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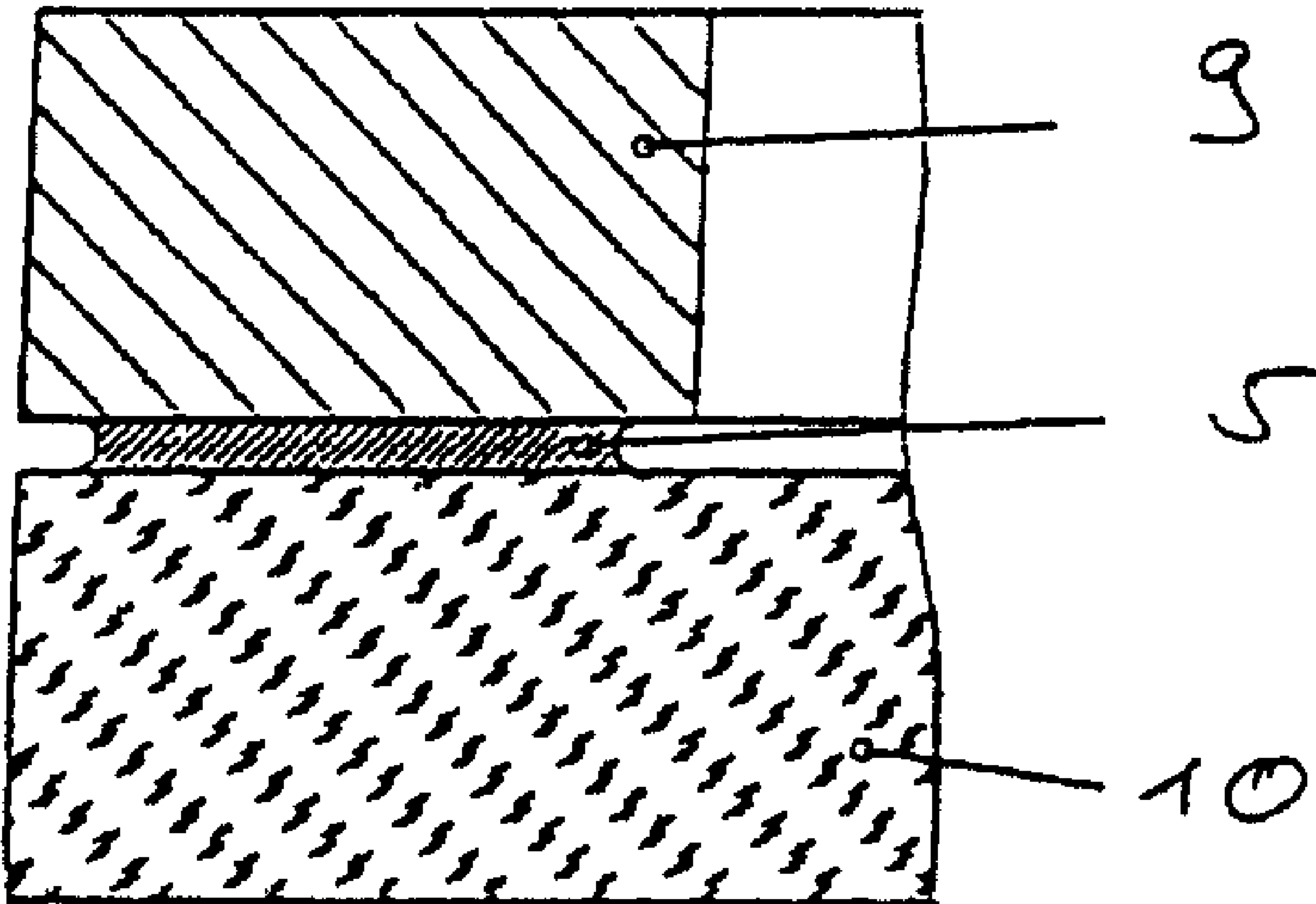
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(54) Title: METHOD FOR HERMETICALLY HOUSING OPTICAL COMPONENTS AND OPTICAL COMPONENTS
PRODUCED ACCORDING TO SAID METHOD



(57) Abrégé/Abstract:

To allow a reliable and inexpensive, preferably hermetic join to be produced between metal sleeve and glass pane in a process for producing a housing body, or at least parts of a housing body, in particular for producing an encapsulation or packaging for



(57) Abrégé(suite)/Abstract(continued):

optoelectronic components, comprising the steps of joining together a housing element and a preferably metallic housing arrangement, bringing housing element and housing arrangement into contact with a glass solder, it is provided that before the housing element and housing arrangement are joined, the glass solder is applied as a shapeable material, in particular as a paste, that the glass solder is pre-vitrified and its shape fixed by energy being introduced at least once, in particular as a result of organic constituents being burnt off, and that after the housing element has been inserted into the housing arrangement, a join which is hermetic at least in regions is produced between pane and housing arrangement.

Abstract

To allow a reliable and inexpensive, preferably hermetic join to be produced between metal sleeve and glass pane in a process for producing a housing body, or at least parts of a housing body, in particular for producing an encapsulation or packaging for optoelectronic components, comprising the steps of joining together a housing element and a preferably metallic housing arrangement, bringing housing element and housing arrangement into contact with a glass solder, it is provided that before the housing element and housing arrangement are joined, the glass solder is applied as a shapeable material, in particular as a paste, that the glass solder is pre-vitrified and its shape fixed by energy being introduced at least once, in particular as a result of organic constituents being burnt off, and that after the housing element has been inserted into the housing arrangement, a join which is hermetic at least in regions is produced between pane and housing arrangement.

**METHOD FOR HERMETICALLY HOUSING OPTICAL COMPONENTS AND
OPTICAL COMPONENTS PRODUCED ACCORDING TO SAID METHOD**

Technical Field

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The invention relates to a process for hermetically housing optical components, in particular for producing a housing body or parts thereof, in which preferably optoelectronic components are hermetically encapsulated or packaged, and
10 also relates to optical components produced in accordance with the process.

Background

15 Hermetically packaged or encapsulated housings are often used to protect sensitive components, such as lasers or photodiodes, from environmental influences and help to ensure a sufficient service life of these components.

20 Hitherto, glass-metal joining technologies which are known per se to the person skilled in the art and in which the housing comprises a metal component and a glass component acting as a window, which are hermetically joined to one another, have been used to produce housings/optical caps of
25 this type.

Housings of this type often comprise a sleeve-like metal body and a glass pane which can be received in the sleeve and serves as a window. In the known production of
30 housings/optical caps of this type, the metal and glass components were joined by means of a glass solder arranged in the form of a ring which was used as a sintered shaped part. In this case, before the components were actually joined

together, the glass solder shaped part had to be produced in a separate operation using sintering technology. Then, the shaped part was inserted in an accurately fitting manner into the sleeve-like metal component and covered with the round glass pane. This was followed by the fusion operation in which sleeve and glass pane were joined to one another in a hermetic and force-fitting manner. To ensure the desired hermetic sealing of the housing, the position and shape of the glass solder between metal sleeve and glass pane in each case had to be adapted in an appropriate way. Tight tolerances have to be observed both for the housing components and for the glass solder. Therefore, considerable attention has to be paid when producing and inserting the glass solder shaped parts, which is time-consuming and expensive. Often, in particular in the case of inclined joining surfaces, it was nevertheless impossible to prevent high scrap rates, since any running of the glass solder shaped parts led to inaccurate application.

Furthermore, this technology is confronted with pronounced feasibility limits as soon as the glass window is no longer required in the form of a round disk, but rather with a polygonal contour, in particular as a right angle or in other shapes which deviate from a simple round geometry or the surface which is to be covered with glass solder is not horizontal or convex in shape. On account of their shape, there are very considerable restrictions on the glass solder shaped parts which can be produced by sintering technology, especially with the degree of accuracy required.

30

The conventional process is also unsuitable for optical caps, the windows of which are arranged obliquely in the metallic sleeve, on account of an excessive quantity of solder and on account of the solder ring slipping before it is melted or during the soldering operation.

35

Summary

The invention is based on the object of developing an accurate process, which can be used for various housing geometries,
5 which allows a reliable and inexpensive, preferably hermetic, join to be produced between metal sleeve and glass pane.

Certain exemplary embodiments can provide a process for producing a housing body, or at least parts of a housing body,
10 in particular for producing an encapsulation or packaging for optoelectronic components, comprising the steps of: joining together a housing element and a housing arrangement; bringing the housing element and the housing arrangement into contact with a glass solder; wherein before the housing element and
15 the housing arrangement are joined, the glass solder is applied as a shapeable material, in particular as a paste; wherein the glass solder is pre-vitrified and its shape fixed by energy being introduced at least once, in particular as a result of organic constituents being burnt off; and wherein
20 after the housing element has been inserted into the housing arrangement, a join which is hermetic at least in regions is produced between a glass pane as the housing element and the housing arrangement by heating.

25 There are considerable advantages if the glass solder is applied as a shapeable material, in particular as a paste, before the housing element and housing arrangement are joined and the glass solder is pre-vitrified and its shape fixed by energy being introduced at least once, in particular as a
30 result of organic constituents being burnt off, since it is possible for virtually any shape, both two-dimensional planar shapes and convex shapes, to be provided with glass solder in a locally accurately defined manner. After the housing element

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has been inserted into the housing arrangement, it is then possible to produce a hermetic join, at least in regions, between pane and housing arrangement by heating.

- 5 In a particularly preferred embodiment, the housing element comprises a window which consists of glass, and the housing arrangement comprises a housing cap.

10 The glass solder paste can advantageously be applied at least in regions to the glass pane and/or the housing cap, it being possible to exactly set the height of glass solder applied and also the quantity of glass solder applied by means of the glass solder being applied more than once.

- 15 If the glass solder paste is applied into the housing cap to a bearing surface arranged in the peripheral region, it is

possible, given a continuous arrangement of the glass solder, to produce a completely hermetic join.

5 It is useful, in particular when relatively large quantities of glass solder are used, if the glass solder paste is applied to the bearing surface in the housing cap in a solder region which is delimited from the remainder of the bearing surface by a bead.

