United States Patent

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[54] **SEALED JOINT INTERSECTION**
10 Claims, 6 Drawing Figs.

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[51] **Int. Cl.** **E01c 11/10**
[50] **Field of Search** 94/18, 22, 51.39; 52/396, 573

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ABSTRACT: The intersection of a plurality of waterstop sealed intersecting joints in a plastic mass is sealed by injecting a sealant into the fractures associated with the joints.

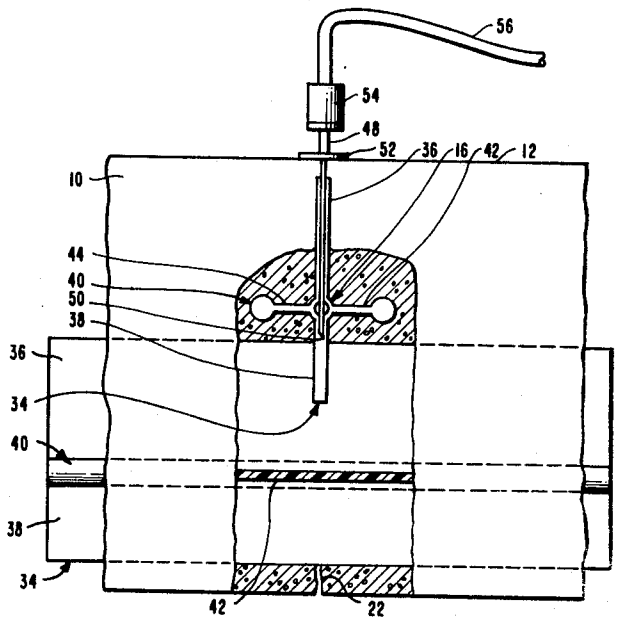
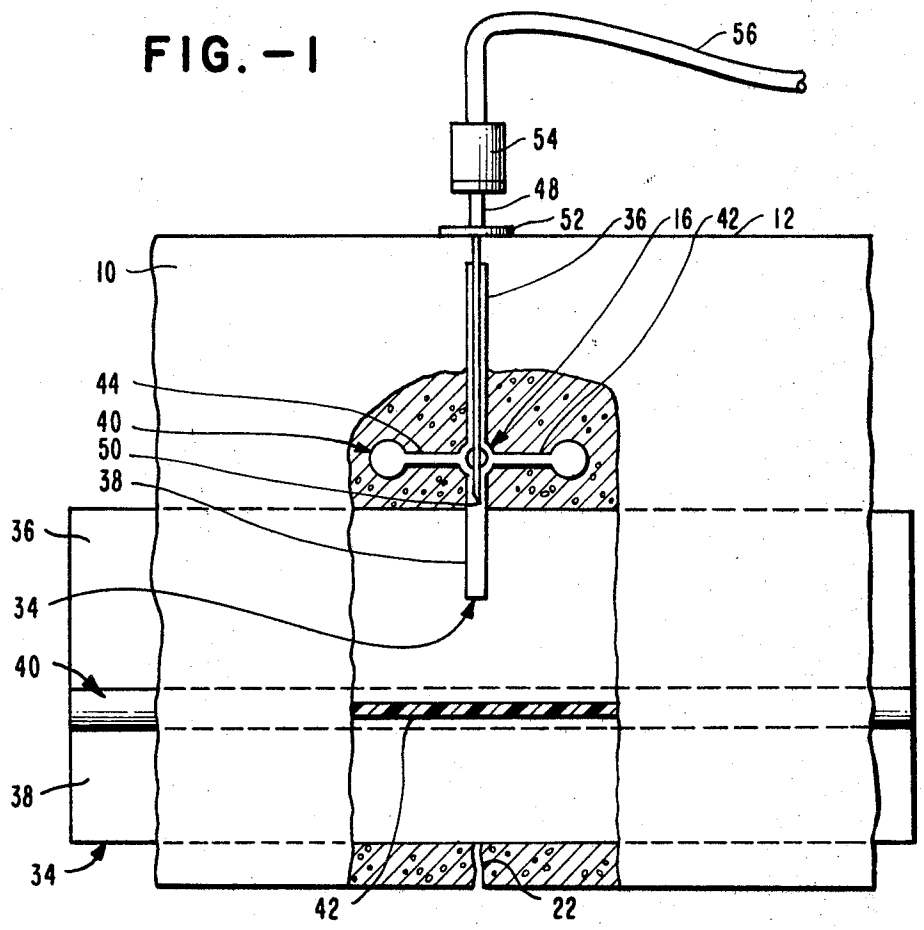


