United States Patent [19]

Stegmeier

[11] **3,871,787**

[45] **Mar. 18, 1975**

[54] **JOINT STRUCTURE FOR CONCRETE MATERIALS AND THE LIKE**

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[22] Filed: **Oct. 30, 1973**

[21] Appl. No.: **411,067**

[52] **U.S. Cl.** **404/48,** 52/396

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

[58] **Field of Search** 404/68, 67, 66, 48, 47, 404/65, 69; 52/468, 396

[56] **References Cited**

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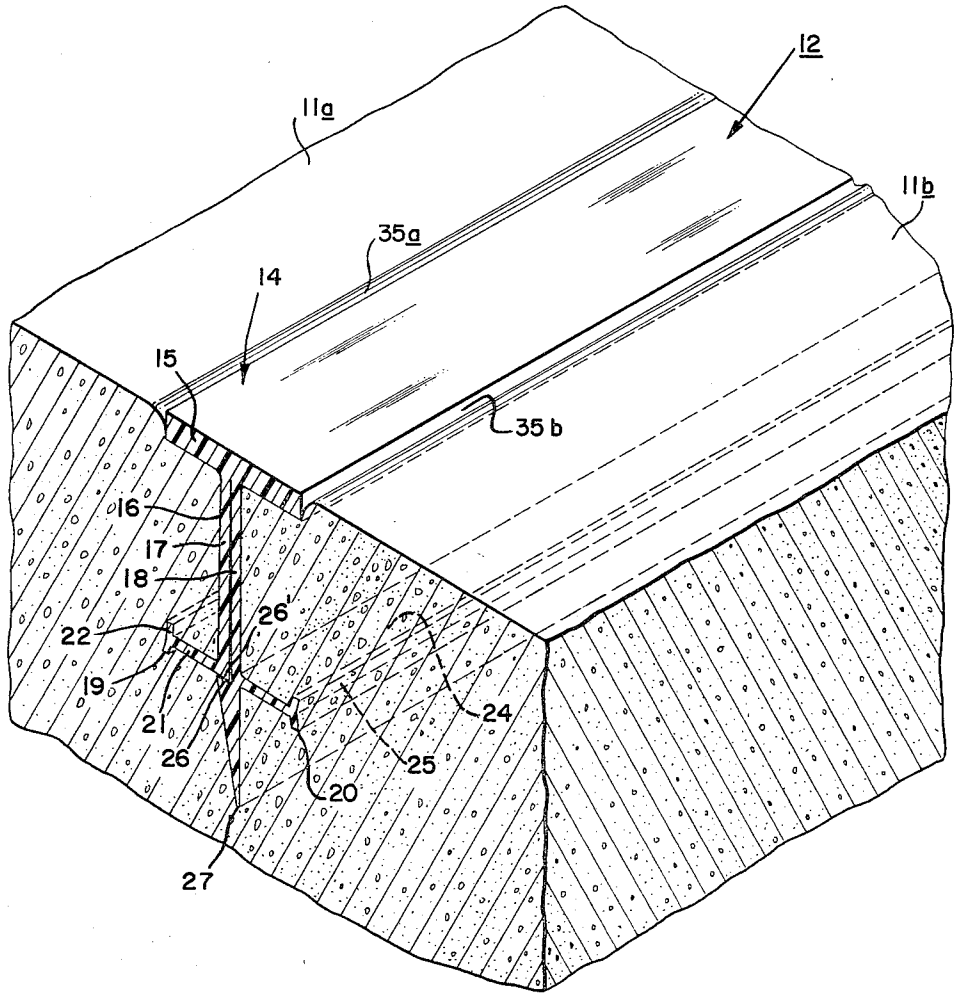
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[57] **ABSTRACT**

The invention is concerned with a joint structure adapted to be embedded in a concrete mass to accommodate relative displacements of sections thereof bounded in common by the joint. The joint structure includes an elongated, generally T-shaped channel having a horizontal flange and a web extending downwardly therefrom. The channel is adapted to be disposed within a concrete mass with the flange oriented in generally planar relation with the upper surface of the mass. The web is divided along a generally vertical plane disposed at its center into side-by-side components that are displaceable transversely relative to each other, and such components are equipped with anchors that effectively secure the same to the sections of the concrete mass bounded in common by the joint. At the time of insertion of the joint structure into a wet or uncured mass of concrete, a cap is removably secured to the channel in overlying relation with the flange thereof, and a protective strip of tape is located intermediate the flange and cap in attachment to the upper surface of the flange. After the wet concrete has been processed and finished, the cap and tape strip are removed to leave the channel in position within the concrete after it cures to serve as a contraction joint.

