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(54) Titre : ENSEMBLE DE RECOUVREMENT DE TRANCHEE  
(54) Title: AN ASSEMBLY FOR COVERING A TRENCH

(57) **Abrégé/Abstract:**

An assembly suitable for temporarily covering a trench comprises an anti-slip tile (30) and a separately formed trench cover. The anti-slip tile (30) may be releasably attached to the trench cover. The anti-slip tile (30) comprises a plurality of cylindrical protrusions (21) integrally formed with a body portion of the tile (30), protruding from an upper surface (6) of the body portion (5), and evenly spaced across the upper surface (6) to minimise the possibility of a wheel of a vehicle slipping as the wheel passes over the anti-slip tile (30) and over the trench cover. The body portion (5) has a plurality of openings (22) extending through the body portion (5), the openings (22) being spaced across the upper surface (6) to reduce the overall weight of the anti-slip tile (30), and to provide a means of draining rainwater from the upper surface of the body portion (5). Two openings (31a) are located at opposite end edges of the body portion (5). During assembly, a number of body portions (5) are placed on the surface of the trench cover and spaced at intervals to evenly cover the surface of the trench cover. A shaped, half round bracket is inserted into the matching opening (31a) in the surface of each body portion (5). The bracket can be fixed to the surface of the trench cover by means of a hardened nail fired from an impact gun.

## ABSTRACT

An assembly suitable for temporarily covering a trench comprises an anti-slip tile (30) and a separately formed trench cover. The anti-slip tile (30) may be releasably attached to the trench cover. The anti-slip tile (30) comprises a plurality of cylindrical protrusions (21) integrally formed with a body portion of the tile (30), protruding from an upper surface (6) of the body portion (5), and evenly spaced across the upper surface (6) to minimise the possibility of a wheel of a vehicle slipping as the wheel passes over the anti-slip tile (30) and over the trench cover. The body portion (5) has a plurality of openings (22) extending through the body portion (5), the openings (22) being spaced across the upper surface (6) to reduce the overall weight of the anti-slip tile (30), and to provide a means of draining rainwater from the upper surface of the body portion (5). Two openings (31a) are located at opposite end edges of the body portion (5). During assembly, a number of body portions (5) are placed on the surface of the trench cover and spaced at intervals to evenly cover the surface of the trench cover. A shaped, half round bracket is inserted into the matching opening (31a) in the surface of each body portion (5). The bracket can be fixed to the surface of the trench cover by means of a hardened nail fired from an impact gun.

"An assembly for covering a trench"Introduction

5 This invention relates to an assembly for temporarily covering a trench, for example a trench made in a footpath or a roadway.

10 It is known to use a large steel trench cover to temporarily cover a trench. Steel sheeting, which is typically manufactured in a foundry rolling process, is commonly used as the means of covering road openings and trenches in order to allow traffic access while works are ongoing. However the use of this material presents a number of problems from a safety point of view, namely the difficulty of ensuring that the surface of the steel sheet has a sufficient Skid Resistance Value (SRV) which will protect vehicles from skidding under adverse or even normal road/weather conditions. In particular slipping of a wheel of a vehicle as the wheel  
15 passes over such a trench cover, or slipping of a foot of a pedestrian as they walk over such a trench cover frequently occurs. This slipping can cause traffic delays and/or lead to accidents occurring.

20 This invention is aimed at providing an assembly for covering a trench which overcomes at least some of these problems.

Statements of Invention

25 According to the invention there is provided an anti-slip element for use with a separately formed trench cover, the anti-slip element comprising: a body portion, the body portion being attachable to the separately formed trench cover, the body portion comprising an upper surface for facing away from the trench cover when the body portion is attached to the trench cover; and slip minimisation means to minimise the possibility of another element slipping upon passage of the other

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element over the body portion, the slip minimisation means being integrally formed with the body portion on the upper surface thereof.

5 The anti-slip element minimises the possibility of a wheel of a vehicle slipping as it passes over the anti-slip element and over the trench cover, or of a foot of a pedestrian slipping as they walk over the anti-slip element and over the trench cover. Thus the possibility of traffic delays and/or accidents occurring is minimised.

10 By attaching the anti-slip element to the separately formed trench cover, this enables the trench cover to be quickly and efficiently manufactured in the most convenient manner, typically by rolling. In particular because the anti-slip element provides the means to minimise the possibility of slipping, the trench cover may be manufactured with smooth surfaces without the manufacturer needing to  
15 consider whether such smooth surfaces would present a potential slipping hazard.

If the manufacturer of the trench covers were to attempt to manufacture trench covers integrally with some form of anti-slip means, this could considerably complicate the manufacturing process. For example, to integrally manufacture the  
20 trench cover with an anti-slip means may necessitate machining the anti-slip means onto the surface of the trench cover after rolling, or may necessitate a special die being used to form the trench cover and integral anti-slip means. Complicating the manufacturing process in this manner could lead to a considerable increase in the time and cost required to manufacture the trench  
25 cover. The extra time and cost required could cause particular problems in the case where the trench cover is relatively large, for example a trench cover having a length of 2.5m and a width of 2m.

30 In one embodiment of the invention the body portion is releasably attachable to a trench cover.

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Because the body portion can be detached from the trench cover, this provides the user with the freedom to re-use and/or re-position and/or repair the anti-slip element, as desired.

The body portion may be attachable to a trench cover by means of a mechanical attachment.

In one case the element comprises an attachment member extendable through the body portion and into a trench cover to attach the body portion to the trench cover. The attachment member may comprise a head part for engaging the body portion, and a leg part extendable through the body portion and into a trench cover. The head part may be detachable from the leg part to facilitate release of the attachment of the body portion to a trench cover. In one case the attachment member is configured to be driven into a trench cover by an impact gun. The body portion may comprise an access opening therethrough, through which the attachment member is extendable.

In another embodiment the body portion comprises a main body part comprising a main opening, and a filler part locatable in the main opening to at least partially fill the main opening. The filler part may comprise the access opening therethrough. In one case the body portion comprises a lower surface for contacting a trench cover when the body portion is attached to the trench cover, and the main opening at least partially tapers inwardly towards the lower surface. The filler part may be at least partially tapered. The filler part may be at least partially substantially wedge shaped. In one case the main opening is located at an edge of the main body part. In cross-section perpendicular to the longitudinal axis of the main opening, the main opening may be substantially "C"-shaped. In cross-section perpendicular to the longitudinal axis of the filler part, the filler part may be substantially "C"-shaped. In cross-section perpendicular to the longitudinal axis of the main opening, the main opening may have an at least partially, substantially half-round shape. In cross-section perpendicular to the longitudinal axis of the filler part, the filler part may have an at least partially, substantially half-round shape.

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In another case the main opening is located substantially in the region of the centre of the main body part. In cross-section perpendicular to the longitudinal axis of the main opening, the main opening may have an at least partially non-round shape. In cross-section perpendicular to the longitudinal axis of the filter part, the filter part may have an at least partially non-round shape.

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In a further embodiment of the invention the element comprises an attachment member for clamping the body portion to a trench cover. The attachment member may comprise a lip for extending over at least part of the body portion to clamp the body portion to a trench cover. The attachment member may comprise a first wing configured to be fixed to a trench cover. The element may comprise a fixing member drivable through the first wing to fix the first wing to a trench cover. The fixing member may be configured to be driven through the first wing by an impact gun. In one case the body portion comprises a fixing opening, the first wing being locatable in the fixing opening. The attachment member may comprise a second wing configured to be located between the body portion and a trench cover. The body portion may comprise a recess for accommodating the second wing.

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A single attachment member may be configured to clamp the body portions of two or more elements to a trench cover.

In certain cases, a user may clamp two or more anti-slip elements to a single trench cover using a single attachment member. This may considerably reduce the time and labour required to cover a trench while ensuring a non-slip environment.

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In a further case the body portion is attachable to a trench cover by means of welding.

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In one embodiment the body portion comprises an upper surface for facing away from a trench cover when the body portion is attached to the trench cover, and the slip minimisation means comprises one or more protrusions protruding from the upper surface. The slip minimisation means may comprise a plurality of protrusions evenly spaced across the upper surface. Each of the protrusions may be substantially identical. The slip minimisation means may comprise one or more first protrusions and one or more second protrusions, the one or more first protrusions protruding a greater distance from the upper surface than the one or more second protrusions. The first protrusion may protrude approximately 4mm from the upper surface. The second protrusion may protrude approximately 2mm from the upper surface. In one case the slip minimisation means comprises a plurality of first protrusions and a plurality of second protrusions, the first protrusions being at least partially arranged in a substantially "W"-shaped pattern relative to the second protrusions.

The "W"-shaped pattern of the protrusions on the anti-slip element has been found in certain cases to be especially effective. In particular it has been found that this pattern causes the wheel of a vehicle to initially contact one of the lower protrusions as the wheel rolls onto the anti-slip element, and then snag on one of the higher protrusions regardless of the direction of approach of the vehicle.

In another embodiment the body portion comprises one or more weight-reducing discontinuities. The discontinuity may comprise an opening extending through the body portion.

The openings through the anti-slip element contribute to reducing the overall weight of the anti-slip element. Thus the anti-slip element effects the function of reducing the possibility of slippage occurring, while remaining easy to handle and transport.

In a further embodiment the body portion comprises drainage means. The drainage means may comprise an opening extending through the body portion.

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The openings provide a means of draining water, such as rainwater, from an upper surface of the body portion. By draining away surface water, the overall anti-slip properties of the tile are improved.

The thickness of the body portion may be between 25mm and 30mm.

In another aspect of the invention, there is provided an assembly for covering a trench, the assembly comprising: -

an anti-slip element of the invention; and

a separately formed trench cover.

In one embodiment of the invention the trench cover comprises a metallic material, and/or a composite material. The metallic material may comprise steel.

The trench cover may be manufactured by rolling, or drawing, or extruding, or casting, or injection moulding.

In one case the length of the trench cover is greater than 2m. The width of the trench cover may be greater than 0.3m. The surface area of the trench cover may be greater than 1m<sup>2</sup>. The mass of the trench cover may be greater than 5kg.

In another embodiment the trench cover comprises an upper surface, and the upper surface is substantially smooth.

The trench cover may be configured to extend over a trench to cover the trench as a substantially continuous cover.

In a further aspect, the invention provides a method for covering a trench, the method comprising the steps of:-

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providing an anti-slip element;

providing a separately formed trench cover;

attaching the anti-slip element to the trench cover; and

positioning the trench cover with respect to the trench to cover the trench.

In one case the anti-slip element is attached to the trench cover before covering the trench. In another case the anti-slip element is attached to the trench cover while the trench cover is in position covering the trench.

In one embodiment the anti-slip element is attached to the trench cover by extending an attachment member through the anti-slip element and into the trench cover. An impact gun may be used to drive the attachment member into the trench cover.

The anti-slip element may be clamped to the trench. In one case a part of an attachment member is extended over at least part of the anti-slip element to clamp the anti-slip element to the trench cover. The method may comprise the step of fixing the attachment member to the trench cover. Two or more anti-slip elements may be attached to the trench cover using a single attachment member.

In one case the anti-slip element is releasably attached to the trench cover. The method may comprise the steps of releasing the attachment of the anti-slip element to the trench cover, and removing the anti-slip element. The attachment of the anti-slip element to the trench cover may be released by detaching a head part of an attachment member from a leg part of the attachment member.

In another aspect the invention provides an anti-slip assembly comprising:-

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a plate having one or more recesses in a surface of the plate; and

one or more corresponding stud elements for location in the one or more recesses to protrude from the surface of the plate.

The plate may comprise a trench cover.

In a further aspect, the invention provides a trench cover comprising:

a cover member for extending over a trench;

the cover member comprising a pair of supporting portions bridged by a central trench covering portion; and

a cushioning member for cushioning the cover member relative to the ground on at least one side of the trench.

The cushioning member acts to minimise vibration of the cover member with respect to the ground, even when the surface of the ground at the side of the trench is uneven. The cushioning member also assists in minimising any noise generated as traffic and pedestrians pass over the trench cover.

In one embodiment of the invention the cushioning member is configured to cushion the cover member relative to the ground on both sides of the trench.

The cushioning member may comprise two or more separate cushioning elements.

In one case the cushioning member is configured to be located between at least part of the supporting portion and the ground on a side of a trench. The cushioning member may be mounted to the supporting portion. The cushioning member may be mounted to the lower surface of the supporting portion. In one case the cushioning member is

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mounted to the supporting portion by means of engagement of a male protrusion in a female recess. The cushioning member may comprise the male protrusion and the supporting portion may comprise the female recess.

The cushioning member may be of a resilient material, such as rubber.

In one embodiment at least part of the cushioning member protrudes downwardly from a lower surface of the cover member.

The cover may comprise means to minimise the possibility of an element slipping upon passage of the element over the cover member.

The invention also provides in a further aspect a trench cover comprising:

a cover member for extending over a trench;

the cover member comprising a pair of supporting portions bridged by a central trench covering portion; and

means to minimise the possibility of an element slipping upon passage of the element over the cover member.

In one embodiment of the invention the slip minimisation means is integrally formed with the cover member.

The cover member may comprise an upper surface for facing away from a trench when the cover member is extended over the trench, and the slip minimisation means comprises one or more protrusions protruding from the upper surface. The slip minimisation means may comprise a plurality of protrusions evenly spaced across the upper surface. Each of the protrusions may be substantially identical.

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In one case in a first cross-section perpendicular to the longitudinal axis of the protrusion, the protrusion has a substantially round shape. In a second cross-section perpendicular to the longitudinal axis of the protrusion, the protrusion may have a substantially square shape. The upper portion of the protrusion may have the substantially square shape and the lower portion of the protrusion may have the substantially round shape.

In one embodiment of the invention the cover comprises a trench element depending from the cover member to confine the cover member with respect to a trench. The trench element may be movable relative to the cover member to facilitate adjustment to a desired width of trench.

Because both of the trench engaging elements are movable relative to the cover member, this enables the cover to be adjusted to suit the width of the trench, while ensuring the cover may be positioned centrally over the trench with substantially equal amounts of the supporting portions on each side of the trench.

A single relatively compact cover may be adjusted to cover a large range of trenches of different widths in a simple, efficient manner.

Also in one case because the trench engaging elements are movable longitudinally rather than rotatably movable, the orientation of the trench engaging elements may be predetermined for any width of trench. Thus, a uniform predictable performance is achieved.

The handle portion enables a user to easily and quickly grip the trench engaging element to move the trench engaging element to a desired position.

In one case the cover comprises interlink means comprising a first interlink means at one transverse side of the cover member and a complementary second interlink means at an opposite transverse side of the cover member, one of the first or second interlink

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means being engagable underneath the other of the first and second interlink means of a like cover on assembly.

The invention further provides an assembly for covering a trench, the assembly comprising a plurality of trench covers of the invention.

The invention enjoys a number of advantages in comparison to alternative anti-skid systems. For example if it were attempted to provide a satisfactory anti-skid surface, with a particular SRV, by applying to a trench cover a combination of epoxy resin which has been impregnated with a specific type of abrasive grit, this method would be laborious and costly to apply and would typically have a life-span of only 6 to 18 months in urban areas with average traffic flows. It would then be necessary to transport the steel plate to a specialist facility each time for processing. It would also be necessary to constantly monitor the system while on site in order to maintain the required SRV.

According to the invention there is provided a method whereby a specially designed and manufactured anti-skid tile is used to provide the required SRV at reduced cost and greatly extended life.

The tile of the invention has an effective mechanical means of fixing to the surface of the steel road plate and can be removed and replaced as individual units when repairs are required.

The tile, which can be cast, formed, or moulded, has a set of protrusions on the upper surface which have been specifically designed and spaced in such a way as to provide the required skid resistance value. On a typical steel sheet of given dimensions, a full set of tiles can be placed and spaced in such a way as to completely cover the surface of the road plate.

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The mechanical fixing method may comprise in one embodiment a location bracket, which would be positioned within recesses in the tile and which would therefore hold the tile in situ.

It is possible to fix the location bracket in position by a variety of means, such as welding or by the firing of a hardened steel nail directly through the location bracket and into the surface of the steel road plate, thus holding the tile in a given position.

The bracket may be removed at any stage, by means of abrasive grinding, if repair or replacement is necessary.

The tile may be manufactured with integral holes between the anti-skid protrusions, as these holes act as a means to facilitate the drainage of water from the surface of the tile in order to maintain the SRV in wet conditions.

#### Brief Description of the Drawings

The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which: -

Fig. 1 is a perspective view of an assembly for covering a trench according to the invention;

Fig. 2 is a side view of the assembly of Fig. 1;

Fig. 3 is a plan view of an anti-slip element of the assembly of Fig. 1;

Fig. 4 is a view along line IV-IV in Fig. 3;

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Fig. 5 is a view along line V-V in Fig. 3;

Fig. 6 is a perspective view of the assembly of Fig. 1, in use;

Fig. 7 is a side view of the assembly of Fig. 1, in use.

