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FR-A- 2 305 584
JP-A-58 187 655

(73) Proprietor: **C.I. KASEI CO., LTD, 18-1 Kyobashi 1-chome, Chuo-ku Tokyo(JP)**

(72) Inventor: **Terauchi, Michiyoshi c/o C.I. Kasei Co. Ltd., Gijutsu Kenkyusho No. 3-1-22, Atago, Ageo-shi Saitama(JP)**
Inventor: **Shinjo, Hiroshi c/o C.I. Kasei Co. Ltd., Gijutsu Kenkyusho No. 3-1-22, Atago, Ageo-shi Saitama(JP)**
Inventor: **Takasaki, Kazuhiro c/o C.I. Kasei Co. Ltd., Gijutsu Kenkyusho No. 3-1-22, Atago, Ageo-shi Saitama(JP)**
Inventor: **Kameda, Takahide c/o C.I. Kasei Co. Ltd., Gijutsu Kenkyusho No. 3-1-22, Atago, Ageo-shi Saitama(JP)**

(74) Representative: **Lehn, Werner, Dipl.-Ing. et al, Hoffmann, Eitle & Partner Patentanwälte Arabellastrasse 4, D-8000 München 81(DE)**

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Description

The present invention relates to band-like joint sealing members for providing a water-tight seal between members in a civil engineering construction or the like.

Sealing elements for such purposes are already known. In FR-A 2 293 574 there are disclosed sealing members made of elastic material with a plurality of ridges on one face or on opposite faces. In JP-A 58 187 655 there is disclosed a sealing member made of a watertight substance containing a resin which swells and gels by absorbing water.

The present invention provides an improved sealing element over the prior known art.

For example, as shown in Figures 1, 2A and 3, plural unit segments 1 are used as work materials in constructing a shield tunnel excavated underground. These unit segments 1 are closely joined in the direction a along the peripheral wall and in the longitudinal direction b of the gallery.

At the four sides of a plate portion of each of segments 1, there are provided front and rear flanges 2 and 3 extending in the circumferential direction a around the peripheral walls, and upper and lower flanges 4 and 5 extending in the longitudinal direction b. When these segments are joined, the adjacent flanges 2 and 3, and the adjacent flanges 4 and 5, are respectively joined and clamped by means of joint bolts 6.

In order to prevent water seeping out of the earth around the gallery from leaking into the gallery, it is necessary to provide a water-tight seal at the respective junctions of the joined flanges. To this end, a band-like joint sealing member 8 is secured by bonding onto one side of the flange surfaces facing gaps 7 between adjacent flange surfaces.

For the illustrated conventional sealing member 8, for example, a well-known water expansible material such as a material obtained by mixing, synthesizing and vulcanizing high hygroscopic resin and synthetic rubber is used. The sealing member 8 is formed into a single layer using the above-mentioned material. The sealing member 8 expands due to infiltration of water W into the joint so as to watertightly seal the gap 7.

In order to completely perform so-called initial water stopping processing before the sealing member expands due to water absorption by using such a conventional sealing member 8, it is necessary to make the sealing member 8 thicker, in which case not only is the material cost high, but also there occurs frequently a problem of the sealing member 8 becoming more easily dislodged from the junction of the segment I in transport or the like.

Figure 2B depicts another prior art arrangement. In the middle portion in the direction of width of each of the outer surfaces of the flanges 2 and 4 of each of the segments a belt-like fitting groove (for example, a groove 4a in the flange 4) is formed, and a joint member 8 is fixed in each of the fitting grooves. The surface of the joint member 8 projects from the outer surface of each of the flanges 2 and 4.

The flanges 2 and 3 of the respective segments IA and IC are fixedly clamped together by three connecting bolts 6, and the flanges 4 and 5 of the respective segments IA and IB are fixedly clamped by two connecting bolts 6 such that the joint member 8 is compressed by a thickness t and the outer surface of the joint member 8 is urged against the outer surface of the flange 5 by elastic force, thereby effecting water stopping processing at the joint junction.