10 Surprisingly, the glass solder paste can be applied to an antireflection coating or scratch proof layer which is arranged on the surface of the housing element, in particular of the window, so that it is possible to mount high-quality optical elements, such as for example lenses, spherical
15 lenses, cylindrical lenses or also optical filters, such as DWDM filters or gratings.

It is advantageous if the shaping of the glass solder paste, in particular the cross section or the thickness of an
20 applied section, is influenced and/or set by setting the rheological properties of the paste, since in this case the viscosity of the glass solder paste can be adapted to the particular mounting conditions; thinner ribbons of solder can be produced at lower viscosities and thicker ribbons of
25 solder at higher viscosities. Furthermore, the running of the applied ribbon of solder can be influenced or matched to the mounting process by means of its viscosity.

If the glass solder paste is applied in metered form by means
30 of a metering apparatus, in particular a dispenser and preferably by means of a needle dispenser, it is even possible for obliquely running surfaces or surfaces which have a complex three-dimensional profile to be reliably provided with glass solder in an accurately predefined way.
35 As a result, by way of example, even cylindrical surfaces of

housings or cylindrical lenses, for example in optical recording or writing systems which scan in the x and/or y directions, to be joined to one another. It is extremely advantageous if the metering apparatus is an annular or
5 rectangular dispenser provided with a nozzle, since, given a suitable application geometry, it is then possible for a single, metered and preferably time-/pressure-controlled application to suffice to apply the entire quantity of glass solder required.

10

As an alternative or in addition, it is also possible for the thickness of the ribbon of the glass solder applied in paste form to be influenced and/or set in an advantageous way by suitable selection of the dispenser needle or the dimensions
15 of the nozzle.

Relatively large surface areas can advantageously likewise be coated with glass solder in a single application operation if the glass solder paste is applied by means of stencil
20 printing, in particular by means of screen printing technology, to the glass pane.

If there is a multiplicity of identical or similar elements, manufacturing can be made inexpensive by first of all
25 applying a glass solder with a predefined surface geometry to a mother pane, which defines or comprises a multiplicity of individual panes, by the glass solder being pre-vitrified and its shape fixed by introduction of energy, in particular as a result of organic constituents being burnt off, individual
30 panes being divided from the mother pane, and the individual pane with pre-vitrified glass solder being inserted into the housing cap and a hermetic join between glass pane and housing cap being produced by the action of heat.

It is advantageous for the individual pane to be divided from the mother glass pane by scoring and breaking or by means of laser cutting.

5 In order to be able to benefit from all advantages, in particular including the advantages of conventional processes, in the case of geometries which comprise simple and more complex structures, it is also possible for a sintered glass shaped body and pasty glass solder to be
10 applied to the housing body and/or the housing element in order in this way for larger quantities of glass solder to be applied by means of the sintered glass shaped body and complex structures to be applied by means of the pasty glass solder.

15 Furthermore, housing bodies with a portion of a pre-vitrified glass solder already represent products which can be marketed independently, since a purchaser can place his own housing elements, such as for example windows, lenses or filters,
20 into the housing body and can hermetically secure them therein by heating or the introduction of energy.

A particularly preferred housing body comprises a metallic, sleeve-like cap, a housing element, which preferably includes
25 a glass pane serving as a window, and a glass solder arranged between window and metal cap.

Brief Description of the Drawings

30 The invention is described in more detail below on the basis of preferred embodiments and with reference to the appended drawings, in which:

Fig. 1 shows part of a housing body which comprises the
35 optical cap of an optoelectronic component, in the present case a semiconductor laser, in the form of a cross-sectional illustration in the plane of the

- longitudinal axis X of the optical cap,
- Fig. 2 shows a view into the optical cap illustrated in Figure 1 in the direction marked by arrow Y in Fig. 1,
- 5 Fig. 3 shows a detail of a cross-sectional view of a rectangular optical cap which is illustrated in its entirety in cross section in Fig. 4,
- Fig. 4 shows a cross-sectional view through a rectangular optical cap showing the position of the detail illustration from Fig. 3,
- 10 Fig. 5 shows a plan view onto the rectangular optical cap illustrated in Fig. 3 and 4,
- Fig. 6 shows a plan view onto a further embodiment of a rectangular optical cap,
- 15 Fig. 7 shows a cross-sectional illustration of the rectangular optical cap from Fig. 6 along the plane BB illustrated in Fig. 6,
- Fig. 8 shows a detail from Fig. 7 denoted by V in Fig. 7,
- Fig. 9 shows a detail from Fig. 6 denoted by W in Fig. 6,
- 20 Fig. 10 shows a further embodiment of an optical cap in the form of a partially cross-sectional illustration in a plane which encompasses the longitudinal axis X- of this optical cap,
- Fig. 11 shows a mother pane with a multiplicity of windows which can each be divided up to form individual windows which can be mounted independently,
- 25 Fig. 12 shows a detail illustration of the mother pane illustrated in Fig. 11 after the application of glass solder,
- 30 Fig. 13 shows a cross-sectional illustration through the detail view from Fig. 12 along plane CC,
- Fig. 14 shows a cross-sectional illustration through an optical cap and a dispenser having an annular or rectangular nozzle before and after application of the glass solder paste.
- 35

Detailed Description of Embodiments

In general, the invention uses a glass solder which can be applied as a shapeable material, preferably a glass solder paste, as the join between, for example, a metal sleeve, which forms a housing body, and, for example, a glass pane, which forms a housing element. With the glass solder in the form of a paste, it is possible for the shape of the glass solder to be very accurately matched to the geometry of the corresponding individual parts.

In this way, it is possible to realize virtually any desired shape of the glass solder, and even complicated surface geometries can be reliably realized in a very accurate form by suitable selection of the corresponding application technique.

Since the shape of the paste can still be altered after it has been applied, the paste can compensate for any dimensional inaccuracies which may still be present. Consequently, the metal sleeve and window can be joined together with a more accurate fit than that provided by the individual components alone.

The position and shape of the glass solder paste is only fixed during a subsequent thermal process, for example after the organic constituents have been burnt off. There is generally no longer any need for an additional operation to produce a separate glass solder shaped body. This process can advantageously also be used to realize optical caps in which the glass window is installed obliquely.

On account of the adhesive force of the paste, the shape of the paste is retained after it has been applied either to the

glass pane or preferably to the metal sleeve. There is no longer any likelihood of undesirable slipping of the ribbon of solder prior to the fusion operation, since the respective local quantity of glass solder applied can be metered very accurately and is not adversely affected by the shape of sintered glass solder parts, for example by the minimum thickness required for such parts.

The following text describes specific and preferred embodiments of the invention on the basis of various housing bodies and housing elements, such as standard optical caps for T052, T005 bases or also inclined optical caps for T052 bases.

In the description which follows, identical reference symbols are used for identical or similar parts of the respective embodiments which differ from one another. Furthermore, the illustrations in the various figures are not necessarily to scale, in order not to detract from the clarity and comprehensibility of the essence of the invention.

Fig. 1 illustrates an optical cap, denoted overall by reference numeral 1, during the production operation. This optical cap 1 comprises a cylindrical or frustoconical metal sleeve 2 with a through-opening 3 in its base surface 4.

The through-opening 3 is suitable for allowing, for example, the light of a laser beam or light under the influence of optical elements, such as for example lenses or filters, to pass through it.

According to the invention, a pasty glass solder layer 5 is applied to the inner side of the base surface 4, in the present example completely surrounding the opening 3 as a ribbon of solder using a needle dispenser.

The completely continuous circle which is formed as a result can be seen more clearly from Fig. 2, which shows a view into the optical cap illustrated in Figure 1 from the direction indicated by arrow Y in Fig. 1. As can be seen from Figure 1, the needle 6 of a needle dispenser moves into the interior of the metal sleeve 3 and applies the pasty glass solder layer 5 to the lower-side end 7 thereof. Needle dispensers of this type are marketed, for example, by Sieghard Schiller GmbH & Co. Kg., Sonnenbuehl, Germany, under the trade name Inline Dispenser.

This makes it possible to achieve lateral tolerances of the glass solder layer applied of $\pm 10 \mu\text{m}$, and within these tolerances it is possible to effect further needle adjustments, also allowing multiple coating operations to be carried out next to or on top of one another with the same level of accuracy.

High levels of accuracy are realized using piezo-translational adjustment systems, the adjustment or advancing movement of which can if necessary also be controlled by interferometry. This results in accuracies in the range of less than $1 \mu\text{m}$. Preferred thicknesses for the applied glass solder paste start from a solder ribbon thickness of approximately $500 \mu\text{m}$, which corresponds approximately to the width of an applied line; there is no restriction to the width of the paste according to the invention.

The application operation comprises controlling or setting the speed of movement of the dispenser needle at least during application of the glass solder paste, the pressure under which the glass solder paste emerges and the time for which the glass solder paste emerges, so that it is in this way possible to set the layer thickness of a particular single

application.

In the case of the application operation illustrated in Fig. 1, the needle 6 is tilted through an angle α of approximately 30 degrees $\pm$ 3 degrees relative to the longitudinal axis X of the optical cap 1 and is displaced parallel to the lower base surface 4 along an ellipse which is oblique with respect to the axis X. The inclination of the base surface 4 is also approximately 30 degrees relative to the longitudinal axis X.

Alternatively, the needle 6 can be guided parallel to the longitudinal axis Y of the optical cap illustrated in Fig. 1.

Repeat applications can be carried out in regions or over the entire periphery in order to achieve thicker layers or layers with a thickness which increases in steps.

After the glass solder has been applied, the metal sleeve 2 together with the glass solder layer 5 is heated, with the result that the pasty glass solder layer 5 is vitrified and then fixed in position. In the process, organic constituents of the pasty glass solder are removed.

The result after this process step is a metal sleeve which can be marketed independently and into which, by way of example, further elements can be introduced by an end user and then fixed in position relative to the metal sleeve 2 by heating.

