May 21, 1946. A. C. FISCHER 2,400,493

WATERSTOP EXPANSION JOINT

Filed Feb. 19, 1941 2 Sheets-Sheet 1

Fig. 1.

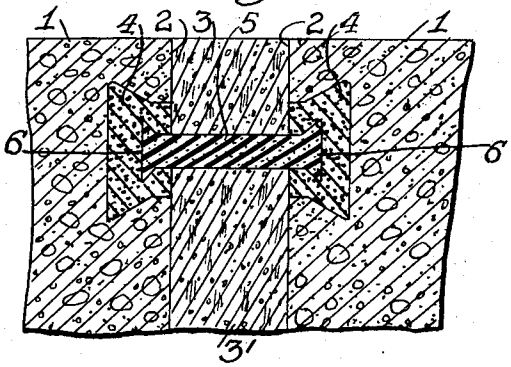


Fig. 2.

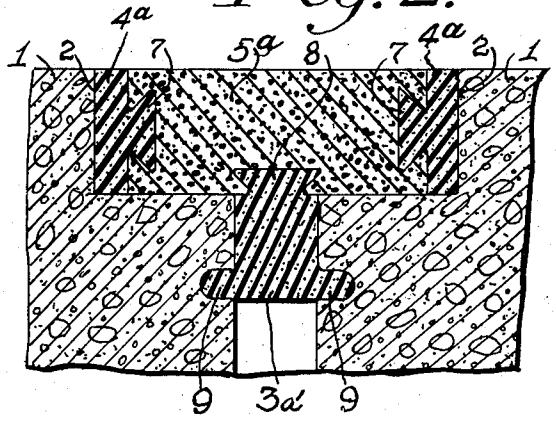


Fig. 3.

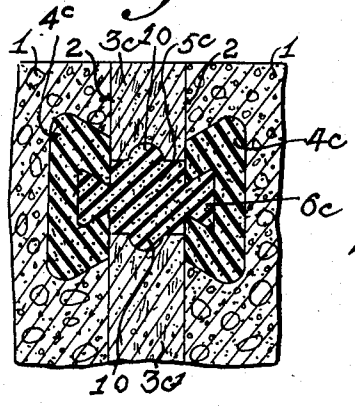


Fig. 4.

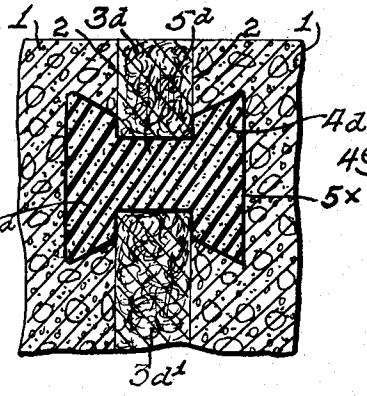


Fig. 5.

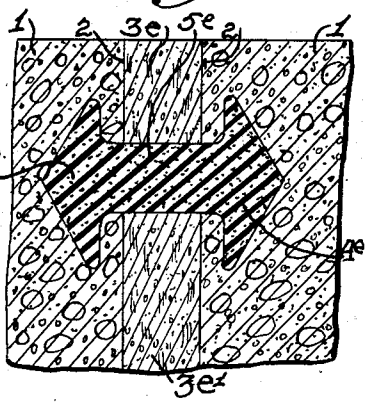


Fig. 6.

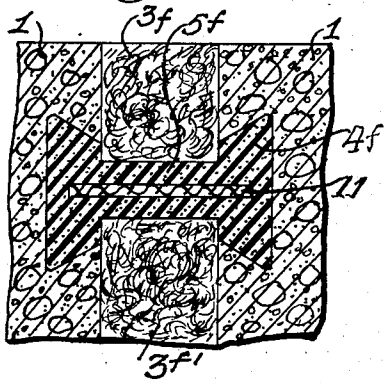


Fig. 7.