Fig. 8 is a plan view from above of an anti-slip element of another assembly for covering a trench according to the invention;

Fig. 9 is a plan view from below of the element of Fig. 8;

Fig. 10 is an end view of the element of Fig. 8;

Fig. 11 is an elevation view of the element of Fig. 8;

Fig. 12 is a view along line XII – XII in Fig. 8;

Fig. 13 is an enlarged, cross-sectional, end view of the element of Fig. 12;

Fig. 14 is a perspective view of a main body part and two filler parts of the element of Fig. 8;

Fig. 15 is a plan view of one of the filler parts of Fig. 14;

Fig. 16 is an elevation view of the filler part of Fig. 15;

Fig. 17 is a view along line D-D in Fig. 15;

Fig. 18 is a plan view of the filler part of Fig. 15 and the main body part of Fig. 14;

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Fig. 19 is a view along line XIX – XIX in Fig. 18;

Fig. 20 is a perspective view of a main body part of an anti-slip element of another assembly for covering a trench according to the invention;

Fig. 21 is a plan view from above of a filler part of the element of Fig. 20;

Fig. 22 is an elevation view of the filler part of Fig. 21;

Fig. 23 is an end view of the filler part of Fig. 21;

Fig. 24 is a plan view from below of the filler part of Fig. 21;

Fig. 25 is another end view of the filler part of Fig. 21;

Fig. 26 is a view along line XXVI – XXVI in Fig. 21;

Fig. 27 is a view along line XXVII – XXVII in Fig. 21;

Fig. 28 is a perspective view from above of the filler part of Fig. 21;

Fig. 29 is a perspective view from below of the filler part of Fig. 21;

Fig. 30 is a plan view from above of a body portion of an anti-slip element of another assembly for covering a trench according to the invention;

Fig. 31 is a plan view from below of the body portion of Fig. 30;

Fig. 32 is an elevation view of the body portion of Fig. 30;

Fig. 33 is a view along line XXXIII – XXXIII in Fig. 30;

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Fig. 34 is a perspective view from above of the body portion of Fig. 30;

Fig. 35 is a perspective view from below of the body portion of Fig. 30;

Fig. 36 is a plan view from above of an attachment member of the element of Fig. 30;

Fig. 37 is an elevation view of the attachment member of Fig. 36;

Fig. 38 is a perspective view from below of the attachment member of Fig. 36;

Fig. 39 is a perspective view from above of the attachment member of Fig. 36;

Fig. 40 is a plan view of a body portion of an anti-slip element of another assembly for covering a trench according to the invention;

Fig. 41 is a plan view of an attachment member of the element of Fig. 40;

Fig. 42 is an end view of the attachment member of Fig. 41;

Fig. 43 is a plan view of the attachment member of Fig. 41 and the body portion of Fig. 40, in use;

Fig. 44 is an enlarged, plan view of the attachment member of Fig. 43 and the body portion of Fig. 43;

Fig. 45 is a perspective view from above of a trench cover according to the invention;

Fig. 46 is a perspective view from below of the trench cover of Fig. 45;

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Fig. 47 is a plan view from above of a cover member of the trench cover of Fig. 45;

Fig. 48 is a plan view from below of the cover member of Fig. 47;

Fig. 49 is an elevation view of the cover member of Fig. 47;

Fig. 50 is a perspective view from above of the cover member of Fig. 47;

Fig. 51 is a perspective view from below of the cover member of Fig. 47;

Fig. 52 is another perspective view from above of the cover member of Fig. 47;

Fig. 53 is an enlarged, plan view from above of the cover member of Fig. 47;

Fig. 54 is another enlarged, plan view from above of the cover member of Fig. 47;

Fig. 55 is a plan view from below of a trench element of the trench cover of Fig. 45;

Fig. 56 is a plan view from above of the trench element of Fig. 55;

Fig. 57 is an elevation view of the trench element of Fig. 55;

Fig. 58 is another elevation view of the trench element of Fig. 55;

Fig. 59 is an end view of the trench element of Fig. 55;

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Fig. 60 is another end view of the trench element of Fig. 55;

Fig. 61 is a perspective view from below of the trench element of Fig. 55;

Fig. 62 is a perspective view from above of the trench element of Fig. 55;

Fig. 63 is a plan view from below of a cushioning member of the trench cover of Fig. 45;

Fig. 64 is a plan view from above of the cushioning member of Fig. 63;

Fig. 65 is an elevation view of the cushioning member of Fig. 63;

Fig. 66 is another elevation view of the cushioning member of Fig. 63;

Fig. 67 is an end view of the cushioning member of Fig. 63;

Fig. 68 is another end view of the cushioning member of Fig. 63;

Fig. 69 is a view along line Z-Z in Fig. 64;

Fig. 70 is a view along line Y-Y in Fig. 64;

Fig. 71 is a view along line X-X in Fig. 64;

Fig. 72 is a perspective view from below of the cushioning member of Fig. 63;

Fig. 73 is a perspective view from above of the cushioning member of Fig. 63;

Fig. 74 is a plan view from above of another cushioning member of the trench cover of Fig. 45;

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Fig. 75 is a plan view from below of the cushioning member of Fig. 74;

Fig. 76 is an elevation view of the cushioning member of Fig. 74;

Fig. 77 is a view along line W-W in Fig. 76;

Fig. 78 is a perspective view from above of the cushioning member of Fig. 74;  
and

Fig. 79 is a perspective view from below of the cushioning member of Fig. 74.

#### Detailed Description

Referring to the drawings, and initially to Figs. 1 to 7 thereof, there is illustrated an assembly 1 suitable for temporarily covering a trench 2. The assembly 1 comprises an anti-slip tile 4 and a separately formed trench cover 3. The anti-slip tile 4 may be releasably attached to the trench cover 3 to minimise the possibility of, for example, a wheel of a vehicle slipping as the wheel passes over the tile 4 and over the trench cover 3.

The trench cover 3 is manufactured from steel in this case, preferably by rolling the steel into the shape of the trench cover 3 as illustrated in Fig. 1. In this case, the trench cover 3 has a width W of approximately 1.2m and a length L of approximately 2.5m, and has a mass of approximately 1000kg.

The upper surface of the trench cover 3 is substantially smooth. When the trench cover 3 is located extending over a trench 2 (Figs. 6 and 7), the trench cover 3 covers the trench 2 as a substantially continuous cover. In particular there are no gaps or spaces through the trench cover 2.

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As illustrated in Figs. 3 to 5, the anti-slip tile 4 comprises a body portion 5 having an upper surface 6 and a lower surface 7. When the anti-slip tile 4 is attached to the trench cover 3, the lower surface 7 contacts the trench cover 3 (Fig. 2) and the upper surface 6 faces away from the trench cover 3 (Fig. 2). The thickness of the body portion 5 is between 25mm and 30mm, in this case.

The body portion 5 comprises a main body part 14a and two filler parts 14b. The main body part 14a has two tapered main openings 11a therethrough, and each filler part 14b has a smaller diameter access opening 11b therethrough. As illustrated in Fig. 5, each main opening 11a tapers inwardly towards the lower surface 7 of the body portion 5. In use, the filler parts 14b are located within the main openings 11a, so that the filler parts 14b substantially fill the main openings 11a. Each filler part 14b is of a tapered shape.

The anti-slip tile 4 comprises a plurality of cylindrical protrusions 8, 9 protruding from the upper surface 6, and evenly spaced across the upper surface 6 (Fig. 3). The protrusions 8, 9 act to minimise the possibility of a wheel of a vehicle slipping as the wheel passes over the anti-slip tile 4 and over the trench cover 3. In this case, the protrusions 8, 9 are integrally formed with the body portion 5.

The plurality of protrusions is divided into a set of first protrusions 8 and a set of second protrusions 9. The first protrusions 8 protrude a greater distance from the upper surface 6, in this case approximately 4mm, than the second protrusions 9, which protrude approximately 2mm from the upper surface 6 in this case.

As illustrated in Fig. 3, along the side edges of the anti-slip tile 4, the first protrusions 8 are arranged in a substantially "W"-shaped pattern relative to the second protrusions 9. In addition, the first protrusions 8 are arranged in a substantially cross-shaped pattern relative to the second protrusions 9 at the centre of the anti-slip tile 4. In Fig. 3, the first protrusions 8 are marked with an X to differentiate between the positions of

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the first protrusions 8 and the positions of the second protrusions 9. However it will be appreciated that all of the protrusions 8, 9 have a cylindrical configuration, in this case.

The anti-slip tile 4 is releasably attached to the trench cover 3 by means of a mechanical attachment arrangement, in this case by extending two attachment members 10 through the corresponding access openings 11b in the filler parts 14b of the body portion 5 and into the trench cover 3. In this case, each attachment member 10 is provided in the form of a nail 15 having a head part 12 for engaging against the frusto-conical shaped wedge filler part 14b, which engages against the sides of the main opening 11a, and a leg part 13 for extending through the access opening 11b in the filler part 14b of the body portion 5 and into the trench cover 3. The nail 15 may be driven into the trench cover 3 using an impact gun, to fix the leg part 13 of the attachment member 10 in position in the trench cover 3.

The head part 12 of the nail 15 is detachable from the leg part 13, for example by grinding the head part 12, to facilitate release of the attachment of the anti-slip tile 4 to the trench cover 3.

In use, the anti-slip tile 4 is positioned with the lower surface 7 of the body portion 5 contacting the trench cover 3 at any desired position on the trench cover 3. The nail 15 is driven through the access opening 11b in the filler part 14b and into the trench cover 3, using an impact gun to fix the leg part 13 of the attachment member 10 in position in the trench cover 3. In this fixed position, the head part 12 engages against the filler part 14b which engages against the sides of the main opening 11a to maintain the anti-slip tile 4 releasably attached to the trench cover 3.

The trench cover 3 with the anti-slip tile 4 attached thereto is then positioned with respect to a trench 2 to cover the trench 2, as illustrated in Figs. 6 and 7.

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If it is desired to release the attachment of the anti-slip tile 4 to the trench cover 3, the head part 12 of the attachment member 10 may be detached from the leg part 13, for example by grinding the head part 12. The anti-slip tile 4 can then be removed.

It will be appreciated that the anti-slip tile 4 may alternatively be attached to the trench cover 3 while the trench cover 3 is in position covering the trench 2.

Two or more of the anti-slip tiles 4 may be attached to the trench cover 3 at any desired positions on the trench cover 3 to achieve the desired level of anti-slip performance.

As an alternative to or in addition to the use of the attachment nail 15, welding may be employed to attach the body portion 5 to the trench cover 3.

To reduce the weight of the anti-slip tile 4, the anti-slip tile 4 may include regions of reduced material, such as an opening through the tile 4. For example by providing an opening through the anti-slip tile 4, between each set of four protrusions 8, 9, the overall weight of the anti-slip tile 4 may be reduced by up to 33%. Such an opening would also lead to the benefit of improving the drainage of water, such as rainwater, from the upper surface of the tile 4. Improving drainage would lead to improved anti-slip performance.

Other anti-slip means may be used in addition to or as an alternative to the protrusions 8, 9. For example, points or grooves may be provided in the upper surfaces 6 of the body portion 5.

Furthermore the height of the protrusions 8, 9 may be varied to achieve any desired anti-slip effect.

It will be appreciated that the anti-slip tile 4 and/or the trench cover 3 could alternatively be manufactured using any other suitable metallic material, or using a

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non-metallic material, or using a composite material. It will further be appreciated that the anti-slip tile 4 and/or the trench cover 3 could alternatively be manufactured by any other suitable manufacturing process, such as drawing, extruding, casting or injection moulding. By manufacturing the anti-slip tile 4 and/or the trench cover 3 by means of an injection moulding process, the overall weight of the anti-slip tile 4 and/or the trench cover 3 may be reduced.

In Figs. 8 to 19, there is illustrated another anti-slip tile 20 according to the invention, which is similar to the tile 4 of Figs. 1 to 7, and similar elements in Figs. 8 to 19 are assigned the same reference numerals.

In this case, the anti-slip tile 20 comprises a plurality of cylindrical protrusions 21 protruding from the upper surface 6, and evenly spaced across the upper surface 6. Each of the protrusions 21 is substantially identical. In this case, each protrusion 21 is in the form of a dimple with a square top.

The body portion 5 has a plurality of openings 22 extending through the body portion 5, the openings 22 being spaced across the upper surface 6. The openings 22 assist in reducing the overall weight of the anti-slip tile 20.

It will be appreciated that the overall weight of the anti-slip tile of the invention may be reduced in a number of possible ways, for example by arranging one or more weight-reducing discontinuities across the body portion 5. The discontinuities could be in the form of openings 22 through the body portion 5 (Figs. 8 to 19), and/or in the form of recesses in the body portion 5, and/or in the form of thinned-down parts of the body portion 5, and/or in the form of a variation in the material of the body portion 5 across the body portion 5.

The openings 22 also provide a means of draining water, such as rainwater, from the upper surface of the body portion 5. By draining away surface water, the overall anti-slip properties of the tile 20 are further improved.

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As illustrated in Fig. 19, a rubber grommet 23 or washer may be provided between the base of the filler part 14b and the trench cover 3. The filler part 14b may be provided as a steel element, and a washer 24 may be included between the head part 12 of the attachment member 10 and the top surface of the filler part 14b.

Figs. 8 to 19 illustrate the countersunk nail insert stud / spacer embodiment of the invention, which comprises the countersunk spacer 14b manufactured from steel / aluminium / plastic / ductile iron, and the anti-skid tile 5 with countersunk location points 11a which will receive the matching countersunk spacer 14b.

During assembly, the tiles 5 are laid out as desired. The countersunk spacer 14b which has been machined with / without a through-hole 11b or slotted hole provides for the insertion of a steel nail 15. The countersunk spacer 14b is placed into the matching receiving points 11a located on the surface of the anti-skid tile 5. A steel nail 15 is fired from an impact gun, or an electric weld, can be used to fix the spacer 14b to the surface of the steel road plate 3.

Fig. 20 to 29 illustrate another anti-slip tile 30 according to the invention, which is similar to the tile 20 of Figs. 8 to 19, and similar elements in Figs. 20 to 29 are assigned the same reference numerals.

In this case, the two main openings 31a in the main body part 14a are located at opposite end edges of the main body part 14a. As illustrated in Fig. 20, when viewed from above, the main openings 31a have a substantially "C"-shape or partially half-round shape. Similarly the filler part 32b has a substantially "C"-shape or partially half-round shape, when viewed from above.

The access opening 33 through the filler part 32b is substantially elongate, in this case, and the filler part 32b tapers inwardly towards the lower surface 7 of the body portion 5.

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Figs. 20 to 29 illustrate the half-round anchor bracket embodiment of the invention, which comprises the half-round bracket 32b manufactured from 2mm mild or stainless steel and formed with a punched, slotted hole 33, and the anti-skid tile 5 with indented edge profile to match the half-round bracket 32b.

During assembly, a set of anti-skid tiles 5 is placed on the surface of the steel road plate 3 and spaced at intervals of 20-50mm in order to evenly cover the surface of the steel sheet 3. A shaped, half round bracket 32b is inserted into the matching slot 31a in the surface of each tile 5.

The shape of the bracket 32b helps to create rigidity.

The bracket 32b can be fixed to the surface of the steel road plate 3 by means of a hardened nail fired from an impact gun. A slotted hole 33 is provided which will also allow the formation of an electric arc weld in the centre of the bracket 32b which will fix each bracket 32b to the surface of the plate 3 and as a consequence, secure the tile 30.

A tile 30 will normally be fixed by a minimum of 2 brackets.

In another method it will be possible to fix a tile 30 with only one bracket located in the centre of the tile 30. This method would require a bracket which has a shape other than circular such as a square shape, so that the tile 30 cannot rotate around its centre.

Referring to Figs. 30 to 39, there is illustrated a further anti-slip tile 40 according to the invention, which is similar to the tile 30 of Figs. 20 to 29, and similar elements in Figs. 30 to 39 are assigned the same reference numerals.

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In this case the attachment member 41 comprises a first wing 42, a second wing 43 and a raised lip 44 bridging the two wings 42, 43 (Figs. 36 to 38). The attachment member 41 is suitable for clamping the body portion 5 to the trench cover 3.

The second wing 43 is insertable through an access opening 45 in the body portion 5, to locate the second wing 43 between the lower surface 7 of the body portion 5 and the upper surface of the trench cover 3. A recess 46 is provided in the lower surface 7 of the body portion 5 to accommodate the second wing 43, while enabling the body portion 5 to lie flush on the trench cover 3.

The body portion 5 has a fixing opening 47 at an edge of the body portion 5, and the first wing 42 may be located in the fixing opening 47 for fixing of the first wing 42 to the trench cover 3. A fixing member, such as the nail 15, may be driven through the first wing 42 and into the trench cover 3 to fix the attachment member 41 to the trench cover 3. An impact gun may be used to drive the fixing member 15 through the first wing 42. In this configuration, the lip 44 extends over the bridging finger 48 between the access opening 45 and the fixing opening 47, and the body portion 5 is thereby clamped to the trench cover 3.

Figs. 30 to 39 illustrate the flat anchor bracket embodiment of the invention, which comprises a flat / stepped anchor bracket 41 manufactured from mild or stainless steel and formed with a raised portion 44 in the upper, central section of the rectangular bracket 41 which is parallel to the lower sections 42, 43 and an anti-skid tile 5 with a rectangular, slotted indentation 47 on two sides / ends, which will receive the anchor bracket 41.

During assembly, the tiles 5 are laid out as desired. The stepped / rectangular bracket 41 is inserted through the matching 30mm slot 45 which has been cast into the tiles 5 at each end. On the underside of the anti-skid tile 5, a counter-sunk position 46 has been cast in order to receive the rectangular bracket 45. This will allow the anti-skid tile 5 to remain flush with the surface of the steel road plate 3. The rectangular

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bracket 42 can then be fixed to the surface of the steel road plate 3 by means of a hardened nail 15 fired from an impact gun. It will also be possible to fix the bracket 41 by means of an electric arc weld.

Figs. 40 to 44 illustrate another anti-slip tile 50 according to the invention, which is similar to the tile 40 of Figs. 30 to 39, and similar elements in Figs. 40 to 44 are assigned the same reference numerals.

In this case the attachment member 51 is elongate, and is extendable over two or more body portions 5 to clamp the body portions 5 to the trench cover 3 using a single attachment member 51, as illustrated in Fig. 43.

The attachment member 51 comprises a plurality of wings 52 separated by a plurality of raised lips 53. Each wing 52 is locatable in a corresponding fixing opening 54 at a edge of the body portion 5, and each lip 53 is extendable over the body portion 5 between adjacent fixing openings 54. By fixing each wing 52 to the trench cover 3, for example by driving fixing members 15 through each wing 52 and into the trench cover 3, the plurality of body portions 5 will be clamped to the trench cover 3.

Figs. 40 to 44 illustrate the strip anchor method embodiment of the invention. It can be seen that it is possible to press the half-round anchor bracket 51 from a continuous strip of metal, referred to as a "strip anchor method". In this method, the user will place a set or row of anti-skid tiles 5 on the surface of the steel road plate 3. It is then possible to place an anchoring strip 51 which, in one continuous length, will anchor a number of plates 3 at one time. The anchor strip 51 is fitted with shaped countersunk portions 52 which will match cutaway notches 54 in the anti-skid tile 5. The anchor strip is provided with a number of slotted holes 55 through which a steel nail can be fired by means of an impact gun or through which an electric arc weld can be made.

