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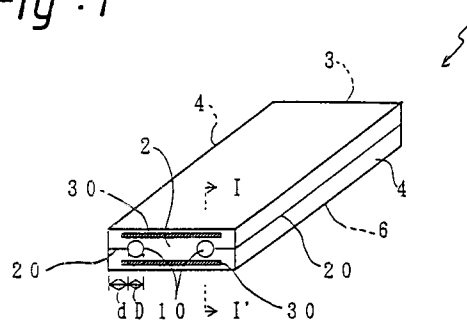
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(54) **WATER EXPANSION CUT-OFF PLATE.**

(57) A water expansion cut-off plate of the invention is one embedded in a concrete placing joint. A tubular grout material injection portion is provided to extend from one end surface in the longitudinal direction of the water expansion cut-off plate to the other end surface thereof, and a grout material discharge portion is provided for discharging a grout material, which has been injected into the grout material injection portion, into a gap between the water expansion cut-off plate and concrete. The grout material discharge portion is expanded by an injection pressure of that grout material which is injected into the grout material injection portion. Thus it is possible to adequately perform cut-off without posing a structural strength problem even when a gap is produced at a concrete placing joint, in particular, that concrete placing joint which is

poured in a reverse manner.

Fig. 1

Technical Field

This invention relates to a water-expansible waterstop plate (water cut-off plate, sealing plate) to be embedded in a concrete joint portion.

Background Art

As a waterstop method applicable to a concrete joint portion, a grout method is heretofore practiced. According to this grout method, a grout impregnating tube is embedded in a concrete joint portion, and a grout material is impregnated to a gap formed by contraction caused by curing of concrete to thereby stop water.

The above grout method has such shortcomings that the concrete once placed is contracted with the passage of time and a small gap is gradually formed between the grout material and the concrete, and therefore, the waterstop effect is deteriorated with the passage of time.

Also, practiced is a waterstop method in which a water expansible waterstop plate is embedded in a concrete joint portion. While a waterstop effect can be obtained according to this method, there is such a problem that when a gap is formed in the water-expansible waterstop plate, structural strength is sometimes adversely affected. This problem is particularly significant in a concrete joint portion which is formed by a reverse concrete placement.

Disclosure of Invention

It is, therefore, an object of the present invention to provide a water-expansible waterstop plate, in which a sufficient waterstop effect can be obtained even in a case where a gap is formed in a concrete joint portion, particularly at a concrete joint portion formed by a reverse concrete placement, without providing a problem in view of a structural strength.

According to the present invention, there is provided, in order to achieve the above object, a water-expansible waterstop plate to be embedded in a concrete joint portion, comprising a tubular grout material inlet portion extending from one longitudinal end face of the water-expansible waterstop plate to the other longitudinal end face thereof, and a grout material outlet portion for discharging a grout material, which has been filled through the inlet portion, to a gap formed between the water-expansible waterstop plate and a concrete.

The water-expansible waterstop plate according to the present invention, when in use, is first embedded in concrete and then, after the concrete has cured, a grout material is filled through the grout material inlet portion. At that time, the grout

material is discharged from the grout material outlet to a gap formed (due to contraction or sedimentation of concrete) between the concrete and a waterstop plate, thereby obviating the deterioration of waterstop effect and the problem in view of structural strength.

According to the water-expansible waterstop plate of the present invention, a sufficient waterstop effect can be obtained even in a case where a gap is formed in a concrete joint portion, particularly at a concrete joint portion formed by a reverse concrete placement, without causing any problem in view of a structural strength.

Brief Description of Drawings

Fig. 1 is a perspective view showing one embodiment of a water-expansible waterstop plate of the first invention;

Fig. 2 is an enlarged sectional view taken on line I-I' of the water-expansible waterstop plate of Fig. 1;

Fig. 3(A) is a perspective view showing a state in which a water-expansible waterstop plate of the present invention is applied to a concrete placement, and Fig. 3(B) is a perspective view showing a process in which a concrete is further placed and a grout material is filled;

Fig. 4 is a perspective view showing another embodiment of a water-expansible waterstop plate of the present invention;

Fig. 5 is a schematic perspective view showing one example of a concrete construction formed by using the water-expansible waterstop plate shown in Fig. 4;

Fig. 6 is an enlarged plan view of the portion indicated by I of Fig. 5; and

Fig. 7(a) is a perspective view showing one example of a cavity portion reinforcement material used in the water-expansible waterstop plate according to the present invention, and Fig. 7(b) is a perspective view showing another example of the cavity portion reinforcement material.

Detailed Description of the Invention

A water-expansible waterstop plate according to the present invention will be described with reference to Figs. 1 and 2.

Fig. 1 is a perspective view showing a first embodiment of a water-expansible waterstop plate according to the present invention, and Fig. 2 is a sectional view taken on line I-I' of the water-expansible waterstop plate shown in Fig. 1.

The water-expansible waterstop plate 1 shown in Figs. 1 and 2 is a water-expansible waterstop plate to be embedded in a concrete joint portion.

The water-expansible waterstop plate 1 includes a grout material inlet portion 10 extending from one end face of the water-expansible waterstop plate 1 to the other end face thereof in a longitudinal direction of the water-expansible waterstop plate 1, and a grout material outlet portion 20 for discharging a grout material, which has been filled through the inlet portion 10, to a gap formed between the water-expansible waterstop plate and a concrete.

More specifically, the water-expansible waterstop plate 1 is formed in a rectangular parallelepiped configuration constituted of one end face 2, the other end face 3, a right and a left side faces 4, an upper face 5, and a lower face 6. Two of such grout material inlet portions 10 have a cylindrical configuration and are formed at the right and left side faces 4 side of the water-expansible waterstop plate 1. The grout material inlet portions 10 extend longitudinally from the end face 2 of the water-expansible waterstop plate 1 toward the other end face 3 thereof.

