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(54) **Contact element**

Kontaktelement

Élément de contact

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Description

[0001] The invention relates to a contact element for connecting electrical conductors, comprising connection means for electrically connecting the contact element to a conductor of a cable as well as a connection plate for connecting the contact element to a contact element of a further cable, wherein the connection plate has at least one locking element and at least one locking hole and wherein the at least one locking element is formed for engaging in a locking hole of the contact element of the further cable.

[0002] Contact elements, often called cable lug, are used in the automotive industry for electrically connecting one or several conductors to a ground connection bolt. These several conductors are generally bundled together to a wire harness. The ground connection bolt and the car body, to which the ground connection bolt is connected, may also be called conductors. The processes during the manufacture of a wire harness or its transportation or its assembly to the ground connection bolt are hardly standardised and, therefore, prone to error and time consuming, especially then, when each cable lug of each individual conductor of a cable has to be individually connected to the ground connection bolt. Furthermore, the danger exists, that the wires get entangled or that an entanglement of the cables is produced.

[0003] To solve this problem, DE 10 2005 061 221 A1 describes a contact element, in which the connection plate forms at least one locking element and at least one locking hole, wherein the at least one locking element is formed for engaging the at least one locking hole of a further contact element. A locking between the two contact elements is to be ensured by means of one locking projection on a free end of the locking element. Thus, all cable lugs, which are to be connected to the ground connection bolt, can be pre-assembled to a unit.

[0004] A further contact element known in the art is shown in EP 1 746 686 A1, document on which the preamble of claim 1 is based.

[0005] The object of the present invention is to provide a contact element, which engagement in a further contact element ensures a secure connection during the assembly processes.

[0006] The object is met by a contact element for connecting electrical conductors, comprising connection means for electrically connecting the contact element to a conductor of a cable as well as a connection plate for connecting the contact element to a contact element of a further cable, wherein the connection plate has at least one locking element and at least one locking hole and wherein the at least one locking element is formed for engaging in a locking hole of the contact element of the further cable, and wherein, furthermore, the at least one locking element has two locking projections, which are effective in opposed directions, for locking with the contact element of the further cable.

[0007] The advantage of this arrangement is, that by means of the several locking projections, a secure locking of the first contact element in a further contact element is ensured. Thus, an axial as well as a radial fixation of two or more contact elements relative to each other is ensured during the transportation of the wire harness and before connecting the contact elements to a ground connection bolt. The contact elements are already pre-positioned and are secured relative to each other by means of this radial and axial fixation, so that the possibility of an undesirable wire entanglement is at least drastically reduced, if not even prevented. All contact elements connected to each other and which represent a type of a packet, can be pushed onto the ground connection bolt at the same time. This also contributes to a reduction of the process duration. These advantages are still increased, when, preferably, the locking projections are arranged at a specific minimal distance to each other.

[0008] In a specific arrangement, it is preferred, that the locking projections are aligned facing away from each other, i.e. are effective. Generally, however, they can also face each and be effective. Preferably, the locking projections are aligned, when seen in circumferential direction, around a hole in the connection plate, facing away from each other.

[0009] In a further embodiment the at least one locking element and the at least one locking hole are arranged on a concentrical circumference around a central hole in the connection plate. By means of the arrangement on a concentrical circumference, it is ensured, that two contact elements can be fixed to each other by means of the at least one locking element and the at least one locking hole, to be able to be pushed onto the ground connection bolt at an angle off-set to each other.

[0010] In a further specific embodiment, several locking elements and several locking holes are provided on the concentrical circumference around the hole. Thus, a good fixation of the at least two contact elements relative to each other can be ensured. Preferably, the locking elements as well as the locking holes are, respectively, arranged diametrically opposite in pairs. More locking holes than locking elements can be provided, so that the contact elements can be positioned and fixed in several angular positions relative to each other.

[0011] In a more concrete embodiment, the at least one locking element has two locking arms, which project from a plane of the connection plate. Thus, the necessary elasticity of the locking element is ensured. Preferably, the locking arms are made integrally from the connection plate by means of stamping and transforming. This structure can be manufactured in a simple manner.

[0012] The locking arms can be formed such, that, respectively, one of the locking projections is arranged at the free end of the locking arms.

[0013] When a first connection plate is coupled to a second connection plate, the connection elements of the first connection plate are passed through the locking holes of the second connection plate and project from the locking holes from the side of the second connection

plate, facing away from the first connection plate. When now a third connection plate is to be coupled to the second connection plate, a space has to be provided on the third connection plate for the locking elements of the first connection plate, so that these are not again detached from their engagement. For this it can be provided, that the locking holes widen at least in the area, in which the locking elements engage, towards the side of the connection plate, which is facing away from the locking elements. Thus, the locking elements of the first connection plate can project through the locking holes of the second connection plate, engage behind these and enter the widened side of the locking holes of the third connection plate.