FIG. -1



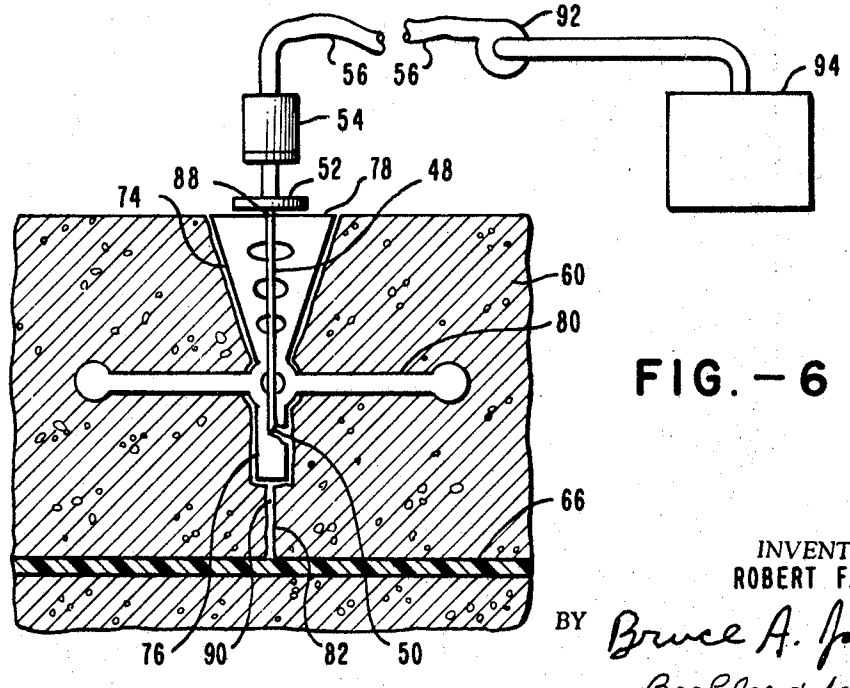
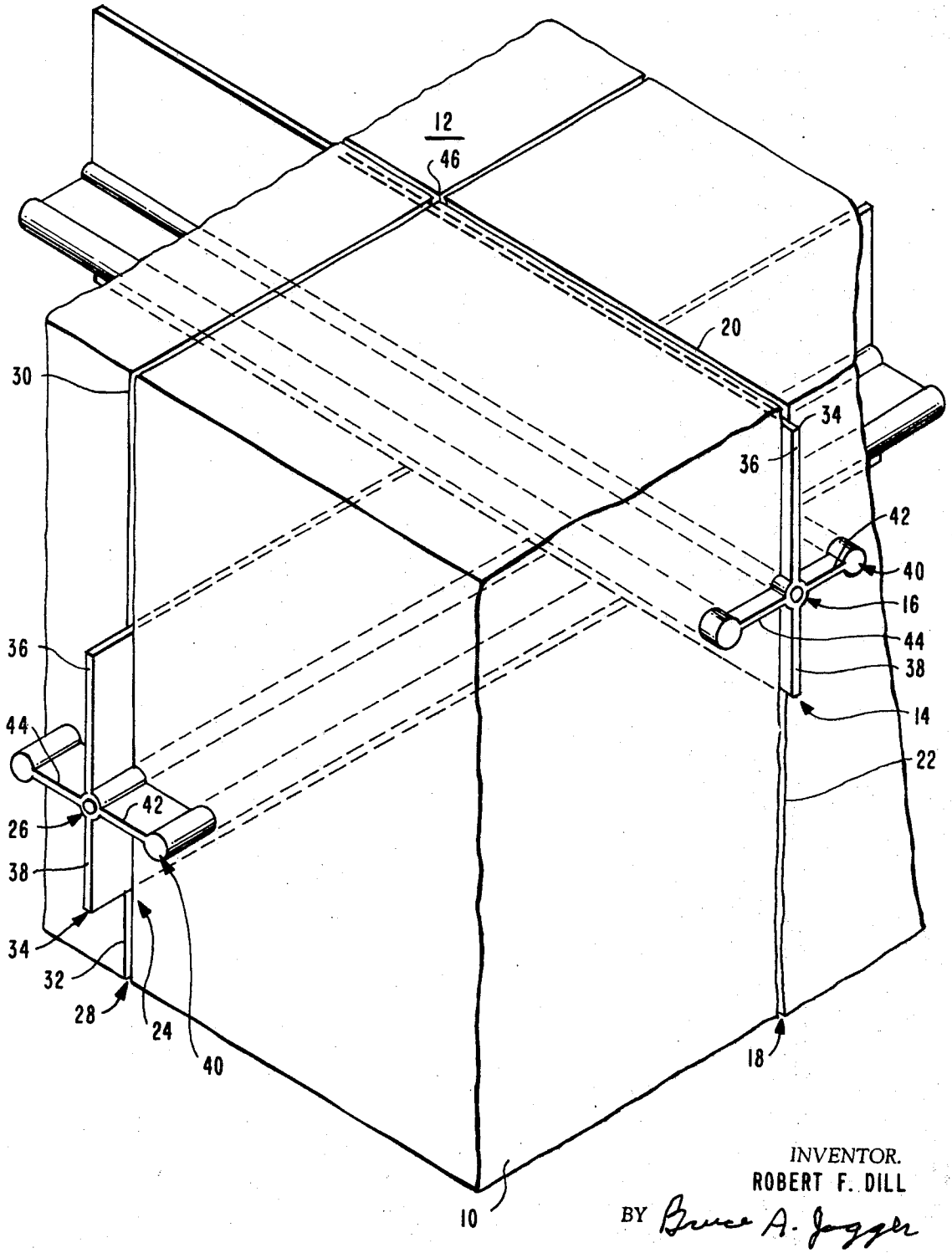