In this arrangement, the joint member 8 must be made thicker so as to sufficiently include the thickness t therein so that the joint member 8 largely projects from the flange 4. Accordingly, not only is a large amount of effort required for screwing on the nuts 6a, but also the projecting edge of the joint member 8 is apt to be caught thereby, causing the joint member 8 to slip out of the fitting groove 4a.

The present invention has been attained to solve the difficulties mentioned above.

A specific object of the present invention is to provide a joint sealing member constituted by a water expansible material in which effective expansion in the direction of thickness can be obtained, stable bonding of the bottom surface of the sealing member can be obtained, and effective initial water stopping processing can be accomplished without increasing the thickness of the sealing member.

Accomplishing the above object, a band-like joint sealing member according to the present invention is featured in that the band-like joint sealing member is formed with longitudinally extending rib-like ridge portions formed integrally on one surface of a band-like base plate made of a water expansible material.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure I is a perspective diagram of a portion of a sealed construction;

Figures 2A and 2B are cross-sectional views taken along a line II-II in Figure I;

Figure 3 is a perspective view, partially cut away, of a sealing member employed in the arrangement of Figure 2A;

Figure 4 is a cross-sectional view, similar to Figure 2B, but illustrating sealing members according to a first embodiment of the invention;

Figure 5 is an enlarged cross-sectional view of a portion of Figure 4;

Figure 6 is a perspective view of a sealing member used in the embodiment of Figures 4 and 5;

Figure 7 shows the sealing member of Figure 6 after it has been swollen by impregnation with water;

Figure 8 shows configurations of other embodiments of sealing members of the invention; and

Figure 9 is a cross-sectional view showing a sealing member according to a further embodiment of the invention.

Referring to the drawings, the present invention will be described hereunder.

As to the terms used in the following description, with respect to directions, the terms "upper and low-

er" and "thickness" are used with respect to the vertical direction in the drawings, and the terms "left and right", "width", and "transverse" are used in conjunction with the horizontal direction in the drawings.

Figure 4 shows a section of a joint junction portion where a wide joint member I7 (one embodiment) and a similarly shaped narrow joint member I8 (another embodiment) are fixed in two rows between a flange I5 of a segment ID and a flange I6 of a segment IE. The joint members I7 and I8 are respectively adhered to fitting grooves I6a and I6b of the flange I6.

Referring to Figures 5 to 7, the joint member I7 will be described in detail (the same applies to the joint member I8).

The joint member I7 is made of a material obtained by mixing, synthesizing and vulcanizing a water expansible material such as high-grade water resin and synthetic rubber. As the synthetic rubber, I,3 diene group rubber containing a crystal domain (or glassy domain) of 5 to I0% at a normal temperature is used.

The joint member I7 has two rows of rib-like ridge portions I7b each having a substantially semi-circular cross-section extending upwardly from one surface of a strip-like elongated base plate portion I7a.

The thickness of the base plate I7a of the joint member I7 is substantially the same as the depth of the fitting groove I6a so that the surface of the base plate I7a is substantially even with the surface of the flange I6. Each of the ridge portions I7b is shaped to have a crest which is high enough to sufficiently project to fill the width t so that, in the state in which the nut 6a is screwed onto the connecting bolt 6 as shown in Figures 4 and 5, the crest portion of each ridge portion I7b is compressed by the thickness t and caused to closely contact with the surface of the flange I5 by its own elastic force.

With the joint member I7 according to this embodiment (the same applies to the joint member I8) arranged in the manner as described above, not only is there an advantage of saving material because of the smaller thickness of the base plate I7a, but also, since the base plate I7a becomes substantially even with the face of the flange I6, there is no risk that the joint member will be pulled out of the fitting groove I6a in the joint connecting operation. Moreover, since the crest portion of the ridge portion I7b is compressed when the fixing nut 6a is screwed on, the tightening operation can be easily performed.

The joint member I7 of this embodiment provides sufficient watertightness due to close contact by the ridge portions I7b even at the initial stage, and after absorbing water W, as shown in Figure 7, the entire joint member I7 conforms to the flange I5 due to the force of expansion so that watertightness is always maintained.

