Jan. 23, 1968 L. L. SHOPE ETAL 3,364,828

STRIP INSERTING APPARATUS

Filed April 11, 1966 3 Sheets-Sheet 1

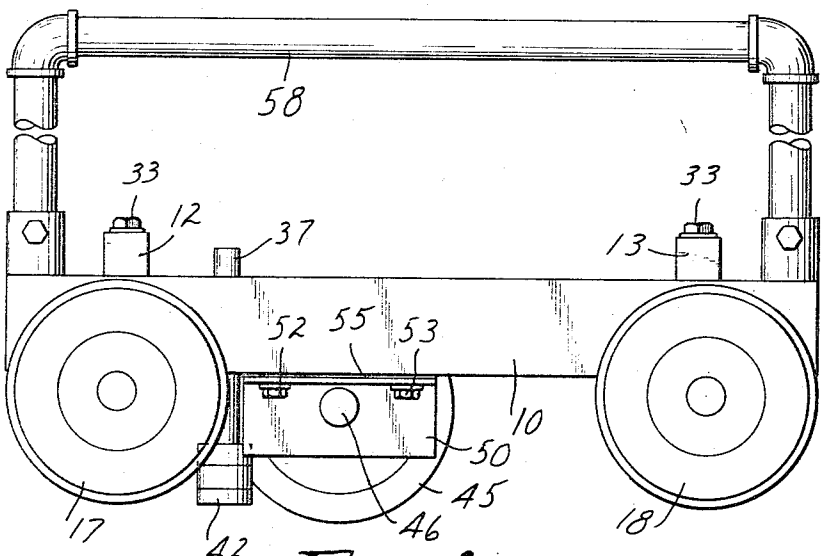


FIG. 1

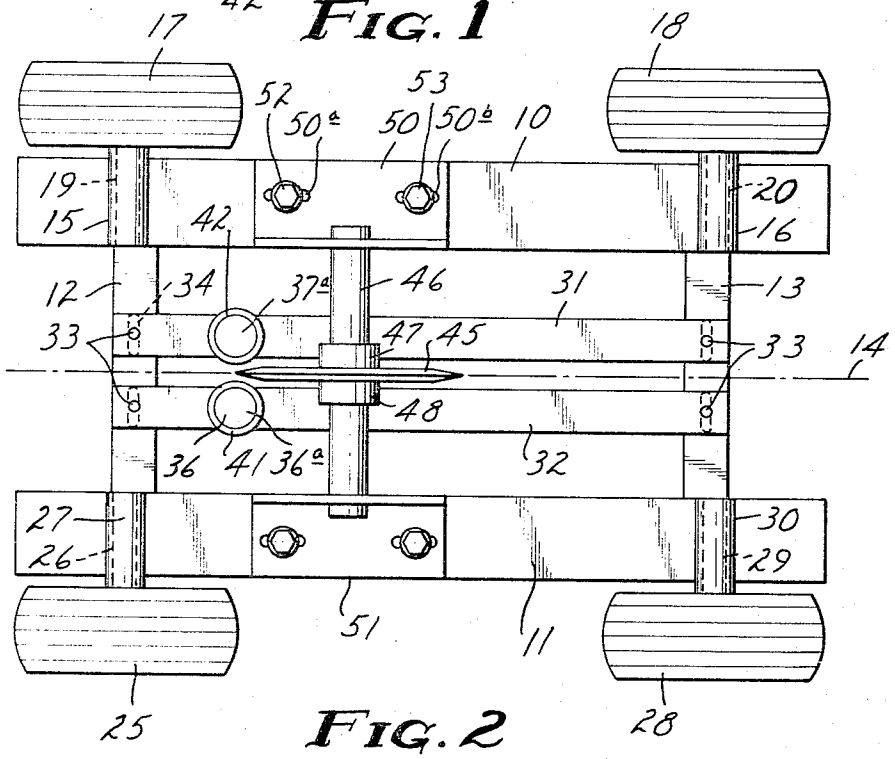


FIG. 2

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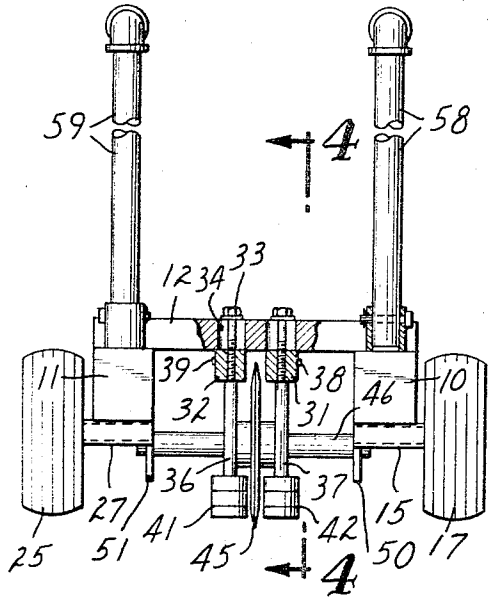