In general terms, the glass solder used may be all glass solders marketed by Schott Glas, for example the glass solders bearing designations 8465, 8467, 8468, 8470, 8471, 8472, 8474 and composite glass solders designated by the

numbers G017-002, G017-344, G017-339, G017-340, G017-383, G017-393, G017-334, as well as crystallizing glass solders, such as for example the glass solders 8587, 8593, 8596, 8597, and glass windows can preferably be soldered in as housing
5 elements, these windows each having a higher thermal stability, i.e. a higher temperature T_g , than the corresponding soldering temperature of the glass solder used.

Preferred glasses include special glasses designated D263,
10 AF37, AF45, B270, BorofloatTM33 and Borofloat40 produced by Schott Glas, Mainz.

The sleeve-like housing cap preferably consists of a metallic alloy which contains certain amounts of nickel, such as for
15 example the alloy designated NiFe47.

A plurality of optical caps, which are not shown in the figures for the sake of simplicity, can be coated in parallel using multi-needle dispensers. In this case, metal sleeves
20 with identically oriented positions are arranged in multiple carriers and coated in a single operation using multi-needle systems.

A depression 7 in the metal sleeve 3, by interacting with a
25 correspondingly shaped lug in a carrier, allows all the optical caps to be simultaneously positioned in an accurate angular position. Several hundred optical caps can be held on carriers of this type and provided with glass solder paste using multi-needle dispensers operating as steppers.

30 After the glass solder has been vitrified, it is possible for a housing element, such as for example a pane of glass 8, which is shown in its mounted position in Fig. 10, to be placed into the sleeve 2. The glass pane 8 consists of one of
35 the abovementioned glasses produced by Schott Glas, Mainz.

After the glass pane has been inserted, the arrangement comprising metal sleeve 2 and glass pane 8 can be heated, with the result that the glass solder layer 5 softens and then produces a hermetically sealed soldered join between the pane 8 and the sleeve 2. The glass pane 8 consists of the abovementioned glass designated D263 and produced by Schott Glas, Mainz.

10 The dispensing of the glass solder using a multi-needle system is preferably carried out using a dispenser head with 2, 4 or 8 needles, which multiplies the productivity of the application by the number of needles.

15 The offset control of the dispenser needles with respect to one another can be implemented by a needle control station. The resulting needle position correction is realized by adjustment axes which are independent of one another, each needle being equipped with its own independent system of
20 axes.

In a further preferred embodiment, the pre-vitrification operation can be carried out together with the soldering-in operation as part of a single heating step, which has a
25 correspondingly longer duration in order to allow organic constituents to be burnt off. Subsequent cleaning of the assembly formed may, although this is not generally necessary, remove residues of the organic constituents.

30 Furthermore, as an alternative to round through-openings 3 and glass panes 8, it is also possible to use rectangular, elliptical, oval or polygonal openings 3 and glass panes 8 or openings 3 and glass panes 8 which are specifically shaped for the particular application, or for optical elements 8 to
35 be secured to the housing elements 2.

Fig. 3 illustrates a rectangular metallic carrier 9 to which a glass pane 10 has been secured by means of a glass solder layer 5.

5

The invention differs from conventional processes, in which hitherto metal layers had to be applied to the glass in order to secure rectangular glass panes of this type to metallic carriers, which were then soldered to the carrier 9 using a metal solder. The process according to the invention no longer requires metal coating of this type, and consequently this form of attachment is very inexpensive and time-efficient.

15 Nevertheless, for example in the case of housings for optical CCD sensors, the glass pane 10 may have an antireflection coating 11, 12 on one or both of its main surfaces.

It is also possible for scratch proof layers to be applied to the glass pane 10, likewise in conjunction with antireflection coatings. It can be seen from Fig. 5, which shows a plan view of the rectangular optical cap illustrated in Figs. 3 and 4, that the glass pane 10, once the housing is complete, may, for example, be arranged in front of a CCD array 13.

25

As an alternative to the CCD array 13, it is also possible for adjustable micromechanical mirror systems, for example of TV and video projection devices, or other elements to be encapsulated with a rectangular input or output window.

30

Fig. 6 shows a further embodiment of a housing arrangement according to the invention, in which, however, the glass pane 10 does not have the same side dimensions as the metallic carrier 9.

35

In this embodiment, the metallic carrier 9 has a web 14 which defines a bead 15 in which the glass solder layer 5 is arranged on a support defined by the carrier 9. The glass solder is laterally delimited by the web 14 and the bead 15 and it is also possible to use softer, more free-flowing glass solder with a lower viscosity.

In the embodiment illustrated in Figs. 6 to 9 it is possible for a metallic edge region 16 to be used for further holding purposes, for example at an external assembly 17. The edge region 16 may, for example, be used for a seal to bear on in the case of recloseable housings or windows or may be applied to external housings by means of further securing techniques, such as for example adhesive bonding or soldering. The metallic carrier may therefore form part of a complex housing structure, in particular a larger housing cap.

As an alternative to being applied to a metallic carrier or a metal sleeve, it is also possible for the glass solder layer 5 to be applied to a glass, as illustrated, for example, in Figs. 11 to 13.

Furthermore, without restricting the general scope of the invention, it is also possible for glass solder to be applied both to the metallic sleeve 2 or the carrier 9 and to a glass pane or a further housing element.

It is also possible for conventional sintered shaped parts to be used together with the pasty glass solder, in which case, by way of example, more complex shapes can be applied adjacent to a sintered shaped part using a needle dispenser or printed on using the techniques described below.

Fig. 11 shows a mother plate 18 on which a multiplicity of preferably identically shaped window surfaces 19 to 24 are defined by the application of the glass solder layer 5.

- 5 Although the glass solder layer 5 can in this embodiment too be applied using multi-needle dispensers, the stencil printing technique, in particular the screen printing technique, is preferred for this purpose.
- 10 If screen printing is used, it is likewise possible, by suitable selection of the screen, together with setting of the rheological properties of the glass solder paste, to influence the thickness of the glass solder layer 5.
- 15 According to the invention, the glass solder layer 5 can be printed onto a single-piece mother plate 18 in pre-defined form, pre-vitrification can be effected by heating, and it is then possible for the individual panes or the window surfaces 19 to 24 to be divided up along breaking edges 25, 26 and 27, 20 for example by scoring and breaking the mother plate 18.

As an alternative to scoring and breaking, it is also possible to use other cutting or dividing operations, such as for example laser cutting or ultrasound cutting.

25

- As an alternative, it is also possible for a multiplicity of window surfaces 19 to 24 which have already been divided up to be held together by the mother plate 18, which is then designed as a rectangular frame, and this arrangement can be 30 suitably printed and pre-vitrified.

The pre-vitrification can be carried out before or after the respective window surfaces 19 to 24 have been divided into individual window surfaces.

Furthermore, in a further configuration of the invention, as diagrammatically depicted, for example, in Fig. 14 for the optical cap illustrated in Fig. 10, it is possible for a
5 completely continuous ribbon of solder 26 to be applied by means of just a single application operation. This is done with the aid of a dispenser 27 which has an annular nozzle 28 and preferably also comprises a time/pressure control device for the application operation.

10

Furthermore, the mother plate 18 illustrated in Fig. 11 can also be printed in steps using a correspondingly shaped rectangular single or multiple nozzle, with a stepper apparatus in each case producing an offset preferably by the
15 width or length of one window surface of the windows 19 to 24.

The processes described above make it possible for even extremely small and complicated glass geometries to be
20 provided with a glass solder layer with the required degree of accuracy, so that they are suitable even for use in the housing of extremely small assemblies, including even individual micromechanical elements, MEMs.

Claims

1. A process for producing a housing body, or at least parts of a housing body, in particular for producing an encapsulation or packaging for optoelectronic components,
5 comprising the steps of:

joining together a housing element and a metallic housing arrangement;

bringing the housing element and the housing arrangement into contact with a glass solder;

10 wherein before the housing element and the housing arrangement are joined, the glass solder is applied as a shapeable material, in particular as a paste;

wherein the glass solder is pre-vitrified and its shape fixed by energy being introduced at least once; in
15 particular as a result of organic constituents being burnt off; and

wherein after the housing element has been inserted into the housing arrangement, a join which is hermetic at least in regions is produced between a glass pane as the
20 housing element and the housing arrangement by heating.

2. The process as claimed in claim 1, wherein the housing element comprises a window which consists of glass and the housing arrangement comprises a housing cap.

25 3. The process as claimed in claim 1 or 2, wherein the glass solder paste is applied at least to regions of the glass pane or the housing cap.

4. The process as claimed in claim 1, 2 or 3, wherein the glass solder paste is applied into the housing cap on a bearing surface arranged in the peripheral region.

5. The process as claimed in one of claims 1 to 4,
5 wherein the glass solder paste is applied to the bearing surface in the housing cap in a solder region which is delimited from the remainder of the bearing surface by a bead.

6. The process as claimed in one of claims 1 to 5,
10 wherein the glass solder paste is applied to a polygonal, preferably rectangular glass pane or housing cap.

7. The process as claimed in one of claims 1 to 6,
wherein the glass solder paste is applied to an antireflection coating or scratch proof layer which is
15 arranged on the surface of the housing element, in particular of the window.

8. The process as claimed in one of claims 1 to 7,
wherein the shaping of the glass solder paste, in particular the cross section or thickness of an applied
20 section, is influenced or set by setting the rheological properties of the paste.

9. The process as claimed in one of claims 1 to 8,
wherein the glass solder paste is applied in metered form by means of a metering apparatus including a dispenser or
25 a needle dispenser.

10. The process as claimed in claim 9, wherein the metering apparatus is an annular or rectangular dispenser provided with a nozzle.

11. The process as claimed in claim 9 or 10, wherein the
5 thickness of the ribbon of glass solder applied in paste form is influenced or set by selecting the dispenser needle or the dimensions of the nozzle.

12. The process as claimed in claims 9 to 11, wherein the glass solder is pressed out of the needle under
10 pressure/time control or the speed of displacement of the dispenser needle is set at least during application of the glass solder paste.

13. The process as claimed in one of claims 1 to 7, wherein the glass solder paste is applied to the glass
15 pane by means of screen-printing technology.

14. The process as claimed in claim 13, wherein the shaping of the glass solder paste, in particular the thickness of the ribbon of solder, is influenced or set by virtue of the paste being applied more than once.

