April 14, 1964 S. D. BRADLEY 3,128,576

WATERSTOP

Filed Nov. 25, 1960

FIG. 1

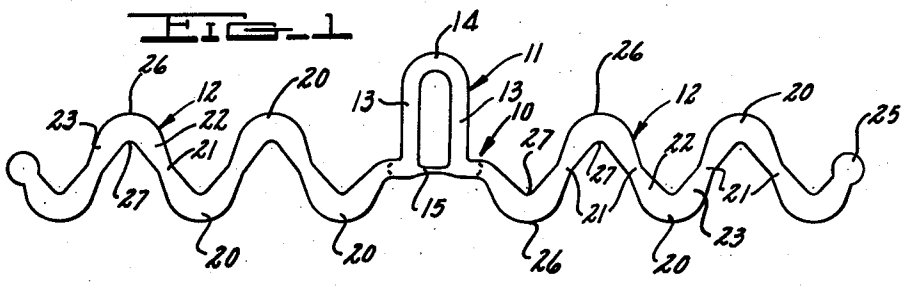


FIG. 2

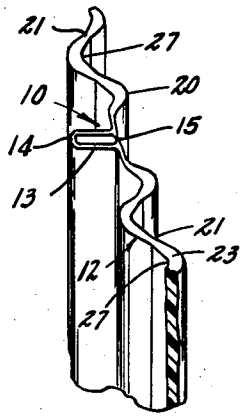
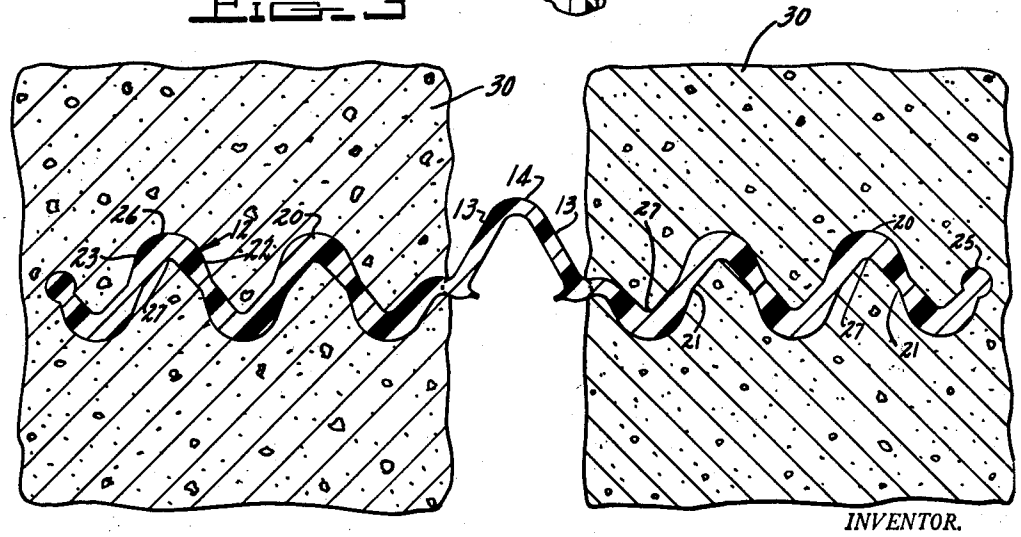


FIG. 3



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WATERSTOP

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The present invention relates to a waterstop for use in forming a fluid-tight expansion and contraction joint between adjacent concrete panels. More particularly, the present invention relates to a sealing strip for sealing adjacent cast concrete members to one another by means of flanges embedded in the adjacent concrete members to maintain a seal therebetween.

Many different designs of elastomeric waterstops have been proposed in the prior art, such waterstops being adaptable for utilization between adjacent cast concrete members, such as between the side walls and footings of a building, between consecutively poured concrete highway slabs or between adjacently poured swimming pool sections or the like. Such waterstops typically comprise an elastomeric membrane, preferably formed of synthetic vinyl compositions, having a central portion bridging the gap between the adjacent poured cast shapes and integral flanges embedded in the cast shapes by positioning and retention within the forms as the forms are filled with the fluid concrete. The elastomeric character of the membrane accommodates limited shifting of the cast shapes, and the flanges are conventionally formed with longitudinally extending ribs or the like disposed angularly to the longitudinal plane of the membrane to resist displacement of the membrane flanges from the cast concrete. Additionally, such ribs serve to provide an elongated, tortuous flow path for water seeping between the membrane and the cast shape in an attempt to by-pass the membrane. Thus, the flanges are provided to serve the dual functions of (1) preventing displacement of the membrane upon shifting of the cast concrete sections and (2) preventing the seepage of water between the cast concrete and the flanges to by-pass the membrane.

