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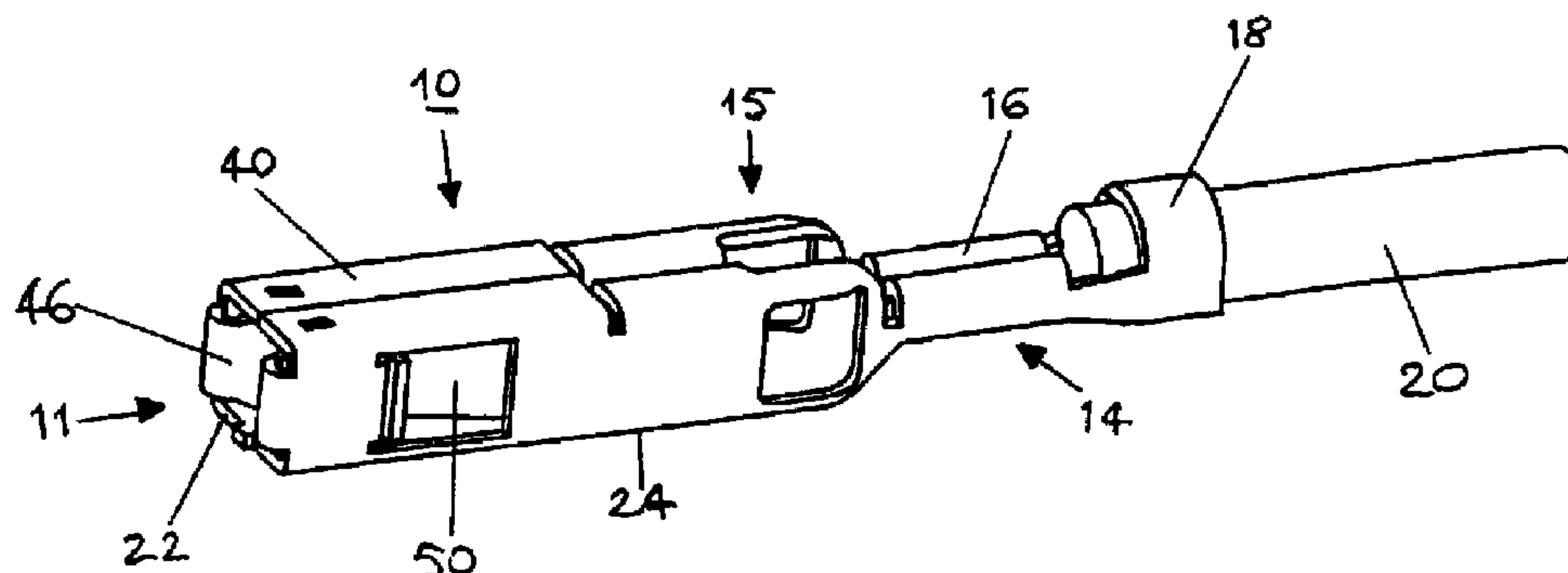
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(54) Titre : BORNE DE CONTACT ELECTRIQUE FEMELLE A PRESSION DE CONTACT CONTROLEE

(54) Title: FEMALE ELECTRICAL CONTACT TERMINAL WITH CONTROLLED CONTACT PRESSURE



(57) Abrégé/Abstract:

Female electrical contact terminal obtained from a single electrically conducting metal sheet and having a rear part enabling it to be connected to an electrical conductor and a front part in the form of a cage consisting of an end, of two side walls (26), which are provided with means (46) for guiding a male contact (12) during its insertion and with means (50) for fixing this cage in connection housings, in which one of the side walls has deformations which act alternately on the opposite surfaces of the contact blade (29) which is associated with the wall so as continuously to control the contact pressure exerted by the blade on the surface of the male contact when it is inserted.



**Female electrical contact terminal with
controlled contact pressure**

ABSTRACT

Female electrical contact terminal obtained from a single electrically conducting metal sheet and having a rear part enabling it to be connected to an electrical conductor and a front part in the form of a cage consisting of an end, of two side walls (26), which are provided with means (46) for guiding a male contact (12) during its insertion and with means (50) for fixing this cage in connection housings, in which one of the side walls has deformations which act alternately on the opposite surfaces of the contact blade (29) which is associated with the wall so as continuously to control the contact pressure exerted by the blade on the surface of the male contact when it is inserted.

Figures 3

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FEMALE ELECTRICAL CONTACT TERMINAL WITH
CONTROLLED CONTACT PRESSURE

5 The present invention relates to a one-piece female
electrical contact terminal, made of cut and formed sheet
metal, intended to receive a male contact. In particular but
not exclusively, the present invention relates to a terminal
10 of the type comprising a front body in the form of a cage
having an end, an upper wall and two side walls each having an
internal tab which is joined to them by a 180°-fold and which
at the front has a cantilevered part constituting a contact
blade.

 Contact terminals of the type defined above are already
15 known, these being able to be manufactured by cutting,
folding, forming and possibly rolling of a sheet of metal
strip much more economically than lathe-cut terminals. On the
other hand, existing contacts made of cut and formed sheet
metal have a number of drawbacks. If the contact blades
20 initially bear against each other and require a high force to
separate them, which is conducive to establishing a high
contact pressure guaranteeing an electrical connection of good
quality, the insertion force is high and there is a risk that
introduction is difficult. This first drawback may become
25 serious if a large number of contact terminals are provided in
the same connector. If, on the other hand, the contact blades
are initially separated, the pressure exerted by each contact
blade may in some cases be insufficient to ensure good
electrical connection.

