April 28, 1970 T. S. ROWE 3,508,474

EXPANSION JOINT SEAL, ETC.

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FIG. 1

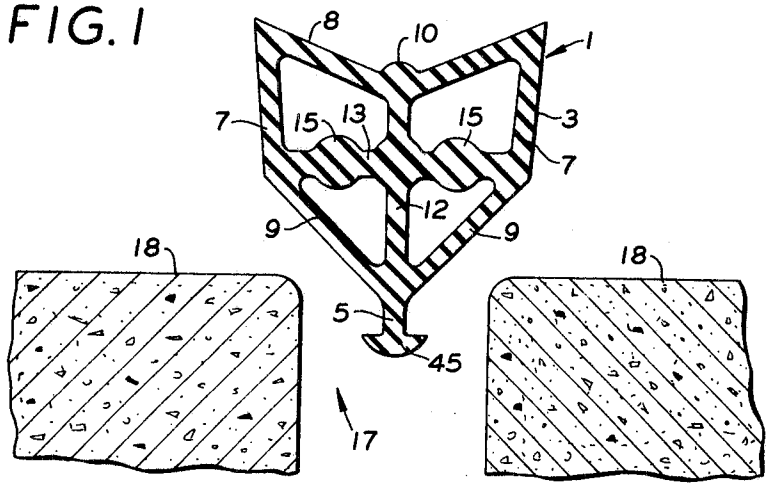


FIG. 2

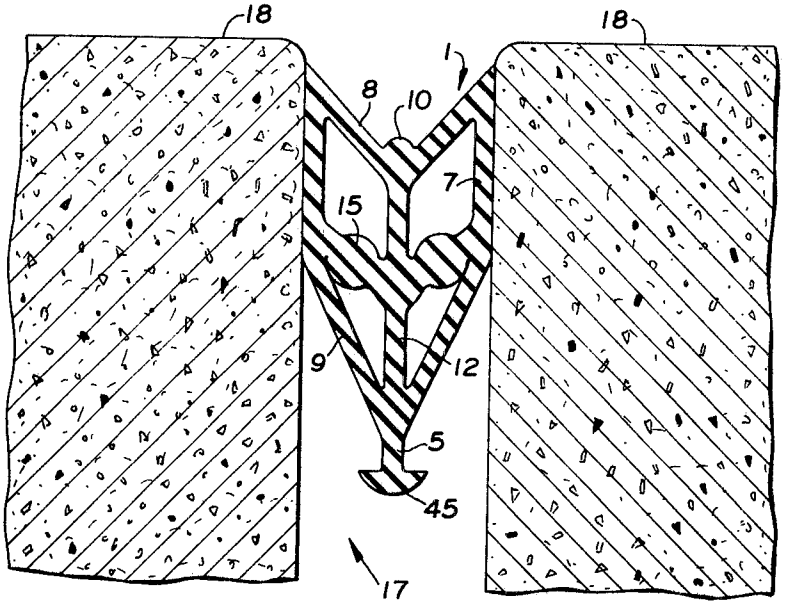


FIG. 7

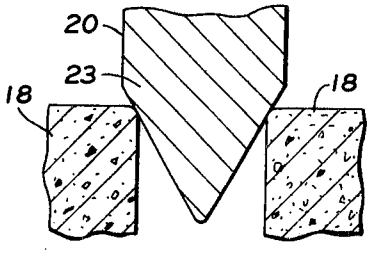
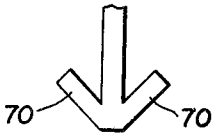


