Dec. 31, 1968 C. CIMINI 3,418,898

CONCRETE JOINT SEAL

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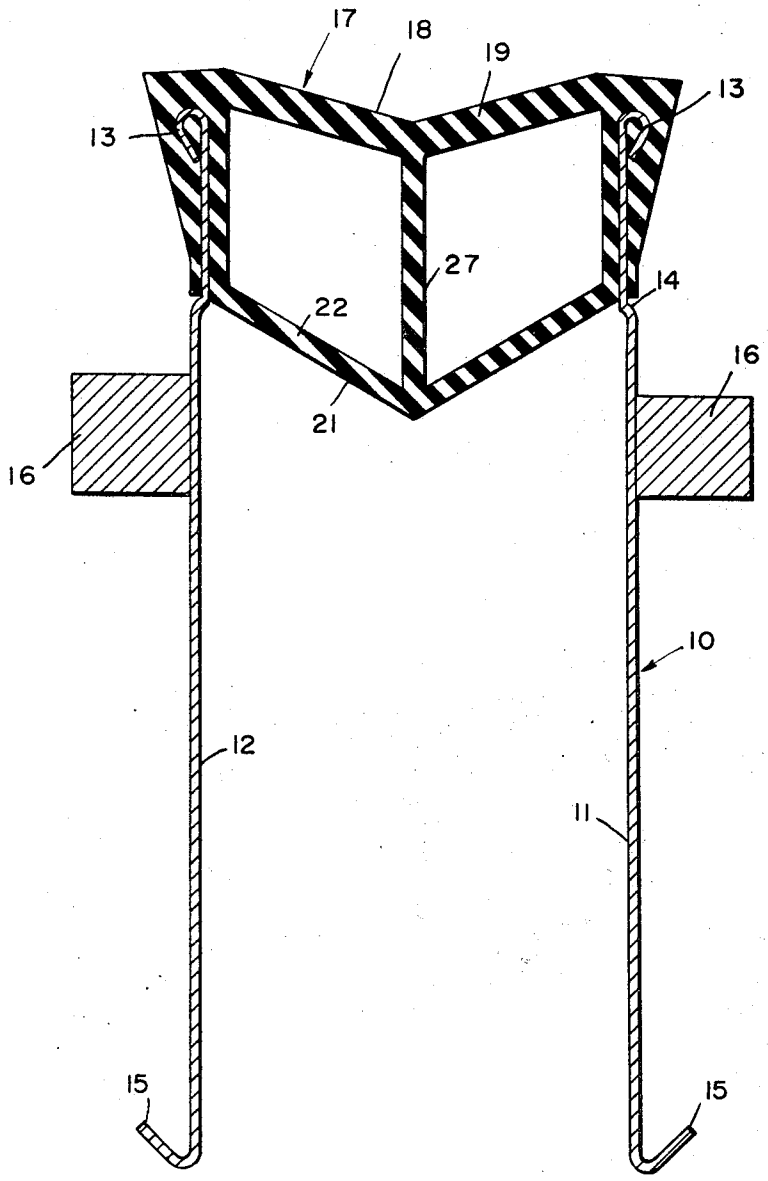