24 Claims, 7 Drawing Figures



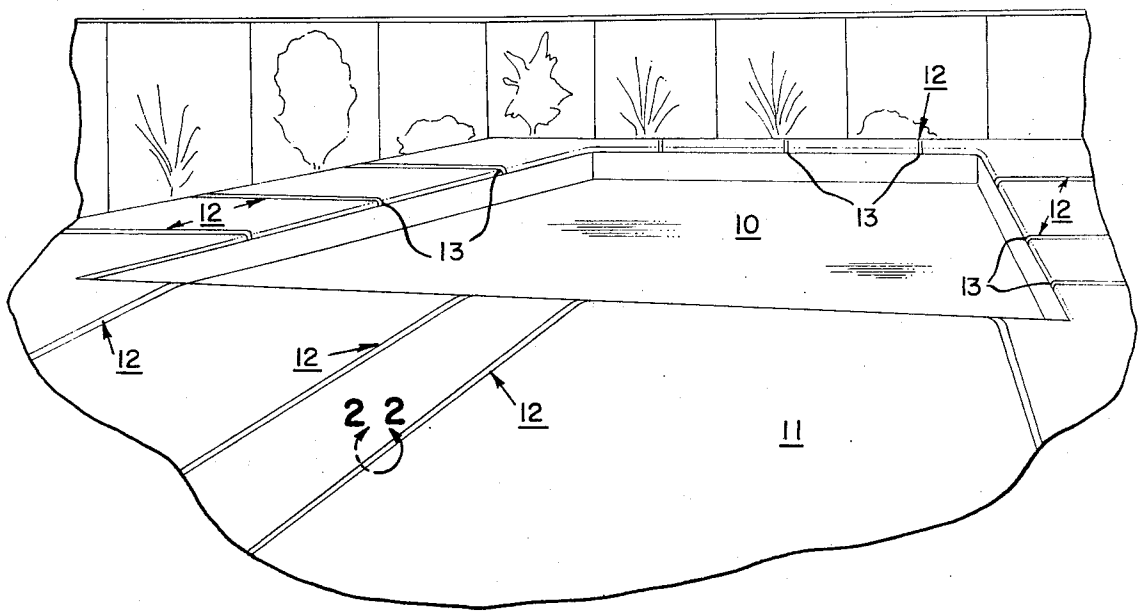

12
13
10
12
13
12
12
12
2 2
11

FIG. 1

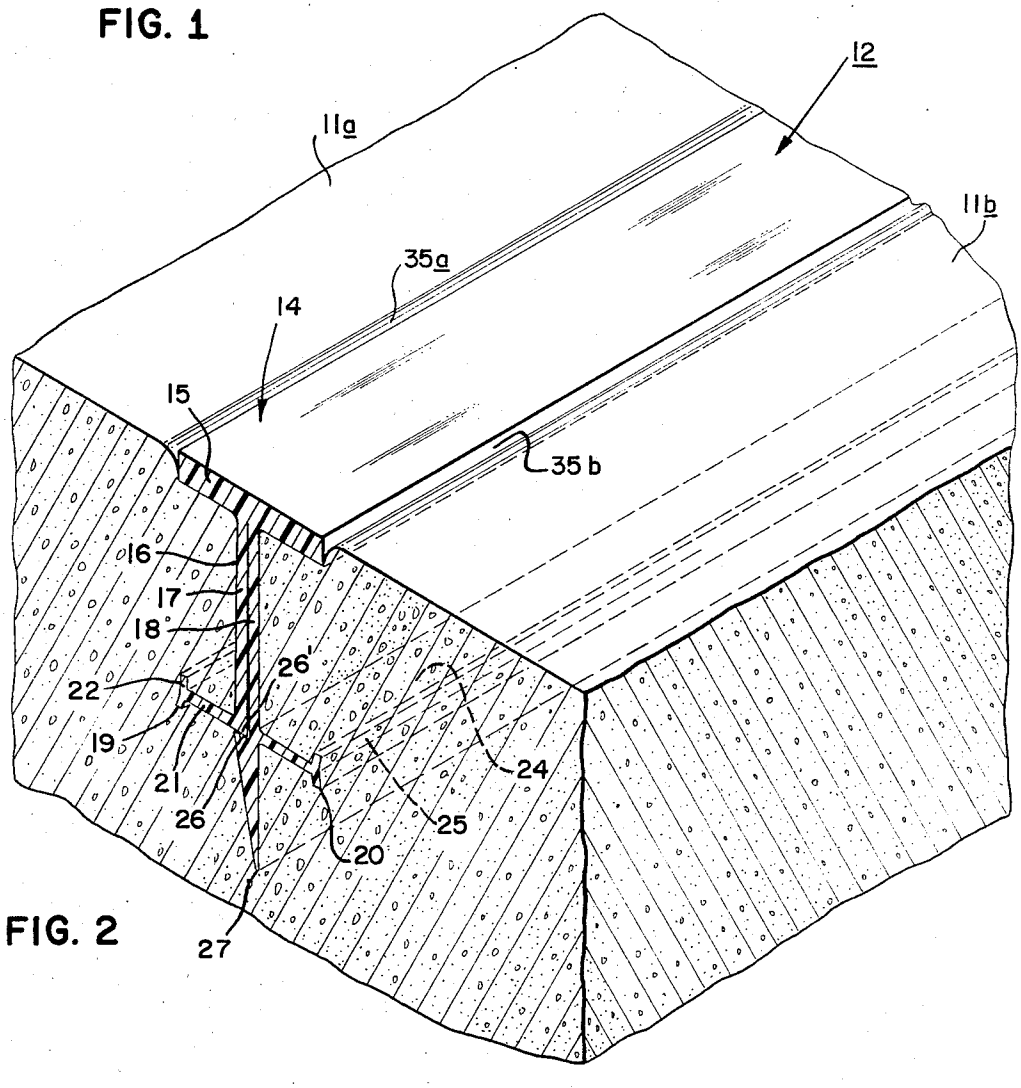

12
11a
11b
35a
14
15
35b
16
17
18
22
26'
19
21
26
20
25
24
27

FIG. 2

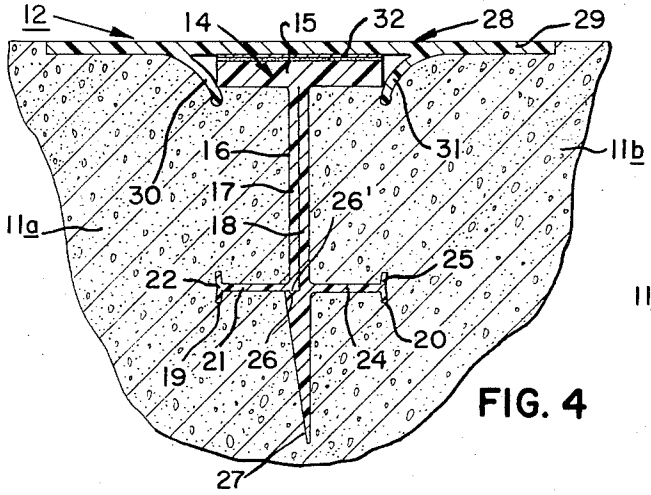


FIG. 4

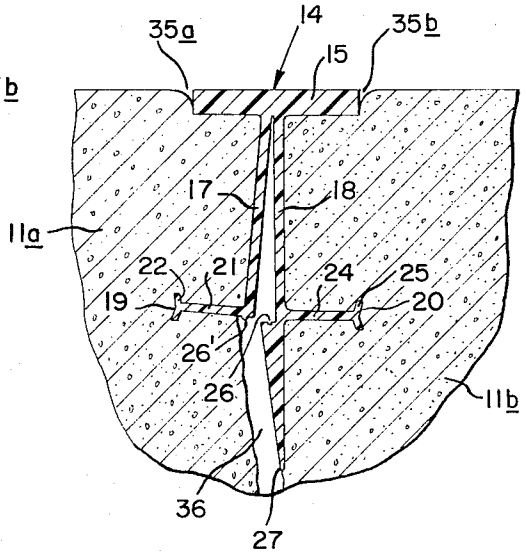


FIG. 7

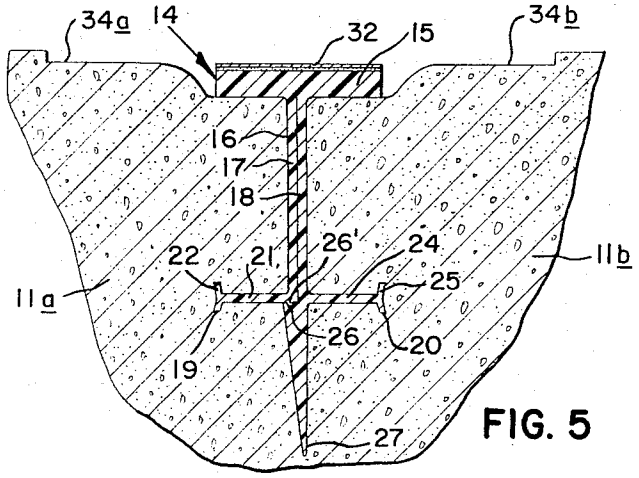


FIG. 5

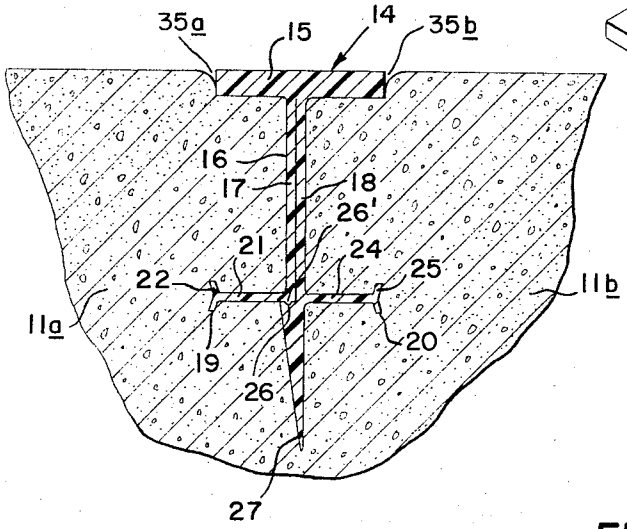


FIG. 6

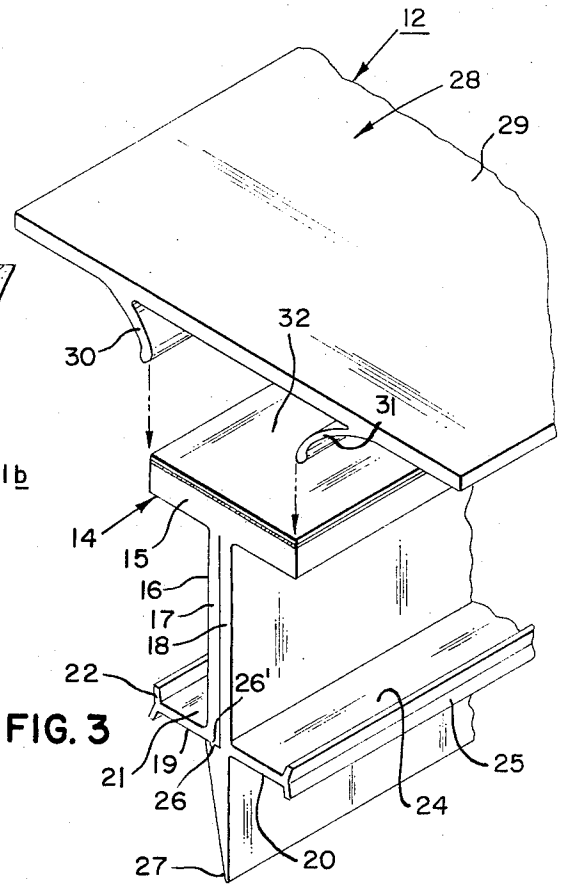


FIG. 3

JOINT STRUCTURE FOR CONCRETE MATERIALS AND THE LIKE

This invention relates to concrete slabs and the like and, more particularly, to joint structures for use with concrete and similar materials to accommodate relative displacements of sections thereof bounded in common by a joint embedded within a mass of such material.

Substantially all materials are subject to thermally induced expansions and contractions, and construction materials such as concrete and the like are specific examples thereof. The difficulties encountered by thermally-induced movements of such materials are aggravated when they are used to surface relatively large ground areas, especially when placed directly upon an earthen bed, because of movement enforced on the materials by changes in the earthen mass (sometimes referred to as "heaving") as a consequence of moisture penetration, freezing, temblors, etc. All such movements enforced on these materials tend to crack the same particularly when they are placed in tension because tensile weakness is a characteristic thereof especially with a nonhomogenous aggregate such as concrete.

Concrete, it may be noted, often tends to have cracks introduced therein as a characteristic of its curing process. That is to say, the curing of concrete is a complex process entailing both a mechanical step of moisture evaporation and a chemical reaction in which heat is generated as a by-product. The heat thus permeating the concrete mass can be fairly substantial, and as the mass cools toward and upon termination of the chemical reaction, the consequent shrinkage or contraction of the concrete mass tends to create fissures therein because of the tensile stresses that such movement of the concrete mass creates.

For all of these reasons, it is common to use joint structures with concrete and similar materials at fixed intervals therealong to separate the mass into sections which may move relative to each other along the common boundaries defined by the joint structures. In many instances, the joint structures employed are entirely utilitarian such as in the construction of roadways, and they may constitute a soft material such as felt or fiber packing covered with tar for waterproofing purposes. In other instances, the joint structures are employed for decorative or aesthetic purposes in addition to their utilitarian use, and examples thereof are the decks of swimming pools (both domestic and commercial), domestic driveways and patios, and commercial malls. Decorative joint structures of this type are often formed of plastic materials such as polyvinylchloride, and many of those used heretofore have provided large open spaces within the interiors thereof and a thin exposed topwall that lies substantially flush with the upper surfaces of the sections of material bounded in common thereby.