Although it is preferable to use the joint member according to this embodiment of the present invention received in a fitting groove, the advantageous effects of the invention can be attained even in the case where the joint member is attached to a junction having no fitting groove.

In addition to the case of water stopping processing at the joint junction of tunnel segments, the joint member according to the present invention can be widely used with the same effects in water stopping processing in joints of secondary concrete products such as culvert boxes, manholes, or the like, in joints of secondary steel products, colgate pipes, or the like. In this case, the shape of the cross-section of the joint member is properly established in accordance with the conditions at hand. Possible shapes for the joint member are shown in Figure 8, chosen taking the following design factors into consideration.

(a) Base Plate:

As the shape of the base plate, a rectangle, trapezoid, oblique trapezoid, or the like, is preferable. As the thickness is increased, the watertightness is improved, while the workability for installation is lowered so as to cause, for example, a reduction in the strength of reinforcement. On the contrary, if the base plate is made too thin, the opposite result is caused.

(b) Number of ridge portions:

Two rows are preferable. In the case of one row, the member is superior in compressibility and retention, but inferior in watertightness. The opposite result is caused in the case of three ridge portions.

(c) Shape of ridge portions:

A shape such as an arch, triangle, rectangle, oblique trapezoid, or the like, may be employed. It need not be isogonal or symmetrical. It is proper to select the height of the ridge portion in a range of 5% to 300% (20-I50% is more preferable) of the thickness of the base plate of the joint member. Although the width of the ridge portion is not specifically limited, it is preferable to select it to be I0-40% of the width of the base plate of the joint member. It is preferable to select the sectional area of the ridge portion to be I-200% of the sectional area of the base plate (5-I00% is more preferable). If the ridge portion is too small, it is inferior in compressibility as well as in retention, and if it is too large, on the contrary, the watertightness is lowered.

As described above, a joint member for civil engineering works according to the present invention is formed such that longitudinally extending rib-like ridge portions are formed integrally on one surface of a belt-like base plate made of a water expansible material so that it is possible not only to reduce the cost of the joint member due to the reduction in thickness of the joint member, but also to improve its ease of installation.

A sealing member 22 according to a further embodiment, as shown in Figure 9, is constituted by two (upper and lower) layers, one being an expansible portion 23 positioned in the center and the other being a non-expansible portion 24 constituted by opposite side frames integrally formed through a transversely extending bottom plate portion 24a

(the member 22 being constituted by three layers in the transverse direction).

In the thus-arranged sealing member 22 according to the further embodiment, in addition to the effects of the first embodiment, there is an advantage that the bonding force of the sealing member 22 is increased.

In the arrangement of the sealing member, the amount of expensive water expansible material is reduced so that the production costs of the sealing member can be reduced.

Claims

I. A band-like joint sealing member (I7) for providing a water-tight seal between frame members (I) in a civil engineering construction having a band-like base (I7a) made of a water-expansible material characterized by one or more ridge portions (I7b) formed longitudinally and integrally of the same material on one side of said base (I7a).

2. A band-like joint sealing member (I7) according to claim I, characterized in that a height of said ridge portion or portions is selected in a range of 20-I50% of the thickness of said base, a width of said ridge portion or portions is selected to be I0-40% of the width of said base, and a sectional area of said ridge portion or portions is selected to be I-200% of the sectional area of said base.

3. A band-like joint sealing member (I7) according to claim I or 2, disposed in a groove (I6a) formed in one of the two adjacent and joined frame members (I) characterized in that the thickness of the band-like base (I7a) is substantially equal to the depth of said groove (I6a).

4. A band-like joint sealing member (I7) according to claim I, 2 or 3, characterized in that the height of said ridge portion (I7b) is greater than a gap width between said adjacent and joined frame members (I).

Patentansprüche

1. Ein bandartiges Verbindungsdichtelement (17) für die Schaffung einer wasserdichten Verbindung zwischen Rahmenteilen (1) in einer Baukonstruktion, welches Dichtelement eine bandförmige Basis (17a) aus einem sich in Wasser ausdehnenden Material besitzt, gekennzeichnet durch einen oder mehrere Rippenbereiche (17b), die an einer Seite der genannten Basis (17a) in deren Längsrichtung und integral mit diesem Material ausgebildet sind.