The grout material outlet portion 20 has a straight-line slit continuously formed from the right and left side faces 4 toward the grout material inlet portions 10 such that the grout material outlet portion 20 is dilated by pressure of the grout material filled in the grout material inlet portion 10.

The width of the slit forming the grout material outlet portion 20 is preferably $d = 0.1 \times D$ to $200 \times D$, and more preferably $d = 0.5 \times D$ to $50 \times D$.

In the above equation, as shown in Fig. 1, reference character d denotes a width of a slit forming the grout material outlet portion 20, and D denotes a diameter of a section (in the case where the section is a circle) of the grout material inlet portion (unit of both of them is the same). In the case where the section of the grout material inlet portion is not circle, the diameter is converted as a diameter of a circle having the same area.

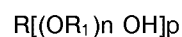
Further, the water-expansible waterstop plate 1 has two expansion inhibiting members 30 for inhibiting longitudinal expansion of the water-expansible waterstop plate 1, one at an upper surface 5 side and the other at a lower surface 6 side. The expansion inhibiting members 30 are provided in such a manner that they longitudinally pierce through the water-expansible waterstop plate 1, namely, from the end face 2 toward the other end face 3. Owing to the provision of the expansion inhibiting members 30, positional discrepancy caused by the longitudinal expansion of the water-expansible waterstop plate 1 can be prevented.

Acceptable examples of a water-expansible material constituting the water-expansible waterstop plate 1 of this embodiment include a water-expansible resin (C) obtained by kneading a non-water-expansible thermoplastic resin (A) with a water-expansible material (B).

Examples of the non-water-expansible thermoplastic resin (A) include natural rubbers; synthetic rubbers (e.g. EPDM); vinyl chloride resins such as polyvinyl chloride and its copolymers; ethylene-vinyl acetate copolymers, polyethylene, polypropylene and their copolymers; and silicone resins. It is preferable to use rubber resins such as natural rubbers and synthetic rubbers. When vinyl chloride resins are used, it is preferred to employ plasticizers simultaneously.

Further, examples of water-expansible material (B) kneaded with the above-described non-water-expansible thermoplastic resin (A) include water-expansible urethane resin, carboxymethyl cellulose, polyvinyl alcohol, polyethylene glycol, hydroxyethyl cellulose, methyl cellulose, starch-acrylic acid copolymer, styrene-maleic anhydride copolymer and the salts of these copolymers, sodium polyacrylate, polyvinyl alcohol-maleic anhydride copolymer and their cross linked materials, vinyl ester-ethylenically unsaturated carboxylic acid copolymer and the saponificated materials thereof. It is preferable to use water-expansible urethane resin having the strength and water-expansible property.

A typical example of the water-expansible urethane resin includes prepolymer(s) having isocyanate groups, in which the content of terminal NCO groups amounts to 1 to 12%, preferably 2 to 7%, obtained by the reaction of one or more polyether polyols represented by the following general formula and polyisocyanate;



wherein R represents a polyhydric alcohol residue; $(OR_1)_n$ represents a polyoxyalkylene chain comprising oxyalkylene groups each having an oxyethylene group and an alkylene group carrying three or four carbon atoms, provided that the content of the oxyethylene groups amounts to 20 to 100% of the total molecular weight;

n is a number corresponding to the degree of polymerization of the oxyalkylene groups and giving a hydroxyl group equivalent of 200 to 2500; and

p is a number of 2 to 8, preferably 2 to 4.

Examples of the polyhydric alcohol represented as R (polyhydric alcohol residue) in the above-described general formula include aliphatic dihydric alcohols such as ethylene glycol, propylene glycol, 1,4-butylene glycol and neopentyl glycol; trihydric alcohols such as glycerol, trioxisobutane, 1,2,3-butanetriol, 1,2,3-pentanetriol, 2-methyl-1,2,3-propanetriol, 2-methyl-2,3,4-butanetriol, 2-ethyl-1,2,3-butanetriol, 2,3,4-pentanetriol, 2,3,4-hexanetriol, 4-propyl-3,4,5-heptanetriol, 2,4-dimethyl-2,3,4-pentanetriol, pentamethyl glycerol, pentaglycerol,

1,2,4-butanetriol, 1,2,4-pentanetriol and trimethylolpropane; tetrahydric alcohols such as erythritol, pentaerythritol, 1,2,3,4-pentanetetrol, 2,3,4,5-hexanetetrol, 1,2,3,5-pentanetetrol and 1,3,4,5-hexanetetrol; pentahydric alcohols such as adnate, arabitol and xylitol; and hexahydric alcohols such as sorbitol, mannitol and iditol.

The polyether polyols represented by the above-described general formula may be obtained by adding alkylene oxide having 3 to 4 carbon atoms and ethylene oxide to these polyhydric alcohol in such a conventional manner as to give the desired molecular weight and to give the desired content of the ethylene oxide group. Either random or block addition of the alkylene oxide having 3 to 4 carbon atoms and the ethylene oxide may be employed therefor. The content of the oxyethylene group based on the molecular weight of polyether polyols ranges 20 to 100% by weight. When the content of the oxyethylene group is less than 20%, the expandable ratio of the prepolymer having isocyanate groups obtained by reacting isocyanate becomes small, so that sufficient water-proof cannot be obtained.

