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(54) Electrical contact for contacting a foil conductor

(57) An electrical contact for making contact with a foil conductor surrounded by an insulating foil layer, that has a contacting section (2) with a baseplate (4) with at least one protruding section (5) and at least one lateral lug (6) attached to the baseplate (4), where the lug is basically arranged at right angles to the baseplate (4), capable of piercing through the foil and having a lateral section that can be bent over onto the foil, the lateral section being provided with a lower edge (9) which is separated from the baseplate (4) by a slot and with the lateral section being bendable over to make contact between the foil conductor and the middle section (7), wherein by the bending action, the insulating foil layer on top of the foil conductor is stripped off the foil which is located between the protruding section (5) and the lower edge (9) of the lateral section (8) thus establishing electrical contact with the foil conductor.

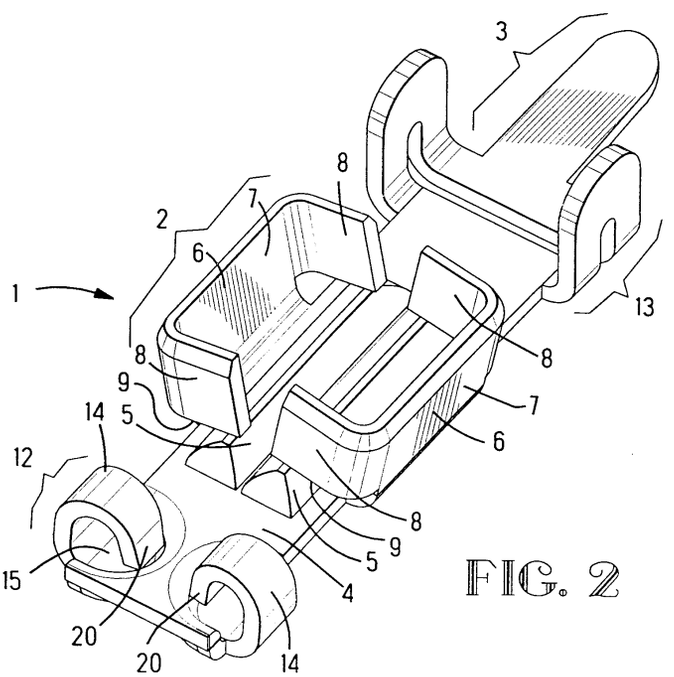

FIG. 2

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Description

[0001] This invention relates to an electrical contact for making contact with a foil conductor, the conductor being surrounded by an insulating foil layer, said contact comprising a contact making section having a baseplate with at least one protruding section and having at least one lug at the side of the baseplate that is attached to the baseplate basically at right angles and that can be pierced through the foil and bent over in order to make contact with the foil conductor.

[0002] In order to make contact with foil conductors it is standard practice to pierce contacts through the foil. For many applications this way of contact making is, however, not sufficient. More recently, flexible foils with foil conductors surrounded by insulating layers of foil are also frequently used to make electrical connections in cars. For such applications secure contacting with foil conductors is required under conditions where there are strong vibrations.

[0003] US 4, 669,798 discloses an electrical contact for contacting a foil conductor surrounded by an insulating foil layer. The electrical contact is provided with a first section for connecting to a complementary contact pin, and a second section for the contacting of the foil conductor. The section for contacting the foil conductor is provided with a baseplate which has several embossed sections, as well as lugs staggered in relation to each other and attached to the back plate which are to pierce through the foil and then be bent over. By bending the lugs over, the foil conductor is deformed by the embossed sections in the baseplate. The ends of the crimp lugs further pierce through the foil conductor and the insulating foil layer that surround it, thereby making contact with the foil. In the case of such an arrangement, it is necessary to ensure that the crimp is made in such a way that the contact with the foil remains secure even over long periods.

[0004] It is an object of the invention to describe an electrical contact for contacting a foil conductor that ensures secure contact with the foil.

[0005] In order to achieve the set object, an electrical contact is described in claim 1. Advantageous developments are set forth in the dependent claims.

[0006] An electrical contact according to the invention is provided with a contact section having a baseplate with at least one protruding section and at least one lug attached to the side of the baseplate that extends basically perpendicular to the baseplate. The lugs can pierce through the foil and then be bent over to the baseplate in order to make contact with the foil conductor. The lug is also provided with a middle section that is attached to the baseplate and located opposite the protruding section and at least one lateral section that is joined to the middle section. The lateral section having a lower edge that is separated by a slot from the baseplate. The lateral section can be angled against the middle section for the purpose of contacting the foil conductor. This angling or bending action results in the insulating layer of the foil located between the protruding section and the lower edge of the lateral section being stripped-off the conductor so that contact is established.

[0007] In contrast to the known crimp connections with foil conductors the sideways folding is of particular advantage since in this way the connection can be established by a very simple process. In addition, the connection can be optically checked and the spring characteristics can be varied as desired by way of the attachment of the lug to the baseplate, as well as by the configuration of the protruding sections.