30 One solution to this technical problem has been provided
in Patent Application FR-A-2,621,180 which describes a female
contact terminal which simultaneously guarantees satisfactory
electrical connection and provides guidance of the male
contact while it is being introduced. Thus, each side wall
35 has, at the front, a flap folded over inwards, retaining the
flexurally prestressed contact blade in a position in which it
is not in contact with the other contact blade.

 At the present time, many contact terminals made of
folded sheet metal furthermore run the risk of being crushed

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while they are being handled in production or at the premises of harness manufacturers. This is particularly the case with female electrical contact terminals in the form of a cage, but having a single wall, such as those described in Patents US-A-
5 4,453,799 or EP-A-0,697,752, or else those having contact blades which do not contribute to the required stiffness in order to try to prevent crushing of the cage described, for example, in Patent Application FR-A-2,627,020.

Single-wall electrical terminals must moreover withstand
10 any pull-out action or shearing action of the metal strip of which they are made. Thus, because of the cutting-out, forming and bending operations performed on these thin metal sheets, the intersections of the lines of cutting may shear and tear due to a mechanical thrust being exerted on a wall.

15 This risk is particularly high in the thinned regions, such as the transition region between the rear part for connection to an electrical wire and the front part formed by the cage, or else in the windows of the cage which are provided for fixing the terminal in plastic housings of the
20 connectors receiving the terminals.

Finally, mention should be made of the risk of the forcible introduction of a male contact whose dimensions are greater than the internal dimensions of the cage, which contact would consequently apply a pressure, on the contact
25 blades, greater than the pressure of the elastic deformation limit of the metal of which the contact blade is made, which would lead to eventual deterioration of the blade having then reached its plastic deformation limit.

These drawbacks become particularly important when, for
30 economic requirements, the manufacturers, seeking solutions to reduce costs without impairing quality, envisage reducing the thickness of the metal strip of which the single electrically conducting metal sheet is made.

The invention thus aims to provide a female electrical
35 contact terminal obtained from a single electrically conducting metal sheet having a rear part enabling it to be connected to an electrical conductor and a front part in the form of a cage having an end, two side walls provided with means for guiding a male contact during insertion of this male

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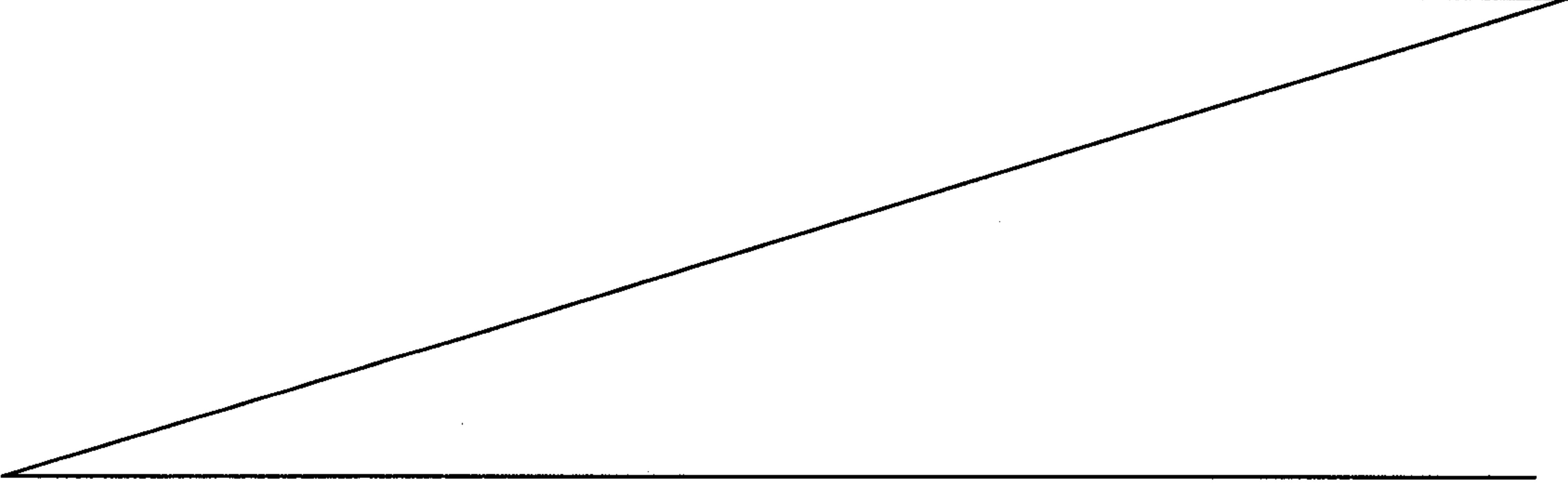
contact, means for fixing the cage in a connection housing,
and two upper half-walls. Each upper half-wall and side wall
is linked by 180°-folding to an internal tab defining a
contact blade, and at least one of the side walls has two
5 deformations which act alternately on opposite surfaces of the
contact blade which is associated with the side wall. The two
deformations define a clearance space limiting maximum
movement of the contact blade between a passive position when
no contact pressure is exerted and an active position when the
10 contact blade exerts maximum contact pressure, so as to
control continuously the contact pressure exerted by the
contact blade on a surface of the male contact when the male
contact is inserted.