Example of the polyisocyanate include any polyisocyanates such as 1,4-butane diisocyanate, 1,6-hexane diisocyanate, dicyclohexylmethane diisocyanate, cyclohexane diisocyanate, 1,5-bis-isocyanato-1,3,5-trimethyl-cyclohexane, 1,3-bis-(isocyanatomethyl)-benzene and methylcyclohexane diisocyanate. Fatty acid triisocyanate may be employed together partially. Examples of aromatic polyisocyanate include any aromatic diisocyanates such as 2,4- or 2,6-tolylene diisocyanate or their isomer mixtures; 4,4'-diphenylmethane diisocyanate, 3,3'-dimethyldiphenylmethane-4,4'-diisocyanate, m- or p-phenylene diisocyanate, 1,5-naphthylene diisocyanate and their isomers. Further, aromatic polyisocyanate having carbodiimide-, urethodione-, urethane-, urethoimine- or biuret group or isocyanurate ring(s) may be employed alone or together.

The prepolymer having isocyanate groups, which is a calking compound, thus obtained can be used independently or simultaneously with an active hydrogen compound by mixing and curing.

The active hydrogen compound is polyol, polyamine or a mixture thereof each having 2 to 6 of active hydrogen atoms per one molecule and having an average molecular weight per active hydrogen atoms of 30 to 15,000, for example, low-molecular weight di or triols such as ethylene glycol, 1,4-butanediol, glycerol and trimethylolpropane; polyalkylene glycols such as polypropylene glycol, ethylene oxide-propylene oxide copolymers; polymers of alkylene oxide such as ethylene oxide-propylene oxide and low-molecular weight triols such as glycerol, trimethylolpropane, 1,2,6-hex-

anetriol, low-molecular weight tetraols such as pentaerythritol or low-molecular weight hexaols such as solbitol; or polyamines such as ethylenediamine, 4,4'-methylene-bis-1-chloroaniline or polymers of these polyamines and the above-described alkylene oxide.

In the reaction of the prepolymer having isocyanate groups and the active hydrogen compound, any well-known catalyst for promoting the reaction of isocyanate group and an active hydrogen compound can be added. Examples of the catalyst to be added include triethylamine, triethylenediamine, N-morpholine, stannous octoate and dibutyl dilaurate. In connection with the ratio of the polyisocyanate and the active hydrogen compound in the above-described prepolymer having isocyanate groups, $[NCO] / [H^+]$ is preferably 0.8 to 1.4, more preferably 1.0 to 1.2.

Further, the above-described water-expandable urethane resin may further contain high molecular materials such as other urethane resins, epoxy resins and acryl resins, optionally, and additives of these resins such as calcium carbonate, clay, aluminium silicate, talc or titanium dioxide. Appropriate amount of color former and antioxidant can be also added thereto.

Regarding the blending rate of the above-described non-water-expandable thermoplastic resin (A) and the above-described water-expandable material (B) in the water-expandable resin (C), it is preferable to blend and knead 10 to 97% by weight of the non-water-expandable thermoplastic resin (A) and 3 to 90% by weight of the water-expandable material (B) [$(A) + (B) = 100\%$ by weight].

Detailed description regarding the water-expandable resin (C) will be given in the case of using vinyl chloride resins as the non-water-expandable thermoplastic resin (A) and water-expandable urethane resin as the water-expandable material (B).

Examples of the preferable above-mentioned vinyl chloride resins include homopolymer of vinyl chloride, copolymer of vinyl chloride and other monomers and graft polymer of vinyl chloride and other monomers, and chlorinated compounds of the homopolymer, the copolymer or the graft polymer. The vinyl chloride resins preferably has an average polymerization degree of 400 to 4000. An average polymerization degree is preferably 500 to 3000, more preferably 700 to 2000. When the average polymerization degree is less than 400, the strength of the water-expandable resin (C) lowers, and when it is more than 4000, the workability deteriorates.

The vinyl chloride resins may be used in an amount of 10 to 97% by weight based on the mixture of the vinyl chloride resins and the water-expandable urethane resin, and it is preferably from 20 to 95% by weight, still preferably 30 to 90% by

weight. When the amount of the vinyl chloride resins is less than 10% by weight, its workability etc. is lost, and the adjustment of hardness according to the plasticizer becomes difficult. Contrarily, when it exceeds 97% by weight, the water expansibility deteriorates.

It is preferable to employ a plasticizer when vinyl chloride resins is used as the non-water-expansible thermoplastic resin (A). This plasticizer is not particularly limited. Examples of such a plasticizer are those usually employed when preparing vinyl chloride resins, for example, phthalates such as dioctyl phthalate and ditiidecyl phthalate; trimellitates such as trioctyl trimellitate; pyromellitates such as tetra 2-ethylhexyl pyromellitate; and adipate which is a condensate of adipic acid and diol such as 1,2-propylene glycol, triethylene glycol, neopentyl glycol or the like.

The plasticizer may be added in an amount of 0 to 200 parts by weight, preferably 15 to 150 parts by weight, based on 100 parts by weight of the vinyl chloride resins. When it exceeds 200 parts by weight, bleeding occurs and waterstop lowers.

The above-mentioned water-expansible resin (C) may further contain additives generally added to the vinyl chloride resin. Examples of such additives include an organotin thermostabilizer such as dialkyltin mercaptide, dialkyltin malate and dialkyltin laurate; a metal soap such as calcium stearate, zinc stearate, cadmium stearate, barium stearate and lead stearate; an inorganic stabilizer such as lead tribasic sulfate, lead dibasic stearate, calcium hydroxide and calcium silicate; a chelating agent such as trisnonylphenylphosphite and alkylmonoallylphosphite; waxes such as ester wax and hydrocarbon wax; an epoxide compound such as epoxidized soybean oil, epoxidized linseed oil and epoxidized bisphenol(s); and a filler such as calcium carbonate, talc, clay and mica. Pigment, antistatic agent, antioxidant, ultraviolet ray absorbing agent and the like may be also contained therein optionally.

