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Welch

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[54] **MULTIDIRECTIONAL ELASTOMERIC EXPANSION JOINT**

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[52] **U.S. Cl.** **404/66,** 404/47, 52/396

[51] **Int. Cl.** **E01c 11/02**

[58] **Field of Search** 52/396, 669; 404/37, 40, 404/47, 67, 69, 68, 66

[56] **References Cited**

UNITED STATES PATENTS

3,363,522	1/1968	Galbreath	404/67
3,650,184	3/1972	Kolm et al.	404/50
3,690,226	9/1972	Hein	404/68
3,758,220	9/1973	Hein	404/67
R26,733	12/1969	Welch	404/67

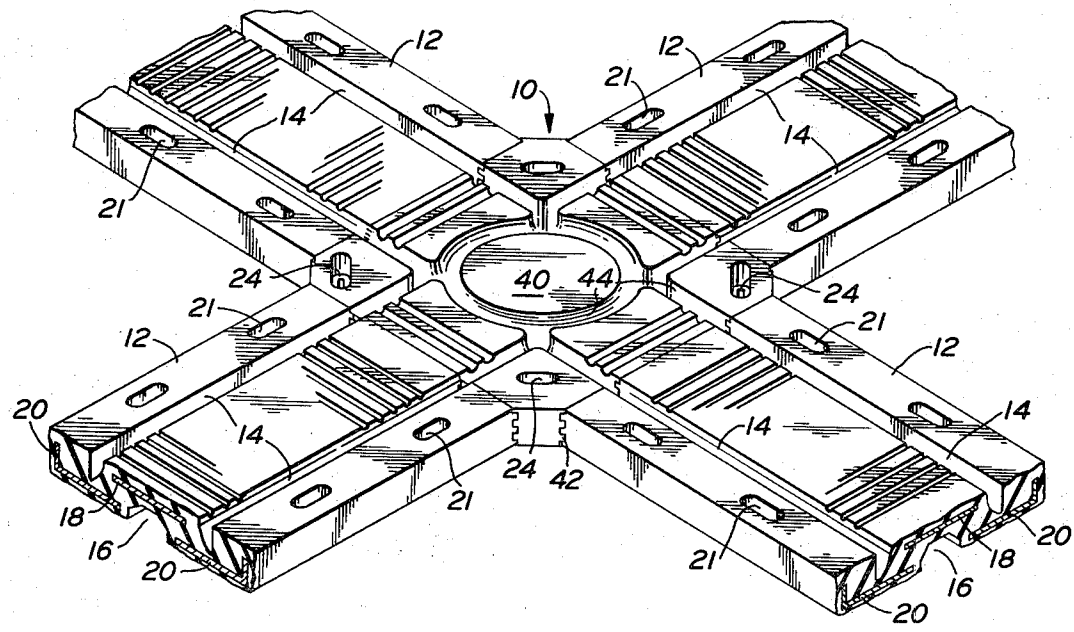
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[57] **ABSTRACT**

A load bearing multidirectional expansion joint seal structure including a several corner plate members adapted for connection in load bearing relation to the corners of adjacent deck sections at the intersection of the gaps between the deck sections, a center plate member vertically disposed in overlapping relation with respect to all of the corner plate members, and elastomeric support means disposed between and bonded to the faces of the overlapping portions of all the members. The support means provide vertical support between said overlapping portions and are adapted to deform in shear to accommodate respective relative horizontal movement between the corner plate members and the center plate member. Elastomeric interconnecting and facing means defines a substantially horizontal upper surface for vehicular traffic and defines grooves to permit relative horizontal movement between the members without compressive deformation of the support means.