According to a non-restrictive illustrative
15 characteristic of the invention, the deformations provide,
respectively, flexural prestressing of the blade when in its
passive position and the limit of elastic deformation of the
blade when in its active position.

According to another non-restrictive illustrative
20 characteristic of the invention, the deformations comprise a
flap and a fold of the sheet, respectively, and these folds of
the two side faces of the cage converge in the same plane so
as to prevent introduction of a male contact not conforming to
the dimensions of the terminal.

25 According to a further non-restrictive illustrative
characteristic of the invention, the electrically conducting
metal sheet has a thickness of less than 0.3 mm.

The foregoing and other objects advantages and features
of the present invention will become more apparent from
30 reading of the following non-restrictive description of an
illustrative_____



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embodiment of the invention, given by way of non-limiting example. The description refers to the drawings which accompany it, in which:

Figure 1 is a perspective view showing a female
5 electrical contact terminal according to the invention;

Figure 2 is a plan view of a sheet intended to be folded, in order to make the terminal of the invention;

Figures 3A and 3B are sectional views of the front part in the form of a cage;

10 Figure 4 is a partial section of a terminal positioned in an insulator;

Figures 5 and 5A are two perspective views with a cut-away part showing the terminal in Figure 1;

15 Figures 6 and 6A are two perspective views with a cut-away part showing another detail of the terminal in Figure 1;

Figure 7 is a plan view of a sheet intended to be folded in order to make a terminal of the prior art.

20 The terminal whose final construction is shown in Figures 1 and 3 to 6, produced from a sheet of the kind shown in Figure 2, is intended to be inserted into a connector housing whose general construction may be conventional. The terminal 10 is made of a single piece, and may be regarded as having a front body 11 intended to
25 receive a male contact 12 and a rear part or stem 14 to be crimped. These two parts are separated by a transition region 15. The stem 14 has two sets of tabs 16 and 18, respectively intended to be crimped onto the core and onto the sheath of an electrical wire 20.

30 The body of the terminal 10 is in the form of a cage having an end 22 and two sides 24. Each side 24 is double. It comprises an external wall 26 and an internal tab 28. Each external wall 26 is produced by folding the original sheet at 90° along one of the lines 30 indicated
35 by the dot-dash lines in Figure 2. The internal tab 28 is connected to the external wall 26 by a 180°-fold along the edge indicated at 32 in Figure 2. The two together, wall 26 and tab 28, make a right-angled fold along the lines denoted by 34 in Figure 2.

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As may be seen in Figure 2, each internal tab 28 is joined to the corresponding external wall 26 only in its rear part. The front part of each internal tab 28 thus forms an elastic bearing contact blade 29 which
5 generates a pressure on the surface of the male contact 12 when the latter is inserted.

In another embodiment, not shown, each contact blade 29 could be divided by a slit over part of its length starting from the free end, which allows more
10 uniform bearing; however, this division is not absolutely necessary. One of the contacts (or both of them) could have no slit. Conversely, it will be possible to provide more than one slit in each contact blade.

Between the wall 26 and the tab 28 a wall part
15 close to the 180°-fold forms a half-ceiling of the cage. In the embodiment shown, the cutting of the original sheet leaves tabs 40 which bear in abutment one against the other and form a continuous ceiling in the cantilevered region of the contact blades 29. This latter
20 solution reduces the risks of the terminals catching on each other when they are grouped together in bundles or when loose, and ensures complete protection of the contact blades.

Advantageously, each contact blade 29 has a shape
25 of the kind shown in Figures 3 and 4. The cantilevered part, forming the electrical contact, represents somewhat more than half the total length of the internal tab 28 and is formed so as to bow inwards. In addition, it has a thickened bent part 27 facing the other contact blade,
30 in the immediate vicinity of its free end. The elastic force due to the bowing of the contact blade 29, tending to move the two blades closer to each other, is absorbed by a flap 46, folded over towards the rear, of the corresponding external wall 26. This flap 46, which in
35 addition enables the male contact to be guided during its insertion, thus retains the flexurally prestressed contact blade 29 in a position close to the external wall 26 to which it is linked, that is to say in a position in which it is not in contact with the other contact blade

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29 which is opposite it. It may be seen in Figure 1 that the fold of the flaps lies in front of the terminal edges of the side walls of the cage and has a rounded shape, which makes it easier to introduce the terminal into the insulator 51 of a connector housing, not shown, and reduces the risks of damaging this insulator. In order to further reduce the risk during introduction, the edges of the end and of the ceiling may be softened.

Made in the external walls 26 are openings 50 intended to enable the terminal to be immobilized in an insulator 51 by means of a locking finger 52 which may have any of the constructions currently used. In the embodiment shown in Figure 4, this finger consists of an elongate beam made during the moulding of the insulator, having a projection 53 facing the inside of the cavity of the insulator and able to be engaged in the window 50. Because of the fact that the beam 52 extends in front of the projection 53, it is possible to unlock the terminal by pushing in a tube through the front passage 54 of the insulator (delimited by an annular lip having a gap allowing the beam 52 to be mounted), this tube sliding between the side of the terminal and the beam. Because of the symmetrical positioning of the two windows 50, the terminal may occupy one or other of the two symmetrical positions in the cavity of the insulator.