Acceptable examples of a material constituting the expansion inhibiting member 30 include a wire net and a plastic net-like molded product. In view of strength, flexibility, durability and the like, it is preferred to use a stainless steel net and more preferred to use a flat-shaped one.

The diameter of a wire in case a net-like molded product is used as the expansion inhibiting member is preferably 0.15 m/m to 0.8 m/m and more preferably 0.2 m/m to 0.5 m/m, because if the diameter is too large, it becomes difficult to change the shape of the product and maintain the shape. The size of mesh of the net-like molded product causes a change in the ratio of the water-expansible material united through the meshes. If the mesh is too small, integrity is reduced and the

net-like molded product tends to be easily peeled off. In contrast, if the mesh is too large, the effect of the net-like non-expansible member is diminished and the inhibition of expansion becomes impossible. Accordingly, the mesh of the net-like molded product is preferably in a range of from 5 mesh to 80 mesh, and more preferably in a range of from 10 mesh to 40 mesh.

The water-expansible waterstop plate of the present invention can be easily produced by molding or extruding the water expansible material into a desired shape, then forming a slit, etc. to provide the grout material outlet portion, and then cutting the material into an appropriate length.

Next, a waterstop method using the water-expansible waterstop plate of the present invention will be described with reference to Fig. 3. In this embodiment, a reverse concrete placement is illustrated. It should be noted, however, that this method is likewise applicable to the normal concrete placement. In addition, in this embodiment, the concrete placement surface is small in difference between the longitudinal direction and the width direction. However, it should be noted that this method is likewise applicable to a case in which the longitudinal length is several times as large as the width length as in the case with a general concrete placement.

Fig. 3(A) is a perspective view showing a state in which a water-expansible waterstop plate of the present invention is applied to a concrete placement, and Fig. 3(B) is a perspective view showing a process in which a concrete is further placed and a grout material is filled.

In order to practice the waterstop method using the water-expansible waterstop plate according to the present invention, as shown in Fig. 3(A), for example, the waterkd-expansible waterstop plate 1 is connected, through adhesive or the like, to a lower surface (further concrete placing side) of the cured concrete 41 with the end face 3 being intimately attached to the concrete wall 40 which has already been placed.

Thereafter, as shown in Fig. 3(B), the concrete 42 is placed at the lower surface of the concrete 41 such that only the end face 2 of the water-expansible waterstop plate 1 is exposed. At the time when the concrete 42 has been cured, a grout material is filled through the grout material inlets 10 under a predetermined pressure. As a consequence, since the end face 3 side is closed, the grout material is discharged through the grout material outlet portion 20 and the grout material is filled in the gaps 43 formed between the cured concretes 41 and 42 and between the concrete 42 and the water-expansible waterstop plate 1.

In a construction to which a waterstop treatment is applied according to the above-mentioned

waterstop method, the gap formed at the stage when the concrete is cured is closed with the grout material, and the gap formed by contraction with the passage of time can be closed by expansion of the water-expansive waterstop plate.

As the grout material, the conventional grout material can be used as desired. However, it is preferred to use, for example, a mortar (including cement and expansible mortar) series grout material, a liquid rubber (including water expansible rubber) series grout material, a silica sol series grout material, a bentonite/siliceous soda series grout material, a foamed urethane (including prepolymer) series grout material, and an epoxy resin (including emulsion) series grout material.

The pressure at the time when grout material is filled, is preferably 0.1 kg/cm^2 to 50 kg/cm^2 at the inlet portion and more preferably 1 kg/cm^2 to 10 kg/cm^2 .

It should be noted that the water-expansive waterstop plate of the present invention is not limited to the above embodiment. For example, although the sectional configuration of the grout material inlet portion 10 is preferably circular or a shape similar to a circle, it may be a polygon such as a triangle, a square, a hexagon, an octagon, etc. It may also be an indeterminate shape. It may vary depending on a certain position in the longitudinal direction. In the case where the other end face is not closed unlike in the above-mentioned waterstop method, the grout material inlet portion 10 may take a construction not piercing in the longitudinal direction (namely, construction in which the other end face 3 side is closed). However, it is preferred that in order to perform an easy confirmation of cleaning and communication (filling), the other end face of the grout material inlet portion is open as in the above-mentioned embodiment, and that it is closed with the use of a closing tool such as a bolt or the like, after the cleaning and communication (filling) has been confirmed.

The grout material outlet portions 20 may be arranged at a predetermined space and it may be a slit formed in a slant fashion. It may also be arranged as a valve construction.

In the case where the concrete is reversely placed or in other similar cases, the grout material outlet portion 20 may be provided on the upper surface of the water-expansive waterstop plate. In that case, the water-expansive waterstop plate is first placed in concrete by provisionally adhering the upper surface of the water-expansive waterstop plate provided with the grout material outlet portion 20 to the lower surface of the concrete by a double faced taped, or the like. Then, concrete is further placed. At the time when the concrete has cured, the grout material is filled (under pressure). Here, since the water-expansive waterstop plate is

disposed by means of a provisional adhesion, the provisional adhesion is removed by the filling of the grout material under pressure. Then, the grout material is filled into the gap formed by contraction of the concrete. At that time, the grout material outlet portion 20 may be of other construction than mentioned above. For example, it may be a U-shaped groove or the like.

Another embodiment of the present invention will now be described with reference to Figs. 4 to 6. It should be noted that those parts which are not specifically described are the same as the preceding embodiment.