Respecting use of such joint structures with concrete, they are usually pressed into the concrete after it has been poured and spread but before it has cured, and they do not extend completely through the concrete mass because they are substantially shorter in depth that the concrete mass into which they are embedded. The concrete mass is then tamped; surfaced with a large or "bull" float; troweled, grooved, and edged; and then provided with a surface finish (a broomed or roughened surface) all after the joint structures are in place. Although the typical decorative joint structure of the type being considered does not penetrate from top to bottom of the concrete mass in which it is embedded, its presence therein introduces a line of weakness along which the concrete mass may crack or fissure, but the crack is covered by the joint structure which conceals the same and accommodates relative displacements of the sections bounded in common thereby along the fissure.

Decorative joint structures now in common use have a number of disadvantages among which include the difficulty encountered by workmen using the same in maintaining a straight-line disposition of the joint structure while embedding the same in a concrete mass. The reason for this difficulty is attributable to the flexibility of the joint structures in lateral or transverse directions which permits the structures to bend or "snake" as they are being pressed into the concrete. Another disadvantage is that the exposed topwalls of such structures are relatively weak and are damaged (usually perforated) when a sharp object is pressed thereagainst such as a pebble, narrow shoe heel, or child's toy. The reason that such joint structures are damaged along their topwall is that the latter is necessarily made relatively thin for economic purposes so that the entire quantity of material used in the joint structure will not make the cost thereof so great that it is practicably infeasible to use the same in a cost-conscious market. Another disadvantage with certain decorative joint structures is that they do not provide a positive water stop inhibiting the downward flow of water from the top surface of the concrete mass to the underlying earthen bed via a path along the joint structure and any crack underlying the same. Damage to a joint structure may increase the water-leakage tendency which is undesirable because moisture penetrating the underlying soil may cause the same to swell and heave especially with certain clay-type soils present in many parts of California and elsewhere. It may also be observed that these joint structures are frequently scuffed or marred and otherwise damaged during processing of the concrete masses after the joints are embedded therein, even though it is common to attempt to protect the joint structures with a layer of tape along the upper surface thereof. The use of such tape has itself created problems because of the requirement that a durable, high-tack adhesive be employed in order to maintain the tape in protective relation with the joint structure, and adhesives of this type tend to be affected by the sun and following exposure thereto may be exceedingly difficult to remove, thereby resulting in an unsightly surface. Certain joint structures are also quite buoyant and tend to float out of position in the dense concrete prior to curing thereof.

In view of all of the foregoing, a general object of the present invention is to provide an improved joint structure adapted to be embedded in concrete materials and the like to accommodate relative displacements of sections thereof bounded in common by such joint, and which joint structure overcomes the various disadvantages and limitations of conventional joint structures as noted hereinbefore.

Further objects, among others, of the present invention are in the provision of an improved joint structure of the character described that is relatively stiff or rigid especially in a transverse sense so that it can be pressed into a wet concrete mass along a substantially straight line without difficulty by a workman, thereby obviating

the time and expense otherwise necessitated by conventional structures which in many instances requires the joint structure to be pre-set on supports provided for this purpose before the concrete is poured; that has a relatively thick and sturdy topwall or transverse flange directly reinforced by underlying concrete which is thereby effective to resist perforation and analagous-type damage that characterizes the exposed topwall of conventional joint structures; that serves as a water stop to prevent penetration therealong through an associated concrete mass of water collecting along the exposed upper surface of a concrete mass and tending to flow downwardly therethrough along the juncture of the concrete mass with the joint structure; that provides anchorage between the joint structure and associated concrete sections bounded in common thereby at locations sufficiently remote from the upper surfaces of the concrete sections that cracks or fissures do not tend to be created along the exposed concrete surfaces because of the anchorage between the sections and joint structure; that pre-coves the concrete mass extending along the transverse flange of the joint structure to improve the aesthetic appearance of the upper surface of the cured concrete and to facilitate manual coving of the lines of juncture of the flange with the concrete mass; that incorporates protective features that enable workmen to tamp, bull-float, trowel, and otherwise process a concrete mass associated with the joint structure without in any way damaging or disfiguring the latter which then appears completely clean and unblemished at the time that the concrete has completely cured and is ready for use; and that is non-buoyant.

Additional objects and advantages of the invention, particularly as respects specific features and characteristics thereof will become apparent as the specification continues.

In brief summary form, the joint structure embodying the present invention in the particular form thereof disclosed herein may be taken for convenience to be a tripartite structure including a generally T-shaped channel, a cap removably secured thereto, and a strip of protective material disposed intermediate the cap and channel to protect the upwardly facing surface of the latter. The T-shaped channel has a transverse flange defining a topwall adapted to be disposed in generally planar relation with the surfaces of a mass of concrete material subdivided into sections bounded in common by the joint structure. The channel further includes a web that extends downwardly from the flange at substantially the midportion thereof, and the web is divided intermediate its transverse edges into web components which, in their initial condition, are disposed in substantially parallel side-by-side juxtaposition. The web components are displaceable transversely relative to each other, and they are each equipped with a transversely projecting anchor effective to secure the web component to an associated concrete section for movement therewith. One of the web components is longer than the other and is provided with an offset shoulder underlying the shorter web to protect the same during insertion of the joint structure into a mass of wet and uncured concrete.

An elongated cap that is substantially wider than the transverse flange of the channel is equipped with downwardly extending spring fasteners that extend generally along the length thereof and are adapted to grip the edges of the flange to removably secure the cap thereto. The spring fasteners have an arcuate configuration that tends to enforce a rounded recess or cove-type channel in the concrete mass along the transverse edges of the channel flange. A strip of protective material that may take the form of a low-tack, pressure-sensitive tape is interposed between the cap and upper surface of the transverse flange to protect such surface against damage since it will be the visible surface of the joint structure after the concrete has cured. The tripartite joint structure is pressed into an uncured mass of concrete at the proper location, and after the initial processing of the concrete mass has been completed, the protective cap is removed. After the surface of the concrete has been broomed or otherwise finished, the protective tape strip is removed to expose the unblemished upper surface of the joint structure.