Although the anti-slip tile of the invention has been described in relation to attachment to a trench cover, it will be appreciated that the anti-slip tile is also applicable for

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attachment to a variety of other surfaces. For example the anti-slip tile could be attached to a floor of a building, such as a factory.

In another embodiment of the invention, a trench cover could be manufactured with a series of recesses on an upper surface of the trench cover. A corresponding series of stud elements could be fitted into the recesses so as to partially protrude from the upper surface. The partially protruding stud elements will therefore act to minimise the possibility of a wheel of a vehicle slipping as the wheel passes over the trench cover and the studs.

Referring to Figs. 45 to 79, there is illustrated a trench cover 101 according to the invention. The trench cover 101 is similar to the trench covers described in International patent applications published under numbers WO 02/084033 and WO 01/21898, the relevant contents of which are incorporated herein by reference. The trench cover 101 may be used to cover a trench in the ground and a number of the trench covers 101 may be interlinked to follow the contour of the ground in which the trench is dug.

The cover 101 comprises a cover member 102 for extending over a trench, especially in a roadway. The cover member 102 comprises a pair of supporting portions 110, 111 bridged by a central trench covering portion 112. The cover member 102 is of a generally convex shape in transverse cross section (Fig. 49), the side portions 110, 111 reducing in cross section towards opposite marginal edges 114, 115 of the cover member 102 to define a slight ramp to facilitate vehicle wheels and the like passing thereover. The exposed upper surface of the cover member 102 has anti-slip formations which in this case are defined by protrusions 116.

The protrusions 116 protrude upwardly from the upper surface of the cover member 102, and are integrally formed with the cover member 102. The protrusions 116 are evenly spaced across the upper surface of the cover member 102, with each of the protrusions 116 being substantially identical. In this case, each protrusion 116 has a

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lower portion with a substantially round-shaped cross-section and an upper portion with a substantially square-shaped cross-section (Fig. 54). The lower portion is located closer to the upper surface of the cover member 102 than the upper portion.

In use, as traffic / pedestrians pass over the cover member 102, the protrusions 116 act to minimise the possibility of the traffic / pedestrians slipping.

Fig. 54 illustrates the dimpled upper surface of the cover member 102 which is covered with a dimpled / coarse surface which creates an anti-skid surface for vehicles and pedestrians.

In one application, this surface is as shown whereby a raised / round dimple will have a square top which provides for a given skid resistance value (SRV) according to traffic regulation guidelines.

Anchor holes 119 are provided in the supporting portions 110, 111 to facilitate anchoring to the ground, if desired. A central recessed area 120 is provided for attachment of a reflector strip or the like. To facilitate erection of a post for a warning flag, sign or the like the cover member 102 has a mounting hole 121. Another recess may be provided to receive a coding means such as an identity tag or transponder unit to uniquely identify the cover 101 for tracing and the like. The supporting portions 110, 111 also have slots therein defining carrying handles 109 for the cover 101.

The cover member 102 has a pair of transverse sides 125, 126 extending transversely between opposite marginal edges 114, 115. Confinement means in the form of trench engaging elements 127, 128 confine the cover 101 with respect to the opening of the trench. Referring in particular to Fig. 46, it will be noted that the two trench engaging elements 127, 128 depend from the central trench covering portion 112 of the cover member 102, and are oppositely directed so that, in use, they can engage opposite side walls of the trench.

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The trench engaging elements 127, 128 are linearly movable relative to the cover member 102 to facilitate adjustment to a desired width of trench. In particular, the trench engaging elements 127, 128 comprise arms 1000, 1010 with elongate slots 1020, 1030 respectively for adjustment relative to the cover member 102.

Means to lock the trench engaging elements 127, 128 in a desired position relative to the cover member 102 are provided in the form of fixing pins 1040, 1050 respectively. The pins 1040, 1050 are extendable through aligned openings in the arms 1000, 1010 and the cover member 102 to lock the trench engaging elements 127, 128 in a particular position. In this case, the fixing pins 1040, 1050 are provided in the form of threaded bolts coupled to corresponding threaded nuts.

As illustrated particularly in Figs. 55 and 56, each slot 1020, 1030 has a range of discrete enlarged openings 1100. Each trench engaging element 127, 128 is movable between a number of discrete locations as defined by the enlarged openings 1100. The cover has two protrusions 1500, 1510 on the underside thereof for engagement in the slots 1020, 1030 and openings 1100. The protrusions 1500, 1510 each have an enlarged portion 1520, 1530 for engagement in one of the openings 1100 respectively in the trench engaging elements 127, 128. Each protrusion 1500, 1510 also comprises an elongate extension 1540, 1550 for engagement in the slots 1020, 1030. In this case there are five discrete enlarged openings 1100 in each of the trench engaging elements 127, 128. When the trench engaging elements 127, 128 are moved inwardly to their fullest extent, this corresponds to a given trench width, of say 300 mm. When the trench engaging elements 127, 128 are moved outwardly to the fullest extent, this corresponds to a maximum trench width, of say 500 mm. Adjustment of the trench engaging element 127, 128 from one hole to the adjacent hole represents an extension of the trench engaging element 127, 128 by a fixed distance, of say 25 mm. To move the trench engaging element 127, 128 from one hole to the next, the fixing bolts 1040, 1050 are released and the trench engaging element 127, 128 is lifted off the protrusion 1500, 1510 and moved linearly until the protrusion 1520, 1530 is in line with the desired hole 1100. The trench engaging element 127, 128 is then engaged with the

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protrusion 1500, 1510 and the fixing bolts 1040, 1050 tightened to fix the trench engaging elements 127, 128 to the cover member 102 in position corresponding to the desired width. The trench engaging element 127, 128 may have an imprint therein adjacent to each hole 1100 to indicate the corresponding trench width to a user.

Thus, to adjust the distance between the trench engaging elements 127, 128 to correspond to the width of a trench to be covered, one or both fixing pins 1040, 1050 are released, the arms 1000, 1010 linearly adjusted and the fixing pins 1040, 1050 are then re-locked. The trench engaging elements 127, 128 are adjustable to accommodate a range of trench widths, typically from 300 to 500 mm. The trench engaging elements 127, 128 are preferably incrementally adjustable in increments of typically 25 mm.

Each arm 1000, 1010 has a depending handle formation 2500 at the opposite end to the fixing pins 1040, 1050 (Fig. 46). The handles 2500 enable a user to easily grip and move the trench engaging elements 127, 128.

Protective side walls 2510, 2520, which are fixed relative to the cover member 102, also depend from the central trench covering portion 112 of the cover member 102 on both sides of the arms 1000, 1010. The side walls 2510, 2520 guide and protect the movable arms 1000, 1010.

Interlink means are also provided in the form of a first male interlink means and a second female interlink means, the interlink means of adjacent like covers 101 being interengagable on assembly of the covers 101.

In this case, the male interlink means comprises a head part 135 projecting from the transverse side 126 of the cover member 102. The head part 135 has an area of reduced cross section defining a neck 136 and is located centrally of the transverse side 126.

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The female interlink means comprises a downwardly opening slot 140 at the transverse side 125. The slot 140 is defined in the underside of the cover member 102 by downwardly extending walls and portion of the transverse wall. The width of the slot 140 is oversize with respect to the width of the head part 135 of the male interlink to permit limited relative movement between adjacent covers 101 on assembly so that the covers 101 can follow the contour of the ground. Similarly, the length of the head part 135 is less than the length of the recess 140. It will be noted that the upper ends of the head part 135 are tapered to facilitate assembly of the head part 135 into the recess 140.

The interlink means in this case also comprises a pair of end wings 150, 151 which extend from the transverse side 125. The end wings 150, 151 are located on either side of the recess 140 and extend generally from the supporting portions 110, 111 of the cover member 102 respectively. On assembly, the end wings 150, 151 are received underneath an adjacent cover 101. In this case, the end wings 150, 151 are received in recessed areas 152, 153 respectively flanking the head part 135.

The end wings 150, 151 engaging underneath an adjacent cover 101, in combination with the inter-engagement of the head part 135 in the slot 140 secures adjacent covers 101 together in such a way as to facilitate relative movement between adjacent covers 101 to follow the contour of a trench.

Because both of the trench engaging elements 127, 128 may be moved relative to the cover member 102, this enables the cover 101 to be adjusted so that the cover 101 is confined with respect to the trench regardless of the trench width, while also enabling the cover 101 to be positioned centrally over the trench with substantially equal amounts of the supporting portions 110, 111 on each side of the trench. The width adjustment may be made at a depot or on site so that the cover 101 is configured for a particular trench size.

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The trench cover 101 further comprises two separate mats 300, 301 on each supporting portion 110, 111. The larger "L"-shaped mat 300 is provided in the region of the corner of the marginal edge 114, 115 and the transverse side 126, and extends partially along the transverse side 126 towards the head part 135 (Fig. 46). The smaller mat 301 is provided in the region of the corner of the marginal edge 114, 115 and the transverse side 125 (Fig. 46).

Each of the mats 300, 301 is mounted to the lower surface of the supporting portion 110, 111. In particular the larger mat 300 has three male protrusions 302 which are engagable in three corresponding female recesses 303 in the lower surface of the supporting portion 110, 111 to mount the mat 300 to the lower surface of the supporting portion 110, 111. Similarly the smaller mat 301 has one male protrusion 304 which is engagable in a corresponding female recess 305 in the lower surface of the supporting portion 110, 111 to mount the mat 300 to the lower surface of the supporting portion 110, 111.

In use, the mats 300, 301 are located between part of the supporting portions 110, 111 and the ground on each side of the trench. The mats 300, 301 are of a resilient material, in this case rubber. Thus the mats 300, 301 act as cushioning members to cushion the cover member 102 relative to the ground on both sides of the trench. In particular the mats 300, 301 minimise vibration of the cover member 102 and minimise any noise generated as traffic / pedestrians pass over the cover member 102. The mats 300, 301 may become at least partially compressed as traffic / pedestrians pass over the cover member 102. The resilient nature of the mats 300, 301 enable the mats 300, 301 to accommodate fluctuations in the surface of the ground either side of the trench.

The larger mat 300 has a stepped configuration, as illustrated in Figs. 72 and 73. In particular the larger mat 300 has a relatively thick portion 350 located in the region of the corner of the "L", and two relatively thin portions 351, 352 either side of the thick portion 350. As illustrated in Fig. 46, the thick portions 350 protrude downwardly

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from the lower surface of the cover member 102, so that in use the thick portions 350 support the cover member 102 suspended by a small distance off the ground. Upon passage of traffic over the trench cover 101, the resilient thick portions 350 at least partially compress until the cover member 102 contacts the ground. In this manner the thick portions 350 accommodate any unevenness in the surface of the ground.

The thin portions 351 contact the end wings 150, 151 of an adjacent trench cover 101, when two adjacent trench covers 101 are interlinked. When two trench covers are interlinked, the thin portions 351 are located between the end wings 150, 151 of one trench cover 101 and the recessed areas 152, 153 of the adjacent trench cover 101. The resilient thin portions 351 therefore act as insulators to minimise vibration and noise as traffic passes over the interlinked trench covers 101.

It will be appreciated that the cushioning means may be provided in a variety of possible configurations and is not limited to the particular shape of the mats as described with reference to Figs. 45 to 79.

Furthermore it will be appreciated that a variety of possible means may be employed to mount the mats to the cover member.

Advantageously the mats are replaceable for repair / replacement, as required.

In use, the cover 101 is located over a trench in the ground with the supporting portions 110, 111 on either side of the trench and the central portion 112 bridging the trench.

Like covers 101 are then interengaged, by locating the head part 135 of one cover 101 into the slot 140 of an adjacent cover 101. The end wings 150, 151 of one cover 101 are also received in the recessed areas 152, 153 of an adjacent cover 101 during interlinking.

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In this manner, a plurality of covers 101 may be interlinked to form a cover assembly over a trench of any length or configuration.

Because the trench cover 101 of the invention permits a degree of relative movement between adjacent covers 101 of an assembly, it is possible for the covers 101 to follow a curvilinear course, for example to cover a curved trench.

On assembly, end covers 101 may be anchored to the ground and because of the inter-engagement on both transverse sides 125, 126, none of the covers 101 in the assembly can be removed by an unauthorised person. This prevents theft and also enhances the safety aspects of the assembly. In addition, the end wings 150, 151 have the important advantage that they at least partially occlude any gap between adjacent covers 101 on assembly. This is also an important safety feature as there is no gap on which to snag a bicycle wheel or the like.

At least one transverse side, in this case the transverse side 125 is shaped to facilitate limited relative movement between side edges 125, 126 of adjacent covers 101. In this case the transverse side 125 is of generally convex curvilinear shape.

The covers 101 are readily assembled as described above to form a rigid temporary trench cover that can be easily disassembled. Importantly, controlled relative movement is allowed so that the cover 101 follows the contour of the ground, preferably in both the vertical and horizontal planes. This ensures a particularly safe and even temporary surface over a trench opening.

The covers 101 may include a code tracking means such as a transponder which may be housed within the cover 101 to allow the location of the cover 101 to be determined from a remote location. In this way the hire and use of the covers 101 can be controlled.

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The invention provides a simple yet extremely effective temporary cover 101 for a range of trench widths. Adjacent covers 101 are readily interconnected as described above. The fittings allow the cover 101 to readily follow both the contour of the ground in which the trench is dug and also the path of the trench.

The trench cover 101 may be anchored into position. Usually, the cover 101 will be anchored at either end by, for example, an anchor bolt which may subsequently be temporarily covered. The cover 101 may also be anchored to the trench at any suitable point, for example at 5m length. The anchoring may be achieved by a releasable hook linkage between the cover 101 and a trench strut.

The trench cover assembly of the invention is easily handled and can therefore be used to allow traffic access and avoid the necessity for temporary backfilling. Thus, the labour force can be concentrated on the trench digging operation, which is thereby optimised.

Although specific configurations for the anti-slip protrusions have been described above with reference to Figs. 1 to 79, it will be appreciated that the anti-slip means could be provided in a variety of possible configurations within the scope of the invention. For example the anti-slip means could be provided in the form of a stepped protrusion, a recess or opening may be provided extending into the centre of a protrusion, adjacent protrusions may or may not have differing heights.

The invention is not limited to the embodiments hereinbefore described, with reference to the accompanying drawings, which may be varied in construction and detail.

## Claims

1. An anti-slip element for use with a separately formed trench cover, the anti-slip element comprising:
  - 5 a body portion, the body portion being attachable to the separately formed trench cover, the body portion comprising an upper surface for facing away from the trench cover when the body portion is attached to the trench cover; and
  - 10 slip minimisation means to minimise the possibility of another element slipping upon passage of the other element over the body portion, the slip minimisation means being integrally formed with the body portion on the upper surface thereof.
2. An element as claimed in claim 1 wherein the body portion is releasably  
15 attachable to the trench cover.
3. An element as claimed in claim 1 or 2 wherein the body portion is attachable to the trench cover by means of a mechanical attachment.
- 20 4. An element as claimed in claim 3 wherein the mechanical attachment includes an attachment member configured to be driven into the trench cover by an impact gun.
- 25 5. An element as claimed in claim 1 wherein the element comprises an attachment member for clamping the body portion to the trench cover.
6. An element as claimed in claim 5 wherein the attachment member comprises a lip for extending over at least part of the body portion to clamp the body portion to the trench cover.  
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7. An element as claimed in claim 5 or 6 wherein the attachment member comprises a first wing configured to be fixed to the trench cover.
8. An element as claimed in claim 7 wherein the element comprises a fixing

member drivable through the first wing to fix the first wing to the trench cover.

9. An element as claimed in claim 8 wherein the fixing member is configured to be driven through the first wing by an impact gun.

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10. An element as claimed in any of claims 7 to 9 wherein the body portion comprises a fixing opening, the first wing being locatable in the fixing opening.

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11. An element as claimed in any of claims 7 to 10 wherein the attachment member comprises a second wing configured to be located between the body portion and a trench cover.

12. An element as claimed in claim 11 wherein the body portion comprises a recess for accommodating the second wing.

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13. An element as claimed in any of claims 9 to 12 wherein a single attachment member is configured to clamp the body portions of two or more elements to the trench cover.

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14. An element as claimed in any of claims 1 to 13 wherein the body portion is attachable to the trench cover by means of welding.

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15. An element as claimed in any of claims 1 to 14 wherein the slip minimisation means comprises one or more protrusions protruding from the upper surface.

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16. An element as claimed in claim 15 wherein the slip minimisation means comprises a plurality of protrusions evenly spaced across the upper surface.

17. An element as claimed in claim 16 wherein each of the protrusions is substantially identical.

18. An element as claimed in any of claims 1 to 17 wherein the body portion

comprises one or more weight-reducing discontinuities.

19. An element as claimed in claim 18 wherein the one or more discontinuities comprise one or more openings extending through the body portion.

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20. An element as claimed in any of claims 1 to 19 wherein the body portion comprises drainage means.

21. An element as claimed in claim 20 wherein the drainage means comprises an opening extending through the body portion.

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22. An assembly for covering a trench, the assembly comprising:- an anti-slip element as claimed in any of claims 1 to 21; and a separately formed trench cover.

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23. An assembly as claimed in claim 22 wherein the trench cover comprises an upper surface, and the upper surface is substantially smooth.

24. A method for covering a trench, the method comprising the steps of:-  
providing an anti-slip element;  
providing a separately formed trench cover;  
attaching the anti-slip element to the trench cover; and  
positioning the trench cover with respect to the trench to cover the trench.