Fig. 4 is a perspective view showing another embodiment of a water-expansive waterstop plate of the present invention, Fig. 5 is a schematic perspective view showing one example of a concrete construction formed by using the water-expansive waterstop plate shown in Fig. 4, and Fig. 6 is an enlarged plan view of the portion indicated by I of Fig. 5.

The water-expansive waterstop plate 1A shown in Fig. 4 has connection holes 50A piercing from the ground material inlet portion 10A to the longitudinal side face 4A of the water-expansive waterstop plate 1A, so that a plurality of water-expansive waterstop plates can be connected together through the connecting holes 50A via joint tools 60A fitted thereto.

More specifically, two of such connecting holes 50A are provided generally at central portion of the side face 4A in such a manner as to correspond to the grout material inlet portions of another water-expansive waterstop plate. As shown in Fig. 4, the L-shaped joint tools 60A are embedded and fitted in the grout material inlet portion 10A and the connecting holes 50A such that one ends of the tools 60A project sideways. Then, by fitting the grout material inlet portions of another water-expansive waterstop plate 1 (water-expansive waterstop plate described in the above embodiment), in other words, by fitting the water-expansive waterstop plate 1 in the direction as indicated by an arrow, into the projected ends of L-shaped joint tools 60A, a plurality of water-expansive waterstop plates can be connected.

The joint tools 60A will now be described. Each tool 60A is an L-shaped tubular member made of plastic, metal or the like. The tool 60A has a passageway hole (not shown) at its angular portion. The passageway hole is adapted to flow the grout material filled in the grout material inlet portion 10A.

Next, one mode of use of the water-expansive waterstop plate of this embodiment will be described with reference to Figs. 5 and 6.

A concrete construction 70A shown in Fig. 5 is a construction for the use in a vertical tunnel. This

concrete construction 70A is built up under the ground by digging the ground from the surface. Reference numeral 71A denotes an outer surface (surface surrounded by earth surface), and 72A denotes an inner surface (inner surface of the tunnel).

As shown in Fig. 5, in the concrete construction 70A, the water-expansive waterstop plates 1 having the connecting holes perpendicular in the width direction and the water-expansive waterstop plates 1 having no connecting hole in their longitudinal direction are arranged such that the water-expansive waterstop plates 1A and the water-expansive waterstop plates 1 are alternately connected together over the entirety of the construction, thus providing a waterstop construction.

As shown in Fig. 6, the water-expansive waterstop plates 1A and the water-expansive waterstop plates 1 are connected together through the connecting holes 50A formed in the water-expansive waterstop plates 1A and through the joint tools 60A disposed at the grout material inlet portions 10A.

One mode for filling the grout material into the water-expansive waterstop plates 1A and 1 will now be described. The grout material is filled per each block a as shown in Fig. 6. Specifically, the grout material is filled in the grout material inlets in the block a. After the grout material coming out of the grout material outlets 74A has been confirmed, the grout material outlets 74A are closed and the grout material is filled in the gaps under pressure.

In view of the ground material being filled in such a way as mentioned above, it is preferred that two of such ground material inlet portions are provided to the water-expansive waterstop plates 1A and 1, respectively.

In the water-expansive waterstop plate of the present invention, a cavity portion reinforcement material may be disposed within the grout material inlet portion.

Examples of the cavity portion reinforcement material include a pipe 100 having a plurality of apertures 101 as shown in Fig. 7(a), a rubber tube (not shown) made of a hard rubber material, a molded member 100' having a spiral shape as shown in Fig. 7(b), and the like. Examples of material forming the pipe and molded member include plastic, metal, and the like.

Owing to the provision of the cavity portion reinforcement member within the grout material inlet portion, the grout material inlet portion can be improved in strength. Accordingly, even in the case where the water-expansive waterstop plate is used in place where loads of concrete are particularly incurred, the cavity of the grout material inlet portion is not crushed, and therefore, decrease of discharge efficiency of the grout material can be prevented.

Industrial Applicability

A water-expansive waterstop plate according to the present invention is embedded in a concrete joint portion in various constructions. For the use of the water-expansive waterstop plate, the cut-off plate is first embedded in concrete. At the time the concrete has cured, a rout material is filled through a grout material inlet portion. At that time, the grout material is discharged into a gap formed (due to contraction or sedimentation of concrete) between the concrete and the waterstop plate, thereby obviating the deterioration of waterstop effect and the problem in view of structural strength.

With the water-expansive waterstop plate according to the present invention, a sufficient waterstop effect can be obtained even in a case where a gap is formed in a concrete joint portion, particularly at a concrete joint portion formed by a reverse concrete placement, without causing any problem in view of a structural strength.

Claims

1. A water-expansive waterstop plate to be embedded in a concrete joint portion, comprising:
 - a tubular grout material inlet portion extending from one longitudinal end face of said water-expansive waterstop plate to the other longitudinal end face thereof; and
 - a grout material outlet portion for discharging a grout material, which has been filled through said inlet portion, to a gap formed between said water-expansive waterstop plate and a concrete.
2. A water-expansive waterstop plate to be embedded in a concrete joint portion as claimed in claim 1, wherein said grout material outlet portion is dilated by pressure of the grout material filled through said ground material inlet portion.
3. A water-expansive waterstop plate as claimed in claim 1, further comprising an expansion inhibiting member disposed in said water-expansive waterstop plate in a longitudinal direction thereof, said expansion inhibiting member being adapted to inhibit expansion of said water-expansive waterstop plate in the longitudinal direction.
4. A water-expansive waterstop plate as claimed in claim 1, wherein said water-expansive waterstop plate has a connection hole piercing from said grout material inlet portion to one longitudinal side face of said water-expansive waterstop plate, said connecting hole being

fitted with a joint tool so that a plurality of said waterstop plates can be jointed.