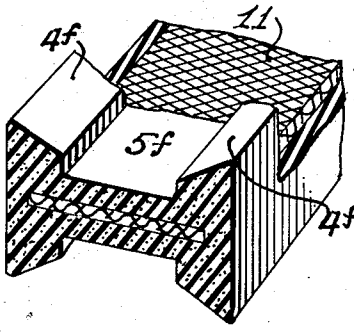
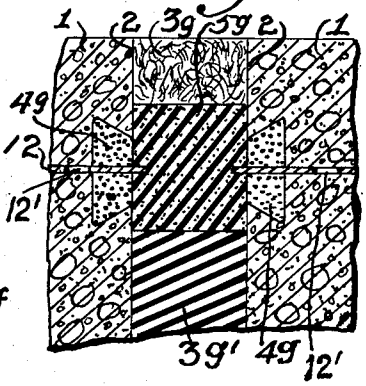


Fig. 8.



Inventor;
Albert C. Fischer,
By Knight Bros
Attorneys.

May 21, 1946. A. C. FISCHER 2,400,493

WATERSTOP EXPANSION JOINT

Filed Feb. 19, 1941 2 Sheets-Sheet 2

Fig. 9.

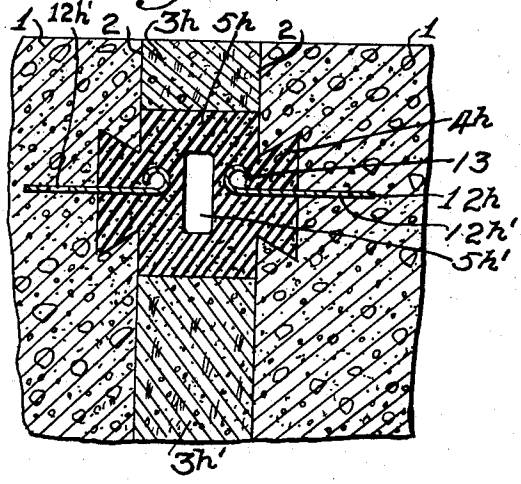


Fig. 10.

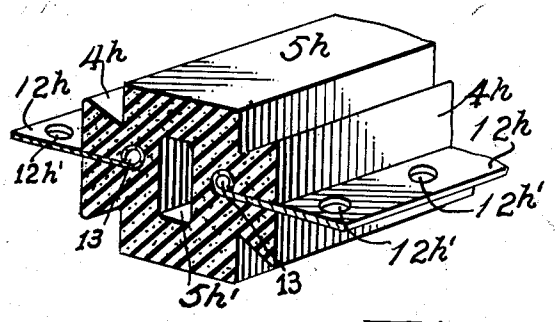


Fig. 11.

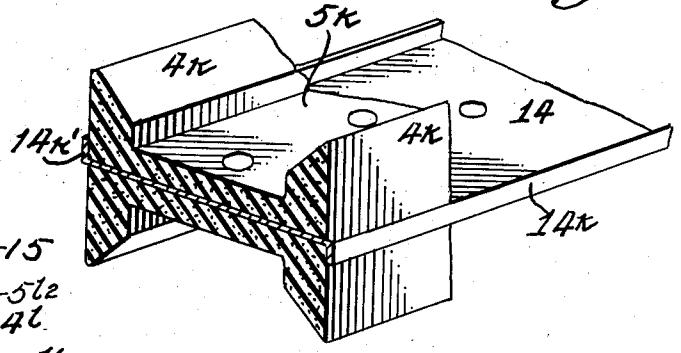


Fig. 12.

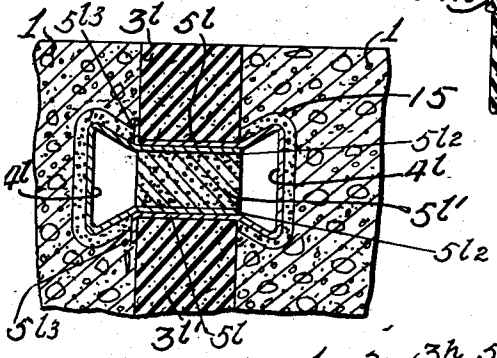
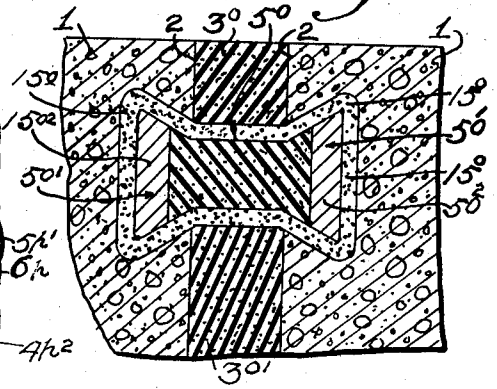


Fig. 13.



