April 19, 1966 D. D. BROWN 3,246,390

TOOL FOR COMPRESSING AND INSERTING COMPRESSIBLE STRIPS IN SLOTS

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FIG. 1

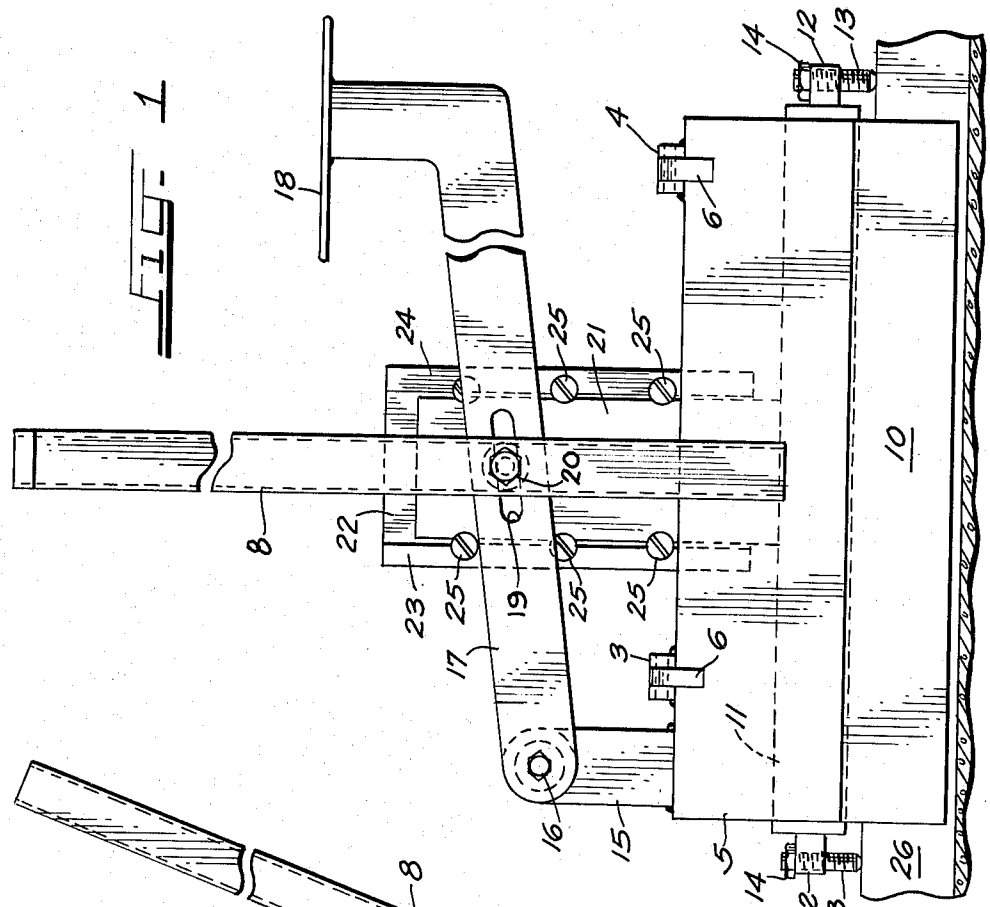
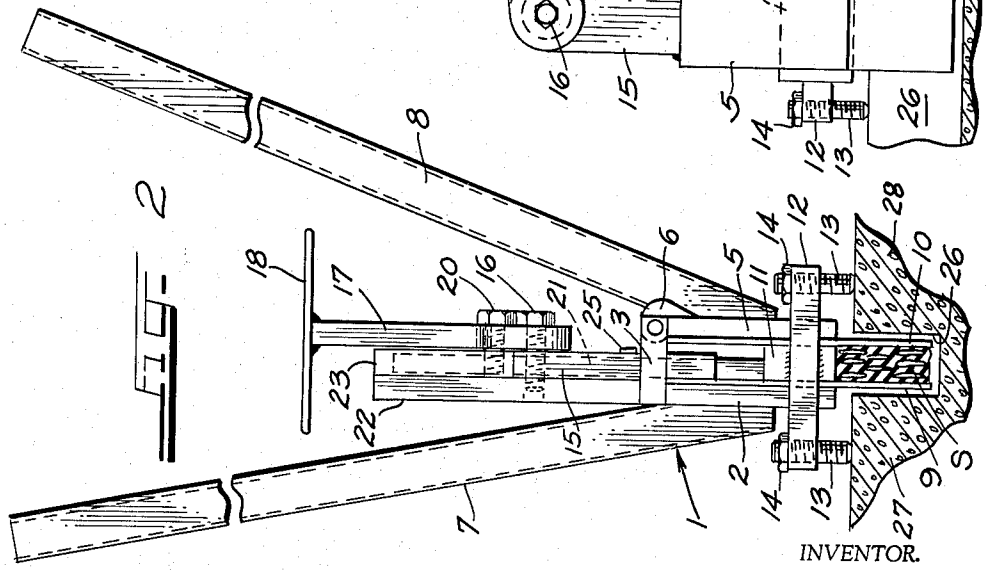