[0014] Furthermore, the object is solved by a connection arrangement with at least two contact elements of the above described type, wherein the at least two contact elements are connected to each other, such that, respectively, a locking element of a first of the at least two contact elements is locked in a locking hole of a second of the at least two contact elements.

[0015] In this case, it can be provided, that the locking projections of each locking element on the side of the second contact element facing way from the first of the two contact elements, engage behind the respective locking hole.

[0016] In the following, a preferred embodiment is described by using the figures. It shows

Figure 1 a contact element according to the invention in a perspective view,

Figure 2 two contact elements locked to each other in a perspective view,

Figure 3 a connection arrangement with eight contact elements according to the invention,

Figure 4 a longitudinal sectional view through the connection arrangement of Fig. 3 parallel to a longitudinal axis of the connection arrangement and

Figure 5 an alternative embodiment of a contact element according to the invention.

[0017] In the following, Figures 1 to 4 will initially described together.

[0018] The contact element 1 consists of a flat connection plate 3 with a central through hole 8, which represents a central opening and by means of which the contact element 1 can be plugged onto a ground connection bolt 11, shown in Fig. 3. Connection means 2 extend in a radial direction from the connection plate 3 in form of a crimping connection, which serves in the present invention for contacting a connection sleeve 12, in which opening 13 a not shown end of an electric conductor of a cable, which insulation is removed at an end, can be accommodated. Alternatively, the connection means 2 can also be formed in any other form, e.g. as an insulation displacement contact, a screwed contact or a soldered connection.

[0019] In this case, the outer circumference 9 of the connection plate 3 is formed octagonal. Other forms are also possible. Between the outer circumference 9 and the central through hole 8, two locking elements 4, 4' and six locking holes 6 are arranged on a concentrically enlarged circumference around the central through hole 8 or around their geometrical centre. The two locking elements 4, 4' are arranged diametrically to each other. Furthermore, the locking holes 6 are arranged in pairs diametrically to each other. On the respective circumferential portions between the locking elements 4, 4', three locking holes 6 are arranged.

[0020] Each locking element 4, 4' is formed by two locking arms 5, 5', which can be manufactured by stamping and transforming from the connection plate 3 and can project to one side vertically or nearly vertically from the plane of the connection plate. As the locking arms 5, 5' or the locking elements 4, 4' were produced from the connection plate 3, material holes are produced radially within the locking elements 4, 4'.

[0021] At their free ends, i.e. facing away from the bending area towards the connection plate 3, the locking arms 5, 5' have, respectively, locking projections 7, 7' in form of projections 16 facing parallel to the connection plate 3. The locking projections 7, 7' can simply be formed by means of stamping and transforming. The distance of the projection 16 to the upper face of the connection plate 3 is, preferably, a bit larger than the material thickness of the connection plate 3. The locking projections 7, 7' of a locking element 4, which consists of two locking arms 5, 5', are aligned facing away from each other. This means, that the locking projections 7, 7' of one locking arm 5, 5' are aligned, when seen in circumferential direction around the central through hole 8 in the connection plate 3, facing away from each other. "Aligned facing away from each other" means, that they enclose an obtuse angle between each other, i.e. that the directions, in which the locking projections 7, 7' extend, enclose a right angle or a larger angle.

[0022] As a further embodiment, but not shown, a locking element can also have three locking arms, respectively with one locking projection. In a top view onto the locking arms, these are arranged approximately 120 ° off-set to each other, i.e. the directions, in which the locking projections extend, enclose an angle of approximately 120°. Thus, the locking projections are aligned facing away from each other.

[0023] As a further embodiment, but not shown, a locking element can also have four locking arms, respectively, with one locking projection. In a top view onto the locking arms, neighbouring locking arms are arranged offset to each other by 90° concerning the directions, in which the locking projections extend. Thus, the locking projections of the locking arms, which are arranged off-

set to each other by 180º, are aligned facing away from each other.

[0024] In Fig. 2 two identically formed contact elements 1, 1', locked to each other, are shown, which form a connection arrangement 10. The upper contact element 1' is locked relative to the lower contact element 1 such, that the connection means 2 are arranged at an angle to each other. In the present case, the angle off-set is 45º, because of two locking elements 4, 4' and six locking holes 6 which are being uniformly distributed about the circumference. It is visible, that the locking arms 5, 5' of the lower contact element 1 project upwards through the corresponding locking holes 6 of the upper contact element 1'. When pushing the locking arms 5, 5' through the locking holes 6, the locking arms 5, 5' slide along angular sliding-slants of the locking projections 7, 7' through the locking holes 6, whereby the two locking arms 5, 5' of a locking element 4 are elastically deformed towards each other, so that they are pre-biased. As soon as the locking projections 7, 7' have reached the upper face of the connection plate 3, the locking arms 5, 5' of a locking element 4 snap because of the pre-biasing, again away from each other and the locking projections 7, 7 lock the two contact elements 1, 1' relative to each other. Thus, the lower contact element 1 is locked, respectively, via a locking arm 5 by the locking projection 7, i.e. via the projection 16 of the locking arm 5 facing parallel to the plane of the connection plate 3, relative to the connection plate 3, i.e. relative to the upper face of the connection plate 3, of the upper contact element 1'.