FIG. -6

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FIG. - 2



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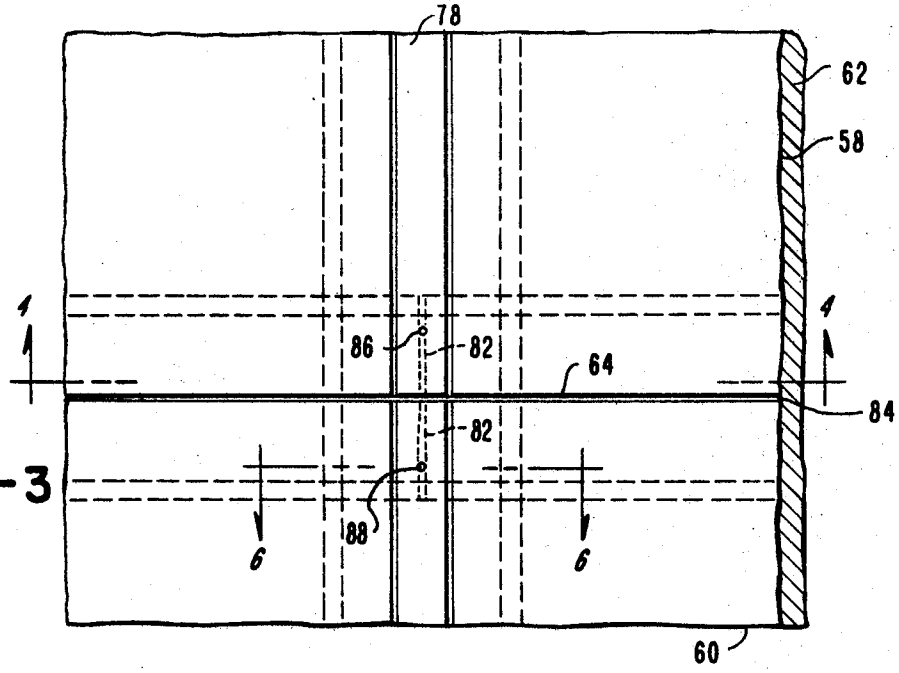