FIG. 2



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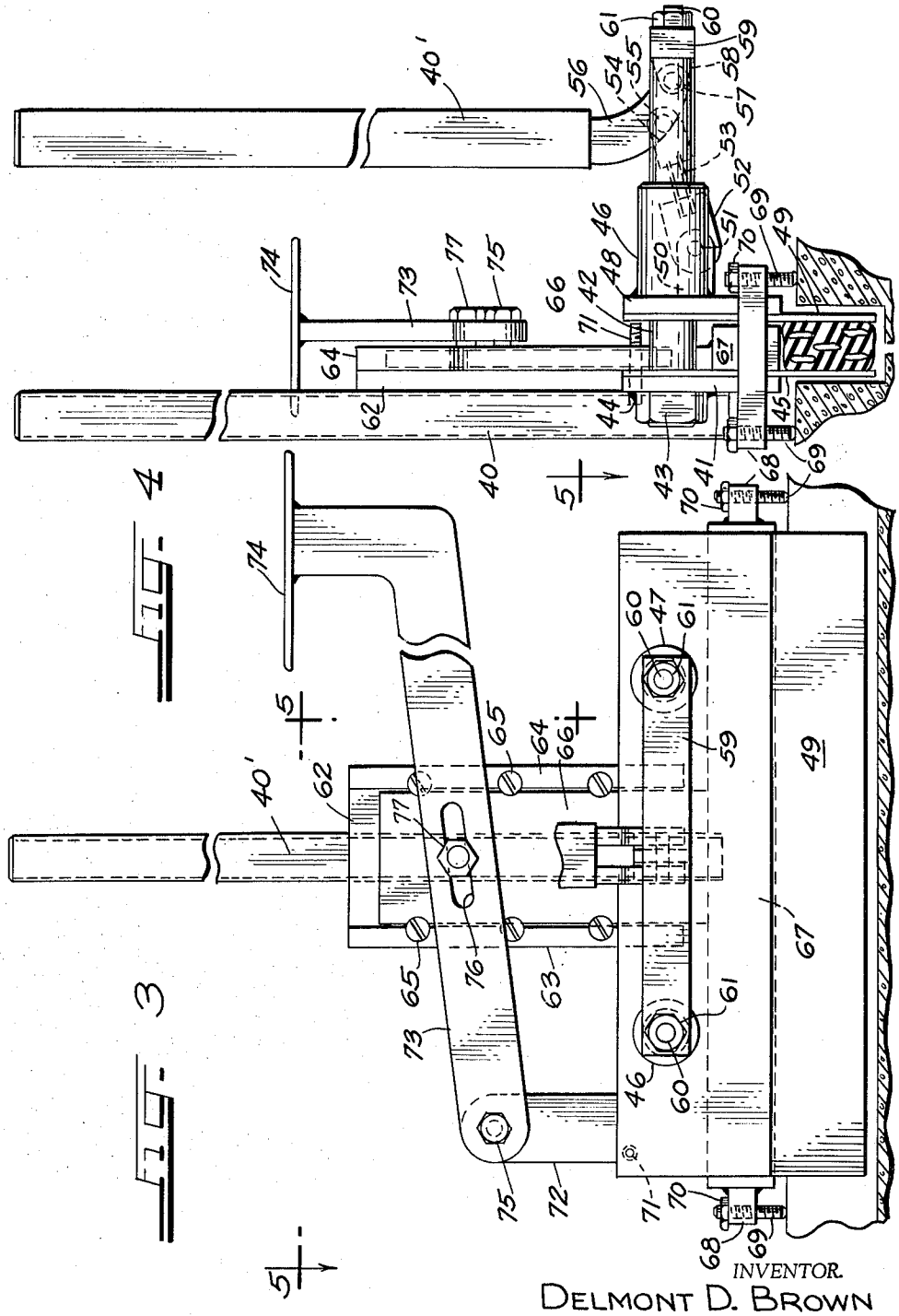