20 15. The process as claimed in claims 13 and 14, wherein the shaping of the glass solder paste is influenced or set by the geometry of the screen or of a printing stencil.

16. The process as claimed in one of claims 13 to 15,
wherein:

first of all a glass solder with a predefined
surface geometry is applied to a mother pane, which
5 defines or comprises a multiplicity of individual panes;

the glass solder is pre-vitrified and its shape
fixed by introduction of energy, in particular as a
result of organic constituents being burnt off;

individual panes are divided from the mother pane,
10 and the individual pane with pre-vitrified glass solder
is inserted into the housing cap; and

a hermetic join between glass pane and housing cap
is produced by the action of heat.

17. The process as claimed in one of claims 12 to 16,
15 wherein the individual pane is divided from the mother
glass pane by scoring and breaking or by means of laser
cutting.

18. The process as claimed in one of claims 1 to 17,
wherein a sintered glass shaped body and pasty glass
20 solder are applied to the housing body or the housing
element.

19. A housing body which is producible or has been
produced by the process as claimed in one of
claims 1 to 18.

25 20. The housing body as claimed in claim 19, which
comprises a portion of a pre-vitrified glass solder.

21. The housing body as claimed in claim 19 or 20, comprising a metallic, sleeve-like cap, a housing element, which includes a glass pane serving as a window, and a glass solder arranged between window and metal cap.

5 22. The housing body as claimed in claim 21, which comprises an optical cap for encapsulating optical components, such as lasers or photodiodes.

23. The housing body as claimed in claim 22, comprising:
a round or rectangular metal sleeve and
10 a round or rectangular glass pane, which is substantially congruent with an inner end face of the metal sleeve and at the end side is in contact with the metal sleeve from the inner side of the latter, and
a glass solder which has been applied to glass pane
15 or metal sleeve by means of dispensing or screen printing.

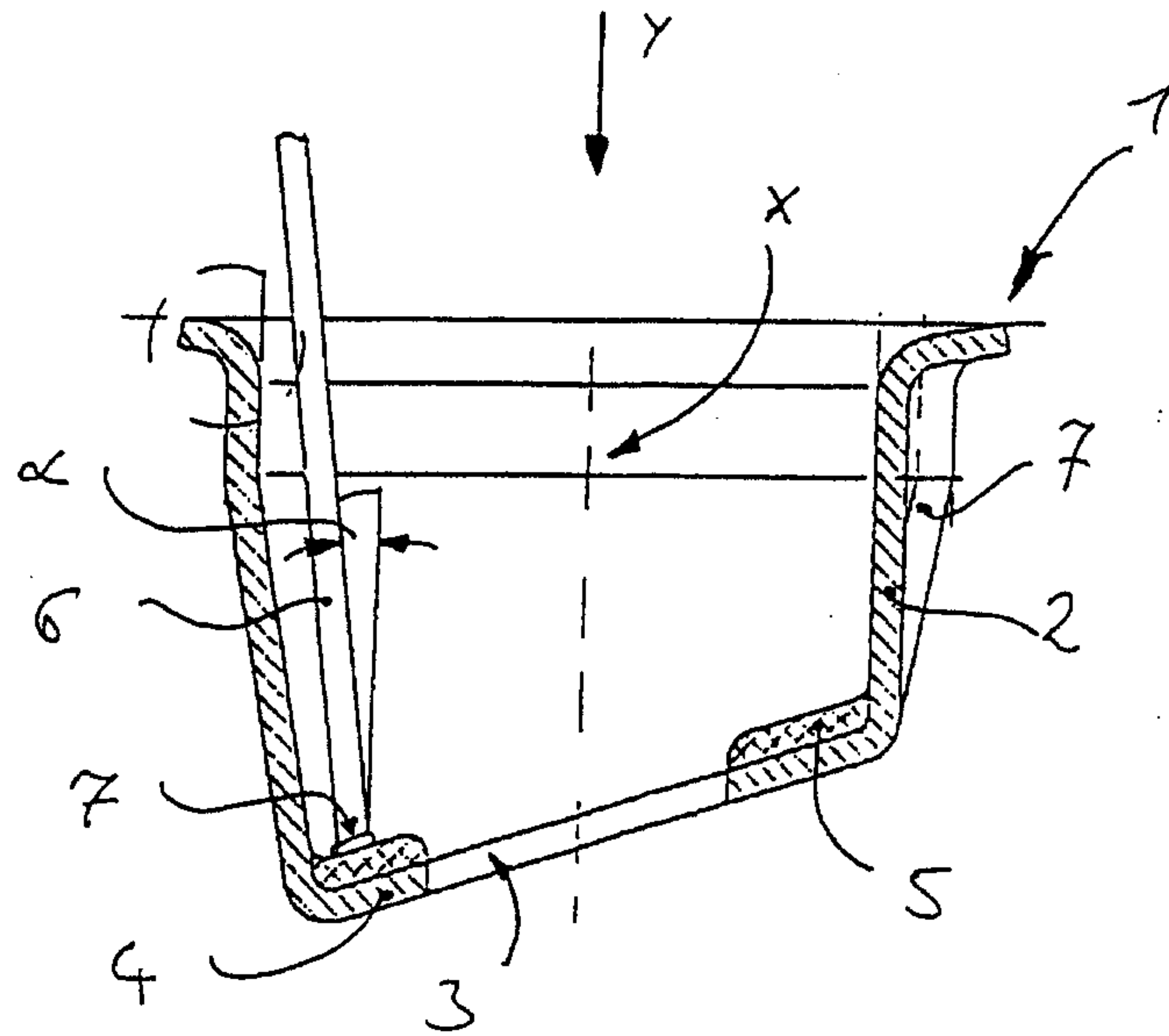
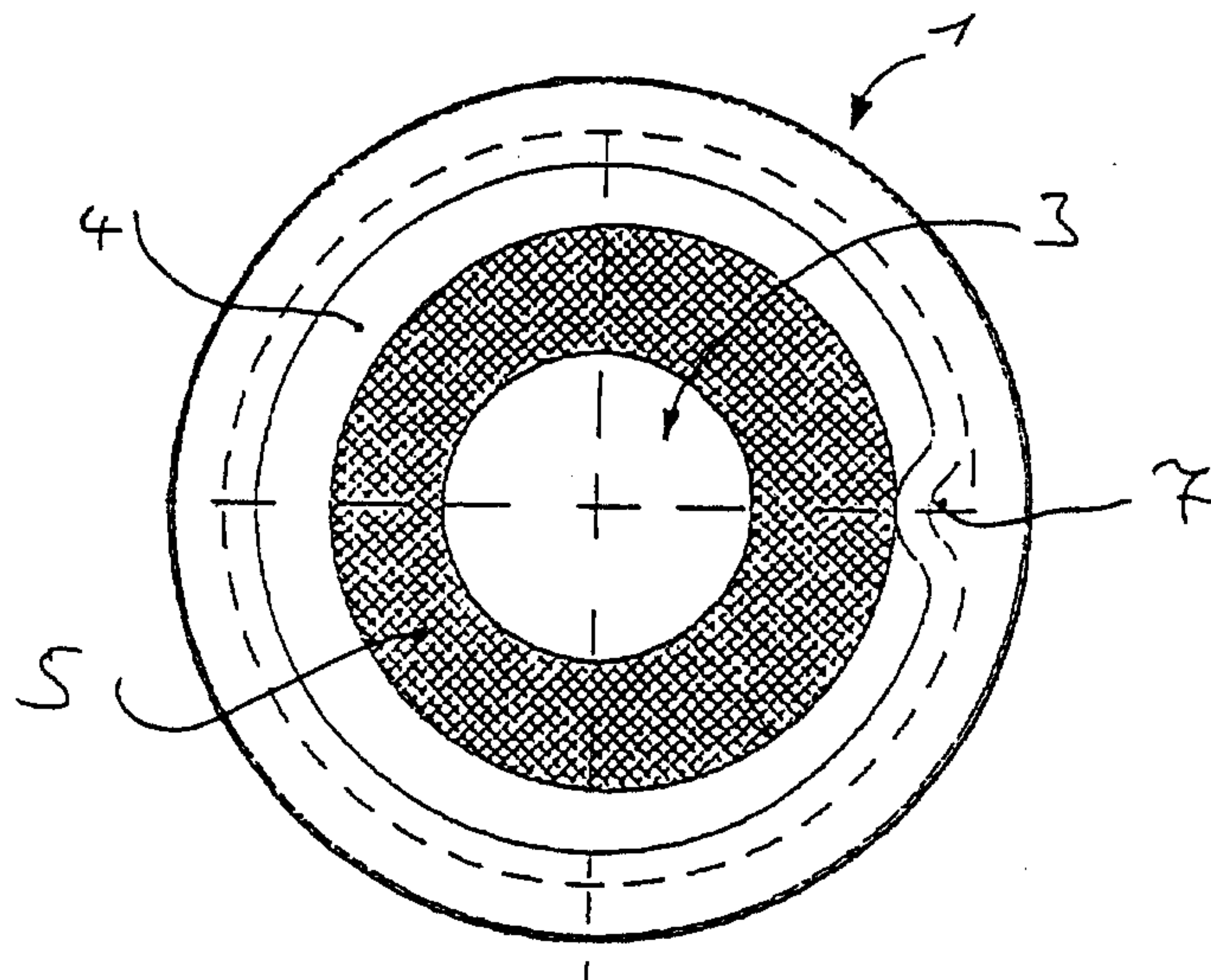
24. The housing body as claimed in claim 23, wherein the metal sleeve, in its interior, has a support running around the end side, on which the glass solder paste is
20 arranged.

25. The housing body as claimed in claim 24, wherein the support running around the end side has a bead which delimits a solder region intended for the glass solder from the remaining surface of the support.

25 26. The housing body as claimed in one of claims 19 to 25, wherein the plane of the support running around is inclined relative to a longitudinal axis of the housing body.

27. The housing body as claimed in one of claims 19 to 26, wherein the glass pane is provided with an antireflection coating or a scratch proof layer and is soldered onto the inclined support.
- 5 28. The housing body as claimed in claim 21, wherein the housing element comprises an optical element which is a lens, cylindrical lens or spherical lens.