[0025] If now a further contact element, formed identically to the first two contact elements, is connected, this can be put onto the upper of the two contact elements 1', wherein this, for example, is again off-set by 45º to the upper of the two first contact elements 1'. Thus, the locking elements of the upper contact element 1' can engage in the locking holes of the further contact element. To prevent, that the locking connection between the two first contact elements 1, 1' is not again detached by means of plugging-on the further contact element, the locking holes 6 are formed such, that they are formed enlarged in the direction towards the respective locking arms 5, 5', by which they are penetrated for locking. At least in the areas, in which the locking arms 5, 5' engage behind the locking holes 6, i.e. in the shown embodiment, the locking holes 6, are formed enlarged relative to their extension in circumferential direction. On the narrower side of a locking hole 6, thus, this serves for engaging behind the locking arms 5, 5'. On the wider side of the locking hole 6, the locking arms 5, 5' or the locking projections 7, 7' of a contact element 1, 1' can enter, which is locked to a directly neighbouring contact element 1, 1'. The configuration of the locking holes 6 in a longitudinal sectional view is visible in Fig. 4.

[0026] Fig. 3 shows a connection arrangement 10 consisting of eight contact elements 1, 1' after the plugging onto a ground connection bolt 11. By means of a nut 15, the contact elements 1, 1' are secured on the ground connection bolt 11. By means of the locking elements 4, 4' and the locking holes 6, distributed evenly about the circumference, the contact elements 1, 1' form a star-like arrangement.

[0027] The advantage of this locking is, that by means of the several locking projections 7, 7', a secure locking of the first contact element 1 to a further contact element 1' is ensured. Thus, an axial as well as a radial fixing of two or more contact elements 1, 1' to each other during the transportation of the wire harness or before the connection of the contact elements 1, 1' to the ground connection bolt 11 is ensured.

[0028] Fig. 5 shows an alternative embodiment of a contact element 1, wherein the locking arms 5, 5' extend not freely radially outwards, but extend radially inwards forming a hole. For the rest, the contact element 1 corresponds to that of Fig. 1, wherein corresponding features are provided with the same reference numeral.

Reference numerals list

[0029]

1	contact element
2	connection means
3	connection plate
4	locking element
5	locking arm
6	locking hole
7	locking projection
8	central through hole
9	outer circumference
10	connection arrangement
11	ground connection bolt
12	connection sleeve
13	opening
14	sliding-slants
15	nut
16	projection

Claims

1. Contact element (1) for connecting electrical conductors, comprising connection means (2) for electrically connecting the contact element (1) to a conductor of a cable as well as
a connection plate (3) for connecting the contact element (1) to a contact element of a further cable,
wherein the connection plate (3) has at least one locking element (4) and at least one locking hole (6) and
wherein the at least one locking element (4) is formed for engaging in a locking hole of the contact element (1') of the further cable,
characterised in
that the at least one locking element (4) has two locking projections (7, 7'), which are effective in op-

posed directions, for locking with the contact element (1') of the further cable.

2. Contact element according to claim 1,
characterised in
that the locking projections (7, 7'), preferably when seen in circumferential direction around a central through hole (8) in the connection plate (3), are aligned facing away from each other.

3. Contact element according to one of the preceding claims,
characterised in
that the at least one locking element (4) and the at least one locking hole (6) are arranged on a concentrical circumference around a central hole (8) in the connection plate (3).

4. Contact element according to one of the preceding claims,
characterised in
that several locking elements (4, 4') and several locking holes (6) are provided.

5. Contact element according to claim 4,
characterised in
that, respectively, two locking elements (4, 4') are diametrically arranged opposite to each other and
that, respectively, two locking holes (6) are diametrically arranged opposed to each other in pairs.

6. Contact element according to one of the preceding claims,
characterised in
that the at least one locking element (4) has two locking arms (5, 5'), which project from a plane of the connection plate (3).

7. Contact element according to claim 6,
characterised in
that the locking arms (5, 5') are integrally manufactured from the connection plate (3) by means of stamping and transforming.

8. Contact element according to one of claims 6 or 7,
characterised in
that, respectively, one of the locking projections (7, 7') is arranged at the free ends of the locking arms (5, 5').

9. Contact element according to one of the preceding claims,
characterised in
that the locking holes (6) expand at least in the area, in which the locking elements (4) engage, towards the side of the connection plate (3), which is facing away from the locking elements (4).