As may be seen in Figures 2 to 4, the window 50 on one of its sides has a wall portion which during manufacture allows production of a deformation of the metal strip so as to form a fold 55. This fold 55 defines a shoulder whose surface 56 is intended to bear against the upper bearing surface 57 of the projection 53 enabling the terminal to be fixed in the cavity of the insulator.

It will be noted that the end of this deformation 55 faces inwards and forms a stop acting on the outer surface of the contact blade 29 so as to avoid any risk of exceeding the elastic limit of the said blade.

This arrangement, combined with the arrangement described above in which the flap 46 retains a flexurally prestressed contact blade 29, thus enables the contact

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pressure of the blade on the male contact to be continuously controlled, that is to say throughout the life of the terminal, at each insertion of the latter.

The advantage of such an arrangement is that, by virtue of the two deformations, namely the flap 46 and the fold 55, a clearance space is defined which delimits the movement of the contact blade 29 between a so-called passive position when it is retained by the flap 46 and when no male contact has been inserted and a so-called active position when it limits the maximum outward movement of the blade due to the force created by introduction of the male contact.

As may be seen in Figure 3, the folds 55 of the two external walls 26 converge in the same horizontal plane so that the points of contact, on the one hand, between the male contact 12 and the contact blades 29 and, on the other hand, between the contact blades 29 and the folds 55 define a space which eliminates any possibility of introducing a male contact not conforming to the dimensions of the female terminal.

As depicted in Figure 4, the fold 55 has two orientations. The first folding operation turns part of the precut strip so as to face the centre of the terminal and than a second operation turns the same part of the strip through 180° so as to face the outside of the terminal, thus reinforcing the mechanical integrity of the shoulder formed by the fold 55. Moreover, it will be noted that the lower surface 56 of the fold 55 has a large area for bearing on the upper surface 57 of the projection 53, which avoids any risk of the sheet shearing despite the reduction in thickness of the strip. This surface 56 is substantially greater in area than the bearing surface 57 so that the force exerted on these surfaces is as uniform as possible and does not produce a cantilever.

The respective planes of the complementary bearing surfaces 56 and 57 define an angle α with the plane perpendicular to the longitudinal axis of the terminal so that their respective opposite slopes create a self-

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engaging effect between the terminal and the insulator. By way of example, the value of the angle α of the surface 57 of the projection is between 1° and 45° , and preferably has a value of 15° .

5 Referring to Figure 7, it will be noted that the windows 50a made in the walls of the electrical terminals of the prior art may clearly include the folds 55 although these walls are single walls.

10 Figures 5 and 5A show a device for strengthening the terminal 10. Thus, for the purpose of compensating for the reduction in the thickness of the sheet, the flap 46 has a width L approximately equal to the internal width defined by the walls of the terminal once folded over so that the lateral edges of the flaps 46 come to
15 bear on the inner surface of the end and of the upper walls of the terminal. Furthermore, these walls are provided with openings 60 into which tenons 61 made on the ends of the lateral edges of the flaps 46 engage.

Apart from the fact that the flaps 46 are thus
20 solidly fixed, this strengthening of the cage forming the terminal 10 thus enables the walls of this cage to be braced and enables any accidental crushing to be avoided.

It will be noted that the flaps 46 may be fixed in the cage by a single tenon 61 provided on one or other
25 of the lateral edges of the flap 46.

Figures 6 and 6A show another arrangement suitable for increasing the mechanical rigidity of the terminal in general.

In fact, between the front body 11 of the
30 terminal 10 and the stem 14 to be crimped there is a so-called transition region 15 which may undergo deformations or misalignments prejudicial to installing the terminals in the insulators.

In these figures, it may be seen that this
35 transition region is of smaller size. This is because the walls 26 of the front body 11 are extended by two right-angled branches 71 and 72 which with the end 22 and the wall 26 define an opening 70, thus consisting of 4 sides which together strengthen this partially cut-away region.

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It will be noted that the opening 70 allows introduction of any device for the secondary lateral locking of the terminal in a connector housing. Likewise, it should be noted that provided between the two right-angled parts, each arranged on a wall 26, is a space 73 which allows positioning of the end of any wire to be crimped which slightly exceeds the required dimensions, thus preventing this wire from pushing the terminal beyond the required standards for correct positioning of the terminal in its insulator.

A brief description will now be given of a possible process for manufacturing the terminals according to the invention, making it possible to obtain the terminals in the form of tapes for feeding a machine which automatically crimps onto wires.

In the case of the terminals of the invention which are intended for the motor-vehicle industry, the manufacture takes place by cutting and forming (folding) of strips of copper alloy having a thickness of 0.29 mm. In a first work station, the strip is cut in order to create successive sheets of the kind shown in Figure 2, these being joined together by a connecting strip 66. The folding lines, indicated by the dot-dash lines in Figure 2 may be marked out in a press. The contact blades 29 are shaped by bending and striking, and the flaps 46 are formed. As may be seen in Figure 4, it is advantageous to give both the flaps and the free terminal part of the contact blades 29 a slope, for example of about 15°, which makes it easier to introduce the male contact.