FIG. 11



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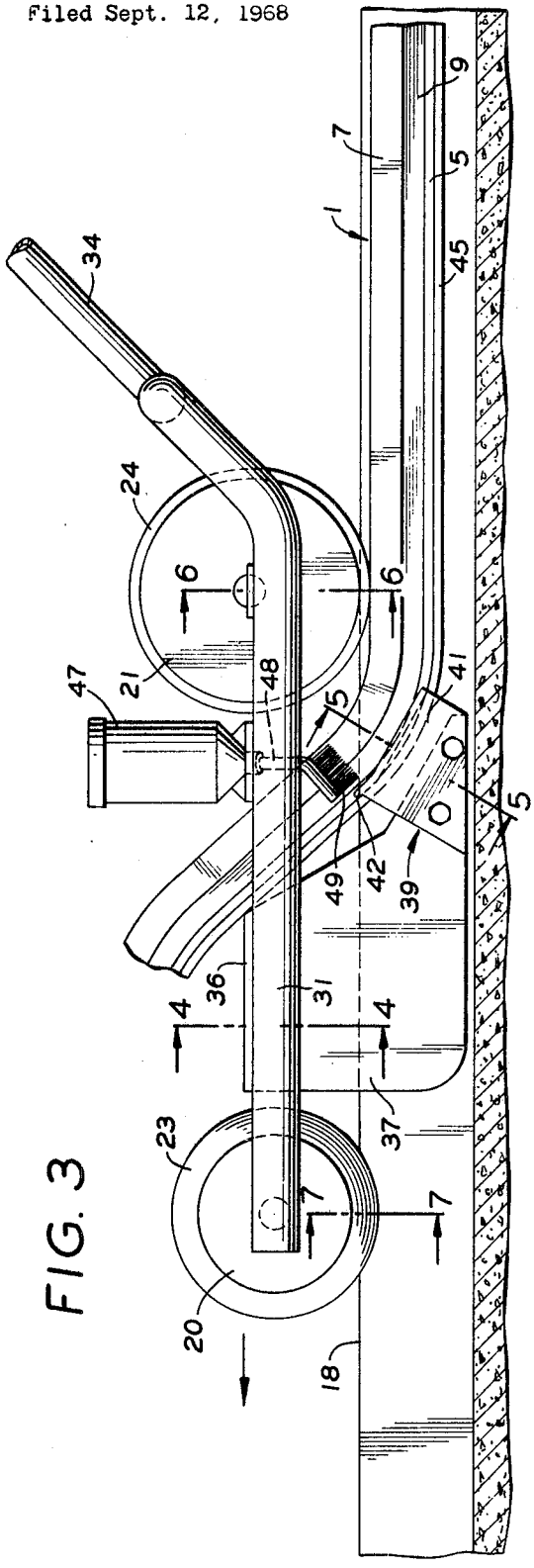


FIG. 3

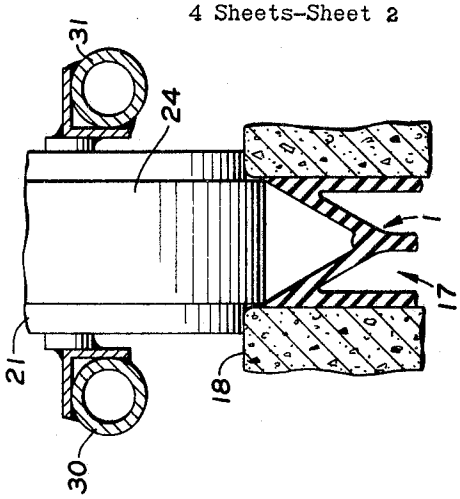


FIG. 6

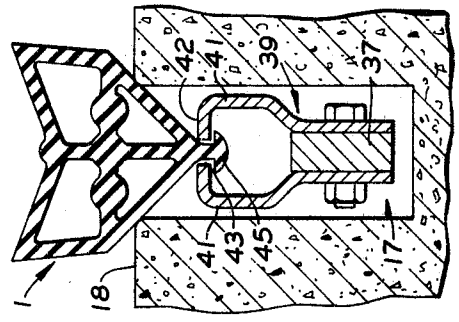


FIG. 5

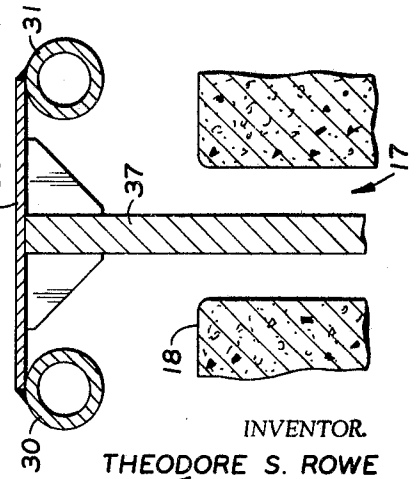


FIG. 4

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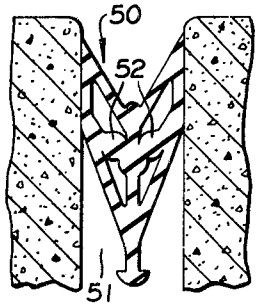


