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(54) Titre : PROCÉDE DE PRODUCTION DE GOUTTIÈRES DE TRANSFERT POUR DES BRACKETS
 (54) Title: METHOD FOR PRODUCING TRAYS FOR BRACKETS

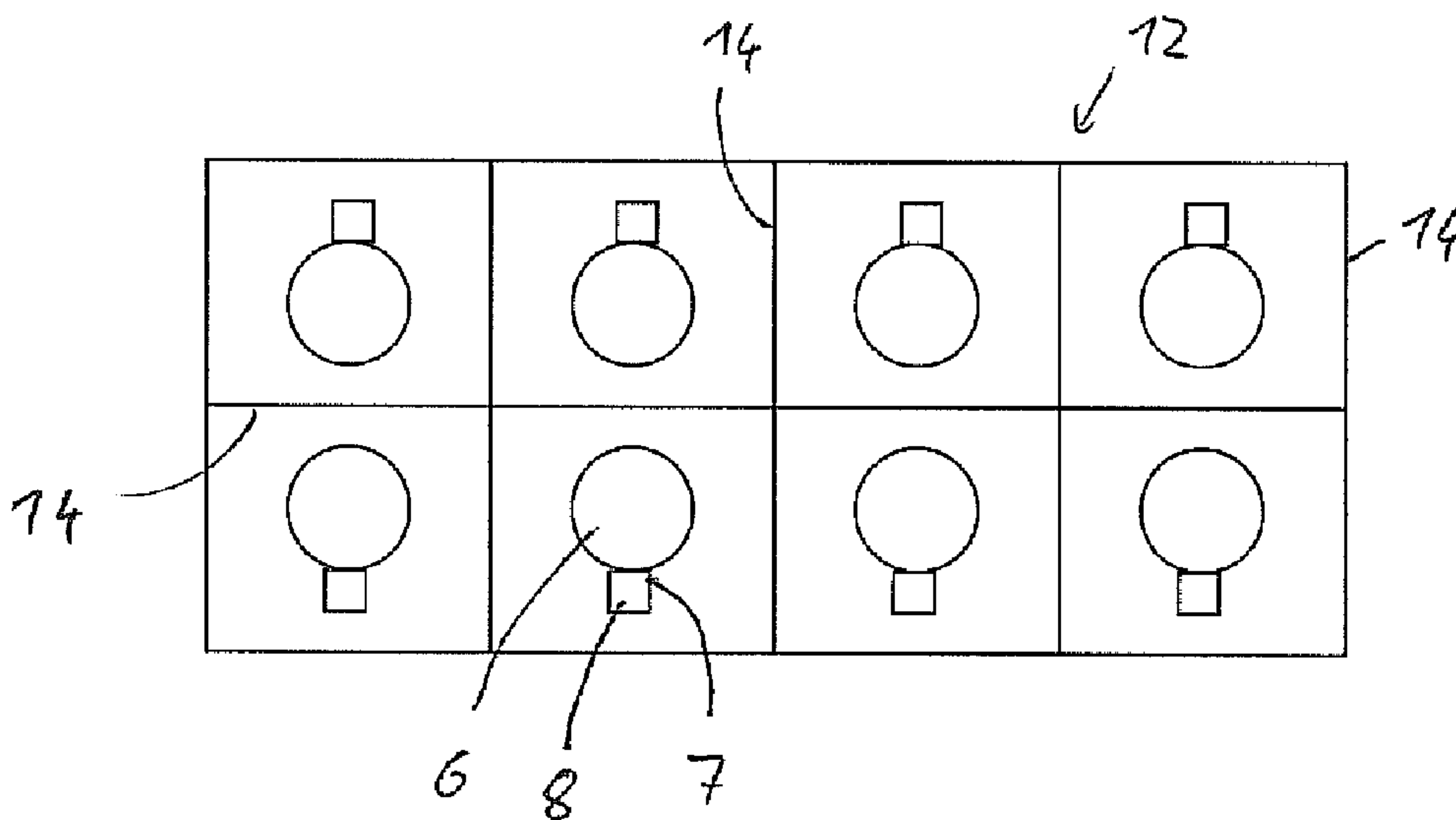


Fig. 6

(57) **Abrégé/Abstract:**

The invention relates to a method for producing individual trays for positioning brackets. However, the known aids and methods all have disadvantages. Thus, the aim of the invention is to specify a method by means of which a tray for placing brackets can be created in a simple manner, which tray allows brackets to be placed quickly and with high accuracy. For this purpose, keeping a large working area free is advantageous. Easy detachment of the trays from glued-on brackets should be ensured, and the brackets should nevertheless be adequately retained in the tray. Said aim is achieved by a method for producing individual trays (13) for positioning brackets, comprising the following steps: a) producing a real model (5), wherein the at least one model is a reproduction of at least sections of at least two tooth crowns of teeth in a jaw and contains bracket reproductions or brackets associated with the reproductions of the tooth crowns; b) producing at least two trays (13) by producing at least one impression of the real model (5), characterized in that the trays (13) each comprise an impression of only at least one tooth crown part (6) of the at least two tooth crowns and only at least one bracket part (8) of the at least two bracket reproductions or brackets, wherein the at least one bracket part (8), viewed from the occlusal surface of the associated tooth crown, extends vertically to at most the end of the wire guide (9) and/or to the end of the first undercut of the bracket and/or bracket reproduction, which is arranged after the upper wing (10) in the view from the occlusal surface.



1 **ABSTRACT**

2 The invention relates to a method for producing individual trays for positioning brackets.
3 However, the known aids and methods all have disadvantages. Thus, the aim of the invention is
4 to specify a method by means of which a tray for placing brackets can be created in a simple
5 manner, which tray allows brackets to be placed quickly and with high accuracy. For this
6 purpose, keeping a large working area free is advantageous. Easy detachment of the trays from
7 glued-on brackets should be ensured, and the brackets should nevertheless be adequately
8 retained in the tray. Said aim is achieved by a method for producing individual trays (13) for
9 positioning brackets, comprising the following steps: a) producing a real model (5), wherein the
10 at least one model is a reproduction of at least sections of at least two tooth crowns of teeth in a
11 jaw and contains bracket reproductions or brackets associated with the reproductions of the
12 tooth crowns; b) producing at least two trays (13) by producing at least one impression of the
13 real model (5), characterized in that the trays (13) each comprise an impression of only at least
14 one tooth crown part (6) of the at least two tooth crowns and only at least one bracket part (8) of
15 the at least two bracket reproductions or brackets, wherein the at least one bracket part (8),
16 viewed from the occlusal surface of the associated tooth crown, extends vertically to at most the
17 end of the wire guide (9) and/or to the end of the first undercut of the bracket and/or bracket
18 reproduction, which is arranged after the upper wing (10) in the view from the occlusal surface.

1 **Description**

2 Method for producing trays for brackets

3 **Technical field**

4 [0001] The invention relates to a method for producing individual trays for positioning
5 brackets.

6 [0002] Brackets are used in various forms with further aids, such as in particular wires, for the
7 orthodontic correction of malocclusions. For this purpose, generally at least two
8 brackets or bands are applied to or over crowns of teeth. This generally involves
9 brackets being adhesively attached to tooth crowns. Brackets may in this case be
10 adhesively attached both to the buccal surface and to the lingual surface of the teeth.
11 The brackets generally have a slot for receiving an arch bar, in particular an archwire,
12 in particular with a rectangular cross-sectional area. In this case it is possible to
13 transfer forces and torques to the teeth via the arch bar, in order in this way to
14 influence their position and alignment.

15 [0003] Originally, laboriously bent bands that had to be adapted for the various stages of
16 treatment were used. By contrast, the straight-wire technique has become established,
17 a technique in which the brackets are shaped in such a way that there is generally no
18 need for laborious bending of the band. In particular, movements of a first, second and
19 third order are rendered superfluous by corresponding formation of the brackets. Thus,
20 for example, the bendings of the first order are replaced by variation of the bracket
21 base height. As a result of the specifications that are variously incorporated in the
22 brackets, such brackets are also referred to as programmed bracket appliances. When
23 brackets of the straight-wire technique are used, the exact positioning of the brackets
24 on the teeth plays a particularly important role, since only then can the incorporated
25 specifications be transferred to the teeth in the desired way.

