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(54) Electrical contact system

(57) The invention relates to an electrical contact system having a plug contact (1) and a socket contact (2). The socket contact has at least two parallel fixed areas (3, 4). The plug contact (1) has, at the end pointing towards the insertion direction, two spring legs (7 and 8), which can be moved towards one another during the insertion process into the socket contact (2). The free ends of the spring legs (7 and 8) are bent as insertion inclined sections (9, 10 and 11).

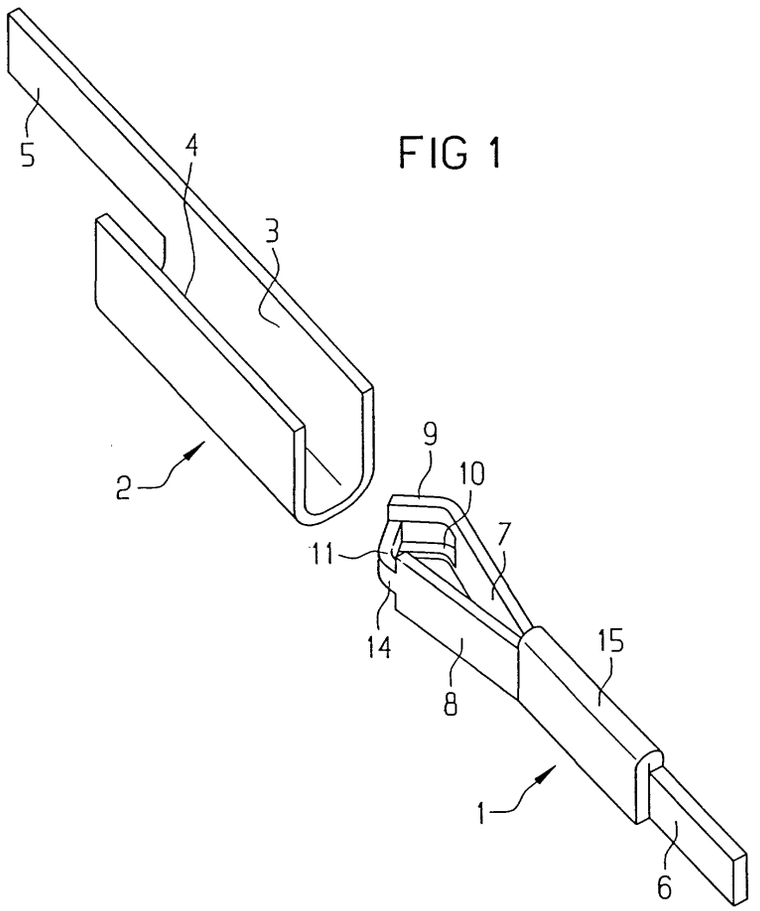

FIG 1

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Description

[0001] The invention relates to an electrical contact system comprising a plug contact and a socket contact.

[0002] Traditionally, in when mating contacts together, the plug contact is configured as a contact pin or contact blade and the socket contact is provided with spring legs, between which the contact pin or the contact blade is inserted.

[0003] In this time of miniaturization and high speed signal, it is generally desired to house as many contacts as possible in a confined space. Consequently, since maximum permitted external dimensions are predetermined, the dimensions of the contacts must be as small as possible to allow more contacts to be positioned within the housing.

[0004] However, even though miniaturization is desired, a positive electrical connection must be insured. Therefore, the mating region between the plug contact and the socket contact must be sufficiently large to avoid the contacts being damaged during insertion.

[0005] If several contacts are arranged in a grid, often a certain mismatch or misalignment between mating contacts can occur. One reason for this misalignment results from the inability to accurately calculate in advance the contraction (shrinkage) behaviour of the connector housings, which are injection moulded from synthetic material.

[0006] In order to insure proper mating conventional contact pins or contact blades are embossed or tapered at the point, to keep the insertion inclined sections in the socket contact. In addition, the spring legs on the socket contact are bent outwardly at the plug-sided end in a tulip-shaped manner, so that they form an insertion funnel or lead-in for the plug contact.

