Oct. 9, 1962 R. JANOWITZ 3,057,274

METHOD OF FORMING ROAD JOINTS AND MACHINE FOR USE THEREIN

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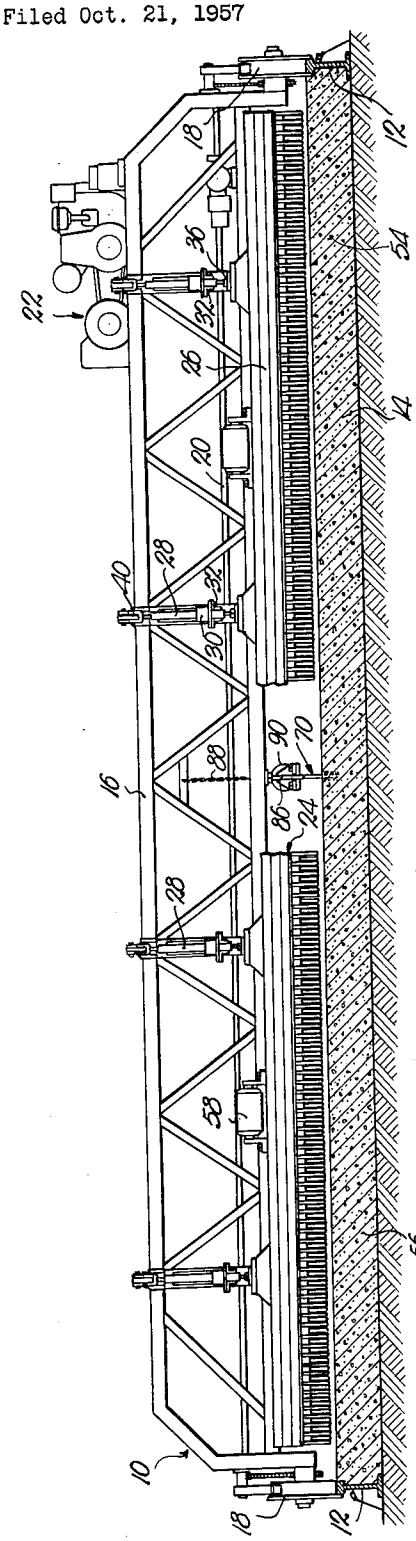


Fig. 1.

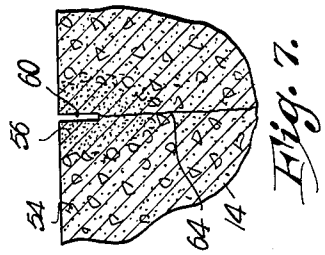


Fig. 7.

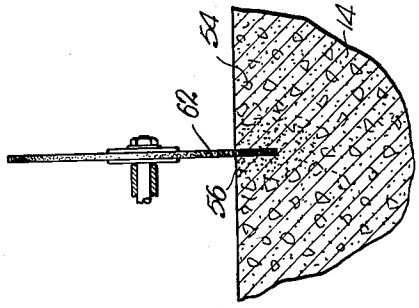


Fig. 6.

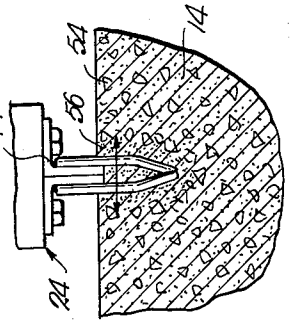


Fig. 5.

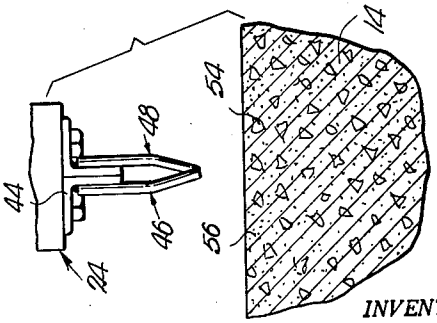


Fig. 4.

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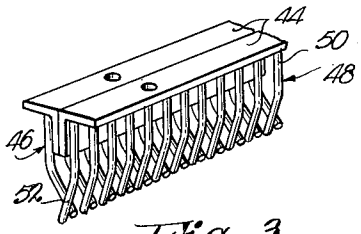


Fig. 3.