10. Connection arrangement (10) with at least two contact elements (1, 1') according to one of the preceding claims,
characterised in
that the at least two contact elements (1, 1') are connected to each other, such that, respectively, one locking element (4) of a first of the at least two contact elements (1) engages in a locking hole of a second of the at least two contact elements (1').

11. Connection arrangement (10) according to claim 10,
characterised in
that the locking projections (7, 7') of each locking element (4) engage on the side of the second contact element (1'), facing away from the first of the two contact elements (1), behind the respective locking hole.

Patentansprüche

1. Kontaktelement (1) zum Verbinden von elektrischen Leitern, umfassend Verbindungsmittel (2) zum elektrischen Verbinden des Kontaktelements (1) mit einem Leiter eines Kabels sowie
eine Anschlussplatte (3) zum Verbinden des Kontaktelements (1) mit einem Kontaktelement eines weiteren Kabels,
wobei die Anschlussplatte (3) zumindest ein Rastelement (4) und zumindest ein Rastloch (6) aufweist und
wobei das zumindest eine Rastelement (4) zum Eingriff in ein Rastloch des Kontaktelements (1') des weiteren Kabels ausgebildet ist,
dadurch gekennzeichnet,
dass das zumindest eine Rastelement (4) zwei in entgegensetzte Richtungen wirksame Rastnasen (7, 7') zur Verrastung mit dem Kontaktelement (1') des weiteren Kabels aufweist.

2. Kontaktelement nach Anspruch 1,
dadurch gekennzeichnet,
dass die Rastnasen (7, 7'), vorzugsweise in Umfangsrichtung um einen zentralen Durchbruch (8) in der Anschlussplatte (3) betrachtet, voneinander abgewandt ausgerichtet sind.

3. Kontaktelement nach einem der vorangehenden Ansprüche,
dadurch gekennzeichnet,
dass das zumindest eine Rastelement (4) und das zumindest eine Rastloch (6) auf einem konzentrischen Umfang um einen zentralen Durchbruch (8) in der Anschlussplatte (3) angeordnet sind.

4. Kontaktelement nach einem der vorangehenden Ansprüche,
dadurch gekennzeichnet,

dass mehrere Rastelemente (4, 4') und mehrere Rastlöcher (6) vorgesehen sind.

5. Kontaktelement nach Anspruch 4,
dadurch gekennzeichnet,
dass jeweils zwei Rastelemente (4, 4') paarweise diametral gegenüberliegend angeordnet sind und
dass jeweils zwei Rastlöcher (6) paarweise diametral gegenüberliegend angeordnet sind.

6. Kontaktelement nach einem der vorangehenden Ansprüche,
dadurch gekennzeichnet,
dass das zumindest eine Rastelement (4) zwei Rastarme (5, 5') aufweist, die aus einer Ebene der Anschlussplatte (3) herausragen.

7. Kontaktelement nach Anspruch 6,
dadurch gekennzeichnet,
dass die Rastarme (5, 5') einstückig aus der Anschlussplatte (3) durch Stanzen und Umformung hergestellt sind.

8. Kontaktelement nach einem der Ansprüche 6 oder 7,
dadurch gekennzeichnet,
dass an den freien Enden der Rastarme (5, 5') jeweils eine der Rastnasen (7, 7') angeordnet ist.

9. Kontaktelement nach einem der vorangehenden Ansprüche,
dadurch gekennzeichnet,
dass sich die Rastlöcher (6) zumindest in dem Bereich, in dem die Rastelemente (4) in Eingriff kommen, zu der Seite der Anschlussplatte (3) hin erweitern, die den Rastelementen (4) abgewandt ist.

10. Verbindungsanordnung (10) mit mindestens zwei Kontaktelementen (1, 1') nach einem der vorangegangenen Ansprüche,
dadurch gekennzeichnet,
dass die mindestens zwei Kontaktelemente (1, 1') miteinander verbunden sind, indem jeweils ein Rastelement (4) eines ersten der mindestens zwei Kontaktelementen (1) in ein Rastloch eines zweiten der mindestens zwei Kontaktelementen (1') eingerastet ist.

11. Verbindungsanordnung (10) nach Anspruch 10,
dadurch gekennzeichnet,
dass die Rastnasen (7, 7') jedes Rastelements (4) auf der dem ersten der beiden Kontaktelemente (1) abgewandten Seite des zweiten Kontaktelements (1') das jeweilige Rastloch hintergreifen.

Revendications

1. Elément de contact (1) pour connecter des conducteurs électriques, comprenant
un moyen de connexion (2) pour connecter électriquement l'élément de contact (1) à un conducteur d'un câble ainsi que
une plaque de connexion (3) pour connecter l'élément de contact (1) à un élément de contact d'un câble supplémentaire,
dans lequel la plaque de connexion (3) possède au moins un élément de verrouillage (4) et au moins un orifice de verrouillage (6) et
dans lequel l'au moins un élément de verrouillage (4) est formé pour entrer en engagement dans un orifice de verrouillage de l'élément de contact (1') du câble supplémentaire,
caractérisé en ce que
l'au moins un élément de verrouillage (4) a deux saillies de verrouillage (7, 7'), qui sont efficaces dans des directions opposées, pour se verrouiller avec l'élément de contact (1') du câble supplémentaire.