26 **Prior art**

27 [0004] Numerous techniques are known to facilitate the work here of the orthodontist when
28 applying the bracket and ensure reliable treatment and avoid errors. For example, it is
29 known from EP 1 941 842 A2 to use or produce bracket feet areas that are adapted to
30 the individual surface of the teeth, so that each bracket can only be attached to the
31 respective tooth in the previously planned alignment and placement.

32 [0005] In addition, it is known from US 3,738,005 to fix the brackets on a setup and cast a tray
33 thereover. Subsequently, the tray with the brackets received therein is broken away

1 from the setup and, with the aid of the tray, the brackets placed therein are transferred
2 to the patient.

3 [0006] It is also known to produce the trays from a virtual set-up by rapid prototyping.

4 **Summary of the invention**

5 [0007] However, the known aids and methods all have disadvantages. For instance, they are
6 either not very accurate and/or involve a great amount of effort and high costs. In
7 particular, the individual, exactly fitting fabrication of bracket feet areas is laborious and
8 also leads to significantly less stable brackets. In addition, the covering of a large part
9 of the surface of the tooth must be counted as a negative aspect. Attaching the
10 brackets is hindered thereby. On the other hand, the initially manual fixing on a setup,
11 as in US 3,738,005, already entails inaccuracies. In addition, the casting over of the
12 brackets and their subsequent removal from the setup, carried out by applying
13 comparatively great force, is accompanied by disadvantages with respect to accuracy.
14 Trays manufactured by rapid prototyping often have problems with durability. In
15 addition, removal of the trays after attachment of the brackets to the tooth crown is
16 often problematic.

17 [0008] It is consequently an object of the invention to provide a method by which a tray for the
18 placement of brackets can be created in an easy way and which allows brackets to be
19 placed quickly and with great accuracy.

20 [0009] To this end, keeping free a large area of operation is advantageous. Also an easy
21 separation of the trays from the attached brackets should be assured by otherwise
22 sufficient hold of the brackets in the tray.

23 [0010] This object is achieved by a method according to Claim 1 and a tray according to claim
24 15. Dependent Claims 2 to 14 provide advantageous developments.

25 [0011] The method according to the invention comprises the following steps:

26 [0012] At least one actual, in particular one-part, model is produced, the at least one model
27 being a replica of at least portions of at least two tooth crowns of teeth located in a jaw
28 and comprising bracket replicas or brackets assigned to the replicas of the tooth
29 crowns. Connections of a planned size and shape between a bracket and a tooth
30 crown, in particular virtual connections, may also be comprised. Consequently, at least
31 one model is created, and is in particular a one-part model. In this case, at least a
32 portion of each of the two tooth crowns with assigned bracket replicas or brackets is
33 replicated by the model. In addition, the bracket replicas or brackets are replicated in

1 reality and, if present, the respective connections are also reproduced in the actual
2 model. Consequently, a model of at least a respective portion of two tooth crowns with
3 the assigned brackets and any connections that may be arranged therebetween is
4 produced. In particular, an actual model of at least one or two entire jaws or the tooth
5 crowns located in at least one jaw or in at least two jaws is created. This
6 advantageously involves also actually reproducing in the model all the assigned
7 brackets and any connections arranged therebetween.

8 [0013] In this case, it is sufficient to reproduce a sufficiently large part of each tooth crown and
9 each bracket, and of any connection there may be, to be able later to produce from the
10 model a tray that is definitively oriented on the tooth crown and clearly defines the
11 position of the bracket. If trays are formed over multiple tooth crowns, definitive
12 orientation in relation to these multiple tooth crowns is sufficient.

13 [0014] The modelled bracket replicas must also only be reproduced in a sufficient part or with
14 sufficiently faithful detail to allow the actual brackets to be later arranged reliably and
15 stably in the predetermined orientation in the tray.

16 [0015] In the creation of the model, the arrangement of the individual tooth crowns in relation
17 to one another must only be reproduced with respect to the tooth crowns in the model
18 on the basis of which a common tray is to be created in the end. Otherwise, the models
19 of the individual tooth crowns with the assigned bracket replicas and, if present, the
20 respective connections may be placed freely in space. This is advantageous for easy
21 creation of the model, and in particular for the subsequent creation of the tray. Thus, in
22 particular whenever each tray is to be created only on the basis of one tooth crown
23 model, each tooth crown model can be arranged at a distance from the others, in
24 particular multiple models or all models spaced apart next to one another.

25 [0016] The trays are distinguished by the fact that they respectively comprise an impression of
26 only in each case at least one tooth crown part of the at least two tooth crowns and
27 only in each case at least one bracket part of the at least two bracket replicas or
28 brackets. In this case, the at least one bracket part respectively extends vertically, as
29 seen from the occlusal surface of the assigned tooth crown, at most up to the end of
30 the wire guide and/or up to the end of the first undercut of the bracket and/or bracket
31 replica that is arranged after the upper wing when viewed from the occlusal surface.

32 [0017] This provides sufficient retention, a large-sized free working space and at the same
33 time great precision and a very simple and rapid manner of production.

- 1 [0018] Brackets usually have wings, in particular two wings, which extend above and below
2 the wire lead-through. The wings are partially curved slightly towards the bracket foot
3 or, when viewed from the plane of the occlusal surface, create undercuts or comprise
4 undercuts. These are reproduced in the bracket part.
- 5 [0019] When viewed from the plane of the occlusal surface, the wire guide of the bracket also
6 usually comprises undercuts. These may likewise be included in the model. However,
7 not included in the model, according to the invention, when viewed from the plane of
8 the occlusal surface, is the extent of the bracket beyond the wire lead-through.
9 Depending on the embodiment, in particular if thermoforming film is used when taking
10 the impression, undercuts of the wire lead-through do not comprise part of the bracket
11 part either. Then, when viewed from the plane of the occlusal surface, the bracket part
12 extends in particular up to before the beginning of the wire lead-through or the
13 undercuts thereof.
- 14 [0020] In general, however, it should be ensured that the bracket part is chosen to be
15 sufficiently large that a connection between the tooth crown replica and the bracket
16 replica is included in the model. As a result and due to any undercuts that may be
17 present, a sufficient and exact retention of the bracket in the tray is ensured.
- 18 [0021] It is also advisable depending on the application to choose the extent of the bracket
19 part up to within the wire lead-through, in particular to the middle thereof. This is
20 sometimes necessary in order to include a connection between the tooth crown replica
21 and the bracket replica, but may otherwise also contribute to better retention of the
22 bracket in the tray.
- 23 [0022] However, a bracket part going beyond the wire lead-through should not be chosen,
24 since it is then more difficult to detach the adhesively bonded brackets and the working
25 area is unduly restricted.
- 26 [0023] The tooth crown part is advantageously chosen such that, seen from the plane of the
27 occlusal surface, it extends up to the end of the bracket part.
- 28 [0024] The model of each tooth crown advantageously comprises no more than the
29 corresponding tooth crown part and, of each bracket or bracket replica, no more than
30 the corresponding bracket part. This allows direct production of the trays to be
31 achieved.
- 32 [0025] In an alternative embodiment it is possible that the model of one or more tooth crowns
33 comprises more than the corresponding tooth crown part and/or the model of one or

1 more brackets or bracket replicas comprises more than the corresponding bracket part.
2 In this case, after the taking of the impression, the corresponding trays then likewise
3 comprise more of an impression of the tooth crown or of the bracket than an
4 impression of the tooth crown part or of the bracket part. After the taking of the
5 impression, according to the invention, these trays are then shortened such that, of the
6 tooth crown, they only have an impression of the tooth crown part and/or, of the
7 bracket, they only have an impression of the bracket part. This may take place for
8 example by grinding or milling.