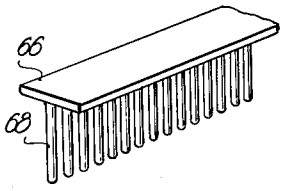


Fig. 9.

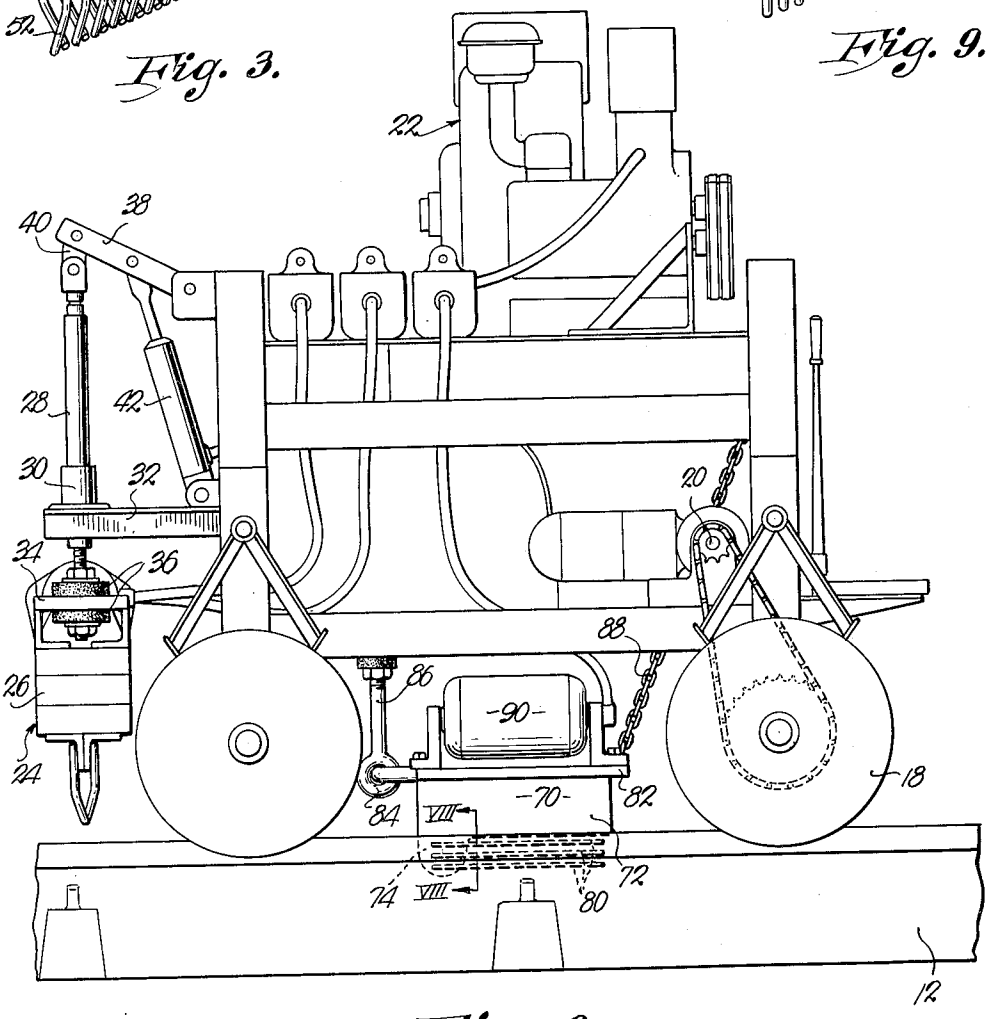


Fig. 2.

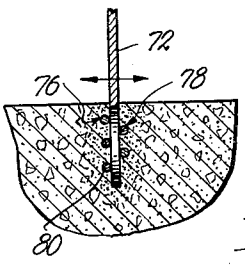


Fig. 8.

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United States Patent Office 3,057,274 Patented Oct. 9, 1962

3,057,274
METHOD OF FORMING ROAD JOINTS AND MACHINE FOR USE THEREIN

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Filed Oct. 21, 1957, Ser. No. 691,430
7 Claims. (Cl. 94—45)

This invention relates to the art of road building and particularly to pavements made from concrete and containing aggregate in the usual manner. More particularly, the invention relates to problems incident to contraction and expansion which have long since universally been rectified by provision of joints or lines of weakness causing cracking to be localized or controlled along predetermined lines.