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Fig. 1Fig. 2

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Fig. 3

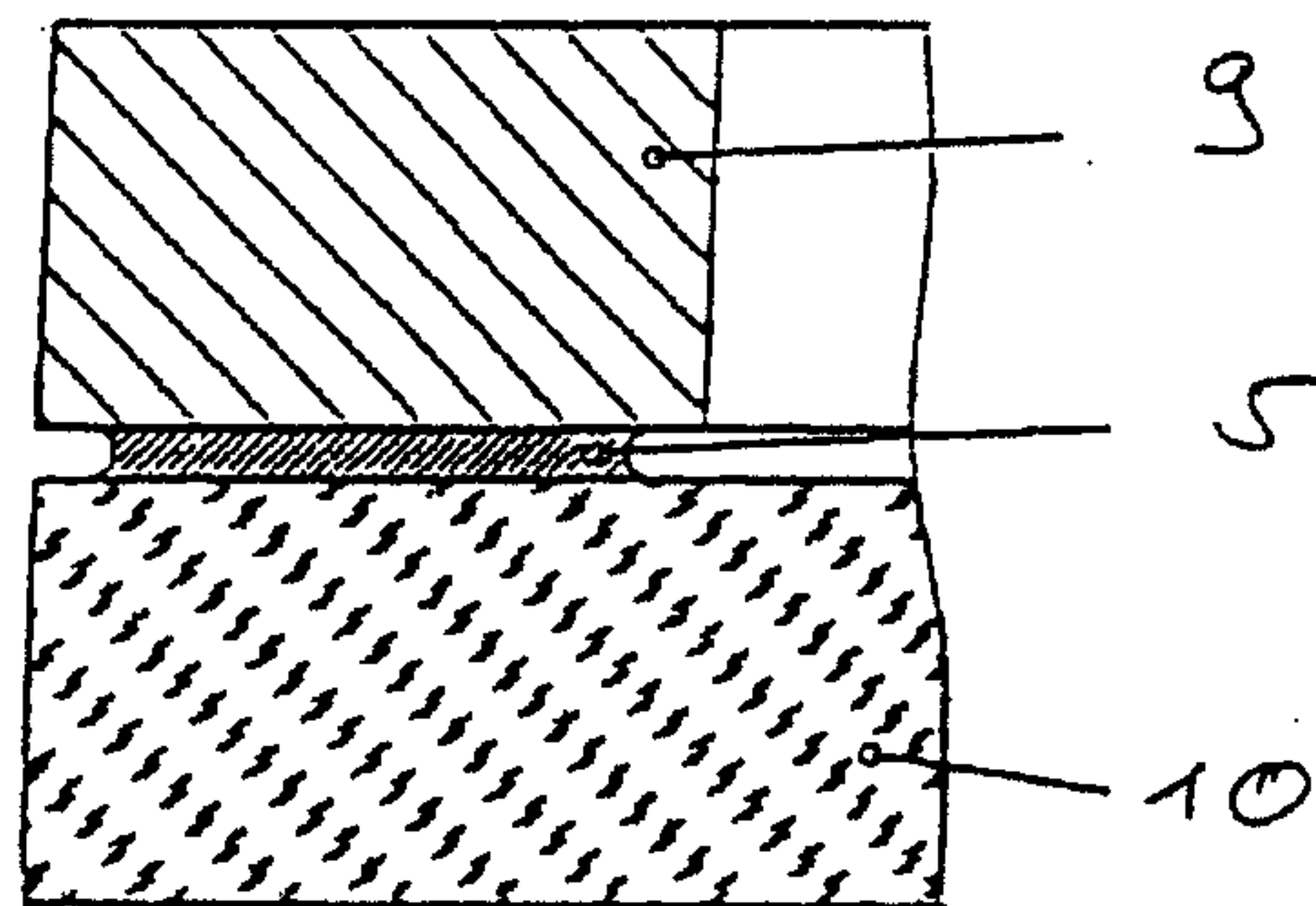


Fig. 4

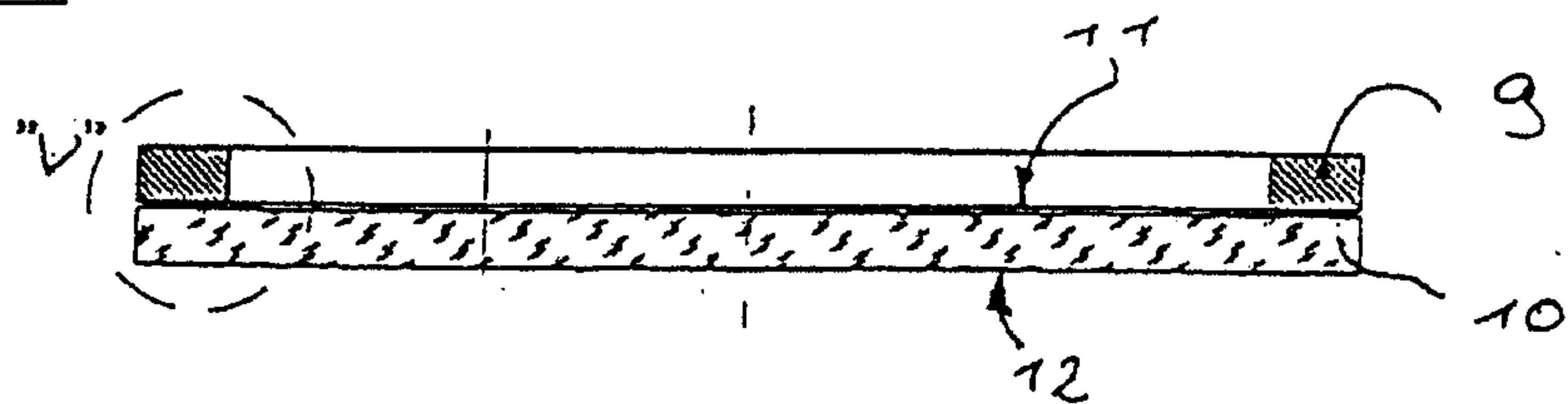
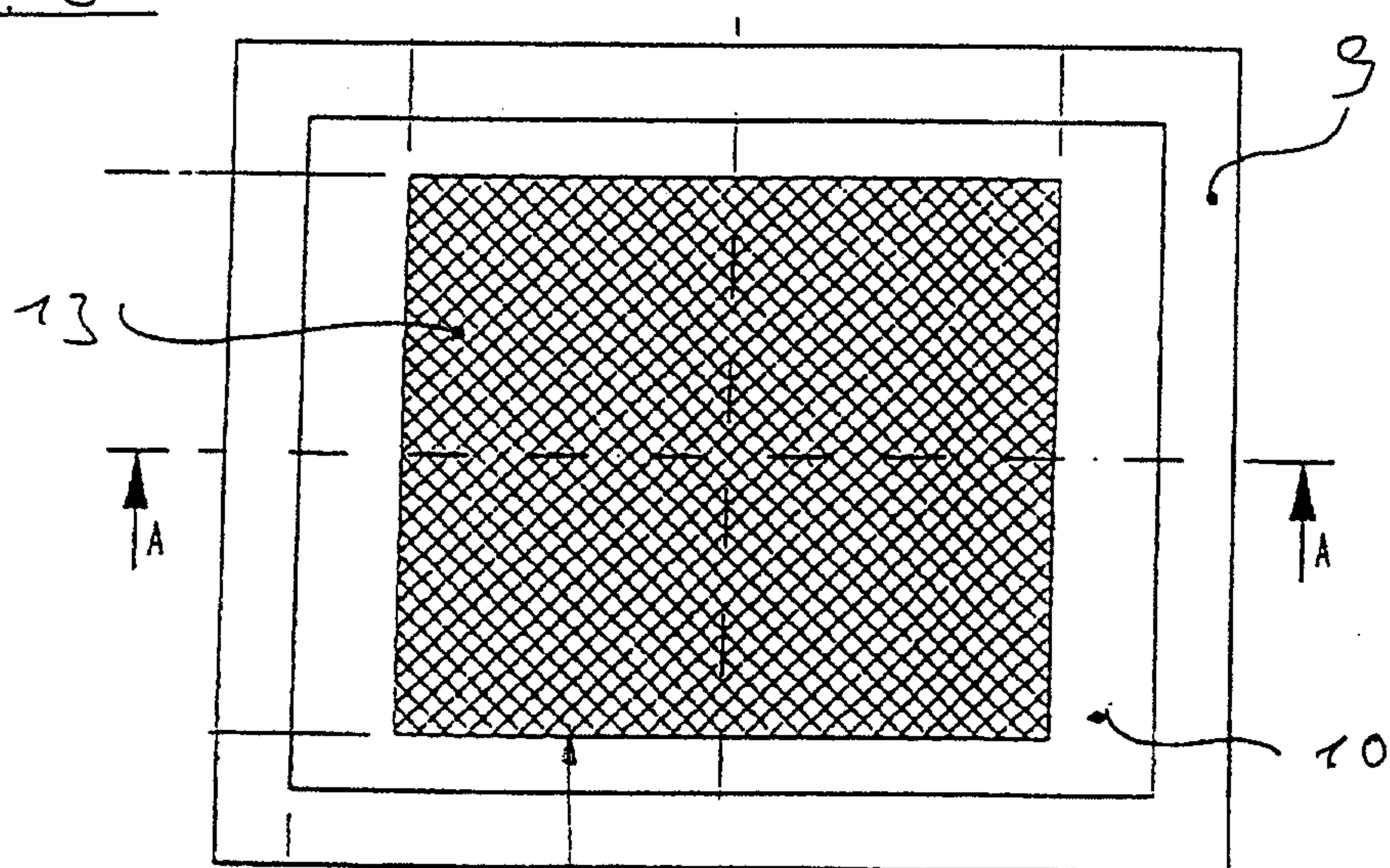