An embodiment of the invention is illustrated in the accompanying drawings, in which;

FIG. **1** is a broken perspective view illustrating a swimming pool having a poured concrete deck thereabout equipped with joint structures embodying the present invention;

FIG. **2** is a greatly enlarged, broken sectional perspective view of a portion of such deck adjacent one of the joint structures, the view being taken generally along the line **2—2** of FIG. **1**;

FIG. **3** is a broken perspective view of the joint structure illustrating the protective cap in spaced relation with the T-shaped channel and tape strip thereon;

FIG. **4** is a broken, vertical sectional view illustrating the entire joint structure embedded in a concrete mass after the upper surface of such mass has been finished with a bull float and troweled;

FIG. **5** is a broken, vertical sectional view similar to that of FIG. **4**, illustrating the interrelationship of such concrete mass and the joint structure after the protective cap has been removed from the latter;

FIG. **6** is a broken, vertical sectional view similar to those of FIGS. **4** and **5**, illustrating the concrete mass and joint structure after an edger has been run along the joint structure to finish the coving, and after which the protective tape has been removed from the exposed upper surface of the joint structure; and

FIG. **7** is a broken, vertical sectional view similar to that of FIG. **6**, but illustrating relative transverse displacement between the concrete sections bounded in common by the joint structure, such relative displacement of the concrete sections being, for example, enforced thereon by thermal contractions thereof.

The typifying use of joint structures is illustrated in FIG. **1**, and it is perhaps one of the more difficult environments therefor in the sense that substantial quantities of water are present, the earthen materials supporting the concrete may be fill and therefore subject to shifting, and thermally-induced expansions and contractions and differential displacements may be aggravated over other uses for joint structures. In more specific terms, the environment depicted in FIG. **1** is a swimming pool **10** having a poured concrete, cantilever deck **11** extending thereabout. As respects the present invention, the pool **10** and deck **11** may be substantially conventional, and each may be fabricated by any conventional technique. It will be appreciated that the deck **11** is subjected to the presence of considerable quantities of water, and it also is exposed to substantial sunlight, thereby enforcing substantial thermally-

induced expansions and contractions thereon whereas those portions of the pool **10** which are protected by the large body of water therein, tend to remain at relatively constant temperature which may result in differential expansions and contractions as between the deck **11** and those protected portions of the pool **10.** The deck **11** and mass of concrete material defining the same is divided into sections by a plurality of joint structures **12** embedded therein. All of the joint structures **12** may be identical, for this reason, only one such structure will be described in detail hereinafter. It may be noted that each joint structure **12** has a downwardly turned end **13** along the overhanging edge portion of the cantilever deck **11** which may be provided in a variety of manners, such as by cutting out portions of the web of a straight joint structure to bend or curve the same downwardly in general conformity with the configuration of the overhanging edge of the deck.

As previously indicated, it is conventional to form pool decks **11** of poured concrete, and the joint structure **12** is especially suited for use with concrete masses especially because they tend to contract as they cure owing to the loss of heat developed during the chemical changes that occur as a part of the curing process. Nevertheless, the joint structures **12** can be used with other materials both for their decorative effect and for the functional advantages attributable thereto. It will also be understood that the joint structures may be employed in a great number of environments where concrete and other materials are used especially when employed for surfacing purposes. Accordingly, the deck **11** and use of the joint structures **12** in association therewith may be taken to be exemplary.

The joint structures illustrated in the drawings are of tripartite construction, as shown most clearly in FIGS. **3** and **4.** In this respect, each joint structure **12** includes a longitudinally extending, generally T-shaped channel **14** having a transverse flange **15** disposed at its upper end and defining a topwall adapted to be disposed in generally planar relation with the surfaces of concrete sections bounded in common by the joint structure as shown in FIGS. **1, 2,** and **4** through **7.** The channel **14** is an elongated continuous component and in the form shown, it is fabricated from a plastic material such as polyvinylchloride, and may be an extruded member cut into any appropriate length, ten feet for example. Extending downwardly from the flange **15** at substantially the center thereof is a web **16** that is formed integrally with the flange.

As is seen most clearly in FIG. **7,** the web **16** is divided intermediate the transverse edges thereof, and at substantially its medial plane, into web components **17** and **18** that initially are disposed in side-by-side, substantially parallel juxtaposition but are displaceable transversely relative to each other, as is evident by comparing FIGS. **6** and **7.** The web components **17** and **18** merge with each other and with the flange **15** so as to be integral therewith, and the juncture of the components **17** and **18** adjacent the flange **15** defines a pivotal axis about which the web components are displaceable relative to each other. The flange **15** and web **16** are substantially coextensive in length, and the web is generally disposed with respect to the plane of the flange **15** at at 90° angle therewith. It will be apparent that the material from which the channel **14** is fabricated should be sufficiently flexible to enable the web components **17** and **18** to be displaced repetitively relative to each other in transverse directions in accordance with any relative displacements enforced thereon by the sections of the concrete mass bounded in common by the joint structure.

Each of the web components **17** and **18** is equipped with a transversely projecting anchor effective to secure the same to the associated concrete section for movement therewith. In this reference, the component **18** is provided with an anchor **19** disposed at generally right angles with respect to the vertical plane of the web, and the web **18** is similarly provided with an anchor **20** extending transversely therefrom. The anchors **19** and **20** are located at the lower terminus of the web component **17,,** and they are oriented in transverse alignment so that together they have a generally I-shaped configuration. Thus, the anchor **19** has a generally horizontal web **21** substantially parallel in disposition with the flange **15** and terminating at its outer end in a vertically extending flange **22** substantially paralleling the web **16.** Similarly, the anchor **20** has a horizontally disposed flange **24** terminating in a vertically oriented flange **25.** It will be apparent that the anchors **19** and **20** are located at the lower terminus of the web component **17** so that each of the anchors is remote from the upper surface of the concrete mass **11** in which the anchor structure is embedded. This relationship has the advantage of providing a substantial thickness of undisturbed concrete intermediate each anchor and the upper surface of the concrete mass so as to minimize any tendency for the concrete to crack or fissure because of the presence of the joint structure **12** and anchors **19** and **20** thereof.

The web component **18** is seen to be longer than the web component **17,** and it is provided adjacent the lower end of the web **17** with an offset shoulder recessed or grooved at **26** that underlies the web **17** and protects the same during insertion of the joint structure into a mass of uncured concrete, thereby tending to prevent the web component **17** from spreading and to prevent solids such as stones and pebbles comprised by the concrete mass from wedging beneath the web component **17.** The web component **17** has a rib or tongue **26'** that seats within the groove **26** to further inhibit spreading of the webs. The web component **18** tapers downwardly from the shoulder **26** thereof to a relatively sharp point or edge **27** that facilitates penetration of the concrete mass by the joint structure.

