found in the literature, but which have not gone into use, evidence by their complexities the difficulty of satisfactorily accomplishing this simple task of forming the grooves at desired intervals.

It is the object of the present invention to solve these problems and to provide a method and means for forming the grooves at the proper time, that is, within a matter of minutes after the pouring is completed, without having to wait until after hours which is the frequent practice with sawed joints where the operation has to be performed at the right stage in the setting process and where the rate of cure varies with atmospheric conditions. It is my further purpose to employ a groove forming device

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which can be removed without damage to the concrete, which is inexpensive, which can be repeatedly used without wearing out, and which forms a groove of non-varying, exact, dimensions.

In the drawings:

FIG. 1 is a perspective view of a concrete roadway under construction;

FIG. 2 is a perspective exploded view of one end of my novel groove forming mold;

FIG. 3 is a view similar to FIG. 2, but showing the spreader in place;

FIG. 3a is an enlarged view of the apex of the groove forming mold;

FIG. 4 is a diagrammatic side elevation view of the inserting jaws;

FIG. 5 is a vertical section of the upper portion of the concrete slab, showing the mold fully inserted;

FIG. 6 is a vertical section corresponding to FIG. 5, but with the inserting mechanism out of the way;

FIG. 7 shows the mold with its side walls converged after the wedge has been removed;

FIG. 8 is a diagrammatic view of the groove that is formed, with the mold removed;

FIG. 9 is a view corresponding to FIG. 8 showing the groove filled with mastic, and

FIG. 10 is a view showing the crack formation.

Referring to FIG. 1, the reference numeral 2 shows a roadway that has been poured between the side forms 4 and 6. The numerals 8, 9 and 10 designate successive grooves that have been formed according to my invention and 3 designates a longitudinal center groove. At 12, superimposed over the location for the next succeeding transverse groove, is indicated diagrammatically the inserting and retracting machine which is supported on wheels 14 riding on the form 4 as a track and on corresponding wheels (not shown) on the opposite side riding on form 6 as a track. In this way the machine 12 bridges the road and may readily be moved along to successive groove locations.

Machines of the type suggested diagrammatically at 12 for inserting a groove forming mold are known and available in the industry. The particular kind of machine forms no part of my present invention, except as herein-after indicated, and in FIG. 4 I have shown diagrammatically enough of the machine for an understanding of my present invention, as will be referred to below.

My novel joint former or wedge 15, as shown in its preferred embodiment in FIGS. 2 and 3 is composed of two parts, a mold 20, which is V-shaped in vertical section, and a spreader 22. The mold 20 has a pair of side walls 24 and 26, joined at an apex juncture 28. It is made of a water and caustic-resistant material such as vinyl resin extruded from a die in the form of the V. The spreader 22, molded of the same material, has tapered sides 28 and 30 of a predetermined angular divergence to be described and has a top 32 formed with side flanges 34 and 36 protruding outwardly from the sides 28 and 30 respectively a distance approximating the thickness of the side walls 24 and 26 of the mold so that, when the spreader is in place, fully inserted between the side walls 24 and 26, as in the assembled view, FIG. 3, the flanges rest on the upper edges of the side walls of the mold, thus limiting the extent of the insertion, and forming a smooth, uninterrupted continuation of the outer surfaces of the side walls. When fully inserted the lower blunt edge 38 of the spreader is substantially midway of the depth of the mouth internally separating the side walls 24 and 26 of the mold.

The joint former, composed of mold and spreader, may be of any convenient length for use in forming the longitudinal groove 8, ranging from perhaps 10 feet to 15 feet. For use in forming transverse grooves I have

found that joint formers in lengths varying between 11 feet and 12 feet accommodate the most frequently occurring slab widths of 11, 12, 22, 24 or 25 feet, but the length can, of course, be varied as desired, and when two are needed to fit crosswise between the forms 4 and 6 the machine 12 usually inserts them simultaneously, holding them in alignment between the inserting jaws.

The jaws of the inserting machine 12 are represented diagrammatically in FIG. 4 at 40 and 42, shown holding a joint former mold 20 and a spreader 22 in position above the surface 50 of the freshly poured concrete. The jaws are suitably constructed to open and close for insertion and release of the joint former. They are vibrated in a direction laterally of the groove to be formed, as indicated diagrammatically by arrows and FIG. 4 shows, for that purpose, an eccentric 52 mounted on bracket 54 carried by jaw 42 and suitably power driven.

