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FLEXIBLE SEALING SYSTEM

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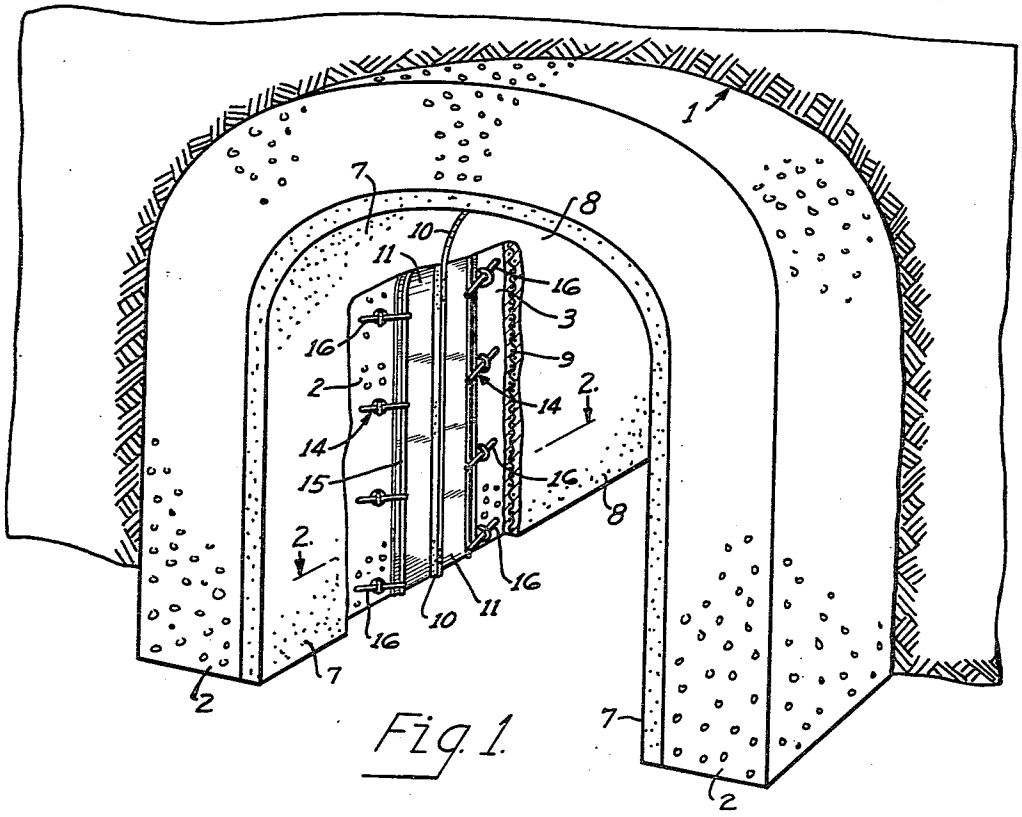



Fig. 1.

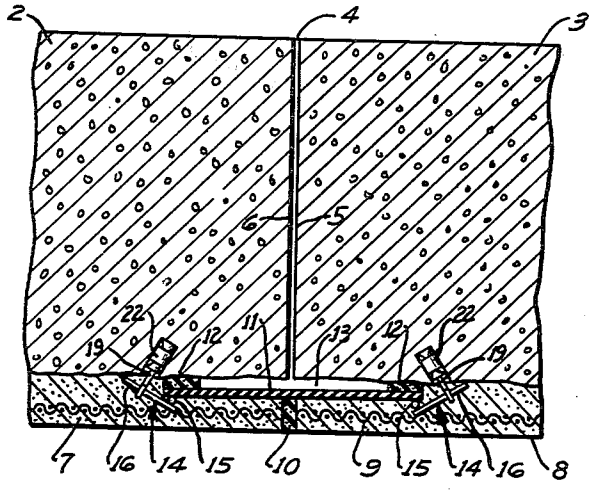
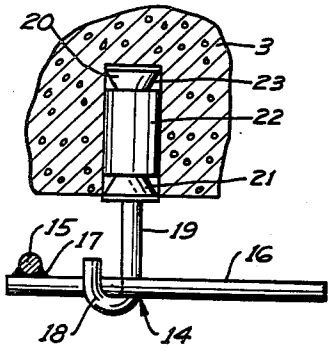



Fig. 2.

Fig. 3.




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# FLEXIBLE SEALING SYSTEM

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This invention relates to a flexible sealing system for controlling the seepage of liquids through a discontinuity in a natural or artificial formation such as a wall, dam, bulkhead, tunnel, tank or the like.