The 180°-fold between the internal and external tabs and walls and the 90°-fold inwards separating the part of the internal tab belonging to the side and that belonging to the ceilings are formed; simultaneously, the tenons 61 penetrate the windows 60 and the walls formed come into contact with the edges of the flaps 46.

The invention is not limited to the particular embodiments which have been shown and described by way of examples. Many variants of the invention are possible. For example, it is possible to form a terminal whose

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faces are not exactly parallel but exhibit a slope; a notch allowing passage of the angled male blade, this being required for certain sealing embodiments, which is intended to receive a sealing tab may be made at the
5 front of the ceiling of the contact. It should be understood that the scope of the present patent extends to such variants as well as, more generally, to any other ones remaining within the context of equivalences.

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The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

5 1. A female electrical contact terminal obtained from a single electrically conducting metal sheet having a rear part enabling it to be connected to an electrical conductor and a front part in the form of a cage having an end, two side walls provided with means for guiding a male contact during
10 insertion of said male contact, means for fixing said cage in a connection housing, and two upper half-walls, each upper half-wall and side wall being linked by 180°-folding to an internal tab defining a contact blade, at least one of the side walls having two deformations which act alternately on
15 opposite surfaces of the contact blade which is associated with the side wall, wherein the two deformations define a clearance space limiting maximum movement of the contact blade between a passive position when no contact pressure is exerted and an active position when the contact blade exerts maximum
20 contact pressure, so as to control continuously the contact pressure exerted by the contact blade on a surface of the male contact when the male contact is inserted.

2. The female electrical contact terminal according to
25 claim 1, wherein the deformations provide, respectively, flexural prestressing of the contact blade when in its passive position and the limit of elastic deformation of the contact blade when in its active position.