FIG. 1

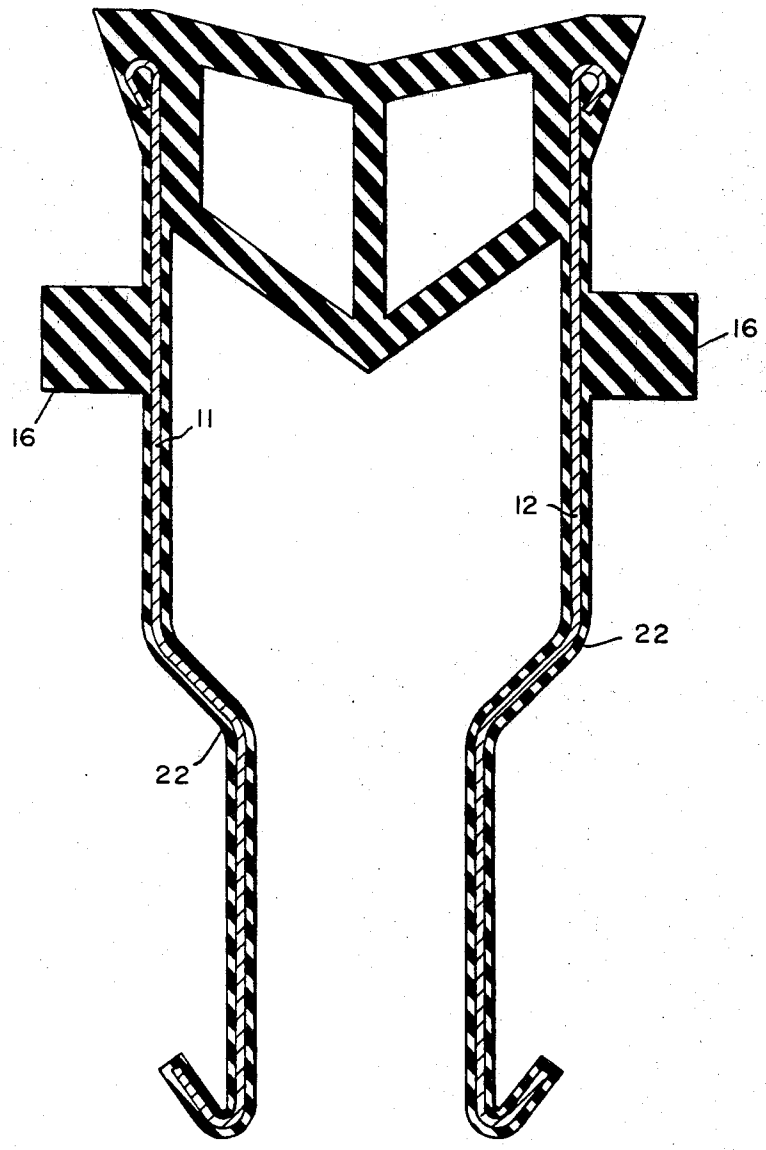


FIG. 2

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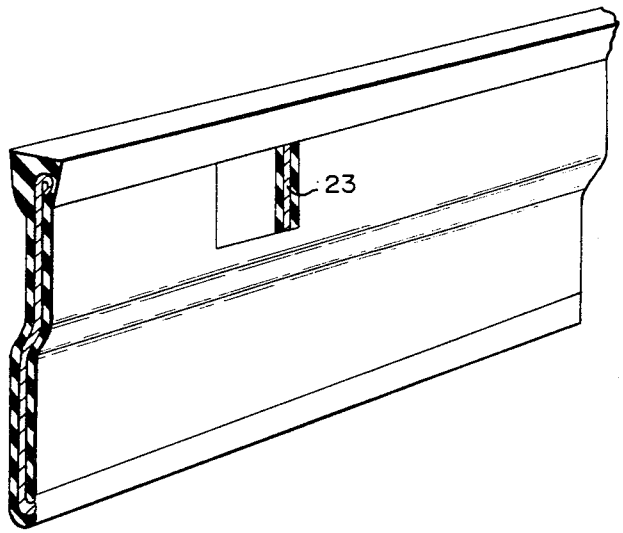