In formations of this nature, whether of natural or artificial origin, fissures, cracks and similar discontinuities are produced with time as the result of settling, vibration, thermal movement, etc. In masonry structures, the need for providing expansion joints at intervals introduces analogous discontinuities. So also does the common practice of erecting masonry structures in sections, a practice resulting in construction joints of kinds that in many cases can be only incompletely caulked. In general, discontinuities so produced, whether in natural or man-made structures, tend to give rise to seepage problems. Sometimes a limited amount of seepage can be tolerated, but when cracks appear or a joint expands, the likelihood of seepage is often substantially increased. In many cases, this seepage can be contained or controlled by the sealing system of the present invention.

The principal object of the invention is to provide a sealing system which will channel away seepage in orderly fashion. Where caluking compounds are relied on to seal cracks, this is often impossible. As opposed to the unreliable results produced by caulking, the present invention provides a tight sealing system which, by virtue of its flexibility, adapts itself to the needs of almost any situation. As will appear, the sealing system is such that its presence may, if desired, be largely or entirely concealed by the application of a surface layer of cementitious material. Other objects, advantages and features of the invention will be apparent from the description which follows and from the accompanying drawings.

The drawings, showing one of many ways in which the invention may be employed, are to be considered illustrative rather than limitative of the invention. In such drawings:

FIGURE 1 is a perspective of a tunnel entrance showing the manner in which the sealing system of the invention may be used to control seepage between sections of concrete spaced by a construction joint.

FIGURE 2 is a horizontal section on a somewhat larger scale on line 2—2 of FIGURE 1; and

FIGURE 3 is a fragmentary showing on a still larger scale of a detail from the right-hand end of FIGURE 2.

Referring first to FIGURE 1, it will be noted that the tunnel is characterized by a series of spaced concrete sections of which two adjacent sections, 2 and 3, appear in the drawings. These sections result from the technique used in erecting the structure, which in a typical case requires pouring the concrete in sections lengthwise of the tunnel, first in end section 2, then in section 3, and so on. This results in a construction joint 4 between the opposing faces 5 and 6 of adjacent sections (FIGURE 2). Through discontinuities of this and analogous types (including cracks resulting from thermal movement, vibration or settling of the structure) water often tends to seep into open space within the tunnel.

When the sealing system of the invention is being installed, either during construction of the tunnel or subsequently one of the usual steps forming part of the procedure is that of finishing the exposed surfaces of the tunnel. This is done by means of the previously-mentioned surface layer of cementitious material, which, if not interrupted or omitted, may largely or entirely conceal the mechanical components of the sealing system. FIGURES 1 and 2 show two sections 7 and 8 of such a layer reinforced by wire mesh 9, such sections corresponding in width to sections 2 and 3 of the tunnel. Expansion means 10 separate the sections as indicated near the top of FIGURE 1.



Expansion means 10 preferably take the form of a fin-like rib of a soft, yieldable material such as sponge rubber. If, as may conveniently be the case, it is made from natural rubber, it can advantageously conform to ASTM specification R–11; on the other hand, if it is made from chloroprene rubber such as that sold under the trademark "Neoprene," it can conform to ASTM specification SC–11. In either case the durometer measurement may be of the order of 25/56 (Type "00"). It is preferably cemented by a suitable rubber cement to the flexible containing strip 11, seen in elevation in FIGURE 1 and in horizontal cross-section in FIGURE 2, which extends longitudinally of joint 4 from the base of the wall of the tunnel on one side across the overhead arch to the base of the opposite wall of the tunnel.

Containing strip 11, which in a typical case may measure 12" from side to side, can be ⅛" or more in thickness. Preferably it consists of a moderately stiff, but nevertheless somewhat flexible, band of elastomeric material. Vulcanized rubber, chloroprene rubber and the like are typical examples. In either case it should have a durometer hardness of 50/60 (Type "A"), a tensile strength of 1500 to 1600 lbs. per sq. in. and an elongation in the range between 350% and 500%. If formed of chloroprene, it may advantageously conform to ASTM specification SC–515.

Back of containing strip 11 are longitudinally extending edge pads 12, one on each side of the containing strip: see FIGURE 2. These edge pads are preferably formed of a yieldable material of physical characteristics similar to those of the material used to form expansion rib 10. When containing strip 11 is urged into place, these pads assist in sealing off space 13 (shown in somewhat exaggerated fashion in FIGURE 2) behind containing strip 11. After containing strip 11 has been installed, seepage through joint 4 is confined to space 13. Used along with the containing strip are hold-down means 14, the same being located at the edges of the containing strip outwardly of pads 12.