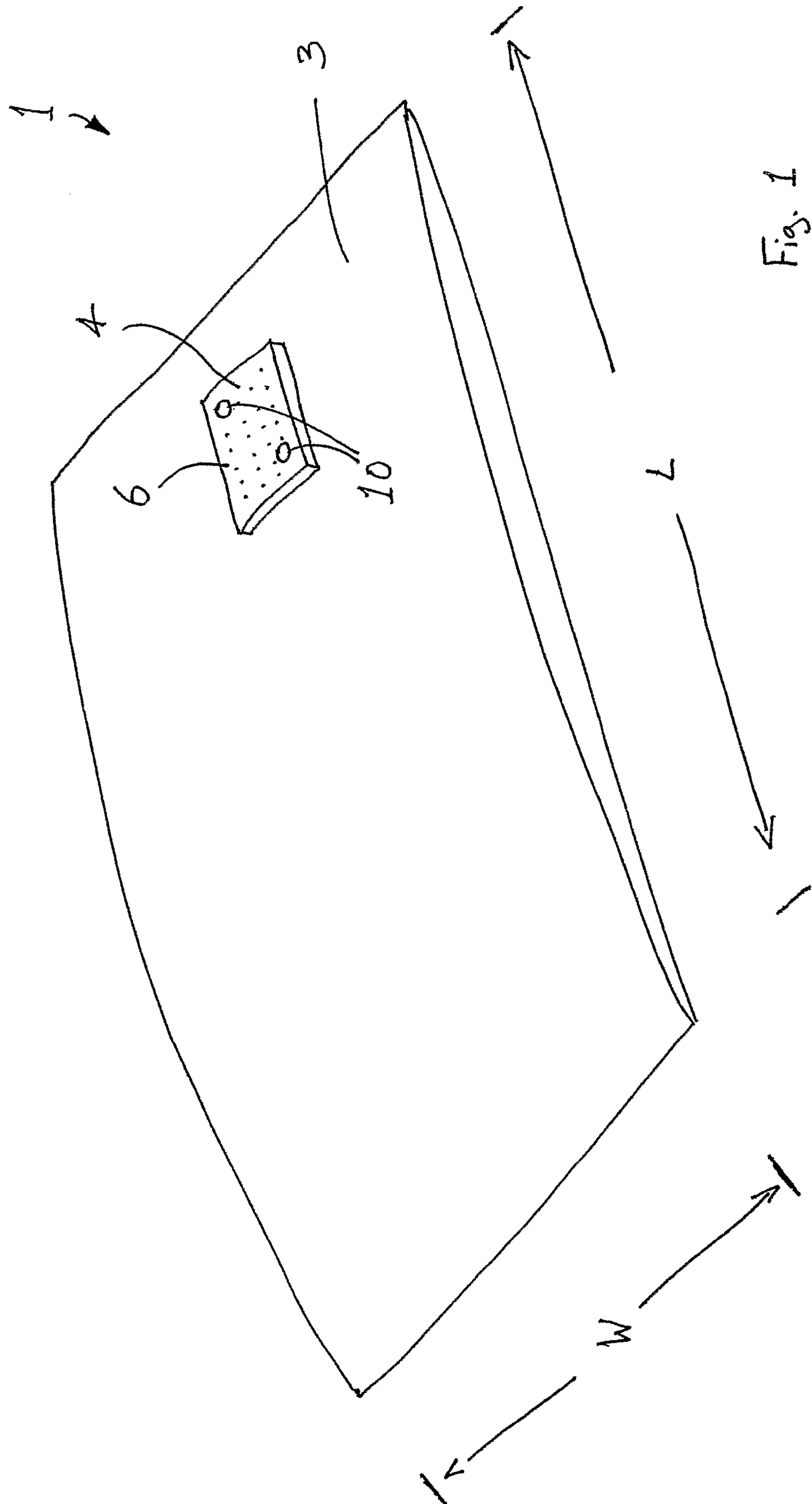
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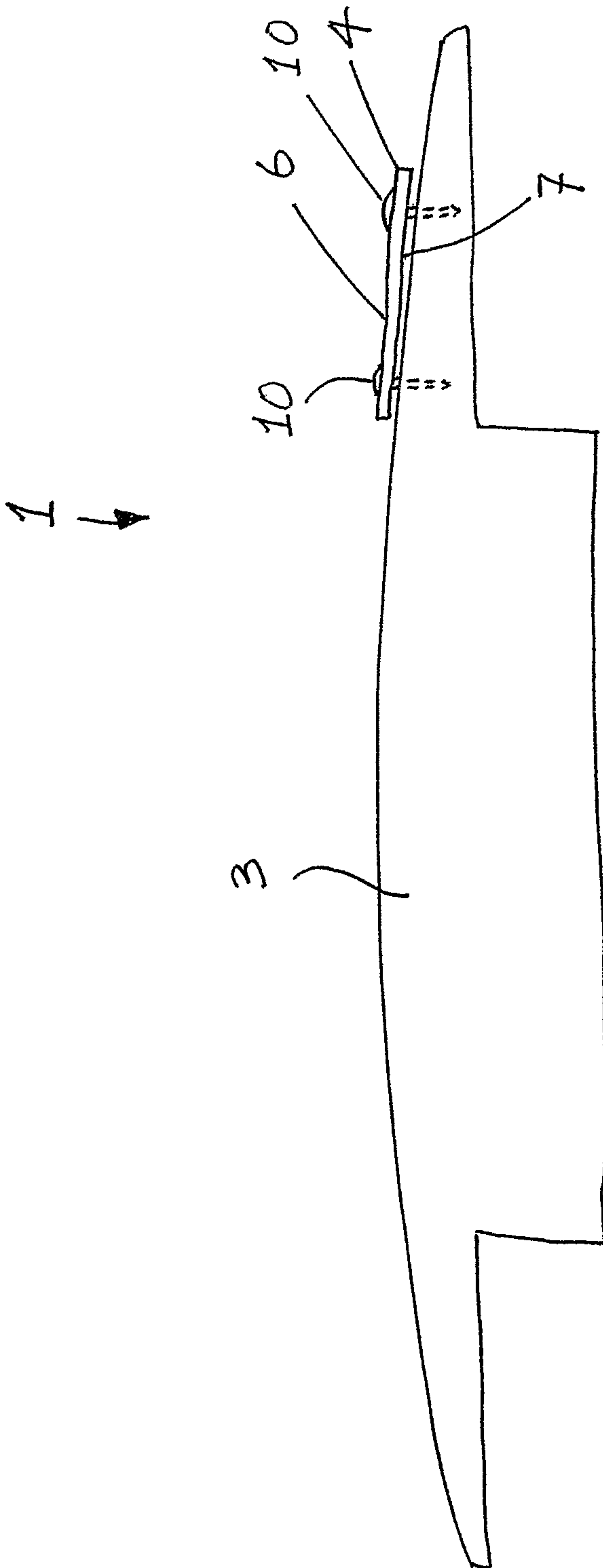
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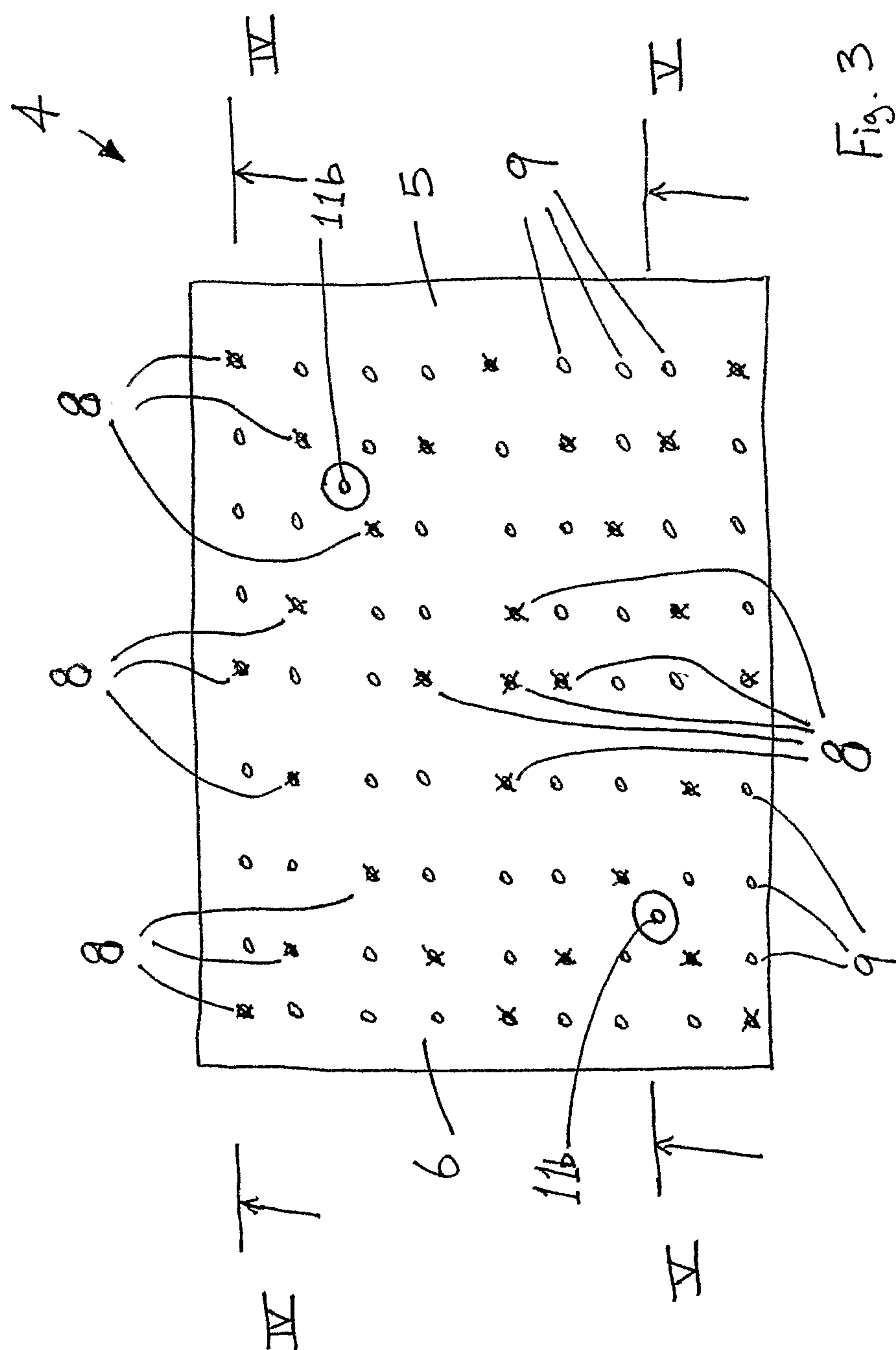
25. A method as claimed in claim 24 wherein the anti-slip element is attached to the trench cover before covering the trench or the anti-slip element is attached to the trench cover while the trench cover is in position covering the trench.

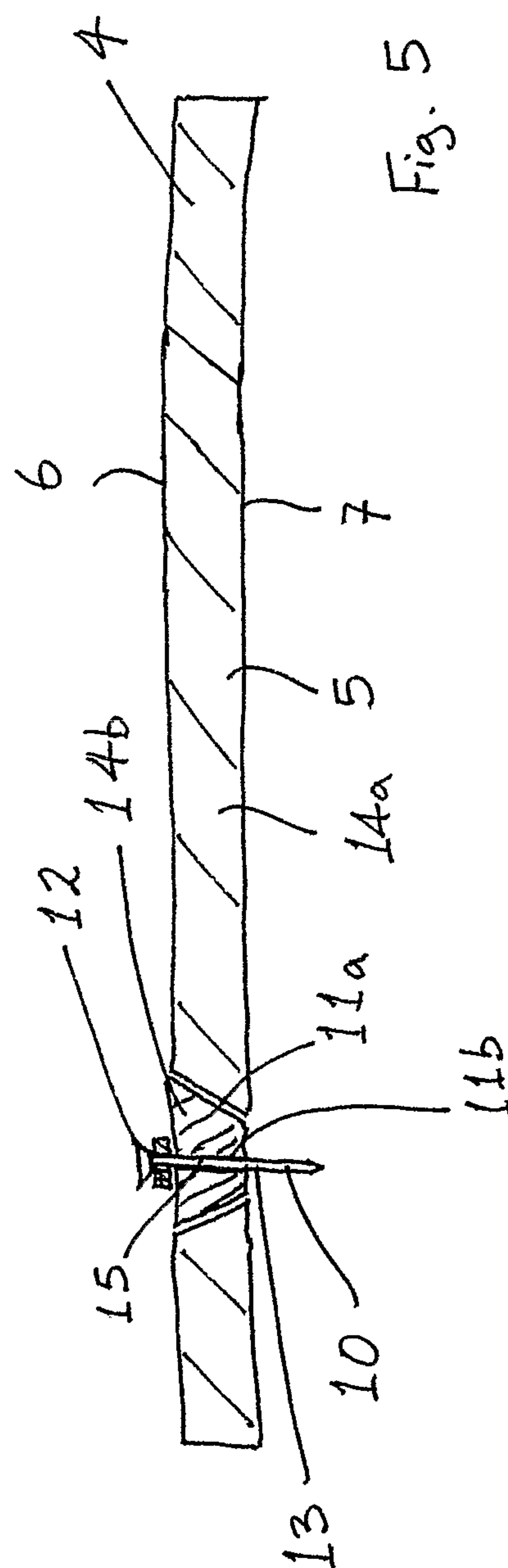
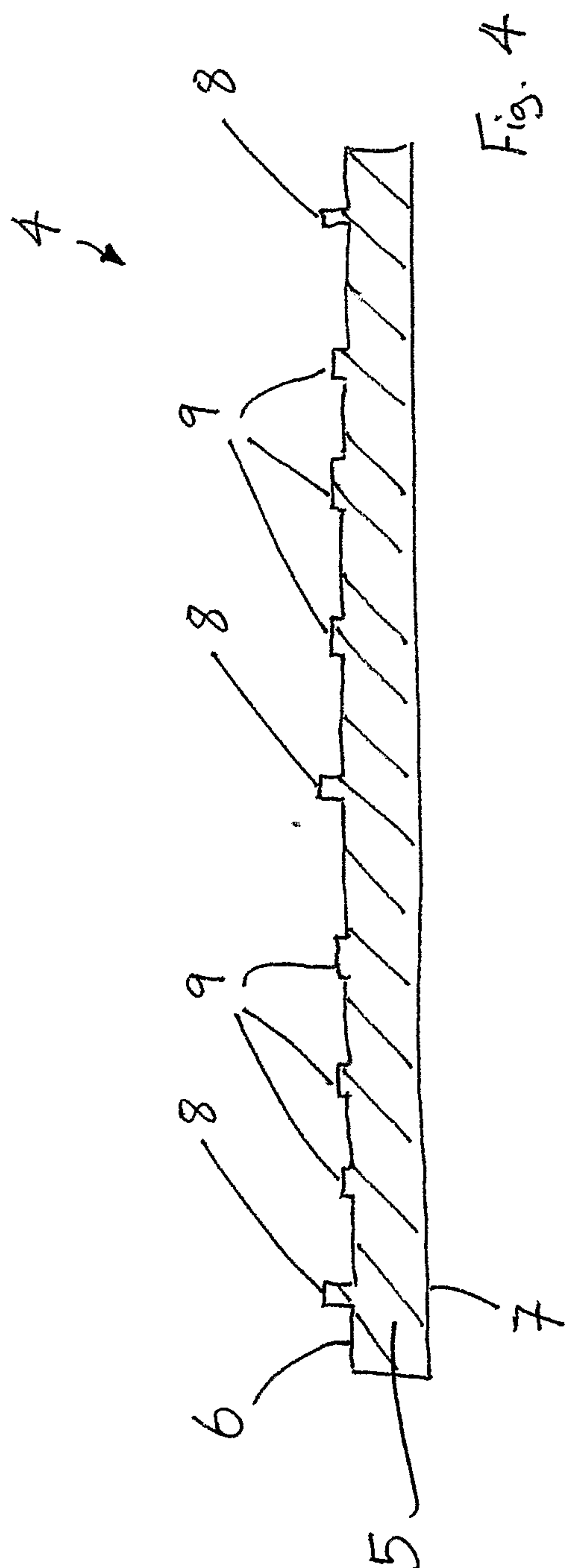
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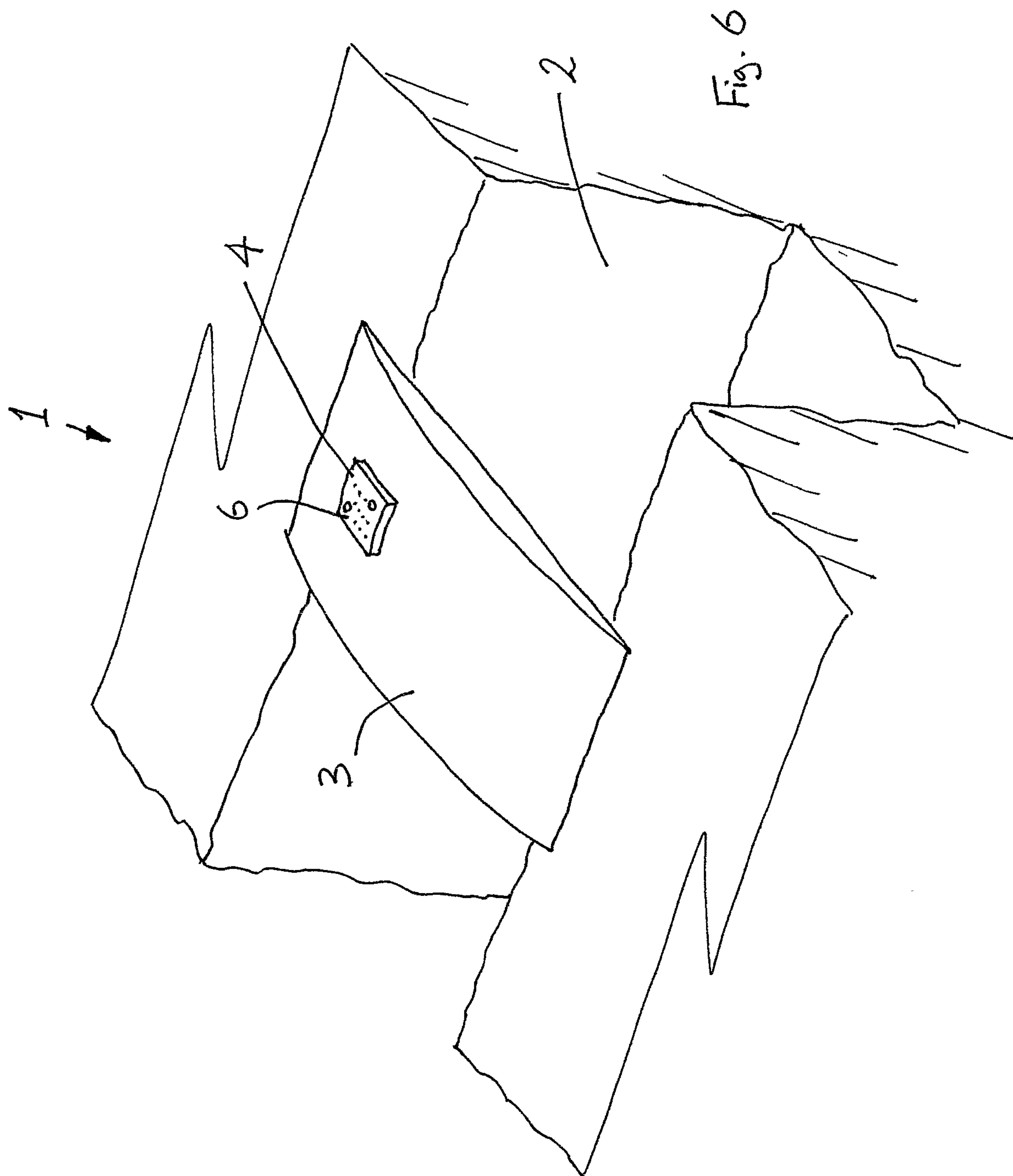
26. A method as claimed in any of claim 25 wherein the anti-slip element is releasably attached to the trench cover.