[0008] An advantageous feature of this invention is the spreading of the strain in the foil conductor that is achieved by providing the middle sections, at diagonally opposite ends, with a lateral section such that each of these lateral sections will move towards each other when the contact is being made.

[0009] A further advantage arises from the lugs being positioned on opposite sides, as this prevents displacement of the foil conductor when the lateral sections are bent over. Such displacement would prevent the contact with the foil conductor from being made.

[0010] A particular advantage is that the contact sections have strain-relief incorporated therewith. This is achieved by a strain-relief arrangement next to the contact section of the electrical contact.

[0011] Another particular advantage is that the strain relief-arrangement has crimp lugs that face each other and at least one embossed section. The free ends of the crimp lugs will press into the embossed section, thus producing a secure fit between the free end of the lug and the embossed section. The embossed section is designed so that longitudinal play of the crimp lugs is prevented, thereby eliminating movement of the foil along the longitudinal axis. Strain on the foil therefore does not affect the contact.

[0012] A further particular advantage is that the foil can be fixed in position before the contact is established. This is achieved by closing the strain-relief arrangement in a first step followed by bending over the lateral sections of the contact section. It is also evident that the provision of a strain-relief section on each side of the contact making section is advantageous to ensure a secure grip on the foil.

[0013] Yet another particular advantage is that between the foil conductor contact making section and the connecting section of a complementary contact, which is in the form of a pin or socket section, an elastic section may be provided. Where there are high vibrations, this elastic section provides compliance between the foil conductor contact making section and the pin or socket section, thereby reducing the corrosion at the contact sections.

[0014] Referring to the figures two embodiment cf the invention will now be discussed.

Figure 1 is an isometric view of an electrical contact

according to the invention in its uncrimped state;
Figure 2 is an isometric view of the electrical contact according to the invention in its crimped state;
Figure 3 is an isometric view of the electrical contact according to figure 1 which has been pierced through a foil with a foil conductor;
Figure 4 is an isometric view of the arrangement according to figure 3 with the strain-relief arrangement closed;
Figure 5 is an isometric view of the arrangement according to figure 3 with the strain-relief arrangement closed and a contact established with the foil conductor;
Figure 6 is an isometric view of a further embodiment of a contact according to the invention in its closed state;
Figure 7 is an isometric view of a contact for 15 ampere according to the invention;
Figure 8 is an isometric view of a contact for 7.5 ampere according to the invention; and
Figure 9 is an isometric view of a contact for 30 ampere according to the invention.

[0015] Figure 1 shows an isometric view of an electrical contact 1 according to the invention. The contact 1 is provided with a contacting section 2. The contacting section 2 is used for making contact with a foil conductor which is surrounded by an insulating foil. In addition to this contacting section 2, the claimed electrical contact 1 is also provided with a section for connecting to a complementary contact 3. This is a schematic drawing as contact section 3 is not fully shown in figure 1. This contact section 3 can take the form of a contact pin or a socket contact section as is well known in the field.

[0016] The contacting section 2 includes a baseplate 4. The baseplate 4 is provided with at least one protruding section 5. The protruding section 5 stands outward of the plane of baseplate 4. This protruding section 5 can, for example, be achieved by embossing the baseplate 4. In the present embodiment two elongated protruding sections 5 are provided on the baseplate 4 which extend in the direction of the longitudinal axis of contact 1 and which are arranged parallel and next to one another. A lug 6 is provided adjacent to the protruding sections 5 on each side of the baseplate 4. The two lugs 6 are arranged opposite to each other. They are arranged at approximately right angles to the baseplate 4. The lugs 6 are folded to the same side of the baseplate 4 where the protruding sections 5 stand. The lug 6 is provided with a middle section 7. The middle section 7 is attached to the baseplate 4. A lateral section 8 is attached to both sides of the middle section 7. The lateral sections 8 are formed as one part with the middle section 7, but they are provided with a lower edge 9 that is facing the baseplate 4 and they are separated from the baseplate 4 by a slot 10. The lugs 6 are provided with a chamfer 11 at the free upper end opposite the lower edge 9 to facilitate the piercing of the foil with the lugs 6.

[0017] In addition to the contact making section 2 and the section for connecting to a complementary contact 3, the contact 1 shown in figure 1 is provided with a strain-relief 12. Adjacent to the strain-relief 12 is the contact making section 2, followed by the elastic section 13 and this latter section followed by the section for connecting to a complementary contact 3.

[0018] The strain-relief 12 consists of the continuation of the baseplate 4 and a crimp lug 14 at each of the two opposite sides of the baseplate 4. The crimp lugs 14 are at right angles to the baseplate 4. Where the crimp lugs 14 are joined to the baseplate 4, the latter is embossed 15. While the crimp lugs 14 are elevated towards one side of the baseplate 4, the embossed section 15 is directed towards the other side of the baseplate 4. The interaction of the embossed section 15, with the bent over crimp lugs 14, achieves a particularly good engagement between the contact 1 and the foil.