The tripartite joint structure **12** further includes a cap **28** removably secured to the channel **14** in generally overlying relation with the flange **15** thereof, as is evident in FIG. **4.** In more particular terms, the cap **28** is in the form of a relatively flat or planar topwall **29** that is substantially wider in transverse dimension than the flange **15** of the channel **14,** and it may be thinner than the flange **15,** as illustrated in FIG. **4.** The substantial transverse width of the topwall **29** provides considerable resistance to transverse bending of the cap particularly when it is united with the channel **14** so as to maintain the latter in a straightline disposition during insertion of the joint structure into a concrete mass. The cap **28** further includes a pair of transversely spaced fasteners **30** and **31** in the nature of spring fingers or clips adapted to releasably engage the flange **15** to removably secure the cap **28** thereto. The spring fasteners **30** and **31** are formed integrally with the topwall **29,** and they are substantially coterminus in length therewith. Not only do the fasteners **30** and **31** releas-

ably secure the cap **28** to the channel **14**, but they also tend to stiffen the cap to constrain the same against transverse snaking especially when the cap is secured to the channel, and they are further configurated so as to impose a convex curvature onto the concrete mass so as to define a cove finish along the joint structure **12** after the concrete has cured, as is evident in FIGS. **2**, 6, and **7**. The protective cap **28** may be formed from a variety of materials, and in the embodiment illustrated, it is fabricated from a plastic such as polystyrene which is less expensive than polyvinylchloride and therefore preferred especially since it will be removed and discarded, if desired, after the joint structure is in position and the concrete mass finished. The relatively thin dimension of the cap **28** may enable the same to be coiled into a roll for storage and reuse, should this be desired, and enables the same to be packaged conveniently for separate sale in the event that a customer should not wish to purchase the joint structure with the channel **14** and cap **28** united, as in the condition thereof shown in FIG. **4**.

The tripartite joint structure **12** in the embodiment thereof illustrated, includes a strip of material **32** located intermediate the flange **15** and cap **28** to protect the upwardly-facing surface of the flange **15** during certain processing of the concrete mass with which the joint structure is used. The protective strip **32** is in the form of an elongated strip of tape which may have a paper backing equipped along one side thereof with a pressure-sensitive tape enabling the protective strip to be removably secured to the flange **15**. In the joint structure **12**, a low-tack, pressure-sensitive tape may be employed which is not significantly influenced by heat and light so as to become undesirably anchored to the surface of the flange **15** because the protective strip is covered by the cap **28** during a substantial part of the manipulations performed on the wet concrete in finishing the same whereas in the absence of the cap **28**, a high-tack, pressure-sensitive tape is necessarily employed to provide sufficient adherence to the flange **15** to protect the same, but such tapes are influenced by heat and light and become virtually impossible to remove in many instances. Several tapes are available which can be used in the joint structure **12**, and a specific example thereof, is a low-tack, pressure-sensitive Mylar tape of the type now in extensive use to protect transparent plastic material such as Plexiglass against surface scratching and marring during shipment and storage thereof.

In use of the joint structure **12**, it can be preset on supports provided therefor and the concrete mass thereafter poured, but there is no necessity of doing so with the present joint structure since the straightness thereof can be maintained during insertion into a mass of wet or uncured concrete. Further, presetting a joint structure is a substantial inconvenience as well as being time consuming because it interferes with free movement of wheelbarrows used to distribute wet concrete throughout the area to be covered thereby. Usually then, the concrete mass is poured against forms provided for this purpose and is screeded or leveled usually by moving a long two by four or similar piece of lumber along the concrete mass while the two by four is supported on the upper edges of the form members. After this has been accomplished, the joint structure **12** in the configuration thereof illustrated in FIG. **4** is pushed downwardly into the concrete mass at suitable locations the spacings between which are calculated in accordance with the thickness of the concrete, composition thereof, and other parameters to prevent cracking except at the locations of the joint structures.

As previously indicated, the joint structures remain very straight as they are pushed into the concrete mass because they are highly resistant to transverse deflections or snaking because of the presence of the cap **28** and cooperative structural relationship thereof with the channel **14**. Not only does the cap **28** in structural association with the channel **14** constrain the joint structure against flexing, as explained, but it establishes rather positively the depth to which the joint structure can be depressed because of the relatively large surface area of the cap in engagement with the underlying concrete. Moreover, the wide cap **28** tends to enforce a substantially vertical orientation onto the web **16** of the joint structure and, correspondingly, to enforce a substantially horizontal orientation onto the flange **15**. Such accuracy in the positioning of the joint structure is advantageous because it provides an enhanced functional association with the associated sections of the concrete mass, and it also improves the aesthetic appearance of the finished concrete product in that the upper surface of the flange **15** is essentially coplanar with the exposed upper surface of the concrete mass. Insertion of the joint structure is facilitated by the pointed lower end **27** of the web, and the shoulder **26** tends to prevent spreading of the web components **17** and **18** during insertion.

Once the joint structure (i.e., all of the joint structures in any given area of concrete) is inserted into the concrete mass, the concrete is processed and finished in a conventional manner which usually entails tamping the concrete to compact the same and bring moisture to the surface of the concrete which is useful in subsequent finishing operations. Tamping of the concrete can be effected in any conventional manner which, in many instances, is effected by a workman impacting a hand-held tamping implement against the surface of the concrete. Next, the surface is smoothed with a large, flat tool that is referred to as a "bull float" and constitutes a large magnesium trowel-type implement that may be relatively heavy and spans a substantial area. The bull float is moved freely over the cap **28** so that after this operation is completed, the upper surface of the concrete mass is essentially at the elevation of the upper surface of the cap **28**, as shown in FIG. **4**. The tamping, and bull-floating procedures result in the concrete mass being compacted tightly about the channel **14** and particularly against the web **16** thereof so as to underlie the flange **15** with substantially no voids or unsupported surface areas thereof. The mass also compacts firmly against the arcuate spring fasteners **30** and **31** of the cap **28** so as to pre-cove the concrete mass along the transverse edges of the flange **15**.