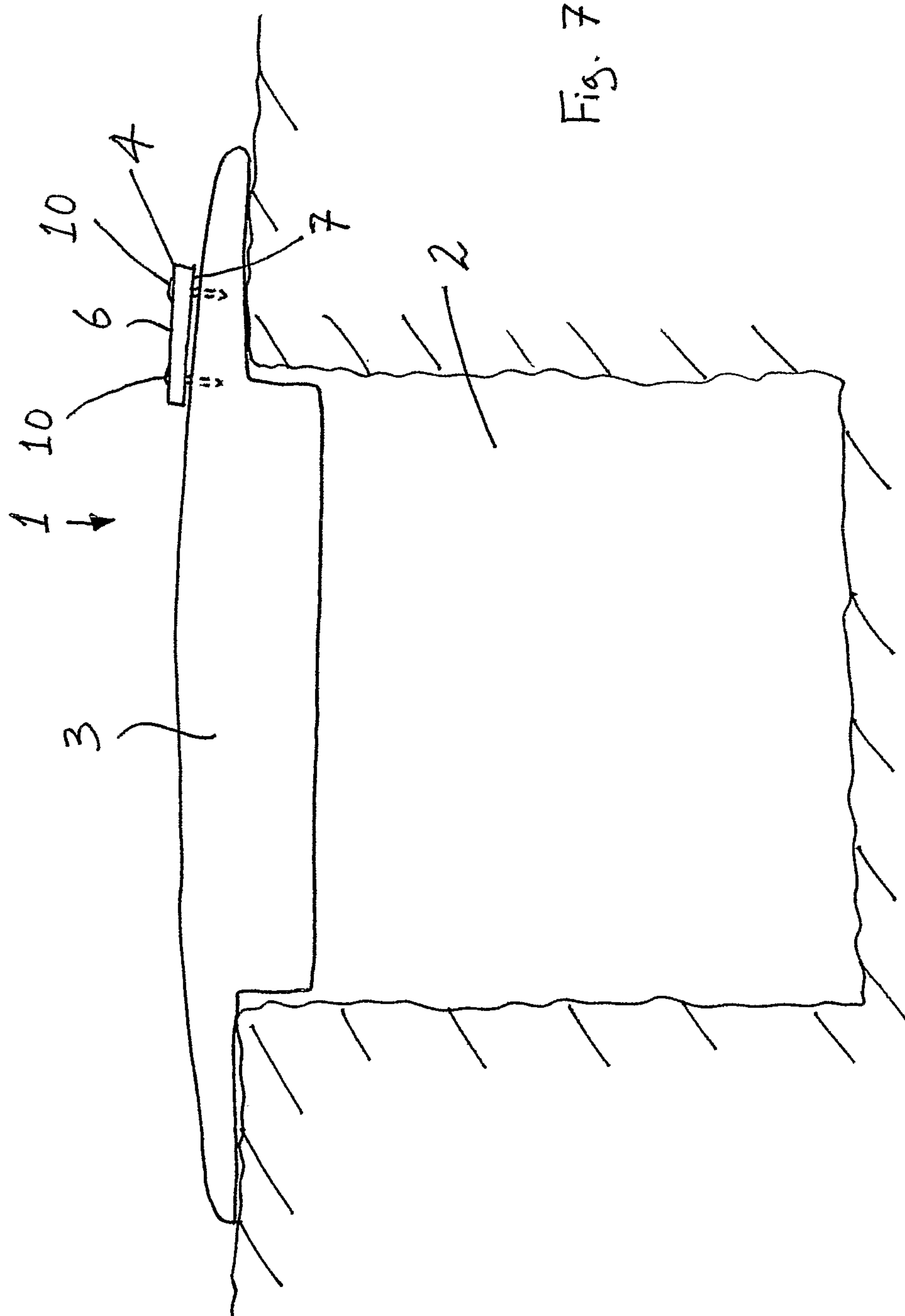


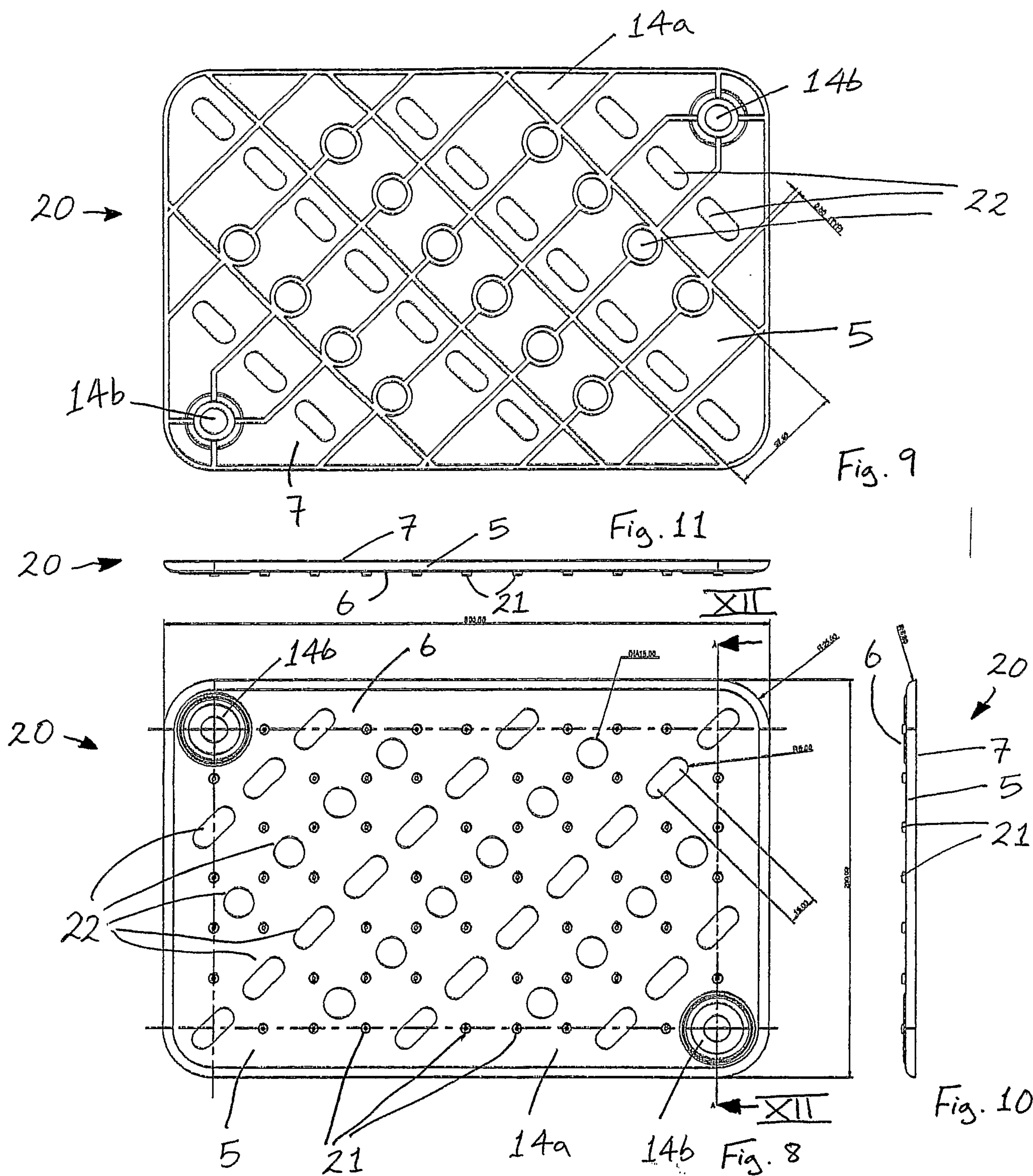


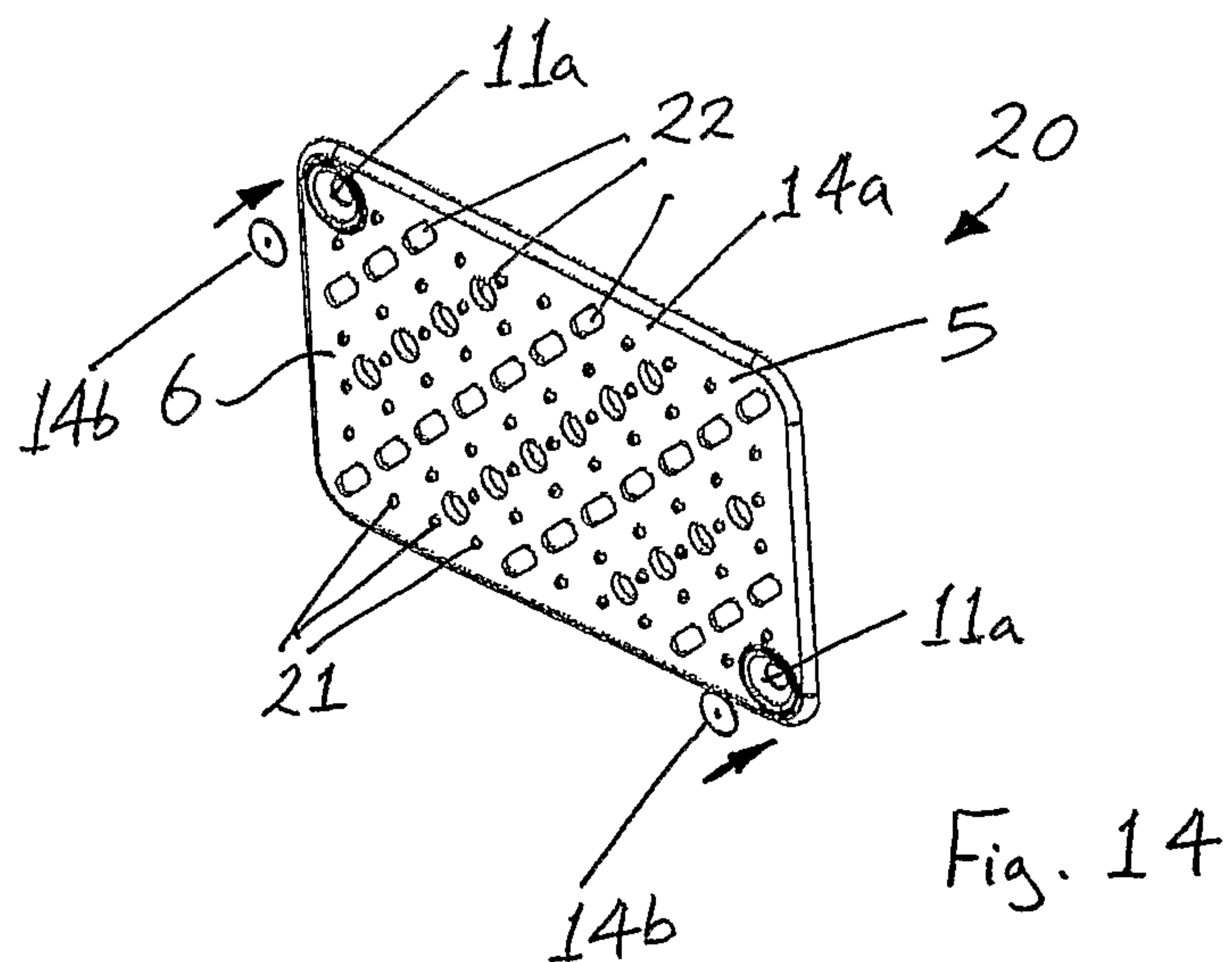
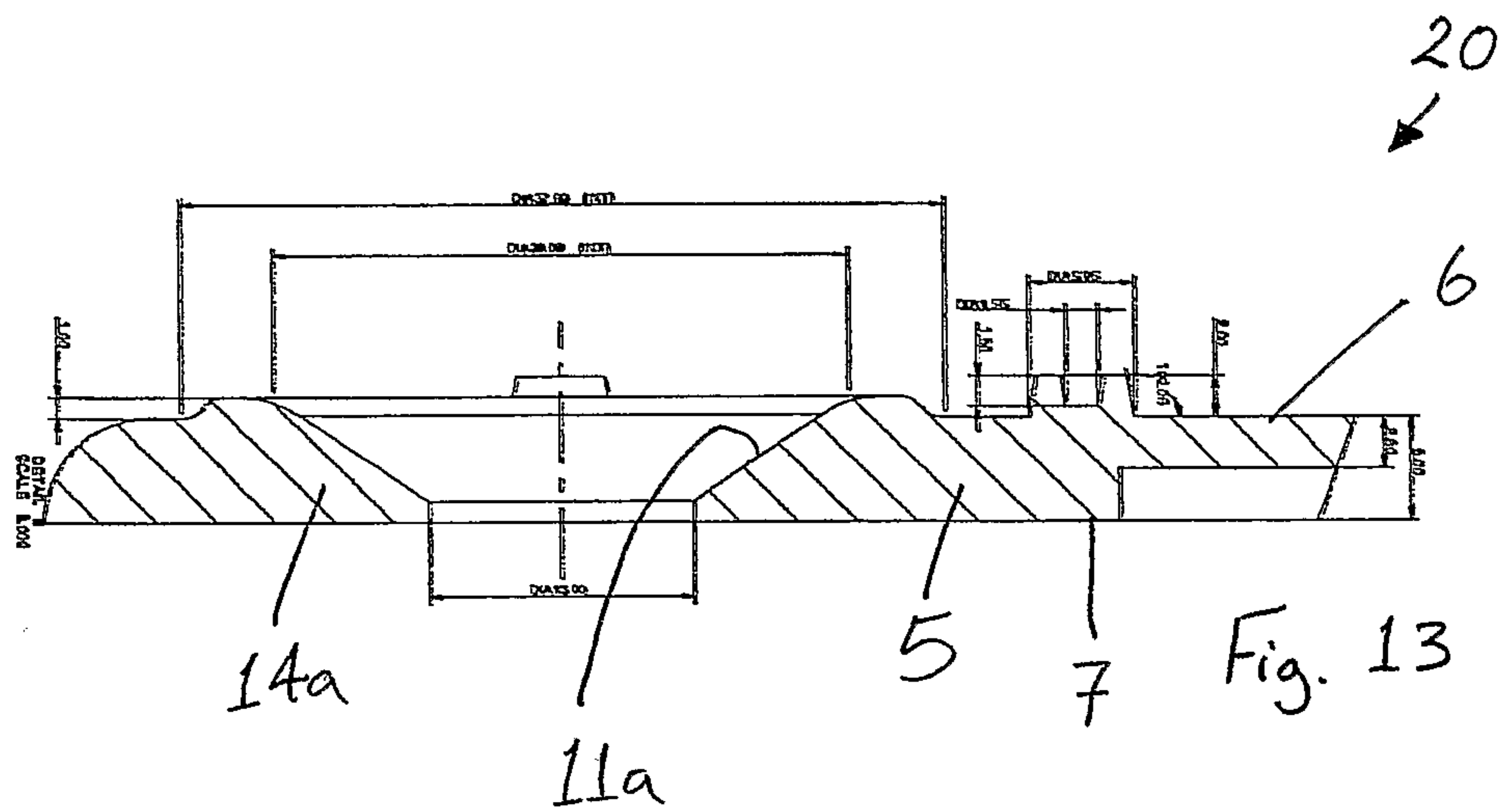
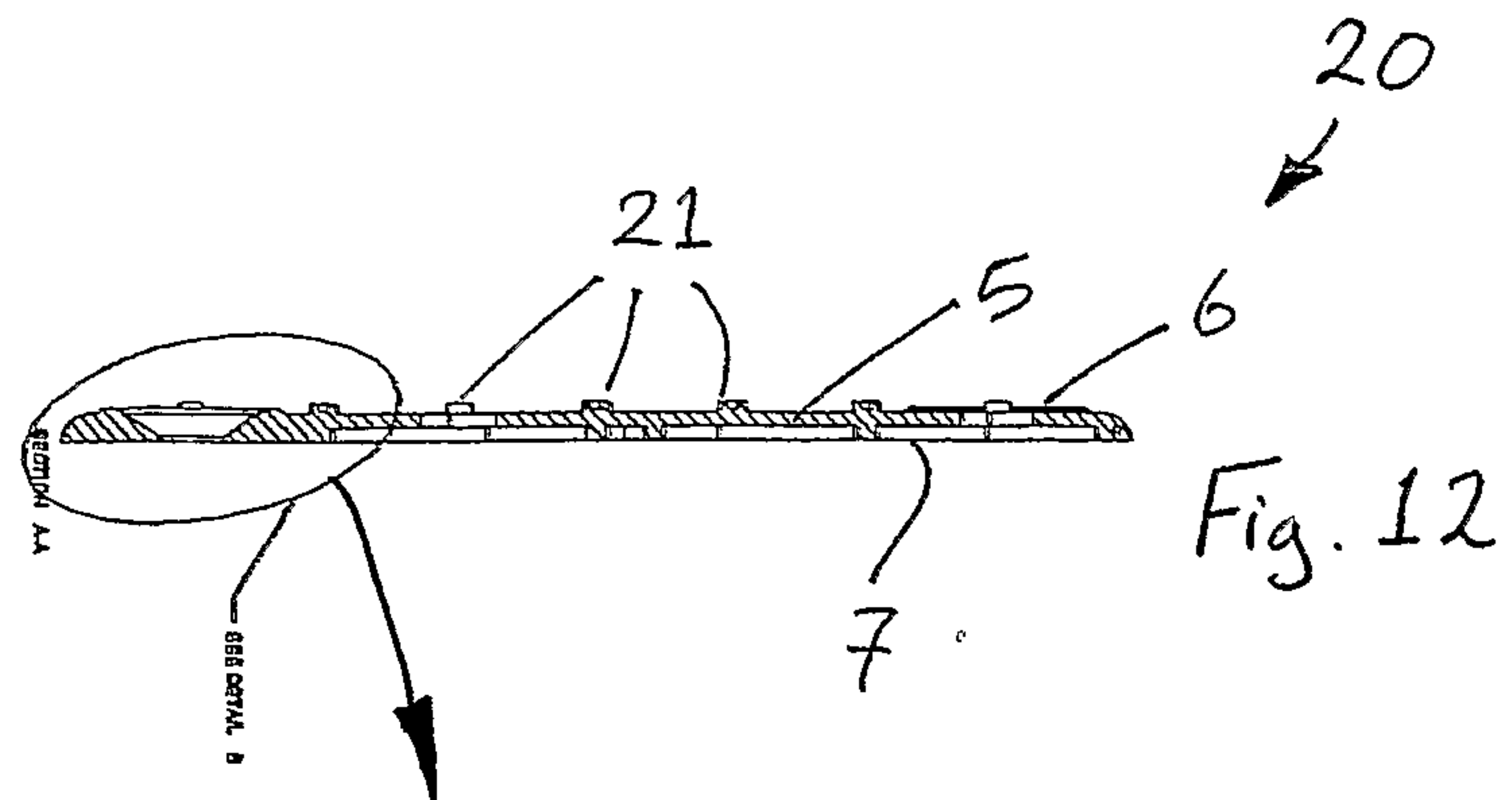


