

(51) International Patent Classification:
H01R 13/17 (2006.01)

(21) International Application Number:

PCT/EP2009/066756

(22) International Filing Date:

9 December 2009 (09.12.2009)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

102008064590.7 19 December 2008 (19.12.2008) DE

(71) Applicant (for all designated States except US): **TYCO ELECTRONICS AMP GMBH** [DE/DE]; Amperestrasse 12-14, 64625 Bensheim (DE).

(72) Inventors; and

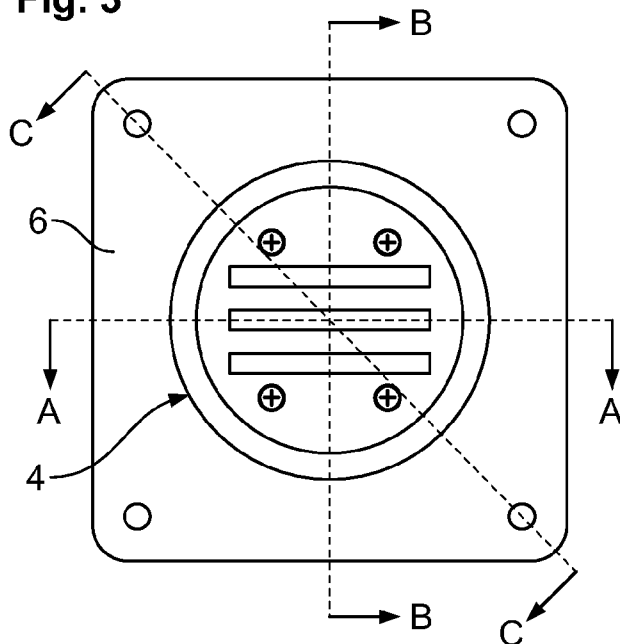
(75) Inventors/Applicants (for US only): **ABOULKASSEM, Mohamed** [DE/DE]; Parkstrasse 51, 64291 Darmstadt (DE). **BERGNER, Bert** [DE/DE]; Kinzigstrasse 42, 64625 Bensheim (DE). **KRAEMER, Rudolf** [DE/DE]; Schlossergasse 14, 64686 Lautertal (DE). **PURAS, TRUEBA, Luis, Javier** [ES/DE]; Neckarstrasse 20, 68259 Mannheim (DE). **SCHARF, Thomas** [DE/DE];Weiherstrasse 9, 64625 Bensheim (DE). **SCHRETTINGER, Christian** [AT/DE]; Bachgasse 5 d, 64625 Bensheim (DE).(74) Agent: **AFRAM, Tony**; Tyco Electronics UK Ltd, European Patent Department, Faraday Road, Dorcan, Swindon Wiltshire SN3 5HH (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

[Continued on next page]

(54) Title: CONTACT ARRANGEMENT FOR CONNECTION WITH A POLYGONAL SOCKET

Fig. 3

(57) Abstract: The invention relates to an electrical contact arrangement (K) for high pulsed currents and for connection with a polygonal socket (B), with two contact arms (2, 2') extending substantially in a plug-in direction (S), of which one (2') is resiliency deflectable relative to the other (2) in a deflection direction (A) extending perpendicularly to the plug-in direction (S). To ensure a secure connection between contact arrangement (K) and socket (B), even if external forces seek to twist the contact arrangement (K) around the plug-in direction (S), according to the invention the contact arrangement (K) comprises at least one further contact arm (2'), which is arranged spacedly relative to the other two contact arms (2, 2'), the resiliency deflectable contact arm (2') being movable in the deflection direction (A) at least in part into the interspace (Z) between the other two contact arms (2, 2'), and the contact arrangement (K) with the contact arms (2, 2', 2'') being held in the socket (B) by way of a three-point mounting.



MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, **Published:**
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, — *with international search report (Art. 21(3))*
ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

**CONTACT ARRANGEMENT FOR CONNECTION WITH A POLYGONAL
SOCKET**

5 The invention relates to an electrical contact arrangement for high pulsed currents and for connection with a polygonal socket, with at least two contact arms extending substantially in a plug-in direction, of which one is designed to be resiliently deflectable relative to the other in a deflection direction extending perpendicularly to the plug-in direction, the two contact arms being at least in part arranged spaced from one another in
10 the deflection direction.

 Electrical contact arrangements which withstand pulsed currents and are designed for connection with a polygonal socket are known from the prior art. US 5,533,915, for example, discloses a plug connector with two contact arrangements extending in the plug-
15 in direction, said contact arrangements being formed of a cuboid contact pin and a flexible tongue. The flexible tongue is attached to one side of the contact pin, and bends in its arcuate course firstly away from the contact pin, in order subsequently to bend back towards the contact pin.

20 In the prior art such a flexible tongue is generally made from a resiliently readily deformable steel, for example a spring steel, and has a cross-section which permits a sufficiently strong spring force.

 On an opposite side from the flexible tongue, the contact pin comprises a contact
25 surface for electrical connection with a mating contact, into the socket of which the contact arrangement may be inserted in the plug-in direction.

 A contact arrangement configured in this way has the advantage that the mating contact may be of simple construction and in particular does not require any flexible
30 tongue to press down the contact pin, since this is provided by the contact arrangement. The contact arrangement is compactly configured, despite the flexible tongue. The mating contact may be shaped for example as a busbar, in which a polygonal and in particular rectangular socket has been punched. A socket body may be dispensed with, since the socket does not comprise any further parts; the socket configuration cannot be simplified
35 any further.

 Without external forces acting on the contact arrangement, the contact pin inserted into the socket rests against a connection side of the socket and there forms the

electrically conductive part of the plug-and-socket connection. The flexible tongue rests against a side wall of the socket and presses the contact pin against the opposing, connection side of the socket. However, the flexible tongue contributes only insignificantly to current conduction, since, compared to the contact pin, it comprises a smaller cross-section and a lower specific electrical conductivity than the contact pin, which is made as a rule from a metal with good electrical conductivity.

However, if a mechanical force acts on the contact arrangement, this force may lead to tilting or twisting of the contact pin, in particular around the plug-in direction. This entails the risk of the contact pin becoming detached from the mating contact and the plug-and-socket connection between contact arrangement and mating contact being indeterminate. The conductivity of the plug-and-socket connection may diminish drastically.

The forces possibly twisting the plug connector may be caused for example by cables hanging from the contact arrangement. Even if no external mechanical forces act on the contact arrangement, the contact pin may tilt if the plug-and-socket connection is arranged in a possibly weak external magnetic field and a pulsed current of a few thousand amperes flows through the contact arrangement at least for a short time, i.e. for example for a period of a few milliseconds. Such pulsed currents may for example occur in the region of power electronics circuits in the event of switching processes and generate Lorentz forces, by means of which the contact arrangement may be twisted in the socket.

An indeterminate plug-and-socket connection possibly deteriorating in the event of high currents may lead to operating malfunctions of the power electronics and possibly cause arcing between the contact pin and the mating contact, by which the two contacts may be welded together virtually inseparably. The service life of the contact arrangement or of the mating contact may also be severely reduced by arcing which may arise and by erosion of the contact faces brought about thereby.

It is therefore an object of the invention to provide an electric contact arrangement which ensures a reliable plug-and-socket connection in the event of high pulsed currents even with a simply configured polygonal socket.

35

The object is achieved for the above-mentioned contact arrangement in that at least one further contact arm is provided, which extends in the plug-in direction and which is arranged spaced from the other two contact arms in a transverse direction

extending perpendicularly to the longitudinal and deflection directions, the resiliently deflectable contact arm being movable in the deflection direction at least in part into the interspace between the other two contact arms.

5 The solution according to the invention is structurally particularly simple and has the advantage that, as a result of the offset arrangement of the three contact arms relative to one another and in particular of the resiliently deflectable contact arm in the transverse direction between the other two contact arms, mechanically stable three-point mounting of the contact arrangement in the socket is ensured. Mechanical forces which seek to twist
10 or tilt the contact arrangement inserted into the socket may be resisted better by the contact arrangement according to the invention, whereby the contact arms rest reliably against the socket. The electrical plug-and-socket connection is thus markedly more reliable and the service life of the contact arrangement is longer without a socket of complicated construction being required or the contact arrangement occupying more
15 room than the contact arrangements of the prior art.

 In addition, the pulsed current may also flow from the contact arrangement into the socket through a plurality of contact zones; in the prior art the current flows solely through one contact zone. Using a plurality of contact zones allows the current density to
20 be reduced, so also reducing magnetic or thermal loads in the individual contact zones in comparison with the prior art. The current flowing overall through the contact arrangement may still be high.

 The solution according to the invention may be further improved by various
25 configurations which are each in themselves advantageous and may be combined as desired with one another. These configurations and the associated advantages will be looked into below.

 According to a first configuration, the contact arms may comprise contact portions
30 directed away from the contact arrangement, which contact portions may, in a plane arranged perpendicularly to the plug-in direction and in which the socket may extend, define at least in part a cross-section of polygonal outline, which cross-section may correspond substantially to the socket and in particular to the inner contour thereof. The contact portions may here be arranged in a sub-portion of the contact arms in the middle
35 in the plug-in direction and extend over a large part of the contact arms in the plug-in direction. For example, the contact portions may be of planar construction, so that they may be placed flush against contacting faces likewise of planar construction of a socket of rectangular construction, whereby particularly good, maximally extensive electrical contact is produced between contact arrangement and socket.

In particular, the contact portions of the two contact arms may be arranged directed away from the contact portion of the resiliently deflectable contact arm. This arrangement of the contact portions ensures good connectability of the contact arrangement with a socket of rectangular internal contour.

5

When the contact arrangement is inserted into the socket, the resiliently deflectable contact arm may be moved in the deflection direction at least in part and against a spring force into the interspace between the other two contact arms. By means of this spring force, said other two contact arms are also pressed against contacting faces
10 of the socket. The contact arrangement may be secured against undesired movements at least in the plug-in direction by means of frictional engagement between the contact portions and the contacting faces in the socket. In this respect, the spring force applied by the resiliently deflectable contact arm generates a large part of the retaining forces.

15 In order to distribute the spring force or the retaining forces brought about by the spring force as uniformly as possible between the contact portions, the contact arms may form an equilateral triangle and be arranged at the corners thereof, wherein the resiliently deflectable contact arm may be provided at the apex of the triangle. In particular, the deflection direction may coincide with the bisector of the apex of the triangle. The contact
20 portions of the contact arms arranged at the other corners of the triangle may extend parallel to the base of the triangle connecting these two corners. The triangle may also be equilateral or irregular, depending on the requirements of the socket geometry.

However, if the socket comprises a different, for example hexagonal inner
25 contour, the contact portions arranged in the corners of the equilateral triangle may also be arranged differently and in particular perpendicularly to the connecting lines between the corners of the triangle and a marked point of the triangle. The marked point of the triangle may for example be the centre point of an inscribed circle of the triangle or the centre of gravity of the triangle or any other desired marked point. The contact portions
30 may also be differently oriented and in particular extend angled towards one another in the plug-in direction, in order to extend parallel to the contacting faces of the socket when inserted therein. Advantageously, at least one of the contact portions points away from at least one other contact portion to hold the contact arrangement in the socket.

35 The ends pointing in the plug-in direction of at least two contact arms may be connected rigidly together by way of a contact yoke. If the end of the resiliently deflectable contact arm is connected to the end of one of the other contact arms, in this way the spring constant of the resiliently deflectable contact arm may be increased. It is particularly advantageous, however, for the ends of the other two contact arms to be

connected together, since the spring force is intended to be applied purposefully by the resiliently deflectable contact arm, while the other two contact arms, being substantially rigid and immovable relative to one another, are intended to introduce the spring force into the socket.

5

In order to be able to insert the contact arrangement simply into the socket and to prevent the contact arms from becoming hooked together with edge areas of the socket at least at the start of the insertion process, the end of the contact arrangement pointing in the plug-in direction may be of tapered profile, insertion bevels being formed which
10 extend in the transverse direction and are angled relative to the plug-in direction. The insertion bevels may extend at an angle outwards from the contact arrangement and be of v-shaped arrangement when viewed parallel to the transverse direction. Together with the contact yoke adjoining the insertion bevels in the plug-in direction, the end of the contact arrangement pointing in the plug-in direction may be Y-shaped when viewed parallel to
15 the transverse direction, wherein the contact yoke may form the perpendicular stroke of the Y pointing in the plug-in direction.

To protect in particular the resiliently deflectable contact arm, which may be provided with a free end in the plug-in direction, this free end may, in a rest position, in
20 which the resiliently deflectable contact arm is not deflected against the spring force, project into the portion of the slot-shaped interspace defined by the contact yoke in the plug-in direction. The free end of the resiliently deflectable contact arm may thus be protected, at least in the transverse direction, by the other two contact arms against undesired movements. In addition, one of the insertion bevels may be arranged at the free
25 end, such that the free end is also protected in the deflection direction against undesired movements.

In addition to the individual, resiliently deflectable contact arm, the other two contact arms, which transversely define the interspace and which, in the preceding
30 description of the invention, may be regarded as being of rigid construction, may also be resiliently deflectable at least parallel to the deflection direction and in particular contrary to the deflection direction.

In this way, the contact arrangement may be conformed still better to any
35 unevenness which may possibly be present in the socket configuration. For example, the contacting faces of the sockets may extend at an angle towards one another and thus deviate from a preferred parallel profile. All the resiliently deflectable contact arms may respond at least partially mutually independently to such deviations and compensate them.