Following the bull-float processing of the concrete mass, the cap **28** is removed from the channel **14**, whereupon the assemblage has the configuration shown in FIG. **5**. The cap **28** may be treated as a disposable item and simply discarded, or it may be coiled or otherwise preserved for reuse. Upon the removal of the cap **28**, a slight depression will be present in the concrete corresponding to the thickness and extent of the cap **28**, and such depressions are indicated in FIG. **4** by the numerals **34A** and **34B**. Such surfaces have a relatively sharp outer transverse edge, and along the inner

transverse edges thereof they curve downwardly toward the under surface of the flange **15** in accordance with the arcuate configuration enforced on the concrete by the spring fasteners **30** and **31** of the removable cap. The slight voids along the lower outer corners of the flange **15** created by the inner edges of the fasteners **30** and **31** (see FIG. **4**) tend to fill because of the fluidity of the concrete, as is indicated in FIG. **5.** The workman then finishes the coating along the transverse edges of the flange **15** either by use of a walking edger or a hand edger, either of which is in the nature of a trowel with an arcuate edge having the desired curvature and depth to be enforced on the concrete along the coving. The edgers are sufficiently wide to extend outwardly beyond the terminae of the depressions **34A** and **34B** so as to smooth the same.

After the edging has been completed which may or may not be accompanied by any necessary hand troweling to further smooth and finish the concrete surface, the surface is given a final texture which may comprise running brooms thereover to roughen the surface slightly and thereby provide an antislippage texture, or it may have a special heat-reflective or resistive coating applied thereto such as Frontier Kooldeck. In any case, after all of the finishing procedures have been completed, the protective strip **32** is removed quickly and easily and thereby leaves an unblemished upper surface, and the assemblage has the configuration shown in FIG. **6** in which the upper surface of the concrete mass and surface of the flange **15** are substantially coplanar, and the concrete surfaces merge with the flange along the coves **35A** and **35B**.

During all of the concrete-processing procedures, the upper surface of the flange **15** is protected at all times by the strip **32** and during the initial processing steps by the cap **28.** Therefore, the upper surface of the flange **15** is substantially unblemished when the concrete mass has cured and is ready for use. The flange **15** is thick relative to the web **16** and anchors **19** and **20,** and referenced to the upper wall member of many prior art water stop structures. Nevertheless, the total quantity of material used in the channel **14** does not exceed the total mass of material used in such prior structures. Not only is the flange **15** structurally strong because of the mass of material therein but it is completely supported along the entire undersurface thereof by the underlying mass of concrete, as is shown in each of FIGS. **4** through **7.** Thus, the flange **15** is not readily deformed or perforated upon impact from sharp objects such as pebbles, narrow shoe heels, etc.

The anchors **19** and **20** are completely encapsulated or surrounded by the concrete mass, and the vertical orientation of the anchor flanges **22** and **25** prevents any tendency of the concrete to draw free from the anchor webs **21** and **24** upon movement of the concrete mass, and especially the adjacent sections **11A** and **11B** thereof bounded by the common joint structure. Such configurations of the flanges **22** and **25** together with the rather long or tortuous path required for water to penetrate the concrete mass along the joint structure makes the same an effective water stop inhibiting downward migration of water from the upper surface of the concrete to the earthen mass underlying the same. This is particularly significant in soil that is adapted to swell when wet, and also in areas sufficiently cold to cause the ground to freeze, each of which conditions result in ground movement or heaving that tends to enforce relative displacements onto the concrete sections **11A** and **11B.**

The joint structure when embedded into a concrete mass tends to localize cracks that develop in such mass by creating lines of weakness or intentional faults therein. This result is evident when it is understood that concrete is relatively weak in tension (although it has substantial compressive strength), so that reducing the effective area of concrete to resist a tensile force applied thereto as by inserting a divider in the form of the joint structure into the concrete mass, tends to cause any fissure in the concrete to occur along such restricted area: namely, that area underlying the joint structure **12.** Any such crack that does develop, remains concealed from view because of the presence of the joint structure and does not, therefore, become aesthetically unsightly, and it also remains isolated from moisture because of the barrier or water-stop function performed by the joint structure as a consequence of its intermediacy between such crack and the exposed upper surface of the concrete mass.

As previously indicated, any crack in the concrete mass tends to occur intermediate the sections **11A** and **11B** bounded in common by the stop structure. Often, a crack develops as part of the curing procedure because the concrete necessarily shrinks or contracts somewhat as it looses the heat developed during the curing process and therefor cools. Any such shrinkage might result in the somewhat exaggerated configuration of the assemblage shown in FIG. **7** in which the web components **17** and **18** have been displaced transversely relative to each other, thereby leaving a void intermediate the same. The web components **17** and **18** move in mechanically enforced displacement with the respectively associated concrete sections **11A** and **11B** because of their anchorage thereto via the anchors **19** and **20,** but the sections may separate below such anchors, as indicated by the cleavage or open area **36** in FIG. **7.** A similar type of relative displacement might occur upon other thermally-induced contraction of the concrete sections, and should they tend to expand because of being heated and thereby move toward each other, the void between the web components **17** and **18** simply tends to close and the size of the cleavage or open area **36** reduces. The same general accommodation of relative displacement occurs if the supporting soil tend to heave, but whatever action occurs, it remains essentially concealed from view and protected from water and other environmental conditions.

It will be appreciated that whereas the snap-type interconnection of the tongue **26'** and groove **26** provides a sufficient frictional interlock to maintain the webs **17** and **18** closed during insertion of the joint structure into wet concrete, it is of no significance in resisting the inexorable forces of contraction of the concrete mass. The absence of voids in the joint structure **12** materially reduces the buoyancy thereof, thereby making the joint structure essentially nonfloatable in wet concrete. As a result, workmen are not required to repetitively push the joint structure downwardly into the wet concrete to return the joint structure to its proper position after it has risen or floated upwardly due to its buoyance, as in certain conventional arrangements.

As previously indicated, the channel **14** and cap **28** may be sold as separate components, or may be sold in assembled form, as illustrated in FIG. **4.** Accordingly,

the same cap **28** might be usuable a number of times with different channels **14.** By way of giving a specific dimensional example for illustrative purposes, the flange **15** of the channel **14** may be approximately one-half inch in transverse dimension and have a vertical thickness approximating 3/32 of an inch. The transverse width of the anchors **19** and **20** from flange **22** to **25** thereof may be approximately one-half inch, and the overall vertical dimension of the channel from the upper surface of the flange **15** to the point **27** may be approximately 1 5/16 inches. The thickness of each web component **17** and **18** and of the anchor webs **21,** 24 and anchor flanges **22, 25** may all be approximately 0.030 of an inch. The cap **28** may have a transverse dimension of approximately 1¾ inches across the topwall **29,** and a topwall thickness somewhat less than that of the flange **15,** approximately one-sixteenth of an inch. The fasteners **30** and **31** may have approximately the same thickness, and a length sufficient to grip the lower outer corners of the flange **15** with an arcuate curvature of a one-fourth inch radius. As suggested, the exemplary dimensions may be varied considerably, but have been found effective in specific embodiments of the invention.