FIG. 3

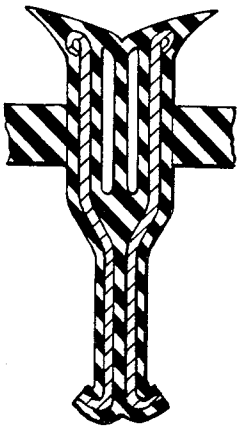


FIG. 4

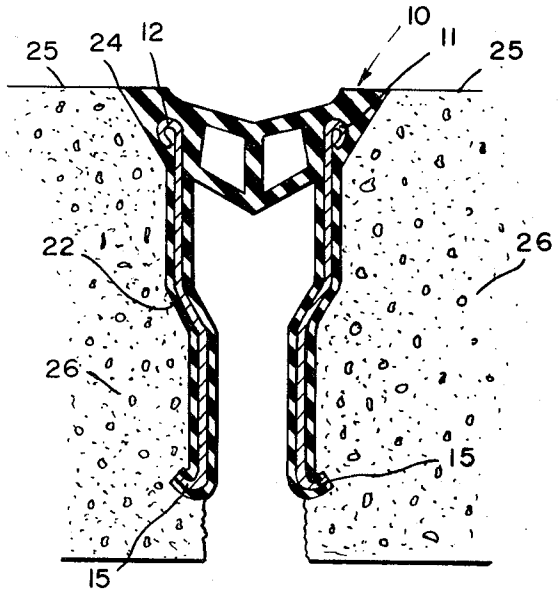


FIG. 5

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CONCRETE JOINT SEAL

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ABSTRACT OF THE DISCLOSURE

A preformed seal for sealing joints in concrete structures is disclosed wherein a resilient, distortable chevron-shaped sealing member (composed, e.g., of neoprene) is positioned between the upper marginal portions of two opposed, metal strips. The upper portions of the strips are imbedded in the side walls of the sealing member. Tie wires are wrapped around the periphery of the joint seal to maintain compression of the sealing member which tie wires can be severed subsequent to the insertion of the joint seal in the wet concrete structure to permit expansion of the sealing member.

This invention relates to means for sealing the joints in concrete structures.

As the description proceeds, it will become obvious that the seal has utility in, and may be used with all types of joints between concrete sections, but because the seal has special advantages in sealing the joints between pavement slabs, aprons, and floorings, it will be described in relation to such uses.

Concrete expands and contracts. Not only is there an initial contraction as the wet concrete hardens, but thereafter the concrete mass expands and contracts in response to the changes in temperature. Although the movement is small, it still is sufficient to enlarge the gap between adjacent slabs to such a degree that water can easily penetrate and soak the subgrade. But an even worse difficulty occurs when, as in the case of a roadway, traffic pounds dust, sand, and road debris into the joints. It is conventional, therefore, to seal the joints between adjacent concrete slabs in such a manner that a tight, leak-proof seal is maintained at all times despite the linear motions of the concrete slab.

Conventionally, the joints between concrete slabs have been sealed by pouring a melted thermoplastic compound into the joint space. But more recently, a much more effective seal has been introduced comprising a preformed, expansible rubber member held between steel reinforcing members. Under ordinary conditions, these seals give excellent performance and prevent, to a far better degree than the poured-in seals which previously were used, the penetration of dirt, moisture, and road debris into the joint space.

In the northern tier of States, however, where it has become the practice of the highway departments to plow roads completely bare, and lower plow blades until they contact with the concrete surface as the plowing progresses, a number of such seals have been damaged during the winter months. Damage occurs where the concrete surface has worn below the level of the steel, or where uneven finishing allows the steel margin to project above the concrete surface, for then the strip can be struck by the blade of a plow, causing a considerable length of seal to be ripped out of the concrete. Not only is the seal destroyed, but substantial repairs to the margins of the slab may be required.

I have discovered that if the upper margins of the metal reinforcing strips are bedded in the rubber member itself and thus no metal is exposed at the wearing surface of the joint seal, the plow blade merely causes the sealing material to deflect, and never catches on or tears the reinforcement.

The principal object of this invention, accordingly, is to prevent the occurrence of such plow-caused damage, and additionally to produce a presealed expansion or construction joint which will expand and contract with the seasonal movement of the concrete slab, which will maintain a tightly sealed joint, well protected against the penetration of dirt, sand, and water; to produce a joint which, once installed, either by a joint-planting machine or by hand, permits all main components of the seal to remain in place; to provide a joint seal which eliminates the step of packing or pouring a distortable filling material into the joint space, and particularly to produce a seal in which no reinforcing or supporting element is exposed directly at the surface of the slab, and to protect the reinforcing structures from the action of the weather and the wear of traffic.