The configuration of the contact arrangement with three resiliently deflectable spring arms is also particularly advantageous if forces act on the contact arrangement arranged in the socket and seek to twist the contact arrangement.

5 In this case in particular, a plurality of and in particular all three resiliently deflectable contact arms may secure the electrical connection, by on the one hand counteracting the externally acting forces with spring forces which may secure the position of the contact arrangement and on the other hand being able to effect compensating movements if the external forces should lead to twisting of the contact
10 element in the socket.

It is particularly advantageous for each of the resiliently deflectable contact arms already to be configured or designed as a spring portion for fixing the contact arrangement in the socket. Thus, the resiliently deflectable contact arm may fulfil twin
15 functions, in which it takes the form both of a conductor withstanding high pulsed currents and of a spring portion giving rise to retaining forces.

For example, the resiliently deflectable contact arm may be of a different geometry from the other two contact arms, possibly being thinner in the deflection
20 direction, at least in part, whereby its resilience is increased in comparison to the other two contact arms and it is more readily deformable. The resiliently deflectable contact arm may also be made from a material which has better resilient characteristics and is possibly softer than the material from which the other two contact arms are made.

25 In an in itself particularly advantageous development, the material and geometry of the three contact arms may be substantially the same, wherein in particular the cross-section of the contact arms perpendicular to the plug-in direction may be substantially identical. The other two contact arms may then be regarded as a second resiliently deflectable contact arm, whose spring constant in or contrary to the deflection direction
30 may be approximately twice the spring constant of the originally individual resiliently deflectable contact arm.

Alternatively, the other two contact arms may also be designed in such a way that their spring constants are lower, possibly even in total, than the spring constant of the
35 third resiliently deflectable spring arm. For example, the other two contact arms may be thinner, at least in part and in particular in an area applying the spring force, than the one resiliently deflectable contact arm.

In order to obtain a contact arrangement which may be handled in one piece, the ends of the contact arms pointing in the opposite direction from the plug-in direction may be shaped as part of a contact element and joined together. The contact arms may in this case be joined together by way of a contact arm holder and for example screwed, riveted, 5 welded or soldered thereto. Of particular advantage is a configuration in which the contact arm holder and the contact arms are shaped in one piece, for example from a piece of high conductivity metal.

To improve further the mechanical connection between the contact arrangement 10 and the socket of the mating contact, the contact arrangement may comprise a spring clip. Like the contact arms, the spring clip may for example be constructed in one piece with the contact arm holder. However, it is simpler to produce a separate spring clip, which may be placed on the contact element in the opposite direction from the plug-in direction.

15 Once the spring clip has been placed in an assembled state onto the contact element, so as to complete the contact arrangement, the spring clip may be resiliently deformed at least in part in or contrary to the deflection direction. Once inserted into the socket, the spring clip rests against the two mutually opposing contact surfaces of the socket and contributes in the plug-in direction, through frictional engagement with the 20 socket, to securing of the contact arrangement against undesired displacement in the plug-in direction.

The spring clip may comprise a hollow cylindrical retaining portion, which may be slid over the contact arm holder. The contact arm holder may then be accommodated 25 in a substantially complementary manner in the hollow cylindrical retaining portion of the spring clip. In the plug-in direction, the retaining portion of the spring clip placed onto the contact element may for example be secured by way of a dowel pin against movement relative to the contact arm holder. In addition, the retaining portion may be configured in such a way that it lies tightly against the contact arm holder and is substantially immobile 30 relative to the contact arm holder. A cuboidal configuration of the contact arm holder contributes to this, since retaining faces of flat construction, against which the retaining portion on the contact arm holder may rest, support the retaining portion optimally against twisting around the plug-in direction.

35 Instead of a retaining or dowel pin, the retaining portion may also be screwed or riveted together with the contact arm holder. If the spring clip is also intended to be connected electrically conductively with the contact element, a bonded joint is particularly advantageous. Soldering or welding are bonded joints worthy of particular consideration here.

The spring clip may comprise a plurality of spring arms, which may rest in the socket in a number of directions. In the assembled state, in which the spring clip has been placed onto the contact element contrary to the plug-in direction, at least three of these spring arms may extend substantially in the plug-in direction. To make the contact arrangement as compact as possible, these three spring arms extending in the plug-in direction may take the form of complementary spring arms, wherein two of the complementary spring arms may, in the assembled state, be arranged transversely in front of and behind the resiliently deflectable contact arm. The third complementary spring arm may be arranged between the other two contact arms. Such an arrangement of the complementary spring arms relative to the contact element may result in a contact arrangement of compact cross-section, which turns out to be only insignificantly larger, if at all, than the cross-section of the contact arrangements in the prior art.

To protect the complementary spring arms against undesired deflection above all during insertion of the contact arrangement into the socket, the ends of the complementary spring arms pointing in the plug-in direction may be joined together by way of a, possibly rigid, clip yoke. In the assembled state this clip yoke may be arranged downstream of the contact yoke in the plug-in direction and spaced from the contact yoke at least when the contact arrangement has been inserted into the socket.

To simplify insertion of the contact arrangement into the socket, the spring clip may also taper in the plug-in direction, wherein the ends pointing in the plug-in direction of the opposing complementary spring arms may curve towards one another in the deflection direction.

As an alternative, the ends, situated in the plug-in direction, of the complementary spring arms to the front or rear in the deflection direction may be connected to the clip yoke by way of an insertion plate angled away from the spring clip in relation to the plug-in direction and be constructed as a loop when viewed in the transverse direction.

The complementary spring arm arranged in the interspace may cover the resiliently deflectable contact arm at least in part in the deflection direction and thus prevent overextension of the resiliently deflectable contact arm in the deflection direction. In particular, the free end of the resiliently deflectable contact arm may strike against the complementary spring arm in the case of impending overextension of the contact arm.

In addition, the complementary spring arms may be arranged or shaped to complete the polygonal cross-section defined at least in part by the complementary spring

arms so as substantially to yield the socket cross-section. Thus, the cross-section of the contact arrangement extending perpendicularly to the plug-in direction may be even better conformed to the cross-section of the socket. Consequently, the volume available in the socket is put to optimum use and above all the contacting faces of the socket are connected substantially fully with the contact arrangement. To this end, it may be particularly advantageous for any gap between the spring arms and the contact arms adjacent thereto to be as small as possible. The spring arms and the contact arms may possibly even rest against one another in the transverse direction. However, this requires very precise manufacture both of the contact element and of the spring clip.

In a sub-portion of the complementary spring arms located in the middle in the plug-in direction, pressure portions pointing away from the spring clip may be arranged, which may be configured to lie extensively against the contacting faces of the socket. If the socket comprises a hexagonal inner contour, for example in a plane extending transversely of the plug-in direction, the pressure portions may be arranged in such a way relative to the contact portions of the contact arms that the contact arrangement substantially resembles a hexagonal cylinder extending in the plug-in direction. In this case, the pressure portions may also be arranged in the corners of a possibly equilateral triangle, wherein the pressure portion arranged in the interspace may be provided at the apex of the triangle and the pressure portions may possibly be oriented perpendicularly to lines extending through a marked point of the triangle and through the corners thereof. The two triangles, in which the contact portions or the pressure portions are arranged, may be identical to one another, wherein the triangles may extend in a common plane and may be rotated in this plane by 180 degrees relative to one another.

There is also a possibility of the socket having a triangular cross-section. In this case, either the contact portions of the contact arms or the pressure portions of the complementary spring arms may be shaped in such a way that they may possibly be arranged in a form-fitting manner in the corners of the triangle. The portions not arrangeable at the corners may be placed against sides of the socket extending between the corners.

The contact arrangement may also be used with differently shaped polygonal bushings, wherein at least the contact arms may be arranged as described above and may rest in the socket transversely of the plug-in direction by way of a three-point support.

However, if the socket has a rectangular cross-section, in the assembled state the pressure portions may be aligned with the contact portions of the contact arms in the transverse direction at least when the contact arrangement has been inserted into the

socket. In this way, the contacting faces may be connected substantially over their full area with the contact arrangement, whereby the contact arrangement may be accommodated in a particularly stable manner in the socket.

5 Combining in particular the contact element according to the invention with three contact arms and the spring clip according to the invention with three complementary spring arms gives rise to a highly stable mechanical connection between socket and contact arrangement. This connection protects the contact arrangement from twisting in particular around the plug-in direction. Both the contact element and the spring clip in
10 each case form a three-point support with the contacting faces of the socket. The six contact points between contact arrangement and socket do not result in a mechanically overrigid connection, since the spring clip and the contact element are only connected together rigidly in the area of the contact arm holder and the complementary spring arms and the contact arms rest separately from one another against the contacting faces due to
15 their resilience and so create two three-point supports acting at least partially independently of one another.

If the spring clip is intended to contribute appreciably to the electrical conductivity of the contact arrangement, the spring clip may be connected electrically
20 conductively to the contact element and in particular to the contact arm holder. It is advantageous for this purpose for the retaining portion of the spring clip to rest substantially over its entire surface against the contact arm holder and possibly even to be joined thereto in bonded manner at least in part. The contact arm holder and the retaining portion may form a first current node, wherein the complementary spring arms and the
25 contact arms between said first current node and the contacting faces of the socket, which form a second current node, may be regarded as two electrical conductors connected together in parallel. If contact and complementary spring arms lying next to one another are in extensive contact with one another, the contact element and the spring clip may function as a single large cross-section electrical conductor.

30

In order to be able to ensure as uniform as possible a flow of current both through the contact arms and through the complementary spring arms, the width of the complementary spring arms transversely of the plug-in direction may correspond to the width of the contact arms in this direction. If in particular the widths in the deflection
35 direction correspond, or the complementary spring arms and the contact arms have a substantially equally large cross-section and are made from materials with a comparable specific electrical conductivity, the current flow to the socket may be equally distributed through the contact element and the spring clip.

The pressure and contact portions arranged next to one another may form a substantially continuous contact surface, in order to be able to rest over as complete an area as possible against the contacting faces of the socket and thus allow the smallest possible transition resistance between contact arrangement and mating contact. In particular the mutually aligned pressure and contact portions, which are conformed above all to a socket with a rectangular outline, may form this continuous contact face. Should the contact arrangement nevertheless become twisted around the plug-in direction despite the multiple three-point support as a result of exposure to force, at least the complementary spring arms and also the resiliently deflectable contact arm may compensate this movement at least to a certain degree due to their resilient deformability and the retaining forces acting in the direction of the contacting faces of the sockets, such that the electrical contact between contact arrangement and mating contact remains substantially constant and the current flow even of high pulsed currents is not broken off.

As the result of a spring clip connected to the contact element in an electrically conductive manner, further contact points may be available in addition to the contact points between the contact element and the socket, namely those between the spring clip and the socket. In this way, the current flow through the individual contact points may be further reduced, without the entire current flow from the contact arrangement to the mating contact having to be less; thermal and magneto-mechanical loads caused by the current may be reduced further in this way than without a spring clip. In particular, the contact arrangement with contact element and spring clip may withstand current intensities which may lead to overloading and possibly to damage of the contact element or socket in a contact arrangement without spring clip.

25

The invention is explained below by way of example by means of embodiments and with reference to the drawings. The various features of the embodiments may be combined mutually independently, as has already been explained with reference to the individual advantageous configurations.

30 In the drawings:

Fig. 1 is a perspective representation of a first exemplary embodiment of the contact arrangement according to the invention;

Fig. 2 is a perspective representation of a spring clip;

35 Fig. 3 is a perspective representation of the contact arrangement with a mating contact;

Fig. 4a is a schematic representation of the contact arrangement of the exemplary embodiment of Fig. 3;

Fig. 4b is a sectional representation of the contact arrangement of the exemplary embodiment of Fig. 4a;

Fig. 5 is a perspective representation of a further exemplary embodiment of the invention, in which the contact arrangement is illustrated inserted into a socket of the
5 mating contact;

Fig. 6 is a perspective representation of a further exemplary embodiment of the invention, in which the spring clip is shown inserted into the socket;

Fig. 7 is a perspective representation of a further exemplary embodiment of the invention, in which the contact arrangement is shown inserted into the socket;

10 Fig. 8a is a side view of the exemplary embodiment of Fig. 7;

Fig. 8b is a sectional representation of the exemplary embodiment of Fig. 8a.

First of all, the structure and function of a contact arrangement K according to the invention will be described with reference to the exemplary embodiment of Fig. 1. A
15 contact element 1 with three contact arms 2, 2', 2'' extending in a plug-in direction S is shown perspectively herein. Contrary to the plug-in direction S, the contact arms 2, 2', 2'' are shown connected to a contact arm holder 3 and may in particular be formed in one piece with the contact arm holder 3. Alternatively, the contact arms 2, 2', 2'' may also be fastened differently to the contact arm holder 3 in an electrically conductive manner. Both
20 the contact arm holder 3 and the contact arms 2, 2', 2'' are made from an electrically conductive material and in particular from a metal and are possibly coated with another metal. The contact arm holder 3 is of substantially rectangular cross-section.

The contact arms 2, 2' spaced from one another in a transverse direction Q
25 pointing at right angles to the plug-in direction S are connected together by way of a contact yoke 5 at their ends 4, 4' pointing in the plug-in direction S. The contact arms 2, 2' are illustrated as being in particular immobile relative to one another and enclose together with the contact yoke 5 a slot-shaped interspace Z, which extends in the plug-in direction S and is defined in and contrary to the transverse direction Q by the contact
30 arms 2, 2'. The interspace Z ends contrary to a deflection direction A at right angles to the plug-in direction S and to the transverse direction Q at the contact arm 2''.