[0019] The elastic section 13 is located between the contact making section 2 and the contact section 3 for connecting to a complementary contact. The elastic section 13 is provided with two U-shaped bent lugs 16 which are at right angles to the baseplate 4 and attached to the same with one leg 17 whereas the other leg 18 is joined to the contact section 3. The baseplate 4 and the contact section 3 are separated by a slot 19.

[0020] Figure 2 shows the contact according to figure 1 again, this time, however, in an isometric view in its closed position where the contact with a foil would be made. In this illustration, the contact section 3 is shown in full with a representative contact blade. The strain-relief arrangement 12 is also shown in a closed configuration. Both crimp lugs have been bent over and join the embossed sections 15 with their free ends 20. Thus a particularly good fastening of the foil to the contact is achieved.

[0021] For making contact with the foil conductor the lateral sections 8 of the lugs 6 are bent away from the middle sections 7. When the lateral sections are bent they are bent over towards the baseplate 4. After bending, the lateral sections 8 take a position which is generally at right angles to the baseplate 4 and at right angles to the middle sections 7. The protruding sections 5 provided in the baseplate 4 rise in the same direction from the baseplate 4 as the lugs 6. The height of the protruding sections 5 is determined by the fact that when the lateral sections 8 are bent over, their lower edges 9 scrape over the section of the protrusions on the baseplate 4. If a foil is located between the protruding sections 5 and the lateral sections 8, then the bending over of the lateral sections 6 over the protruding sections 5 will cause the scraping or stripping off of the insulating foil layer from the foil conductor thus making contact with the latter.

[0022] Referring to figures 3 to 5, contacting a foil will be described. Figures 3 to 5 show the contact 1 that was illustrated in figures 1 and 2 as well as a section of foil 21 with a foil conductor 22 embedded within an insulat-

ing layer 23. In figure 3, the crimp lugs 14 and the lugs 6 are not yet bent over. The foil 21 is pressed upon these lugs 6 which have cut through the foil 21. Now the foil 21 is spread basically flat over the baseplate 4 with the foil 21 bulging upwards only over the protruding sections 5 (represented as bulge 24). The contact 1 is now positioned to engage the conductor 22 of the foil 21.

[0023] The next step is shown in figure 4. The crimp lugs 14 are bent over thus fastening the foil 21 to the strain-relief arrangement 12. By doing so, the foil 21 is pressed down into the embossed sections 15. Any pulling of the foil no longer puts any strain onto the contacting section 2.

[0024] The next step involves bending over of the lateral sections 8 of the lugs 6. By bending over the lateral sections 8, they will scrape over that portion of foil 21 that is the bulge 24 which is established by the protruding sections 5, thus stripping off the insulating foil layer 23 from the foil conductor 22. In these sections 25, the foil conductor is now bare and the remainders 26 of the insulating layer of the foil have been accumulated behind the bent over lateral section 8. The stripping off of the insulating foil material is achieved because the lower edge 9 of the lateral section 8 is positioned below the bulge 24 before the bending takes place. Due to the bending of the lateral section 8 the lugs 6 and the protruding sections 5 are elastically deformed by each other, this elastic deformation process provides the necessary forces to make and maintain the contact.

[0025] Figure 6 shows another embodiment of a contact according to the invention, in a crimped or contacted state with the foil removed for clarity. This contact 101 differs from the contact 1 that was previously described in that a further strain-relief section 112 is now located between the contacting section 2 and the elastic section 13. The location of this further strain-relief section has the advantage that the foil is now held on both sides adjacent to the contacting section before the contact is closed. This ensures that the foil is not displaced during the bending over of the lateral sections 8.

[0026] Figure 7 shows a contact 101 according to the invention but without any contact area for connecting to a complementary contact which is eliminated for simplicity. The contact 101 is provided with a contacting section 102 for making contact with a foil conductor that is surrounded by an insulating foil layer. In addition to the contacting section 102, the contact is provided with a strain relief 112 which is adjoining the contacting section 102. The contacting section is provided with a baseplate 104 with a protruding section 105 as in the previously described arrangements. Adjacent to the protruding section 105, a lug 106 is provided on each side of the baseplate 104. The two facing lugs 106 are arranged parallel to each other and at right angles to the baseplate 104. They are also angled to the side of the baseplate 104 into which the protruding section 105 extends. Each lug 106 is provided with a middle section 107. The lug 106 is attached to the baseplate 104 over the length of middle section 107. A lateral section 108 follows on to the middle section 107 of each lug. The lateral sections 108 are joined on to diametrically opposite sides of the middle section 107 of the two lugs 106. The lateral sections 108 are separated from the baseplate 104 by a slot 110. The lateral sections 108 are shown in their angled position as they make contact with a foil conductor.