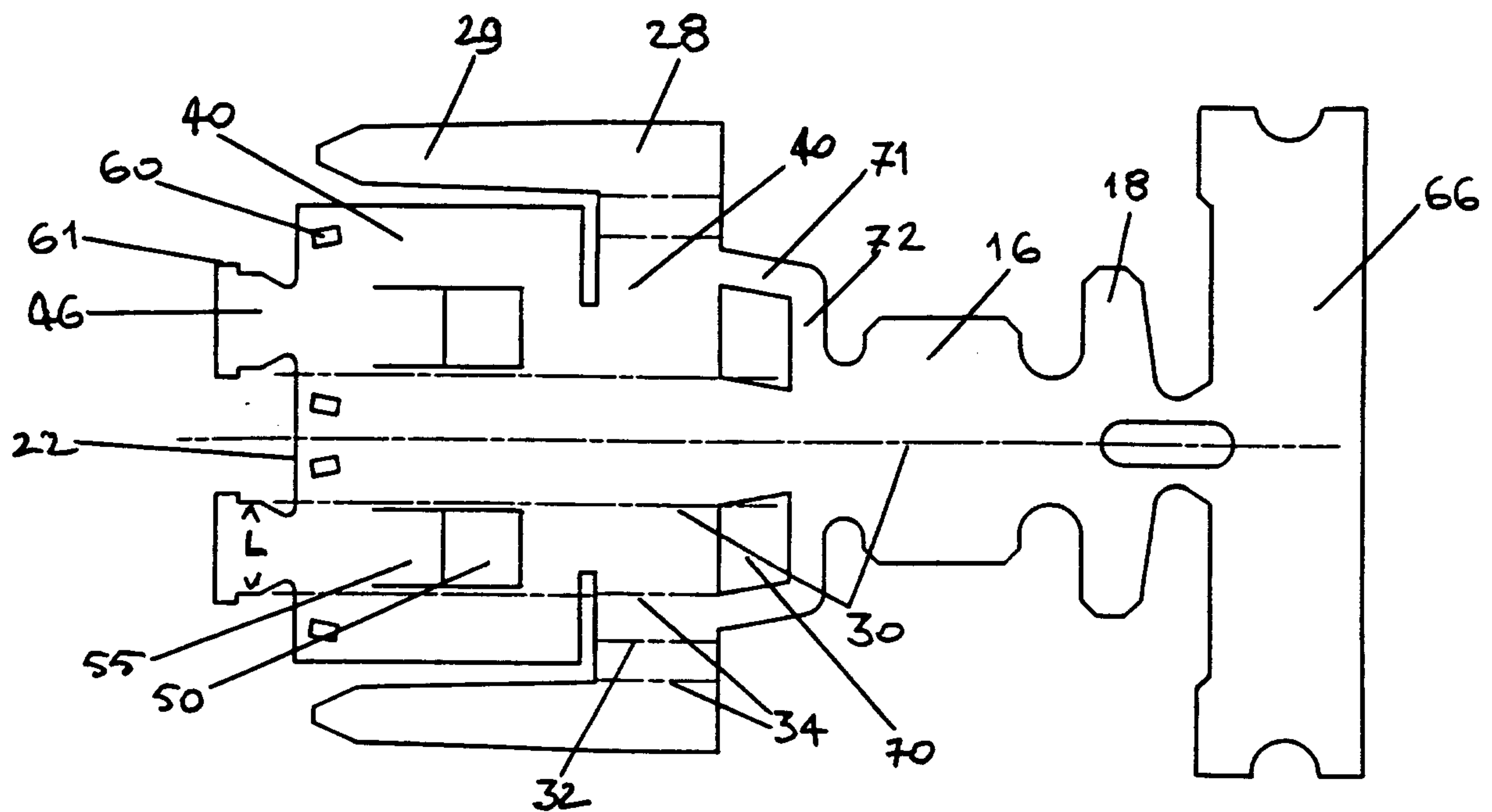
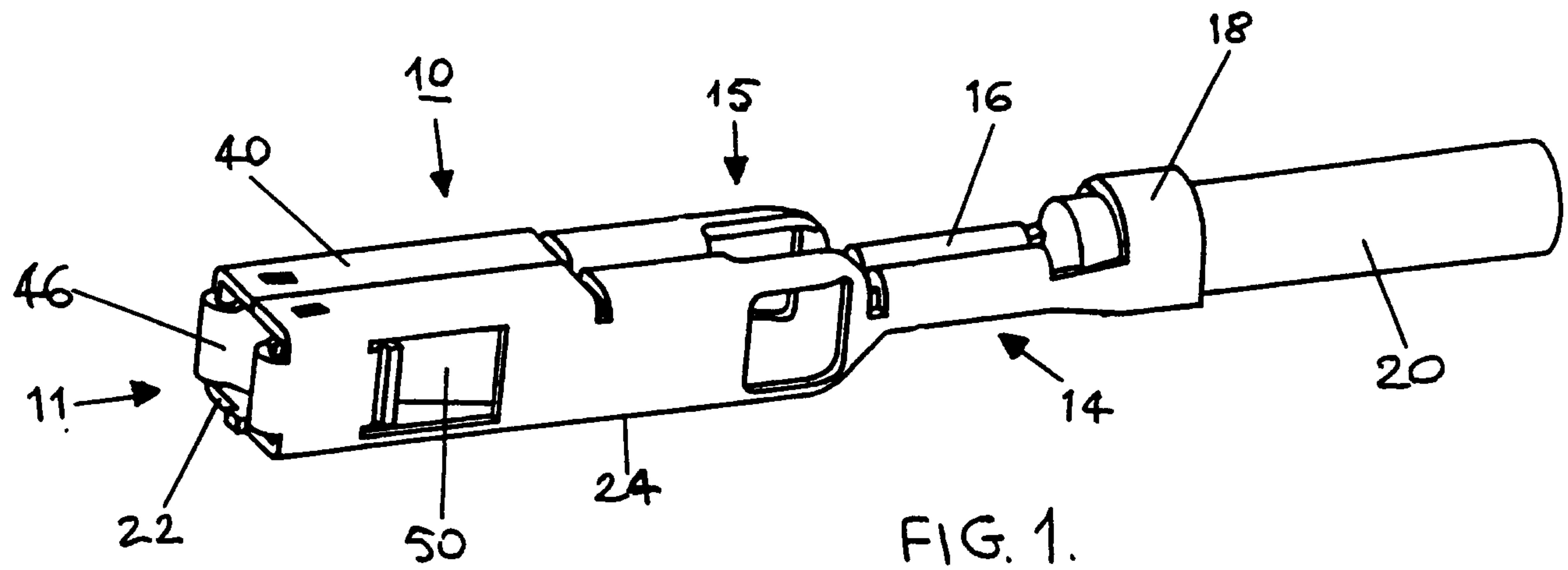
30 3. The female electrical contact terminal according to claim 1 or 2, wherein the deformations comprise a flap and a fold of the sheet, respectively.

35 4. The female electrical contact terminal according to any of claims 1 to 3, wherein folds of two side faces of the cage converge in a same plane so as to prevent introduction of a male contact not conforming to the dimensions of the terminal.

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5. The female electrical contact terminal according to any of claims 1 to 4, wherein the electrically conducting metal sheet has a thickness of less than 0.3 mm.