FIG. 4

FIG. 3

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FIG. 5

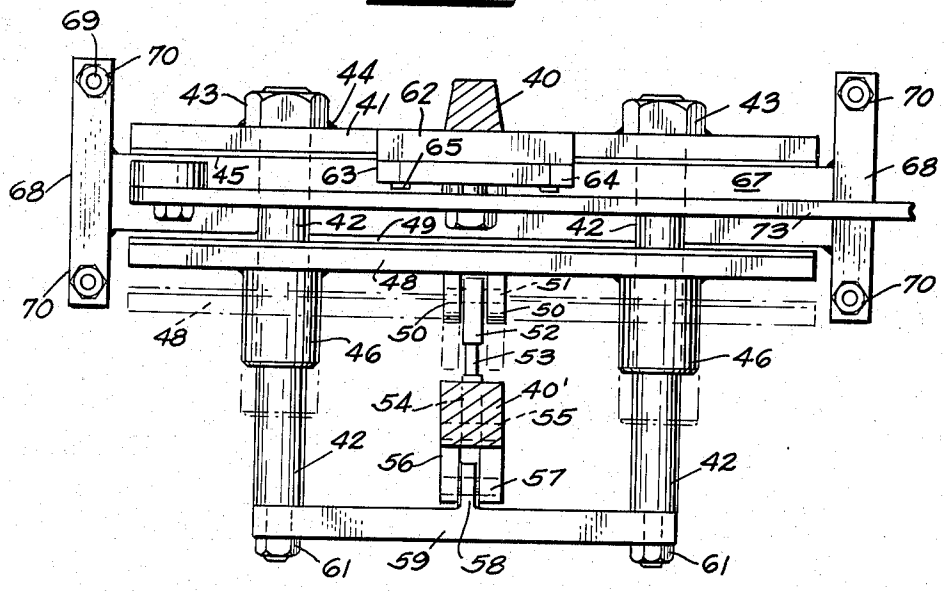
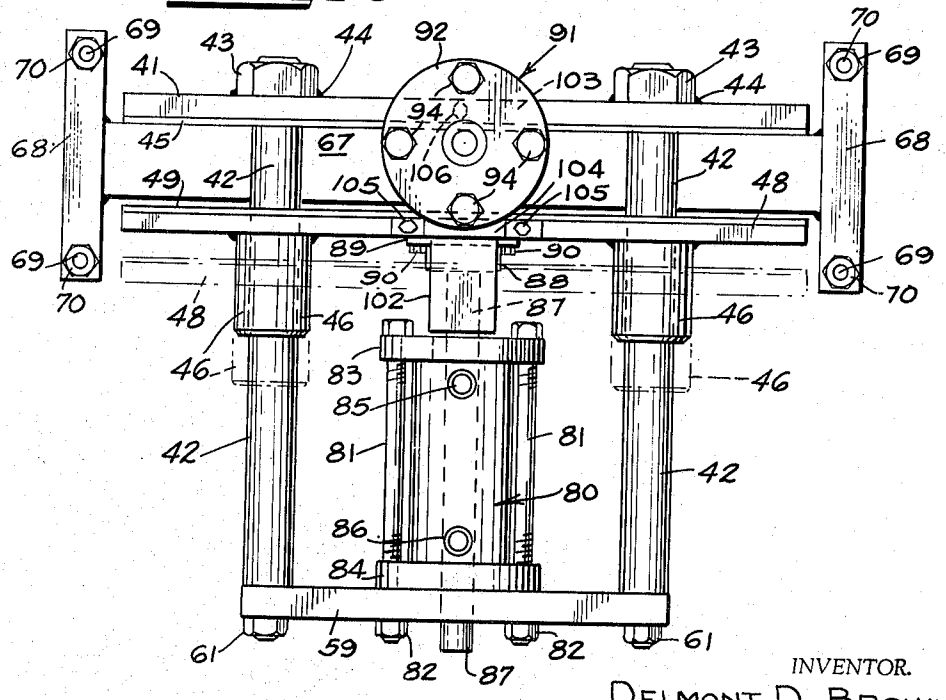