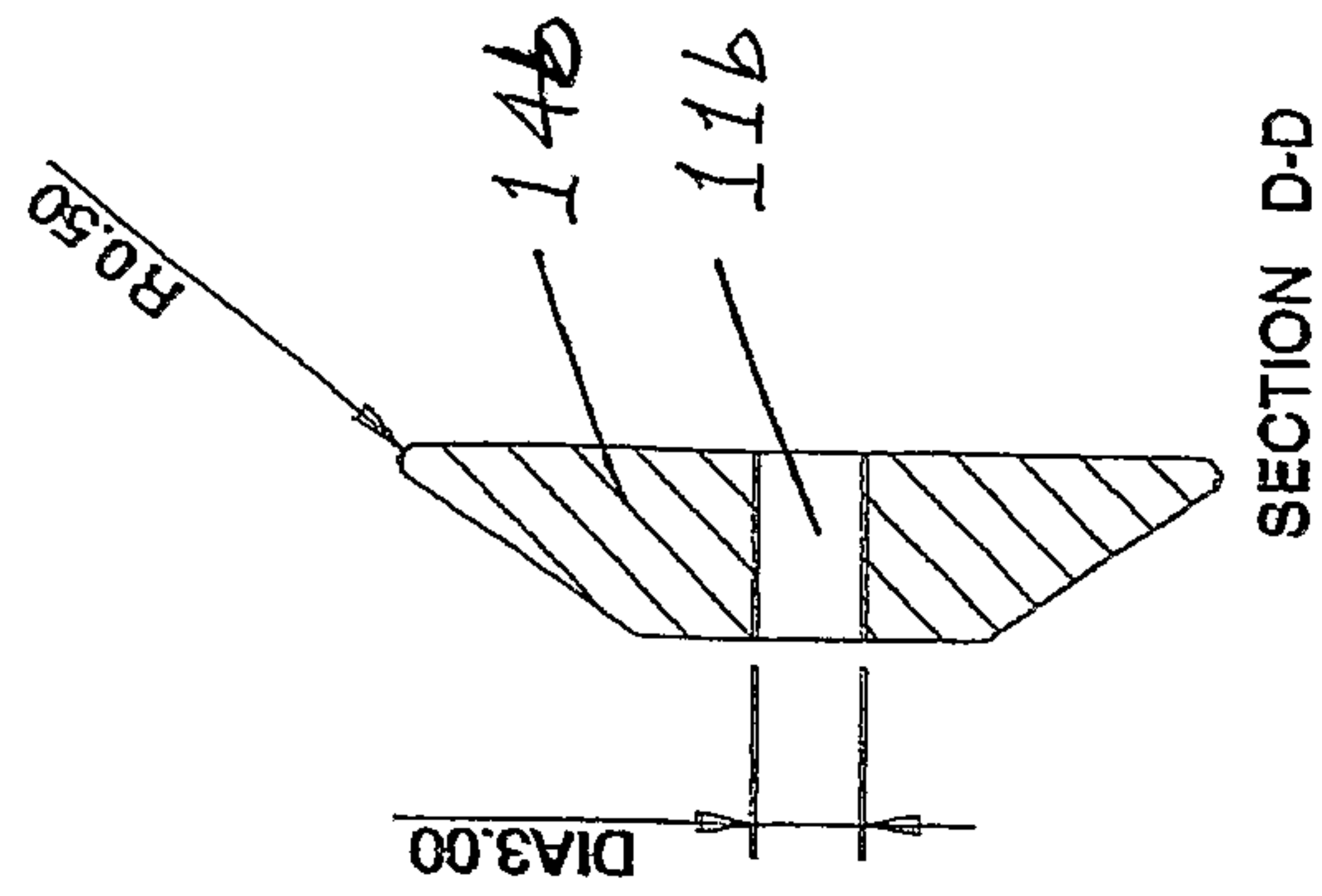
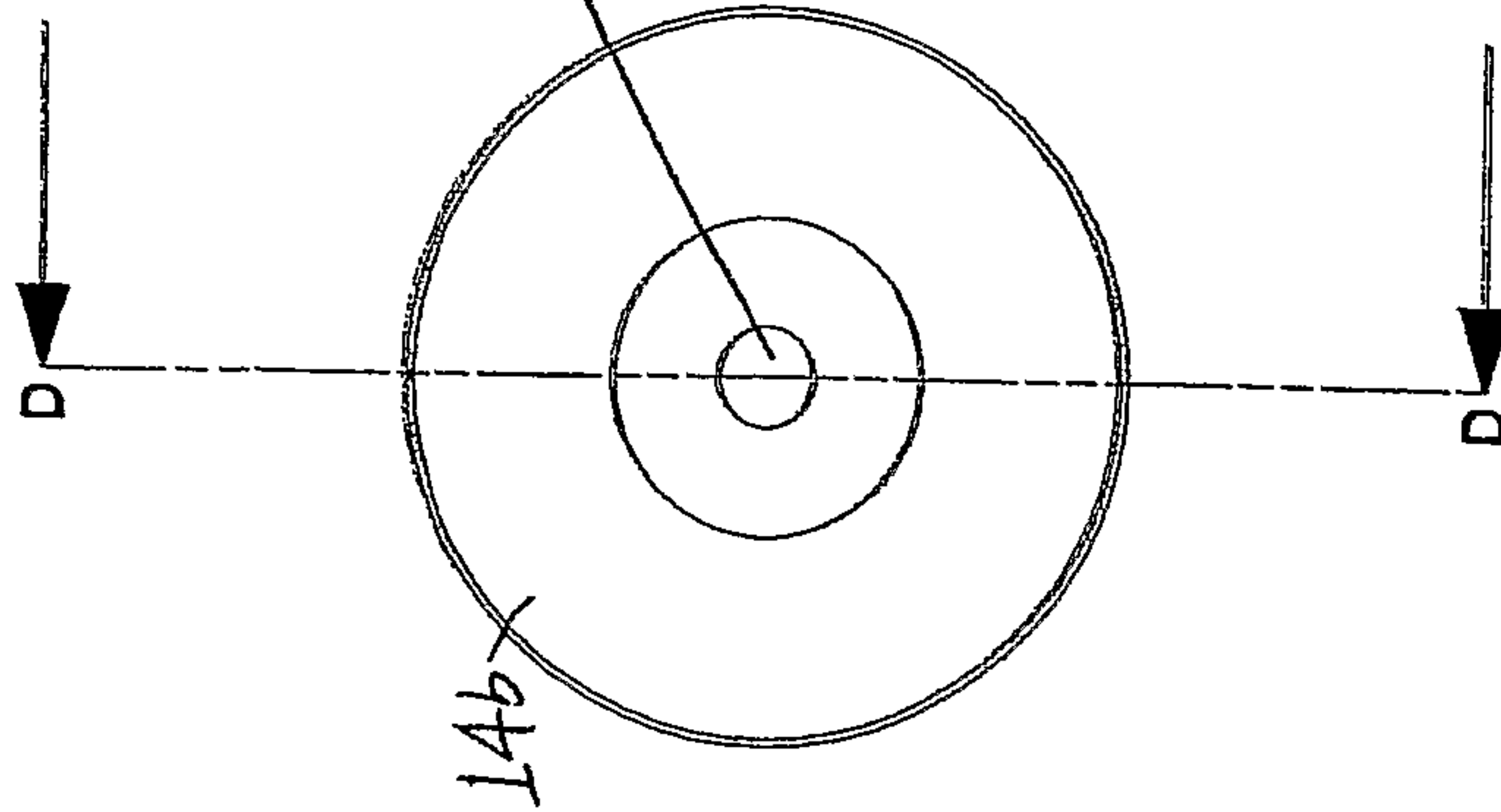
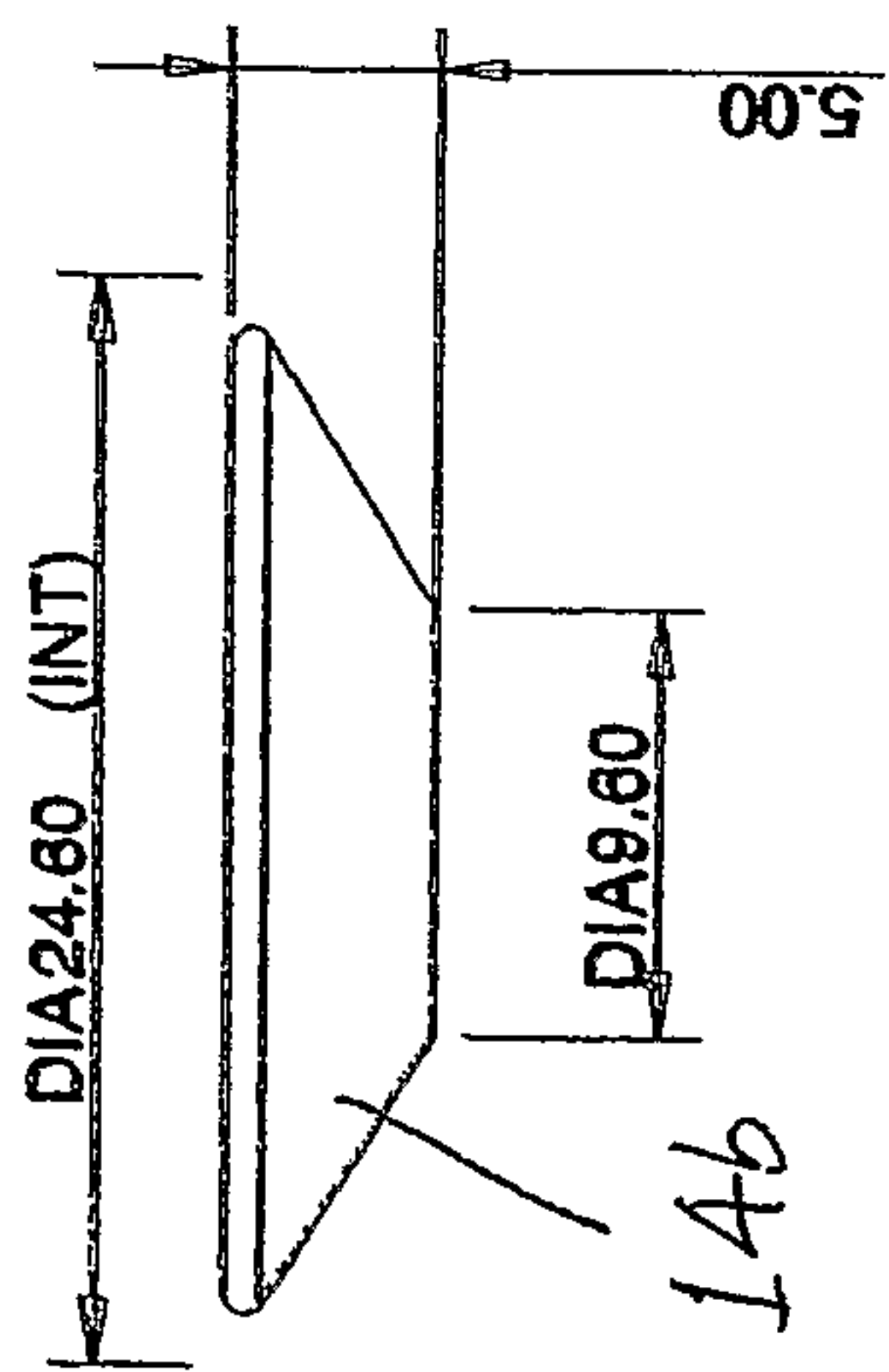


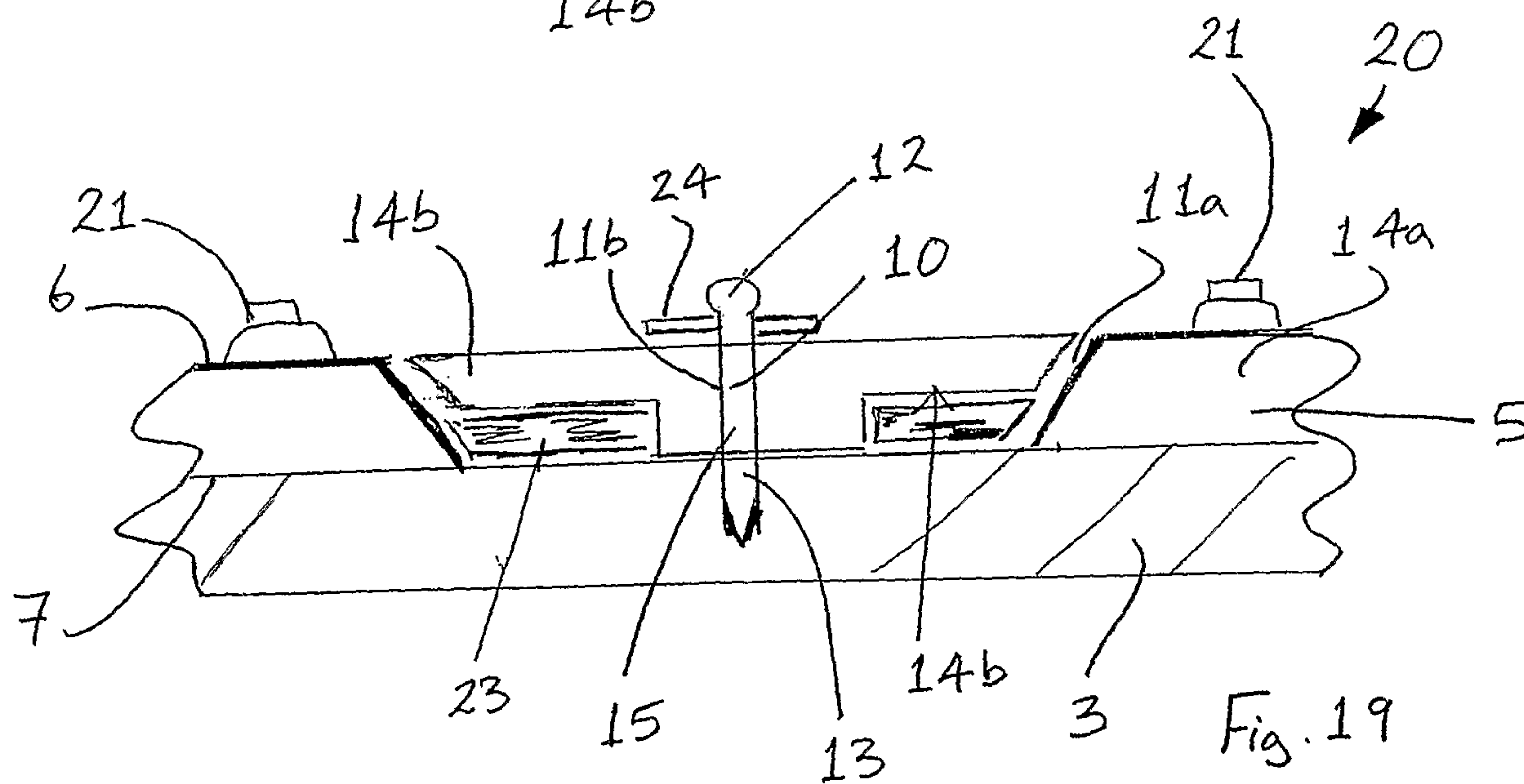
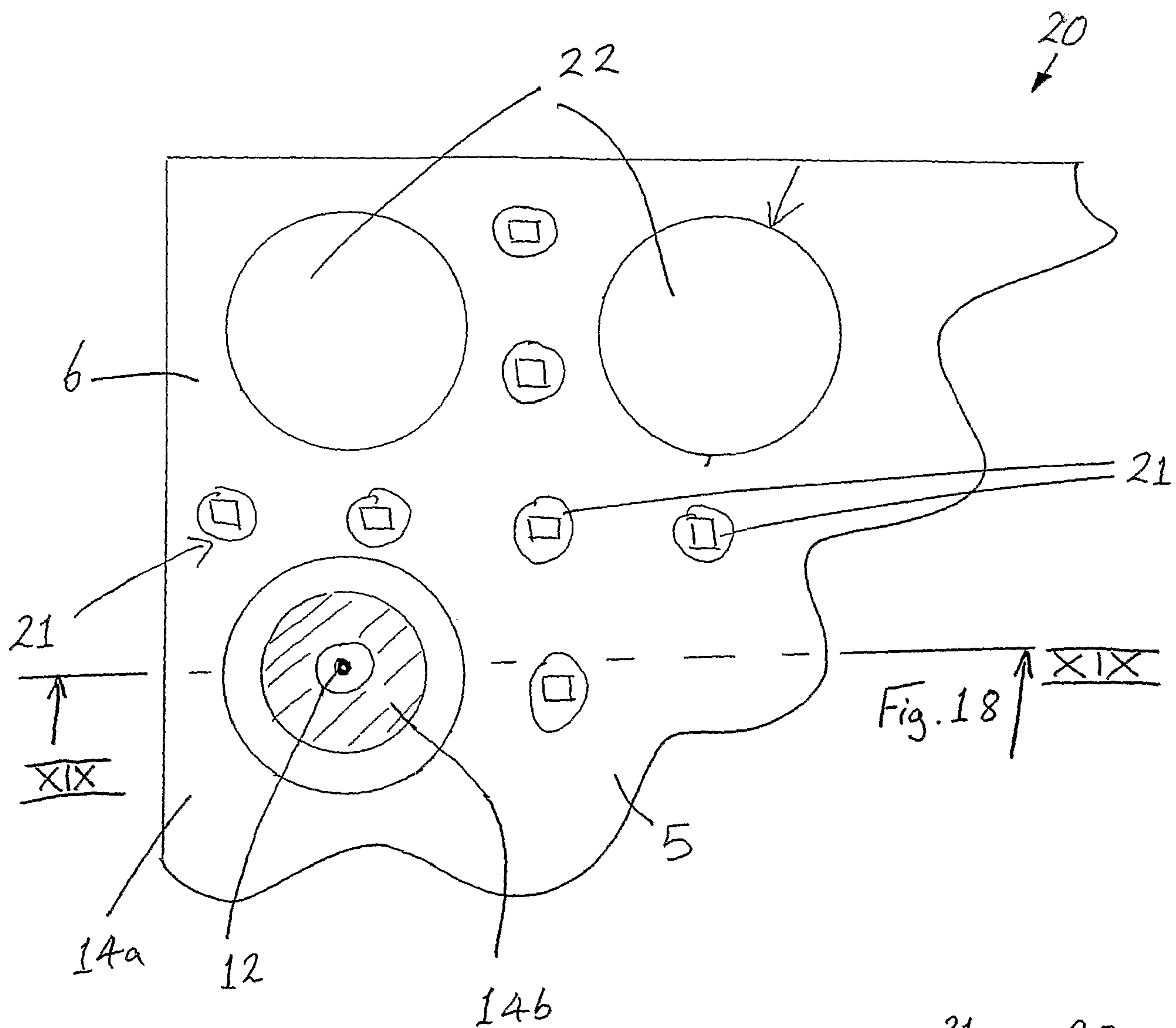