Many suggestions have heretofore been disclosed and placed in use relating to the formation of the joints both transversely and longitudinally of the concrete pavement and for the most part, the joints have been formed while the road is under construction and during the time the concrete is in a plastic condition. It has even been suggested that the aggregate be pushed aside along a straight line whereby to create the line of weakness by virtue of the fact that the absence of aggregate automatically presents a line of weakness where the crack will occur rather than along irregular lines extending in a large number of directions. Furthermore, grooves have been cut into the pavement after hardening thereof without any preparation therefor, during the time the road is under construction and while the concrete is in a plastic state.

The cutting operation is, however, difficult and expensive because of the necessity of the saws used for such purpose, cutting through the aggregate itself since the latter is extremely hard and damaginng to the cutting equipment.

Consequently, it is the most important object of the present invention to form such joints by a method that includes the sawing operation aforementioned, together with certain advantageous steps to be performed while the concrete is still easily penetrable.

An important object of the instant invention therefore, is to provide a novel road joint machine having a specially formed implement as a part thereof which may be inserted into the plastic cement and operable to separate the fine and coarse aggregates by forcing the latter aside while at the same time permitting and causing the fine aggregate to flow inwardly along the line of the joint to be subsequently formed.

From the foregoing it is apparent that an important object of this invention is to facilitate the sawing operation after the concrete hardens by eliminating the necessity of cutting through the coarse aggregate and leaving only the concrete and fine aggregate within the zone of the proposed cut, both of which are easily and quickly severed without undue expense.

Another important object of the present invention is to penetrate the plastic concrete with a furcate implement having tines that function to force aside the coarse aggregate but spaced apart to permit flow of the plastic concrete and the fine aggregate therebetween, all to the end that there is presented a line of weakness, as well as a zone which is easily cut to form the kerf joints, both transversely and longitudinally of the road.

Still another important object of the present invention is to provide a specially formed penetrating implement having the tines thereof laterally bent into overlapping relationship, presenting a transverse configuration that is at least partially V-shaped for ease of insertion and to present a zone which has the aforementioned attributes so far as ease of severance is concerned.

In the drawings:

FIG. 1 is a front elevational view of a road joint machine made pursuant to the present invention and adapted to be used in carrying out the novel method thereof.

FIG. 2 is an enlarged, end elevational view thereof.

FIG. 3 is a fragmentary, detailed, enlarged, perspective view of the penetrating implement of the machine shown in FIGS. 1 and 2.

FIG. 4 is an end view of said implement in relationship to the pavement when the implement is elevated as shown in FIGS. 1 and 2.

FIG. 5 is an end view of the implement as the same appears when inserted into the plastic concrete.

FIG. 6 is an edge view of a cutting tool employed to form a kerf in the pavement.

FIG. 7 is a sectional view through the road showing the kerf cut therein.

FIG. 8 is an enlarged, fragmentary, detailed, cross-sectional view taken on line VIII—VIII of FIG. 2; and

FIG. 9 is a perspective view similar to FIG. 3 illustrating a modified form of penetrating implement.

The road machine illustrated in FIGS. 1 and 2 of the drawings is broadly designated by the numeral **10** and shown supported by the usual side rails **12** between which the concrete of the pavement **14** is poured. To this end, frame **16** is supported by a plurality of wheels **18**, two or more of which may be driven from longitudinal shaft **20** by prime mover **22**.

An elongated penetrating implement broadly designated by the numeral **24** and extending longitudinally of the machine, is carried thereby for vertical reciprocation. It includes a beam **26** extending the full length of the machine and suspended therefrom by means of a plurality of vertical rods or the like **28**. Rods **28** are guided in their vertically reciprocable movement by bearings **30** carried by lateral extensions **32** from frame **16**.

Beam **26** is suspended from the lower ends of rods **28** through the medium of brackets **34**, loosely receiving rods **28** and coupled therewith through the medium of opposed, resilient discs **36** best seen in FIG. 2.

A vertically swingable arm **38** on frame **16** is pivotally coupled with the upper end of rod **28** by a short link **40** and is actuated by a double-acting fluid piston and cylinder assembly **42** pivotally interconnecting arm **38** and frame **16**.

A pair of back-to-back L-plates **44** extending longitudinally of the beam **26**, are attached to the lower face of the latter and support two rows **46** and **48** of horizontally spaced tines **50**. The tines **50** may be welded or otherwise permanently and rigidly secured to the plates **44**, it being noted that the vertical flanges of the latter separate the rows **46** and **48** at the upper ends thereof.