FIG. 6



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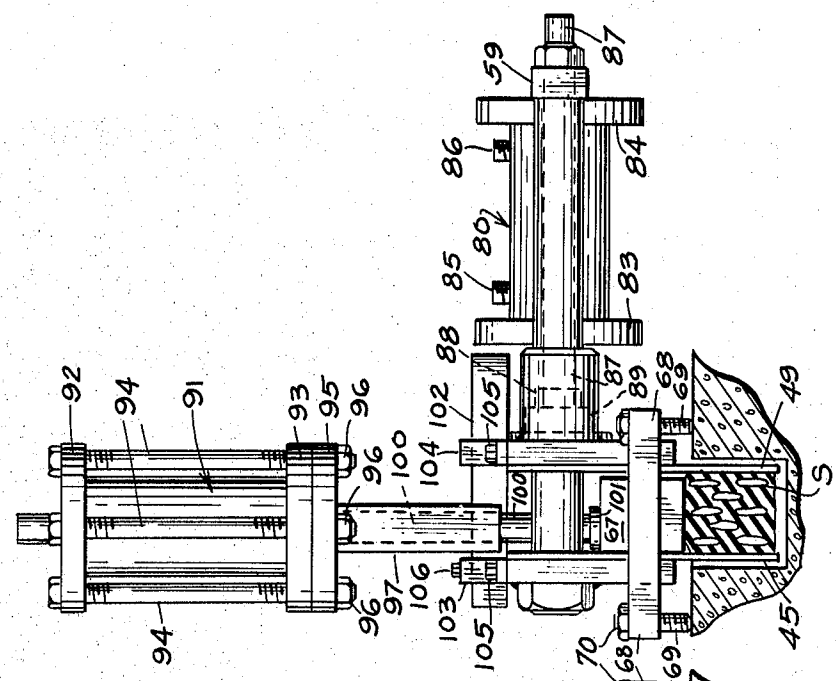


FIG. 8

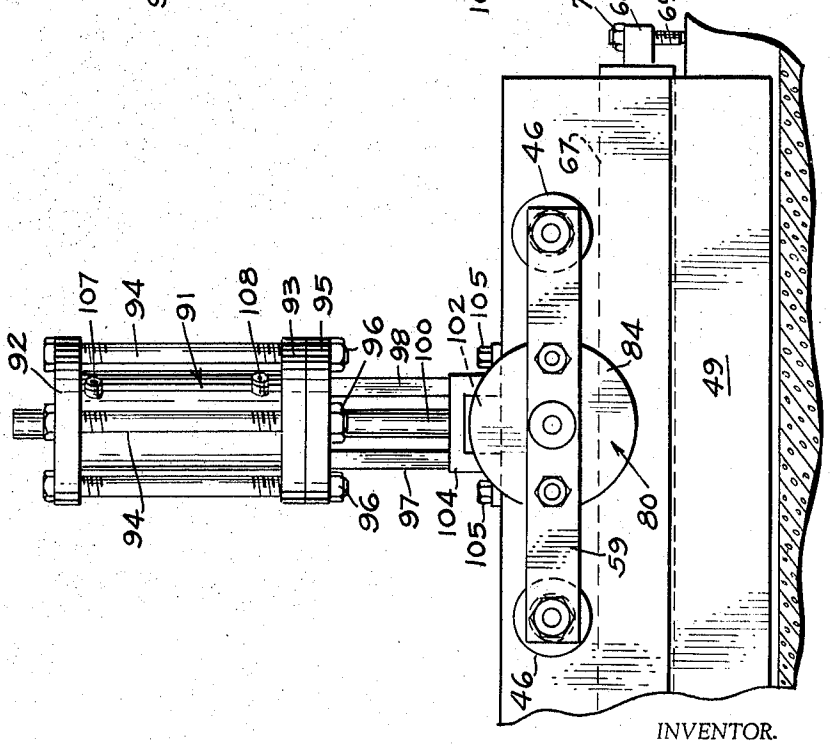


FIG. 7

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United States Patent Office 3,246,390 Patented Apr. 19, 1966

3,246,390

TOOL FOR COMPRESSING AND INSERTING COMPRESSIBLE STRIPS IN SLOTS

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6 Claims. (Cl. 29—235)

This invention, in general, relates to tools for compressing and inserting strips in slots. The invention is particularly adapted for compressing and inserting resilient highway joint seals in the slots formed by highway joints or bridge joints between concrete sections thereof.

In recent years, there have been developed for use as highway joint seals and bridge joint seals elastomer strips which are inserted into highway and bridge joints to seal the joints against intrusion by water, dirt and the like. The sides of the joint seal strips are in tight, sealing contact with the side walls of the slots forming the joints.