Fig. 5



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Fig 6

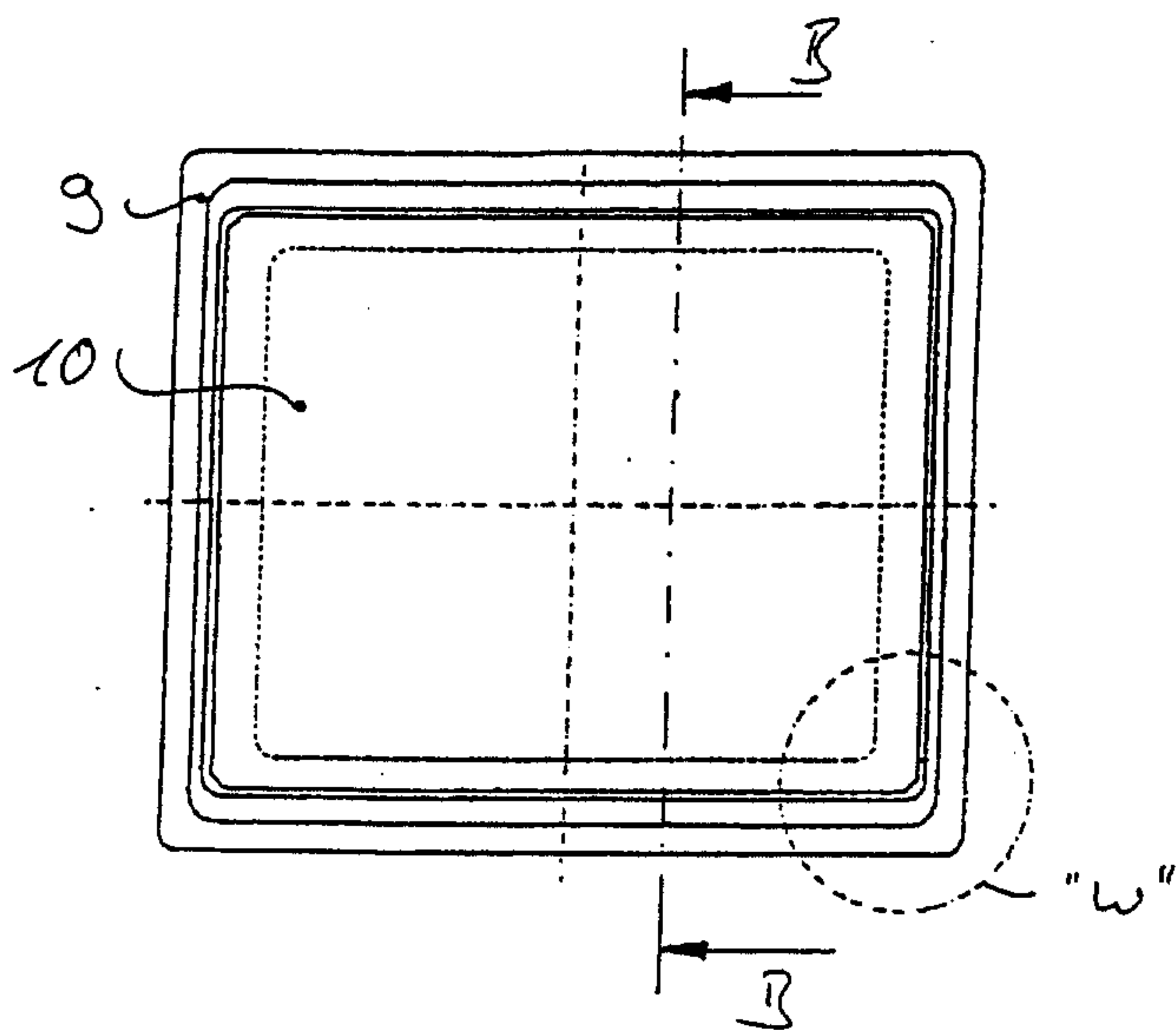


Fig 7