2. Bandartiges Verbindungsdichtelement (17) nach Anspruch 1, dadurch gekennzeichnet, daß die Höhe des Rippenbereichs oder der Rippenbereiche 20 bis 150% der Dicke der Basis, die Breite des Rippenbereichs oder der Rippenbereiche 10-40% der Breite der Basis und die Querschnittsfläche des Rippenbereichs oder der Rippenbereiche 1-200% der Querschnittsfläche der Basis beträgt.

3. Bandartiges Verbindungsdichtelement (17) nach Anspruch 1 oder 2, angeordnet in einer Nut (16a), die in einem der zwei benachbarten und miteinander verbundenen Rahmenteile (1) ausgebildet ist, dadurch gekennzeichnet, daß die Dicke der bandförmigen Basis (17a) im wesentlichen gleich der Dicke der Nut (16a) ist.

4. Bandartiges Verbindungsdichtelement (17) nach den Ansprüchen 1, 2 oder 3, dadurch gekennzeichnet, daß die Höhe des Rippenbereichs (17b) größer ist als die Weite des Zwischenraumes zwischen den benachbarten und miteinander verbundenen Rahmenteilen (1).

Revendications

1. Elément d'étanchéité de joint en forme de bande (17) destiné à établir un joint étanche à l'eau entre des éléments de cadres (1) dans un ouvrage de génie civil, possédant une base (17a) en forme de bande, faite d'une matière gonflant à l'eau, caractérisé par une ou plusieurs portions côtes (17b) formées longitudinalement et venues en une seule pièce de la même matière sur une face de ladite plaque de base (17a).

2. Elément d'étanchéite de joint en forme de bande (17) selon la revendication 1, caractérisé en ce que la hauteur de la portion côte ou des portions côtes est choisie dans l'intervalle de 25 à 150% de l'épaisseur de ladite base, la largeur de ladite ou desdites portions côtes est choisie à une valeur de 10 à 40% de la largeur de ladite base, et l'aire de section de ladite ou desdites portions côtes est choisie à une valeur de 1 à 200% de l'aire de section de ladite base.

3. Elément d'étanchéité de joint en forme de bande (17) selon la revendication 1 ou 2, disposé dans une rainure (16a) formée dans l'un de deux éléments de cadres (1) adjacents et réunis, caractérisé en ce que l'épaisseur de la base en forme de bande (17a) est sensiblement égale à la profondeur de ladite rainure (16a).

4. Elément d'étanchéité de joint (17) en forme de bande selon la revendication 1, 2 ou 3, caractérisé en ce que la hauteur de ladite portion côte (17b) est supérieure à la largeur de la fente entre les éléments de cadres (1) adjacents et assemblés.