FIG. 8A

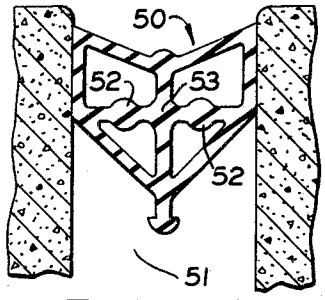


FIG. 8B

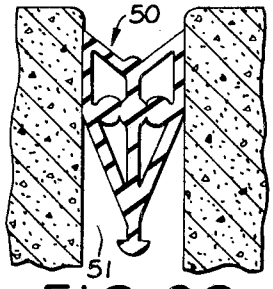


FIG. 8C

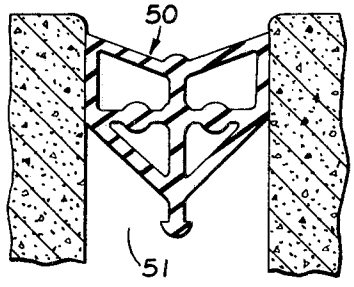


FIG. 8D

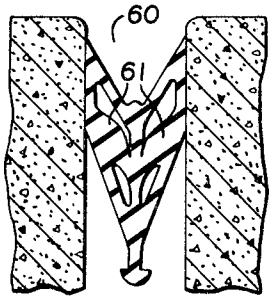


FIG. 9A

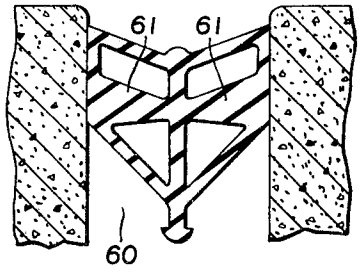


FIG. 9B

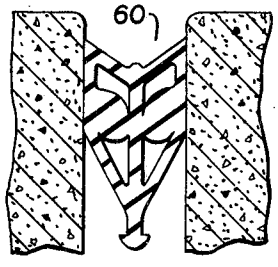


FIG. 9C

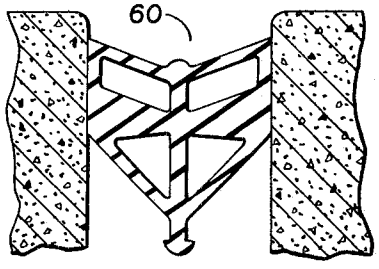


FIG. 9D

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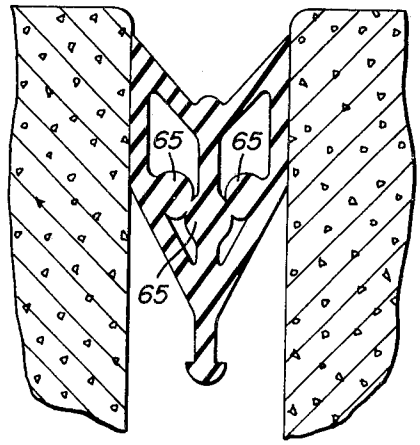