9 [0026] When viewed from the occlusal surface, the tooth crown part advantageously extends
10 at most only up to before the first undercut of the tooth crown.

11 [0027] Creating an actual model can be precede creating a virtual setup of at least two tooth
12 crowns of teeth located in a jaw can be. The setup is understood as meaning the
13 desired arrangement, or arrangement to be achieved, of the teeth that are actually
14 located in the jaw. This replicates at least two teeth, in particular at least a complete
15 jaw. The setup generally only comprises the crowns of the teeth and not the roots,
16 since the corresponding impression, of an actual or virtual nature, generally only
17 replicates the tooth crowns. These are then transferred into the setup and arranged
18 there as desired.

19 [0028] For this purpose, actual impressions of tooth crowns are generally taken according to
20 prior art techniques, subsequently cast back into positives and then sawn, and
21 subsequently positioned as desired, generally in wax. Such a setup usually forms the
22 basis for the creation of aids for influencing tooth positioning. The setup is generally
23 fitted into an articulator, in order to be able to reproduce the movement of the jaws.

24 [0029] However, such a setup may preferably also take place virtually after the recording of
25 the initial situation with the patient.

26 [0030] This is followed by the arrangement of a respective bracket replica in relation to at least
27 two replicas of the tooth crowns in the setup. The bracket replicas are advantageously
28 virtual replicas of actual brackets, in particular at least a large part of the outer contours
29 thereof. In this case, each virtual bracket replica has a bracket replica foot area. The
30 bracket replica foot area is advantageously a replica of an actual bracket foot area.
31 With such a bracket foot area, a bracket is arranged on a tooth and adhesively bonded
32 to it. The adhesive thereby comes to lie between the bracket foot area and the tooth.

- 1 [0031] The arrangement is advantageously performed in a straight-wire arrangement. This is
2 understood as meaning an arrangement of the bracket replicas or the brackets that
3 allows use of the straight-wire technique. In particular, in the case of a straight-wire
4 arrangement, the placement of the brackets is of decisive importance, so that in the
5 case of such an arrangement the advantages of the invention particularly come into
6 effect.
- 7 [0032] In the arrangement of the bracket replicas, an intermediate space may remain between
8 the bracket replica foot areas and the replicas of the tooth crown surface. The
9 intermediate space that is possibly present between the bracket replica foot areas or
10 the bracket foot areas and the tooth crown replica is later bridged by adhesive.
- 11 [0033] Creating a connection between the bracket replica foot areas and the respective
12 replication of the tooth crown can follow for bridging intermediate spaces between
13 bracket replica foot areas and the respectively assigned replica of the tooth crown in
14 cases in which the bracket replica foot area does not lie against the replica of the tooth
15 crown, in particular not with surface area contact. Such a creation of the connection is
16 advantageously performed fully automatically. Advantageously, the shortest connection
17 between bracket replica foot areas and the respective replica of the tooth crown is
18 bridged. Advantageously, the bridging has in this case a sufficient thickness, so that a
19 model that is correspondingly later fabricated is statically stable. Advantageously, the
20 bridging is formed all the greater in cross section the longer it is. The bridging in this
21 case respectively runs between a bracket replica foot and the replica of the tooth crown
22 to which the respective bracket replica foot area is assigned. If the bracket replica foot
23 area already lies against the replica of the tooth crown, in particular in surface area
24 contact, creation of a bridge is not required, since the bridging is already ensured by
25 the bracket replica foot area.
- 26 [0034] The connection is advantageously formed in cross section over the entire lateral extent
27 of the bracket replica foot area, so that partial impressions later created on the model
28 do not engage in undercuts between the tooth crown and the bracket foot area. It is
29 also conceivable for the connection on the tooth crown or the replica thereof to be
30 advantageously formed in cross section greater than or identical to the bracket foot
31 area. This makes particularly clean handling of the later adhesive bonding possible.
- 32 [0035] To produce the actual model, instead of a transformation back into the initial situation
33 with the patient, the replicas of the tooth crowns are advantageously aligned with one

1 another in such a way that the wire guides of the bracket replicas or brackets are in
2 line. As a result, a model with wire lead-throughs in line is created, which greatly
3 facilitates the production of the trays and also already of the mould for producing the
4 tray that comprises the actual model. This is the case in particular if the length of the
5 bracket part is based on the wire lead-through and in this respect is chosen to be the
6 same in all bracket parts, that is to say for example the bracket parts all extend up to
7 the upper beginning of the wire lead-through or all extend up to the middle of the wire
8 lead-through or all extend up to the lower end of the wire lead-through, in each case
9 seen from the occlusal surface of the tooth crown as above.

10 [0036] It may also be advantageous to fabricate the model, including further walls, bases
11 and/or delimitations, in particular to fabricate a complete casting mould as a model, or
12 to bring the model into a mould, in particular a reusable mould, in such a way that a
13 finished casting mould for a tray to be cast is produced.

14 [0037] In particular in the case of the arrangement of multiple tooth crown/bracket units in a
15 model, the provision of such walls between the individual tooth crown/bracket units of
16 the model is preferred when taking an impression by casting, since individual trays can
17 then be created in a simple way on the basis of a single model.

18 [0038] The creation of the actual model may be performed for example by rapid prototyping
19 and/or three-dimensional printing. In this case, additional walls, bases, mounts and the
20 like can be created in one operation.

21 [0039] This is followed by the production of trays, in particular at least two trays, in particular
22 flexible trays, by producing partial moldings of the at least one actual model that are
23 respectively suitable for receiving at least partially one of the at least two tooth crowns
24 and at least partially a bracket replica that is moreover assigned to the respective tooth
25 crown, or a corresponding actual bracket, receiving them in such a way that the
26 arrangement of the bracket replica and of the replication of the tooth crown is
27 reproduced in reality by the bracket received and the tooth crown received. Therefore,
28 in particular at least two trays are created, each for receiving at least one bracket, in
29 particular one each, which trays are respectively designed such that they receive a part
30 of the bracket, and a part of the tooth crown in such a way that the planned
31 arrangement between the tooth crown replica and the bracket replica is later
32 reproduced in reality by the tooth crown and the bracket.

- 1 [0040] The production of such trays may be performed for example by overmoulding or by
2 thermoforming of thermoforming film.
- 3 [0041] When taking an impression by casting, a compound that shrinks during curing is
4 advantageously used. Such shrinkage allows the clamping effect of the tray to be
5 increased. Such shrinkage may also be taken into consideration in the creation of the
6 model and the model may be partly produced slightly enlarged, in order for example to
7 increase the clamping effect only in some regions, in particular only on the bracket.
8 Thus, for example, the tooth crown part may be included in the model in a
9 correspondingly enlarged form.
- 10 [0042] Advantageously, a tray that only comprises one tooth crown is created per bracket.
11 This makes it possible for the brackets together with the trays to be introduced
12 particularly easily into the oral cavity of the patient. This can also be made by disjoining
13 n impression. However, trays for multiple tooth crowns or multiple brackets may also be
14 created. In an embodiment that is not preferred, in the end only one tray that can
15 receive all of the assigned brackets is provided.
- 16 [0043] Advantageously one actual model per replica of tooth crowns provided with a bracket
17 replica is created in the production of the actual model. The separate creation of a
18 model per tooth crown replica with an assigned bracket part allows particularly easy
19 production of a corresponding tray.
- 20 [0044] In another embodiment, advantageously a single actual model of all the replicas of
21 tooth crowns, provided with a bracket replica, and the bracket replicas and connections
22 of one or two jaw of a human is first created, and this is subsequently divided up such
23 that each fragment is a replica of at least parts of only one tooth crown with a bracket
24 and possibly a connection. Common production may lead to savings in the creation of
25 the model; in particular, it is then initially only necessary to keep one model. In
26 particular, in the case of rapid prototyping, a single production compound can be used.
27 Subsequent sawing apart in turn makes it possible for corresponding trays to be easily
28 produced. However, in a single model the individual tooth crown part/bracket part units
29 can also be separated from one another such that individual trays can be produced on
30 the one model. However, when taking an impression by casting, separating walls may
31 thus also be created at the same time when producing the actual model, so that
32 individual trays can be created unproblematically without sawing them apart.