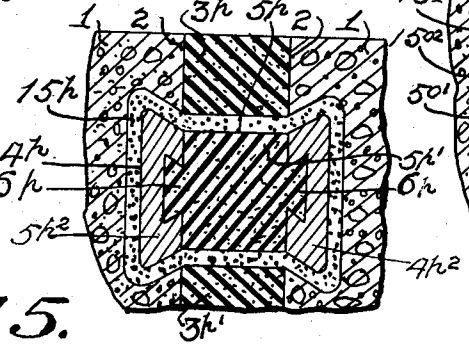


Fig. 15.

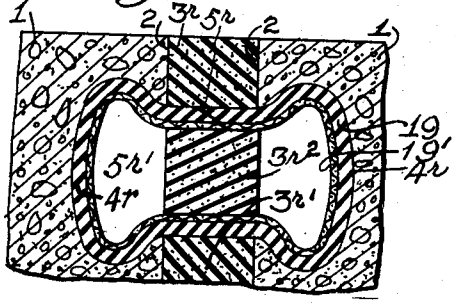


Fig. 14.

Inventor:
Albert C. Fischer,
By Knight Bros
Attorneys

Patented May 21, 1946

2,400,493

UNITED STATES PATENT OFFICE

2,400,493

WATER STOP EXPANSION JOINT

Albert C. Fischer, Chicago, Ill.

Application February 19, 1941, Serial No. 379,671

7 Claims. (Cl. 94—18)

This invention relates to expansion joints of the type in which deformable cores are employed to fill and exclude dirt and moisture from thermal expansion spaces conventionally left between the sections of masonry of such joints. The invention has for its primary object to insure such a joint against admission of seepage moisture through crevices tending to open between the filling core and the masonry in such a joint, during contraction of the masonry under a drop in temperature; to which end the invention proceeds upon the principle of not only yieldingly filling the thermal expansion space by a deformable dirt and moisture excluding core, but also maintaining, under tension across the filling core between the masonry sections, and in addition to and independently of said filling core, a waterstop apron having its ends hermetically anchored to the respective masonry sections, beyond the dirt excluding core, which said apron has the capacity of preventing escape of seepage water past the apron in either direction.

A collateral object of the invention is to maintain the assembly of masonry sections, the dirt and water excluding core and the waterstop apron, in a manner to prevent injury to any element of the assembly, to wit, the filling core, the waterstop apron or the anchorages of said apron in the said masonry sections, from occurring under any excessive relative movement between the masonry sections such for instance as vertical relative movement that would impose shearing stresses upon the anchoring ends of the apron or stresses of tension imposed by excessive thermal contraction of the apron; and to accomplish this without detracting from the hermetic nature of the anchorage of the apron in the masonry sections; namely, by anchoring the apron ends through the medium of enlargements thereon that will become embedded in the masonry as the latter is cast thereabout; by having the enlargements compressible transversely; by having said enlargements and consequently the matrices of the cast masonry in which they are enveloped, tapered in the direction of tension imposed upon the apron and the anchorages, therefore, sluggishly yielding under both transverse as well as longitudinal stresses; and to thereby leave the apron independently of the filling core self relieving under excessive stresses without impairing the hermetic nature of its water seal.

The transverse compressibility of the anchoring enlargements that enables them to yield transversely to shearing stress of vertical relative movement between the masonry sections as well as yielding movement in the direction of tension in the apron, as distinguished from and independently of the filling core is obtained from flexible sheet metal hollow structures as well as from masses of inherently plastic and resiliently deformable asphaltic, rubber waterproofed fibrous masses, etc.

Further objects of the invention, as will appear from the ensuing description are concerned with various embodiments of the different constituent elements of the invention whereby their several identifying functions may be rationally, efficiently and economically realized.