FIG. 3

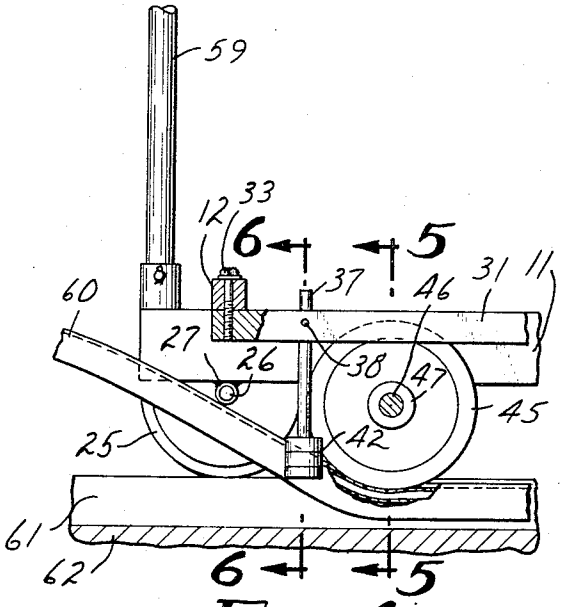


FIG. 4

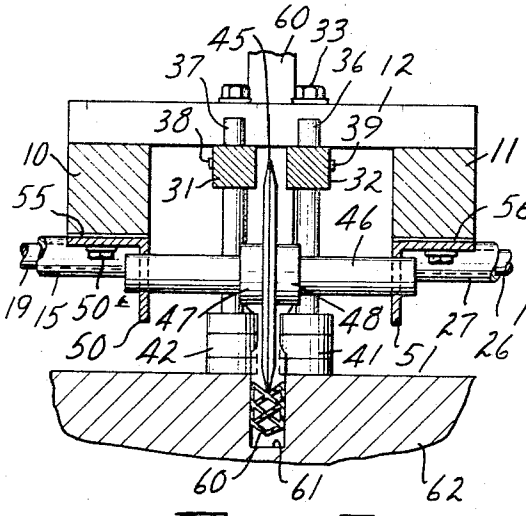


FIG. 5

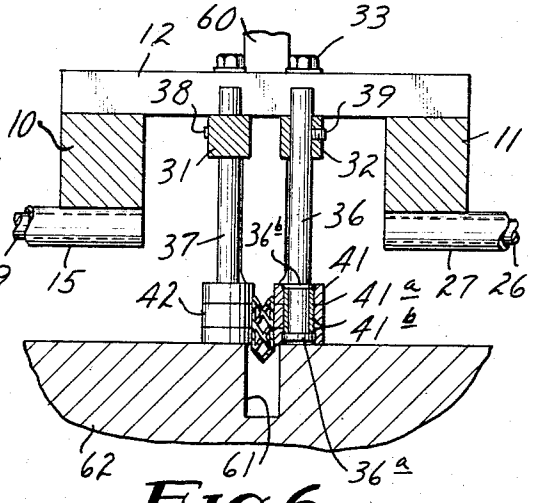


FIG. 6

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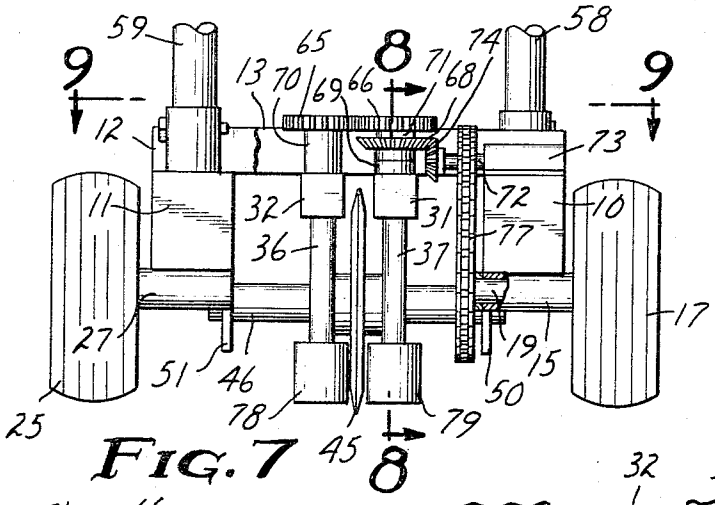