15 Claims, 5 Drawing Figures



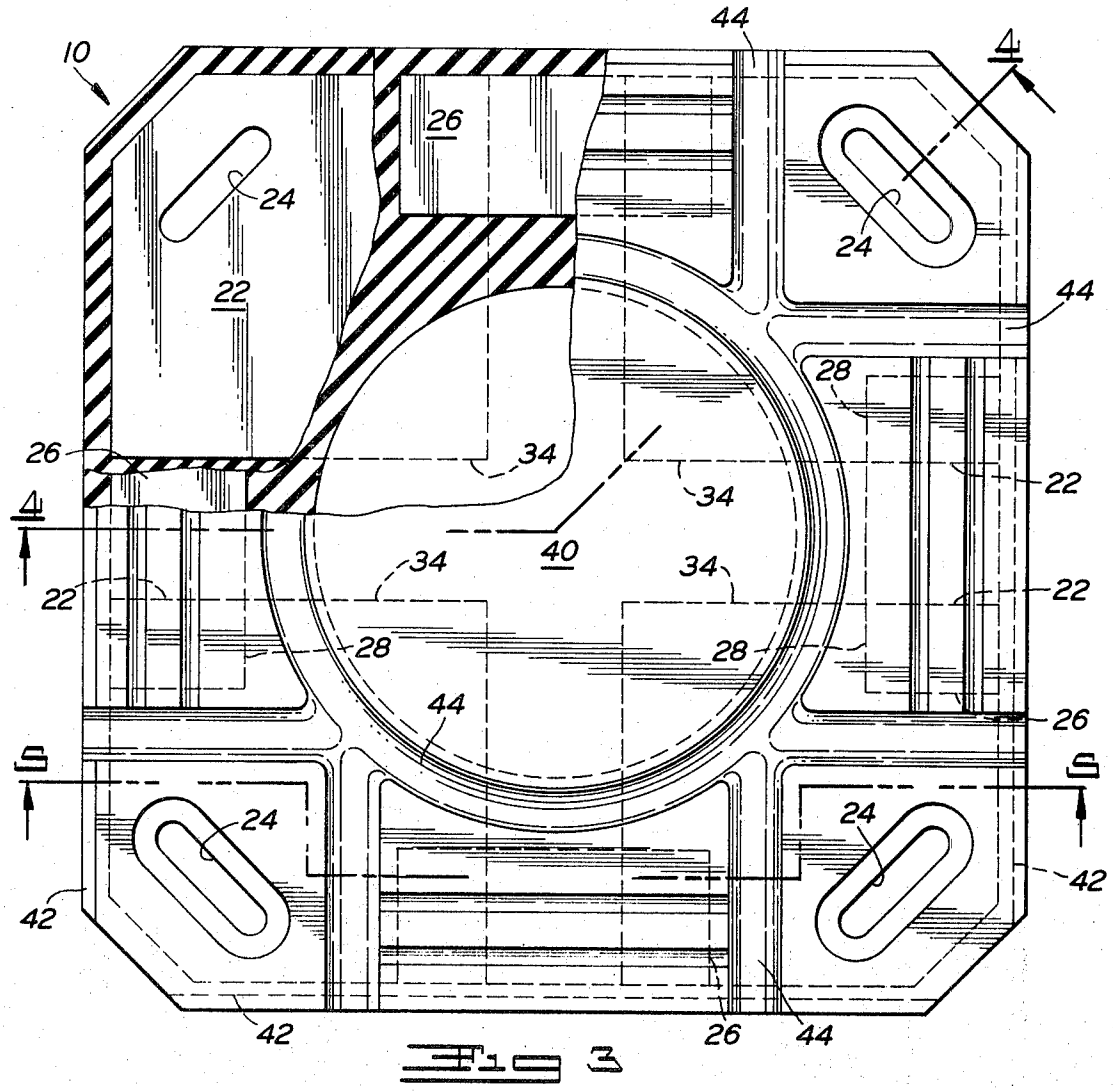


Fig 3

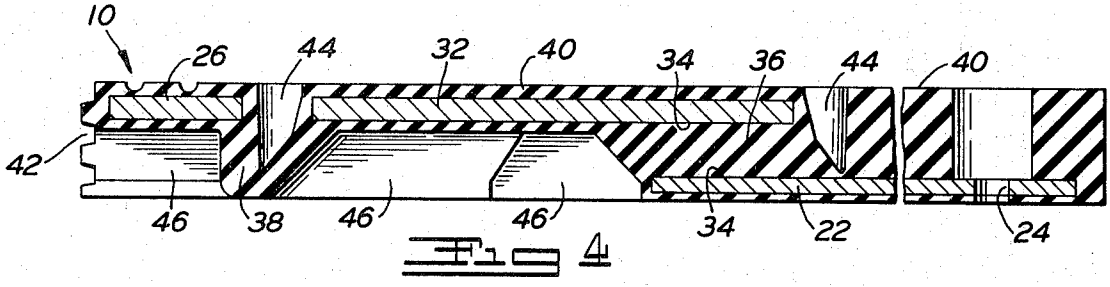


Fig 4

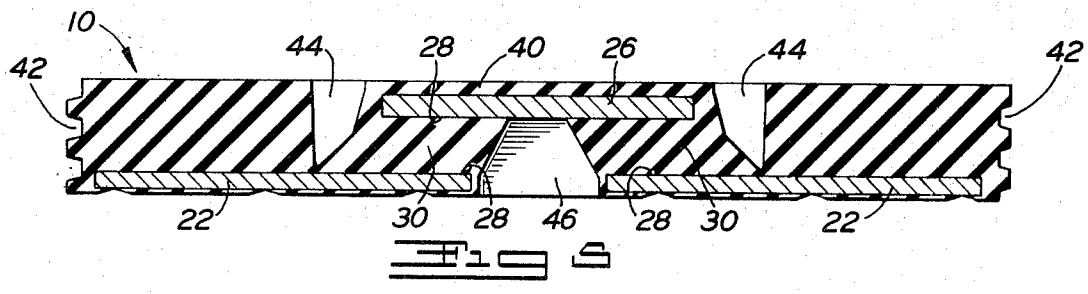


Fig 5

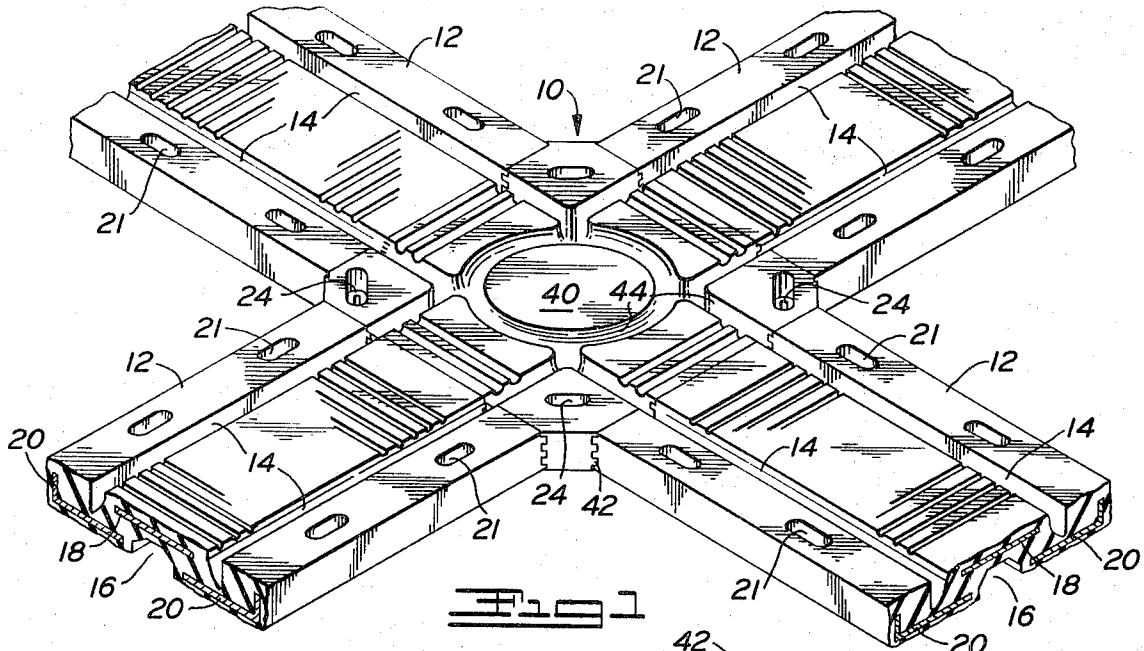


FIG. 1

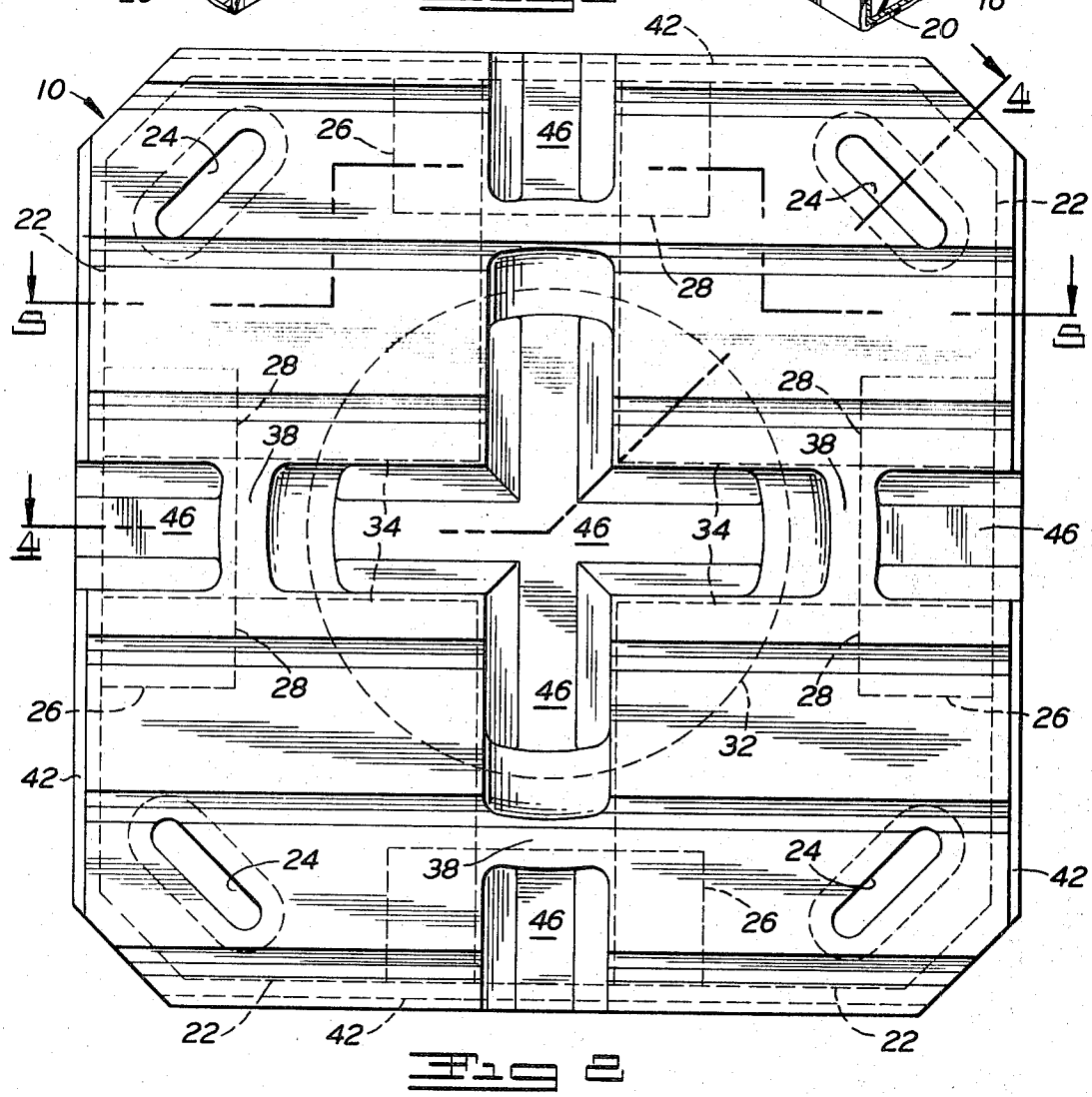


FIG. 2

MULTIDIRECTIONAL ELASTOMERIC EXPANSION JOINT

BACKGROUND OF THE INVENTION

This invention generally pertains to elastomeric expansion joint seals adapted for use to span the clearance gaps or slots provided between sections of highways, bridges, aircraft runways and the like for thermal expansion and contraction of the sections and adapted to support the load of traffic traversing such gaps or slots. The invention more particularly pertains to a multidirectional elastomeric expansion joint seal adapted to span an intersection of gaps or slots at the juncture of deck sections of structures such as wide bridges, parking decks, playgrounds, runways and the like and adapted to support the load of traffic traversing such intersection while maintaining a substantially smooth and level surface between the deck sections. The gap or slot intersections formed by such deck sections may be in the shape of an "X," "T" and the like.