2. Elément de contact selon la revendication 1,
caractérisé en ce que
les saillies de verrouillage (7, 7'), de préférence quand vues dans une direction circonférentielle autour d'un orifice traversant central (8) dans la plaque de connexion (3), sont alignées en se tournant le dos.

3. Elément de contact selon l'une quelconque des revendications précédentes,
caractérisé en ce que
l'au moins un élément de verrouillage (4) et l'au moins un orifice de verrouillage (6) sont agencés sur une circonférence concentrique autour d'un orifice central (8) dans la plaque de connexion (3).

4. Elément de contact selon l'une quelconque des revendications précédentes,
caractérisé en ce que
plusieurs éléments de verrouillage (4, 4') et plusieurs orifices de verrouillage (6) sont fournis.

5. Elément de contact selon la revendication 4,
caractérisé en ce que,
respectivement, deux éléments de verrouillage (4, 4') sont agencés diamétralement à l'opposé l'un de l'autre, et **en ce que**,
respectivement, deux orifices de verrouillage (6) sont agencés diamétralement à l'opposé l'un de l'autre par paires.

6. Elément de contact selon l'une quelconque des revendications précédentes,
caractérisé en ce que
l'au moins un élément de verrouillage (4) possède deux bras de verrouillage (5, 5'), qui font saillie d'un plan de la plaque de connexion (3).

7. Elément de contact selon la revendication 6,
caractérisé en ce que
les bras de verrouillage (5, 5') sont fabriqués intégralement à partir de la plaque de connexion (3) par estampage et transformation.

8. Elément de contact selon la revendication 6 ou la revendication 7,
caractérisé en ce que,
respectivement, une des saillies de verrouillage (7, 7') est agencée au niveau des extrémités libres des bras de verrouillage (5, 5').

9. Elément de contact selon l'une quelconque des revendications précédentes,
caractérisé en ce que
les orifices de verrouillage (6) s'étendent au moins dans la zone dans laquelle les éléments de verrouillage (4) entrent en engagement, vers le côté de la plaque de connexion (3) qui tourne le dos aux éléments de verrouillage (4).

10. Agencement de connexion (10) avec au moins deux éléments de contact (1, 1') selon l'une quelconque des revendications précédentes,
caractérisé en ce que
les au moins deux éléments de contact (1, 1') sont connectés l'un à l'autre, de sorte que, respectivement, un élément de verrouillage (4) d'un premier des au moins deux éléments de contact (1) entre en engagement dans un orifice de verrouillage d'un deuxième des au moins deux éléments de contact (1').

11. Agencement de connexion (10) selon la revendication 10,
caractérisé en ce que
les saillies de verrouillage (7, 7') de chaque élément de verrouillage (4) entrent en engagement sur le côté du deuxième élément de contact (1'), tournant le dos au premier des deux éléments de contact (1), derrière l'orifice de verrouillage respectif.