- 1 [0045] Thus, for example, all the models of tooth crowns may be arranged in a series or in a
2 number of series running parallel to one another, in particular straight lines. One or two
3 series per jaw would be suitable here in particular. In this case, the series are
4 advantageously connected to one another and produced together from one piece.
5 Alternatively or in addition, a certain intermediate space may be left between the
6 individual models of the tooth crowns, so that for example the individual models of the
7 tooth crown replicas with the brackets and possible connections can be found at a
8 certain distance apart on a straight bar. A distance is also advantageously provided
9 between parallel series, so that the tooth crown part/bracket part units do not touch.
10 The connections between the units can then be created for example by a common
11 mount. Such a model can be produced particularly easily and in a standardized form
12 and can in particular be handled well in the further procedure. In particular, with a
13 corresponding distance between the individual tooth crown part/bracket part units,
14 there is no need for sawing up for the production of individual trays.
- 15 [0046] It is advantageous to proceed in the creation of the virtual setup by initially creating an
16 actual impression of at least two tooth crowns of teeth located in a jaw and then
17 creating a virtual replica of the impression, and subsequently producing a virtual setup
18 on the basis of the virtual impression. In this case, the actual impression will initially be
19 a negative impression. It is subsequently possible first to produce a positive of the
20 impression and then to transform this into a virtual replica. Alternatively, a virtual replica
21 may also be produced immediately and directly from the actual negative impression
22 and then converted into a virtual positive, on which the creation of the virtual setup is
23 then based. It is also conceivable to continue working with a virtual negative impression
24 and to create a negative virtual setup and arrange the bracket replicas or bracket
25 replica foot areas on the boundary areas thereof.
- 26 [0047] In another alternative it is advantageous to proceed in the creation of the virtual setup
27 by initially creating an actual impression of at least two tooth crowns of teeth located in
28 a jaw and subsequently producing an actual setup on the basis of the actual
29 impression. This may be performed for example by sawing up and setting in wax.
30 Subsequently, a virtual replica of the actual setup is created and a virtual setup is thus
31 produced. In the creation of the actual impression, generally a negative impression is
32 initially obtained, and then an actual positive impression is created from it before an
33 actual setup is produced.

- 1 [0048] The transformation into the virtual form may be respectively performed by various
2 methods, such as for example scanning by laser or reconstruction from computed
3 tomography data.
- 4 [0049] In another procedure, the creation of the virtual setup is advantageously carried out by
5 initially producing a virtual replica of at least two tooth crowns of teeth located in a jaw,
6 in particular by optical measurement of the at least two tooth crowns. On this basis, a
7 virtual setup is then produced. The creation of the virtual impression may be performed
8 for example by laser scanner directly in the oral cavity of the patient. Alternatively, it
9 may also be produced on the basis of an X-ray CT. Other methods are conceivable in
10 principle.
- 11 [0050] The selection of a bracket replica from a bracket library is advantageously carried out
12 first, the bracket library consisting of a set of virtual replicas of brackets that are
13 actually available. Such a selection allows the production step concerning brackets to
14 be simplified, by relying on standard components. The selection from various brackets
15 makes it possible however for treatment to be specially adapted.
- 16 [0051] It is advantageous to proceed in the creation of the tray by initially dividing up the
17 actual model into portions having only one tooth crown replica with a bracket replica
18 and possibly a connection and subsequently producing partial impressions.
19 Alternatively, depending on the application, it may be advantageous to proceed by
20 initially making a partial molding on the basis of at least models of the at least two tooth
21 crowns and subsequently dividing up the partial molding, in particular such that each
22 part produced only represents a partial impression of a tooth crown with an assigned
23 bracket and possibly a connection.
- 24 [0052] The bracket replicas are advantageously virtual replicas of actual one-part brackets.
25 One-part brackets are those which, apart from movable parts, in particular for locking
26 devices, are formed as one part. One-part brackets can be produced particularly easily
27 and have particularly good stability. The use of particularly adaptable, individually
28 fabricated and/or individually adapted brackets, in particular those of which the length
29 is adaptable or is adapted, is not necessary in the case of the present method, since an
30 alignment and setting of the distance on the basis of the trays is possible without any
31 problem.
- 32 [0053] Advantageously, bracket replica foot areas of a thickness that is increased in
33 comparison with the actual bracket foot areas of the respectively replicated actual

1 bracket by a minimum adhesive material thickness of the adhesive material that can be
2 used for adhesively bonding the bracket to the tooth crowns are advantageously used.
3 If the brackets were arranged in the virtual replication or the virtual bracket replicas
4 were arranged in the virtual arrangement immediately on the virtual tooth crown
5 replicas, in the end there would in fact be no space for adhesive compound in the
6 placement of the brackets with the aid of the tray, so that the interposed adhesive
7 material compound would give rise to inaccuracies, in particular on account of the
8 deformation of the elastic tray, and/or the adhesive would be excessively forced out of
9 the adhesive area, so that reliable adhesive bonding would not be possible. For this
10 reason, allowance for a minimum thickness of the adhesive material is already
11 advantageously made in the bracket replica foot areas, so that unproblematic adhesive
12 bonding is later possible. Greater distances can be bridged without any problem by
13 more adhesive compound. In this case, the alignment is provided by the tray.

14 [0054] Actual brackets corresponding to the bracket replicas or the brackets are
15 advantageously set into the partial impressions such that they are arranged there in the
16 same way as the bracket replicas or brackets were arranged in the production of the at
17 least one actual model. As a result, the brackets are arranged in the partial moldings,
18 that is to say in the trays, in such a way that they can be transferred with an exact fit
19 into the patient, or onto the tooth crowns of the patient, to be specific precisely as
20 planned in advance.

21 [0055] For this purpose, the brackets are advantageously screwed into the partial impressions
22 and thereby screwed into an undercut or undercuts of the partial impressions. Insertion
23 into undercuts without screwing is either not possible or often changes the partial
24 impressions in such a way that the brackets are then only retained poorly or not at all
25 any longer. Insertion by screwing allows the bracket to be inserted or screwed into
26 undercuts, for example on the upper wing and/or the wire lead-through, without the
27 retaining effect in the tray being noticeably reduced.

28 [0056] The partial moldings are advantageously produced by thermoforming of thermoforming
29 film, in particular elastic tough thermoforming film. In this way, corresponding partial
30 moldings, that is to say trays, can be produced particularly reliably, quickly and
31 inexpensively.

32 [0057] A gripping aid may be provided on each tray, to facilitate the gripping and positioning of
33 the tray in the oral cavity of the patient. For this purpose, a columnar structure may be

1 provided in particular on the tray, in particular on the upper side thereof, which is the
2 side that is facing the occlusal surface. This structure may have in particular a
3 narrowing, which can be at least partially enclosed by a corresponding instrument, for
4 example tweezers. The gripping aid is in this case rotationally symmetrical about at
5 least one axis and, in interaction with the instrument, offers mobility at least about this
6 axis. The gripping aid may, for example, be formed from metal and have in particular a
7 base by which it is connected to the tray. This may take place by adhesive attachment,
8 by fusing in or by casting in when creating the tray by casting. The narrowing is
9 arranged in particular between the tray and a region with a greater diameter. The
10 narrowing may also be arranged between an end hemisphere to sphere with a greater
11 diameter and the tray. The instrument can then at least partially enclose the sphere
12 and also engage in the narrowing such as to rule out the possibility of slipping off from
13 the gripping element. In this way it can also be ensured that there is mobility between
14 the gripping aid and the instrument that goes beyond the mobility about the axis of
15 symmetry. In particular, tilting between the axis of symmetry and the longitudinal axis of
16 the instrument through a defined angular range is then also possible. In particular, the
17 instrument has two shells with quarter- to hemispherical clearances, which are made to
18 match the end hemisphere to sphere in diameter and by which the end hemisphere to
19 sphere can be engaged. In particular, the instrument, which may be included in a
20 system comprising an instrument and at least one gripping aid or at least one tray with
21 a gripping aid, is formed such that it does not release a gripping aid once gripped
22 without force being externally applied, and release can be achieved by correspondingly
23 applying force to the instrument.