Over the course of the contact arms 2, 2', said arms bend in first sub-portions 6, 6' in the direction of the deflection direction A and extend in these first sub-portions 6, 6'
35 angled relative to the plug-in direction S. After the first sub-portions 6, 6' in the plug-in direction, the contact arms 2, 2' extend in middle sub-portions 7, 7' substantially in the plug-in direction S. The middle sub-portions 7, 7' are formed with contact portions 8, 8', which are here illustrated pointing in the deflection direction A and away from the contact

element 1. The contact portions 8, 8' are shown as extending parallel to one another, but they may also be angled relative to one another. After the middle sub-portions 7, 7' in the plug-in direction S, the contact arms 2, 2' extend in insertion portions 9, 9' once again angled relative to the plug-in direction S, wherein the contact arms 2, 2' are here shown angled contrary to the deflection direction A. At end portions 10, 10' pointing in the plug-in direction S, at which the contact arms 2, 2' are connected together by way of the contact yoke 5, the contact arms 2, 2' again extend in the plug-in direction S. In particular, the end portions 10, 10' may be aligned with the contact arm holder 3 in the plug-in direction S. The contact yoke 5 tapers in its course in the plug-in direction S and forms a free end of the firmly connected-together contact arms 2, 2'.

At its end 11 directed away from the plug-in direction S and connected to the contact arm holder 3, the contact arm 2'' is shown angled contrary to the deflection direction A or inclined relative to the plug-in direction S, wherein the end 11 of the contact arm 2'' is shown to be arranged upstream of the first sub-portions 6, 6' of the contact arms 2, 2' in the plug-in direction S. The interspace Z ends contrary to the plug-in direction S in the area of this end 11. In its further course pointing in the plug-in direction S the contact arm 2'' comprises a middle sub-portion 12, which extends in the plug-in direction S. The middle sub-portion 12 of the contact arm 2'' may be oriented at an angle relative to the plug-in direction S, but also at least partially contrary to the deflection direction A. The contact arm 2'' is provided at least in its middle sub-portion 12 with a contact portion 8'' pointing away from the contact element 1. The end of the middle sub-portion 12 pointing in the plug-in direction S is adjoined by an insertion portion 13, which is angled relative to the plug-in direction S in the deflection direction A and whose free end 14 projects into the portion of the interspace Z defined by the insertion portions 9, 9' and the contact yoke 5.

The insertion portions 9, 9', 13 are configured in such a way that they cause the contact element 1 to taper in its end region pointing in the plug-in direction S, wherein the insertion portions 9, 9', 13 are shown in each case with an insertion bevel 15, 15', 15''. The insertion bevels 15, 15', 15'' extend parallel to the transverse direction Q, are angled relative to the plug-in direction S and point away from the contact element 1.

The contact arm 2'' is constructed to be resiliently deflectable at least by way of its end 11 connected with the contact arm holder 3 or its middle sub-portion 12 and may be deflected at least in part in the deflection direction A. The contact arm 2'' then generates a spring force F directed contrary to the deflection direction A. The interspace Z is dimensioned such that the resiliently deflectable contact arm 2'' may move at least in part further into the interspace Z.

The contact arm holder 3 is provided on its side 16 pointing in the deflection direction with a retaining pin 17 of cylindrical construction extending in the deflection direction A. The retaining pin 17, serves to secure a spring clip shown later. The retaining pin 17 may be constructed in one piece with the contact arm holder 3 or be inserted as a
5 separate retaining pin 17 in an opening provided for said retaining pin 17 in the contact arm holder 3. Alternatively, the retaining pin 17 may also take the form of a possibly hump-shaped snap-in elevated portion or as a snap-fastening recess.

The spring clip may however also be connected in some other way to the contact
10 arm holder 3. For example, the spring clip may be riveted, screwed, welded or soldered to the contact arm holder 3. In particular, the spring clip may be connected electrically conductively to the contact arm holder 3.

Fig. 2 shows a further exemplary embodiment, the same reference signs being
15 used for elements which correspond in function and structure to the elements of the exemplary embodiment of Fig. 1. For the sake of brevity, only the differences from the exemplary embodiment of Fig. 1 will be looked at.

Fig. 2 is a perspective representation of a spring clip 18 which may be placed onto
20 the contact element 1. The spring clip 18 is provided at its end situated contrary to the plug-in direction S with a hollow-cylindrical retaining portion 19, which is of substantially rectangular cross-section.

The retaining portion 19 is provided with fastening openings 20, 21 for fastening
25 the spring clip 18 to the retaining pin 17, said openings extending in the deflection direction A. If the contact arm holder 3 of the contact element 1 comprises differently configured fastening means, the retaining portion 19 may be adapted thereto. In particular, the retaining portion 19 may be weldable or solderable to the contact element 1.

30

The side faces 22, 23 comprising the fastening openings 20 and 21 and extending parallel to the transverse direction Q are adjoined in the plug-in direction S by three spring arms, which take the form in particular of complementary spring arms 24, 24', 24" and extend substantially in the plug-in direction S. The complementary spring arms 24,
35 24', 24" are designed to be deformable in or contrary to the deflection direction A.

The complementary spring arms 24, 24' arranged next to one another in the transverse direction Q and substantially aligned with one another extend in first sub-

portions 25, 25' at least partially away from a first sub-portion 25'' of the complementary spring arm 24''. In the plug-in direction S the complementary spring arms 24, 24', 24'' extend in a middle sub-portion located downstream of the first sub-portion 25, 25', 25'' in the plug-in direction S at least in part parallel to the plug-in direction S. In the middle sub-portions the complementary spring arms 24, 24', 24'' are provided with pressure portions 26, 26', 26'' pointing away from the spring clip 18. In the region of the end 27 pointing in the plug-in direction S of the spring clip 18, the complementary spring arms 24, 24', 24'' extend at least partially towards one another. The complementary spring arms 24, 24' starting from the side face 23 directed contrary to the deflection direction A are connected together by way of an insertion plate 29 at their ends 28, 28' pointing in the plug-in direction S. In the deflection direction A the insertion plate 29 extends substantially angled relative to the plug-in direction S towards the complementary spring arm 24''. The insertion plate 29 and the end 30 of the complementary spring arm 24'' pointing in the plug-in direction S are connected firmly together by way of a clip yoke 31.

15

In particular, the spring clip 18 may be made from one piece of readily resilient contact material, for example spring bronze. When viewed from the transverse direction Q, the complementary spring arms 24, 24', 24'' enclose a substantially convex cavity and form a loop. If the complementary spring arms 24, 24', 24'' are moved towards one another in or contrary to the deflection direction A, the clip yoke 31 may move in the plug-in direction S.

20

The two complementary spring arms 24, 24' are aligned substantially with one another in the transverse direction Q and extend parallel to one another at a distance D.

25

Fig. 3 shows a further exemplary embodiment of the contact arrangement K according to the invention with a mating contact, the same reference signs being used for elements which correspond in function and structure to the elements of the exemplary embodiments of Figs. 1 or 2. For the sake of brevity, only the differences from the exemplary embodiments of Figs. 1 and 2 will be looked at.

30

In addition to the contact element 1, Fig. 3 also shows the mating contact G, which consists of a busbar of rectangular cross-section. The mating contact G comprises a socket B, which is likewise of rectangular cross-section transversely of the plug-in direction S and has been punched through the mating contact G in the plug-in direction S.

35

In Fig. 3 the spring clip 18 is shown placed onto the contact element 1 contrary to the plug-in direction S, wherein the opening 20 in the retaining portion 19 has been

pushed over the retaining pin 17 provided on at least one side of the contact arm holder 3. To make it easier to push the spring clip 18 onto the contact element 1 and latch the opening 20 together with the retaining pin 17, the side 32 pointing in the deflection direction A may be angled relative to the plug-in direction S, such that the retaining pin 17 has a wedge-shaped cross-section and its end pointing in the plug-in direction S ends flush with the side 16 of the contact arm holder 3 pointing in the deflection direction A. The side 32 of the retaining pin 17 thus forms a lead-in bevel.

The complementary spring arm 24" extends at least partially in the interspace Z arranged between the contact arms 2, 2', wherein at least the middle sub-portions 7, 7' of the contact arms 2, 2' and the middle sub-portion of the complementary spring arm 24" extend substantially parallel to one another. The clip yoke 31 terminating the spring clip 18 in the plug-in direction S is arranged downstream of the contact yoke 5 in the plug-in direction and, in the basic position shown here, in which the contact arrangement K has not been inserted into the socket in the mating contact, may rest against the contact yoke 5. Alternatively, the clip yoke 31 may also already be spaced from the contact yoke 5 in the plug-in direction S even in the basic position, in order to compensate manufacturing tolerances acting in the plug-in direction S.

Fig. 4a is a frontal view in the deflection direction A of the contact arrangement K of Fig. 3 with the spring clip 18 placed onto the contact element 1. A section plane I extends perpendicularly to the plane of the drawing in the deflection direction A and the plug-in direction S and cuts centrally through the contact element 1 in the transverse direction Q.

25

Fig. 4b is a sectional side view of the exemplary embodiment of Fig. 4a, the same reference signs being used for elements which correspond in function and structure to the elements of the exemplary embodiment of Fig. 4a. For the sake of brevity, only the differences from the exemplary embodiment of Fig. 4a will be looked at.

30

The section plane I of Fig. 4a extends, as is apparent from Fig. 4b, through the resiliently deflectable contact arm 2" and through the complementary spring arm 24" arranged between the contact arms 2, 2'. In this view in particular it is apparent that the resiliently deflectable contact arm 2" and the complementary spring arm 24" both arch away from one another in their course directed in the plug-in direction S thereof. The complementary spring arms 24, 24' arranged in front of and behind the resiliently deflectable contact arm 2" in the transverse direction Q are arched contrary to the deflection direction A. The contact arms 2, 2' surrounding the spring arm 24" in the

transverse direction Q are arched in the deflection direction A. Altogether, in this view the contact arrangement K has a biconvex basic shape.

5 The free end 14 of the resiliently deflectable contact arm 2" is shown arranged at least in part next to the insertion portions 9, 9'. The complementary spring arm 24" lying opposite the resiliently deflectable contact arm 2" is configured as a limit stop for the free end 14 of the resiliently deflectable contact arm 2". Thus the resiliently deflectable contact arm 2" is secured against overextension in the deflection direction A.

10 In the deflection direction A the complementary spring arms 24, 24', 24" have a width W, which is smaller in the exemplary embodiment shown here than the width of the contact arms 2, 2', 2" in this direction. However, the width W of the complementary spring arms 24, 24', 24" may also be greater than in the exemplary embodiment shown here and may in particular correspond to the width of the contact arms 2, 2', 2" in the
15 same direction. This may improve the electrical conductivity of the spring clip 18. Fig. 5 shows a further exemplary embodiment of the invention, the same reference signs being used for elements which correspond in function and structure to the elements of the exemplary embodiments of the previous Figures. For the sake of brevity, only the differences from the exemplary embodiments in the above-described Figures will be
20 looked at.

In Fig. 5 the contact element 1 is shown with the middle sub-portions 7, 7', 12 of the contact arms 2, 2', 2" inserted in the plug-in direction S into the socket B of the mating contact G. The resiliently deflectable contact arm 2" is deflected in the deflection
25 direction A and presses with the spring force F directed contrary to the deflection direction A against a contacting face 33 of the socket B pointing in the deflection direction A. The contact portion 8" of the contact arm 2" thus rests in an electrically conductive manner against the contacting face 33.

30 The contact portions 8, 8' of the contact arms 2, 2' rest against a further contacting face 34, opposite the contacting face 33, of the socket B, the contact portions 8, 8' resting against the contacting face 34 with the spring force F. The contact element 1 is thus connected electrically conductively with the mating contact G by way of three contact points 35, 35', 35" formed between the contact portions 8, 8', 8" and the contacting faces
35 33, 34.

The contact element 1 rests with the three contact portions 8, 8', 8" against the contacting faces 33, 34 by way of the contact points 35, 35', 35", whereby the contact

element 1 is held in the socket B by means of a three-point support. Such a three-point support secures the contact element 1 in the socket B optimally against twisting, in particular around the plug-in direction S.

5 In addition to the contact points 35, 35', 35" extending in the transverse direction Q, the contact element 1 may be connected to the mating contact G by way of at least one further contact point extending in the deflection direction A. Thus, for example, the contact arm 2 may rest against a side of the socket B pointing in the transverse direction Q, so forming an electrically conductive contact point. Altogether, the contact element 1
10 may thus be connected to the mating contact G by way of up to five contact points 35, 35', 35". It may here be advantageous for the hitherto rigid contact arms 2, 2' to be resiliently deflectable at least in or contrary to the transverse direction Q and possibly to be convex or bent outwards in this direction. In most cases, however, it is sufficient for the contact element 1 to be connected to the mating contact G by way of the three contact points 35,
15 35', 35".

Fig. 6 shows a further exemplary embodiment of the invention, the same reference signs being used for the elements which correspond in function and structure to the elements of the exemplary embodiments of the previous Figures. For the sake of brevity,
20 only the differences from the exemplary embodiments in the above-described Figures will be looked at.