FIG. 1 PRIOR ART

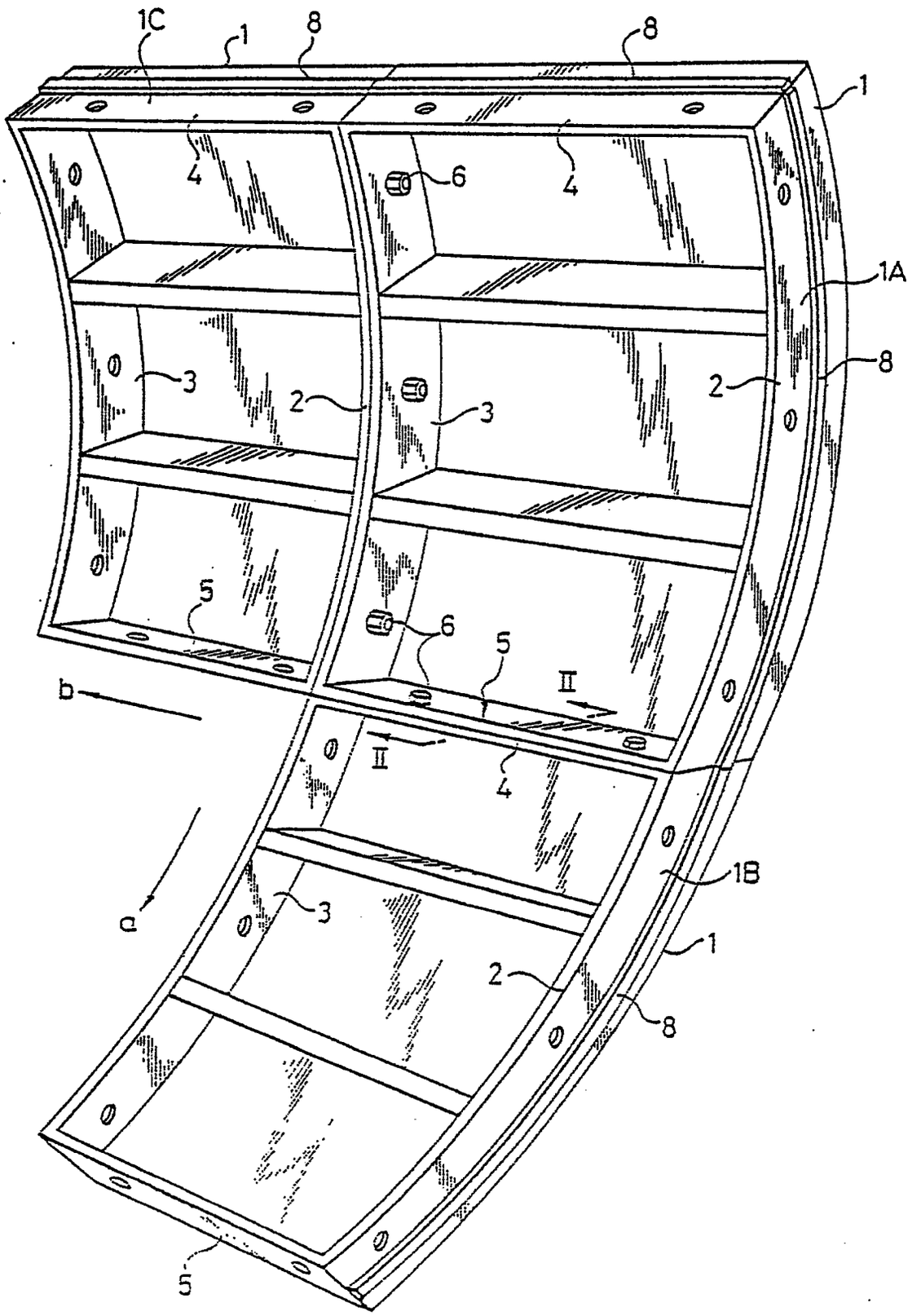

FIG. 2A PRIOR ART

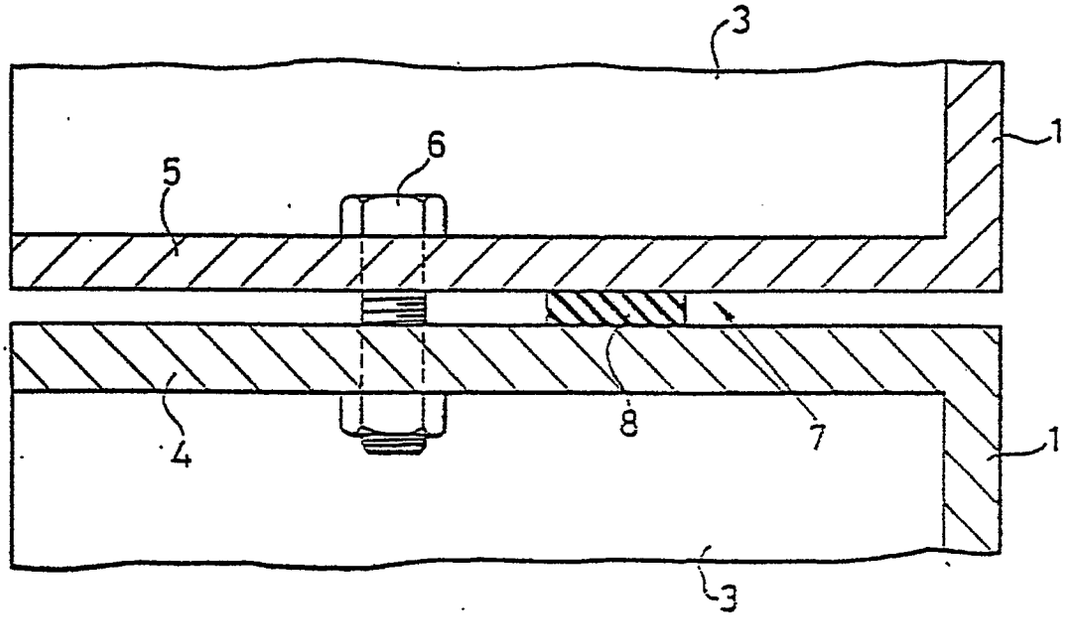