24 [0058] The object is also achieved by a tray according to Claim 15, the comments made with
25 respect to the method applying with respect to the extent of the tray and being
26 applicable to the tray.

27 **Brief description of the drawings**

28 [0059] In the figures, which are schematic and given purely by way of example:

29 [0060] Figure 1 shows a view of an entire replica

30 [0061] Figure 2 shows a view of a model

31 [0062] Figure 3 shows a view of a mould

32 [0063] Figure 4 shows a view of a model with a tray

33 [0064] Figure 5 shows a view of a single-series mould

1 [0065] Figure 6 shows a view of a two-series mould

2 [0066]

3 **Way(s) of carrying out the invention**

4 [0067] In Figure 1 an entire replica is shown, comprising a tooth crown replica 1, a connection
5 replica 3 and a bracket replica 2. The bracket replica 2 has a wire lead-through 9 as
6 well as two wings 10 and wing undercuts 11.

7 [0068] According to the invention, however, such an entire replica 4 is not used. Rather, a
8 model 5 such as that shown in Figure 2 is used instead of such a replica.

9 [0069] Figure 2 shows a model 5 comprising a tooth crown part 6, a connection part 7 and a
10 bracket part 8. It can be seen that the bracket part 8 has a wing undercut 11. A part of
11 the wire lead-through 9 or the undercut thereof is also included in the bracket part 8. As
12 a result, the bracket part 8 has two undercuts. In this embodiment, the tooth crown part
13 6 also has a small undercut, which can be seen on the left side.

14 [0070] On the basis of such an actual model, a tray can be produced in various ways.

15 [0071] Figure 3 shows a mould 12 for the production of a tray by casting. Apart from the model
16 5, which has already been shown in Figure 2 and which comprises a tooth crown part 6
17 as well as a connection part 7 and a bracket part 8, the mould 12 comprises a base 15
18 and walls 14. The walls 14 have the effect of creating a closed mould 12, which can be
19 filled with corresponding material. This allows the tray to be produced.

20 [0072] Figure 4 shows the production of a tray 13 by using a thermoforming film. A model 5
21 comprising a tooth crown part 6, a connection part 7 and a bracket part 8 can be seen.
22 A tray 13 is produced on this model by thermoforming of a thermoforming film.

23 [0073] Figure 5 shows a mould 12, comprising multiple tooth crown parts 6, connection parts 7
24 and bracket parts 8. The mould 12 is enclosed by walls 14. Likewise shown are dashed
25 cutting lines, where the tray produced by casting can be divided up, so that then
26 individual trays are produced.

27 [0074] Figure 6 shows a two-series mould 12, comprising eight tooth crown parts 6,
28 connection parts 7 and bracket parts 8. The mould 12 not only has exterior walls 14.
29 Rather, it also has interior walls 14, which run horizontally and vertically and divide the
30 mould 12 up into eight individual moulds, with the aid of which eight individual trays can
31 be produced directly in a simple operation.

32 [0075] List of designations

33 1. Tooth crown replica

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
2. Bracket replica
 3. Connection replica
 4. Entire replica
 5. Model
 6. Tooth crown part
 7. Connection part
 8. Bracket part
 9. Wire lead-through
 10. Upper wing
 11. Wing undercut
 12. Mould
 13. Tray
 14. Wall
 15. Base
 16. Cutting line

Claims

1. Method for producing individual trays (13) for the positioning of brackets, comprising the steps of:
 - a) producing an actual model (5), the at least one model being a replica of at least portions of at least two tooth crowns of teeth located in a jaw and comprising bracket replicas or brackets assigned to the replicas of the tooth crowns;
 - b) producing at least two trays (13) by producing at least one impression of the actual model (5) that is/are respectively suitable for at least partially receiving at least one of the at least two tooth crowns and an actual bracket that corresponds to the bracket assigned to the respective tooth crown or corresponds to the assigned bracket replica, receiving them in such a way that the arrangement of the bracket replica or bracket (2) and of the replication of the tooth crown (1) in the model is reproduced in reality in the model by the bracket received and the tooth crown received,
characterized in that
the trays (13) respectively comprise an impression of only in each case at least one tooth crown part (6) of the at least two tooth crowns and only in each case at least one bracket part (8) of the at least two bracket replicas or brackets, the at least one bracket part (8) respectively extending vertically, as seen from the occlusal surface of the assigned tooth crown, at most up to the end of the wire guide (9) and/or up to the end of the first undercut of the bracket and/or bracket replica that is arranged after the upper wing (10) when viewed from the occlusal surface.
2. Method according to Claim 1, the at least one bracket part (8) respectively extending vertically, as seen from the occlusal surface of the assigned tooth crown, at most up to, in particular up to, the beginning of the wire guide (9) and/or at most up to, in particular up to, the beginning of the first undercut of the bracket and/or bracket replica that is arranged under the upper wing (10).
3. Method according to one of the preceding claims, the at least one tooth crown part (6) in particular extending vertically from the occlusal surface at most up to, in particular up to, the first undercut of the corresponding tooth crown.

4. Method according to one of the preceding claims, the actual model (5) comprising of the brackets only the bracket parts (8) and/or of the tooth crowns only the tooth crown parts (6).
5. Method according to one of the preceding Claims 1 to 4, the actual model (5) comprising more a replica of the at least one tooth crown than the tooth crown part (6) and/or more a replica of the bracket replica or bracket than the bracket part (8) and, after the taking of the impression, the at least two trays (13) initially likewise comprising more impression and being correspondingly shortened after the taking of the impression, in particular by grinding.
6. Method according to one of the preceding claims, in step b) initially one impression being created and this impression subsequently being divided up such that each piece is a replica of only one tooth crown with a bracket.
7. Method according to one of Claims 1 to 4, in step b) initially at least two partial impressions being created, so that each partial impression is a replica of only one tooth crown with a bracket.
8. Method according to one of the preceding claims, the replicas of the tooth crowns being arranged in the actual model (5) along parallel running straight lines, in particular along one or two parallel running straight lines.
9. Method according to one of the preceding claims, the model (5) comprising along with the replicas further devices (14, 15) for taking impressions, in particular thermoforming and/or casting.
10. Method according to one of the preceding claims, the at least one impression being created by casting the model (3) and using as casting compound in particular such a compound that shrinks during curing.
11. Method according to one of Claims 1 to 9, the at least one impression being created by thermoforming a thermoforming film on the model.

12. Method according to one of the preceding claims, after step b) at least one bracket being inserted into the tray such that it is arranged there in the same way as the bracket replicas or brackets were arranged during the production of the at least one tray and in particular being retained by a clamping effect.
13. Method according to Claim 12, the brackets being screwed into undercuts of the tray.
14. Method according to one of the preceding claims, in which a gripping aid is provided on each tray (13).
15. Tray for placing at least one bracket on a tooth crown, characterized in that the tray (13) merely comprises a bracket part (8) of each bracket replica or bracket, which extends vertically, as seen from the occlusal surface, at most up to the end of the wire guide (9) and/or up to the end of the first undercut of the bracket and/or bracket replica that is arranged underneath the upper wing (10).