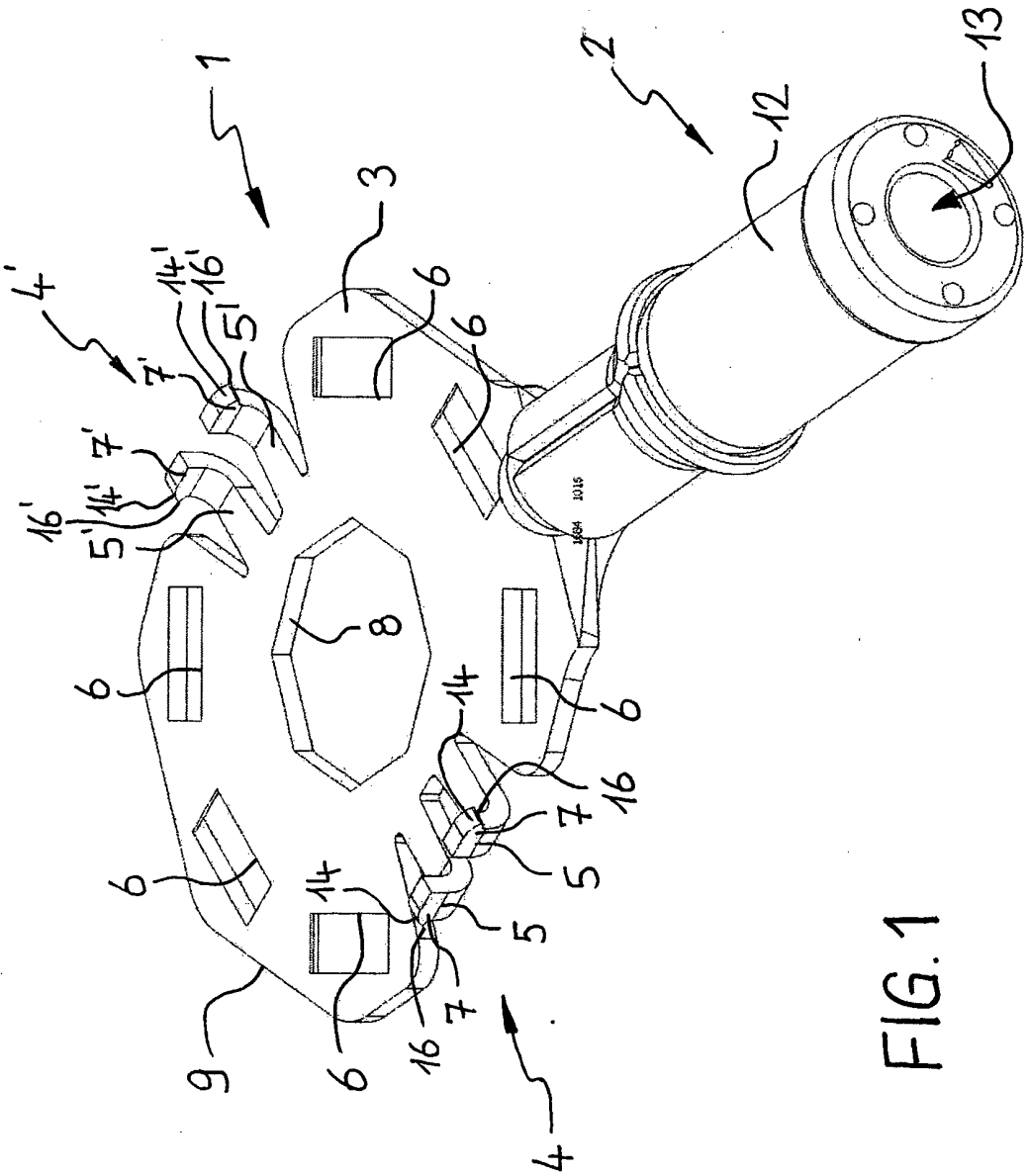


FIG. 1

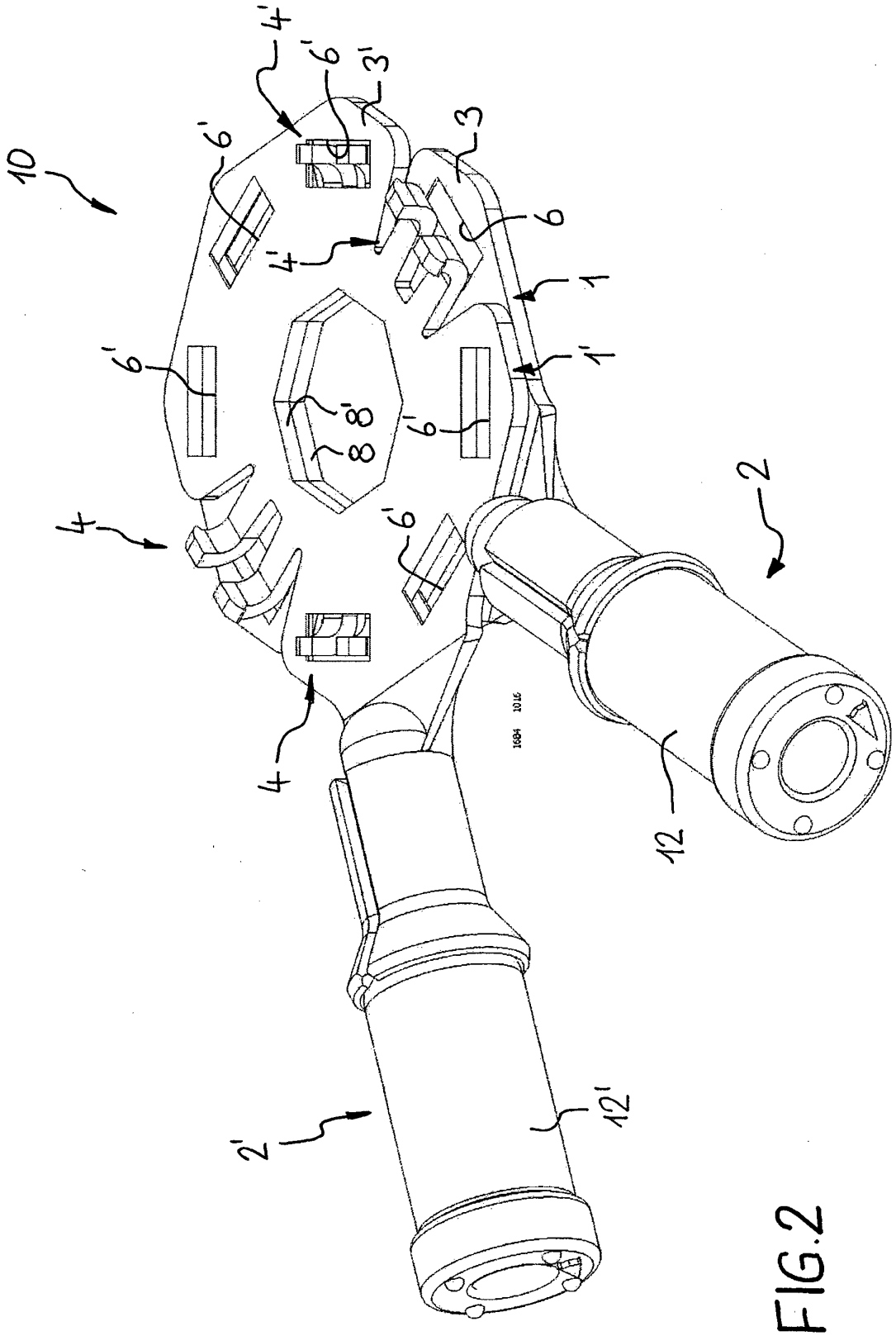


FIG.2