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Fig. 1

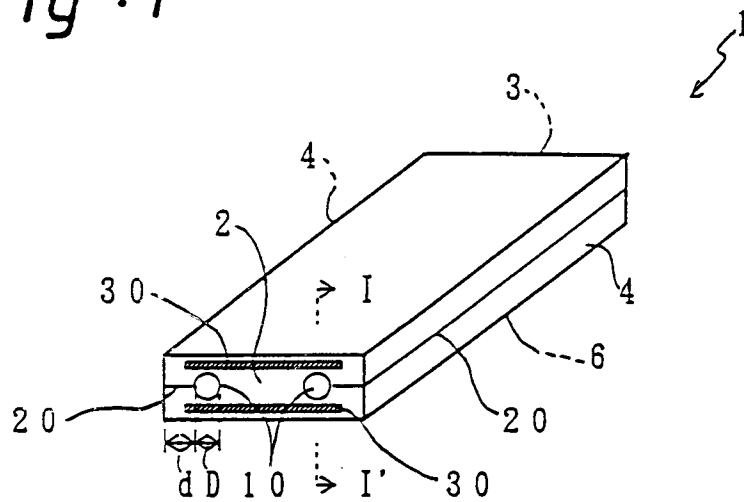


Fig. 2

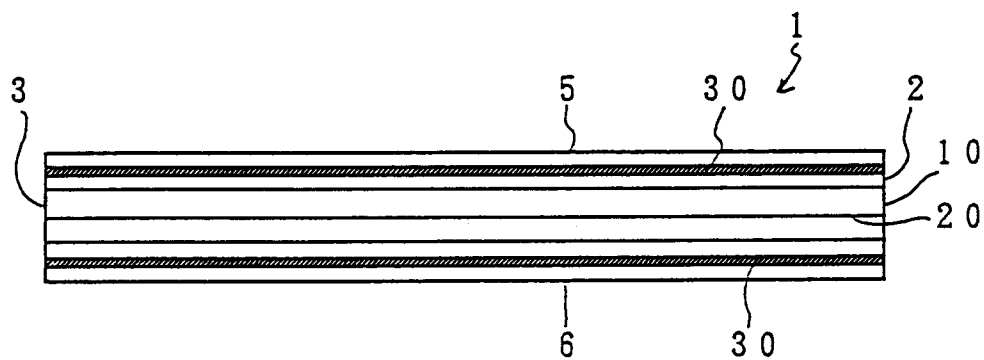


Fig. 3

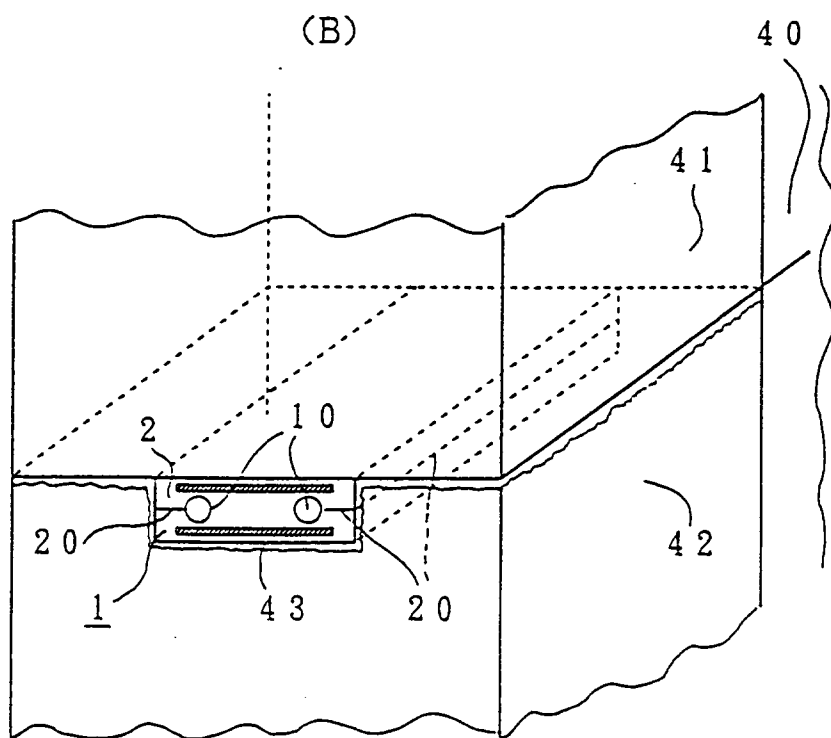
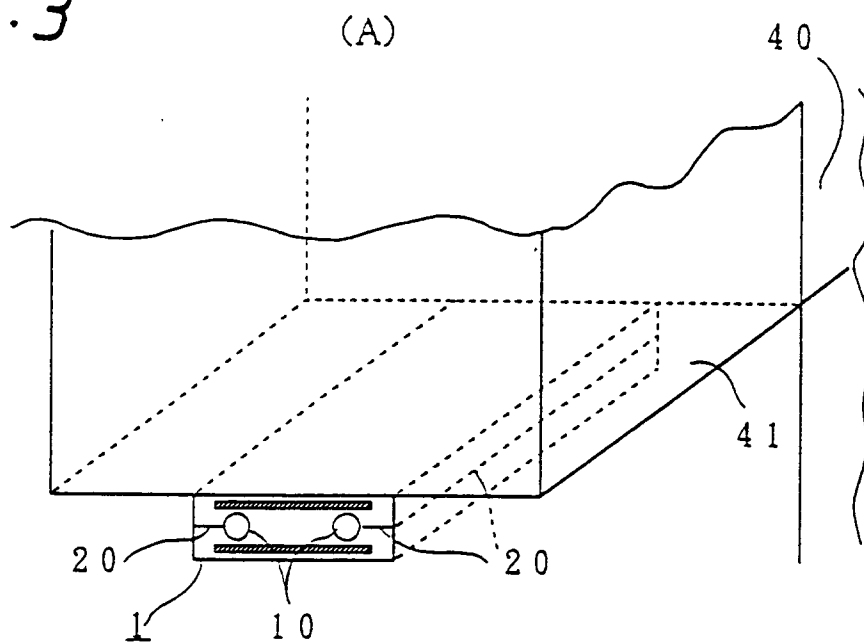