The accomplishment of these and other objects will become apparent as this specification proceeds, and from the drawings in which:

FIG. 1 is a transverse cross-section of the improved joint seal,

FIG. 2 is a transverse cross-section of an alternative form of the invention,

FIG. 3 is a transverse cross-section of a portion of one of the side members showing the means of anchoring the seal to the concrete,

FIG. 4 is a vertical cross-section of the collapsed sealing strip, and

FIG. 5 is a vertical cross-section of the seal embedded between two concrete slabs.

The seal **10** comprises two especially contoured metallic strips **11** and **12** of the length sufficient to extend uninterruptedly either across or along one entire margin of a concrete slab. The upper, longitudinal margins of each strip are out-turned and beaded as indicated at **13**. A shoulder **14** is formed in each strip, spaced from the beaded margins **13** at approximately one quarter of the distance between top and lower margins. The lower margins of the strip are out-turned to form the hook-type, outwardly directed anchors **15—15** which are upturned at an angle of approximately 45°. In use, the anchors project into the concrete mass.

The sides of the strips **11** and **12** in the area immediately beneath the shoulder are pierced with a series of slots, and the metal thus freed is thrust outwardly to form a number of anchoring tongues **16**, as illustrated in FIG. 2.

The sealing element **17** itself is formed of a resilient, extensible substance which generally can be described as an oil-and-ozone-resistant rubber, surmounts both of the strips **11** and **12** at their upper margins.

Seal **17** is securely vulcanized to each strip, and extends from a short distance above the margins **13** to the shoulders **14**.

One, and the preferred, method of manufacture follows: the steel strips **11** are purchased as coiled strips from the mill. The strip is fed continuously into a bank of rollers which deform the strip by bending it at the shoulders **14** forming the beaded margins **13** and the anchors **15—15**.

Usually, in order to resist rusting, strips **11** and **12** are formed of stainless steel, and in usual circumstances are approximately .0020 of an inch thick. Those portions of the strip which are to contact with the rubber seal **17** are coated with any of several proprietary rubber-metal bonding cements known to the art, such as, among others, natural rubber, chlorinated rubber, and vinyl nitrile compositions.

The die of an extrusion machine is arranged to allow

the two strips, separated the required distance, to pass through the die while rubber in the form, e.g., as shown at **17** issues through the die and enfolds that portion of the strip which extends from the margins **13** to the shoulder **14**.

The configuration of the sealing element **17** is that of a two-bar chevron, the top surface **18** of the upper bar **19** forming the wearing surface of the seal, while the lower bar **21** extends from approximately the shoulder **14** to the mid-point of the chevron, and forms an angle of approximately 30° to the horizontal.

Vulcanization can take place with properly compounded rubber compounds in the die itself, but much more commonly the strips, after they have received the rubber sealing element, pass directly from the extrusion head into an oven where the cure of the rubber compound is completed. The process is continuous.

Subsequently, the strips are cut to proper length, and then the metallic side walls are pushed toward each other, collapsing the rubber sealing member **19** until it takes up the form shown in FIG. 4. Tie wires are then tied around the strip, and the strips shipped out in collapsed condition.

Although ordinary steel may be used for the strip elements **11** and **12**, contractors who will use this form of the invention will probably specify stainless steel. The resistance to corrosion which stainless steel insures, increases the life of the joint to such an extent that the higher cost of the stainless material is, in most instances, justified.

Seal **17** may have variable dimensions as the specifications demand, but for the usual highway joint between concrete slabs, seal **17** is a tubular rubber extrusion, approximately one inch wide by 3/16 inch deep. Its general configuration is chevron-shaped, the upper margin dipping from the shoulders to the center at an angle of about 15°, while the lower wall lies at an angle of approximately 30° to the horizontal.