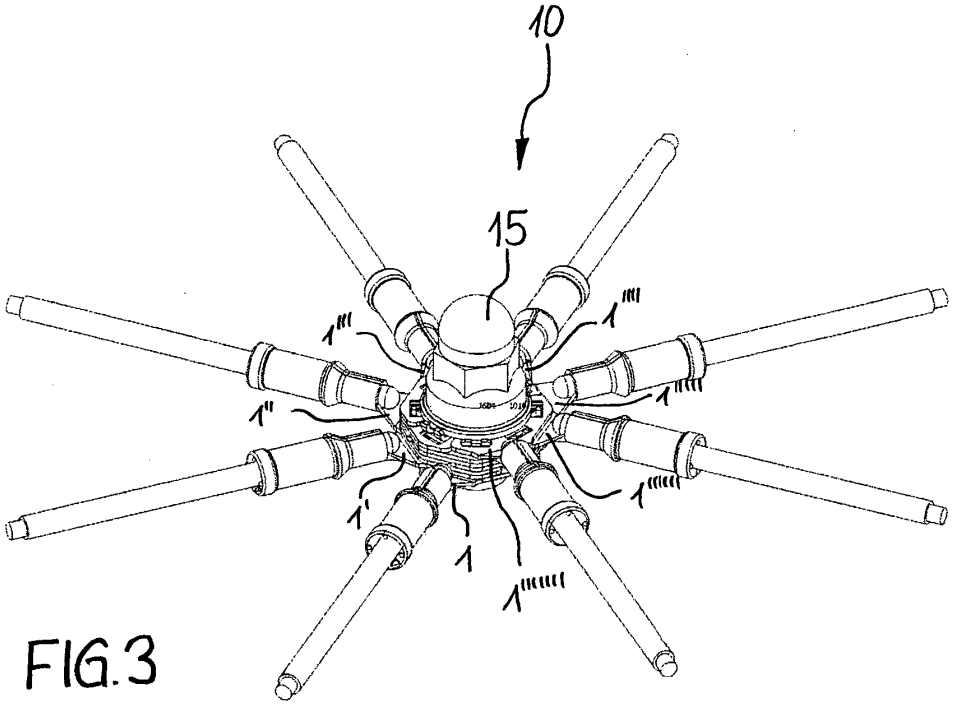


FIG.3

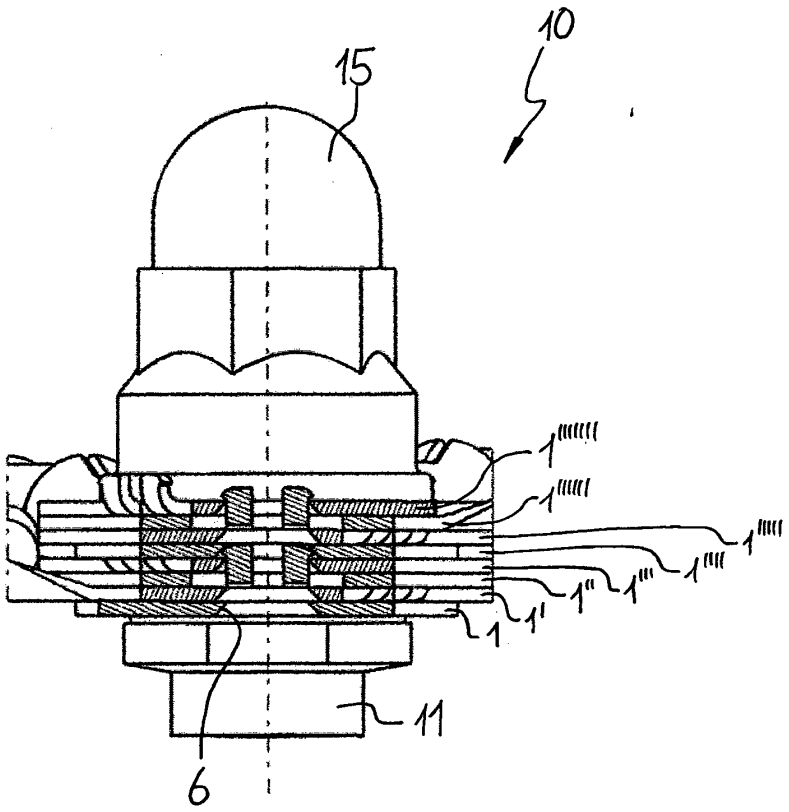


FIG.4