While in the foregoing specification an embodiment of the invention has been set forth in considerable detail for purposes of making a complete disclosure thereof, it will be apparent to those skilled in the art that numerous changes may be made in such details without departing from the spirit and principles of the invention.

What is claimed is:

1. A joint structure adapted to be embedded in concrete materials and the like to accommodate relative displacements of sections thereof bounded in common by such joint, comprising: a longitudinally extending generally T-shaped channel having a transverse flange defining a topwall adapted to be disposed in generally planar relation with the surfaces of such sections and having also a web extending downwardly from said flange, said web being divided intermediate the transverse edges thereof into web components disposed in side-by-side juxtaposition and displaceable transversely relative to each other, means effective to secure each of said web components to the associated section for movement therewith; a cap removably secured to said channel in generally overlying relation with said flange; and a strip of protective material intermediate said flange and cap to protect the surface of the latter.

2. The joint structure of claim **1** in which said means comprises a pair of anchors respectively secured to said web components and projecting transversely therefrom a spaced distance below said flange.

3. The joint structure of claim **2** in which said anchors are disposed in substantial alignment and together have a generally I-shaped configuration.

4. The joint structure of claim **1** in which one of said web components is longer than the other and is provided with a transversely offset shoulder underlying the end of such other web component to protect the same during insertion of said joint structure into a mass of uncured concrete.

5. The joint structure of claim **4** in which said longer web component has a progressively decreasing transverse dimension extending downwardly from said offset shoulder to facilitate insertion of said joint structure into a mass of uncured concrete.

6. The joint structure of claim **1** in which said web components and flange are integral, said web components being angularly displaceable along the juncture thereof with said flange to provide the aforesaid relative transverse displaceability thereof.

7. The joint structure of claim **6** in which one of said web components is longer than the other and is provided with a transversely offset shoulder underlying the end of such other web component to protect the same during insertion of said joint structure into a mass of uncured concrete.

8. The joint structure of claim **7** in which said means comprises a pair of anchors respectively secured to said web components and projecting transversely therefrom a spaced distance below said flange.

9. The joint structure of claim **1** in which said cap is equipped therealong with resilient fasteners releasably engageable with said flange to removably secure said cap to said channel.

10. The joint structure of claim **9** in which said cap is provided with a generally planar topwall adapted to overlie said flange, said resilient fasteners depending from said topwall in transversely spaced relation and being substantially continuous elements cooperative with said flange generally along the length thereof.

11. The joint structure of claim **10** in which each of said resilient fasteners has an arcuate configuration effective to pre-cove along said flange a mass of concrete into which said joint structure is embedded.

12. The joint structure of claim **10** in which the topwall of said cap is substantially wider in transverse dimension than said flange so as to overhang the same.

13. The joint structure of claim **1** in which said strip of material comprises a low-tack, pressure-sensitive tape releasably secured to said flange along the upper surface thereof.

14. The joint structure of claim **13** in which said cap is equipped therealong with resilient fasteners releasably engageable with said flange to removably secure said cap to said channel.

15. The joint structure of claim **1** and further including means having cooperative elements respectively provided by said web components to maintain the same in generally contiguous juxtaposition during insertion of said joint structure into a mass of uncured concrete.

16. The joint structure of claim **15** in which said cooperative elements comprise a tongue provided by one web component and a groove provided by the other for receiving said tongue therein.

17. The joint structure of claim **16** in which one of said web components is longer than the other and is provided with a transversely offset shoulder underlying the end of such other web component to protect the same during insertion of said joint structure into a mass of uncured concrete, said groove being provided in said shoulder and said tongue being provided by the shorter of said web components.

18. In a joint structure adapted to be embedded in concrete materials and the like to accommodate relative displacements of sections thereof bounded in common by such joint, a longitudinally extending generally T-shaped channel having a transverse flange defining a topwall adapted to be disposed in generally planar relation with the surfaces of such sections and having also a web extending downwardly from said flange, said web being divided intermediate the transverse edges thereof into web components in generally side-by-side juxtapo-

sition and displaceable transversely relative to each other, each of said web components being equipped with a transversely projecting anchor effective to secure the same to the associated section of concrete material for movement therewith, and one of said web components being longer than the other and provided with a transversely offset shoulder underlying the end of such other web component to protect the same during insertion of said joint structure into a mass of uncured concrete.

19. The channel of claim **18** in which said web components and flange are integral, said web components being angularly displaceable along the juncture thereof with said flange to provide the aforesaid relative transverse displaceability thereof, and said longer web component has a progressively decreasing transverse dimension extending downwardly from said offset shoulder to facilitate insertion of said joint structure into a mass of uncured concrete.

20. The channel of claim **19** in which said anchors are disposed in substantial alignment and together have a generally I-shaped configuration.

21. The channel of claim **20** in which the channel is an elongated continuous member integral throughout, said web being located adjacent the center of said flange and having a substantially normal orientation with respect thereto.

22. The channel of claim **19** and further including means having cooperative elements comprising a groove disposed along said shoulder and a tongue provided by the shorter of said web components receivable within said groove to maintain said web components in generally contiguous juxtaposition during insertion of said joint structure into a mass of uncured concrete.

23. In a joint structure adapted to be embedded in concrete materials and the like to accommodate relative displacements of sections thereof bounded in common by such joint, a cap adapted to be removably secured to the flange of a generally T-shaped channel to stiffen the latter and protect the flange thereof, said cap having a relatively wide and thin topwall substantially wider than such flange and adapted to overlie the same, said cap further having transversely spaced spring fasteners extending downwardly from said topwall and being formed integrally therewith, and said fasteners each having an arcuate configuration to enforce a cove configuration onto any mass of concrete into which said fasteners are inserted.

24. The cap of claim **23** in which said topwall and fasteners are sufficiently resilient to enable an elongated length of said cap to be coiled into a helical roll.

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