The horizontally, tensionally yielding and vertically flexible waterproofing aprons, with their anchorages in the masonry, may be repeated at levels near the lower or foundation level of the joint; and at such intermediate level or levels as may be desired; and each of the waterproofing adjuncts herein illustrated in detail may be similarly multiplied as may be necessary.

In the accompanying drawings:

Each of Figures 1 to 6 inclusive, shows, in sectional elevation, fragmentary portions of masonry on opposite sides of a subdividing expansion space of a concrete roadway, at each of which is mounted a different construction of combined expansion joint and water stop embodying the subject matter of the present invention.

Figure 7 shows in perspective, partly in horizontal section, the characteristic section of the water stop expansion joint shown in Figure 6.

Figure 8 is an elevational view similar in general character to Figures 1 to 6, illustrating the characteristic section of another embodiment of the invention.

Figure 9 is a view generally similar in character and subject matter to Figure 8, but having the anchoring wings of like material to that of the filler bar or yoke and integral therewith.

Figure 10 is a perspective view with one end in section, of a portion of the water stop expansion joint employed in that form of the invention which is illustrated in Figure 9.

Figure 11 is a perspective view with one end in vertical transverse section and with rear-portions broken away, of a composite waterstop apron.

Figure 12 illustrates in vertical transverse section a form of the invention in which the waterstop is produced largely from thin metal.

Figure 13 is a view similar in character and subject matter to Figure 12 but showing the apron completely filled.

Figure 14 is a view similar to Figure 13, but showing fillers for the wings made of one material and the filler for the yoke made of a different material; and having these two materials assembled together by dovetail tongue and groove construction.

Figure 15 is a transverse sectional view in which the wings and yoke are both made of rubber or its equivalent.

Referring to the drawings more in detail, 1 represents fragments of masonry sections assumed to form parts of a cement or equivalent roadway and having in opposed relation to each other, faces 2—2 that define the space that permits thermal expansion of the sections when in use.

In the space between faces 2—2 is a filler or core made in two sections 3, 3' for the exclusion of foreign matter therefrom including moisture; and this filler when made in accordance with the present invention will keep this space filled at all times. That is to say, in addition to yielding to the narrowing of the space under the expansion of the sections of masonry, the said filler, when the space enlarges by contraction of the masonry sections, will automatically resume a transverse dimension that will continue to fill the space. Accordingly 3 represents a filling body that is not only readily compressible, but possesses the inherent quality of self-restoration from deformation which it experiences under the narrowing of the expansion space and this causes it to function in the manner stated. Filler body 3 may comprise a highly cellular substance such as sponge rubber or fibers, or a body of cork, or cork rubber or wood, or other inherently cellular and resilient substance compounded with an asphaltic or bituminous binder in a proportion lower than that which would induce the said binder to flow and permanently leave the cellular body.

Numeral 4 represents water seal cushions in the form of anchoring wings embedded in the concrete 1 immediately beyond the core 3, 3' and united by a yoke 5 which, as shown in Figure 1 is formed separately from the said wings but is embedded through means of flare or dovetail 6 in the said wings. Yoke 5 extends entirely across the joint material separating its core-sections 3, 3' and by its form, and that of the water seal wings 4, becomes a tension-transmitting tie between the cement sections 1. Said connection, however, is not without yield to the contracting force of the cement; on the contrary, if inherent elasticity in the yoke and the wings is not sufficient to compensate for the contraction of the cement, the flaring form of the wings or of the ends of the yoke, will cause one or both of them to deform to the extent of permitting sliding movement in the matrices which embed them a sufficient distance to make up the necessary additional lost motion to compensate separation of the masonry sections. Wings 4 may be constructed of many different non-absorbent, inherently compressible and reexpansible cushioning material such, for instance, as sponge rubber, rubberized asphalt, polymerized oil or other materials having the functional qualities stated. Yoke 5 will preferably be made of sponge rubber or solid rubber, rubberized bituminous substance or other materials. Yoke 5, in the form shown in Figure 1, is united to the water seal anchoring wings by means of dovetailed tongue-and-groove joints 6 in order that the parts may be produced separately by extrusion or other suitable means.