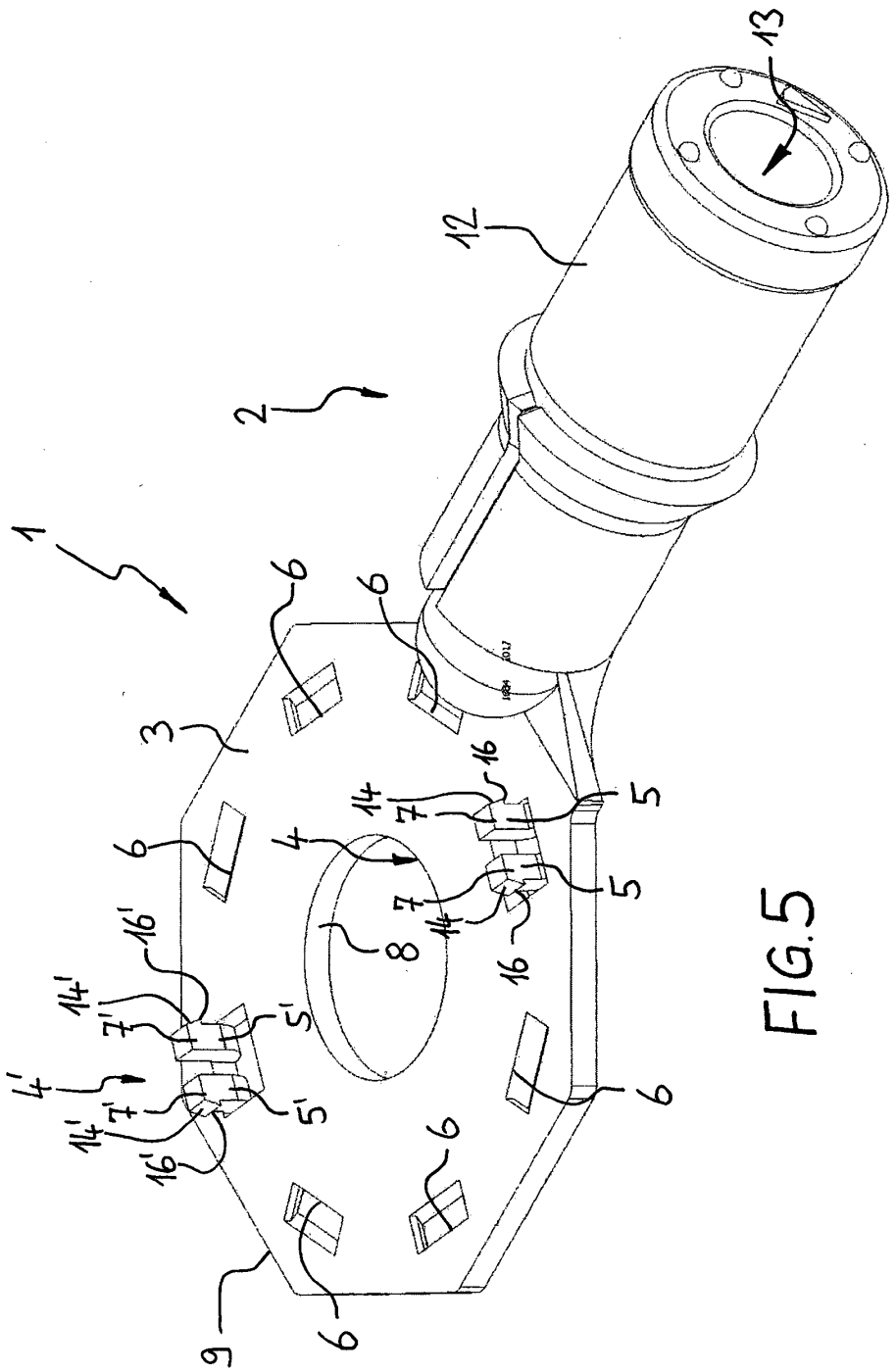


FIG.5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- EP 1746686 A1 **[0004]**