FIG. 10A

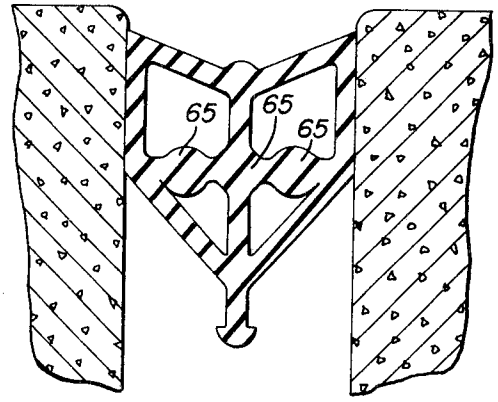


FIG. 10B

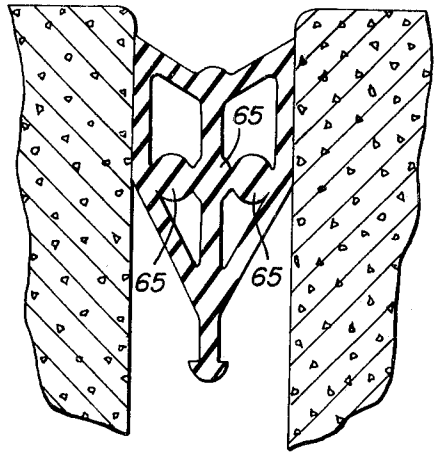


FIG. 10C

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United States Patent Office 3,508,474 Patented Apr. 28, 1970

3,508,474

EXPANSION JOINT SEAL, ETC.

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Continuation-in-part of application Ser. No. 628,608, Apr. 5, 1967. This application Sept. 12, 1968, Ser. No. 777,536

Int. Cl. E01c 21/00

U.S. Cl. 94—22 8 Claims

ABSTRACT OF THE DISCLOSURE

An expansion joint seal is provided which has a resilient body to be squeezed into a crack, and a lip of much less width than the body, which extends from one face. The seal is of substantial length. The body is preferably skeletal with an internal structure such that when the seal is compressed into a crack, the seal maintains outward sealing pressure. Apparatus for inserting the seal into a crack includes at least one wheel, and preferably two in tandem, in which the central portion of the tread is of greater diameter than the edges of the tread, so that the one or more wheels are guided along the crack by the central portion projecting into the crack. The wheels support an inserter below them which fits into the crack. An enlargement on the outer end of the lip is threaded through the inserter as the apparatus is wheeled along the crack. In this manner the seal is progressively drawn into sealing position within the crack.

This application is a continuation-in-part of my application Ser. No. 628,608 filed Apr. 5, 1967, now abandoned.

The invention pertains to an expansion joint seal, apparatus for progressively inserting a long length of the seal in a crack, and the method of inserting the seal in a crack.

THE EXPANSION JOINT SEAL

The expansion joint seal comprises a resilient linear body of relatively greater width and a lip which is usually of equal length but much less width extending from its bottom. This bottom tapers toward the lip to facilitate drawing the seal into a crack in a pavement or a bridge, etc. The seal is preferably skeletal with relatively thin walls, and as the tapered bottom is progressively drawn into a crack by pulling on the lip, the body of the seal collapses, but only to the extent necessary to make it fit into the crack. The crack need not be of uniform width, and the different portions of the seal, throughout its length, narrow to only the amount necessary to enter and fill the portions of the crack into which they are drawn.

Resilient elements may be located within the hollow interior of a skeletal seal which, when the seal is laterally compressed in a crack, are compressed and maintain outward pressure on the side walls of the seal. In a preferred skeletal seal there is a central brace aligned with the lip which pulls the top wall of the seal downward as the seal is inserted in a crack, and this top wall is preferably dished somewhat to facilitate its collapse as the seal is drawn into the crack. The top-center of the wall of the seal may be thickened to inhibit ready collapse of the top of the seal.

In a preferred seal, resilent branches extend from this central brace to the side walls of the seal, and enlargements are arranged along these branches which contact one another as the seal is squeezed into a crack and maintain the side walls of the seal in pressure contact with the sides of the crack. Various types of enlargements may be aligned on opposite sides of the central brace. The branches and enlargements extend the length of the seal, and resist collapse of the seal as it is drawn into the crack. Their compression creates a later mechanical expanding force. It is not necessary that enlargements be arranged along these branches, because the branches themselves may be thick enough to resist compression and thus keep the sides of the seal in pressure contact with the sides of the crack. In a preferred design of this latter type the branches thicken toward their union with the sides walls so as to resist their distortion as the lip is pulled as the seal is inserted into a crack, and maintain outward pressure on the walls of the seal thereafter. The central vertical brace may be omitted, when not necessary.