FIG. 2B PRIOR ART

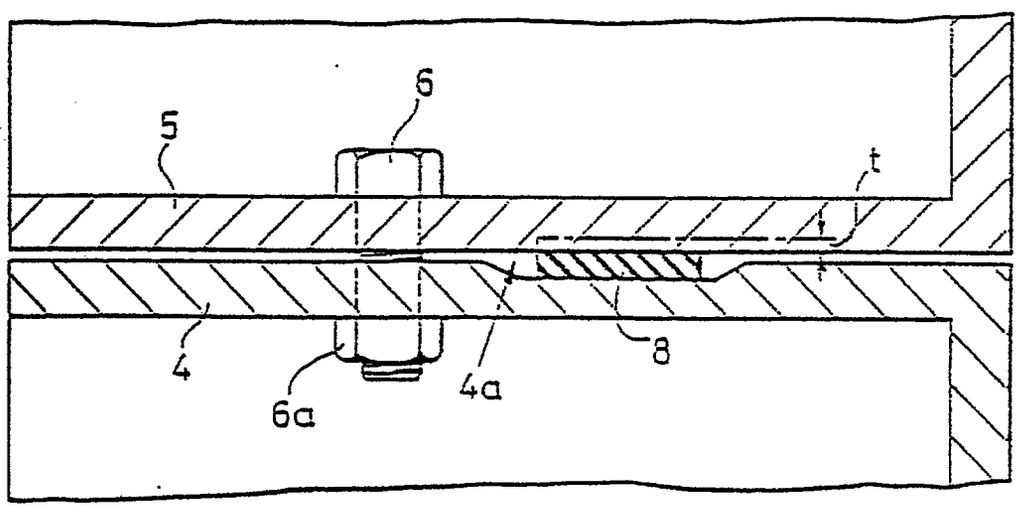

FIG. 3 PRIOR ART

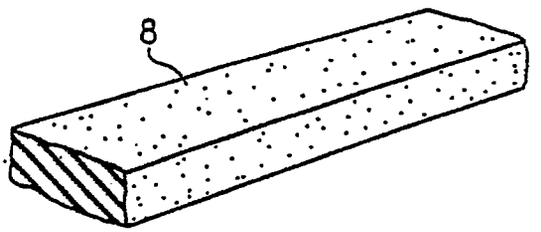

FIG. 4