In order to provide still further contact points in addition to the three above-stated electrical contact points 35, 35', 35", the spring clip 18 may also be used for contacting of
25 the contact element 1 with the mating contact G. In Fig. 6 the spring clip 18 is shown inserted in the plug-in direction S into the socket B of the mating contact G as far as a middle region of its pressure portions 26, 26', 26". Following the insertion process, the complementary spring arms 24, 24', 24" are deflected towards one another and rest against the contacting faces 33, 34. The pressure portions 26, 26', 26" rest substantially
30 against the contacting faces 33, 34 and form together therewith the electrical contact points 36, 36', 36".

The spring clip 18 likewise rests in the form of a three-point support against the contacting faces 33, 34 and in particular against the contact points 36, 36', 36" of the
35 socket B. The pressure portions 26, 26', 26" here rest against the contacting faces 33, 34 and thus also secure the spring clip 18 against twisting, in particular around the plug-in direction S.

Figure 7 shows a further exemplary embodiment of the contact arrangement, the same reference signs being used for the elements which correspond in function and structure to the elements of the exemplary embodiments of the previous Figures. For the sake of brevity, only the differences from the exemplary embodiments in the above-described Figures will be looked at.

In Fig. 7 both the contact element 1 and the spring clip 18 have been inserted together into the socket B of the mating contact G. Both the resiliently deflectable contact arm 2" and the complementary spring arms 24, 24', 24" are deflected parallel to the deflection direction A into the inside of the contact arrangement K and press against the contacting faces 33, 34 of the socket B. In this way, the contact arms 2, 2' are also pressed against the contacting face 34. Altogether, the contact arrangement K is connected to the mating contact G by way of six contact points 35, 35', 35", 36, 36', 36". In this respect, the contact portions 8, 8', pointing in the deflection direction A, of the contact arms 2, 2' are aligned in the transverse direction Q with the pressure portion 26" and form a common and substantially continuous contact surface, which may be interrupted by two narrow slots extending in the plug-in direction S and in front of and behind the complementary spring arm 24" in the transverse direction. The side of the contact arrangement K directed contrary to the deflection direction A and in particular the contact portion 8" of the resiliently deflectable contact arm 2" forms together with the pressure portions 26, 26' a second common and likewise substantially continuous contact surface. The contacting faces 33, 34 extending parallel to the transverse direction Q are thus connected in substantially uninterrupted manner with the contact arrangement K, giving rise to a virtually minimal transition resistance between the contact arrangement K and the mating contact G, which latter reliably even conducts pulsed currents of several thousand amperes. As a result of the spring forces applied by the resiliently deflectable contact arm 2" and the complementary spring arms 24, 24', 24", the contact arrangement K is accommodated non-interlockingly in the socket B of the mating contact G and secured against unwanted displacements in the plug-in direction S.

30

The contact arrangement K is protected optimally against twisting, in particular around the plug-in direction S, by way of the contact element 1 and the spring clip 18, the two of which are in each case held in the socket B by way of a three-point support.

Fig. 8a shows a further exemplary embodiment of the contact arrangement K inserted into the mating contact G, the same reference signs being used for elements which correspond in function and structure to the elements of the exemplary embodiments of the previous Figures. For the sake of brevity, only the differences from the exemplary embodiments in the above-described Figures will be looked at.

Fig. 8a shows the contact arrangement K and the mating contact G in a side view pointing in the contrary direction to the transverse direction Q. A section plane II extending through the deflection direction A and the transverse direction Q runs substantially through the middle, in the plug-in direction S, of the mating contact G.

5

Fig. 8b shows the exemplary embodiment of Fig. 8a, the same reference signs being used for the elements which correspond in function and structure to the elements of the exemplary embodiment of Fig. 8a. For the sake of brevity, only the differences from the exemplary embodiments of Fig. 8a will be looked at.

10

In the sectional representation II the contact points 35, 35', 35'', 36, 36', 36'' are clearly visible. It is very clear that in the area of the middle sub-portions 7, 7', 12 the contact arms 2, 2', 2'' define a cross-section of polygonal and in particular rectangular outline corresponding substantially to the inner contour of the socket. This cross-section is completed by the middle sub-portions and in particular by the pressure portions 26, 26', 26'' of the complementary spring arms 24, 24', 24'' substantially in such a way that the contact arrangement K arranged in the socket B is configured to be virtually wholly complementary to the inner contour of the socket B. The contact arrangement K rests by way of two substantially mutually independently acting three-point supports on the inside of the socket B and is thus substantially protected against undesired twisting, in particular around the plug-in direction S. This support is promoted and reinforced by the rigid connection between the retaining portion 19 of the spring clip 18 and the contact arm holder 3 of the contact element 1.

Due to the electrical connection of the spring clip 18 with the contact element 1 and the mating contact G, the spring clip 18 acts like an electrical conductor connected in parallel with the contact element 1, whereby the electrical conductivity of the contact arrangement K thus not only results from the enlarged area of the plurality of contact points 35, 35', 35'', 36, 36', 36'', but also from the enlarged electrical cross-section of the contact arrangement.

CLAIMS

1. An electrical contact arrangement (K) for high pulsed currents and for connection
5 with a polygonal socket (B), with at least two contact arms (2, 2'') extending substantially
in a plug-in direction (S), of which one (2'') is designed to be resiliently deflectable
relative to the other (2) in a deflection direction (A) extending perpendicularly to the
plug-in direction (S), the two contact arms (2, 2'') being arranged spaced from one another
at least in part in the deflection direction, characterised in that at least one further contact
10 arm (2') is provided, which extends in the plug-in direction (S) and which is arranged
spaced from the other two contact arms (2, 2'') in a transverse direction (Q) extending
perpendicularly to the plug-in (S) and deflection directions (A), the resiliently deflectable
contact arm (2'') being movable in the deflection direction (A) at least in part into the
interspace (Z) between the other two contact arms (2, 2').
- 15
2. A contact arrangement (K) according to claim 1, characterised in that the contact
arms (2, 2', 2'') comprise contact portions (8, 8', 8'') directed away from the contact
arrangement (K), which contact portions, in a plane arranged perpendicularly to the plug-
in direction (S), define at least in part a cross-section of polygonal outline, corresponding
20 substantially to the socket (B).
3. A contact arrangement (K) according to claim 1 or claim 2, characterised in that
the contact arms (2, 2', 2'') are arranged at the corners of an equilateral triangle, the
resiliently deflectable contact arm (2'') being provided at the apex of the triangle.
- 25
4. A contact arrangement (K) according to any one of claims 1 to 3, characterised in
that the ends (4, 4', 14) pointing in the plug-in direction (S) of at least two contact arms
(2, 2', 2'') are connected rigidly together by way of a contact yoke (5).
- 30
5. A contact arrangement (K) according to any one of claims 1 to 4, characterised in
that the end, pointing in the plug-in direction (S) of the contact arrangement (K), has a
tapered profile and insertion bevels (15, 15', 15'') are formed which extend in the
transverse direction (Q) and are angled relative to the plug-in direction (S).
- 35
6. A contact arrangement (K) according to claim 5, characterised in that one of the
insertion bevels (15'') is arranged on the free end (14), pointing in the plug-in direction
(S), of the resiliently deflectable contact arm (2'') and, in a rest position of the resiliently

deflectable contact arm (2''), the free end (14) projects into the portion of the interspace (Z) defined by the contact yoke (5).

7. A contact arrangement (K) according to any one of claims 1 to 4, characterised in that the other two contact arms (2, 2') are resiliently deflectable contrary to the deflection direction (A).

8. A contact arrangement (K) according to any one of claims 1 to 7, characterised in that the resiliently deflectable contact arms (2, 2', 2'') take the form of spring portions for fixing the contact arrangement (K) in the socket (B).

9. A contact arrangement (K) according to any one of claims 1 to 8, characterised in that the ends (6, 6', 11), pointing contrary to the plug-in direction (S), of the contact arms (2, 2', 2'') are connected together, forming a contact element (1).

15

10. A contact arrangement (K) according to claim 9, characterised in that the contact arrangement (K) comprises a spring clip (18), which may be placed onto the contact element (1) contrary to the plug-in direction (S) and which is resiliently deformable in or contrary to the deflection direction (A) when in the assembled state on the contact element (1).

20

11. A contact arrangement (K) according to claim 10, characterised in that the spring clip (18) comprises a plurality of spring arms, of which at least three extend substantially in the plug-in direction (S) in the assembled state and take the form of complementary spring arms (24, 24', 24''), two of the complementary spring arms (24, 24', 24'') being arranged, in the assembled state, in front and behind the resiliently deflectable contact arm (2'') in the transverse direction (Q) and one of the complementary spring arms (24, 24', 24'') being arranged between the other two contact arms (2, 2').

25

12. A contact arrangement (K) according to claim 11, characterised in that the complementary spring arms (24, 24', 24'') are arranged to complete the polygonal cross-section defined at least in part by the contact arms (2, 2', 2'') so as substantially to yield the socket cross-section.

30

13. A contact arrangement (K) according to claim 11 or claim 12, characterised in that pressure portions (26, 26', 26'') pointing away from the spring clip (18) are arranged on the complementary spring arms (24, 24', 24''), which pressure portions are aligned with

35

- 23 -

the contact portions (8, 8', 8'') of the contact arms (2, 2', 2'') in the transverse direction (Q) in the assembled state at least when the contact arrangement (K) has been inserted at least in part into the socket (B).

5 14. A contact arrangement (K) according to any one of claims 10 to 13, characterised in that the spring clip (18) is connected electrically conductively to the contact element (1).

10 15. A contact arrangement (K) according to any one of claims 11 to 14, characterised in that the width (W) of the complementary spring arms (24, 24', 24'') transversely of the plug-in direction (S) corresponds to the width of the contact arms (2, 2', 2'') in this direction.

15 16. A contact arrangement (K) according to any one of claims 13 to 15, characterised in that the mutually aligned pressure (26, 26', 26'') and contact portions (8, 8', 8'') form a substantially continuous contact surface.