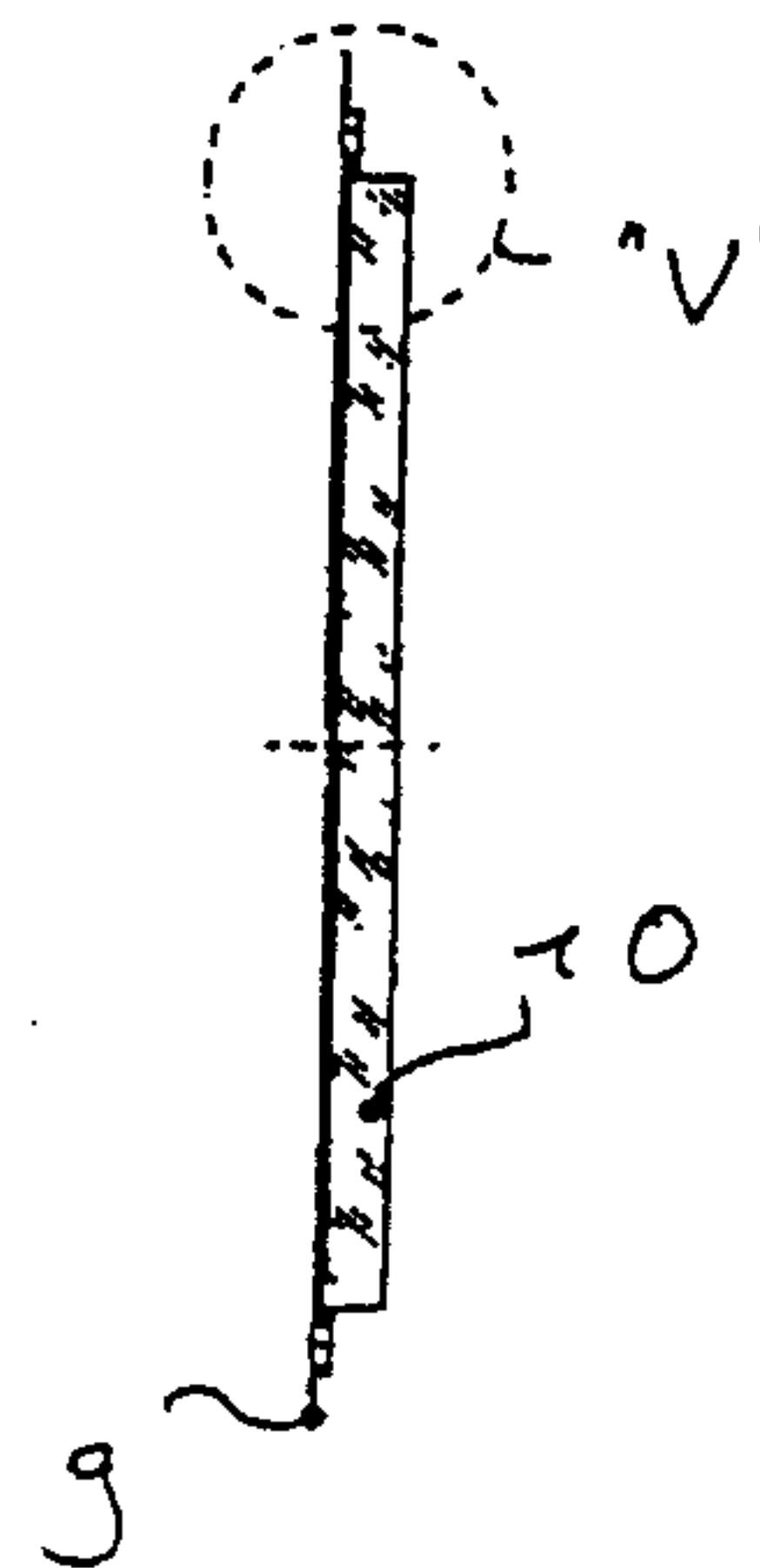


Fig. 8

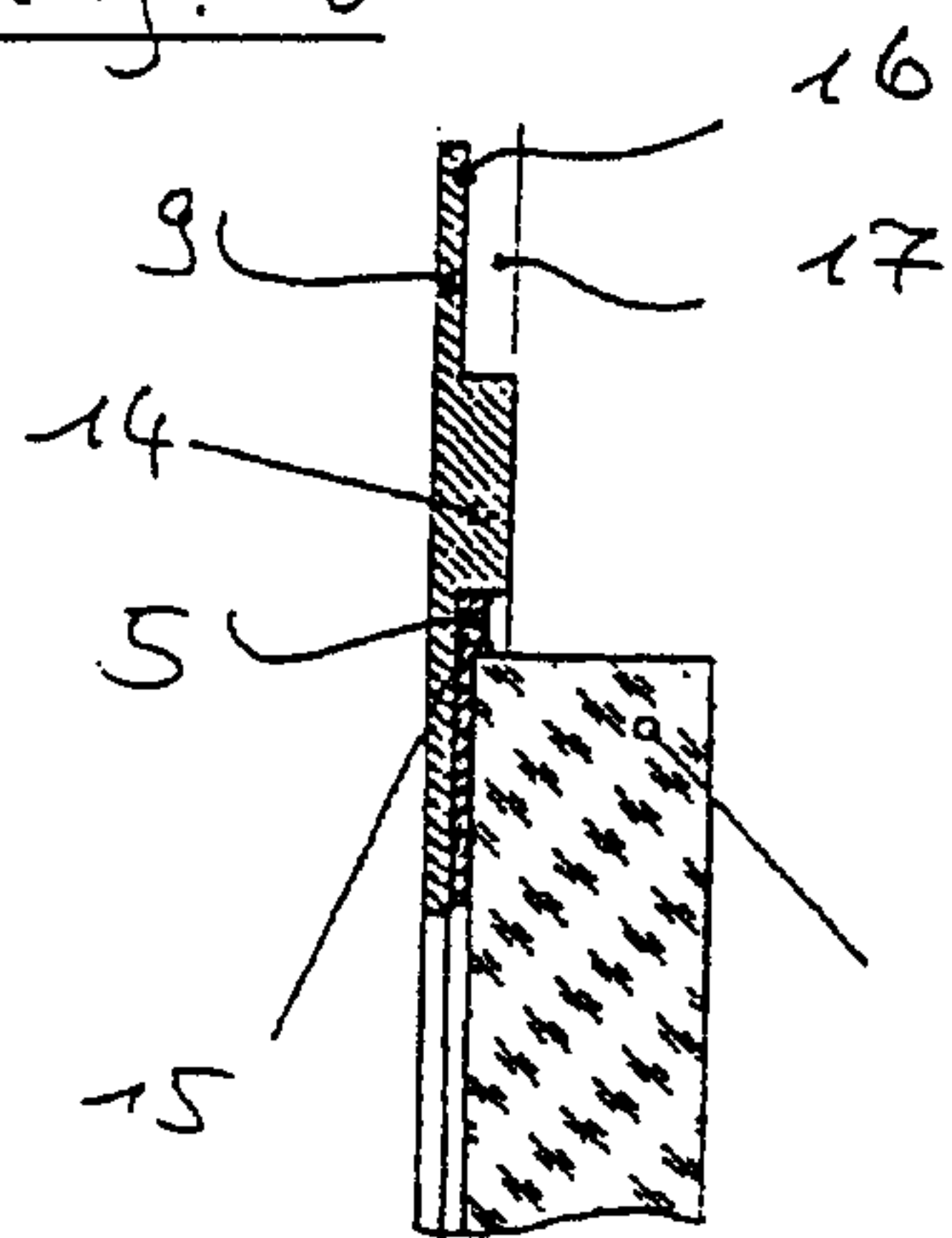
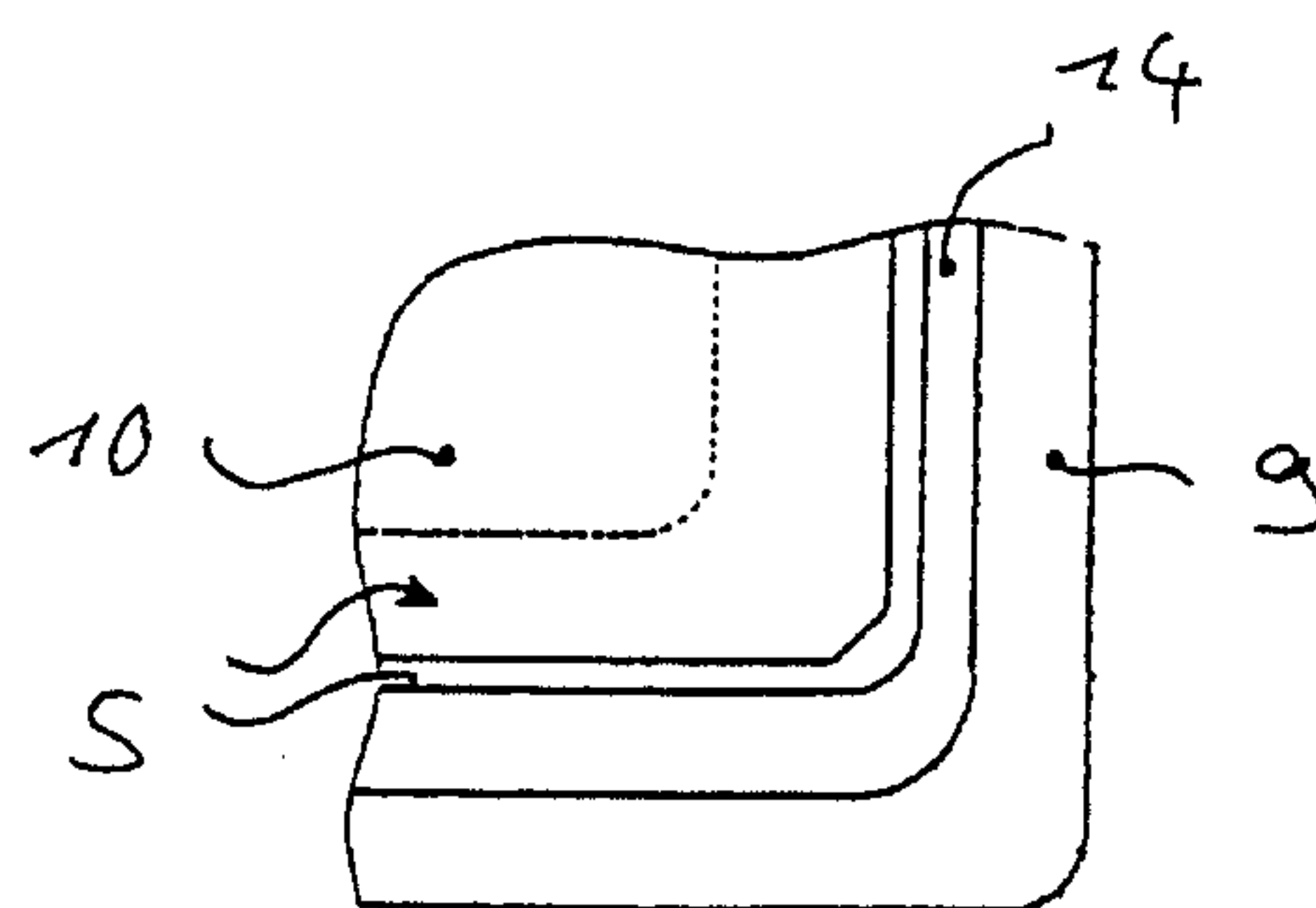