This invention pertains to tools for compressing strips of this character and the like to a width wherein they can be inserted into the slot, after which the strip is ejected from the tool and is allowed to expand outwardly against the side walls of the slot.

The tools of this invention are designed to compress a length of a compressible strip between a pair of compression plates to a width at which the compression plates and the compressed strip can be inserted into the slot. The compression plates are then withdrawn from the slot while another segment of the tool prevents the strip from rising out of the slot with the compression plates. In this manner, the strip is ejected from the tool and is allowed to expand transversely outwardly to tight, sealing contact with the side walls of the slot. The tools of the invention may be manually operated or power operated.

It is, accordingly, a primary object of this invention to provide tools for compressing a compressible strip or a segment thereof and inserting and ejecting the compressed strip in a slot, such as a highway or bridge joint. Another object of the invention is to provide tools wherein a resilient strip may be compressed between a pair of compression plates, inserted in the compressed state into a slot, and ejected from the tool into the slot as the compression plates are withdrawn. A still further object of the invention is to provide improvements in mechanism for compressing and ejecting compressible strips. Still another object of the invention is to provide improvements in tools for inserting resilient highway and bridge joint seals in joints between concrete sections of the highway or bridge.

The foregoing and numerous other important objects, advantages, and inherent functions of the invention will become apparent as the same is more fully understood from the following description, which, taken in connection with the accompanying drawings, discloses preferred embodiments of the invention.

In the drawings:

FIG. 1 is a side elevation, partially in fragment, of an embodiment of the invention in which one of the compression plates is pivotable;

FIG. 2 is a front elevation of the embodiment of FIG. 1 with the lower portion of the compression plates inserted in a highway joint with a compressible strip compressed therebetween;

FIG. 3 is a side elevation of another embodiment of the invention wherein the compression plates have relative reciprocal motion providing a straight-line compression motion;

FIG. 4 is a front elevation of the embodiment of FIG. 3 with the lower portion of the compression plates inserted in a highway joint with a compressible strip compressed therebetween;

FIG. 5 is a cross-sectional view taken on line 5—5 of FIG. 3;

FIGS. 6, 7 and 8 are, respectively, a top plan view and side and front elevations of a power-operated tool of the invention.

Referring to the drawings, the embodiment of FIGS. 1 and 2 comprises a tool 1 having a frame plate 2 extending longitudinally and horizontally of the tool. The frame plate 2 has welded to its upper edge a pair of spaced, cross bars 3, 4 on which are pivotally mounted by means of hinges 6 journalled in the cross bars 3, 4 a longitudinally-extending frame plate 5.

The frame plate 2 has fixedly attached thereto, e.g., by welding, an upwardly-directed handle or rod 7, while the pivotally mounted frame plate 5 has similarly fixedly attached thereto an upwardly-directed rod or handle 8, both rods or handles being shown in fragment. A compression plate 9 is fixedly being shown in fragment. A compression plate 9 is fixedly attached to the inner surface of the frame plate 2 and projects downwardly beyond the lower edge of the frame plate 2. A similar compression plate 10 is fixedly attached to the inner surface of the pivotable frame plate 5. The lower portions of the compression plates 9, 10 are used to compress the compressible strips therebetween when the pivotable frame plate 5 and its compression plate 10 are pivoted toward the frame plate 2 and its compression plate 9 by pushing outwardly on the handle or rod 8.

The tool 1 has a retainer bar 11 positioned between and extending longitudinally of the compression plates 9, 10. This retainer bar 11 restrains the compressible strip S from being withdrawn from a slot in which the strip is inserted when the compression plates 9, 10 are retracted from the slot by means of mechanism described hereafter. At each end of the retainer bar 11 there is a cross bar 12 in which are threadedly mounted a pair of screws 13. The lower ends of the screws 13 act as feet which rest upon the upper surfaces of concrete sections or the like on opposite sides of the slot into which the strip is to be inserted. The relative height of the tool with reference to the slot can be adjusted by adjusting the screws 13 and locking them in position by lock nuts 14. This height adjustment allows the strip S to be inserted in the slot to the desired depth.

The mechanism for retracting the compression plates 9, 10 from the slot is, in this embodiment, a foot operated mechanism. The frame plate 2 has rigidly mounted thereon, e.g., by welding, upwardly-extending arm 15 in which is threaded a bolt 16. The bolt 16 serves as a pivot axis between the arm 15 and lever arm 17, shown in fragment, on which is provided a foot tread plate 18.