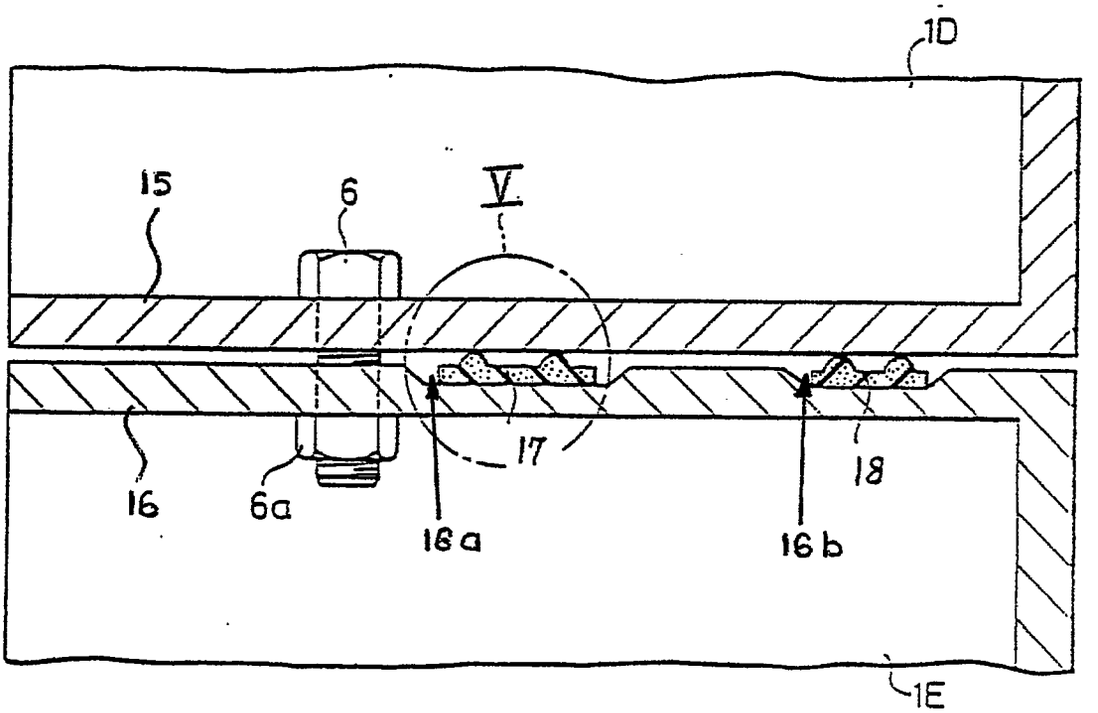

FIG. 5

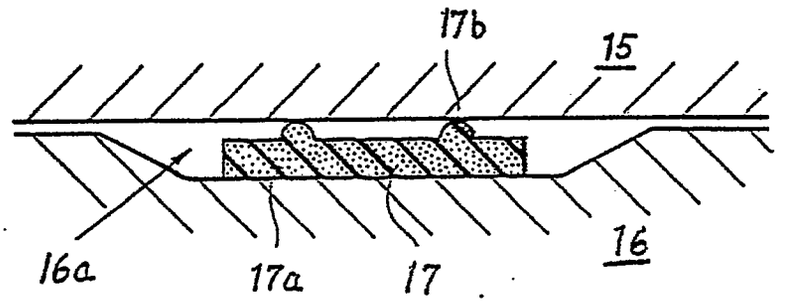

FIG. 6

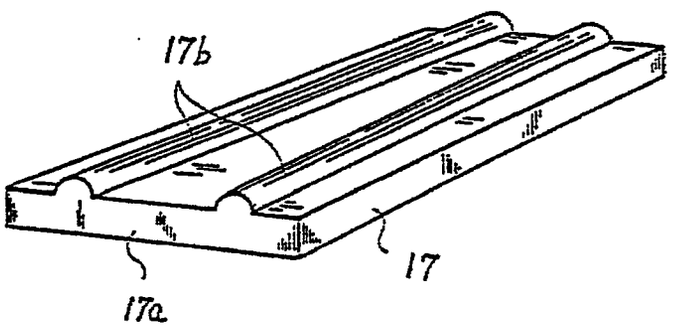