FIG.—3

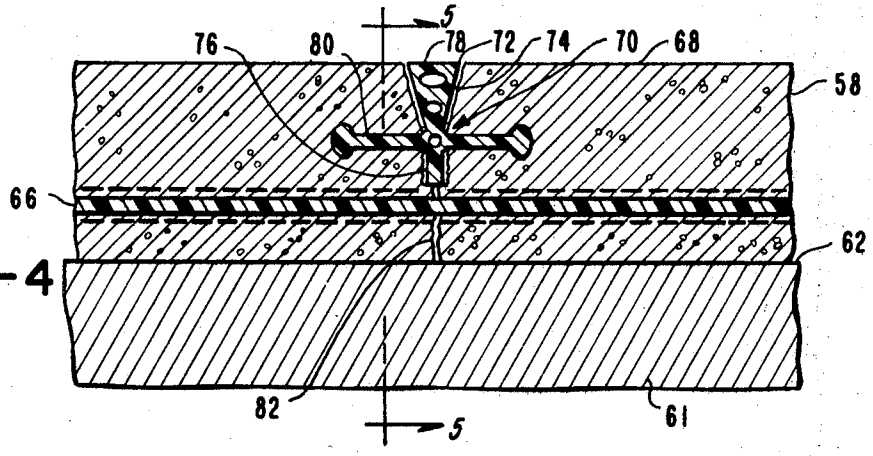


FIG.—4

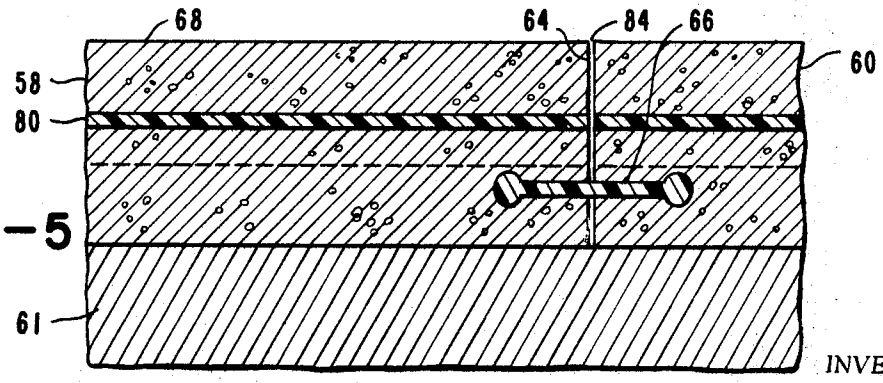


FIG.—5

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SEALED JOINT INTERSECTION

This invention relates to joints in initially plastic masses, such as concrete. More particularly, this invention relates to the sealing of the intersection of a plurality of joints in an initially plastic mass.

Broadly, this invention relates to a structure and method wherein there are fractures associated with intersecting joints which require sealing at the intersection in order to prevent the passage of moisture from one side of the structure through the fracture to the other. The joints to which this invention is particularly applicable include those wherein the joint structure includes a supple, resilient water-impervious seal or waterstop which has an elongated configuration extending generally parallel to one side of the mass in which it is embedded and bridging across a fracture in the mass between adjacent portions of the mass. The function of the waterstop is to prevent the passage of moisture through the joint. These waterstops may be embedded either in a monolithically poured concrete mass before it solidifies or at the edge of a panel poured concrete mass. These waterstops are placed in panel poured concrete by being attached to the form before the panel is poured. These waterstops very effectively prevent the passage of water through the joints except where a fracture extends over the edge of the waterstop member. This condition occurs at the intersection of a plurality of joints. It is possible for water to work through the fractures associated with the intersection of a plurality of joints and completely circumvent the waterstops. The injection of an initially flowable sealant, according to this invention, at a location within the mass and in the region between at least two of the waterstops will effectively seal the fractures so as to prevent the passage of water through the intersection of the joints.

It is well known that monolithically-poured concrete slabs or masses will fracture during cure and afterwards due to the expansion and contraction caused by curing stresses or temperature cycling. These fractures will occur at random unless some provision is made for providing weakened planes at which fracturing will occur preferentially. Preferably the weakened planes are provided by fracturing members which are associated with the waterstops so as to cause the resultant fractures to occur at about the longitudinal center line of the waterstop.

In panel or form poured concrete slabs or masses a given section of concrete is poured within a defined form, and waterstops may be positioned at the edges of the form simply by placing them there prior to the pouring of the concrete. The panel of poured concrete is allowed to at least partially cure before the forms are removed. If a second panel is poured adjacent to the first, a fracture will automatically be defined at the intersection of the two panels.