A diaphragm **27** set on the median line extends between top wall **19** and the bottom wall **21**. The top wall **19** of the seal **17** is made materially thicker (approximately .060") than the bottom wall **21** (approximately .020").

In this specification and the claims, the term "rubber" has been used in its present-day generic sense to indicate a distortable, resilient polymeric material, and is not intended to indicate the chemical nature of the substance. Materials which have substantial oil resistance, and resist abrasion, and have the named "rubber" characteristics have proved suitable as the distortable element in this invention e.g., the actual material may be an artificial rubber such as chlorobutadiene, butadiene/styrene, butadiene/acrylonitrile types of rubbers, isobutene with isoprene or butadiene, ethylene-propylene mixtures, polyurethanes and polyethylene vinyl acetate mixtures and copolymers. For highway service, rubbers made from the copolymer of butadiene and acrylonitrile will be found to fit most of the requirements and performance specifications.

In an alternative form of the invention, the process as described above is generally followed with the exception that the strips **11** and **12** are entirely coated with metal adhesive, and the entire strip passes through the rubber extrusion die or at right angles to the die. The extruded rubber **22** covers both sides of both strips **11** and **12** including the anchor portions **15—15** (see FIG. 2).

Because the entire surface of each metalic strip is covered with a jacket of rubber which is held to the strip by an overall vulcanized bond, moisture working up through the subgrade cannot reach the steel. Sealing

strips made by this alterntaive procedure may utilize ordinary carbon steels with complete satisfaction.

If the anchoring tongues **16** are required in the alternative form of this invention, the piercing of the strips **11** and **12** is done after the strips have been covered with rubber jackets. This operation leaves a raw edge of steel **23** but since the tongues are completely buried in concrete, the steel is thoroughly protected.

The novel product of the present invention is employed in the following manner. The preformed joint seals, still held in the collapsed position by the tie wires as above described, are "planted" in the wet concrete from its surface downwardly. The preformed seal strip is pushed downwardly until the top surface is flush with or slightly below the surface of the concrete. Insertion may be made by hand, but in highway work, particularly, the strips are pushed into the wet concrete by a joint-planting machine. As soon as the strip is planted, a highway surface is finished by running a float across the pavement. Subsequently, the edges of the slabs are hand finished. At this time, or later, the tie wires are cut. The seal can now expand as the concrete shrinks as it cures.

The proper position of the seal in relation to the wearing surface of the slab is shown in FIG. 5. The seal **10** is bedded in the concrete so that the margin **24** of rubber lies in the same plane as does the top surface **25—25** of the abutting slabs **26—26**. Ordinarily, the plow blade passes over the seal without disturbing it to any material degree, but should the concrete surface wear slightly, or should the finish of the concrete at the margins **24** be slightly uneven, an advancing plow blade merely distorts the rubber and leaves the reinforcing strips **11** and **12** undisturbed.

I claim:

1. A joint seal for concrete structures comprising two opposed metallic strips having upper and lower margins and a web extending therebetween; a resilient, distortable sealing member positioned between said upper margins formed of rubber and having side, upper and lower walls, said upper and lower walls being chevron-shaped and connected by a centrally located vertical diaphragm extending between said top and bottom walls, the said side walls of said member surrounding and embedding the said upper margins of said metallic strips to prevent exposure of metal at the wearing surface of the seal; and means for maintaining said strips and said member in compressed relationship comprising tie wires extending around the periphery of the joint seal whereby expansion of said side strips and said member subsequent to the insertion of the joint seal in the wet concrete is effected by severing said tire wires.

2. A seal as claimed in claim **1** having portions of its said web and said lower margins bent outwardly to form anchoring members in the concrete.

3. A seal as claimed in claim **1** wherein the said side walls extend downwardly below said body portion and enfold the entire extent of said metallic strips.

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NILE C. BYERS, *Primary Examiner.*