[0027] The strain-relief arrangement consists of the continuation of the baseplate 104 and is provided at opposite ends of the baseplate 104 with one crimp lug 114 each. The crimp lugs are at right angles to the baseplate 104, their free ends 120 being bent for fastening purposes towards the baseplate. In close proximity to the point where the crimp lugs 114 join the baseplate 104, an embossed section 115 is located in the baseplate 104. The free ends 120 of the crimp lugs 114 are bent onto the embossed section 104 to produce a snug fit between the free ends 120 and the embossed sections 115 thus preventing any longitudinal play of the free ends 120 relative to the embossed sections 115 and also preventing any longitudinal movement of the foil.

[0028] Figure 8 also shows a contact 201. This contact differs from the one in figure 7 in the design of the protruding sections 205 and 205' and the embossed section 215 of the strain-relief arrangement 212.

[0029] The contact making section 202 of the contact 201 is also provided with two facing lugs 206 that are each provided with a lateral section 208. Each lateral section 208, is provided with its own protruding section in the baseplate 205, 205' respectively. Both protruding sections 205 and 205' are offset in a longitudinal direction and in the direction perpendicular to it. In addition they are shaped essentially in a mirror-symmetrical manner providing a steeply rising side 205a and slowly rising side 205b. The strain-relief arrangement 212 is also provided with two crimp lugs 214, both however engaging in one common embossed section 215 where their free ends 220 are held by a positive fit.

[0030] Figure 9 is a further embodiment of the claimed contact. This contact 301 is suitable for current ratings up to 30 ampere. It corresponds essentially to the contact shown in figure 6 but its contact making section 305 is provided with only one protruding section 305 in the baseplate 304.

[0031] For making contact with the foil conductor a contact is suggested which ensures secure contacting even under conditions of vibration, of particular advantage is to assure the strain placed on the foil conductor is unitary, which is achieved by providing two lateral sections for each lug arranged at opposite sides of the middle section which move towards each other during bending over. A further particular advantage is to provide lugs which are opposite to each other since this prevents the displacement of the foil conductor during the bending over of the lateral sections thus ensuring the making of the contact with the foil conductor. Another particular advantage is that the contact making points are strain-relieved. For this purpose a strain-relief arrangement is

located adjacent to the contact making section of the electrical contact. Moreover, it is particular advantageous that the foil has already been fixed in its position before the contact is made. This is achieved by closing the strain-relief arrangement in a first step followed by the bending over of the lateral section of the contact making section which establishes the contact with the foil. It has been found that for the safe grip of the foil the provision of a strain-relief section on both sides of the contact making section is particularly advantageous. Another particular advantage is the provision of an elastic section between the section making contact with the foil conductor and the section connecting to a complementary contact in the form of a pin or socket section. If high vibrations occur this elastic section has a compensatory effect in its position between the contact making section of the foil conductor and the pin or socket section. This should reduce the corrosion of contact points.

Claims

1. An electrical contact for making contact with a foil conductor surrounded by an insulating foil layer, said contact comprising a contacting section (2) with a baseplate (4) having at least one protruding section (5) and at least one lateral lug (6), that is attached to the baseplate (4) arranged perpendicular to the baseplate (4) and capable of piercing through the foil and of being bent over onto the foil, characterised in that the lug (6) is provided with a middle section (7) attached to the baseplate (4) that is located opposite to the protruding section (5), and with at least one lateral section (8) attached to the middle section (7), and characterized in that the lateral section (8) has a lower edge (9), that is separated from the baseplate (4) by a slot (10), and in that the lateral section (8) is bendable relative to the middle section (7), wherein by the bending action the insulating foil layer on top of the foil conductor is stripped off the foil, that is located between the protruding section (5) and the lower edge (9) of the lateral sections (8) thus establishing electrical contact with the foil conductor.

2. The electrical contact according to claim 1, characterised in that two opposite lugs (6) are provided.

3. The electrical contact according to claim 2, characterised in that each lug (6) is adjoined by a lateral section (8) on diametrically opposite sides of the middle section (7) of the lugs (6).

4. The electrical contact according to one of claims 1, 2 or 3, characterised in that each lug (6) is provided with two lateral sections (8) at opposite sides of the middle section (7) which are moved towards each other during bending.

5. The electrical contact according to one of claims 1 to 4, characterised in that each lug (6) is provided with a corresponding protruding section (5).

6. The electrical contact according to one of claims 1 to 5, characterised in that the protruding sections (5) are embossed.

7. The electrical contact according to one of claims 1 to 6, characterised in that a strain-relief arrangement (12) is provided which adjoins the contacting section (2).

8. The electrical contact according to claim 7, characterised in that the strain-relief arrangement (12) is provided with two facing crimp lugs (14) and an embossed section (15).