Hold-down means 14 are preferably of such nature that they can follow the shape assumed by the containing strip even when it departs from planar form, as at the top of the tunnel.

In a typical case, the hold-down means 14 for containing strip 11 will make use of parallel lengths of No. 4 steel rod. Such rod has a nominal diameter of ½". It is susceptible of being bent to follow a curviform surface without undue difficulty. As appears from FIGURES 1 and 2, these rods, designated 15, follow containing strip 11 from one side of the tunnel opening to the other. There are two of them, one at each edge of the containing strip. Rigidly affixed to each of the two longitudinally extending rods 15 is a series of transversely extending rods 16, each attached as by a weld 17 to the longitudinally extending rod with which it is associated.

Coupled to transversely extending rods 16 are the hooked ends 18 of hook bolts 19. These form part of the anchoring devices shown in FIGURE 3. Associated with the inner end of each hook bolt 19 are two cones 20 and 21. The cone 21 is free to travel lengthwise of hook bolt 19, but cone 20 is not. Between cones 20 and 21 is a lead sleeve 22, which, like cones 20 and 21, is received in an opening 23 in the wall forming one of the sections. The anchoring devices comprising hook bolts

19, cones 20 and 21 and lead sleeve 22 are commercially available from Chicago Expansion Bolt Company, Chicago, Illinois.

In practice, openings 23 (FIGURE 3) are formed at regular intervals lengthwise of joint 4 on opposite sides thereof. They are spaced laterally by a distance slightly greater than the width of containing strip 11. Before the latter is applied to sections 2 and 3, the anchoring devices are made ready. When the containing strip is positioned, longitudinally extending rods 15 are applied to its edges, being bent as necessary to follow the contours of the structure in which the sealing system is installed. Each transversely extending rod 16 is urged into position under the hooked end of one of the hook bolts 19, after which the latter is driven into place. This is repeated at intervals until containing strip 11 is secured in place on both sides from one end to the other.

When the sealing system of the present invention is installed, it is usually desirable to provide at the base of the structure a drain or weep pipe (not shown) through which future seepage may be channeled off, as into an open drain.

It is not always desirable to line the entire structure with a surface layer of cementitious material such as that forming sections 7 and 8. In such circumstances, the cementitious layer may be confined to the area occupied by the sealing system and, if desired, the latter may be recessed into the side walls of the structure. The cementitious layer, if used, can conveniently have a thickness of about two inches. The depth of expansion rib 10 is normally of this order of magnitude. Preferably, the cementitious material is pressure concrete ("Gunite") blown into place by means of compressed air through a suitable bxlowing gun. However, it is not necessary to use pressure concrete for these purposes; instead, it is practicable to apply ordinary cement by other methods, as by trowelling it in place.

As previously indicated, the invention may be used for sealing off discontinuities of many kinds, not merely such as result from the practice of erecting masonry structures in sections. It will be apparent that in the practice of the invention various other types of anchoring devices than that illustrated in the drawings may be employed. The manner in which the anchoring device is coupled to longitudinally extending rods 15 may be varied, it being necessary only that there be a rigid connection that will apply firm pressure to containing strip 11 and pads 12, thereby forming space 13 and sealing off joint 4. Other features of the system illustrated in the accompanying drawings may be varied within the skill of those versed in the art to which the invention relates.



It is intended that the patent shall cover, by summarization in appended claims, all features of patentable novelty residing in the invention.

What is claimed is:

1. In a structure of the kind described, two mutually spaced sections sealed without surface grooving of the sections against the seepage of liquid therebetween by means of a flat strip of elastomeric material that extends lengthwise of the space between the two sections parallel to but out of contact with the surfaces of the sections; flat edge pads of soft, yieldable material that occupy only a minor part of the space between the strip of elastomeric material and the mutually spaced sections, said edge pads forming a seepage chamber behind the strip of elastomeric material by serving as spacers that keep the strip of elastomeric material out of contact with the surfaces of the sections; and continuous hold-down means at the edges of the strip of elastomeric material for keeping it flat and holding it in place, said hold-down means comprising a plurality of generally longitudinally extending rods of a metal susceptible of being bent without undue difficulty to conform to a curviform surface, a series of transversely extending rods affixed to said longitudinally extending rods, and a series of anchoring means implanted in the mutually spaced sections on opposite sides of the strip of elastomeric material for retaining said longitudinally and transversely extending rods in fixed relation to said strip of elastomeric material.

2. A structure according to claim 1 in which the transversely extending rods are welded to the longitudinally extending rods.

3. A structure according to claim 2 in which the transversely extending rods are mechanically coupled to the anchoring means.


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