FIG. 7

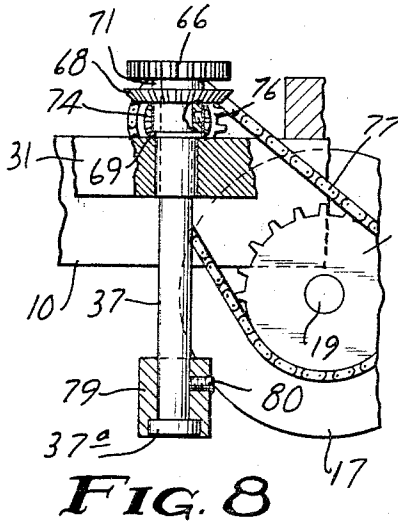


FIG. 8

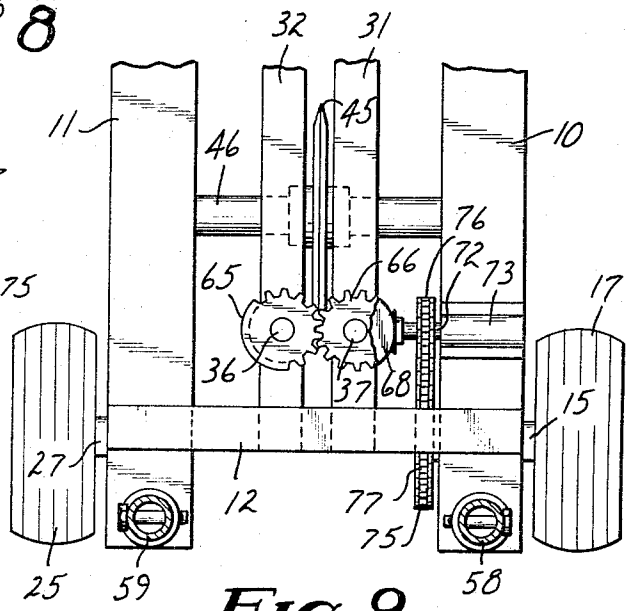


FIG. 9

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STRIP INSERTING APPARATUS

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Filed Apr. 11, 1966, Ser. No. 541,565
7 Claims. (Cl. 94—39)

ABSTRACT OF THE DISCLOSURE

Apparatus for compressing a strip of resilient material and inserting it downwardly into a paving joint. A pair of vertically and horizontally adjustable compression rollers are mounted on a frame provided with wheels for moving it over the paving joint. A circular disk having a tapered peripheral edge is mounted rearwardly of the rollers and extends downwardly into the joint. The strip is thus passed between the rollers to compress it and the disk then presses the compressed strip downwardly into the joint where it expands to fill and seal the joint. In one embodiment, means are provided to rotate the compression rollers to draw the strip between the rollers at the proper rate.

This invention relates generally to apparatus for inserting a strip of resilient material into an elongated slot formed in a generally flat surface, and more particularly relates to apparatus for compressing an elongated strip of resilient material and forcing the strip downwardly into a paving joint.

For many years it has been common practice to provide expansion joints in various structures, especially in concrete roadways or pavements. Unless such joints are provided at regular intervals, such structures will destroy themselves because of the stresses set up in them during the expansion and contraction thereof.

Although the use of expansion joints does prevent destruction of such structures due to the forces of expansion and contraction, it adds new problems that can equally as well destroy the structures. For example, unless the joints are properly sealed, it is possible for water to seep into them to greatly increase the moisture content of the subsurface. When freezing occurs, the excess moisture can cause buckling of the pavement slabs. In addition, excess moisture can reduce the strength of the soil beneath the pavement slab. In any case, seepage of water into expansion joints is undesirable.