In Figure 2, I employ a combined core-section and yoke 5a greatly enlarged in width; preferably made of hard asphaltic planking material containing, for instance, 50% of pulverized mineral and 50% of asphaltic material, which will not cold-flow under ordinary conditions and having at its ends waterseal cushions 4a of rubberized asphalt, sponge rubber or other material capable of making a proper road surface. Waterseal cushions 4a are united to the core or yoke 5a through means of watertight dovetail tongue-and-groove joints 7. Beneath the yoke 5a which serves as one part of the core of the joint in this figure is an auxiliary core section 3a' which has hold-down connection 8 with the yoke 5a and is embedded at its sides in the masonry sections 1 through means of beads 9. The core section 3a' seals the joint against water rising from below and is best made of rubberized asphalt or sponge rubber or solid rubber as it will need a range of compression and reexpansion equal to that of the masonry in order that it may serve as a water-seal as well as a hold-down for the joint 5a, 4a.

In Figure 3, which is in principle similar to Figure 1, though somewhat changed in the dimensions of the parts, 3c, 3c' are separately formed core sections, 5c represents the member of the joint that serves as a yoke between wings 4c and this yoke receives the core sections 3c, 3c', through means of tongued-and-grooved surfaces as at 10. The parts 4c and 5c are formed separately for the advantage of using the extrusion process in producing them, and the connections between them are dovetailed as shown at 6c in order that tension may be transmitted from one masonry section 1 to the other. The material for these parts will preferably be sponge or solid rubber or a rubberized bituminous material.

Figure 4 is quite similar to Figure 3 except for the production of the wings and their connecting yoke in one integral piece, for instance by rolling a bar of material between two suitably shaped rollers or by extrusion, if preferred. The material of which these yoked anchoring wings are made will vary through a considerable range of the materials herein enumerated. The core sections 3d, 3d' above and below the yoke 5d are preferably fibers, matted or felted together.

Figure 5 corresponds substantially to Figure 4, except that the undercut or flaring anchorage wings 4e are reversed in form and will not so freely yield by deformation of their matrices in the concrete, thus making a water stop joint which will be more dependent upon inherent tensional elasticity in the yoke and wings in a transversely uninterrupted structure.

Figures 6 and 7 show a construction that differs from Figure 4 by the introduction in a medial plane in the yoke and anchoring wings, of a fabricated metal reenforce 11. In this construction 4f are the wings and 5f is the yoke between them.

Figure 8 uses a fibrous core section 3g above the yoking section 5g and a rubber or rubberized core section 3g' below the same; the wings 4g are of sponge rubber, formed separately from the yoke 5g, but adhered thereto; and tensional anchorage in the concrete sections 1 is afforded by thin metal plate 12 embedded in the wings and partially in the core and formed with a suitable number of openings 12' to cause interlock with the concrete.

In all of the forms thus far described, important functional characteristics among others are vertical compressibility of the wings and vertical flexibility of the yokes which unite the wings in order that these parts may yield to and save themselves from impairment by shearing forces

developing from vertical movement of one masonry section relatively to the other. Yielding compressibility of the wings is exaggerated in Figures 1 and 8 by reason of the use of sponge rubber to form the wings. In Figure 2 flexibility of the beads 9 will likewise be a factor in avoiding shearing action.

In Figures 9 and 10, the operative principle of Figure 8 obtains with some special advantages contributed by structural details. For instance, auxiliary anchoring plates 12*h* with their apertures 12*h'* that permit interlocking with the concrete, have their inner longitudinal margins fashioned into enlargements 13 which contribute fixed anchorages within the relatively large core 5*h* so that while the wings 4*h* are free to yield by vertical compression and the reenforce plate by flexure, under stresses arising from vertical relative movement of the concrete sections, it is not necessary for them to yield in the direction of tension because of the interior opening 15*h'* in the core 5*h* which permits the side walls of said core to arch outwardly under contraction of the masonry sections.

In Figure 11 the member comprising wings 4*k* and yoke 5*k* is divided in a median horizontal plane and has introduced between its two halves a reenforce plate 14 having positioning flanges 14*k*, 14*k'*; the two said halves being mounted on the plate in a manner to assemble the three parts in effect as an integral structure which will function in the same manner as described with reference to a number of the forms already described, for instance Figure 4.