The seal is formed by extrusion. It is formed of any cured elastomer as, for example, natural rubber or a synthetic rubber such as chloroprene, E.P.T. rubber, polyurethane, etc. although chloroprene and E.P.T. rubber, when cold, tend to stiffen so that their recovery is small and should be used only in warmer climates. When used in paving or in any other location where it is exposed to the weather the seal must be weather resistant. Different elastomers will be used for different sealing jobs. The seal must be resistant to oxygen and any other ambient deteriorating influence. It must be so stiff that when the seal is compressed, it maintains outward pressure against the walls of the crack throughout its life; and the lip and walls of the body must be thick and strong enough to provide the tensile strength required to pull the seal into a crack. Also, the enlargement at the end of the lip must be hard enough to retain sufficient of its shape in the inserter portion of the apparatus, discussed below. A preferred elastomer is polyurethane of about 55 to 70 Shore durometer, for example

THE APPARATUS

The apparatus is designed to insert the seal progressively into a crack as its wheels guide it along the crack. A single guide wheel might be used, but two guide wheels in tandem give better alignment of the seal in a crack. There may be other wheels if the apparatus is to support a motor or a reel of the seal, etc.

The diameter of the centers of the treads of the wheels is greater than the diameters of the sides of the treads to provide a central portion which follows along in a crack as the apparatus is rolled over it.

The apparatus includes an inserter below the wheel level, which is located down in the crack as the apparatus is rolled along the crack. The inserter is hollow and has an opening adjacent its top through which the lip of the seal is threaded as the apparatus is rolled along the crack, and the seal is thus progressively drawn a desired depth into the crack.

The preferred form of the apparatus includes means for supplying a lubricant to the seal as it is drawn into a crack.

There is an enlargement, a sort of bead, at the end of the lip which is engaged by the inserter.

THE METHOD

In locating the seal in a crack, it may be first laid along a crack, or it may be carried on a reel which is mounted on the apparatus. The reel should turn freely so as to feed the seal as required. One end of the seal is threaded through the inserter. The guide wheel or wheels of the apparatus are then aligned in the crack and the apparatus is then pulled or pushed, manually or mechanically, along the crack. In this way, the lower end of the lip is moved through the inserter, and as the

apparatus is moved along, the seal is pulled progressively into place.

THE DRAWINGS

The invention is further described in connection with the accompanying drawings, in which:

FIGURE 1 is a section which is illustrative of a preferred form of the seal before it is located in a crack;

FIGURE 2 is a section of the same, but after it has been drawn into a crack;

FIGURE 3 is an elevation of the apparatus erect on a crack with the seal threaded through the inserter and in the crack;

FIGURE 4 is a section through the apparatus above the crack, on the line **4**—**4** of FIGURE 3;

FIGURE 5 is a section through the seal as it is entering the crack, the inserter and the crack on line **5**—**5** of FIGURE 3;

FIGURE 6 is a section through the seal and the rear wheel of the apparatus on line **6**—**6** of FIGURE 3 after the seal is located in the crack;

FIGURE 7 is a section through the front wheel over the crack, on line **7**—**7** of FIGURE 3;

FIGURES 8A, 8B, 8C and 8D are sections which illustrate the condition of the seal as it is drawn into the crack, and as the crack expands and contracts;

FIGURES 9A, 9B, 9C and 9D are sections which illustrate the condition of a modified seal as it is drawn into the crack, and as the crack expands and contracts;

FIGURES 10A, 10B and 10C are sections through a preferred type of seal in a crack, showing what takes place as the crack expands and contracts; and

FIGURE 11 is a section through a modified lip.

The seal **1** is preferably extruded into a great length, such that it might be referred to as a continuous seal or gasket. It comprises the skeletal body **3** and lip **5**. The side walls **7**, top wall **8** and bottom wall **9** are each several hundredths of an inch thick. The bottom wall **9** tapers to the lip. The top wall **8** is preferably slightly dished to facilitate its entry into the crack. The optional bead **10** which extends along the depression at the center of the top wall, resists collapse of the seal and provides better recovery when the compressing force is lessened.

The crack **17** is between two sections **18** of concrete, or stone, or even wood, etc.