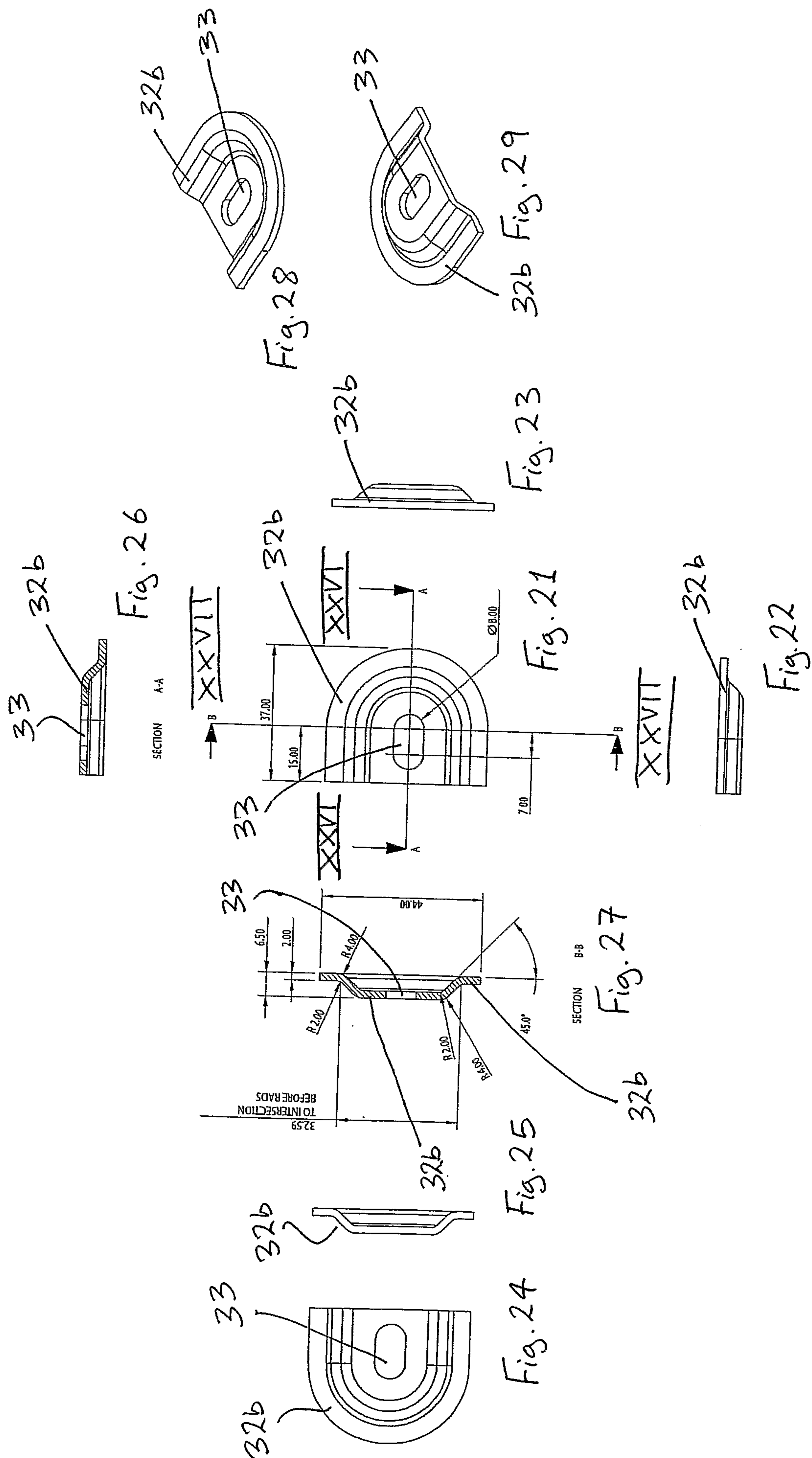


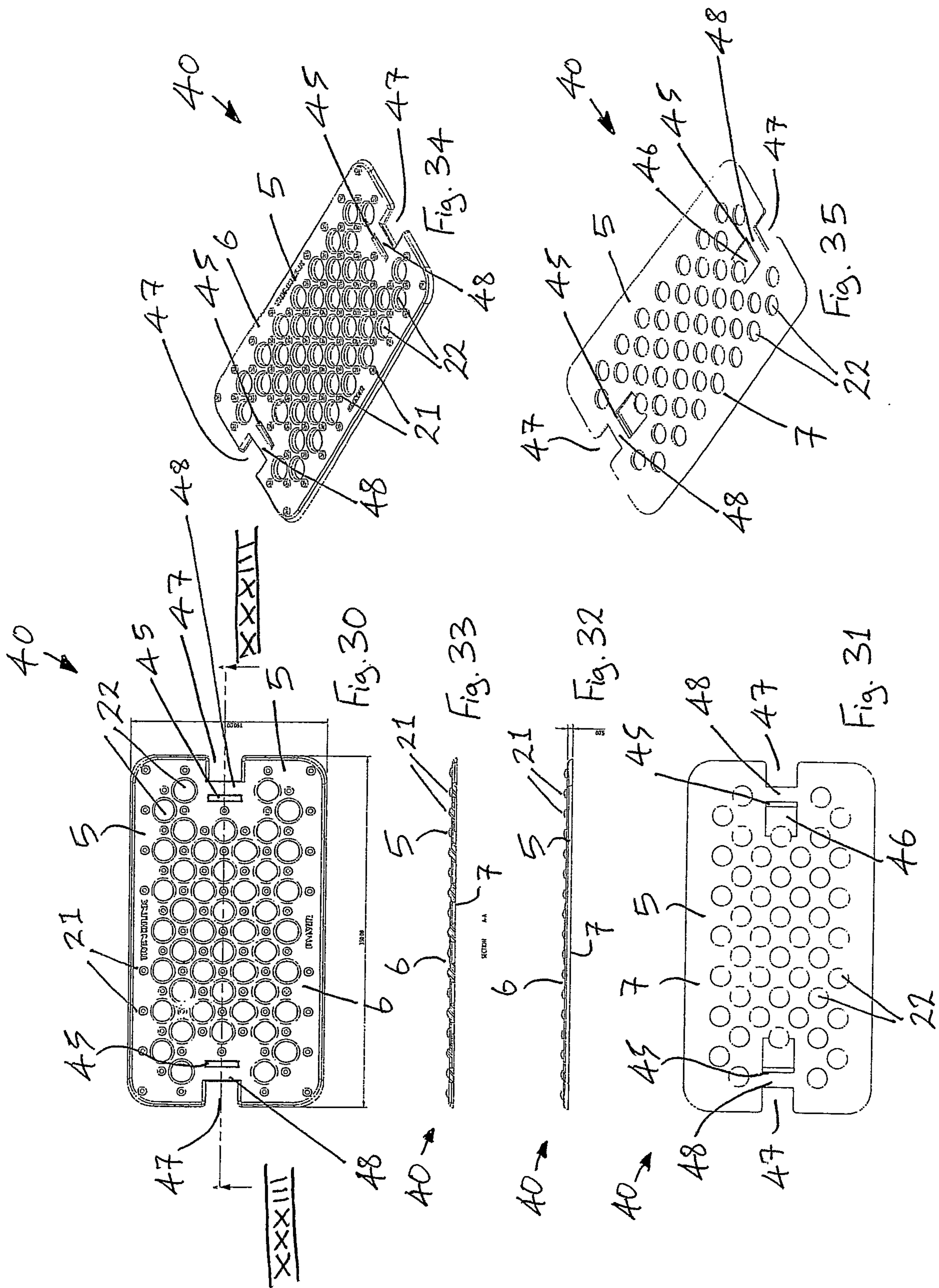












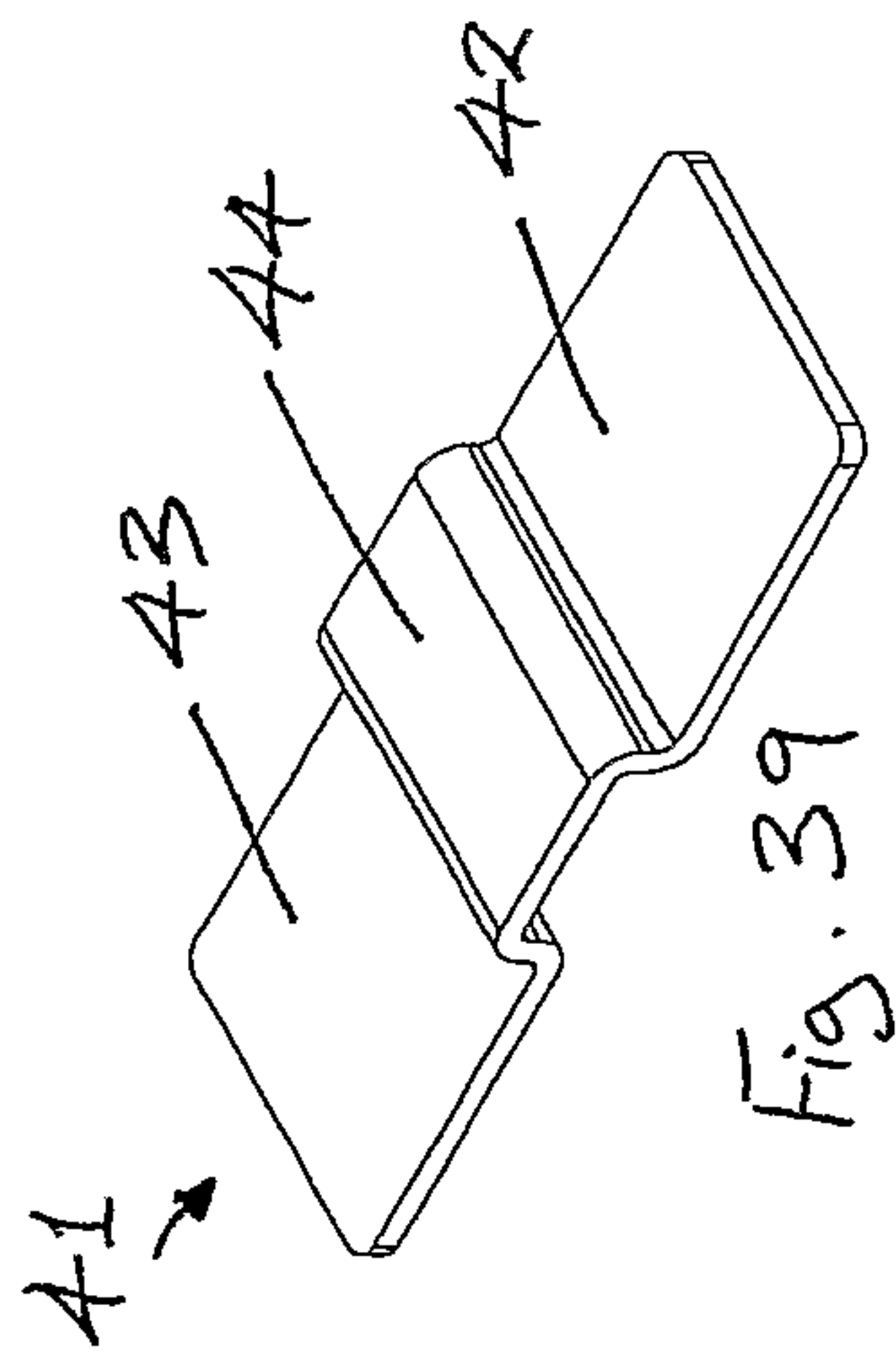


Fig. 39

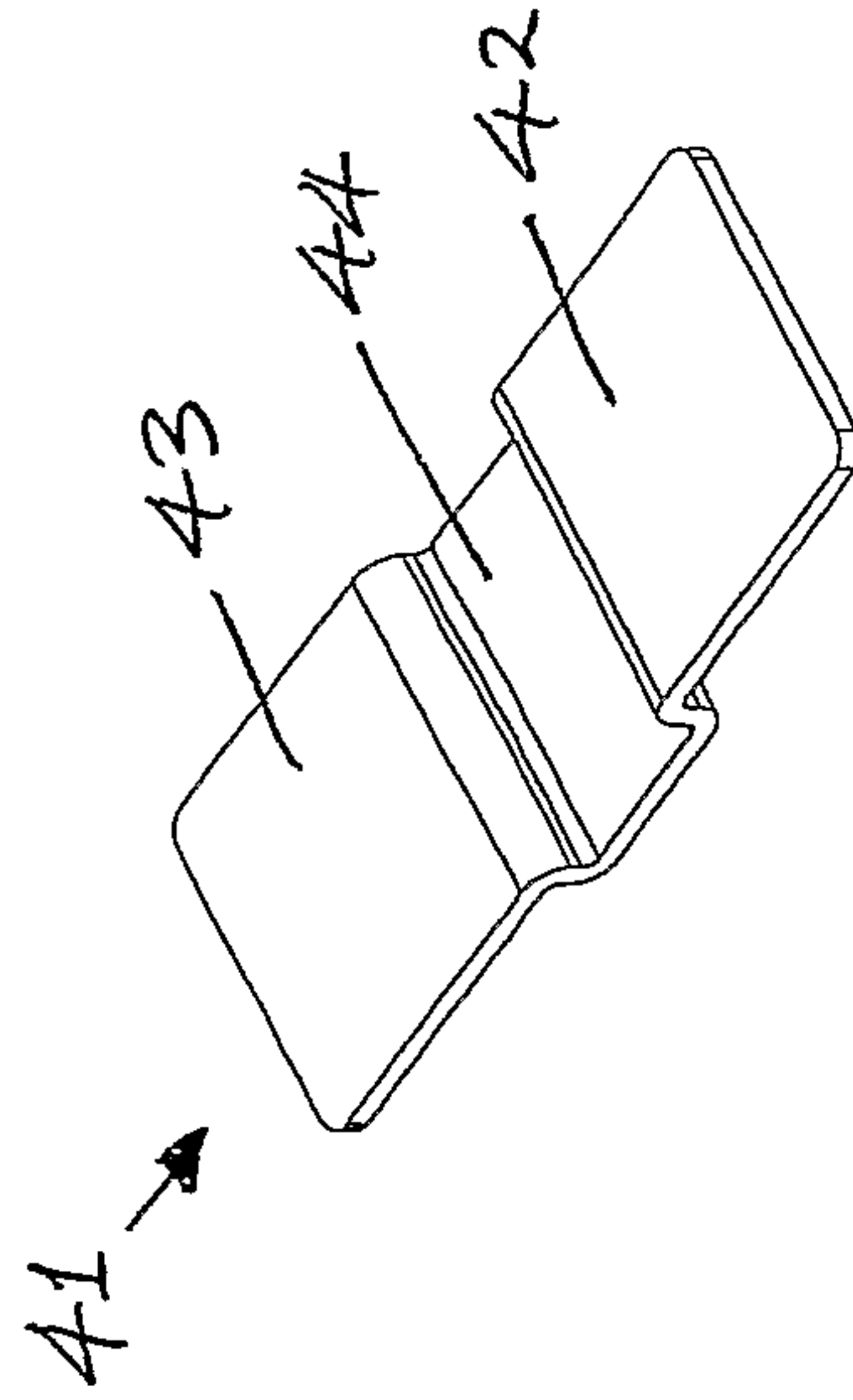


Fig. 38

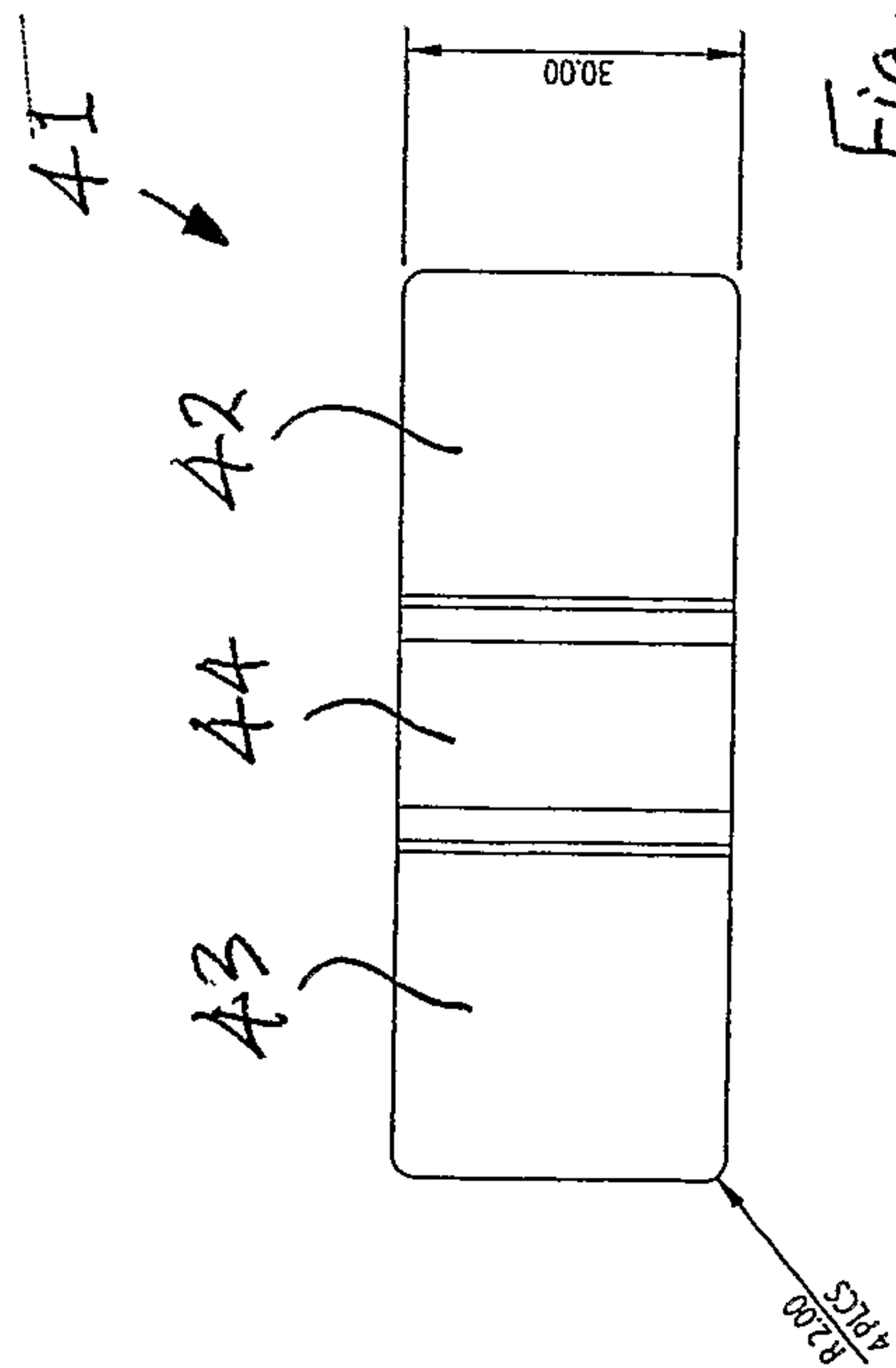