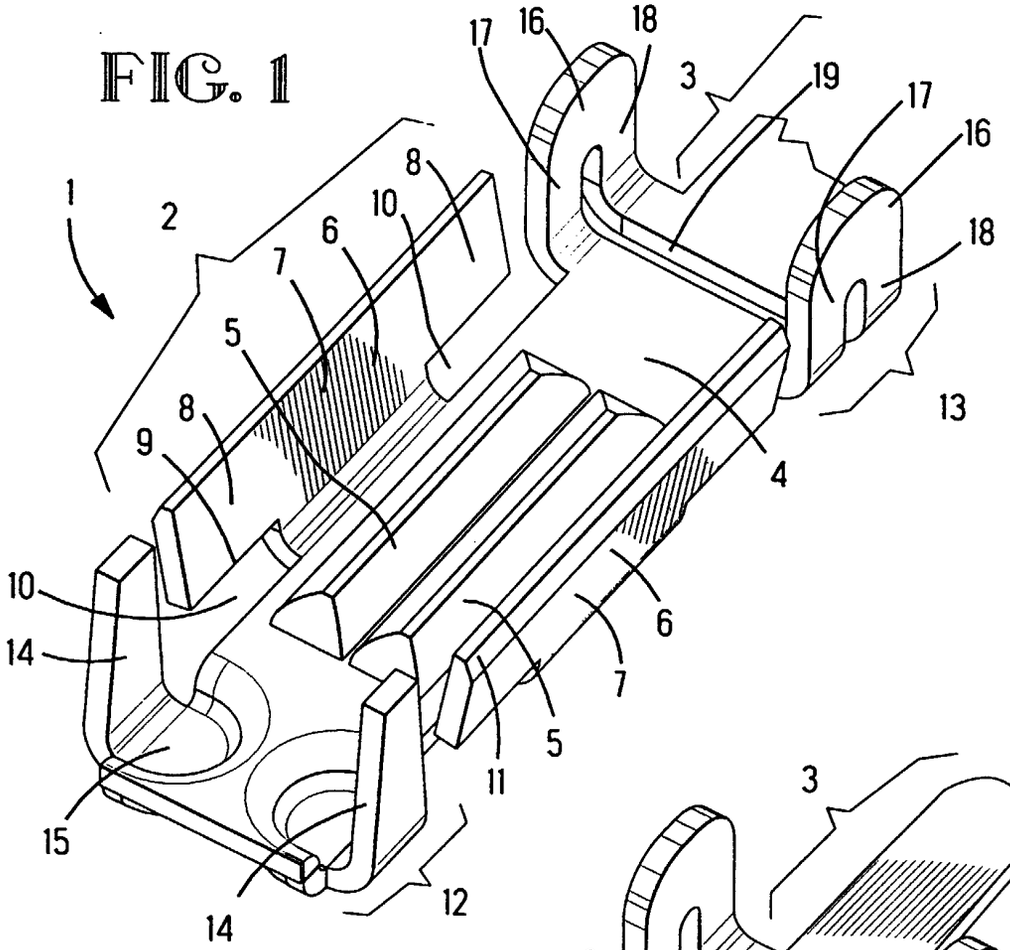
9. The electrical contact according to claim 8, characterised in that the free ends of the crimp lugs (14) form a snug fit with the embossed section (15) when crimped.

10. The electrical contact according to one of claims 1 to 9, characterised in that an elastic section (13) is provided adjoining the contacting section (2).

11. The electrical contact according to claim 10, characterised in that the elastic section (13) is provided between the contact making section (2) and a connecting section (3) for a complementary contact.

12. The electrical contact of claim 8, characterized in that the embossed section (15) extends to an opposite side of the baseplate (4) as the protruding section.