The top and bottom walls are connected by the central vertical brace **12**, and the side walls by the lateral braces **13**. Cylindrical enlargements **15**, which might be enlargements of any one of many shapes, extend along the side braces, preferably the same distance from the central brace. These enlargements might, for example, be flattened to an oval shape, with the vertical axis the longer axis. They might be almost rectangular with the vertical axis the longer axis. They might be humps on the upper surface of the brace with other humps staggered on the underside of the brace. Opposed surfaces of adjacent enlargements might be corrugated to minimize slippage of one over another when they are squeezed into contact with one another. The cylindrical enlargements **15** shown in the drawings are therefore to be considered symbolic of the different enlargements that may be employed.

The tapered bottom wall facilitates entry of the seal into the crack where it is collapsed only so much as required to fit between the sides of the crack. It is not necessary that these sides be smooth. In the collapsed position (FIGURE 2), the pressure on the enlargements **15** compresses them sufficiently to maintain outward pressure on the sides of the seal throughout its life.

The preferred form of the apparatus for manual operation is equipped with two wheels **20** and **21**. The treads are wider than the crack and are preferably shaped so that the central portion is of greater diameter than the edges and fits into the crack to guide the apparatus

while the edges extend beyond the crack and support the apparatus. The tread **23** of the front wheel is shown as pointed, and the tread **24** of the rear wheel is shown as stepped; treads of various shapes may be used.

The wheels are connected by a body which (in the drawings) comprises parallel tubes **30** and **31**, brought together as a handle **34**. They are suitably supported from the wheels. Plate support **36** is welded to the tubes, and this supports bracket **37** to which inserter **39** is attached.

The inserter includes the two bulging sides **41**, the tops **42** of which are spaced to form opening **43**, and fastened below to the bracket **37**. The front of the inserter is elevated. Lip **5** of the seal is accommodated in opening **43** as the seal is progressively threaded through the inserter **39** as it is moved through the crack. The bead **45** prevents the lip from escaping from the inserter.

In locating a seal in a crack, it is laid out lengthwise along the crack or reeled on a reel. The wheel **24** is placed in one end of the crack and one end of the seal is brought down between the tubes **30**, **31** and a sufficient length of it is threaded through the inserter to hold this end of the seal in the crack. Then, as the apparatus is wheeled along the crack, the inserter progressively draws the seal down into the crack, with its top below the tops of the sides of the crack. The sides of the body **3** are sheer so that they slide over the sides of the crack with minimum friction and distortion.

It may be desirable to lubricate the sides of the seal to facilitate its insertion in a crack. An oily composition might be used, but usually water or slimy aqueous lubricant will be preferred. This is conveniently supplied from a container such as the container **47** through a branched conduit **48** (which may be valved) and supplies lubricant to the brushes **49** which wipe opposite sides of the seal **1**.

The size of the crack expands and contracts with the weather. In laying a concrete pavement, it is formed as a continuous sheet and after it has set the cracks are cut into it. These may be, for example, ⅜ inch in width. A crack this wide in the summer may expand to ¾ inch in the winter. FIGURES 8A, B, C and D illustrate the action of enlargements in the branch braces inside of a seal when in use. FIGURE 8A illustrates how a seal **50** inserted in the summer in a crack **51** between two concrete blocks is squeezed into the crack and the pull on the lip misaligns the enlargements **52** in the branches and the enlargement **53** where the braces intersect; how the crack expands in the winter (FIGURE 8B); narrows again (FIGURE 8C) in each succeeding summer when the enlargements within the seal are aligned because there is no pull on the lip; and then expands again (FIGURE 8D) each succeeding winter.

FIGURES 9A, B, C and D illustrate the action of a seal with different braces during use in a crack **60**. As indicated in FIGURES 9B and 9D, when the seal is not compressed, the branch braces **62** extend laterally. When there is pull on the lip as the seal is drawn into the crack the branch braces **61** dip (FIGURE 9A). In doing so, the resistance of the wide braces to compression caused by such dipping, tends to return the seal to its original configuration and the seal presses outward in sealing contact with the sides of the crack. When the winter comes and the crack expands (FIGURE 9B) the seal tends to return to its original shape while remaining in sealing contact with the walls of the groove. The next summer and in succeeding summers the seal will be compressed, but the branches will be contracted laterally (FIGURE 9C) because there is no downward pull on the lip. Each winter it returns to its original position within the crack (FIGURE 9D).