Unless the joints are properly sealed, it is also possible for sand or other foreign material to enter the joints. Such foreign material may well be incompressible, causing the slabs to crack as they expand.

The best approach to the problem of sealing such joints is that of inserting a strip of resilient, compressible material into the joint, where it expands to completely seal the joint. For this purpose, the joint is preferably first formed so as to have uniform depth and width. The sawed or formed joint is then swept clean, and any cracks or spalls in the joint faces are patched with a suitable material. Prior to insertion of the sealing strip, a lubricant may be applied to the sides of the joint to facilitate installation. The lubricant may also have adhesive properties to tightly seal the strip to the sides of the joint after installation.

The particular type of sealing strip that is used is not critical to my invention. Generally speaking, the strip should be manufactured from a material that is both durable and resilient. The strips must be capable of completely sealing the joint under all conditions. When the pavement slabs are expanded to their maximum length, the strip must compress without unduly extruding from

the joint. When the slabs contract, the strip must expand to continue to seal the now wider joint.

A material that is commonly used in joint seals at the present time is neoprene synthetic rubber. Such a seal is typically extruded into a hollow strip that is wider than the paving joint. The hollow neoprene strip is compressed to about half its width and inserted into the open joint. Once inserted, the strip expands and exerts pressure against both sides of the joint to prevent the entrance of water or incompressible materials that could damage the slabs.

Since the joint sealing material is extruded into an elongated strip that is wider than the paving joint, the strip must be compressed and then forced downwardly into the paving joint before it is allowed to again expand. Accordingly, our invention provides a new and unique apparatus for rapidly inserting such seals. Our invention provides vertically and horizontally adjustable rotary compression means mounted closely adjacent the surface of the pavement to compress the strip to a width not greater than the width of the sealing joint. Mounted in close proximity to and rearwardly of the strip compressing means is an adjustable strip depressing means that drives the compressed strip downwardly into the paving joint before it has had the opportunity to expand to its normal width. The apparatus of our invention can be rolled rapidly over the paving strip to compress and insert the strip in a single continuous operation.

It is therefore a primary object of our invention to provide apparatus for rapidly and continually inserting a strip of compressible resilient material into a paving joint in a manner such that the strip is inserted while it is compressed to a width not greater than the width of the joint into which it is inserted.

Other objects of the present invention which will become apparent from a reading of the following specification and claims, taken in connection with the accompanying drawings, wherein:

FIG. 1 is a side view of our invention, with portions thereof cut away;

FIG. 2 is a bottom plan view of our invention;

FIG. 3 is a front view, somewhat reduced in size, of our invention, with portions thereof cut away and portions shown in section;

FIG. 4 is a sectional view of our invention taken substantially along line 4—4 of FIG. 3;

FIG. 5 is a sectional view, somewhat enlarged in size, of our invention, taken along line 5—5 of FIG. 4;

FIG. 6 is a sectional view, somewhat enlarged in size, of our invention taken substantially along line 6—6 of FIG. 4;

FIG. 7 is a front view of a modification of our invention, disclosing means for driving the compression rollers with some portions broken away to more clearly show the drive means and some portions shown in section;

FIG. 8 is a sectional view, somewhat enlarged in size, of a portion of our modified invention, taken along line 8—8 of FIG. 7; and

FIG. 9 is a top view of a portion of our modified invention, taken along line 9—9 of FIG. 7.

Referring now to the various figures wherein like reference characters denote like parts, there is disclosed a frame for supporting our apparatus having a pair of parallel side members 10 and 11. Although shown in the drawings as being manufactured from a solid piece of material having a generally rectangular cross section, it is also possible to construct side members 10 and 11 from another material such as angle iron. Side members 10 and 11 are held in a fixed parallel relationship by a pair of cross members 12 and 13 welded or otherwise connected to the upper surfaces thereof. A rigid generally

rectangular frame results having a longitudinal axis of symmetry 14, as shown in FIG. 2.

Attached to the bottom of side member 10 by a pair of tubular bearing members 15 and 16 that are welded to side member 10 are a front wheel 17 and a rear wheel 18 respectively. Front wheel 17 is mounted on a stub axle 19 that extends into tubular member 15. Rear wheel 18 is mounted on a stub axle 20 that extends into tubular members 16. On the opposite side of the frame, a front wheel 25 mounted on a stub axle 26 is attached to the front end of side member 11 by means of a tubular member 27 welded to side member 11. A rear wheel 28 mounted on a stub axle 29 is attached to the rear end of side member 11 by means of a tubular member 30 welded to side member 11.