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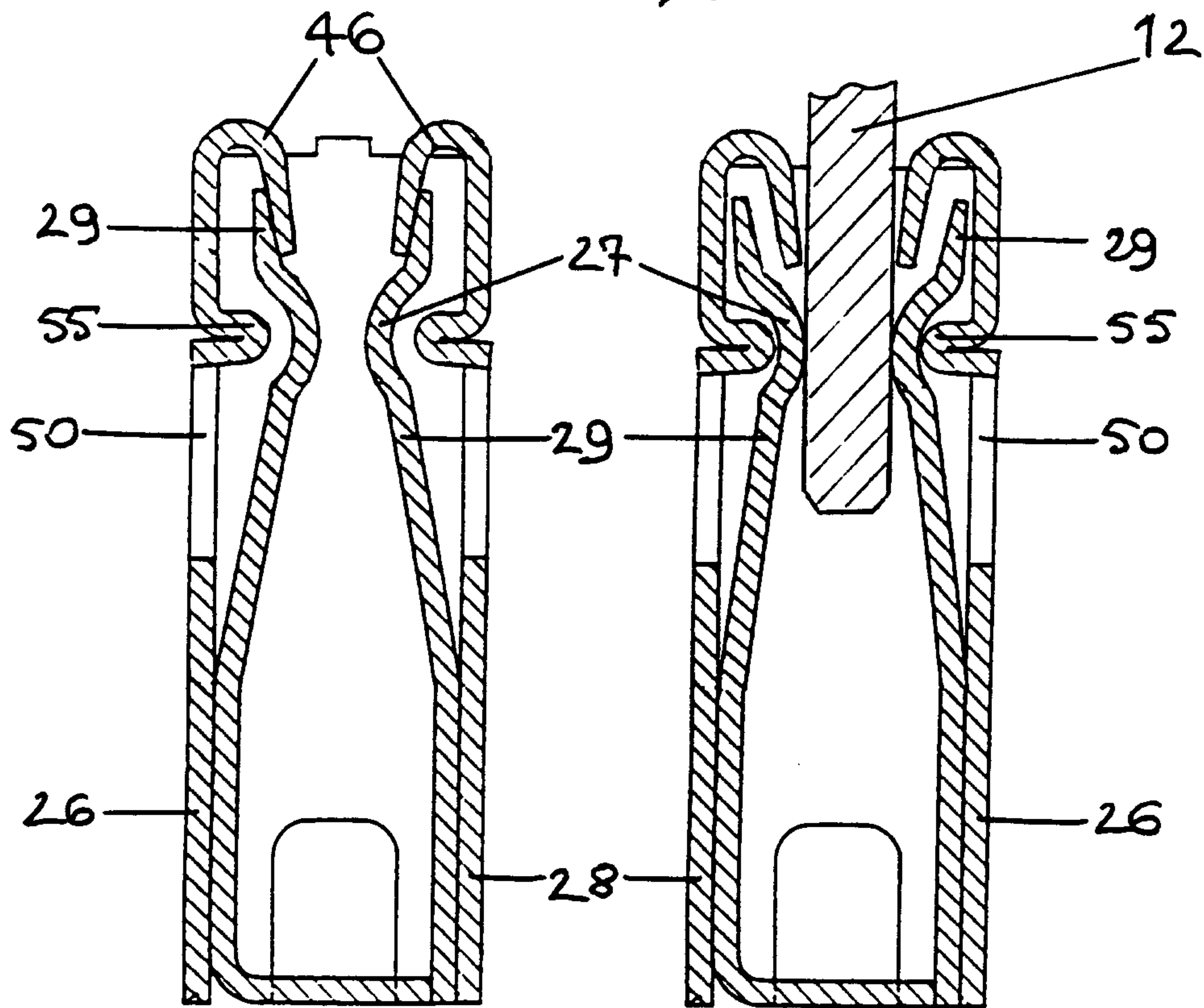