[0007] During assembly, the pins engage the spring legs of the socket and cause the spring legs to deflect outward. This provides sufficient normal force to allow for a proper electrical connection to be effected. In addition, if the mating contacts are misaligned, the spring legs will compensate for the misalignment, which can cause the outward deflection of the spring arms to increase. The socket contacts are generally located in channels arranged next to one another in a row or a grid formation. Therefore, to insure that the mating contacts are properly mated, the channels thus must be dimensioned in such a way that during the insertion process, the spring legs can on the one hand widen and on the other hand be spread apart sideways to accommodate misalignment of the contacts and insure that a positive electrical connection is effected.

[0008] Therefore, as space connectors are continually required to be made smaller, with the conventional spring blade principle, the dimensions of the housing can be reduced only by precisely controlling tolerances and misalignment and by embossing the plug contacts. These solutions can prove to be prchibitively expensive.

[0009] It is the object of the invention therefore to provide an electrical contact system, which can accommodate close spacing of the contacts despite manufacture-related permissible variations and misalignment.

[0010] According to the invention, this object is achieved by the socket contact having at least two parallel fixed areas for contact with the plug contact. The plug contact has, at the end pointing towards the insertion direction, two spring legs, which can be moved towards each other during the insertion process into the socket contact. The free ends of the spring legs are bent to form lead-in surfaces to facilitate the insertion of the plug contact into the socket contact.

[0011] This electrical contact system allows the socket contacts to be arranged very closely next to one another, as during insertion the socket contact is not required to resiliently deform or accommodate for misalignment. Consequently, as the socket contacts do not expand and as the plug contacts compress during mating, the entire contact system in its inserted state does not require more space than it does in a non-inserted state.

[0012] Due to the bending of the free end of the spring legs to form lead-in surfaces or insertion inclined sections, it is insured that the spring legs of the plug contact can be securely guided into the socket contact even if the manufacturing tolerances are not precisely controlled or if some misalignment occurs. As the insertion inclined sections are sufficient for alignment, no additional lead-in surfaces are required on the socket contact.

[0013] In accordance with an embodiment, both spring legs have a generally V-shaped configuration with one leg of the V being the insertion inclined sections. The inclined sections are arranged to extend toward each other such that the ends are proximate each other.

[0014] It is advantageous if the free ends of the insertion inclined sections overlap, so that at the side of the plug insertion, no gap occurs between the two spring legs. This insures that, even in the event of a strong misalignment of the mating contacts, the end of the plug contact will not rub or catch on the socket contact and an optimal insertion into the socket contact is achieved.

[0015] It is advantageous that the insertion inclined sections are configured so that as the plug contact is inserted into the socket contact, the free ends of the inclined sections can move past each other. This insures that during the insertion process the spring legs have a large range of elastic deformation at their disposal. Due to this resiliency of spring, a high contact force and thus a reliable contact can be achieved.

[0016] Further advantageous embodiments of the invention are revealed in the subclaims and the following description.

[0017] The invention will be described in more detail by means of an embodiment with reference to the figures, in which:

Fig. 1 is a perspective view of a contact system of

the present invention prior to mating;

Fig. 2 is a perspective view of the contact system showing the plug and socket contacts mated together;

Fig. 3 is another perspective view of the contact system prior to mating of the contacts;

Fig.4 is another perspective view of the contact system showing the contacts mated together;

Fig.5 is a side view of the contact system prior to mating;

Fig.6 is a side view of the contact system showing the contacts mated together;

Fig.7 is a front view of the contact system prior to the mating of the contacts; and

Fig.8 is a front view of the contact system after the contacts have been mated together.

[0018] Figs. 1, 3, 5 and 7 show the contact system prior to the mating of the individual contacts and Figs. 2, 4, 6 and 8 each show the contact system with the contacts mated together. The invention is described by means of all the figures, without direct reference being made to the latter.

[0019] The contact system according to the invention has a plug contact 1 and a socket contact 2. The socket contact 2 is made from a sheet metal strip, which is U-shaped in the contact region. The two legs of the U form fixed areas 3 and 4, which serve as the contact area with the plug contact 1. On the U-shaped contact region, a connecting piece 5 is formed which, according to any known connection technologies, can be designed for instance as a soldered, crimped, surface mounted or pressed-in connection.