1/4

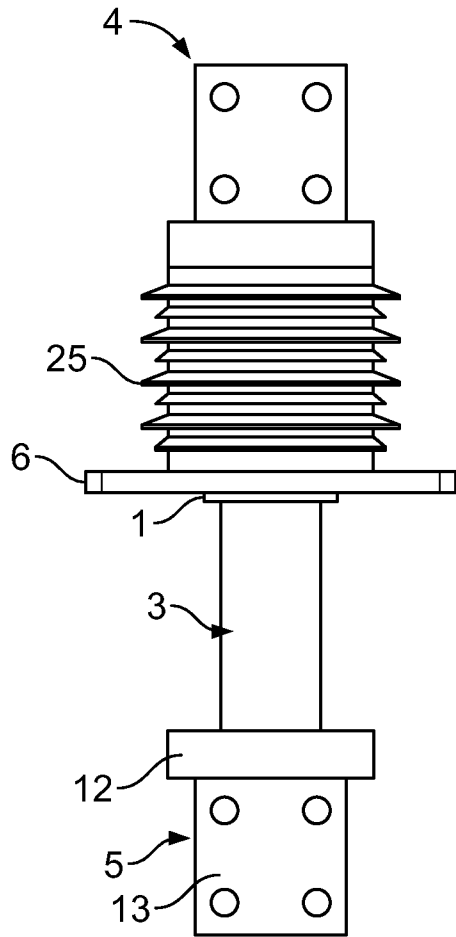


Fig. 1

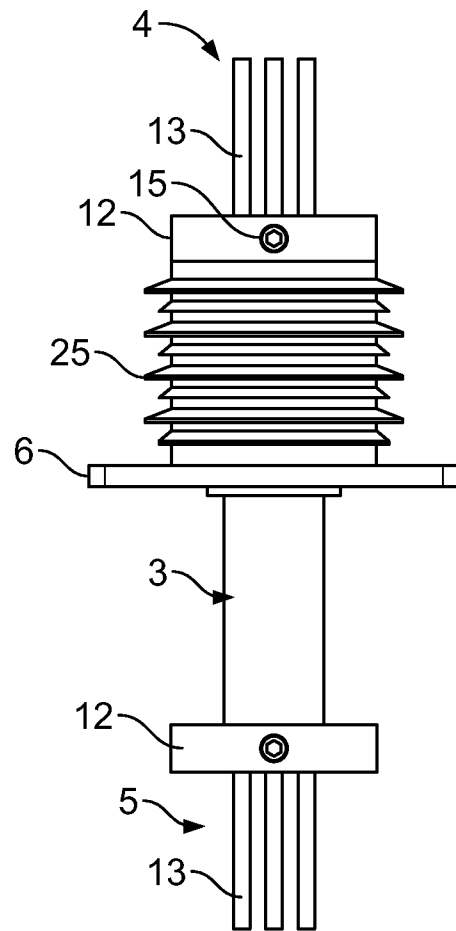


Fig. 2

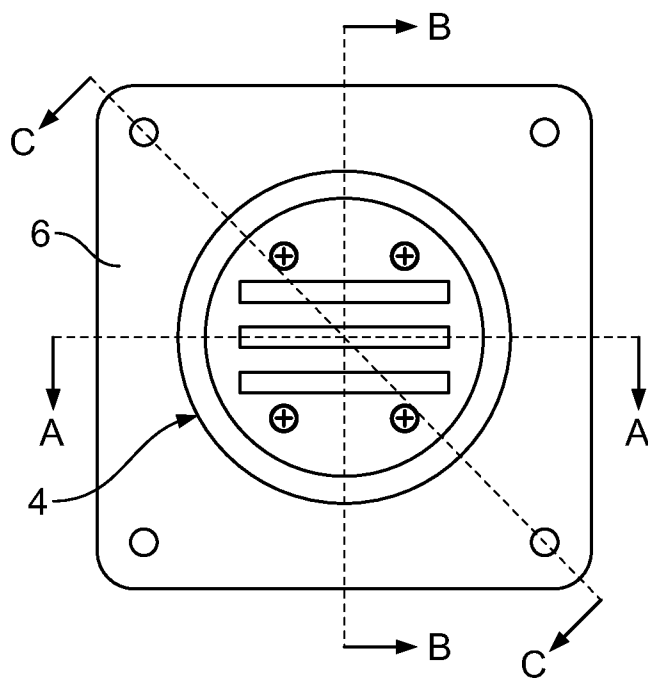


Fig. 3

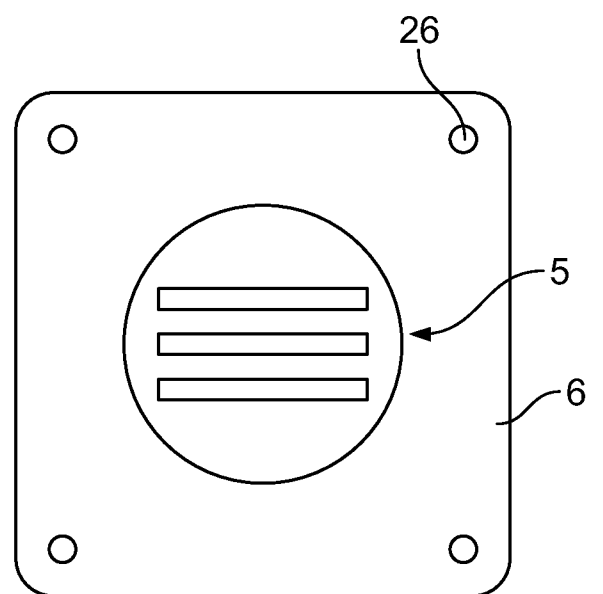


Fig. 4

2/4

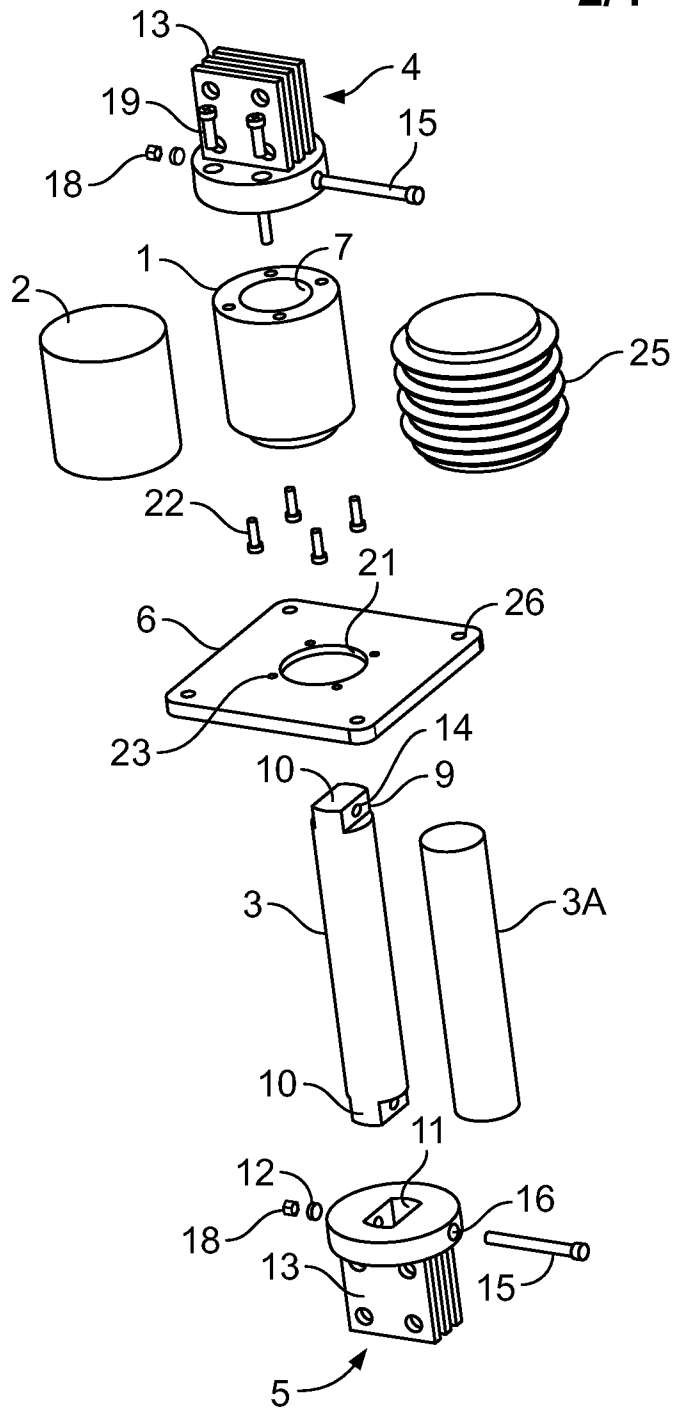


Fig. 5