The present invention now provides a new and improved sealing strip for sealing adjacent cast concrete shapes or members by the utilization of a new principle of retaining flange design. The present invention is an improvement upon the waterstop disclosed in my earlier application, Serial No. 24,315, filed April 25, 1960, in that the central portion of the sealing strip is formed as a hollow shape which has a membrane pre-weakened for rupture, without loss of the seal, upon initial shifting of the concrete members or upon its subjection to excessive water pressures, so as to minimize displacement of the cast-in-place side flanges while maintaining a seal between the members. The present invention is particularly concerned with a novel, improved side flange design effective to provide improved resistance to displacement of the flanges and also to provide improved sealing characteristics.

More specifically, the sealing strip of the present invention preferably incorporates a central, primary seal section extending longitudinally of the strip and side flanges which are longitudinally coextensive with the central section and which project laterally from the central section to be embedded in the cast members between which the central section is interposed. The side flanges are each provided with surface portions which taper inwardly toward the central sections for wedged, water-tight engagement with surrounding portions of the cast members upon attempted separation of the members. By providing such wedged engagement between

the side flanges and the cast members, not only is displacement of the flanges from the cast members prevented upon separation of the cast members, but extended surface engagement between the flange surfaces and the cast members is insured and such wedged engagement effectively prevents the migration or surface flow of water along the flange surfaces, thereby preventing the by-passing of water about the flanges.

Preferably, the side flanges are sinuous in their overall cross-sectional contour and are of variant cross-sectional thickness so that a plurality of tapered portions are provided at laterally spaced intervals, such portions decreasing in thickness toward the central portion of the sealing strip so as to induce wedged, water-tight, sealing engagement with the concrete members upon attempted displacement of the strip flanges. By the utilization of sinuous flanges having longitudinally extending parallel ridges joined by inclined joining portions, the ridges being of greater thickness than the joining portions, the concave inner surfaces of the ridges interlock with the adjacent, inherently rough surfaces of the concrete members for increased frictional resistance to displacement of the cast-in-place flanges upon separation of the cast members. By tapering the joining portions intermediate the ridges, a plurality of tapered surfaces for wedged engagement with the adjacent concrete surfaces are also obtained.

It is, therefore, an important object of the present invention to provide an improved sealing strip having elongated lateral extremities for in situ casting in adjacent concrete shapes.

Another important object of the present invention is the provision of an improved sealing membrane formed of elastomeric material for joining adjacent cast concrete shapes and including spaced lateral extremities to be embedded in the shapes, respectively, the extremities being at least partially tapered for wedged engagement with the concrete shapes upon attempted separation of the shapes to (1) prevent lateral displacement of the seal and (2) prevent the flow of water between the seal and the cast shapes.

It is another important object of the present invention to provide an elastomeric seal provided with a central section and elongated lateral flanges adapted to be embedded in adjacent concrete shapes spanned by the central section, the flanges being sinuous in cross-sectional configuration and being of variant thickness for wedged frictional engagement with the surrounding portions of the cast shapes to resist displacement of the seal therefrom.

Still another, and no less important, object of the present invention is the provision of an improved sealing strip for interposition between a pair of cast shapes and having a marginal portion adapted to be embedded in one of the cast concrete shapes during the casting thereof and having a plurality of longitudinally coextensive, laterally spaced tapered surfaces convergent toward the juncture of the cast shapes for improved frictional engagement and improved surface sealing with the surrounding portions of the cast shape upon attempted displacement of the seal therefrom.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

On the drawings:

FIGURE 1 is an end elevational view of a seal of the present invention;

FIGURE 2 is a perspective elevational view, with parts broken away and in section, of a seal of the present invention; and

FIGURE 3 is an enlarged sectional view of a seal of the present invention installed and in use to join a pair of cast concrete shapes.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

As shown on the drawings:

In FIGURE 1, reference numeral 10 refers generally to a sealing strip of the present invention. This sealing strip 10 is elastomeric in nature and may be formed from any suitable elastomeric material such as rubber, synthetic rubber, polyvinylchloride, or the like.

Preferably, the sealing strip of the present invention comprises a central deformable section 11 and a pair of laterally projecting side flanges 12 formed integrally with the central deformable section 11.

As disclosed in my above-identified earlier filed application, the central section 11 is preferably of inverted U-shape when the sealing strip is oriented as illustrated in FIGURE 1 of the drawings, the central portion comprising upstanding side legs 13 joined by an arcuate upper joining portion 14. Preferably, a lower rip membrane 15 extends laterally across the bottom side of the central portion 11 and, if desired, this membrane may be provided with a plurality of aligned apertures (not shown) for pre-weakening the membrane. Additionally, the central portion 11 is formed of material which is significantly softer than that utilized for the side flanges 12 so that the rip membrane 15 is pre-conditioned for subsequent rupture as will be hereinafter more fully described.

As above explained, the present invention is particularly concerned with the contour and shape of the side flanges 12. It will be noted from FIGURE 1 that the side flanges 12 are sinuous in overall contour to provide spaced ridges 20 lying alternately above and below a medial plane passing substantially through the lateral plane of the rip membrane 15. The ridges 20 are joined by central joining portions 21, these joining portions being of substantially less thickness than the ridge portions 20. Further, it will be noted that the ridge portions 20 are each adjacent a tapered portion 22, the thickness of which decreases toward the central portion 11 and also each of the ridges is adjacent a second tapered portion 23 displaced from the adjacent ridge portion 20 toward the outer extremity 25 of the flange 12. This second tapered portion 23 decreases in thickness toward the outer extremity 25 and the reduced portions 21 of minimal thickness are provided between adjacent tapered portions 23, 22. The outer extremities 25 of the flanges are enlarged to form a terminal bulbous portion which may suitably be cylindrical in contour.