[0020] The plug contact 1 has a connecting piece 6 which can be designed according to the above-mentioned connection technologies. Two spring legs 7 and 8 are positioned on the plug contact. The spring legs 7, 8 extend in a direction away from another in the insertion direction to form a V-shaped member. At the free ends of spring legs 7, 8 insertion inclined sections 9, 10 and 11 are formed. The inclined sections serve to facilitate the insertion of the spring legs 7, 8 between the two fixed areas 3, 4 of the socket contact 2. The insertion inclined sections 9, 10 and 11 are formed by bending the spring leg 7 or 8 in the direction toward the other respective leg 8 or 7. In the embodiment shown, the spring leg 7 comprises two insertion inclined sections 9 and 10 which are spaced from one another. The spring leg 8, on the other hand, comprises only a centrally arranged insertion inclination section 11. The width of the insertion inclination section 11 is dimensioned such that during the insertion process it can be moved between the insertion inclined sections 9 and 10.

[0021] As can be seen in particular in Fig.5, the insertion inclined sections 9, 10 and 11 are bent from the spring legs 7 and 8 so that the free ends of the insertion inclined sections overlap transversely to the insertion direction prior to the mating of the plug contact 1 with the socket contact 2. Figs. 4, 6 and 8 illustrate how the insertion inclination sections 11 are moved relative to the insertion inclined sections 9 and 10 during the insertion process.

[0022] The spring legs 7 and 8 are, at the transition to the insertion inclined sections, reduced to the width of the insertion inclined sections, so that contact points 12, 13 and 14 with relatively small surfaces are created.

[0023] Due to the fact that the entire plug contact is manufactured from one strip and formed through a bending process, it is possible selectively to modify the strip in advance at contact points 12, 13 and 14. Since the contact region is minimised due to the geometry of the spring legs, the surfaces which are to be modified are also reduced, leading to significant cost savings.

[0024] Due to the three contact points 12-14, the likelihood of obtaining a positive electrical connection with t e mating contact is increased in comparison to conventional spring blade contact systems in which only two contact points are provided.

[0025] The misalignment or mismatch between mating contacts is compensated for by the geometry of the plug contact 1.

[0026] Due to the fact that the spring element, formed by the two spring legs 7,8, is arranged at the point of the plug contact 1, and is thus distanced from the fixing point of the plug contact via a long lever arm, permissible variations are accommodated on the one hand by the spring legs 7, 8 and on the other hand by small deformations between the point of the plug contact and the fixing point. The fixing point consists of an intermediate part 15, arranged on the plug contact between the connecting piece 6 and the spring legs 7 and 8, and in which the strip material is folded by 180°.

[0027] The invention is not limited to the represented embodiment, for instance it is also possible to arrange only two insertion inclined sections on the spring legs, which sections move past one another during the insertion process.

Claims

1. An electrical contact system comprising a plug contact (1) and a socket contact (2), **characterised in that** the socket contact (2) has at least two parallel fixed areas (3, 4) for contact with the plug contact (1), and the plug contact (1) has, at the end pointing towards the insertion direction, two spring legs (7, 8), which can be moved towards each other during the insertion process into the socket contact (2), the free ends of which are bent as insertion inclined sections (9, 10, 11).

2. The electrical contact system as recited in claim 1 further **characterised in that** the two spring legs (7 and 8) extend in a direction away from each other in the insertion direction in a V-shaped manner and

the insertion inclined sections (9, 10 and 11) point towards the direction of the opposite spring leg (7 or 8).

3. The electrical contact system as recited in claims 1 or 2 further **characterised in that** free ends of the insertion inclined sections (9, 10 and 11) overlap transverse to the insertion direction.

4. The electrical contact system as recited in any one of claims 1 through 3 further **characterised in that** the insertion inclined sections (9, 10 and 11) can move past one another as the plug contact (1) is inserted into the socket contact (2).

5. The electrical contact system as recited in any one of claims 1 through 4 further **characterised in that** two insertion inclined sections (9, 10) are on the one spring leg, the two insertion inclined sections are distanced from one another transversely to the insertion direction, one other insertion inclined section (11) is provided on the other spring leg (8), whereby as the plug contact (1) is inserted into the socket contact (2), the other insertion inclined section (8) is moved between the two inclined sections (9, 10).