In Figure 12, 3*l*, 3*l'*, are core sections preferably of rubber, rubberized mastic or the like above and below the yoke 5*l* that unites wings 4*l*, which said yoke and wings are made of thin metal and surrounding which said wings is a jacket 15 of cushioning material such as sponge rubber employed to make the wings in Figures 1 and 8, in order that said wings 4*l* may have the capacity to yield to vertical pressure. Within the yoke 5*l* and in vertical alignment with core sections 3*l*, 3*l'*, is a yoke-filling section 5*l'*, which supports the thin walls of the yoke. Preferably the portion of this structure constituting the metal yoke, and uniting the wings, will be formed of two pairs of vertically spaced longitudinal flanges $5l^2$, $5l^3$ of which the inner pair $5l_2$ telescopes between and presses outwardly against the outer pair $5l^3$, while those of the outer pair spring outwardly against the core sections 3*l*, 3*l'* and terminate in deflected ends $5l_2$ that hold said core sections against displacement.

Figure 13 modifies the technique of the structure shown in Figure 12 by enlarging the yoke filler 5*o* and forming it partly of rubber or rubberized mastic or an equivalent thereof, for instance to the point where its sides flare in the hollow yoke and having remaining portions of its hollow filled with another material 5*o'*, for instance plain asphaltic material. In the construction shown in this figure, 15° represents a resilient jacket of sponge rubber, for instance, which completely surrounds the combined thin metal wings and yoke.

Figure 14 has the combined wing and yoke structure 4*p*, 5*p*, jacketed with a cushioning medium (sponge rubber) as shown at 15*p*; and has its filling $5p_1$, $4p_2$ modified as to their manner of assembling, namely through means of dovetail tongue-and-groove joints 6*p*. Core sections 3*p*, 3*p'* in this figure, 14, correspond substantially to forms shown in antecedent figures.

Figure 15 shows a construction in which the wings 4*r* and their connecting yoke 5*r* are made of a rubber structure closely allied to that of a hose in that it has an outside wall 19, of rubber, rubberized asphalt or other equivalent and an inside lining 19' of fabric vulcanized thereto. In this form of the invention the section $3r_2$ of yoke-filler that supports the walls of the otherwise collapsible wing and yoke structure, may be of the same material as the core section 3*r* above the yoke 5*r* and the section 3*r'* below the yoke.

From the foregoing description it will be seen that the present invention contemplates an expansion joint in which there is not only a deformable filler occupying the expansion and contraction chamber between two sections of masonry, and capable of deforming to yield to enlargement of the masonry in said chamber, but adapted to return into filling relation to said chamber as the chamber enlarges under contraction of the sections of masonry but there is also in said chamber a connection between the two sections of masonry an apron having margins that are embedded in the masonry so that each section of masonry has a means of imparting tension to the filling core and drawing it back into space.

What I claim is:

1. An expansion joint for sections of masonry defining a gap therebetween comprising a yielding and deformable core in said gap adapted to conform to the variations of said gap by the movements of said masonry sections, a transverse moisture arresting apron of elastic material independent of said core having the ends thereof anchored in the respective sections of masonry and adapted to yield longitudinally in tension or compression corresponding to the movements of said masonry sections and independently of said core, thereby preventing the seepage of foreign material along the meeting surfaces of said masonry sections and core, the ends of said apron in said masonry sections also having the capability of yielding in a transverse direction to prevent rupture of the apron by stresses acting transversely to the normal expansive and contractile movements of said masonry sections, and water seal cushions around the anchoring ends of the apron, said water seal cushions being of materially greater transverse dimension than the body of the apron and forming enlargements through which the apron under tension imposed by the contracting masonry bears against the deformable core.

2. An expansion joint for sections of masonry defining a gap therebetween comprising a yielding and deformable core in said gap adapted to conform to the variations of said gap by the movements of said masonry sections, a transverse moisture arresting apron of elastic material independent of said core having the ends thereof anchored in the respective sections of masonry and adapted to yield longitudinally in tension or compression corresponding to the movements of said masonry sections and independently of said core, thereby preventing the seepage of foreign material along the meeting surfaces of said masonry sections and core, the ends of said apron in said masonry sections also having the capability of yielding in a transverse direction to prevent rupture of the apron by stresses acting transversely to the normal expansive and contractile movements of said masonry sections, said apron

comprising a hollow body having separable side walls adapted to be drawn apart by tension imposed from one section of masonry through the apron to the other section of masonry, and sheet metal reenforces extending from the respective separable walls of said apron into the sections of masonry.