As soon as the concrete has been poured and given a suitable surfacing treatment, the machine 12, with one or more joint formers inserted between its jaws 40 and 42 is accurately positioned for the formation of the groove along the desired line. The vibrating mechanism is started and as the jaws are lowered the joint former works its way into the wet concrete. The coarse aggregate as well as the fines are pushed aside, as shown in FIG. 5 and the jaws 40 and 42 push their way, with the joint former, below the surface 50 of the concrete until the upper surface of the top 32 of the spreader is $\frac{1}{8}$ inch or so below the surface 50 of the concrete. The jaws 40 and 42 of the inserting machine then retract, opening as necessary, to leave the joint former in place. The jaws need not disturb the concrete unduly, during the process, as they can be made of thin metal, almost knife-like in thickness, and when they retract the mix readily fills the void, aided by the further surface finishing operation which then follows. Alternatively some inserting machines eject the joint former from between the jaws which then can be limited in their downward travel so as not to enter the concrete.

After the insertion of the joint former the further surface finishing is by a conventional flat float drawn over the joint area at right angles to it. This may leave a thin layer of concrete over the top 32 as shown at 61 in FIG. 6. The concrete displaced by the joint former, spread over say $\frac{1}{2}$ foot from the joint line in both directions, represents only a small fraction of an inch added thickness as the increased density of the concrete resulting from the vibration uses most of it.

The concrete is then allowed to set and the joint former should be left in place usually for at least 18 hours and longer if the setting conditions are slow.

At any convenient time thereafter, but preferably not until the joint is to be completely finished, the joint former is removed and until it is removed the groove in the concrete which it has formed is effectively sealed against dirt and moisture.

The facility of the operation of removal is a feature of my invention. The T-shaped spreader is first removed by lifting it straight up, starting with the form on one side, and this permits the side walls of the mold to snap together free of the side walls of the groove as shown in FIG. 7. The mold may then readily be lifted out leaving the open groove 60, FIG. 8. The next operation is to fill the groove with a mastic 62, such as asphalt, FIG. 9. The joint is then complete and is effective to predetermine a plane of weakness vertically of the concrete so that the slab cracks through its full thickness in that plane, as indicated at 64 in FIG. 10 and this crack will occur either during the curing or setting process or occasionally during subsequent changes in atmospheric temperature.

The thickness of the side walls 24 and 26 of my novel mold is adequate to preserve the planar outer surface of the side walls against distortion under the compression of the surrounding wet concrete mix, especially in the

areas of the side walls between the portions supported by the spreader 22 and the apex. The thickness vertically of the material at the apex juncture may be of the order of two or more times the thickness of the walls as shown at X in FIG. 3a to assure that the side walls have a resiliency which forces them to snap inwardly, as shown in FIG. 3, upon removal of the spreader 22. The spreader is conformingly tapered to force the side walls apart against the resiliency of the material at the apex as shown in FIG. 3, so that the outer surfaces of the mold form a groove preferably of tapering configuration. The V-shaped groove which the mold forms is of non-varying volume and dimensions from joint to joint and by its V shape accurately predetermines the position in which the crack thereafter forms. The depth of the groove is desirably about 2 inches for most roadwork and perhaps 3 inches for airfields and the ratio of the depth of groove to the total thickness of the concrete is preferably of the order of from about 1 to 5 to about 1 to 7. The taper in the embodiment illustrated is from about $\frac{3}{8}$ inch at the mouth to about $\frac{1}{8}$ inch at the base of the groove.

I claim:

1. A two-member wedge, comprising extruded elements, for forming a groove in freshly poured concrete, one member, of resilient material, being formed with two sidewalls extending upwardly from an apex juncture at the bottom, the thickness laterally of the sidewalls, in proximity to the juncture, being adequate to withstand, without internal support, the compression of surrounding wet concrete mix, the said apex juncture being formed with a thickness vertically at least approximately twice the said thickness laterally of the sidewalls to afford rigidity at the apex by which the wedge may be driven into the concrete without internal support at the apex and to impart a contractual elasticity to the sidewalls forcing them from a diverging position to a position in which the sidewalls are substantially in contact with each other, the second member being wedge-shaped and inserted between the upper edges of the sidewalls of the first member to hold them in said diverging position.

2. A two-member wedge, comprising extruded elements, for forming a groove in freshly poured concrete, one member, of resilient material, being formed with two sidewalls extending upwardly from an apex juncture at the bottom, the thickness laterally of the sidewalls, in proximity to the juncture, being adequate to withstand, without internal support, the compression of surrounding wet concrete mix, the said apex juncture being formed with a thickness vertically at least approximately twice the said thickness laterally of the sidewalls to afford rigidity at the apex by which the wedge may be driven into the concrete without internal support at the apex and to impart a contractual elasticity to the sidewalls forcing them from a diverging position to a position in which the sidewalls are substantially in contact with each other, the second member being wedge-shaped and inserted between the upper edges of the sidewalls of the first member to hold them in said diverging position, and having a shoulder to cooperate with a said upper sidewall edge to limit the depth of insertion of said second member within said first member.

3. The device as defined in claim 2 wherein the said first member is formed of a rust-and-corrosion resistant, water-insoluble synthetic plastic.

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