The waterstops are positioned at different elevations within the mass so that they do not interfere with one another at the intersections of the joints. In monolithically poured concrete masses both the longitudinal and transverse joints are prepared by inserting intersecting joint forming structures at different depths in the uncured mass of concrete. The joint forming structures are generally plus-shaped in configuration so that a fracture is formed by the vertical fracturing members, and the resulting fracture is sealed by the horizontal waterstop members. In this case both waterstops pass uninterrupted through the intersection at different elevations, but the fracturing members generally cut through one another. Considerable difficulty had previously been experienced in sealing the intersection of these joints. These and other difficulties of the prior art have been overcome according to the present invention.

For the purposes of further illustration reference is made to the accompanying drawings in which:

FIG. 1 is an elevation partially in cross section of the intersection of two joints in a concrete slab;

FIG. 2 is a perspective view of a portion of the intersection of two joints in a concrete slab;

FIG. 3 is a plan view of a modification of the invention illustrative of the intersection of two joints in a panel poured concrete slab;

FIG. 4 is a cross-sectional view taken along line **4--4** in **FIG.** 3;

FIG. 5 is a cross-sectional view taken along line **5--5** in **FIG.** 4; and

FIG. 6 is a cross-sectional view taken along line **6--6** in **FIG.** 3 and including an injection needle in operative position.

Referring particularly to the drawings, there is shown a monolithically poured concrete mass **10** having an upper surface **12**. A first joint indicated generally at **14** is formed extending transversely through concrete mass **10**. First joint **14** is formed by embedding first joint forming structure **16** in a plastic mass of uncured concrete. First joint forming structure **16** is a generally plus-shaped section. A first fracture **18** is formed by structure **16** as the concrete **10** hardens. First fracture **18** has an upper portion **20** and a lower portion **22**. A second joint **24** extends longitudinally of concrete mass **10** and intersects with first joint **14**. Second joint **24** is formed by second joint forming structure **26**. Second joint forming structure **26** has a generally plus-shaped section. Second joint forming structure **26** causes second fracture **28** to form as concrete **10** hardens. Second fracture **28** is divided into upper portion **30** and lower portion **32**. The plus-shaped joint forming structures **16** and **26** are identical in their configuration and corresponding elements are given the same numbering. Fracturing members **34** extend vertically from a location intermediate the side edges of waterstops or seals **40**. Fracturing members **34** have upper portions **36** which extend upwardly from seals **40** towards surface **12**. Lower portions **38** of fracturing members **34** extend below seals **40**. First fracture **18** and second fracture **28** are caused to occur in joints **14** and **24**, respectively, by fracturing members **34**. Seals **40** extend laterally in concrete mass **10** and are continuous from edge to edge. Seals **40** are composed of a water impervious, supple resilient material. Seals **40** are provided with first flanges **42** which extend out and terminate in an enlarged edge and second flanges **44** which extend outwardly and also terminate in an enlarged edge. First flanges **42** are embedded in concrete mass **10** on one side of the fracture, caused by fracturing members **34**, and second flanges **44** are embedded in concrete mass **10** on the other side of the fracture caused by fracturing members **34**. The seals of joint forming structures **16** and **26**, respectively, extend at different elevations through the intersection of these joint forming structures without being broken or interrupted. In order to accomplish this continuous, uninterrupted extension, the seals are positioned within concrete mass **10** in substantially parallel spaced apart planes so that the seal of first joint forming structure **16** passes above and out of contact with the seal of second joint forming structure **26**. The upper portions **20** and **30** of first and second fractures **18** and **28**, respectively, meet at intersection **46**. Injection needle **48** is inserted through fracturing member **36**, at about intersection **46**, until discharge port **50** of injection needle **28** is below seal **40** of first joint forming structure **16** and above seal **40** of the second joint forming structure **26**. The depth to which needle **48** is inserted into first joint forming structure **16** is established at a predetermined depth by the location of index stop **52**. Injection needle **48** is connected by way of fitting **54** to flowable sealant conduit **56**. Flowable joint sealant is supplied under pressure to injection needle **48** by means of a pump (not shown) under sufficient pressure to cause the sealant to rupture the wall of lower portion **38** as it is discharged from discharge port **50** between the respective seals of first joint forming structure **16** and second joint forming structure **26**.