As well known, gaps or slots are provided between adjacent sections of the structures above mentioned to give room for thermal expansion and contraction of such sections responsive to ambient temperature fluctuations. Accordingly, some means is generally incorporated within or across these gaps to contract and expand with movement of the adjacent sections and provide a smooth transition between the surface of adjacent sections.

DESCRIPTION OF THE PRIOR ART

Elastomeric expansion joints which also seal the gap are one such means currently used to span such gaps. Typically, such expansion joints comprise a deformable body of elastomeric material designed to withstand abuse and large and heavy loads from traffic. The expansion joint is usually designed to provide a good water tight seal and to expand and contract with movement of the adjacent road or deck sections while concurrently maintaining a smooth transition between the surfaces of such sections.

Usually, vertically recessed horizontal shoulders are provided in the adjacent roadway sections and the edges of the expansion joint are anchored to such shoulders within the recess formed in a manner whereby the top surface of the expansion joint is substantially flush with the surface of each adjacent section.

Such gaps generally extend the width of a roadway or the entire length and width of a parking deck section, for example. A complete elastomeric expansion joint spanning such a gap is normally constructed of a plurality of longitudinal sections joined end to end along the entire length of the gap.

The invention herein disclosed is adapted for installation and use with elastomeric expansion joints of the type which are provided with rigid reinforcement plates. Such reinforcement plates are bonded to the elastomer and may be totally or partially embedded within the expansion joint to support the weight of traffic passing over the joint and also to prevent vertical buckling of the joint when the joint is expanded or contracted. Such reinforcing plates normally extend substantially throughout the entire length of each section of the expansion joint.

Situations occur wherein there is an intersection of such gaps or slots, such as a cross of X-shaped intersection of gaps formed by the juncture of the corners of four rectangularly shaped parking deck sections installed together or such as a T-shaped intersection of gaps formed by two adjacent deck sections installed along the side of a single member or deck section, for example. There has heretofore been no means available to span such an intersection in a manner accommodating the individual movements of the respective sections while providing a good watertight seal; while concurrently supporting the weight of traffic passing over the intersection; and while also providing a smooth transition between the surfaces of the respective sections.

The invention as shown and described herein may be used with elastomeric expansion joint seals such as disclosed in U.S. Pats. No. 3,650,184 and No. 3,758,220, which are owned by the assignee of the present invention and which are herein incorporated by reference.

The invention also may be adapted for use with elastomeric expansion joints such as disclosed in U.S. Pats. No. Re. 26,733; No. 3,363,522 and No. 3,690,226.

SUMMARY OF THE INVENTION

The present invention provides a multidirectional elastomeric expansion joint seal adapted to seal the intersection of gaps occuring at the juncture of several structural sections while establishing and maintaining a seal with a plurality of linear elastomeric expansion joint seals installed to establish a seal along the lengths of such gaps.