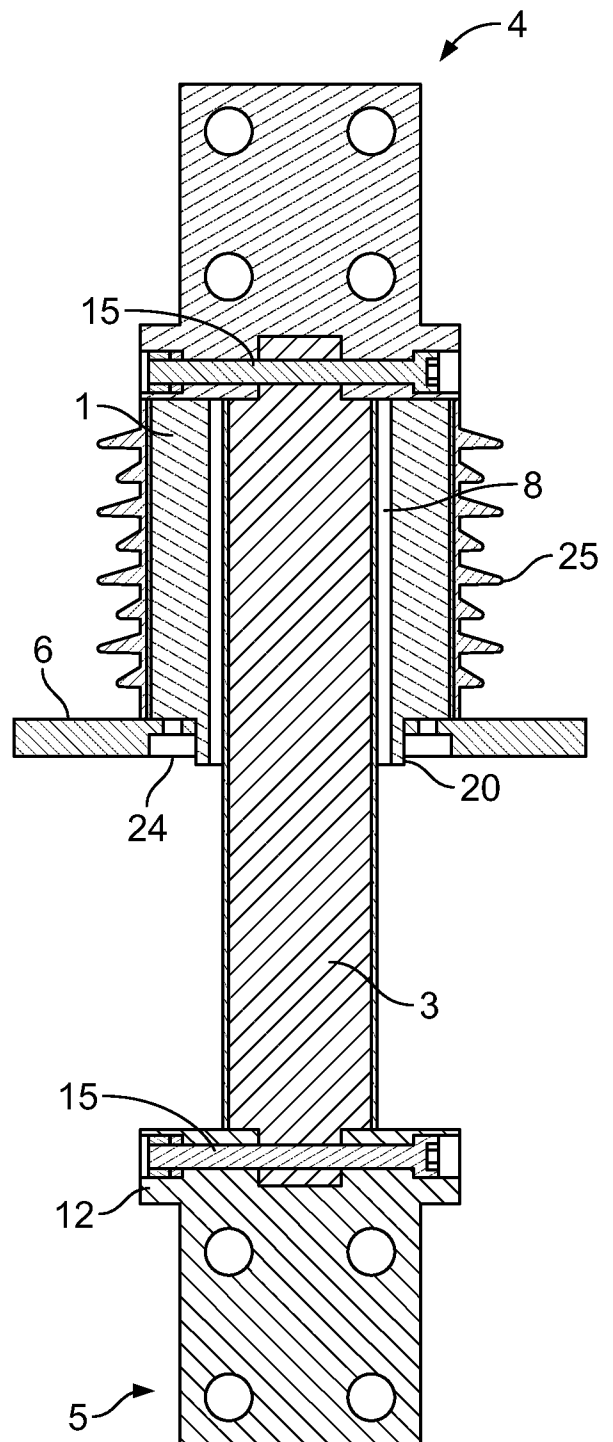


Fig. 6

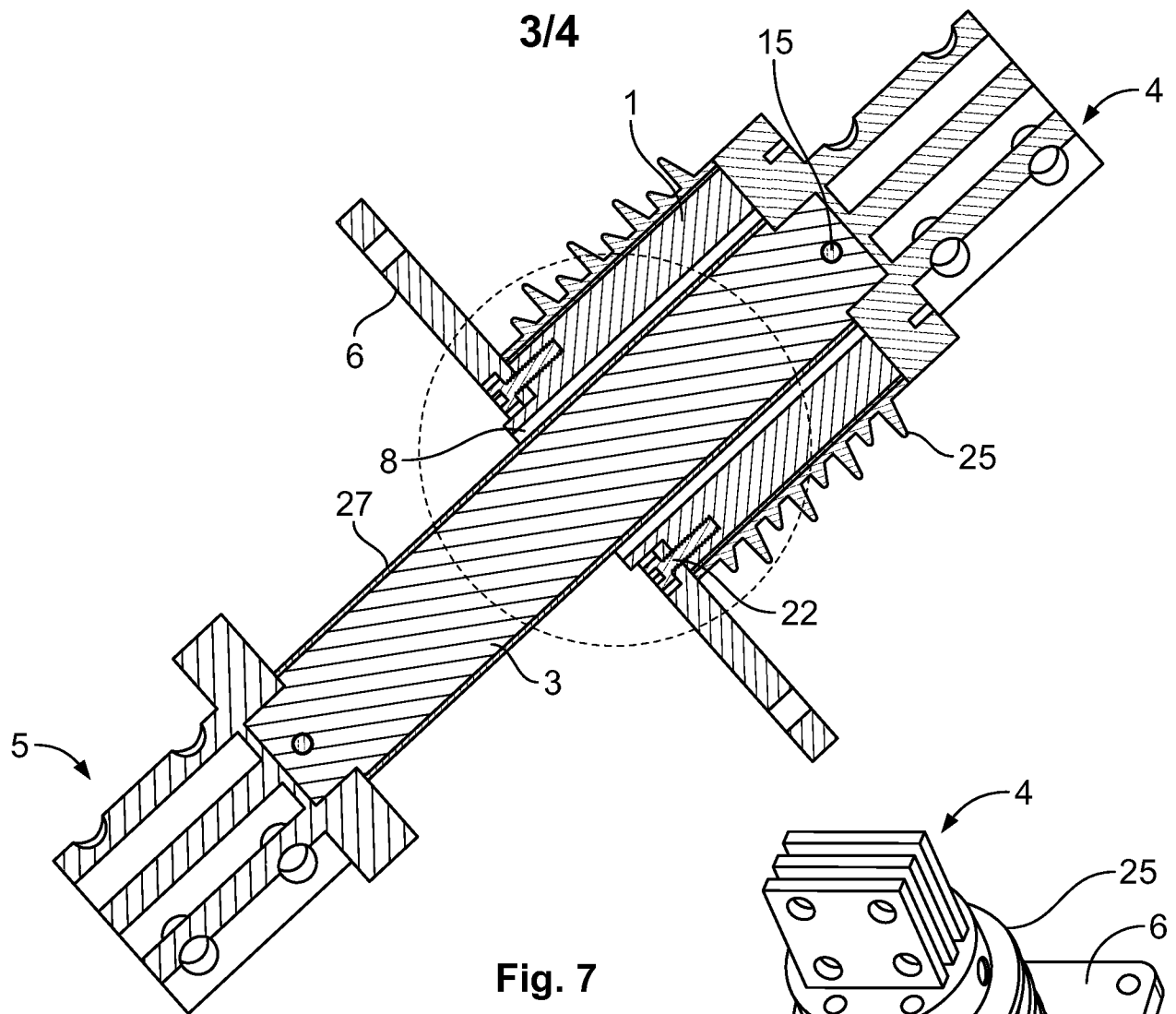


Fig. 7

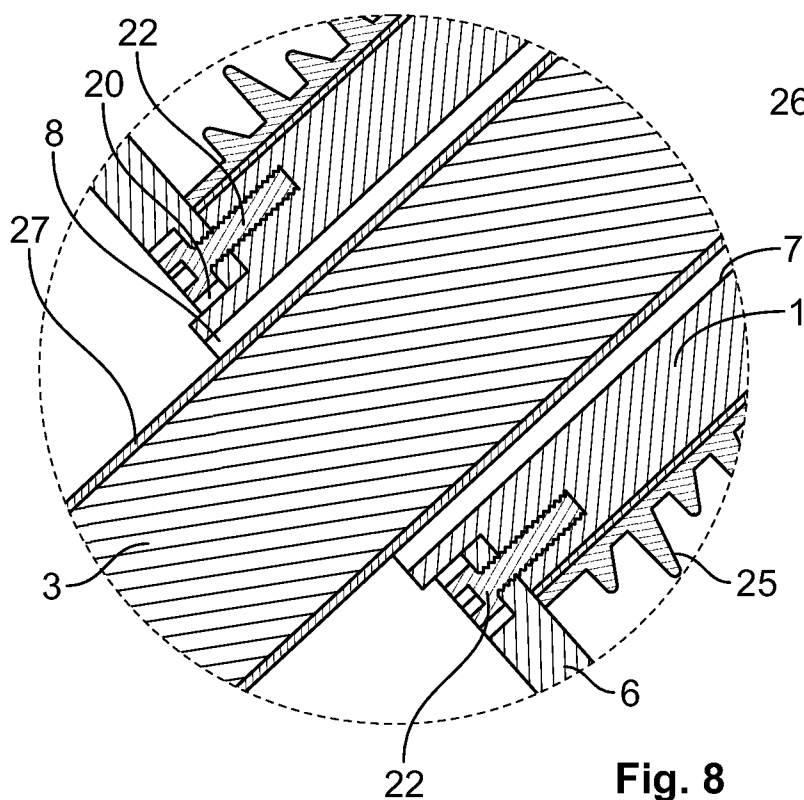


Fig. 8

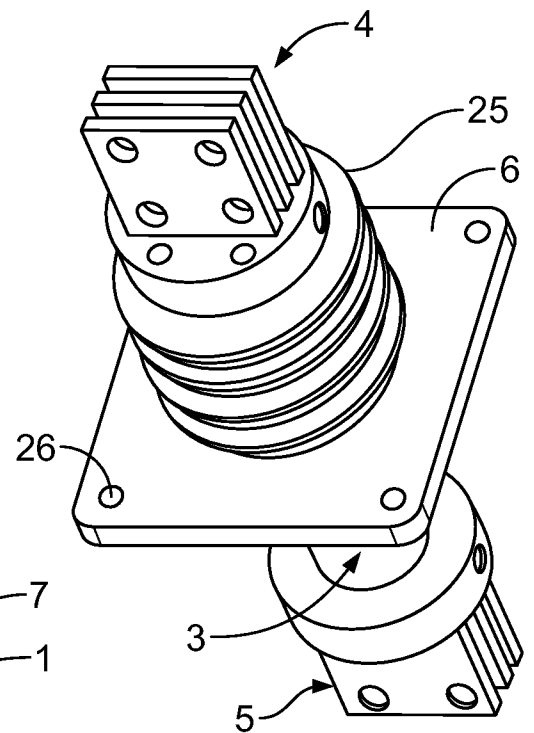


Fig. 9

4/4

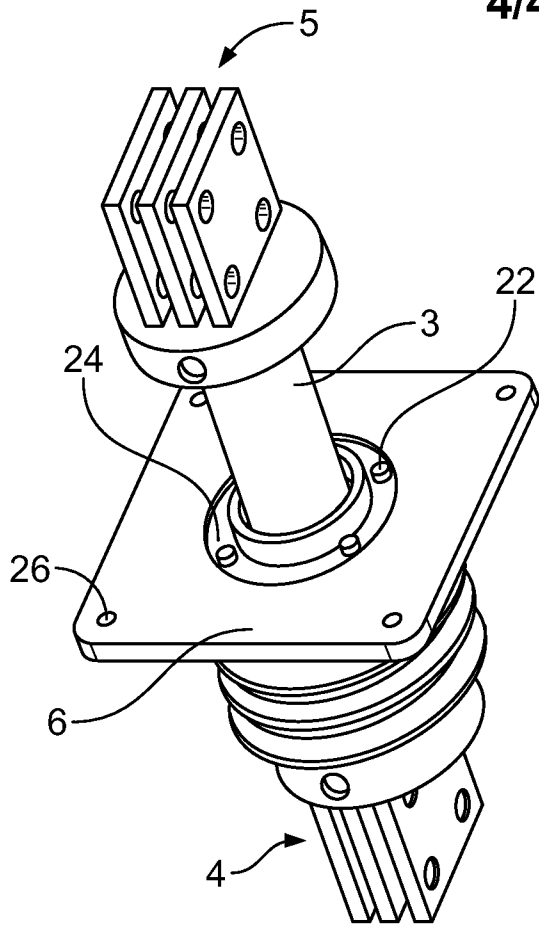


Fig. 10