The straight, vertical lengths of the tines **50** terminate in laterally-extending, inclined, lowermost ends **52**. It is noted that the ends **52** of each row **46** and **48** slope inwardly into overlapping relationship, presenting a configuration that is V-shaped at the lowermost end of the implement **24**. Accordingly, the tines **50** of the row **46** are in staggered interleaved relationship to the tines **50** of the row **48** thereof.

It is contemplated that the machine **10** be used while the concrete **14** is still in a plastic, easily penetrable condition and, as seen in FIG. 4, the coarse aggregate **54**, as well as the fine aggregate **56**, are admixed at random throughout the monolithic material from which the roadway **14** is made.

Accordingly, when the power devices **42** are actuated to lower the implement **24** to the position shown in FIG. 5, the tines **50** will penetrate the cementitious material and

laterally displace the coarse aggregate 54 in both directions.

The spacing between the tines 50 is, however, such as to clear the fine aggregates and permit the same to flow inwardly along the zone of penetration which extends transversely across the pavement 14 throughout substantially the full width thereof.

In order to augment the inward flow of fine aggregates and the outward displacement of the coarse aggregates to thereby separate the same, it is desirable to provide one or more vibrators 58 of any desired character mounted directly upon the beam 26 as best seen in FIG. 1.

By virtue of the limited movement that is provided between the implement 24 and the supporting rods 28 therefor through the resilient elements 36, the vibrators 58 will impart a slight lateral movement to the implement 24 as depicted by the double arrow in FIG. 5 of the drawings. The action of the vibrators 58 tends to immediately displace the coarse particles 54 as the implement 24 is lowered toward the position shown in FIG. 5, thereby facilitating the penetration and avoiding the mere pressing of the heavy particles 54 downwardly to a compact condition along a continuous line immediately beneath the lower tip ends of the tines 50. Instead, from the time the tines 50 first commence piercing the cementitious material, particles 54 will start radiating outwardly and be displaced by concrete and fine aggregate 56 that flows inwardly between and around the tines 50 as is clearly illustrated in FIG. 5 of the drawings. Furthermore, as the implement 24 is retracted upwardly, the continuous vibration thereof will cause the material to dislodge from the tines 50 and flow into place without appreciably interrupting the smooth, uppermost surface along the line of weakness that is formed by the operation of implement 24.

It is seen, therefore, that such line of weakness does not consist solely of cementitious material, but has contained therein and bonded with the concrete, a certain amount of the fine aggregate 56, but the latter is easily cut when a kerf 60 is to be cut along the line of weakness by a suitable saw blade 62 or other cutting instrumentality. FIG. 7 of the drawings vividly illustrates the function of the kerf 60 in defining the course of crack 64 which may occur in the pavement 14 because of contraction or expansion as is well known.

It is to be understood that, while the implement 24 is employed before hardening of the concrete 14, the cutting step to form kerf 60, through use of the saw 62, does not take place until the concrete has firmly set.

It has been found that by virtue of the method above described, and through use of the machine 10, it is not difficult nor expensive to form the kerf 60 since the saw 62 need only cut through the concrete itself and the fine aggregate that is interspersed therein. Blade 62 does not come into engagement with large aggregate particles and, therefore, the saw blades 62 are not quickly damaged or worn as has heretofore been the case.

A modified form of penetrating implement may be made through use of a plate 66 as shown in FIG. 9, having a single row of straight, vertical tines 68 depending therefrom. The tines 68 are spaced apart to clear the fine aggregate 56, but when the same are lowered into penetrating relationship to the pavement, tines 68 effectively displace the heavy aggregates 54 laterally, particularly when vibrators 58 are employed in conjunction therewith. The construction shown in FIG. 9 is satisfactory so far as presenting a zone of weakness is concerned, but such zone is appreciably narrower than that illustrated in FIGS. 5–7 requiring more care in marking off a straight line to be followed by the saw 62 when the kerf 60 is to be formed in the pavement 14.

It is oftentimes desirable or necessary to also define a line of weakness longitudinally of the pavement 14 and such may be accomplished through use of the machine 10 by virtue of a special penetrating unit 70 as shown in FIGS. 1, 2 and 8. Whereas the plates 44 and 66 of the penetrating implements above described are disposed horizontally, plate 72 of the unit 70 is vertically disposed and provided with a leading protuberance 74 at the lowermost and forwardmost edges thereof. Such protuberance 74 supports opposed rows 76 and 78 of horizontally disposed, elongated tines 80.