In use, the sealing strip 10 is positioned and retained by suitable supports in the pouring forms from which the cast shapes 30 (FIGURE 3) are to be formed with the central portion 11 interposed between the cast shapes 30. Upon subjection of the central portion 11 to fluid pressure and to any lateral shifting movement, the rip membrane 15 will rupture, but such rupture will not interrupt the seal between the elements provided by the legs 13 and the medial joining portion 14 of the central portion 11. Further, such rupture will not displace the flanges 12 from the cast shapes 13.

However, upon the subjection of the central portion 11 to fluid under pressure, the flanges 12 will be subjected to tension because of the attempted displacement of the fluid-tight central portion 11. Such tension within the flanges will attempt to displace the flanges laterally inwardly toward the central portion 11. Such attempted lateral inward displacement will be resisted by frictional

engagement between the flanges and the surrounding portions of the cast shape 30. The sinuous configuration of the flanges aids in providing high frictional resistance to such displacement.

It will be noted that the ridges 20 are provided with exterior surfaces 26 of substantially larger radius than the rounded inner surfaces 27 thereof. These concave inner surfaces 27 form relatively sharp corners in full surface engagement with surrounding portions of the cast shape 30 and such relatively sharp interlocking engagement aids in increasing the surface friction and aids in preventing displacement of the flanges. Further frictional resistance to displacement of the flanges is provided by the cylindrical terminal bulbous portion 25.

If the surface friction of the flanges 12 within the cast shapes 30 is insufficient to resist lateral inward movement thereof, such movement is further resisted by the wedging of the tapered portions 22 into the complementary tapered passages formed in the cast shape by the previous in situ casting of the flanges therein. Such wedged engagement is highly effective in resisting displacement of the flanges, since it is necessary to pass the tapered portions 22 and the relatively thick ridge portions 20 through passages of a width corresponding to the thickness of the medial joining portions 21. The utilization of hard, dense material for the flanges 12 prevents substantial compression of the ridges 20 to an extent sufficient for passage through the restricted passages afforded by the space previously occupied by the reduced portions 21.

Additionally, the sinuous flanges 12 provide elongated, tortuous flow paths through which surface moisture must seep along the irregular flange surface in order to by-pass the water impermeable seal 10. The sinuous configuration defines, in effect, a labyrinth seal through which the water cannot readily flow. Additionally, any attempted lateral displacement of the sealing member flanges 12 and the resultant wedged engagement of the tapered portions 22 within the cast members 30 provides an effective wedged seal between the correspondingly tapered surfaces, and such wedged engagement prohibits the passage of fluid along either or both surfaces of the flange.

Thus, it will be seen that the sinuous configuration of the flanges enables the flanges to perform the necessary dual function of preventing displacement of the seal and preventing surface flow of water therealong by (1) providing extended frictional engagement between the flange and the surrounding concrete and (2) providing an elongated, tortuous flow path for fluid between the seal and the surrounding portions of the cast shape. This dual function is further promoted by the provision of the plurality of the tapered portions 22 which serve to (1) wedge in the correspondingly tapered passages in the cast shapes to prevent lateral displacement of the flanges and (2) provide wedged sealing engagement between the flanges and the surrounding portions of the concrete members 30, which sealing engagement becomes even more effective upon lateral displacement.

Having thus described my invention, I claim:

1. A sealing strip for sealing adjacent cast concrete members having abutting faces to one another comprising a deformable central section extending longitudinally of the strip for interposition between said faces and side flanges longitudinally coextensive with the central section and projecting laterally therefrom to be embedded in said members, respectively, said side flanges being sinuous in cross-sectional shape and having longitudinally extending, transversely spaced ridges of appreciably greater thickness than the portions joining the ridges, the portions joining said ridges being tapered toward a restricted medial portion, said side flanges each defining a tortuous flow path for water attempting to bypass the strip and the tapered portions thereof adapted to wedgingly engage that portion of the panel in which the flange is embedded upon attempted separation of said cast members to prevent water

flow between the tapered portions and the surrounding cast members and to resist lateral displacement of the strip.

2. In an elastomeric sealing strip for sealing adjacent cast concrete members to one another, a deformable central section extending longitudinally of the strip and side flanges longitudinally coextensive with the central section and projecting laterally therefrom to be invested in said adjacent cast concrete members, respectively, said side flanges being sinuous in cross-sectional contour and including longitudinally extending parallel ridges lying alternately above and below a medial plane of said strip, said flanges also including joining portions joining said ridges to one another, each of said ridges being of greater thickness than the adjacent joining portions and each of said joining portions being tapered from its adjacent ridge toward a restricted medial portion adjacent said medial plane.

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