FIG. 1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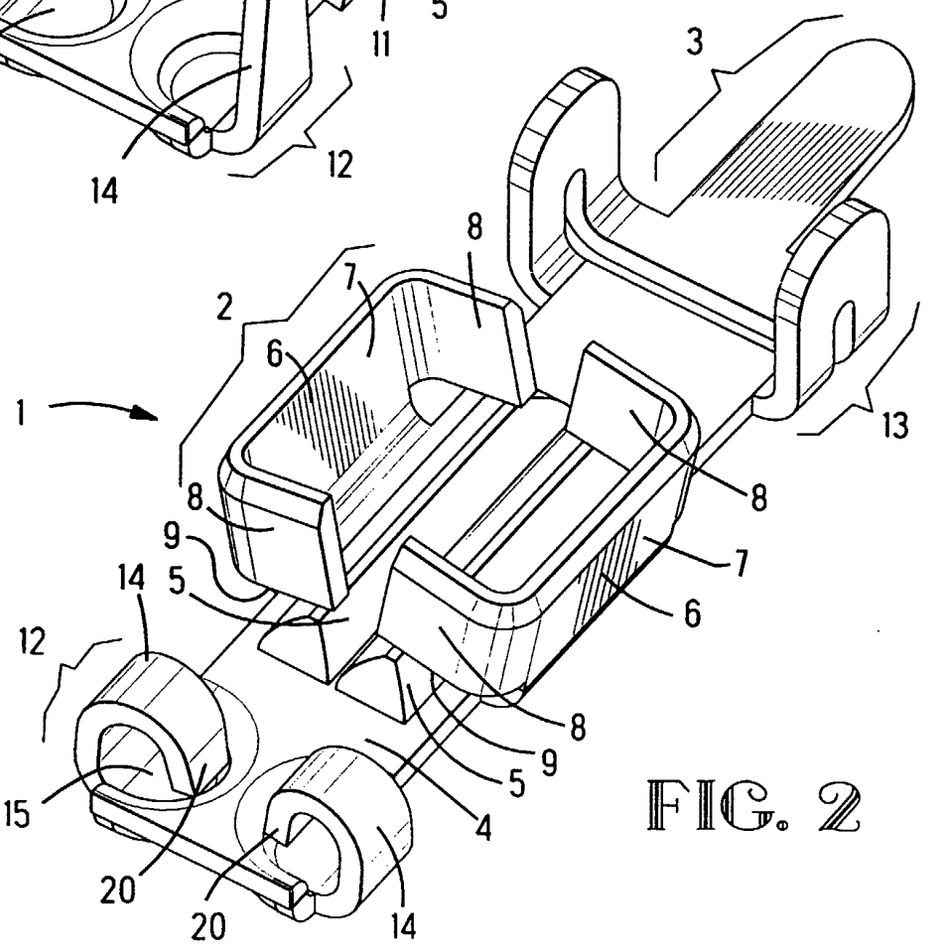
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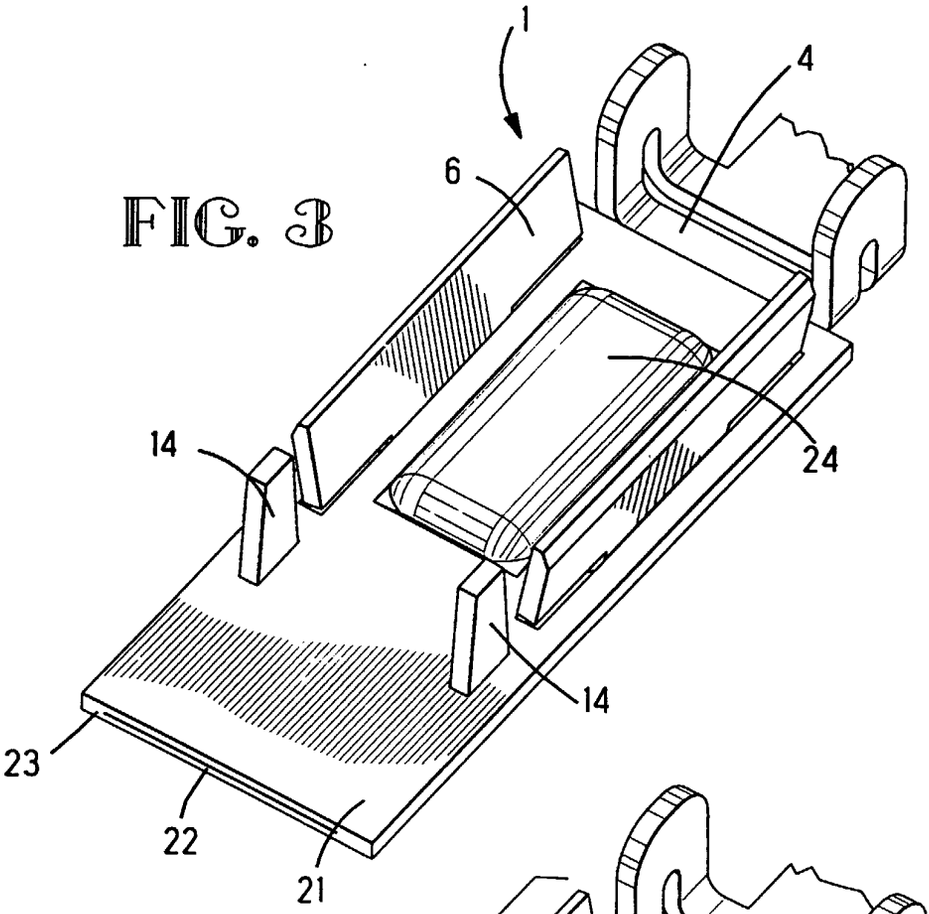
FIG. 2