1/2

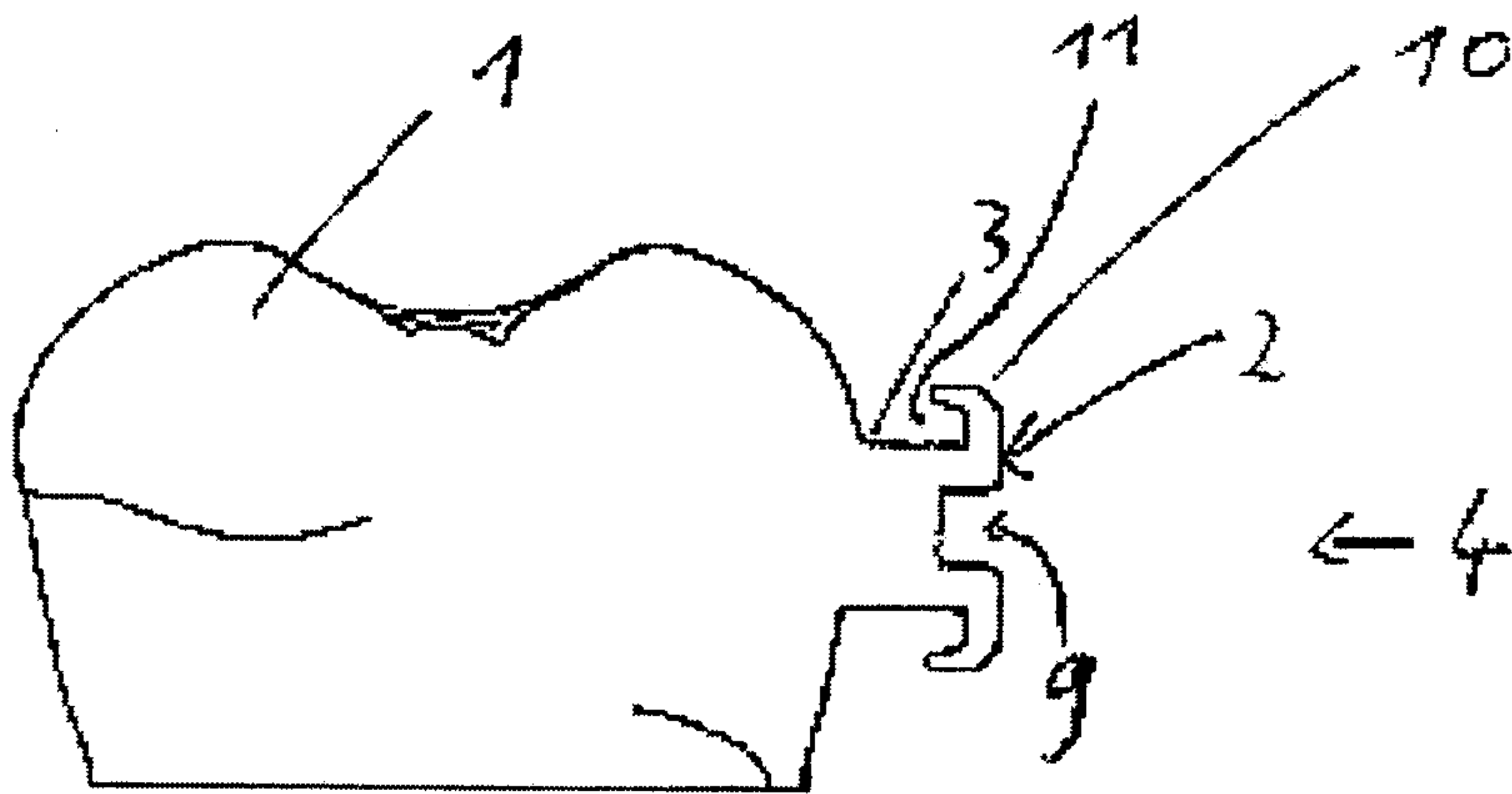


Fig. 1

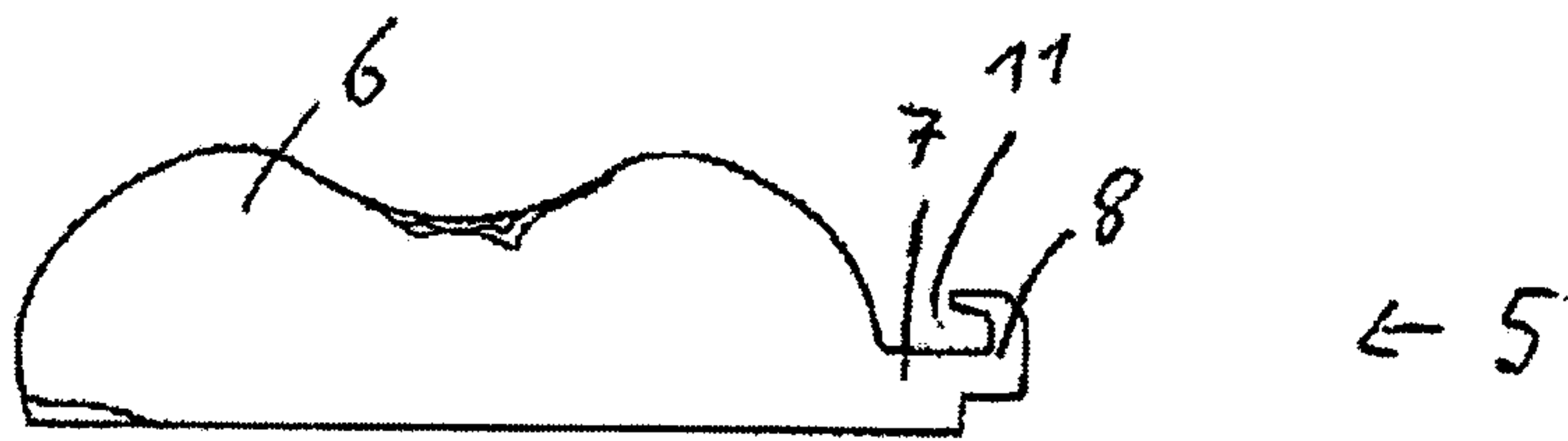


Fig. 2