FIG. 3.a

FIG. 3.b

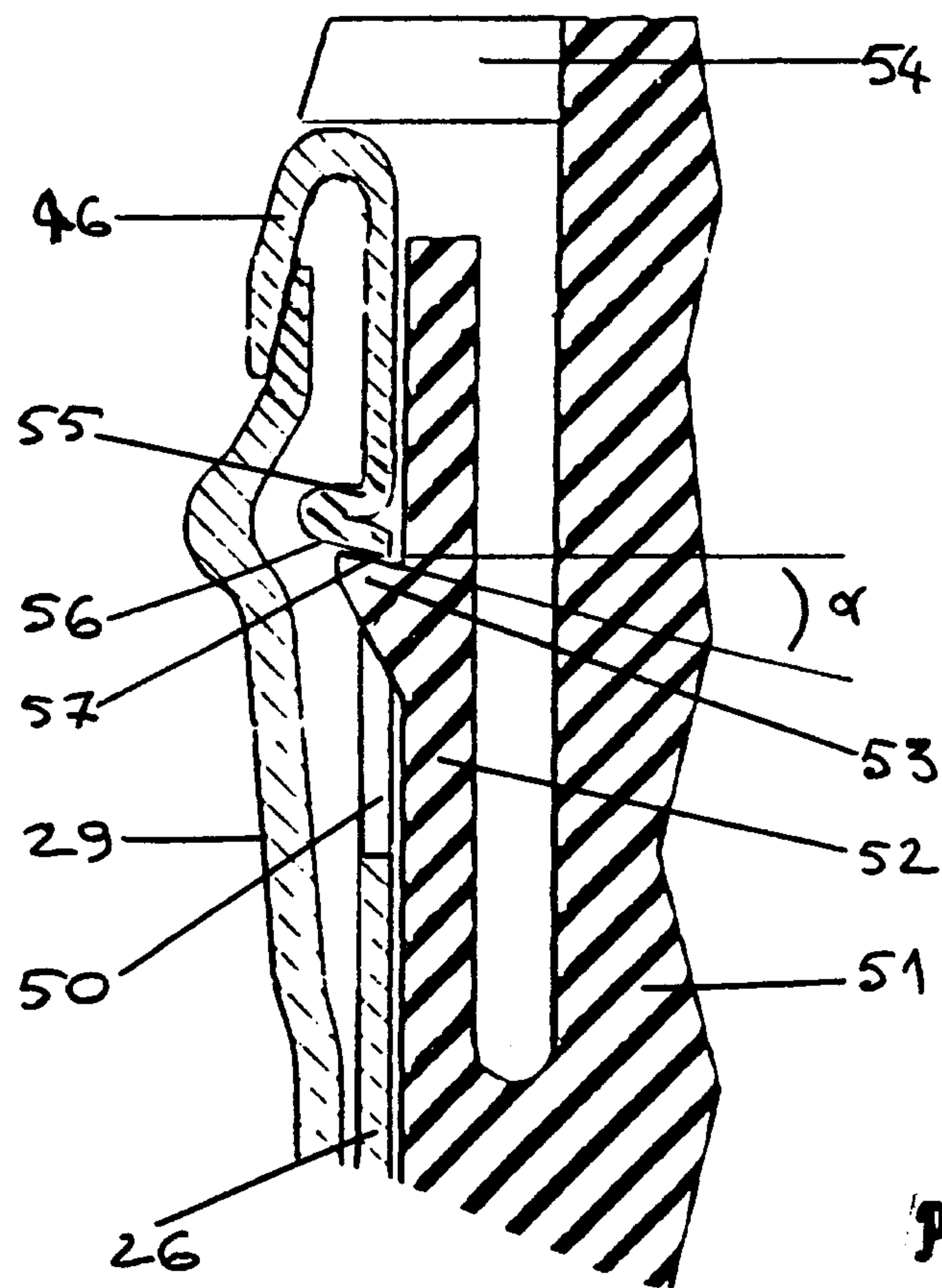
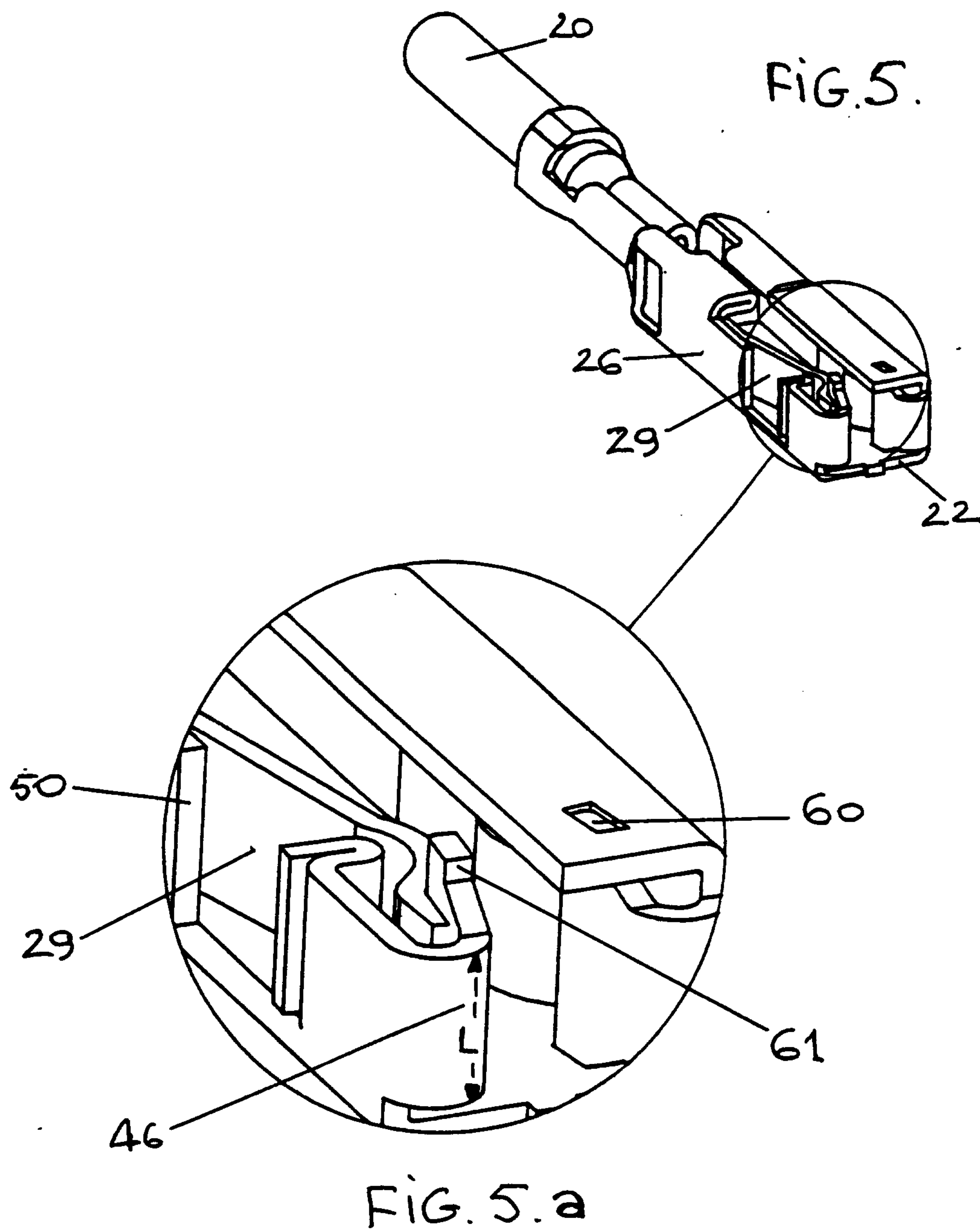


FIG. 4.

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