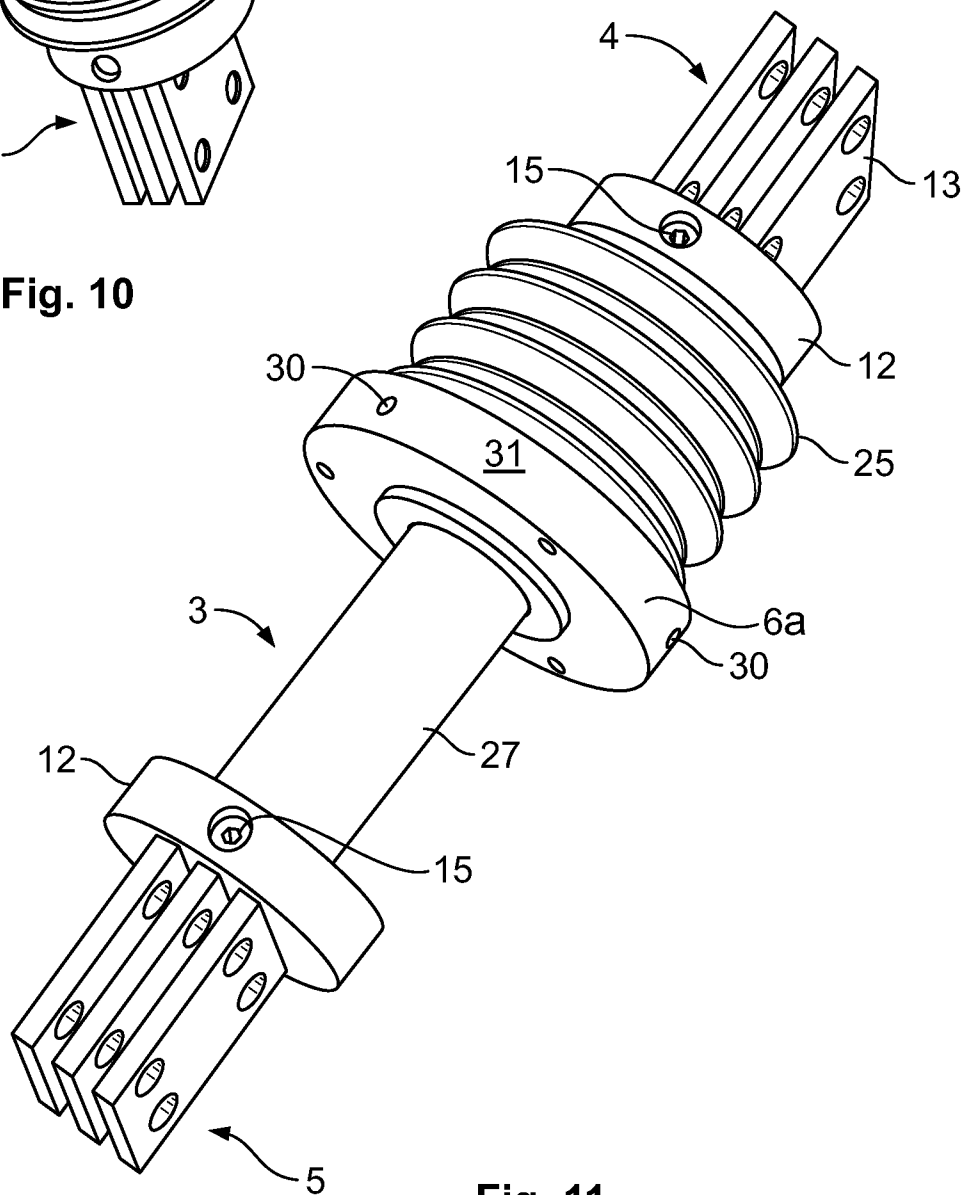


Fig. 11

1/8

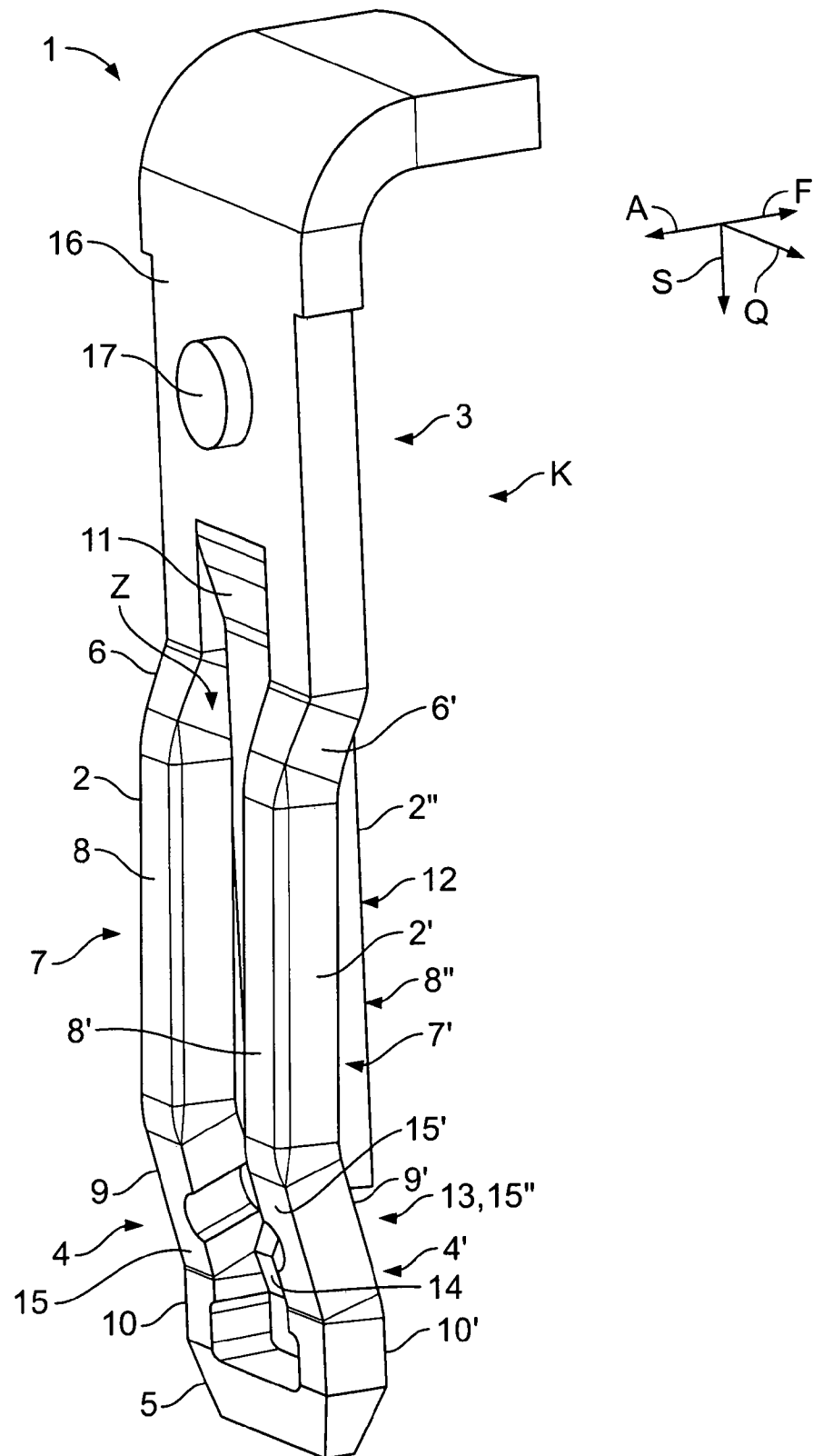


Fig. 1

2/8

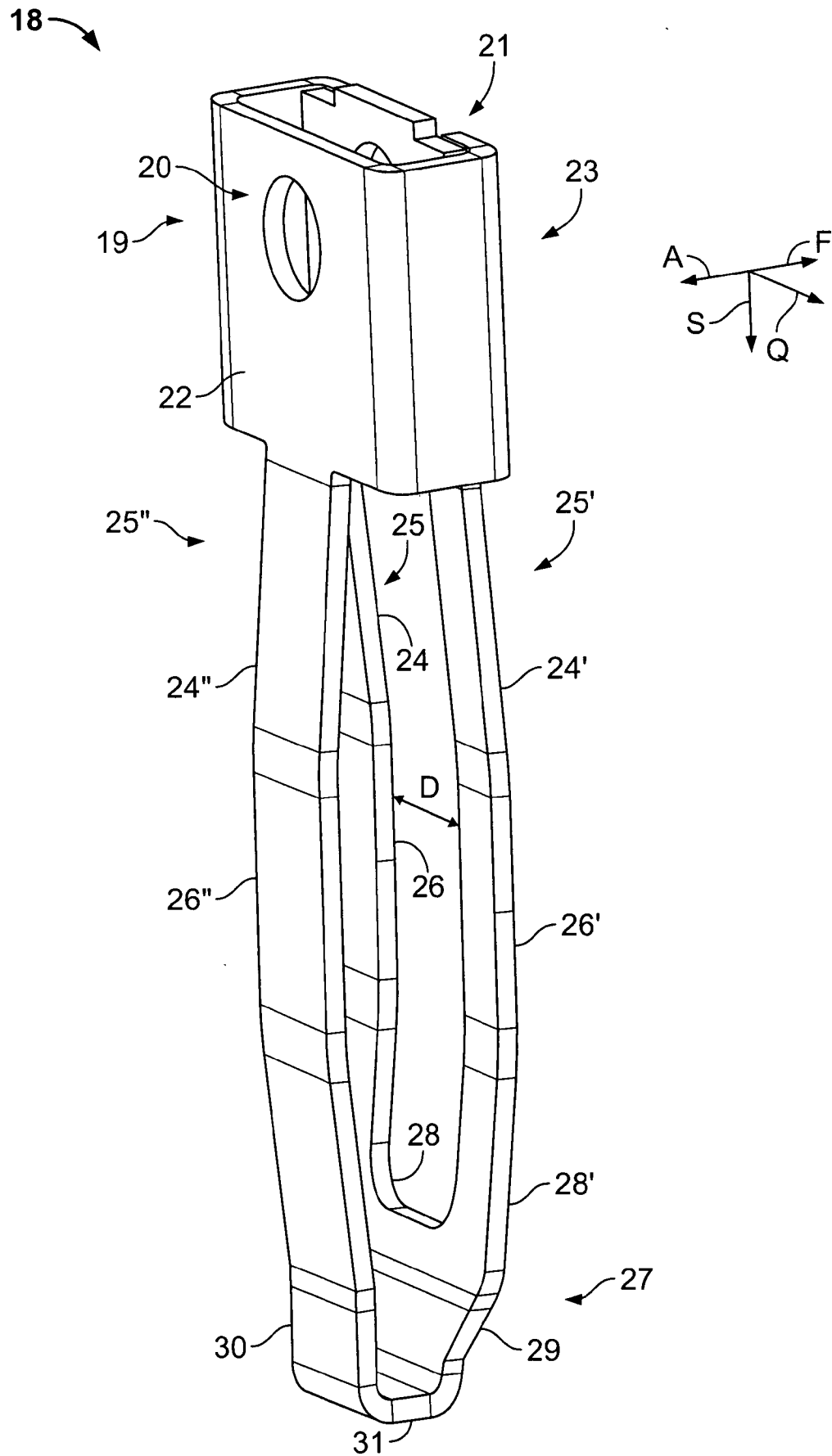


Fig. 2

3/8

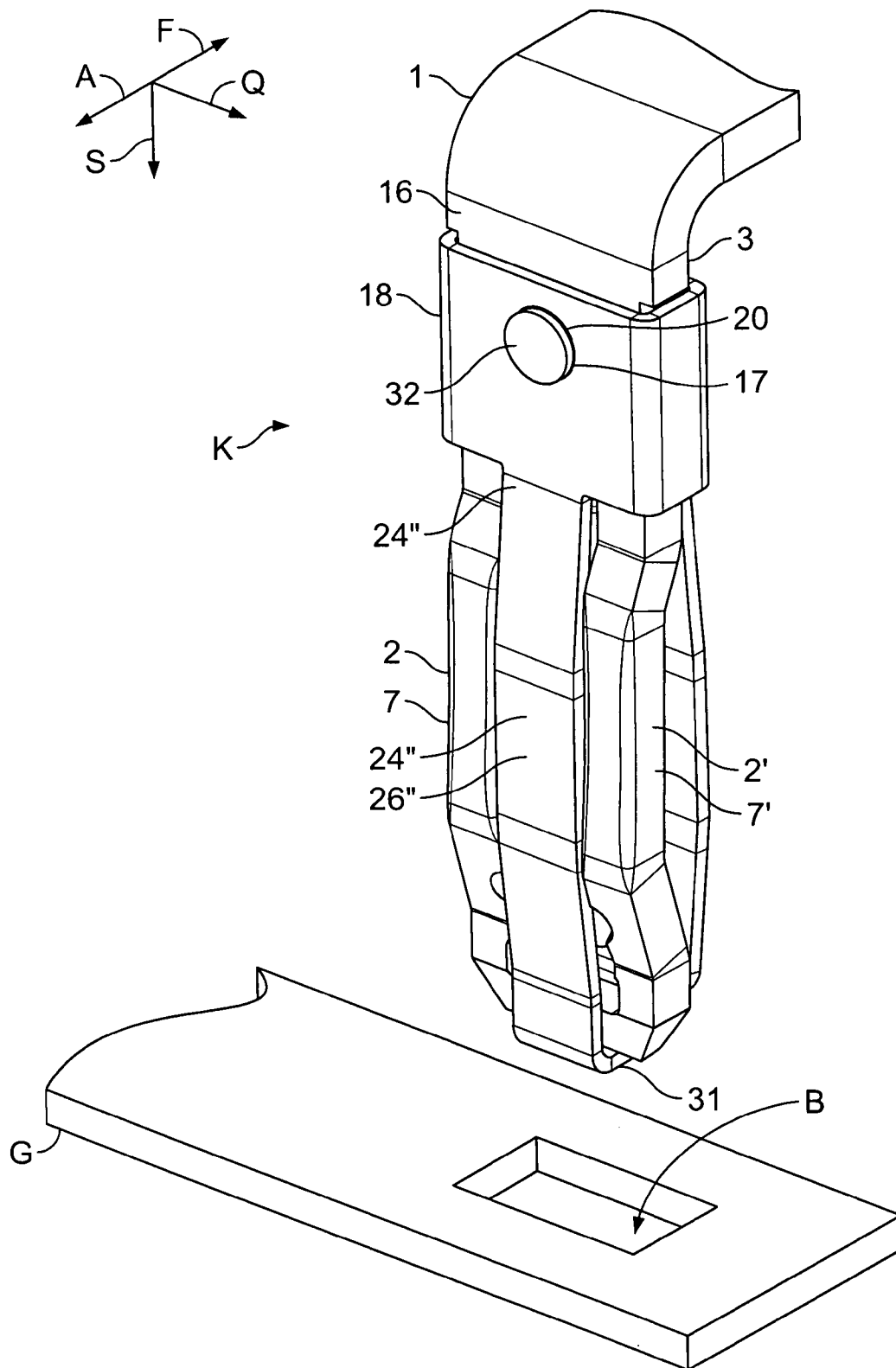


Fig. 3

SHEET INCORPORATED BY REFERENCE (RULE 20.6)