Fig. 36

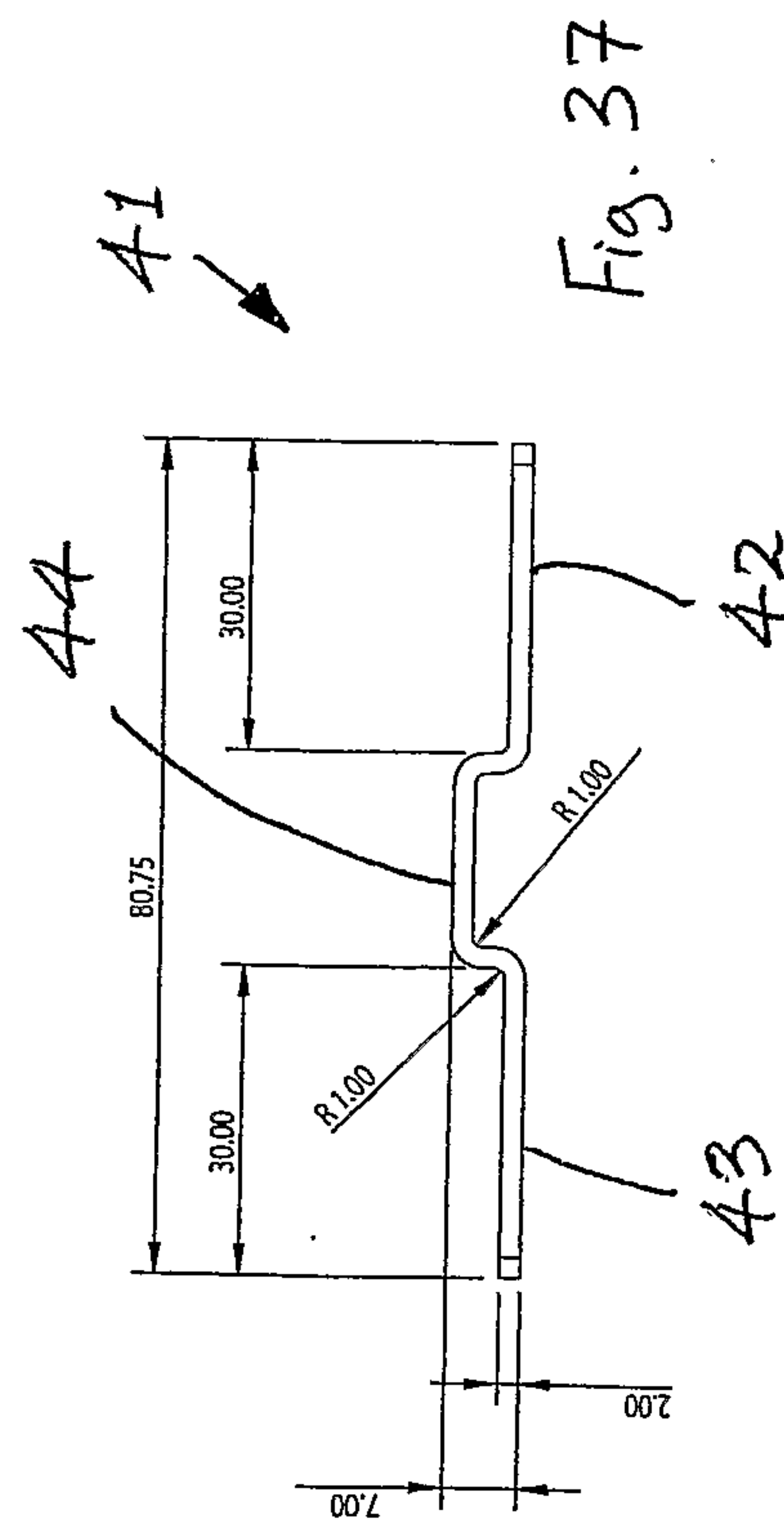
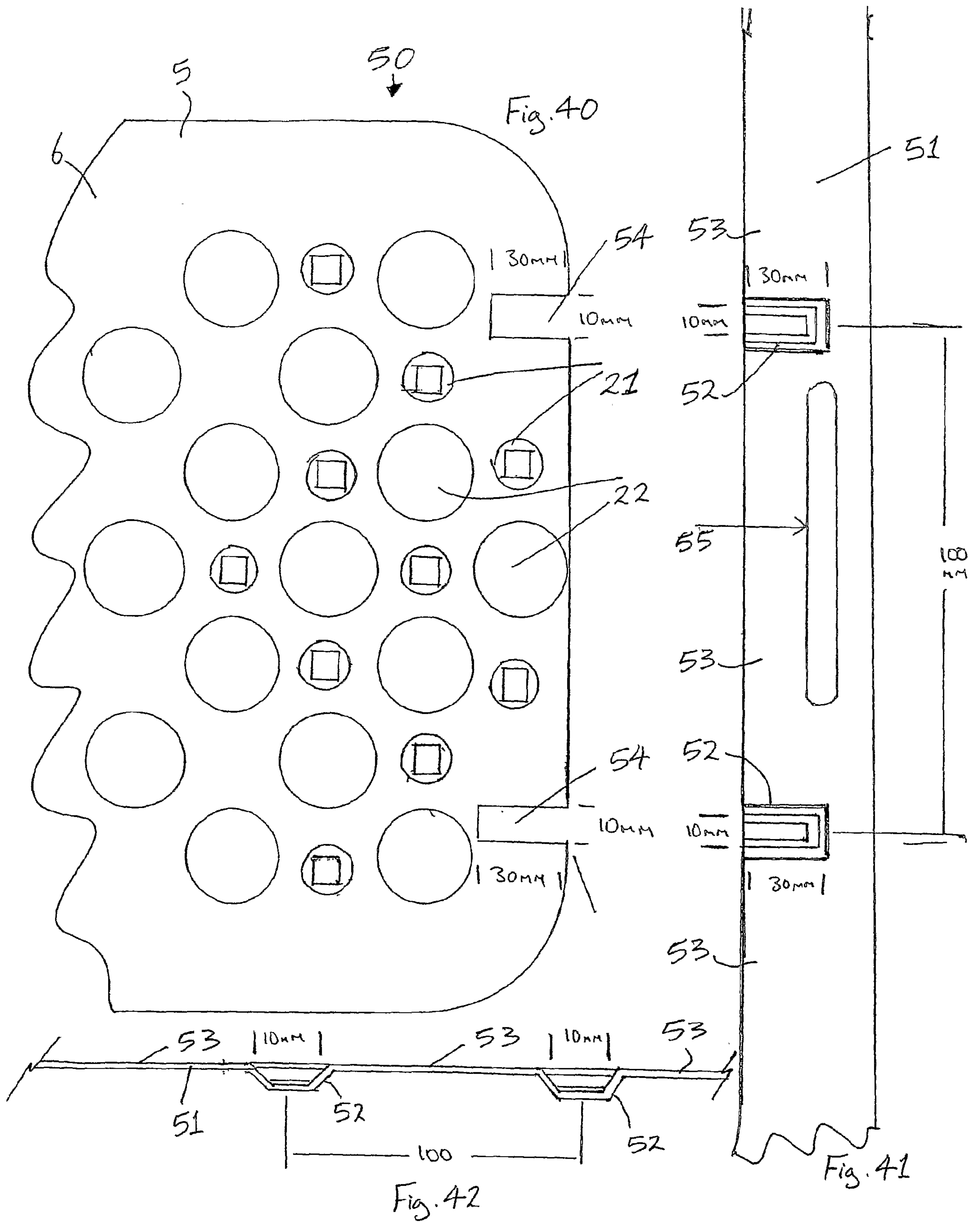


Fig. 37



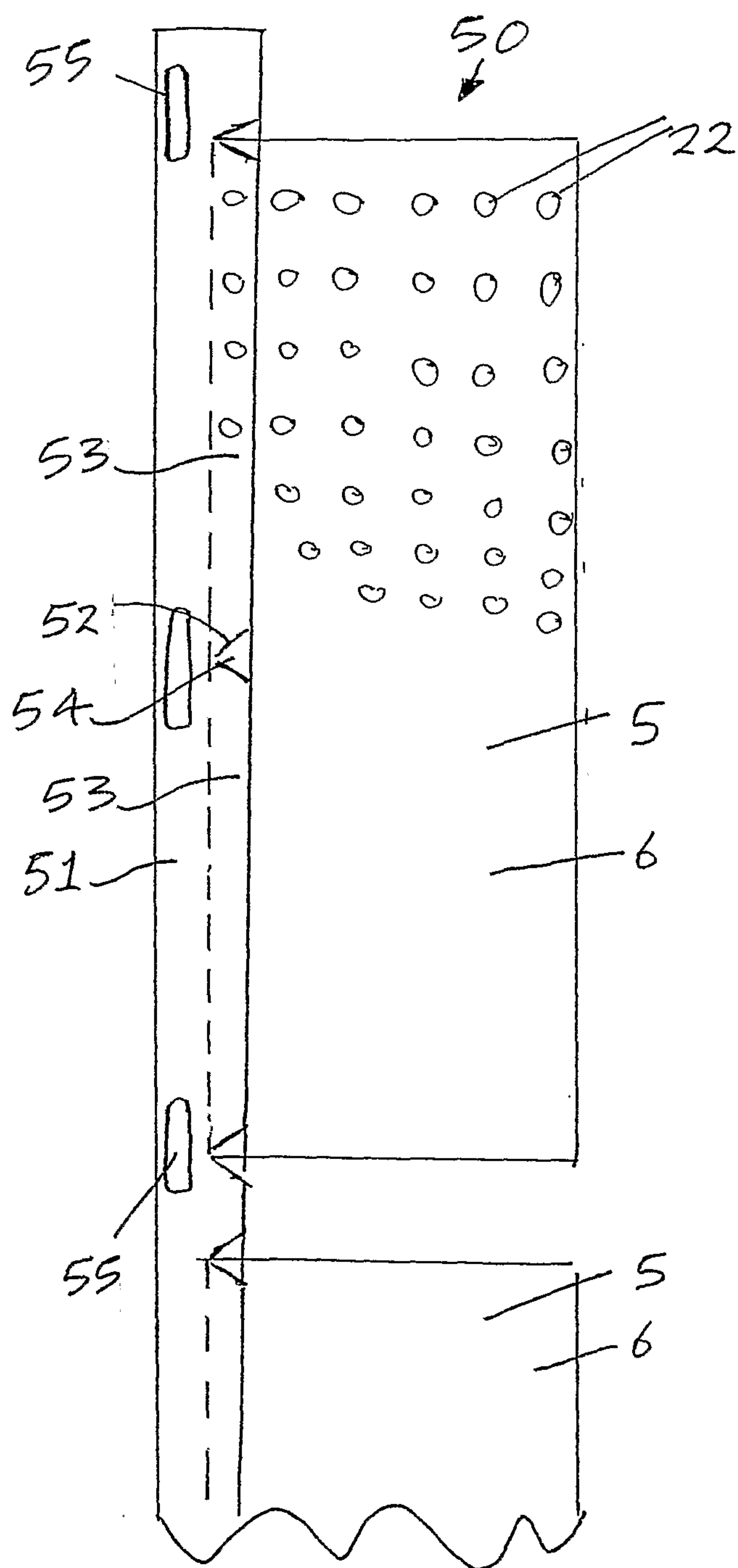


Fig. 44

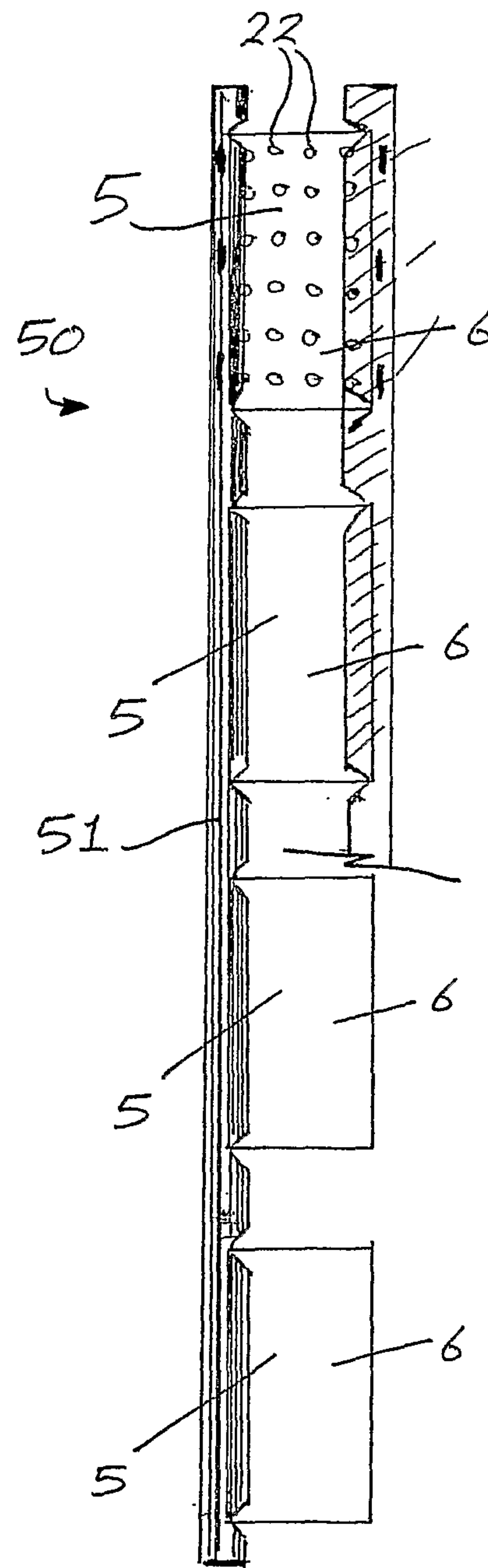


Fig. 43