The lever arms 17 has a longitudinal slot 19 through which extends in slidable relationship with the slot 19 the shank of a bolt 20. The bolt 20 is threadedly mounted in upwardly-extending plate 21 rigidly attached to the retainer bar 11. The plate 21 is reciprocable in a channel formed by a back plate 22 rigidly mounted on the frame plate 2 and by side bars 23, 24 attached by screws 25 to the back plate 22 along the vertical side edges of the latter. The heads of the screws 25 slightly overlap the plate 21 and thereby prevent displacement of the plate 21 from the U-channel formed by the back plate 22 and side bars 23, 24.

By aplying foot pressure to the foot tread 18, the lever arm 17 becomes a first class lever with its fulcrum at the bolt 20. An upward force is transmitted via the bolt 16 to the arm 15 which, in turn, causes the unit comprising the frame plate 2, cross bars 3, pivotable frame plate 5, compression plates 9, 10, back plate 22, side bars 23, 24 to move upwardly. Rotation of this unit is prevented by the engagements of the sides of the plate 21 with the inner

sides of the side bars 23, 24. The compression plates are thereby retracted from the slot 26, i.e., a joint between concrete sections 27, 28 of a highway or bridge, while the resilient strip S is restrained against upward movement by its upper surface coming into contact with the lower surface of the retainer bar 11. During the upward movement of the aforesaid unit, the retainer bar 11, its arms 12 and plate 21 remain fixed. Thus, the resilient strip S is ejected from the tool and is allowed to expand into tight, sealing contact with the side walls of the slot or joint 26.

A long strip can be inserted into a slot 26 by compressing a segment of the strip S between the compression plates 9, 10, inserting the compressed segment of the strip in the slot or joint 26 and ejecting the compressed segment in the manner aforedescribed. This operation is progressively repeated along the length of the strip until the entire strip is inserted in the slot or joint.

FIGS. 3 and 4 illustrate still another embodiment of the invention wherein the compression of the compressible strip is achieved by a reciprocal motion of one of the compression plates relative to the other compression plate instead of a pivotal motion. In this embodiment, the tool comprises an upwardly-extending handle or rod 40 rigidly attached to a frame plate 41. The frame plate 41 has mounted thereon a pair of slide rods 42 extending at right angles to the inner face of the plate 41. The slide rods 42 may be mounted on the frame plate 41 by any suitable rigid mounting means, e.g., by threaded ends of the rods 42 threadedly mounted in nuts 43 rigidly attached to the outer face of the frame plate 41 by welding 44. A compression plate 45, the lower portion of which extends below the lower edge of the frame plate 41, is rigidly attached to the inner face of the frame plate 41.

Each of the rods 42 has slidably mounted thereon a slide head or sleeves 46, 47. The slide heads 46, 47 are rigidly attached, e.g., by welding, to a movable frame plate 48, on which is rigidly mounted compression plate 49.

The slide heads or sleeves 46, movable frame plate 48 and compression plate 49 are thus reciprocable toward and away from the compression plate 45.

The frame plate 48 has a pair of ears 50 projecting outwardly from its outer face. These ears 50 carry a pin 51 on which is pivotally mounted an arm 52. The arm 52 is threadedly connected with a threaded pin 53 to a pivot head 54 rotatably connected by means of pin 55 to a bifurcated, curved lever arm 56. The bifurcated arm 56, in turn, is pivotally connected by means of pin 57 to an ear 58 on a cross bar 59 extending between the slide rods 42 at the outer ends thereof. The cross bar 59 is mounted on the ends of the rods 42 by means of threaded shanks 60 extending from the outer ends of the rods 42 and by nuts 61 threaded on the threaded shank 60. The curved lever arm 56 may have a handle or rod 40' mounted thereon or formed integrally therewith.

Pivotal movement of the curved lever arm 56 and its handle 40' accomplishes the reciprocal motion of the movable frame plate 48 and its compression plate 49. When the handle 40' is pivoted toward handle 40, the force transmitted from the lever arm 56 via pivot head 54, threaded pin 53, pivot arm 52 and ears 50 causes the movable plate 48 and its compression plate 49 to move toward frame plate 41 and its compression plate 45. This, in turn, compresses a compressible strip, or a segment thereof, between the lower ends of the compression plates 45, 49. The compressible strip S in the illustrated case is an elastomer strip in a lattice work form with longitudinally-extending air spaces between webs of elastomer forming the lattice work strip. This type of strip is one type having successful use as a seal for highway and bridge joints. The tool can be used, however, for inserting compressible strips of other types in slots.