Wheels 17, 18, 25, and 28 support the frame a predetermined distance above the pavement surface and provide means for easily moving the frame along the joint into which the strip is being inserted.

Mounted between cross members 12 and 13 are a pair of support members 31 and 32. Support members 31 and 32 are mounted on opposite sides of axis 14 in parallel therewith. The ends of support members 31 and 32 are attached to cross members 12 and 13 by means of bolts. As a specific example, bolts such as 33 extend through holes in support members 31 and 32 and slots such as 34 cut in cross members 12 and 13 to adjustably connect support members 31 and 32 to cross members 12 and 13. With this bolt and slot arrangement being used to connect each end of support members 31 and 32 to cross members 12 and 13, support members 31 and 32 can be moved closer together or further apart as necessary for the particular application.

Mounted beneath support members 31 and 32 is a pair of supporting shafts 36 and 37. Supporting shafts 36 and 37 are mounted on opposite sides of axis 14 and extend vertically downwardly in a parallel relationship. If a first vertical plane can be considered as passing through axis 14, shafts 36 and 37 lie in a second vertical plane perpendicular to the first vertical plane. Shafts 36 and 37 extend slightly less than the predetermined distance below the frame so that they terminate just above the surface over which the frame is being moved.

The top ends of shafts 36 and 37 extend upwardly through support members 31 and 32, and means are provided to set and lock the shafts at a selected position with respect to the support members. The means for adjusting the vertical position of the shafts 36 and 37 include holes drilled upwardly through support members 31 and 32 through which the shafts extend. A pair of set screws 38 and 39 extend horizontally through the sides of support members 31 and 32 respectively to lock shafts 37 and 36 at any selected position.

Mounted on the bottom ends of shafts 36 and 37 are a pair of compression rollers 41 and 42. In the preferred embodiment of our invention, rollers 41 and 42 are in the form of a right circular cylinder and are mounted on shafts 36 and 37 so as to rotate about their longitudinal axis. FIG. 6 discloses roller 41 in section. Roller 41, for example, includes an outer shell 41*a* and an inner bearing surface 41*b*. Bearing surface 41*b* is in direct contact with shaft 36. A cap 36*a* on shaft 36 prevents downward movement of roller 41 with respect to the shaft. Flange 36*b* formed in the lower half of shaft 36 prevents roller 41 from moving upwardly on shaft 36. Roller 42 is mounted on shaft 37 in the same manner as roller 41 is mounted on shaft 36.

It should again be noted at this point that shafts 36 and 37 are adjustable vertically by means of set screws 38 and 39, and are also adjustable horizontally by means of the bolt and slot arrangement that attaches support members 31 and 32 to cross members 12 and 13. The distance at which rollers 41 and 42 are carried above the pavement can thus be adjusted for optimum performance and their spacing apart can also be adjusted to determine the amount of compression of the strip.

Also mounted on the frame is a circular disc 45 having a tapered or V-shaped peripheral edge. Disc 45 is mounted for rotation in the first vertical plane extending through axis 14, on a transverse shaft 46. Disc 45 is mounted at a fixed position on shaft 46 by means of a pair of clamping members 47 and 48 that are attached to shaft 46 on opposite sides of disc 45. Shaft 46 is supported for rotation at each end by a pair of frame extension members 50 and 51. In the preferred embodiment of our invention, frame extension members 50 and 51 are constructed from metal that is formed at a right angle. Extension member 50, for example, has one portion thereof, bolted to the under side of side member 10 and a second right angled portion thereof extending vertically downwardly. A pair of slots 50*a* and 50*b* are formed in the first portion of extension member 50 through which mounting bolts 52 and 53 extend. Similar adjustment means are provided on extension member 51. Extension members 50 and 51 can thus be moved either in a forward or rearward direction with respect to the frame.

The downwardly extending portions of frame extension members 50 and 51 have a hole formed therein corresponding in size to shaft 46. The ends of shaft 46 extend through these holes for support and rotation therein. Referring for a moment to FIGS. 1 and 5, it can be seen that a pair of shims 55 and 56 is mounted between the frame extension members 50 and 51 and the frame. Frame extension member 50, for example, is thus spaced a distance below side member 10 determined by the thickness of shim 55. The same is true of the relationship among extension members 51, shim 56 and side member 11. The distance that disc 45 extends below the frame can therefore be changed by changing the number or sizes of the shims 55 and 56. Disc 45 can thus be moved not only in a fore-and-aft direction, but also in an up or down direction.