Referring particularly to **FIGS.** 3, 4, and 5, there is illustrated a first concrete panel **58** and a second concrete panel **60**. Panels **58** and **60** rest on soil surface **62** of soil base **61**. Panel **58** is prepared by erecting a form (not shown), the inner face of which is positioned at first vertical face **64**. Dumbbell waterstop **66** is positioned by the form at the location shown in these figures. Dumbbell waterstop **66**, as shown particularly in

FIG. 5, has no fracturing member associated with it. First concrete panel 58 is then poured, and the plastic concrete mass is distributed in the form and smoothed somewhat to provide an upper surface 68. Joint forming structure 70 is then inserted in the plastic mass with fracturing member 72 extending generally vertically with the upper wedge shaped portion 74 extending to the upper surface 68 of panel 58. The lower portions 76 of fracturing member 72 extend downwardly towards the upper surface of dumbbell waterstop 66. The base 78 of wedge-shaped portion 74 is positioned substantially parallel with and approximately at upper surface 68. Waterstop or seal 80 then extends horizontally in panel 58. As panel 58 cures and hardens, fracture 82 is formed by fracturing member 72.

The form (not shown) which defines first vertical face 64 is then removed, and second concrete panel 60 is poured against first vertical face 64. The second half of dumbbell waterstop 66 then becomes embedded in second panel 60. The joint forming structure 70, which appears in second concrete panel 60, is inserted while the concrete is in a plastic uncured state. As second panel 60 cures and hardens, straight walled fracture 84 is produced between panels 58 and 60; and fracture 82 is formed by fracturing member 72 of that segment of joint forming structure 70, which is embedded in second panel 60. Fracture 82 is sealed by waterstop 80 so that moisture cannot pass from upper surface 68 through fracture 82 into soil base 61. Straight walled fracture 84 is sealed by seal 66 so that moisture cannot pass through straight walled fracture 84 into soil base 61. However, at the intersection of fractures 82 and 84 it is possible for moisture to by-pass waterstop 80 through straight walled fracture 84 and flow on to the upper surface of dumbbell waterstop 66. Fracture 82 extends from first vertical face 64 below seal 80 and in alignment with fracturing member 72. It is thus possible for water to pass through the portions of fracture 82, shown in phantom in FIG. 3, and over the edge of dumbbell waterstop 66 and then down into soil base 61. In order to prevent moisture in fracture 82 from by-passing dumbbell waterstop 66, an injection needle is inserted through the upper wedge-shaped portion 74 to depth below waterstop 80; and a sealant is injected into fracture 82, as illustrated particularly in FIG. 6. The sealant flows through fracture 82 and seals this fracture in the region of seal 66. The initially flowable sealant is conveniently injected into fracture 82 in first panel 58 at injection point 86, and sealant is conveniently injected into fracture 82 in second panel 60 at injection point 88 (FIG. 3).

As illustrated in FIG. 6, the injection needle 48 is inserted to such a depth that sealant is discharged in fracture 82 between waterstop 80 and dumbbell waterstop 66. Initially flowable sealant 90 ruptures the wall of the lower portion 76 of fracturing member 72 and flows into fracture 82 under the urging of sealant pump 92. Sealant reservoir 94 contains a supply of initially flowable sealant 90.

The waterstop 66 and the joint forming structure 70 are preferably prepared from some liquid impervious inert synthetic polymer, such as polyvinyl chloride and the like.

The initially flowable sealant 90 is preferably a liquid impervious inert synthetic polymer, such as polysulfide, or a bituminous product, or the like. This sealant is preferably non-hardening so that it retains a soft deformable or rubbery consistency which yields with the movement of the concrete slab yet effectively seals the fracture as it changes width with temperature fluctuations.

Generally the preparation of intersecting joints in a monolithically poured concrete mass is accomplished by inserting the longitudinal joints with the finishing machine, and a separate operation is carried out to insert the transverse joints. In general, these joints intersect one another at about 90 degrees, forming a grid pattern. The transverse joints are generally formed by a joint forming structure which is laid so that it extends out of contact with the waterstop on the longitudinal joint. The transverse joints are generally formed by a joint forming structure which passes through the fracturing member of the longitudinal joint. This results in some distortion and deflection of the fracturing member of the longitudinal joint at the intersection, which contributes to the production of an irregular fracture at this intersection.