The remaining structure of the embodiments of FIGS. 3 and 4 is similar to corresponding structure previously described for the embodiment of FIGS. 1 and 2. The mechanism for withdrawing the compression plates 45, 49 from the slot or joint and the structure for supporting the tool on opposite sides of the slot comprise a back plate 62 fixedly attached to the frame plate 41 and/or the handle 40. The frame plate 62 has mounted along ts opposite vertical edges side bars 63, 64 attached to the back plate 62 by means of screws 65. The heads of screws 65 overlap a guide plate 66 slidable in the U-channel formed by the back plate 62 and side bars 63, 64. Slide plate 66, in turn, is welded or otherwise rigidly attached to a frame bar 67 extending longitudinally of the tool. The frame bar 67 has at opposite ends thereof a pair of cross bars 68 in which are threadedly mounted the threaded pins or screws 69 serving as the feet or support members for the tool. The threaded pins or screws 69 are locked in adjusted position by the lock nut 70.

If it is desired to limit the movement of the movable compression plate 49, the frame plate 41 may have threadedly mounted therein a pair of threaded pins 71, the ends of which act as abutments or stops which limit the movement of the plate 49 in a direction toward plate 45.

The mechanism for withdrawing the compression plates 45, 49 from the slot into which the compressible strip S is to be inserted includes a vertical arm 72 on which is pivotably supported, by means of bolt 75, a lever arm 73 having a foot tread plate 74. The lever arm 73 has a longitudinal slot 76 through which extends the shank of bolt 77, which is threadedly mounted in the slide plate 66.

When the lever arm 73 is pivoted by foot pressure on the foot tread 74 about the fulcrum formed by bolt 77, the force transmitted through bolt 75 and the arm 72 causes frame plates 41 and 48 and the parts mounted thereon to move upwardly. The compression plates 45, 49 are thereby retracted from the slot, while the lower surface of the retainer bar 67 prevents the compressible strip S from rising out of the slot with the compression plates. The resilient strip S, or the compressed segment thereof, is left in the slot, e.g., highway or bridge joint, and it expands, because of its resilient nature, into sealing contact with the side walls of the slot.

The embodiment of FIGS. 6, 7 and 8 is similar in many respects to the embodiments of FIGS. 3 and 4, the major difference being that the lever systems for moving the plate 49 toward plate 45 and for withdrawing the plates 45, 49 from the slot are replaced by air-operated motors or hydraulic motors. Where applicable like numerals have been used to designate like parts.

In this embodiment, a compressed air-operated motor or a hydraulic motor 80, comprising a cylinder with an air-driven or hydraulic fluid-driven piston (not shown) of conventional construction, is mounted on the cross bar 59 by means of long bolts 81 and nuts 82. The bolts 81 extend through flange portions of the end plates 83, 84 of the motor 80. The motor has fluid inlet and outlet nipples 85, 86 to which are connected the hoses of an air pressure or hydraulic pressure device. Fluid, e.g., air or a hydraulic fluid, is supplied under pressure through nipple 86 and exhausted through nipple 85 when a strip is to be compressed between compression plates 45, 49. This moves the piston of the motor and its piston rod 87 toward the compression plate 45. The piston rod 87 is connected by means of coupler 88 having a flange 89 bolted by bolts 90 to the frame plate 48.

With the strip S or a portion thereof compressed between compression plates 45, 49, the plates and the strip are inserted into the slot, e.g., concrete joint. The air pressure or hydraulic fluid pressure in the motor 80 should be maintained at this stage to prevent the compressed strip from flowing up past bar 67 which would cause binding. The air motor or hydraulic motor 91 is then activated to withdraw plates 45, 49 from the slot.

The end plates 92, 93 of motor 91 have bolts 94 extending therethrough. The threaded end of the bolts extend through in a motor-mounting plate or disc 95, on

which plate 93 rests, and the motor 91 is mounted on plate or disc 95 by tightening nuts 96 against the undersurface of said plate or disc. The plate 95 is rigidly mounted on vertical support bars 97, 98. The air or hydraulic motor 91 has piston (not shown) with a piston rod 100. The piston rod 100 is coupled by a flanged coupler 101 to the retainer bar 67.