6. The electrical contact system as recited in any one of claims 1 through 5 further **characterised in that** at the transition of the spring leg (7 or 8) to the insertion inclination sections (9, 10 or 11), the width of the spring leg (7 or 8) is reduced to the width of the insertion inclination sections (9, 10 or 11), such that contact points (12, 13 and 14) are dimensioned with the width of the insertion inclination sections (9, 10 or 11).

7. The electrical contact system as recited in any one of claims 1 through 6 further **characterised in that** the plug contact (1) is made from a strip by a forming process.

8. The electrical contact system as recited in claim 7 further **characterised in that** the strip can be selectively modified in advance at the contact points (12 - 14).

9. The electrical contact system as recited in any one of claims 1 through 8 further **characterised in that** the socket contact is a U-shaped bent strip.

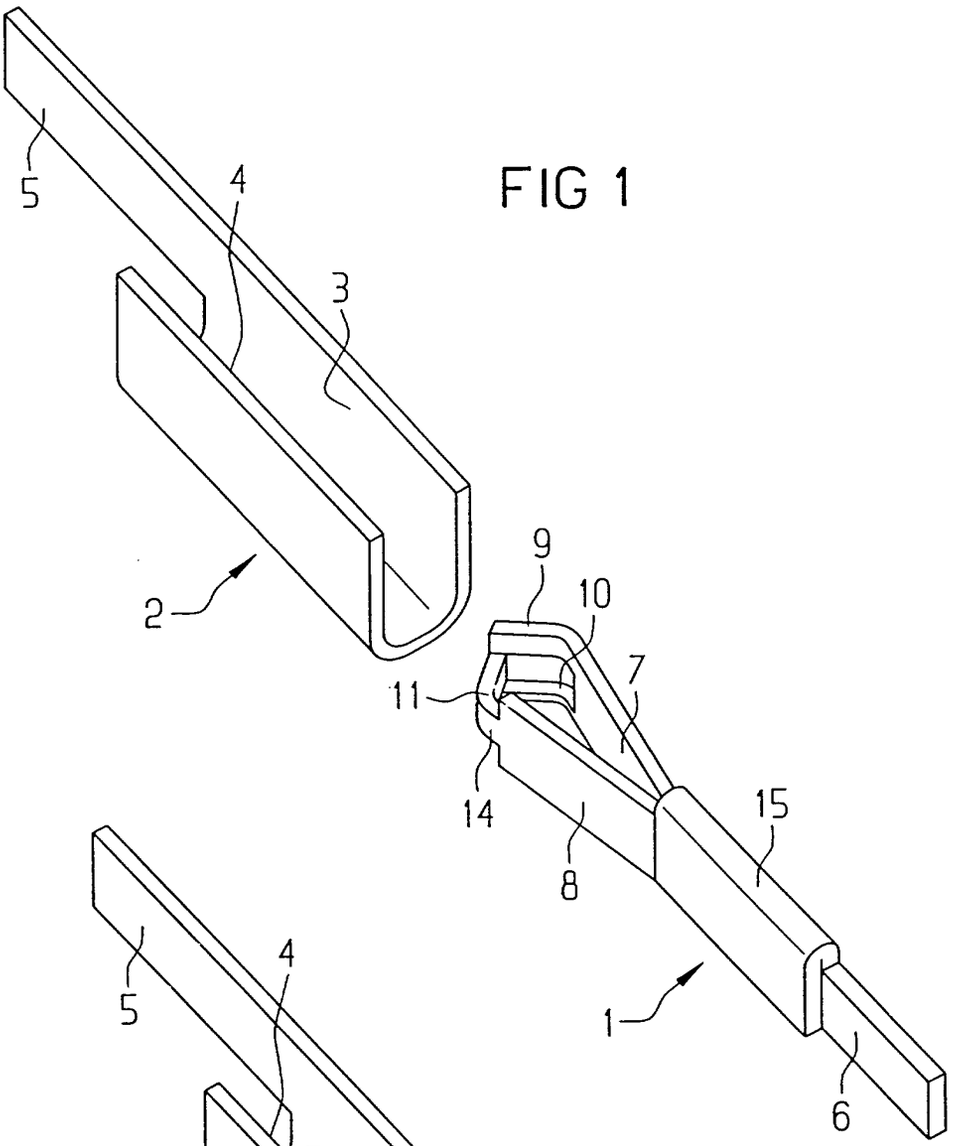

FIG 1

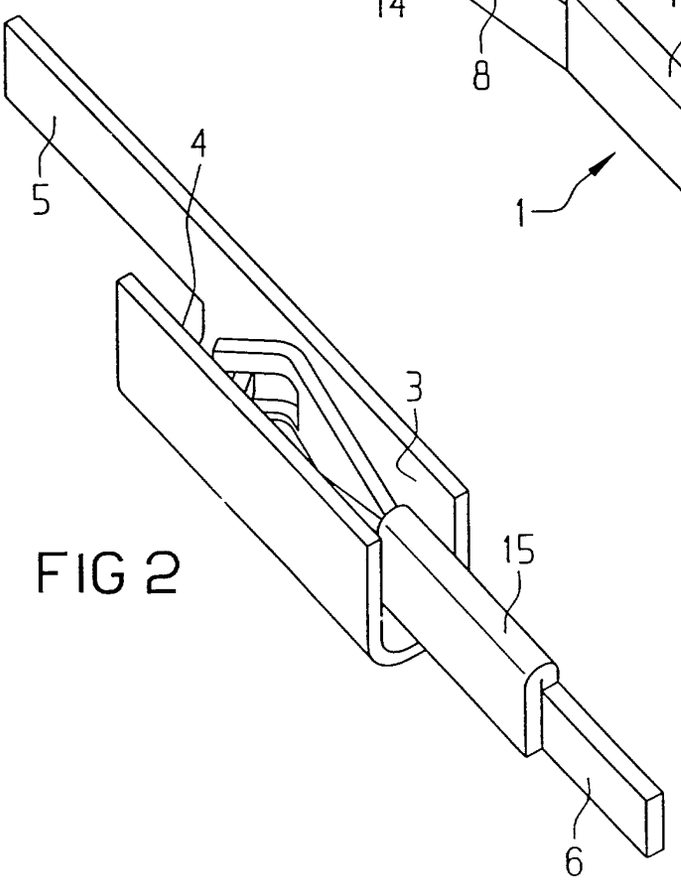

FIG 2

FIG 3

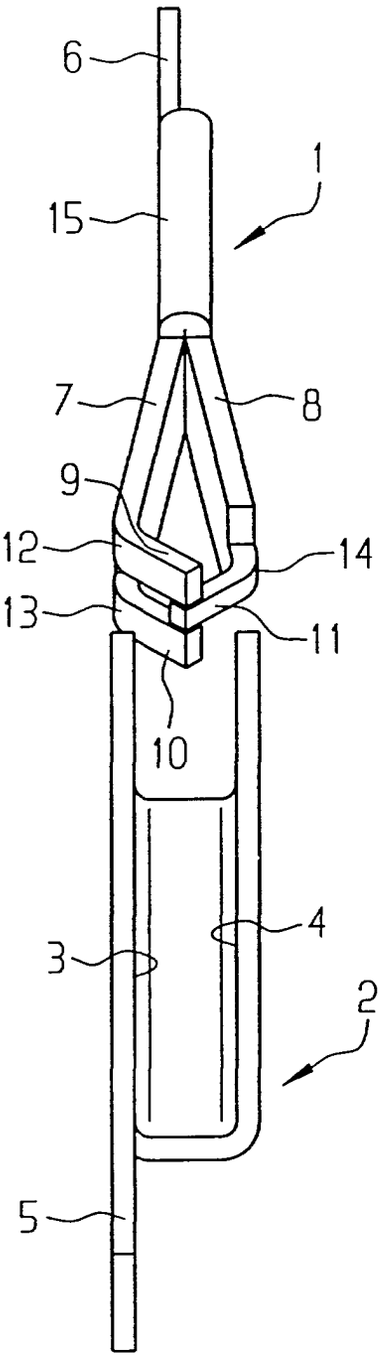

FIG 4

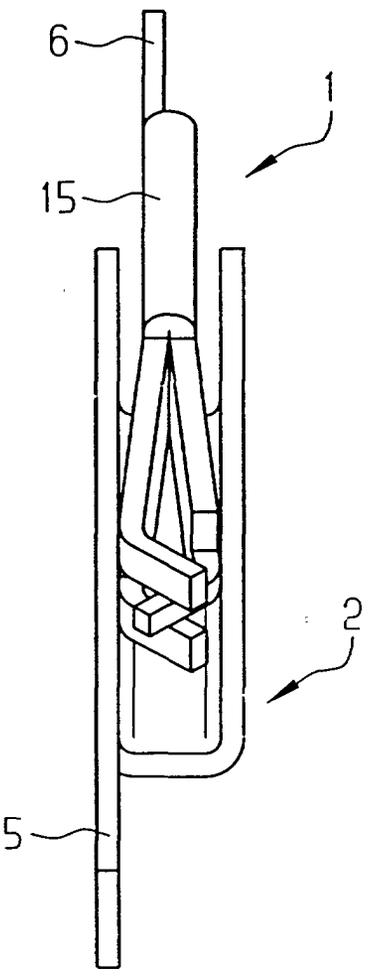

FIG 5

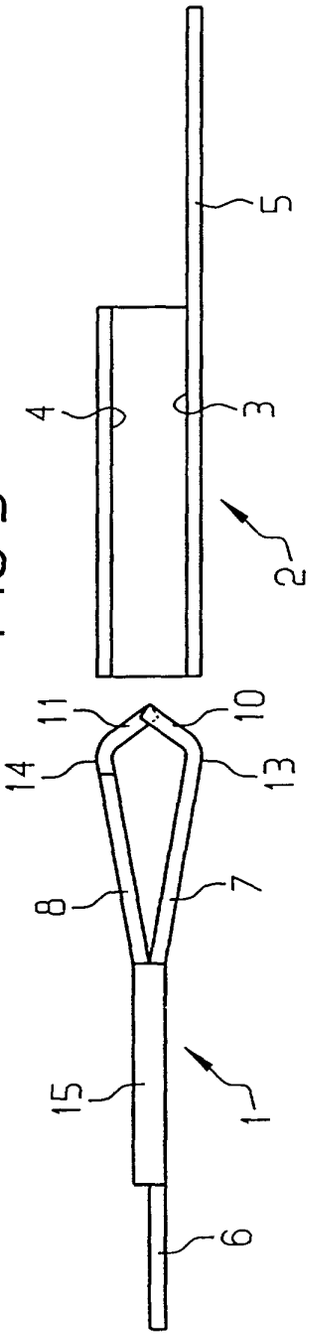

FIG 6

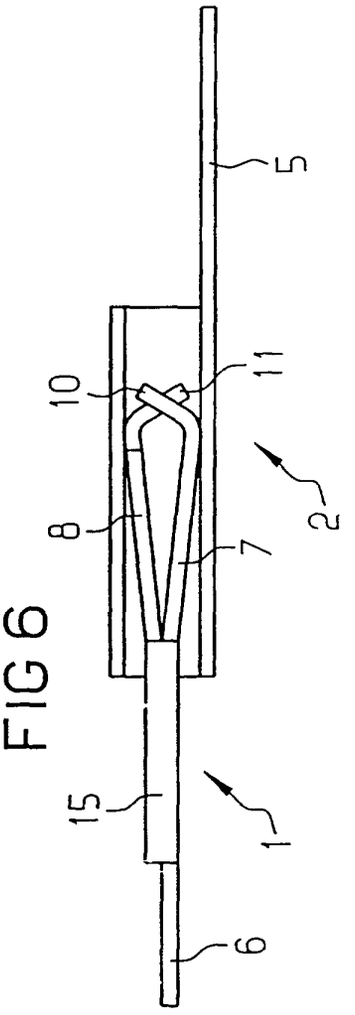

FIG 7

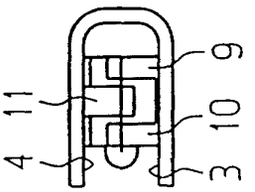

FIG 8