Fig. 4

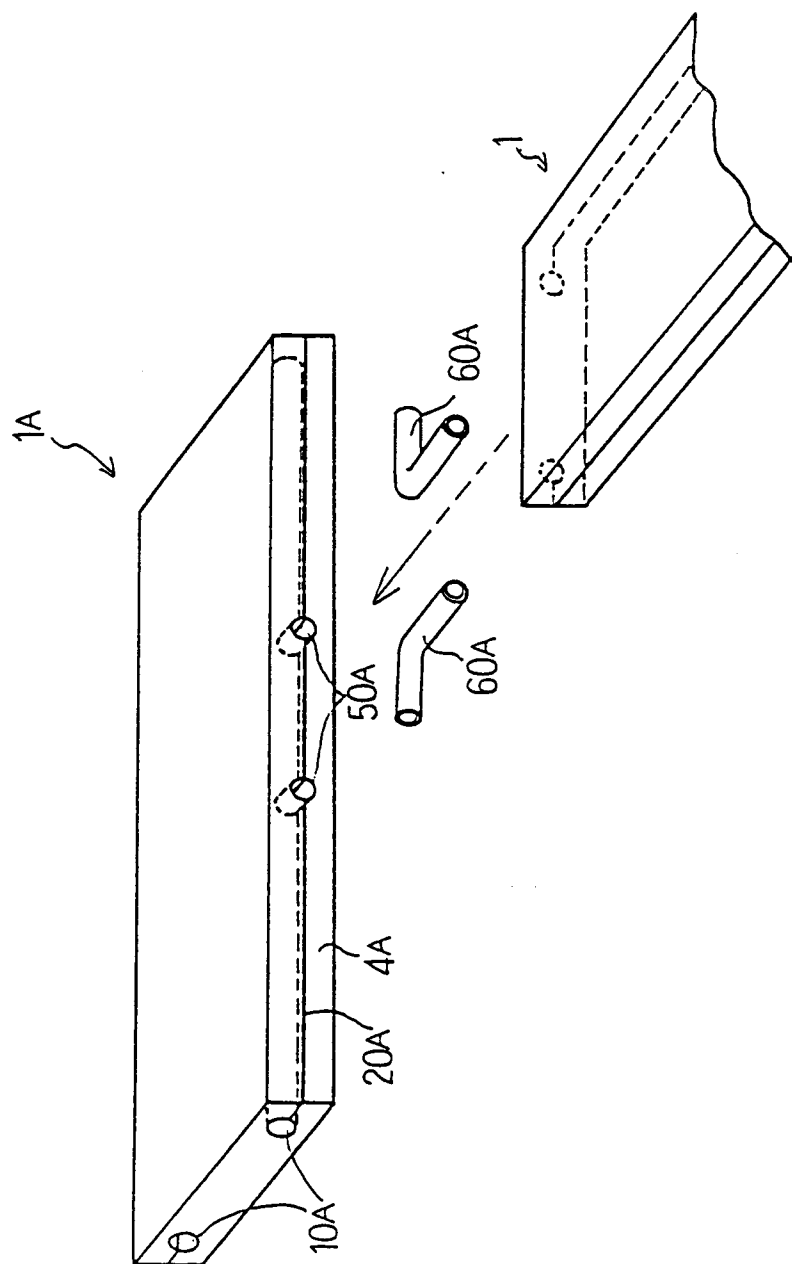


Fig .5

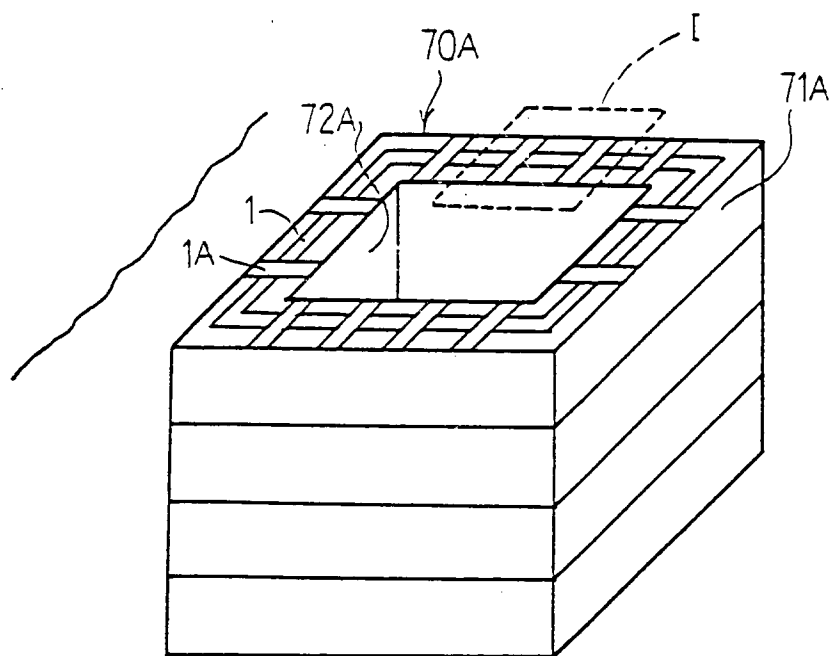


Fig .6

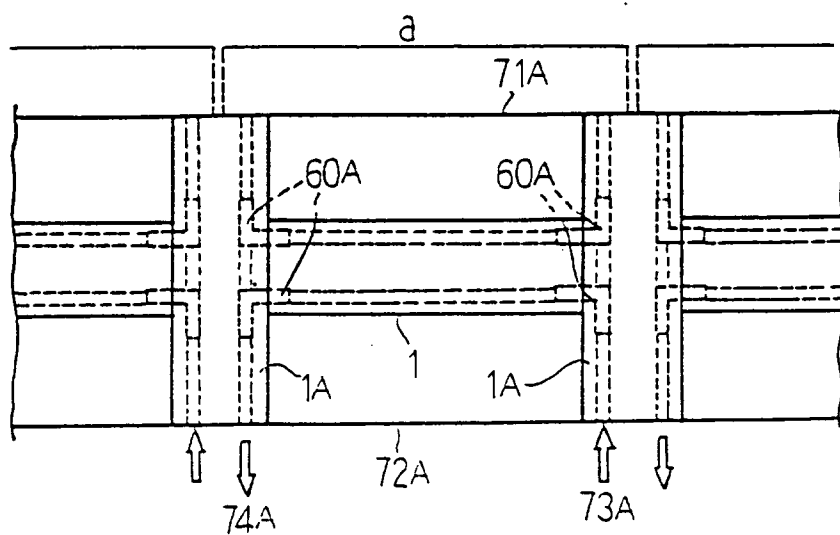
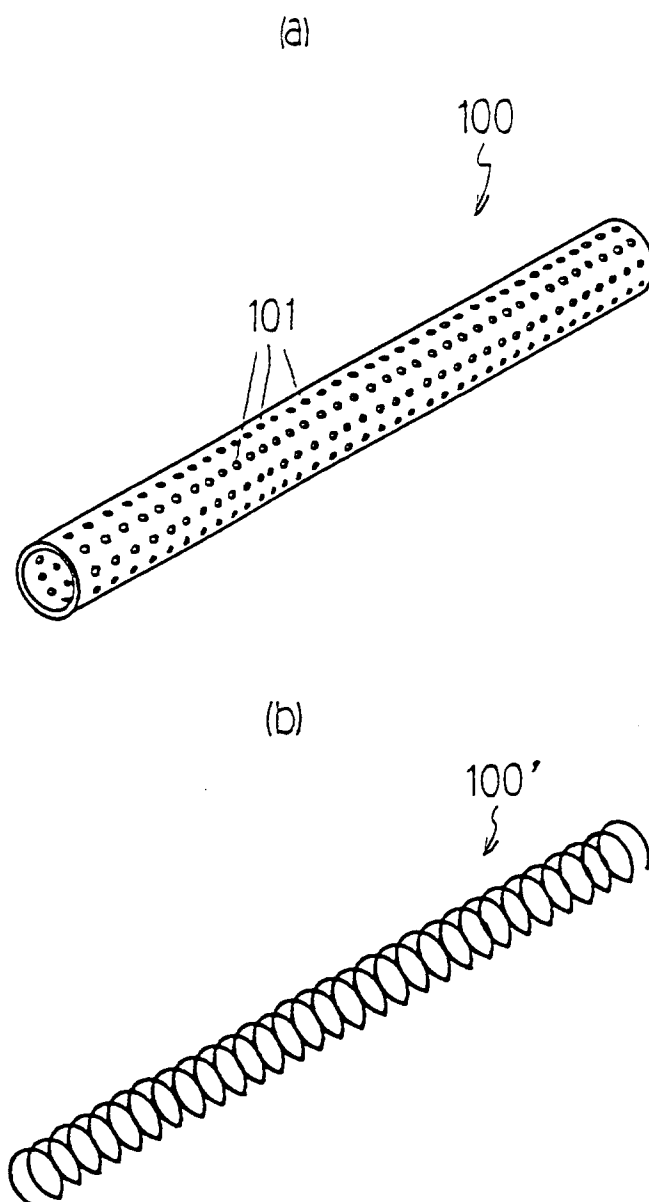


Fig . 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP94/01918

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl⁶ E04B1/68

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl⁶ E04B1/68

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1950 - 1994

Kokai Jitsuyo Shinan Koho 1971 - 1994

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, A, 5-25866 (CI Kasei K.K.), February 2, 1993 (02. 02. 93), Full description, (Family: none)	1, 2
Y	JP, B2, 54-26828 (Mitsuo Morita), September 6, 1979 (06. 09. 79), Full description, (Family: none)	1, 2
Y	JP, U, 49-143143 (Kokoku Gomu Kogyo K.K.), December 10, 1974 (10. 12. 74), Full descriptions, (Family: none)	1
Y	JP, Y2, 59-30022 (Seibu Polymer Corp.), August 28, 1984 (28. 08. 84), Lines 7 to 10, column 3, page 2, (Family: none)	3
Y	JP, A, 3-2440 (Taisei Corp.), January 8, 1991 (08. 01. 91), Full descriptions, (Family: none)	3

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search

December 28, 1994 (28. 12. 94)

Date of mailing of the international search report

January 24, 1995 (24. 01. 95)

Name and mailing address of the ISA/

Japanese Patent Office

Authorized officer

Facsimile No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP94/01918

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, U, 4-70334 (Nishikawa Rubber Co., Ltd.), June 22, 1992 (22. 06. 92), Full descriptions, (Family: none)	4