The bars 97, 98 are rigidly attached to the sides of the cross bar 102 mounted on and extending across the upper ends of frame plates 41, 48 by U-brackets 103, 104 bolted by bolts 105 on the upper edges of plates 41, 48. The cross bar 102 is attached, e.g., by bolt 106, to the U-bracket 103. It is slidable in the U-bracket 104 whereby frame plate 48 may be reciprocated toward and away from frame plate 41. The piston rod 100 extends through a transverse hole in cross bar 102. The rod 100 is slidable in the hole and may, if desired, have a tight, sliding fit in said hole to provide a bearing support for the rod 100.

The motor 91 has threaded, fluid inlet and outlet nipples 107, 108 adapted to be connected with air lines of hydraulic fluid lines of a suitable hydraulic pressure or air pressure device (not shown). When air or hydraulic fluid is admitted through nipple 107 and vented through nipple 108, the piston (not shown) of motor 91 exerts a downward force on the piston rod 100. By virtue of the connection of piston rod 100 to retainer bar 67 and connection of support bars 97, 98 to cross bar 102, the unit consisting of the cross bar 102, the U-brackets 103, 104, frame plates 41, 48, their respective compression plates 45, 49, the rods 42, and the units mounted thereon (including motor 80) are raised when the motor 91, excepting its piston and piston rod 100, raises as a result of the pressure of fluid admitted through nipple 107, which exerts a lifting force against inner side of the upper wall 92 of the motor. The strip S is prevented from rising out of the slot with compression plates 45, 49 when its upper surface contacts the undersurface of retainer bar 67. The latter, as well as its arms 68, vertical bars 97, 98, and piston and piston rod 100, remain stationary as the rest of the mechanism raises to withdraw compression plates 45, 49 from the slot, e.g., concrete joint.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the forms herein disclosed being preferred embodiments for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. A tool for inserting a compressible strip in a slot, said tool comprising a vertically disposed, horizontally elongated frame member; a horizontal, elongated bar extending horizontally adjacent the lower portion of said frame member; a first, vertical, horizontally elongated compression plate on one side of said bar and fixedly attached to said frame member; a second, horizontally elongated compression plate on the opposite side of said bar and disposed opposite to and spaced from said first plate, the lower portions of said plates projecting below the lower side of said bar to provide therebetween a downwardly open, horizontally elongated zone for embracing a compressible strip below said bar and between said lower portions of said plates; means mounted on said frame member for providing relative movement of said second plate toward and away from said first plate; means mounted on said bar and operatively connected to said frame member for moving said frame member, said plates, and said first-mentioned means upwardly relative to said bar to withdraw said projecting lower portions of said plates from the slot, the ends of said horizontal bar projecting beyond the respective ends of said plates; a horizontal cross bar attached to and extending transversely at each respective, projecting end of said elongated bar, and a foot including a vertical, threaded shank threadedly mounted in each end portion of said cross bars, whereby said lower portions of said plates with a compressible strip compressed therebetween may be inserted in a slot with said feet resting on surface on opposite sides of said slot, and said compressed strip may be ejected from said lower portions of said plates into said slot when said frame member, said plates and said first-mentioned means are moved upwardly relative to said bar, said bar preventing said strip from moving upwardly with said plates and thereby holding said strip for ejection from said plates.

2. A tool as claimed in claim 1, said means for providing relative movement comprising rods mounted on and extending horizontally from said frame member, frame means slidably mounted on said rods and supporting said second plate essentially parallel with said first plate, and means carried by said rods for pushing said frame means and said second plate toward said first plate to compress said strip between said lower portions of said plates.

3. A tool as claimed in claim 2 wherein said means carried by said rods includes a cross bar on the outer ends of said rods, on which cross bar is pivotally mounted a lever, said lever, in turn, being operatively connected to said frame means by pivot linkage means.

4. A tool as claimed in claim 2, wherein said means carried by said rods includes a piston-type, fluid operated motor, the piston rod of which is connected to said frame means.

5. A tool as claimed in claim 2, said means carried by said rods including a piston-type, fluid operated motor, the piston rod of which is connected to said frame means; and wherein said means providing said relative movement comprises a fluid motor with a piston in a cylinder and a piston rod projecting therefrom, and means operatively connecting said cylinder and said piston rod with said frame member and said bar for effecting said relative movement upon fluid-operated movement of said piston in said cylinder.

6. A tool as claimed in claim 1, said means for providing relative movement comprising hinges mounted on said frame member and hingedly supporting said second plate thereon for pivotal movement about a horizontal pivot axis adjacent the upper edge of said second plate.

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