The means for moving the apparatus over the surface include a pair of tubular handles 58 and 59 that are bolted firmly to and extend upwardly from side members 10 and 11 respectively.

The operation of our invention as disclosed in FIGS. 1–6 is as follows. The elongated strip of resilient material 60, as shown in FIGS. 4, 5, and 6, is designed to be inserted into a joint 61 in a pavement 62. As best shown in FIGS. 5 and 6, strip 60 is a cellular structure having parallel side walls with a concave generally V-shaped upper surface and a similar convex lower surface.

The inserting apparatus is placed on the pavement with axis 14 aligned directly above joint 61. Axis 14 and joint 61 would thus lie in a common first vertical plane. The inserting apparatus is rolled along pavement 62 by means of manual pressure exerted against the rear of handles 58 and 59. Strip 60 is inserted between rollers 41 and 42 that are spaced apart a distance not greater than the width of joint or slot 61. As strip 60 passes between rollers 41 and 42, it is compressed thereby so that it can be inserted in slot 61. Disc 45, which lies rearwardly of rollers 41 and 42 makes contact with the upper side of strip 60 before it leaves rollers 41 and 42. Since the bottom edge of disc 45 extends below rollers 41 and 42, strip 60 is forced downwardly from between the rollers by disc 45. Disc 45 also extends into joint 61. Disc 45 therefore drives strip 60 vertically downwardly into joint 61. As shown in FIG. 5, strip 60 expands as soon as it is inserted to thereby seal joint 61.

From FIG. 6 it can be seen that the adjoining edges of rollers 41 and 42 are parallel so that strip 60, in passing between the rollers, is compressed an equal amount throughout its depth.

Referring now to FIGS. 7–9, there is discolsed a modified form of our invention in which means are provided for driving the compression rollers in a counter rotating

direction during movement of the frame along the joint to thereby draw the strip between the rollers at a rate equal to that at which the frame is moving to thereby prevent stretching of the strip. In FIG. 7, a front view, cross member **12** has been cut away to completely reveal the driving means for a pair of rollers **78** and **79** hereafter to be described. Mounted at the top of shaft **36** is a drive gear **65** that meshes with a drive gear **66** mounted at the top of shaft **37**. Mounted below gear **66** on shaft **37** is a bevel gear **68** that is supported a fixed distance above support member **31** by a collar or spacer **69**. Bevel gear **68** is suppored a fixed distance away from gear **66** by a hub **71** of gear **68**. This mounting of gears and spacers places shaft **37** at a fixed vertical position with respect to support member **31**. To bring shaft **36** and gear **65** to the same respective position, a spacer **70** is mounted on shaft **36** between gear **65** and support member **32**. Gear **65** then meshes with gear **66**. A rotatable stub shaft **72** is rotatably mounted on side member **10** by means of a housing member **73**. Attached to the end of stub shaft **72** is a bevel gear **74** that meshes with bevel gear **68**.

In the mounting of rollers **78** and **79** to shafts **36** and **37**, respectively, there is provided a cap **37***a* that prevents roller **79** from moving downwardly on shaft **37**. Also provided is a set screw **80** to fixedly attach roller **79** to shaft **37**. Roller **78** is attached to shaft **36** in like manner.

Attached to the inner end of an extended drive axle **19** is a drive gear **75**. Mounted on stub shaft **72** is a similar yet smaller driven gear **76**. A drive chain **77** is meshed with gears **75** and **76**.

Operation of the system shown in FIGS. 7–9 is as follows. Ground engaging wheel **17** provides power to drive rollers **78** and **79** as the apparatus is moved over the surface. Rotation of wheel **17** causes rotation of axle **19** to which drive gear **75** is attached. Rotation of gear **75** is transmitted to gear **76** by means of chain **77**. Rotation of gear **76** causes rotation of stub shaft **72** which is transmitted to shaft **37** via the bevel gears **74** and **68**. Shaft **37** is thus driven in a first direction by wheel **17**. Gear **66** transmits the rotation of shaft **37** to shaft **36** through gear **65**. Shaft **36** thereby rotates in the opposite direction but at the same speed. Rollers **78** and **79**, since they are attached to shafts **36** and **37**, counter rotate to draw strip **60** between them as the apparatus moves over the surface. The drive system is designed so that strip **60** is drawn between the rollers at the same rate as the apparatus moves over the ground. Stretching of strip **60** is eliminated as a result of the lowering of friction between the strip and the counter rotating rollers.