The sealing of intersecting joints, according to this invention, finds particular utility in concrete lined reservoirs and canals where a body of water is constantly standing on the upper surface of the concrete structure.

Although this invention has been described with the reference of concrete structures, it is also applicable to other structures, such as asphaltic or synthetic plastic structures.

What has been described are preferred embodiments in which modifications and changes may be made without departing from the spirit and scope of the accompanying claims.

I claim:

1. The structure comprising:
an initially plastic mass having outer and inner sides;
a plurality of intersecting joints in said mass, each of said intersecting joints being sealed by a waterstop positioned within said mass and bridging across said joint between adjacent portions of said mass to prevent the passage of moisture through said joint from one of said sides to the other, at least one of said waterstops extending uninterrupted through said intersection, said waterstops being positioned in spaced relationship to one another;
a resilient, initially flowable joint sealant injected and solidified in situ in at least one of said joints, said solidified sealant being positioned at about an intersection of said joints and between two of said waterstops.

2. The structure of Claim 1 wherein said initially plastic mass is a monolithically poured concrete mass having an upper surface and said joints comprising fractures extending in said mass generally perpendicular to said upper surface, said fractures being sealed by said waterstops.

3. The structure of Claim 1 wherein said initially plastic mass is a panel poured concrete mass having an upper surface, one of said joints being between adjacent panels of said concrete mass, the waterstop sealing the joint between said adjacent panels being continuous through the intersection of said joints and the other waterstop being interrrupted at the joint between said panels.

4. The structure comprising:
a monolithically poured initially plastic concrete mass having an upper side;
a plurality of intersecting elongated joint forming structures extending generally parallel with said upper side within said mass, each of said joint forming structures comprising a continuous elongated waterstop extending generally laterally within said mass, and an elongated fracturing member extending generally vertically within said mass from said waterstop, the waterstop of each of said structures extending uninterrupted at different elevations through said intersections;
intersecting, generally vertical fractures extending in said mass from said fracturing members;
a resilient, deformable, initially flowable joint sealant injected and solidified in situ in at least one of said fractures, said solidified sealant being positioned at an intersection of said fractures and below at least one of said waterstops.

5. The structure of Claim 4 wherein that portion of the fracturing member of the uppermost joint structure which extends upwardly from the waterstop of said uppermost structure has a generally wedge-shaped section with the base of said wedge being located approximately at and parallel with the upper side of said mass.

6. The structure of Claim 4 wherein the uppermost of the fracturing members extends to about the upper side of said mass and has sufficient width to receive a hollow injection needle between the sides of said uppermost fracturing member.

7. The structure of Claim 4 wherein the joint forming structures have generally plus-shaped sections.

8. A method for sealing the intersection of a plurality of intersecting joints in an initially plastic mass, said mass having outer and inner sides, each of said intersecting joints being sealed by a waterstop positioned within said mass and bridging across said joint between adjacent portions of said mass to prevent the passage of moisture through said joint from one of said sides to the other, at least one of said waterstops extending uninterrupted through said intersection, said waterstops being positioned in spaced relationship to one another, which method comprises injecting an initially flowable sealant into at least one of said joints at about said intersection, said sealant being injected into said joint between two of said waterstops.

9. The method of claim 8 wherein said waterstop comprises a supple, resilient, water impervious seal, inserting an injection needle from the outer surface of said mass through one of said seals and injecting sealant between two of said seals.

10. A method of sealing the intersection of a plurality of joints in a plastic mass comprising:

inserting a plurality of intersecting joint structures beneath the upper surface of an uncured plastic mass;

each of said joint forming structures comprising an elongated elastomeric seal extending generally laterally within said mass and an elongated fracturing member extending generally vertically within said mass, said seals extending uninterrupted and out of contact with one another through said intersection;

allowing said plastic mass to solidify and fracture in alignment with said fracturing members to produce intersecting generally vertical fractures;

inserting a hollow shaft having a discharge port through one of said fractures at about the intersection of said fractures to such a depth below said upper surface that said discharge port is between two of said seals; and

injecting a flowable sealant through said shaft and into at least one of said fractures.