FIG. 7

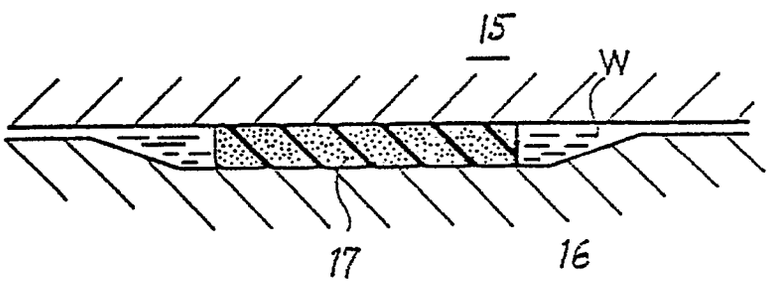

FIG. 8

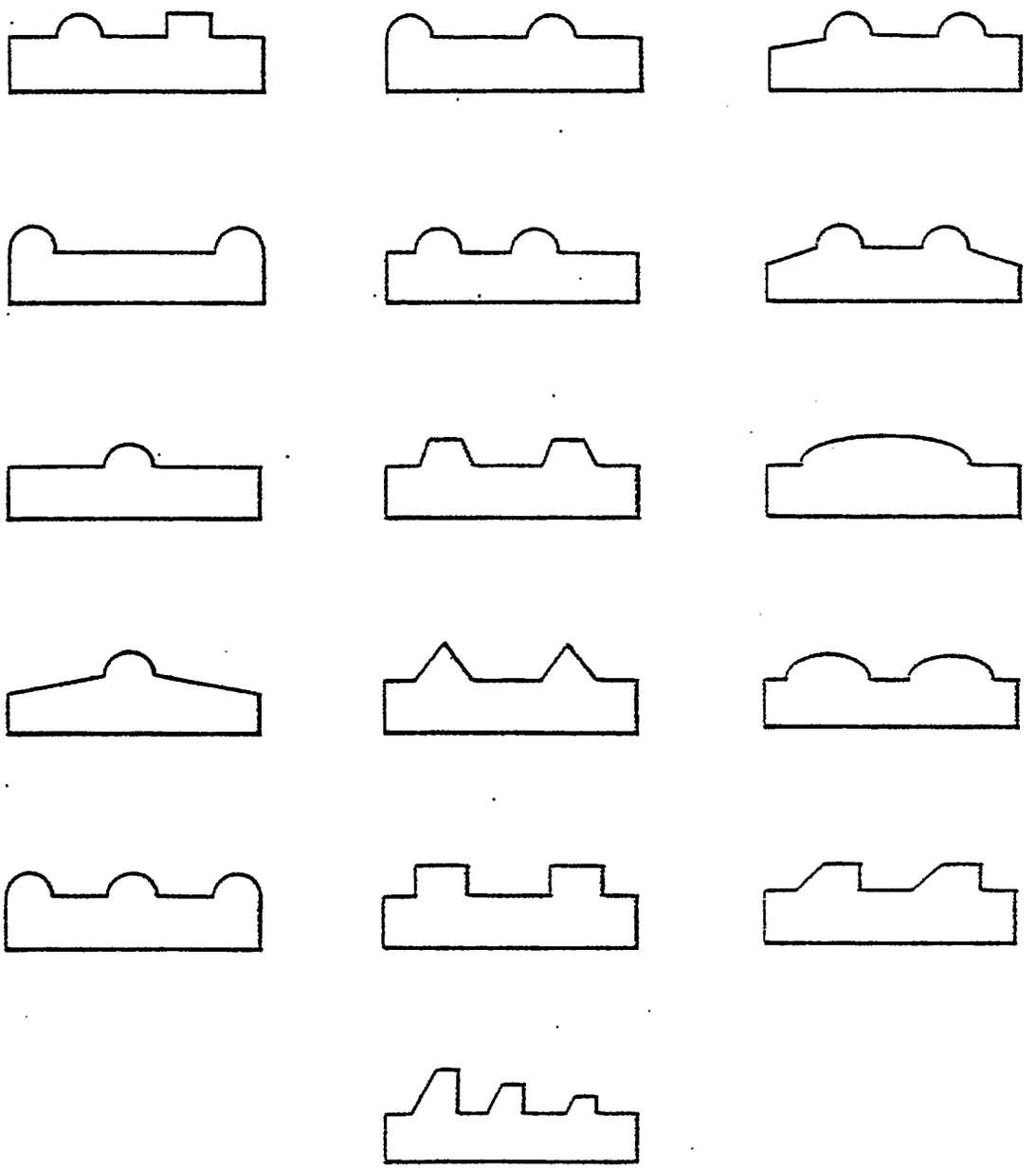

FIG. 9