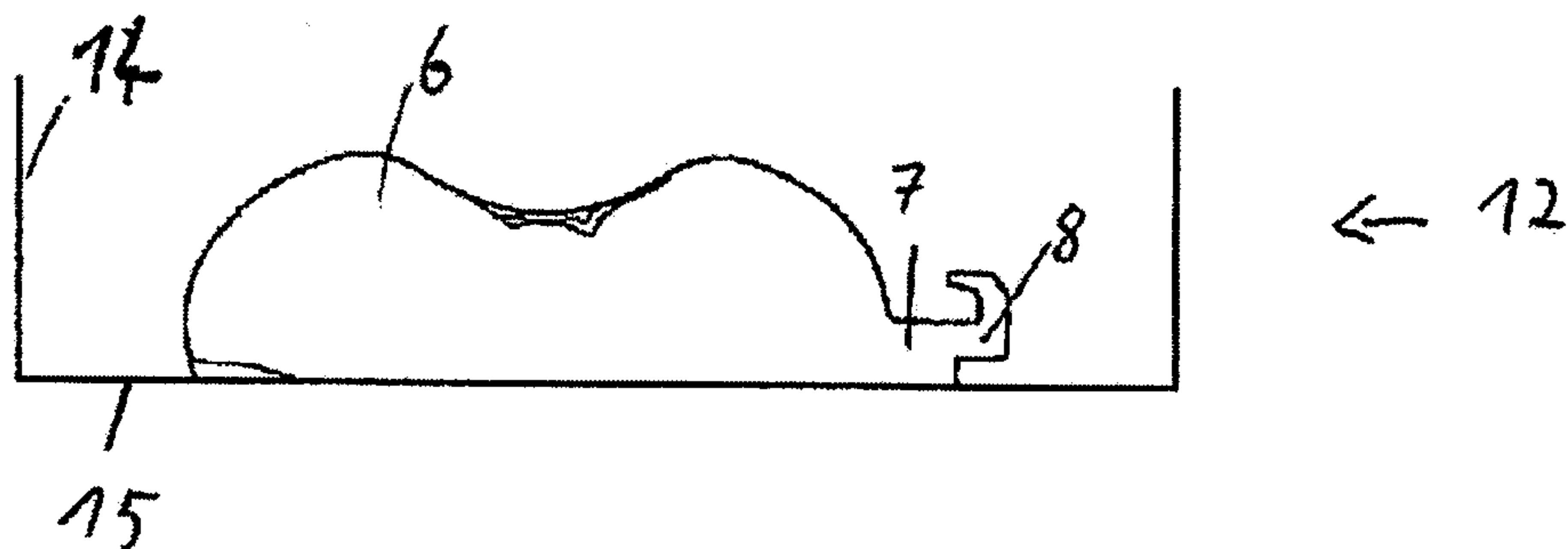


Fig. 3

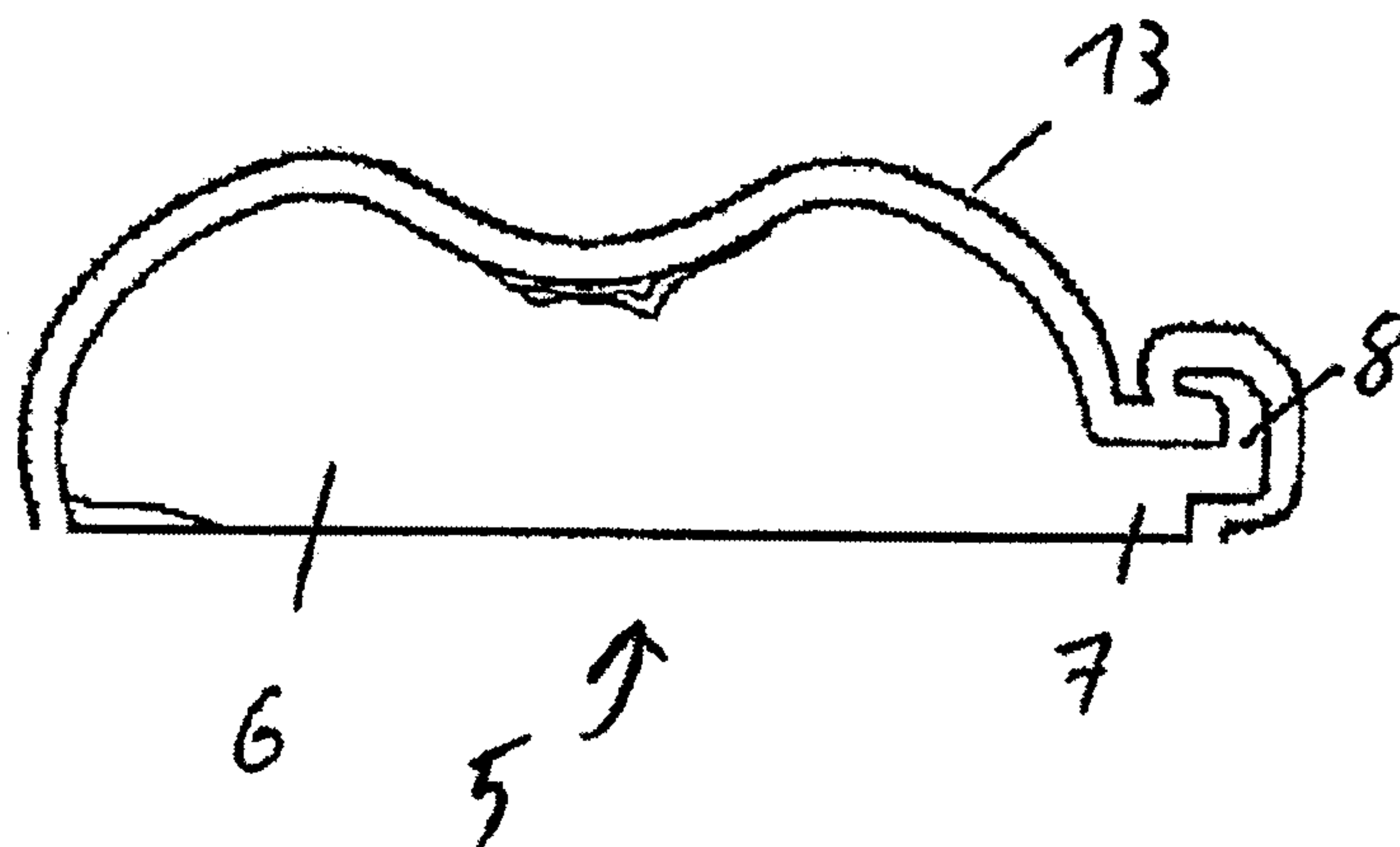


Fig. 4

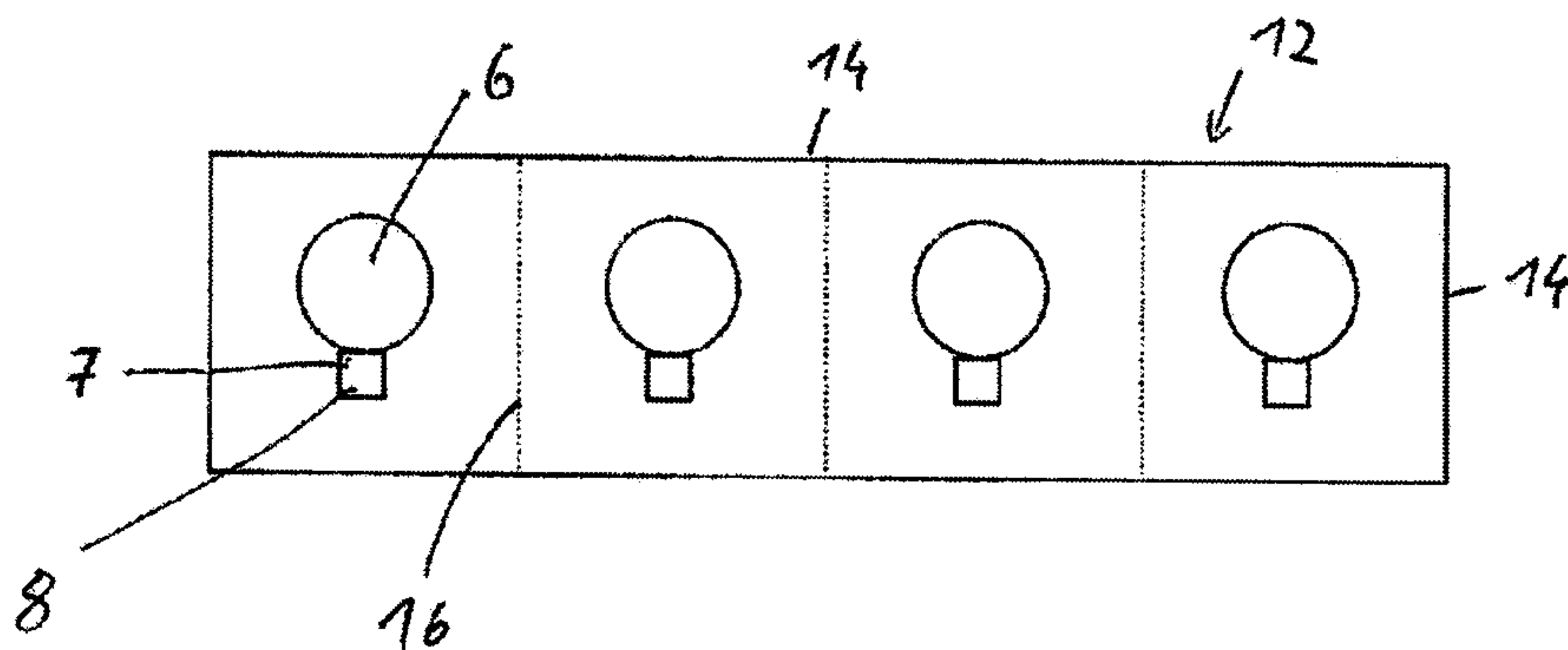