4/8

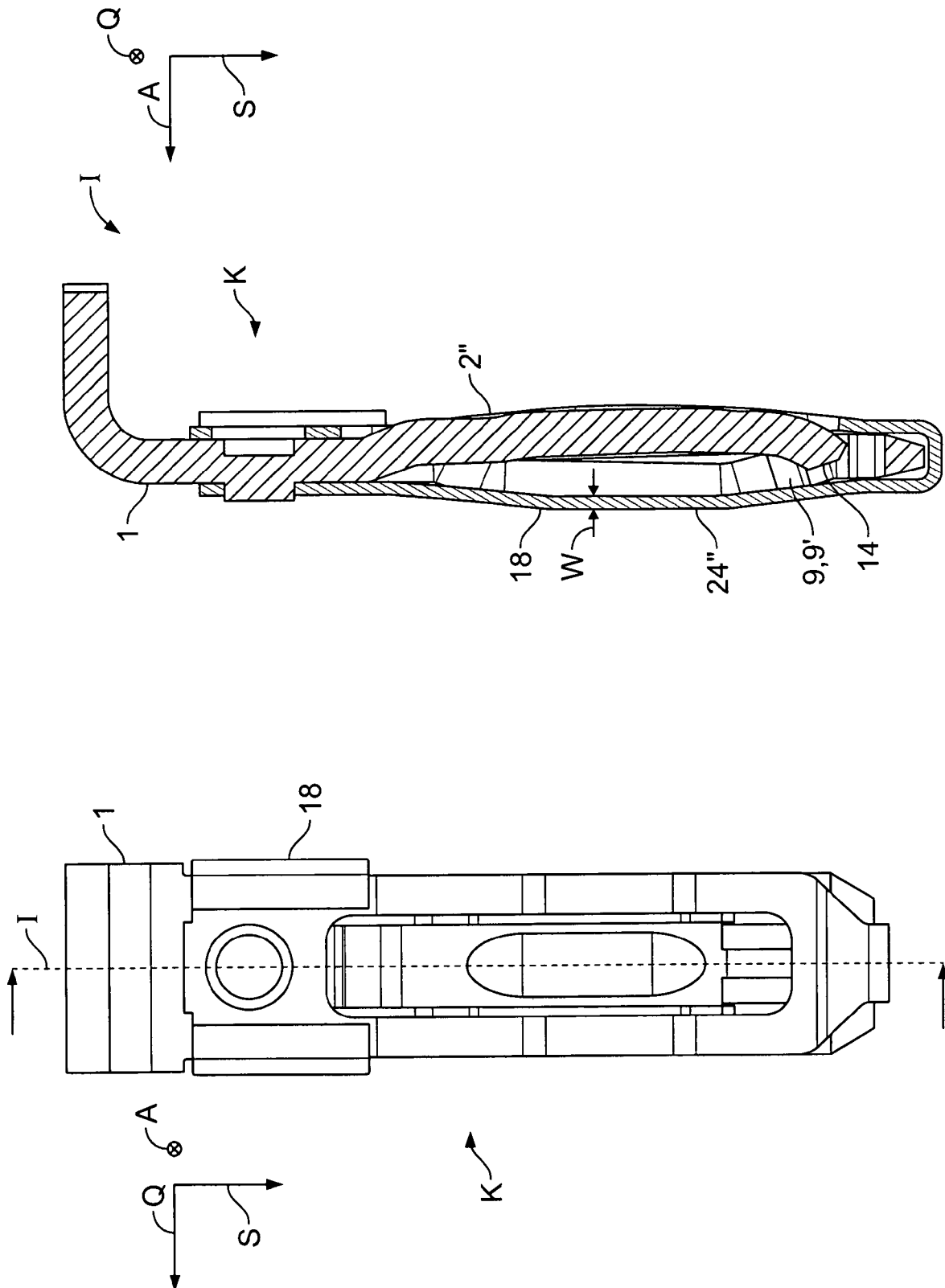


Fig. 4b

Fig. 4a

5/8

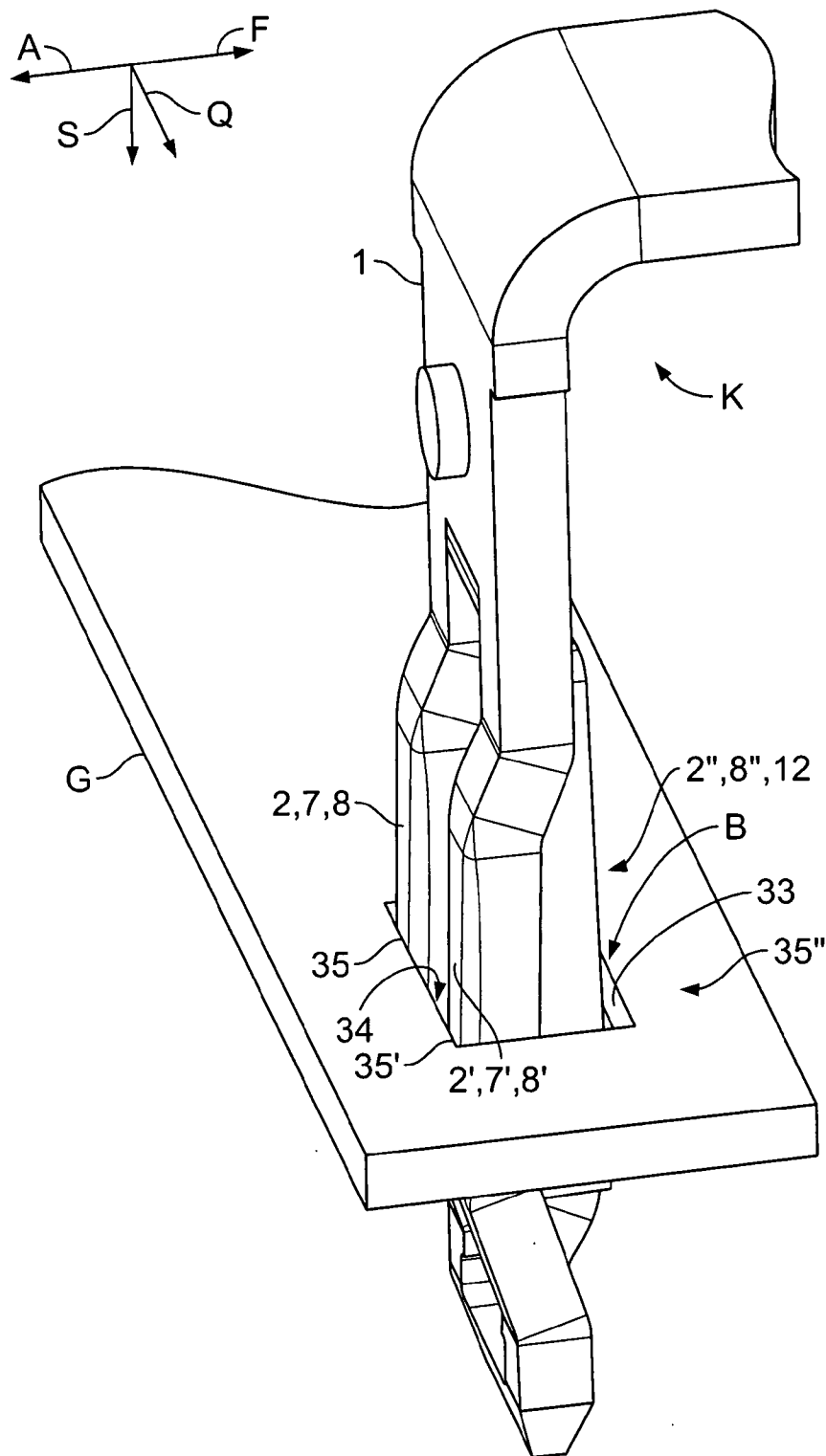


Fig. 5

6/8

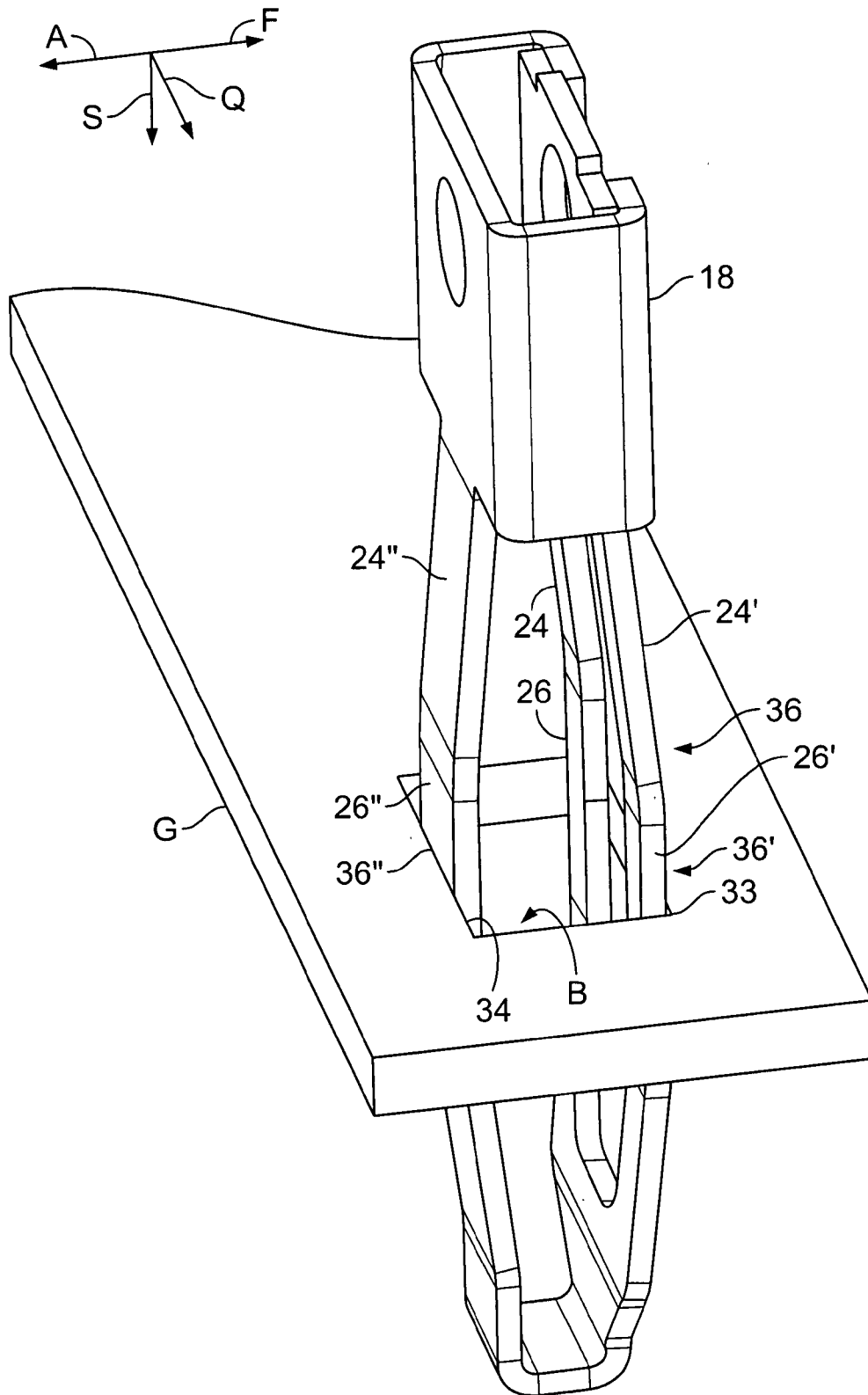


Fig. 6

7/8

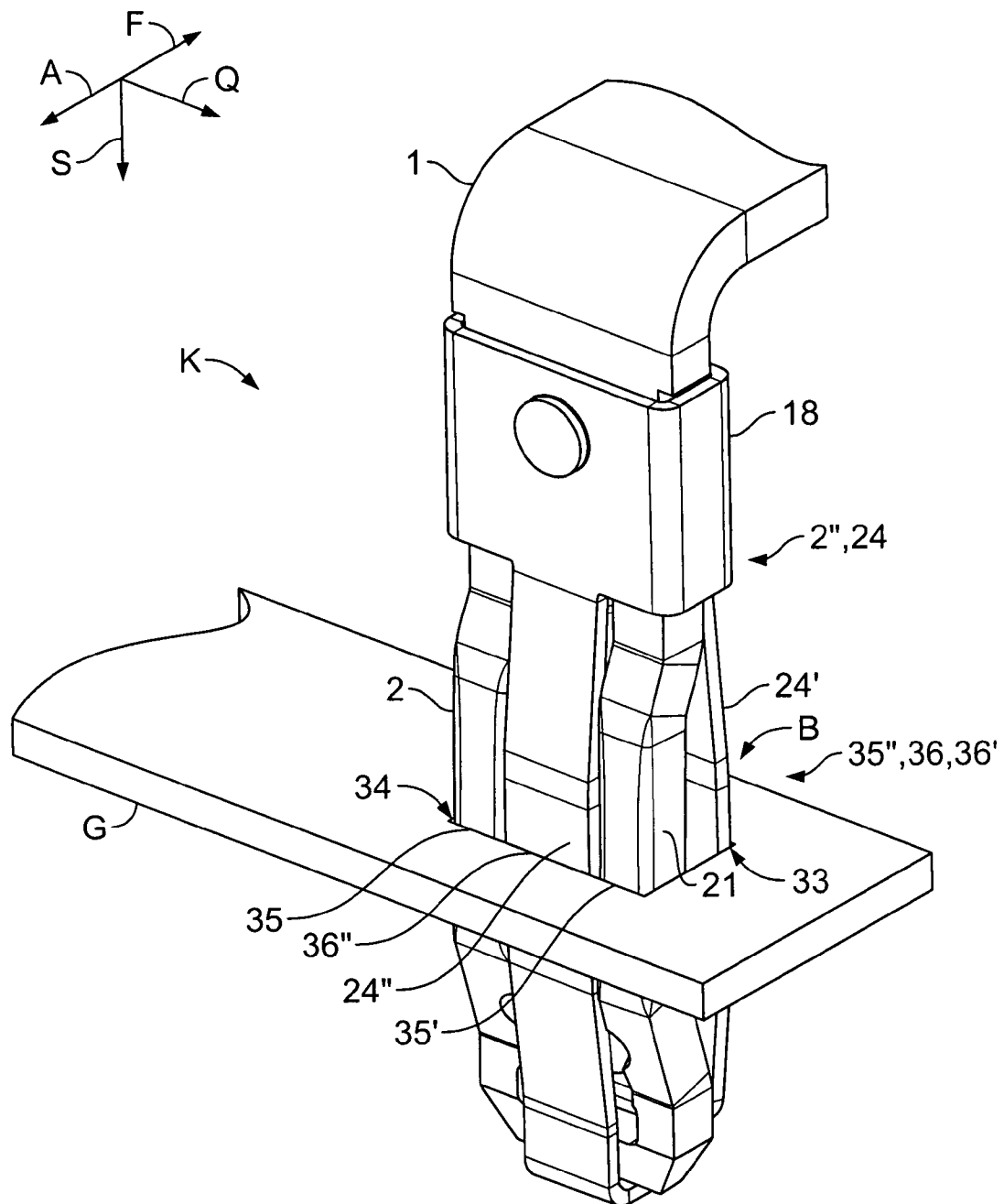


Fig. 7

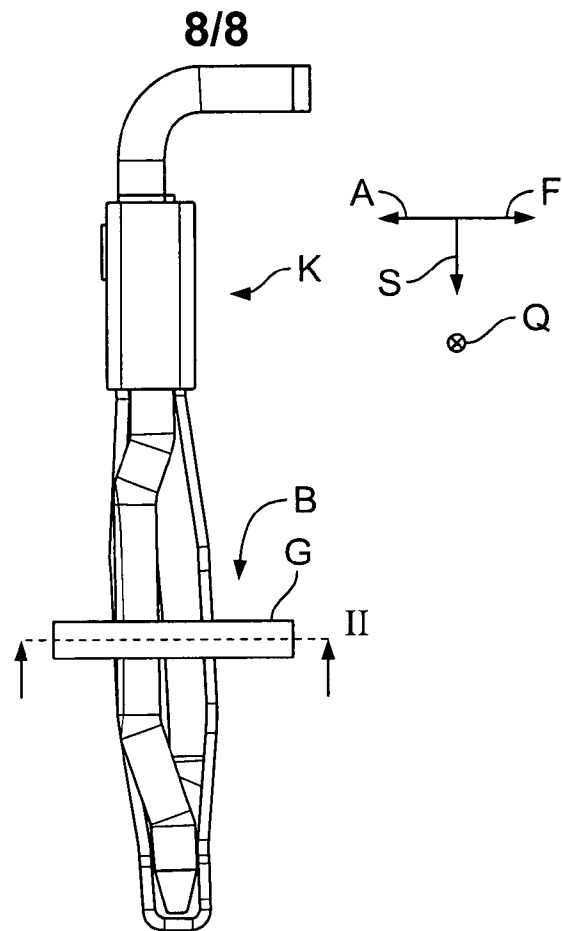


Fig. 8a

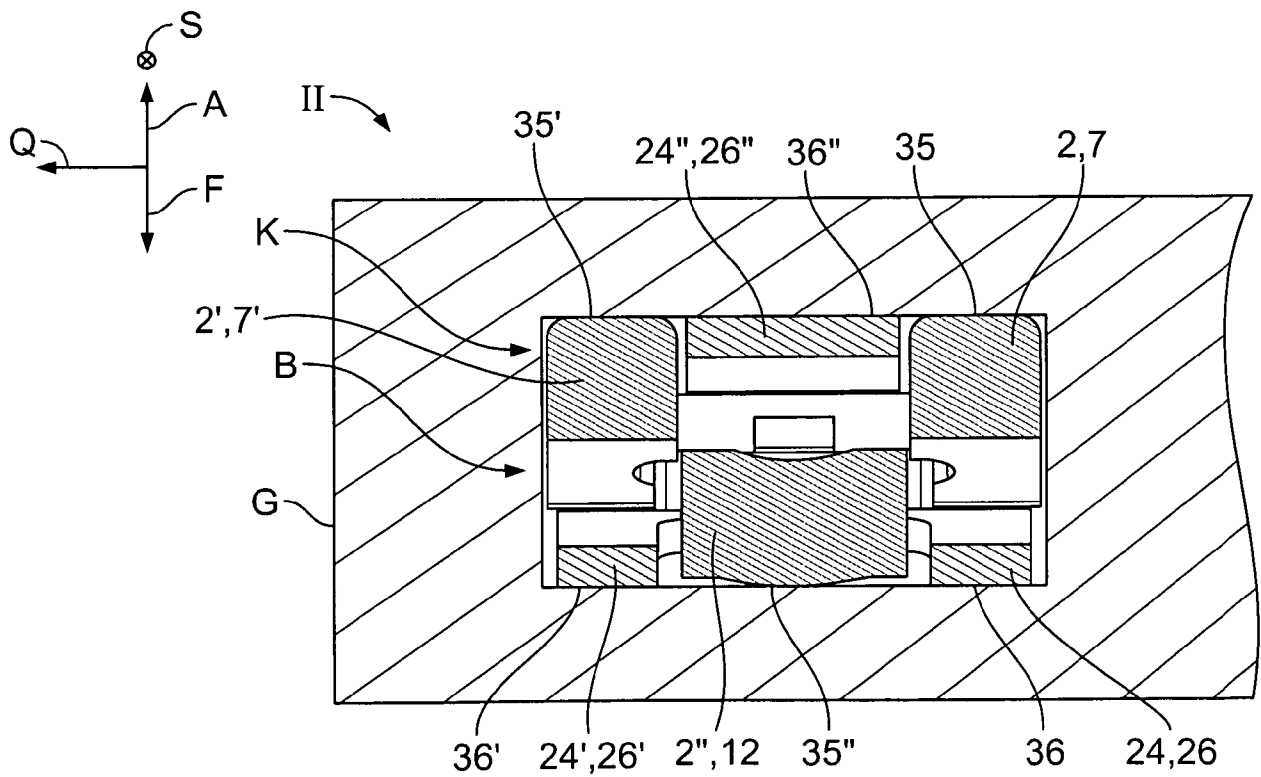


Fig. 8b

SHEET INCORPORATED BY REFERENCE (RULE 20.6)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/066756

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01R13/17

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 363 526 A (ENTRELEC SA [FR]) 19 December 2001 (2001-12-19)	1-4,7,9
Y	page 4, line 33 - page 6, line 7	5-6,8, 10-16
Y	US 4 362 353 A (COBAUGH ROBERT F ET AL) 7 December 1982 (1982-12-07) column 2, line 50 - column 3, line 45	5-6,8
Y	BE 886 321 A2 (HOOP GROENPOL ROTTERDAM B V DE) 16 March 1981 (1981-03-16) page 3, line 25 - page 4, line 20	10-16
Y	GB 1 203 775 A (DUNKEL OTTO GMBH [DE]) 3 September 1970 (1970-09-03) page 2, line 15 - line 117	10-16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

22 February 2010

Date of mailing of the international search report

02/03/2010

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Bertin, Michel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/066756

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 2363526	A	19-12-2001	DE 10129053 A1	07-03-2002
			FR 2810458 A1	21-12-2001
			US 2002031941 A1	14-03-2002
US 4362353	A	07-12-1982	JP 57021081 A	03-02-1982
BE 886321	A2	16-03-1981	NONE	
GB 1203775	A	03-09-1970	CH 470086 A	15-03-1969
			DE 1590323 A1	16-04-1970
			NL 6715239 A	10-05-1968