The present invention also provides a multidirectional expansion joint seal adapted to support traffic loads while maintaining a substantially smooth and level surface between adjacent deck sections.

The foregoing and other provisions may be attained in a traffic load bearing multidirectional expansion joint seal structure having several of corner plate members adapted for respective connection in traffic load bearing relation to the corners of adjacent deck sections at the intersection of the gaps between the deck sections, several of spanning plate members vertically disposed in overlapping relation with respect to adjacent corner plate members and adapted to span the expansion gaps between the deck sections adjacent the intersection, and a center plate member vertically disposed in overlapping relation with respect to all of the corner plate members and adapted to span the intersection. Elastomeric support masses or bodies are disposed between and connected as by bonding to the faces of the overlapping portions of all the members. The support bodies provide vertical support between the overlapping portions and are adapted to deform in shear to accommodate respective horizontal movement between the corner plate members and the spanning plate members and the center plate members. Interconnecting and facing portions of elastomer define a substantially horizontal upper surface for traffic and also define grooves or spaces to permit relative horizontal movement between the members without compressive deformation of the support bodies. The support bodies and the interconnecting and facing portions are combined into an elastomeric unitary body. The interconnecting and facing portions may further include a vertical face defining horizontal tongues and grooves between adjacent members of the corner plate members which are adapted to mesh with complementary tongues and grooves of adjacent expansion joint seals.

The corner plate members include slots extending through the unitary body and adapted to receive threaded fasteners. The center plate member may be circular.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the multidirectional expansion joint seal of the present invention as utilized with four conventional expansion joint seals to cover the intersection of gaps at the juncture of four rectangular deck sections (not shown);

FIG. 2 is a plan view of the bottom side of the multidirectional expansion joint.

FIG. 3 is a plan view of the top side of the multidirectional expansion joint.

FIG. 4 is a sectional view taken along the lines 4—4 of FIGS. 2 and 3; and

FIG. 5 is a sectional view taken along the lines 5—5 of FIGS. 2 and 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 5, there is shown an embodiment of the multidirectional expansion joint seal 10 utilized with four expansion joint seals 12. Each expansion joint seal 12 has a pair of deformation grooves 14 extending along its exposed surface and a deformation groove 16 extending along the bottom surface. A rigid reinforcing plate 18 is located between the deformation grooves 14 and generally spans the expansion slot (not shown) between adjacent deck sections. In addition to the spanning plate 18 each joint has two L-shaped reinforcing plates 20 under each of the deformation grooves 14. The sections of bridge deck on either side of the expansion slot are provided with a platform and a shoulder (not shown). A plurality of studs (not shown) are anchored in the concrete and project up from the platform, spaced to cooperate with holes 21 molded or otherwise formed in the expansion joint. As the sections of the bridge deck expand or contract, the width of the expansion slot decreases or increases and the shoulders and studs exert a compressive force against the sides of the expansion joint. This linear force causes the rubber of the expansion joint to deform in shear resulting in closing or opening of the deformation grooves 14 on top of the joint and groove 16 on the bottom of the joint. Shear type expansion joints 12 such as shown are sold by The General Tire and Rubber Company as Transflex Model 200 and Model 250. Because of the arrangement of the plates and the grooves 14 and 16 in the expansion joint, changes in width of the joint result in shear movement of the rubber in the region of the exposed deformation grooves with very little movement occuring at the top surface of the joint along the spanning plate 18.

The details of the expansion joint seal 10 are shown in FIGS. 2–5. The embodiment shown is designed to be connected to the corners of four adjacent deck sections in and X or cross configuration as shown in FIG. 1. Four corner plates 22 are provided with each corner plate having means to be connected to a respective deck section corner such as the slotted holes 24. Each plate may be bolted to a deck section by means of threaded studs or bolts (not shown).