3. An expansion joint for sections of masonry defining a gap therebetween comprising a yielding and deformable core in said gap adapted to conform to the variations of said gap by the movements of said masonry sections, a transverse moisture arresting apron of elastic material independent of said core having the ends thereof anchored in the respective sections of masonry and adapted to yield longitudinally in tension or compression corresponding to the movements of said masonry sections and independently of said core, thereby preventing the seepage of foreign material along the meeting surfaces of said masonry sections and core, the ends of said apron in said masonry sections also having the capability of yielding in a transverse direction to prevent rupture of the apron by stresses acting transversely to the normal expansive and contractile movements of said masonry sections, said apron and its anchoring wings being of hollow sheet-metal structure with flexible walls.

4. An expansion joint for sections of masonry defining a gap therebetween comprising a yielding and deformable core in said gap adapted to conform to the variations of said gap by the movements of said masonry sections, a transverse moisture arresting apron of elastic material independent of said core having the ends thereof anchored in the respective sections of masonry and adapted to yield longitudinally in tension or compression corresponding to the movements of said masonry sections and independently of said core, thereby preventing the seepage of foreign material along the meeting surfaces of said masonry sections and core, the ends of said apron in said masonry sections also having the capability of yielding in a transverse direction to prevent rupture of the apron by stresses acting transversely to the normal expansive and contractile movements of said masonry sections, said apron comprising a body of hollow sheet-metal construction presenting at the ends thereof beyond the core, hollow and compressible anchoring enlargements provided with jackets of cushioning material adapted to be embedded with the enlargements in the sections of masonry cast against the core.

5. An expansion joint for sections of masonry defining a gap therebetween comprising a yielding and deformable core in said gap adapted to conform to the variations of said gap by the movements of said masonry sections, a transverse moisture arresting apron of elastic material independent of said core having the ends thereof anchored in the respective sections of masonry and adapted to yield longitudinally in tension or compression corresponding to the movements of said masonry sections and independently of said core, thereby preventing the seepage of foreign material along the meeting surfaces of said masonry sections and core, the ends of said apron in said masonry sections also having the capability of yielding in a transverse direction to prevent rupture of the apron by stresses acting transversely to the normal expansive and contractile movements of said masonry sections, said apron being of hollow sheet metal construction with yieldable sides and containing a deformable filling material within it.

6. An expansion joint for sections of masonry defining a gap therebetween comprising a yielding and deformable core in said gap adapted to conform to the variations of said gap by the movements of said masonry sections, a transverse moisture arresting apron of elastic material independent of said core having the ends thereof anchored in the respective sections of masonry and adapted to yield longitudinally in tension or compression corresponding to the movements of said masonry sections and independently of said core, thereby presenting the seepage of foreign material along the meeting surfaces of said masonry sections and core, the ends of said apron in said masonry sections also having the capability of yielding in a transverse direction to prevent rupture of the apron by stresses acting transversely to the normal expansive and contractile movements of said masonry sections, said apron extending through the core, and being of compressible sheet-metal construction with deformable walls and containing a filling material of constituency similar to that of the filling core.

7. An expansion joint for sections of masonry defining a gap therebetween comprising a yielding and deformable core in said gap adapted to conform to the variations of said gap by the movements of said masonry sections, a transverse moisture arresting apron of elastic material independent of said core having the ends thereof anchored in the respective sections of masonry and adapted to yield longitudinally in tension or compression corresponding to the movements of said masonry sections and independently of said core, thereby preventing the seepage of foreign material along the meeting surfaces of said masonry sections and core, the ends of said apron in said masonry sections also having the capability of yielding in a transverse direction to prevent rupture of the apron by stresses acting transversely to the normal expansive and contractile movements of said masonry sections, said apron also being in direct contact with the core, and the ends of the apron which are anchored in the masonry sections being of greater transverse dimension than the body of the apron and adapted to bear against the core in the direction to counteract spreading of the core when the apron is tensioned.

ALBERT C. FISCHER.