FIG. 3



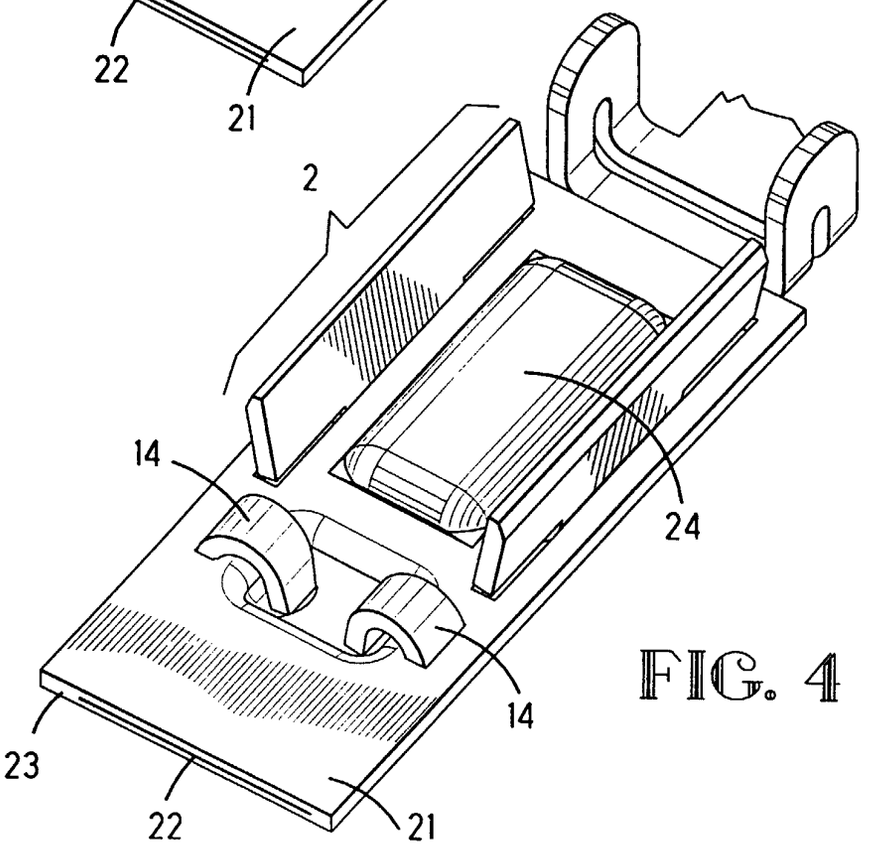
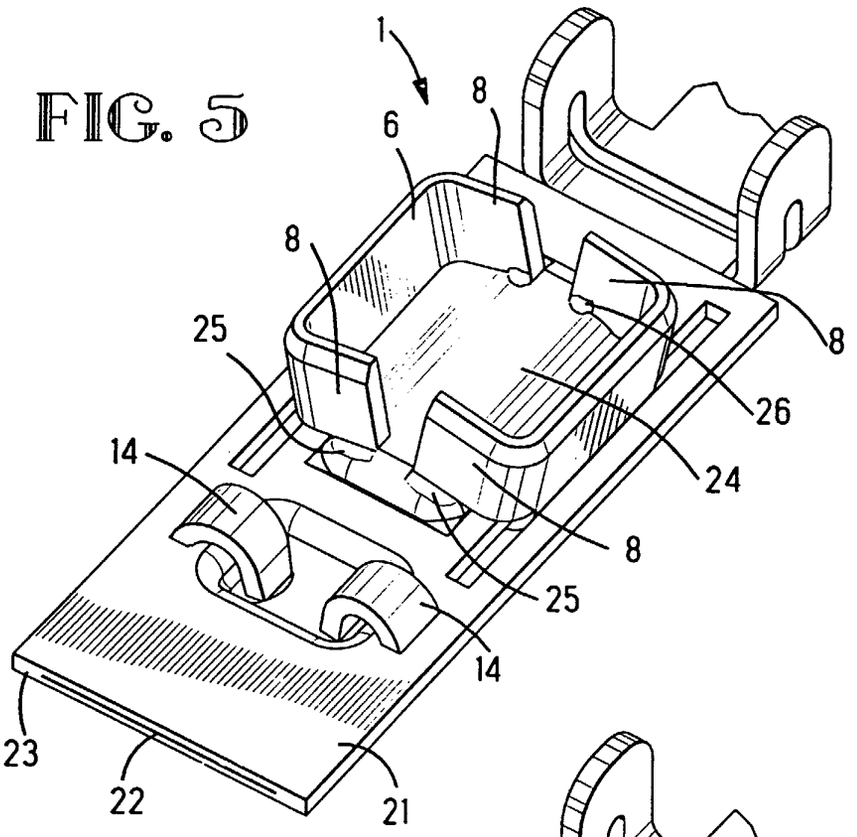