It is noted that the forwardmost ends of the tines 80 are welded directly to the protuberance 74 on opposite faces thereof and that all of the tines 80 extend rearwardly from the protuberance 74 throughout substantially the entire length of the plate 72. The two stacks or rows 76 and 78 are, therefore, separated by the plate 72 and the tines 80 thereof are vertically spaced, it being noted that the tines 80 alternate in much the same manner as the tines 50 of implement 24.

Plate 72 is carried by a suitable support 82 swingable at the forwardmost end thereof in an eye 84 of a heavy bolt or the like 86, depending from frame 16. A chain 88 secured to the support 82 at the opposite end of the latter, permits swinging of the unit 70 to and from a position penetrating the pavement 14. Chain 88 may be attached in any desired manner (not shown) to the frame 16 to limit the extent of downward swinging movement of unit 70 about the eye 84. A vibrator 90 is preferably mounted directly upon the support 82.

Manifestly, as the machine 10 is advanced with the implement 24 in an elevated position as shown in FIG. 2, the unit 70 continues to move through the concrete and by virtue of the action of the tines 80, the fine and coarse aggregate particles are separated in much the same manner as above described with respect to FIG. 5 of the drawings. Here again, during lateral vibration of the tines 80, as illustrated by the arrow in FIG. 8, the coarse particles are displaced laterally in opposite directions as the cement and the fine particles flow inwardly in and around the tines 80.

Subsequently, if desired, the longitudinal line of weakness may be provided with a kerf coincident with such zone of aggregate separation through use of conventional cutting mechanisms having saws or the like 62.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. In a road joint machine for use with plastic concrete of a road under construction wherein the concrete contains fine and coarse aggregates, the improvement of which comprises a support; an elongated furcate implement carried by and depending from the support, said implement being provided with a series of substantially vertically disposed, horizontally spaced tines extending downwardly from said support, said tines being spaced apart a distance sufficient to permit said fine aggregates to pass therebetween and insufficient to permit the major portion of said coarse aggregates to pass therebetween when the tines are caused to penetrate said plastic concrete; mechanism mounting the support and thereby the implement on the machine for vertical reciprocation toward and away from the latter, said implement being normally disposed in relatively close proximity to the road to cause the tines to penetrate the plastic concrete and to force the coarse aggregates laterally and downwardly as the support approaches the lowermost end of its path of travel; and means mounted on the machine and operably coupled to said support for vibrating the latter and thereby the implement including said tines in opposed directions transverse to the longitudinal axis of said implement and in substantially horizontal planes, whereby the coarse aggregates are forced further laterally of said tines to present a relatively narrow, linear zone formed by said fine aggregates alone and adjacent the area of penetration of the plastic concrete by said tines.

2. A machine as set forth in claim 1 wherein said tines comprise a single horizontally aligned row of generally cylindrical, rectilinear members of equal length and movable in a substantially vertical plane.

3. A machine as set forth in claim 1 wherein each

of the tines is provided with an inclined, lowermost terminal end extending in the direction of movement of the machine.

4. A machine as set forth in claim 1 wherein said implement is provided with two rows of spaced tines extending the full width of the support, the tines of one row being interleaved with the tines of the opposite row.

5. A machine as set forth in claim 4 wherein the lowermost terminal ends of the tines of both of said rows are laterally inclined in the direction of movement of the machine, said terminal ends of each row of tines sloping inwardly toward said terminal ends of the opposed row of tines and the terminal ends of each row of tines overlapping the terminal ends of the opposite row of tines.

6. In the method of making a road joint along a narrow zone wherein during construction of the road, the materials of the road include a plastic concrete containing fine and coarse aggregates, the steps of which comprise:

applying spaced forces to the major portion of said coarse aggregates in said zone when the concrete is in a plastic condition to move said coarse aggregates toward the lateral and lower extremities of said zone while the fine aggregates remain within the zone;

applying alternating, horizontal forces to the coarse aggregates adjacent the lateral extremities of the zone when the concrete is in a plastic condition to move said coarse aggregates out of said zone;

permitting said concrete to set; and

forming a kerf in said zone after the concrete has set.

7. A method as set forth in claim 6, wherein said spaced forces and said alternating forces are applied simultaneously.

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