Disposed above and in overlapping relation over adjacent corner plates are a plurality of spanning plates 26. The overlapping portions are indicated at 28 in FIGS. 2, 3 and 5. Respective elastomeric masses or bodies 30 are disposed in vertically supporting relation between the overlapping portions 28 and are connected to the plates 22 and 26 as by bonding. When installed with seals 12 as shown in FIG. 1, each spanning plate 26 spans or bridges the gap adjacent to the intersection (not shown) of the four gaps defined between the deck sections. Each portion of seal structure 10 including a spanning plate 26 is adapted to expand and contract along with the expansion and contraction of the adjacent expansion joint seal 12. Such expansion and contraction between deck section gaps is accommodated by shear deformation of the elastomeric bodies 30.

Centrally disposed in overlapping relation above all four of the corner plates 22 is a spanning central plate member 32. The overlapping portions are indicated at 34 in FIGS. 2, 3 and 4. Elastomeric masses or bodies 36 are disposed in vertically supporting relation between the overlapping portions 34 and are connected to the plates 22 and 32 as by bonding. When installed across the intersection of gaps between four deck sections, the center plate 32 spans or bridges the intersection between the sections. Each respective section may independently expand or contract and the seal 10 will correspondingly expand and contract through shear deformation of the shear bodies 36.

Seal 10 including shear bodies 30 and 36 are joined as an integral or unitary structure by means of elastomeric interconnecting bodies or elements 38 shown in part in FIG. 4, taken in view of FIGS. 2 and 3.

Elastomeric facing materials or members 40 are provided as needed to build up the structure of seal 10 so as to provide a unit having substantially parallel sides and a horizontal upper wear surface for traffic loading.

The sides of seal 10 may be finished with a tongue and groove configuration 42, for example as shown in FIGS. 1, 4 and 5, to enable the seal 10 to be meshed with complementary tongue and groove configurations at the ends of the expansion joint seals 12.

Grooves 44 and 46, as shown, provide the necessary spaces to allow relatively horizontal movement between the plates without causing compressive deformation of the shear bodies 30 and 36.

It is seen that one of the four sides of seal 10 may be readily adapted to enable the seal to be utilized in a T gap intersection. Also, it is readily seen that, if occasion demanded, the seal 10 could be modified to have three sides, five sides and so on. Accordingly, the term "several" as used to designate elements in the claims is intended to mean three or more.

As shown, the various reinforcing plates in the seal 10 are generally thin and planar. Although typically made out of steel, these plates can be made from any other metallic or non-metallic material that is capable of performing the intended function. Furthermore, changes can be made in the shape, size, number and location of these plates while remaining within the purview of the present invention.

The joint is preferably fabricated by molding in a compression mold. The reinforcing plates are positioned in their proper location in the mold, and during the molding and subsequent curing, becomes embedded in and bonded to the elastomer. Alternatively, the plates may be bonded to the exposed surface of the rubber after molding. The joint is preferably compounded from an elastomer such as neoprene or natu-

ral rubber formulated to have good resistance to environmental conditions such as sunlight, heat and abrasion. The cured rubber should have a durometer hardness of between about 40 and 70, for example, and should have good abrasion resistance and flexural properties.

The foregoing description and drawings will suggest other embodiments and variations to those skilled in the art, all of which are intended to be included in the spirit of the invention as herein set forth.

That being claimed is:

1. A load bearing multidirectional expansion joint seal structure comprising:
- A. several corner plate members adapted for connection in load bearing relation to the corners of adjacent deck sections at the intersection of the gaps between said deck sections;
- B. several spanning plate members vertically disposed in overlapping relation with respect to adjacent said corner plate members and adapted to span the expansion gaps between said deck sections adjacent said intersection;
- C. a center plate member vertically disposed in overlapping relation with respect to all of said corner plate members;
- D. elastomeric support means disposed between and bonded to the faces of the overlapping portions of all said members;
- E. said support means providing vertical support between said overlapping portions and adapted to deform in shear to accommodate respective relative horizontal movement between said corner plate members, spanning plate members and said center plate member;
- F. elastomeric interconnecting and facing means defining a substantially horizontal upper surface for vehicular traffic and defining spaces to permit relative horizontal movement between all of said members without compressive deformation of said support means; and
- G. said support means and said interconnecting and facing means comprising an elastomeric unitary body.