Fig. 9



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Fig 10

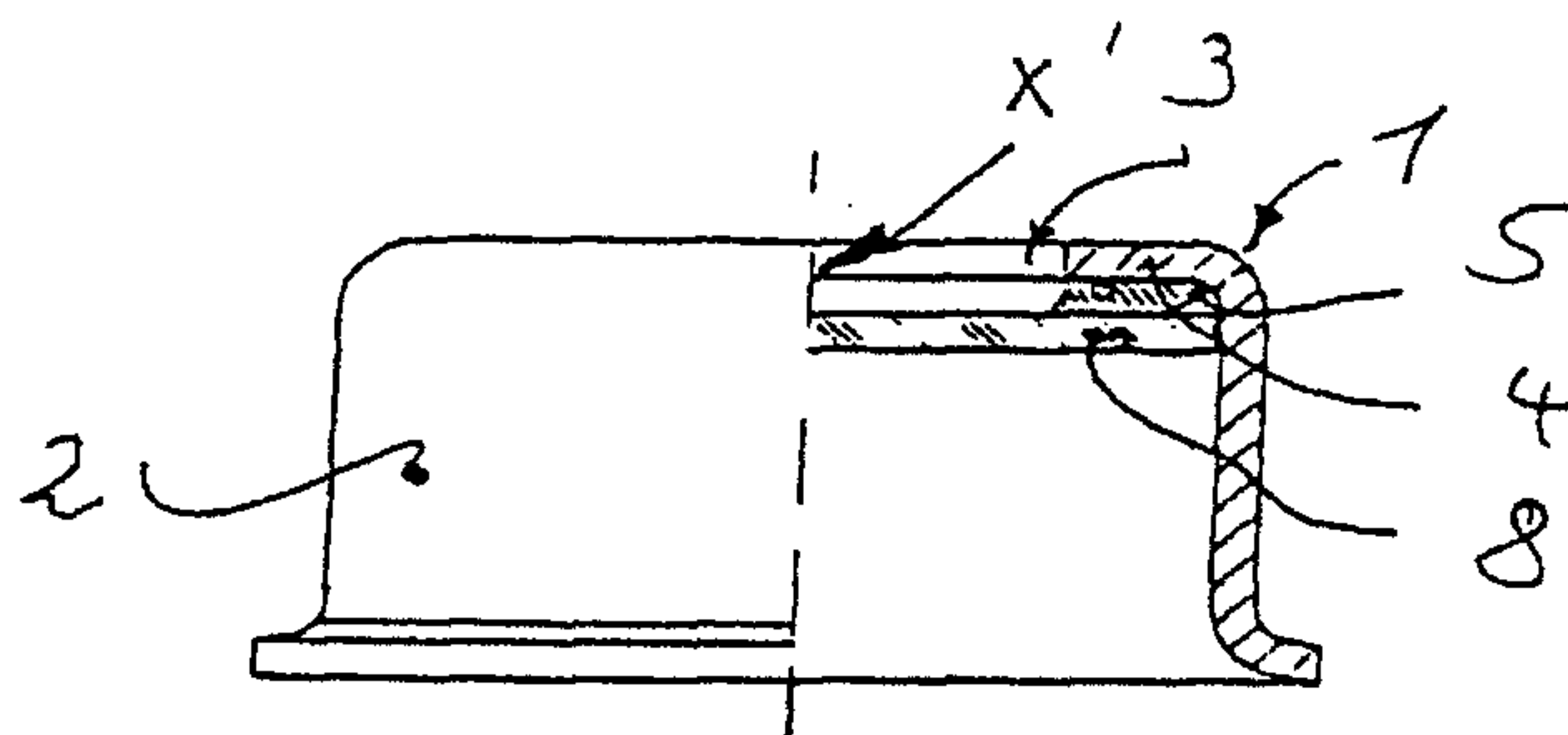


Fig. 11

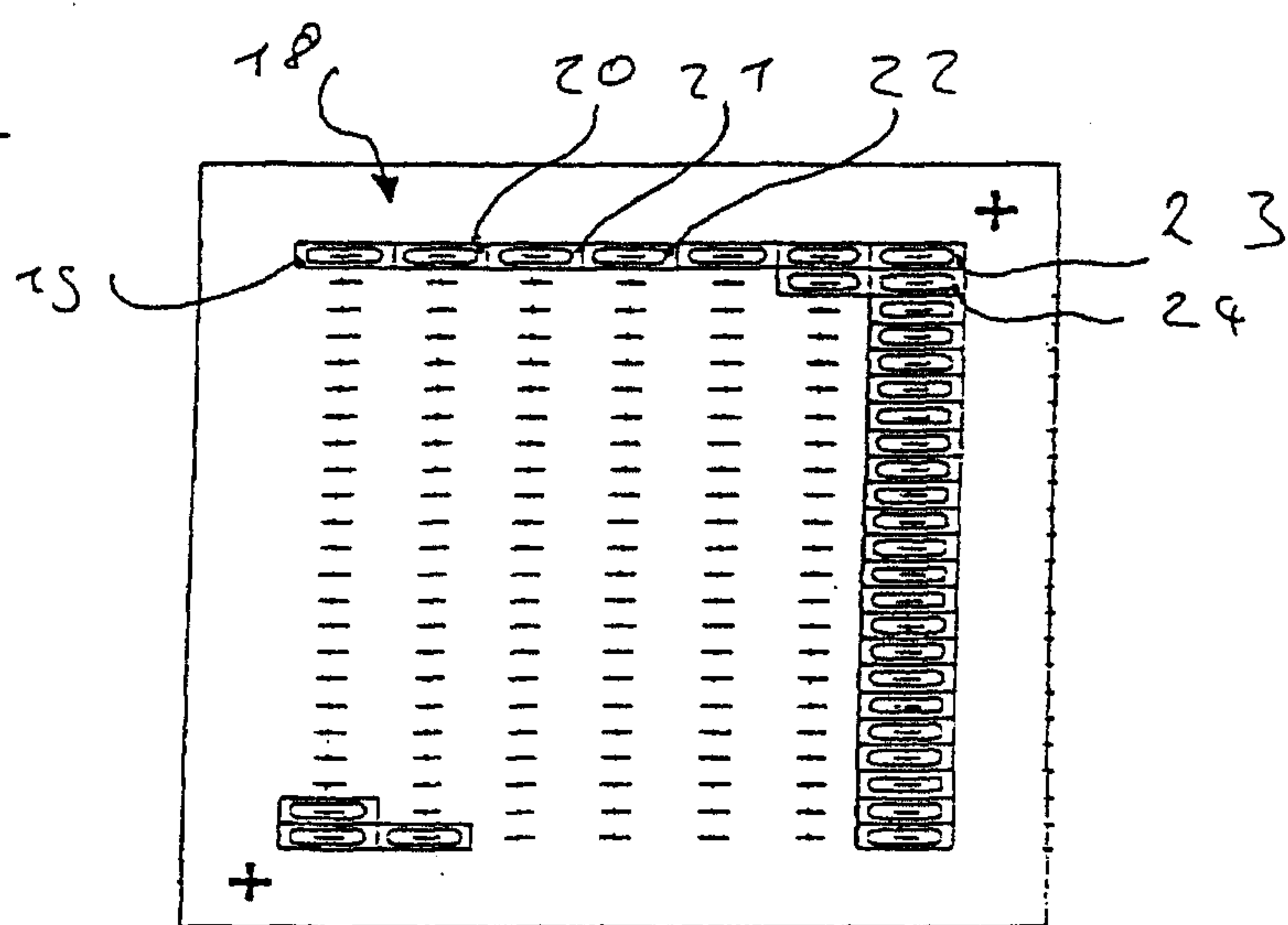


Fig 12

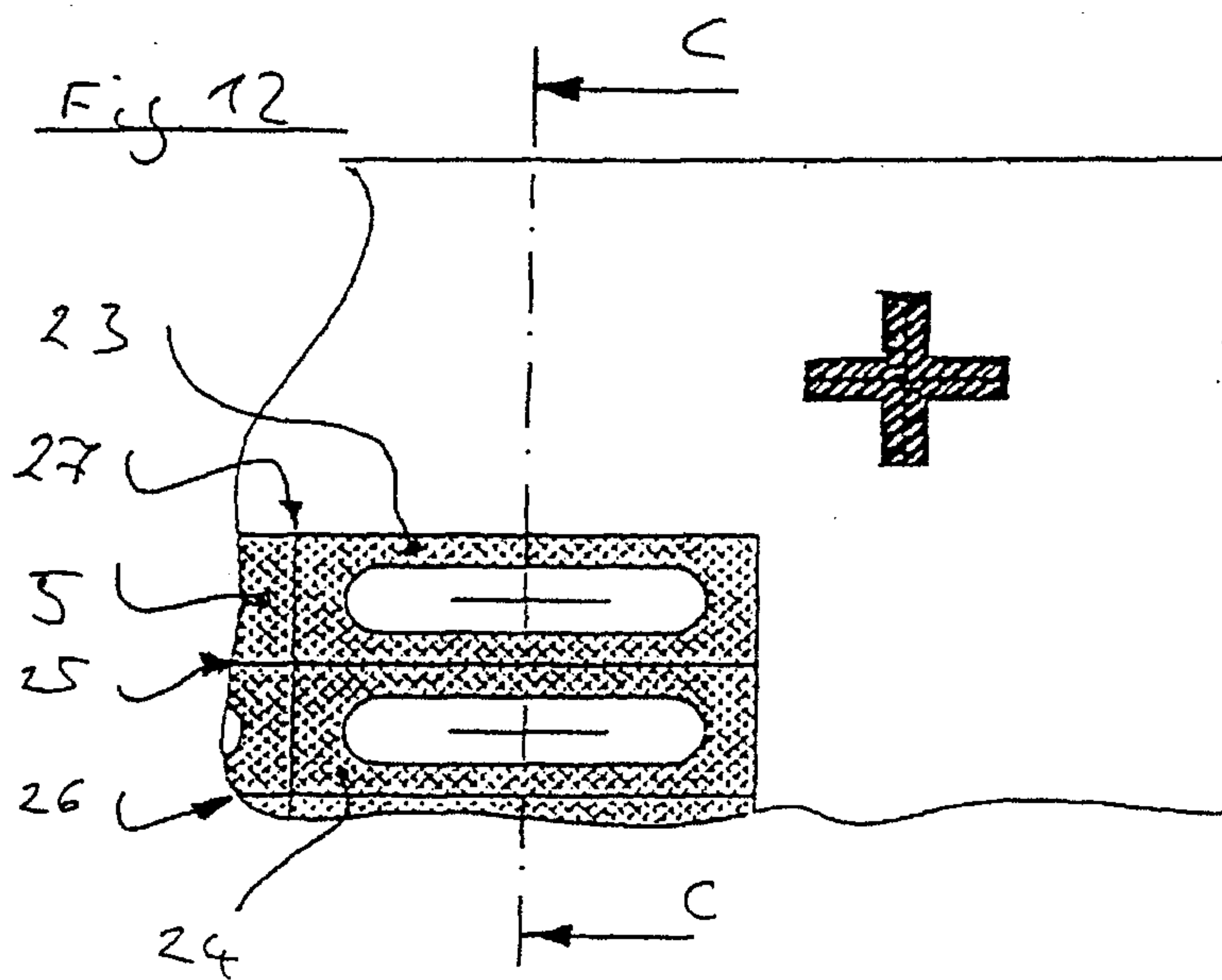
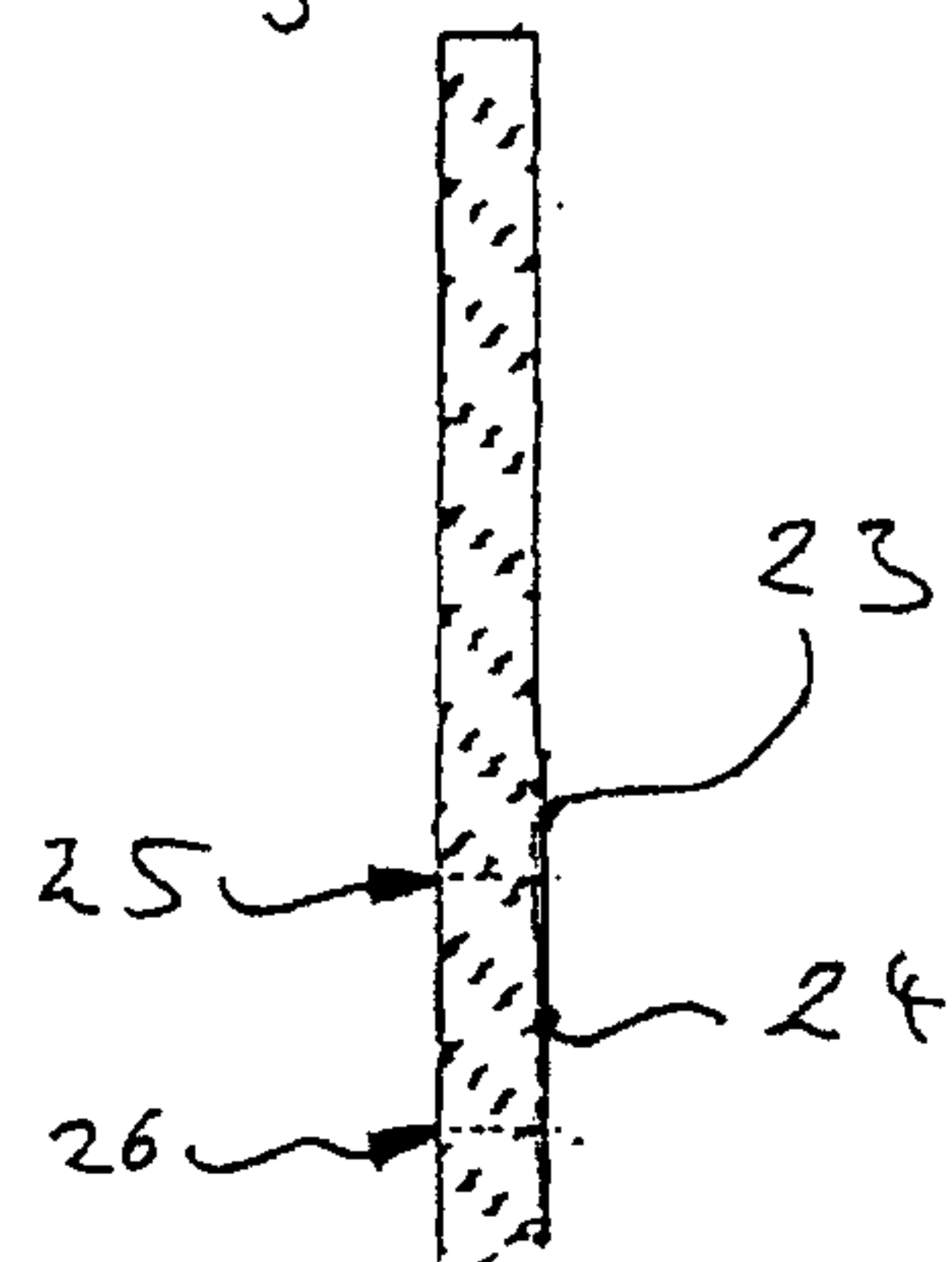


Fig. 13



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Fig. 14