Fig. 5

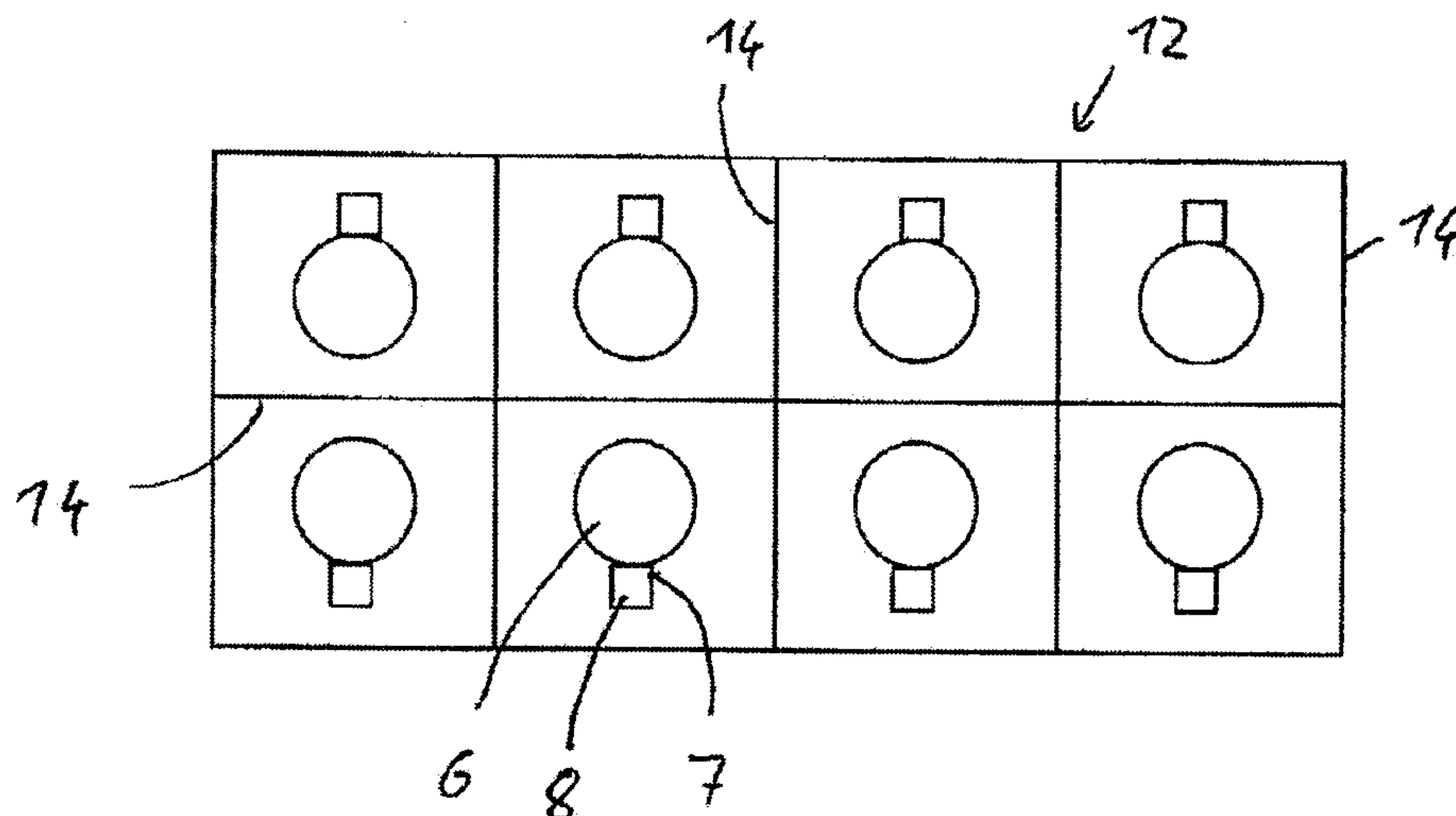


Fig. 6

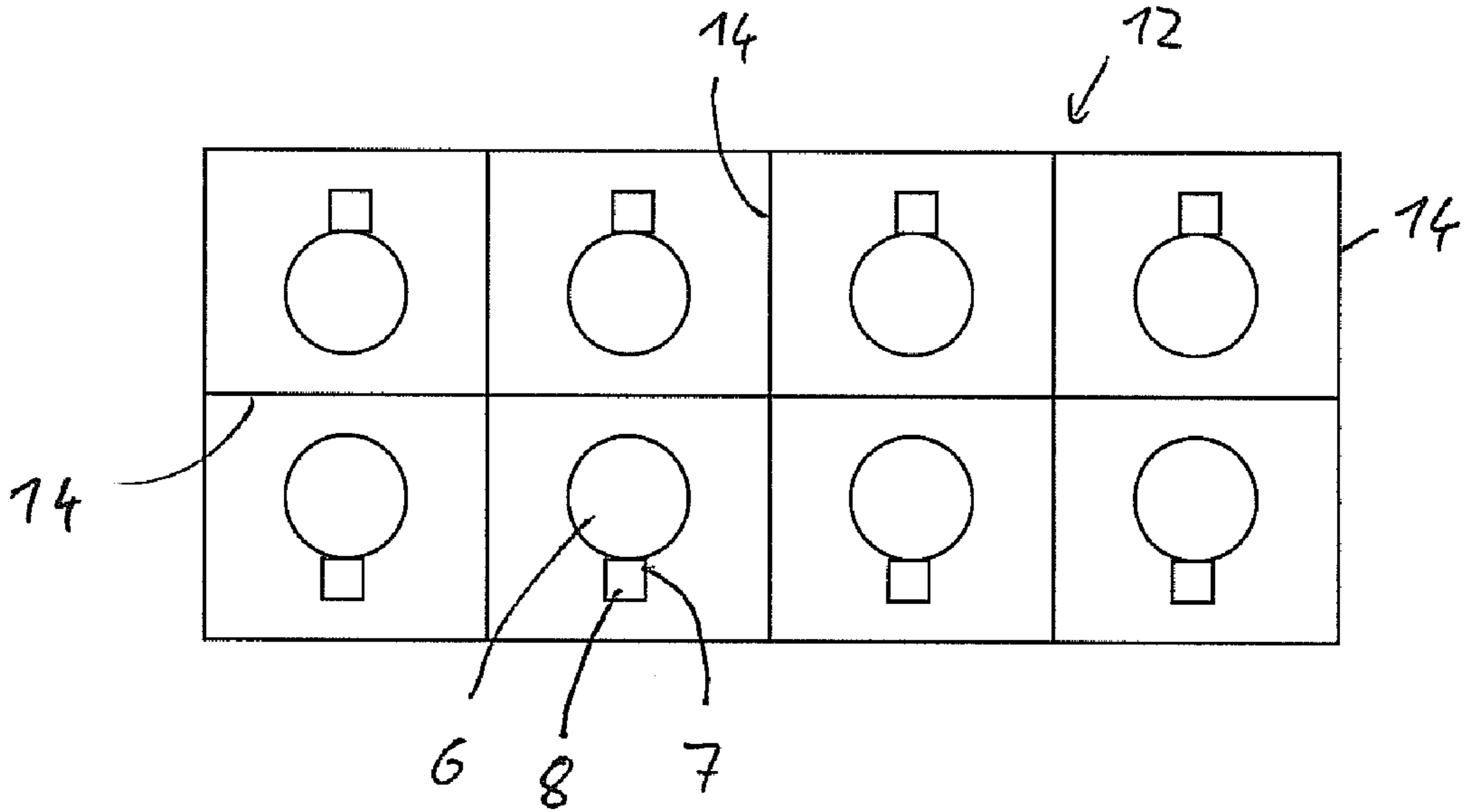


Fig. 6