2. The structure of claim 1 wherein said interconnecting and facing means further comprise a vertical face defining horizontal tongues and grooves between adjacent of said corner plate members which are adapted to mesh with complementary tongues and grooves of adjacent expansion joint seals.

3. The structure of claim 2 wherein the corner plate members define slots extending through said unitary body and adapted to receive threaded fasteners.

4. The structure of claim 3 wherein said center plate member is circular.

5. A load bearing multidirectional expansion joint seal structure comprising:
- A. several corner plate members adapted for connection in load bearing relation to the corners of adjacent deck sections at the intersection of the gaps between said deck sections;
- B. a center plate member vertically disposed in overlapping relation with respect to all of said corner plate members and adapted to span all said gaps of said intersection; and
- C. elastomeric support means disposed between and connected to the faces of the overlapping portions of all said members;
- D. said support means providing vertical support between said overlapping portions and adapted to deform in shear to accommodate respective relative horizontal movement between said corner plate members and said center plate member.

6. The structure of claim 5 wherein the sides of said seal structure define vertical faces having horizontal tongues and grooves between adjacent of said corners plate members which are adapted to mesh with complementary tongues and grooves of adjacent expansion joint seals.

7. The structure of claim 6 wherein said center plate member is circular.

8. A load bearing multidirectional expansion joint seal structure comprising:
- A. several corner plate members adapted for connection in load bearing relation to the corners of adjacent deck sections at the intersection of the gaps between said deck sections;
- B. a center plate member vertically disposed in overlapping relation with respect to all of said corner plate members;
- C. elastomeric support means disposed between and bonded to the faces of the overlapping portions of all said members;
- D. said support means providing vertical support between said overlapping portions and adapted to deform in shear to accommodate respective relative horizontal movement between said corner plate members and said center plate member;
- E. elastomeric interconnecting and facing means defining a substantially horizontal upper surface for vehicular traffic and defining grooves to permit relative horizontal movement between said members without compressive deformation of said support means; and
- F. said support means and said interconnecting and facing means comprising an elastomeric unitary body.

9. The structure of claim 8 wherein said interconnecting and facing means further comprises a vertical face defining horizontal tongues and grooves between adjacent of said corner plate members which are adapted to mesh with complementary tongues and grooves of adjacent expansion joint seals.

10. The structure of claim 8 wherein the corner plate members define slots extending through said unitary body and adapted to receive threaded fasteners.

11. The structure of claim 8 wherein said center plate member is circular.

12. A load bearing multidirectional expansion joint seal structure comprising:
- A. several corner plate members adapted for connection in traffic load bearing relation to the corners of adjacent deck sections at the intersection of the gaps between said deck sections;
- B. a plurality of spanning plate members vertically disposed in overlapping relation with respect to adjacent said corner plate members and adapted to span the expansion gaps between said deck sections adjacent said intersection;
- C. a center plate member vertically disposed in overlapping relation with respect to all of said corner plate members; and
- D. elastomeric support means disposed between and connected to the faces of the overlapping portions of all said members;

E. said support means providing vertical support between said overlapping portions and adapted to deform in shear to accommodate respective relative horizontal movement between said corner plate members, said spanning plate members and said center plate member.

13. The structure of claim **12** wherein the side walls of said seal structure define a vertical face having horizontal tongues and grooves between adjacent of said corner plate members which are adapted to mesh with complementary tongues and grooves of adjacent expansion joint seals.

14. The structure of claim **12** wherein the corner plate members define slots extending through said unitary body and adapted to receive threaded fasteners.

15. The structure of claim **12** wherein said center plate member is circular.

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