Although we have described both a preferred form and a modified form of the invention herein, many other forms of our invention will be apparent to those skilled in the art. We therefore do not intend to be limited by our disclosure, but only by the scope of the appended claims.

What is claimed is:

1. Apparatus for horizontally compressing an elongated strip of resilient material and forcing said strip vertically downward into a paving joint, comprising:

(a) a frame having a longitudinal axis;

(b) means for supporting said frame a predetermined distance above the top of the paving joint and for moving said frame along the joint, said longitudinal axis lying in a first vertical plane common to said joint during operation of said apparatus;

(c) a pair of compression roller supporting shafts each having top and bottom ends;

(d) means for mounting said top ends of said shafts in said frame on opposite sides of said first vertical plane with said shafts vertically disposed in a parallel relationship and lying in a second vertical plane perpendicular to said first vertical plane, said bottom ends being disposed less than said predetermined distance below said frame;

(e) a compression roller having the shape of a right circular cylinder mounted on each of said bottom ends for rotation about said associated shaft, said shafts being located on said frame such that said rollers are spaced apart a distance not greater than the width of the paving joint, said rollers lying closely adjacent the paving surface during operation of said apparatus;

(f) a circular disc having a V-shaped peripheral edge; and

(g) means for mounting said disc below said frame rearwardly of said shafts for rotation in said first vertical plane, the bottom edge of said disc extending beyond said predetermined distance below said frame to thereby extend into the paving joint, said strip of resilient material passing rearwardly between said rollers for compression thereby and being driven vertically downwardly by said disc into the paving joint where said strip expands to seal the joint.

2. Apparatus for inserting a strip of resilient material into an elongated slot formed in a generally flat surface, comprising:

(a) a frame lying in a horizontal plane;

(b) a pair of compression rollers mounted on said frame for counter rotation about generally parallel axes, said axes lying in a second plane that is perpendicular to said horizontal plane, said rollers being spaced apart a distance not greater than the width of the slot and extending a predetermined distance from said frame;

(c) a thin, circular strip depressing disc mounted on said frame for rotation in a first plane mutually perpendicular to said horizontal and second planes, said first plane extending between said rollers, said disc extending beyond said predetermined distance from said frame, whereby a resilient strip passing between said rollers in said first plane is compressed thereby and is forced from between said rollers in a direction away from said frame by said disc;

(d) means for supporting said frame a distance not less than said predetermined distance above the surface and for moving said frame along said surface with said disk extending into the slot so that said strip is forced into the slot by said disk; and

(e) said disk having a tapered peripheral edge to reduce the amount of frictional force required to free said disk from the compressed strip after the strip is inserted in the slot.

3. The apparatus of claim **2** wherein said rollers are mounted on a pair of shafts that extend upwardly through said frame, wherein first adjustment means are provided to set and lock said rollers at a selected position within a predetermined range of distances from said frame, and wherein second adjustment means are provided on said frame to adjust the spacing between said rollers.

4. The apparatus of claim **2** wherein said disc is rotatably mounted on a third shaft extending parallel to said horizontal plane and to said second plane, and wherein adjustable mounting means attached to said frame are provided to support each end of said third shaft so that said third shaft can be adjusted both in a plane parallel to said horizontal plane and in a plane parallel to said second plane.

5. The apparatus of claim **2** wherein a peripheral edge of said disc rotates between opposing portions of said rollers so that a strip passing between said rollers is engaged by said disc before leaving said rollers.

6. The apparatus of claim **2** including means for driving said compression rollers in a counter rotating direction during movement of said frame along the slot to draw the strip between said rollers at a rate equal to that at which said frame is moving, to thereby prevent stretching of the strip.

7. The apparatus of claim **2** wherein means are provided to drive said compression rollers, comprising:

(a) means including ground engaging wheels mounted on said frame for supporting said frame and for moving said frame over the slot in the surface; and

(b) driving means including at least one of said wheels for counter rotating said compression rollers to draw said strip between said rollers at a speed corresponding to the speed of said frame over the slot.

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