FIG. 4

FIG. 5



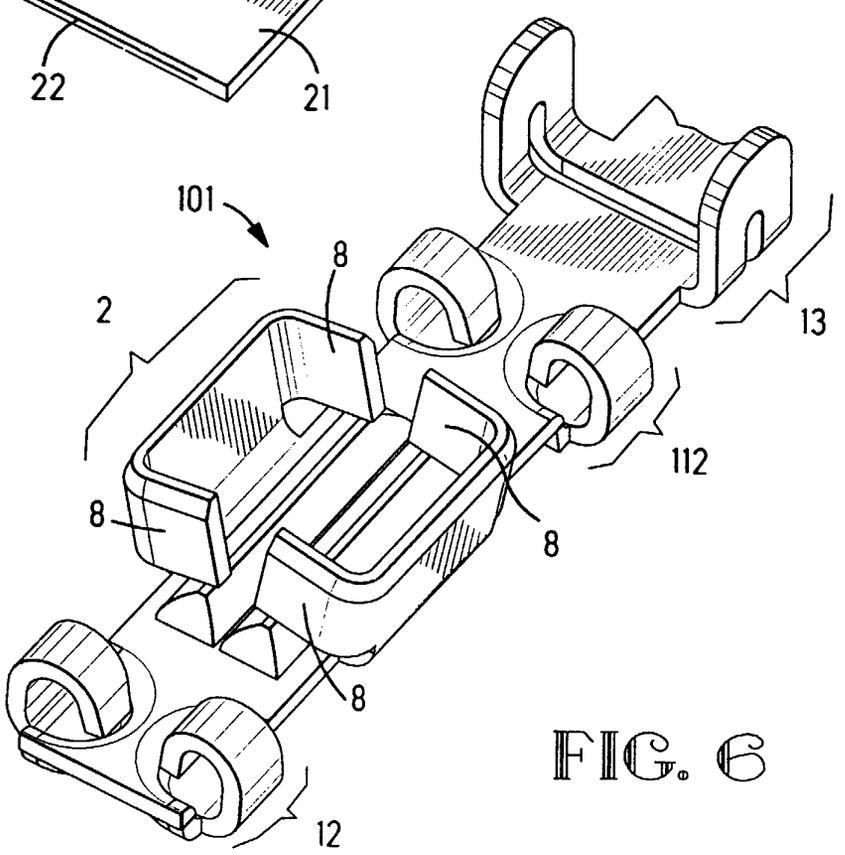


FIG. 6

FIG. 7

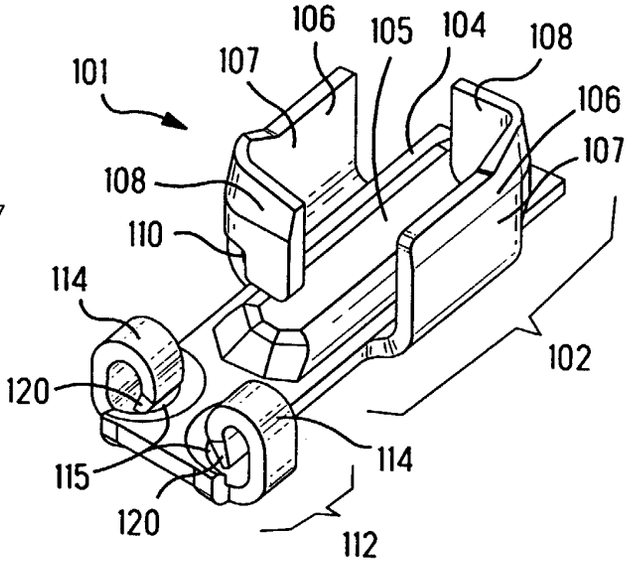


FIG. 8

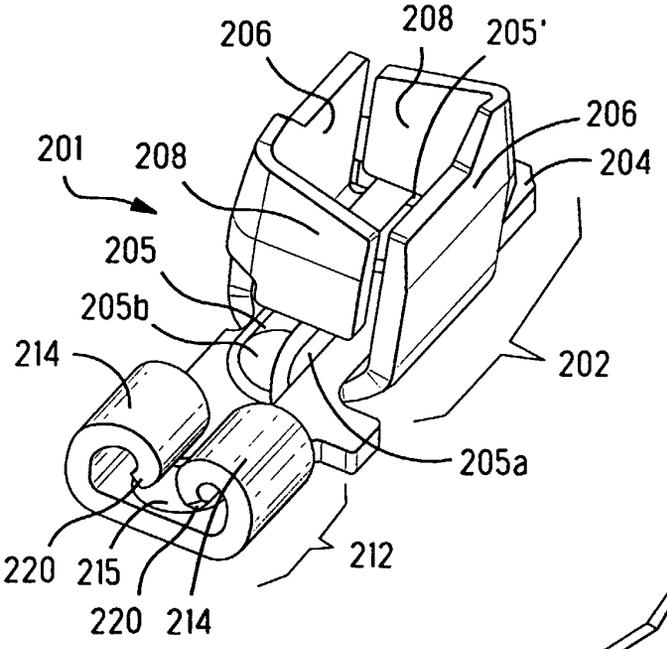


FIG. 9