The views 8A, B, C and D and 9A, B, C and D are merely suggestive. The amount the crack widens and narrows and the consequent effect on the seal will vary.

In a preferred seal, the enlargements are located so that eventually they will become aligned widthwise of the

crack. This is illustrated in FIGURES 10A, 10B and 10C. The enlargements **65** are shown as being generally cylindrical, but obviously they may be of other shapes, they need not all be the same, and there need not be three of them. For instance, they may be oval or octahedral, etc. in cross section.

Assume that the seal is installed during the summer when the concrete has expanded in the heat and the crack is relatively narrow. This is illustrated in FIGURE 10A. The seal has been pulled down in the center so that the enlargements are not aligned. They are too large to permit the retraction of the seal to pull them into line when the pulling tension has been released. That winter, when the concrete has contracted and the crack has enlarged, the tension on the seal is released and it assumes the approximate position shown in FIGURE 10B. There is no substantial tension on the seal and the enlargements are in a line. The next summer, as the crack narrows (FIGURE 10C), the enlargements remain in line. There is no force to drive them out of line. The contraction of the crack is gradual and the enlargements are gradually squeezed against one another, while they remain in line. This makes a very tight seal. The enlargements remain in line during succeeding winters and summers; there is no force to disalign them.

The design of the bead at the bottom of the lip may vary. FIGURE 11 shows a bead formed of backwardly directed flaps **70** which are spread outwardly against the walls **41** (FIGURE 5) of the apparatus as the seal is pulled down into a crack. The brushes **49** should be situated to lubricate the edges of these flaps.

The invention is covered in the claims which follow.

I claim:

1. A continuous linear expansion joint seal for plugging a crack, which seal comprises a resiliently compressible and vertically elongateable skeletal body with outer side surfaces which are substantially sheer from the bottom to the top and a centrally tapering bottom wall, said compressible means comprising enlargements in the skeletal body which are of such size that when the seal is squeezed laterally the enlargements are brought into compressive contact before the side walls contact one another, and a lip extending from said bottom wall, said lip having an enlargement at its outer end to be threaded through an inserter located within the crack, the enlargement being substantially narrower than the body of the seal, the seal being of uniform cross section throughout its length.

2. The seal of claim **1** in which the body is skeletal with the top wall dished.

3. The seal of claim **2** in which a member connects the center of the top of the seal with the center of the bottom of the seal, with lateral bracing means connected to said member and to the side walls of the seal with said enlargements in the bracing means.

4. The seal of claim **3** in which a member connects the center of the top of the seal with the center of the bottom of the seal, the internal compressible means comprises lateral bracing means connected to said member and to the side walls of the seal, the vertical width of said bracing means tapering from the side walls inward and offering substantial resistance to the compression of the seal.

5. A continuous linear expansion joint seal of uniform cross section for plugging a crack, which seal comprises a vertically elongatable skeletal body with resiliently compressible enlargements located in the skeletal body which are substantially aligned cross-wise of the seal when the seal is not under tension, and a lip extending from the bottom wall, said lip having an enlargement at its outer end to be threaded through an inserter located within the crack, the lip enlargement being substantially narrower than the body of the seal.

6. The process of sealing a crack and maintaining the seal during expansion and contraction of the crack due to changes in the temperature, using a linear and vertically elongatable, skeletal seal having resiliently compressible enlargements in the skeletal body aligned cross-wise therein when the seal is not under tension, which process comprises pulling the seal down into the crack and by friction of the crack on the sides of the seal elongating the seal longitudinally and thereby disaligning said enlargements, and then releasing the pull on the seal so that as the crack widens the seal contracts and the alignments become aligned cross-wise in the crack and maintain the sealing of the crack.

7. Apparatus for inserting into a crack a length of resilient expansion joint seal having a linear body and a lip extending therefrom, which apparatus is wheel supported with guide means extending from the support to follow along in the crack, and located below said support a hollow inserter aligned with the guide means, with an opening extending longitudinally through the inserter for the accommodation of the lip as the apparatus is moved longitudinally of the seal.

8. Apparatus of claim **7** in which there are two wheels in tandem and integral with each wheel there is guide means which extends outward from the centers of the treads of the wheels.

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U.S. Cl. X.R.

94—18