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Improvement in or relating to electric plugs

This invention relates to electric plugs and is especially, but not exclusively, concerned with electric plugs for use in domestic and similar wiring systems.

It has been proposed to provide an electric plug with electrically conductive pins which are substantially hollow and have been formed by folding or otherwise shaping a sheet metal or metal alloy preform, for example as shown in UK Patent 618141. It has also been proposed to provide such a preform with a gold inlay prior to folding or otherwise shaping (see, for example, Machine Design Vol. 47, No. 2, January 1975, Page 18).

When an electric plug is electrically connected in a socket outlet but the faces of the plug and outlet are not in interfacial engagement, there is a substantial risk that a child or other person will introduce a finger or other object between these faces and receive an electric shock. To reduce this risk, it has been proposed and is sometimes the practice to provide on at least each line pin of the plug an insulating protective covering which extends around and along a substantial part of the length of the pin projecting from the insulating plug body. By "substantial part" is meant that the pin is covered to the extent necessary to avoid the risk of a person touching a live pin. Such insulating protective pin-coverings may be integral parts of the plug body but more recently it has been proposed to use, for each insulating pin-covering, a separate sleeve of insulating material which fit over a part of a length of a pin or a separate body of insulating material which is moulded in situ on a pin. Examples of these known arrangements are described in UK Patent No. 1181370 and US Patent No. 3710287.

These methods of providing an insulating covering on pins are not readily adaptable to pins formed from folded sheet metal or metal alloy preforms.

According to the present invention, a hollow electrically conductive pin, for use in an electric plug, is formed from sheet metal or metal alloy which has been folded or otherwise shaped to form the pin, characterised in that a substantial part of that surface of the folded sheet metal or metal alloy forming the outer surface of the pin carries a covering of electrically insulating material which extends over a substantial part of that length of the pin which will project from the plug body, said covering having been applied to the sheet metal or metal alloy before the sheet has been folded or otherwise shaped to form the pin, and in that the sheet metal or metal alloy is folded or otherwise shaped so that the edges of that part of the folded sheet metal or metal alloy carrying the covering of electrically insulating material are turned inwardly.

This arrangement has the advantage that if the electrically insulating material becomes detached from these edges the metal or metal alloy underneath is not exposed. Also the distance of these edges of the metal or metal from the surface of the pin is greatly increased, increasing the possible tracking distance and so making the pin less susceptible to high voltage breakdown.

The covering of insulating material preferably has a thickness lying in the range of 0.025 mm to 0.1 mm.

The pin is preferably formed from sheet metal or metal alloy which has a groove or other recess in the surface, and electrically insulating material at least partially fills the recess, preferably so as to fill it. In this way limitations on the thickness of the insulating material are considerably eased.

Preferably, the insulating material is a hardenable thermosetting synthetic resin, for example an epoxy resin. Other suitable hardenable insulating materials that may be employed include systems based on polyurethane.

Alternatively the insulating material may be a linear polymer such as PVC, polythene, nylon or PTFE.

The invention also includes a method of forming a hollow electrically conductive pin for use in an electric plug, which method comprises punching or otherwise cutting a sheet of metal or metal alloy to form a multiplicity of integral pin preforms and, before or after detaching a pin preform from the sheet, folding or otherwise shaping the preform to form a hollow pin, characterised in that before or after the sheet has been punched or otherwise cut but before the preform is folded or otherwise shaped, electrically insulating material is applied to a selected part of a surface of the sheet to cause a layer of electrically insulating material to adhere to said selected part of the surface to form a covering of electrically insulating material, the covered part of the sheet being such that, when each of said pin preforms is detached from the sheet before or after it has been folded or otherwise shaped to form a hollow pin, the pin has on the outer surface of a substantial part of the length of the pin that will project from a plug body, a covering of electrically insulating material, and characterised in that the pin is so folded or otherwise shaped that the edges of that part of the folded sheet metal or metal alloy carrying the covering of electrically insulating material are turned inwardly.

Preferably, a groove or other recess is formed in the said selected part of the surface of the sheet metal or metal alloy before the sheet is folded, the said selected part of the surface of the sheet being the surface of the groove or other recess.

In one preferred method, before or after the sheet has been punched or otherwise cut but

before the preform is folded or otherwise shaped, the sheet is heated and electrically insulating material is applied to the said selected part of a surface of the heated sheet in powdered form and is permitted or caused to coalesce, with or without pressure.

Any convenient method of applying powdered insulating material may be employed. For example, a stream of powdered insulating material may be directed on to the selected part of the surface by at least one appropriately shaped nozzle, if necessary the part of the surface of the sheet that is not to be so coated being suitably masked. Where the sheet is in the form of a strip with the pin preform side by side, the stream of powdered plastics material may be directed on to the selected part of a surface of the strip as the strip is advancing in the direction of its length.

Other methods of applying electrically insulating material to a selected part of a surface of the sheet include electrostatic spraying of powdered material, painting, spraying or brushing a layer of a hardenable liquid material, silk screen techniques, and applying coated tapes.

Alternatively, where a groove or other recess is formed in the strip of metal or metal alloy, a preformed strip or other insert of insulating material may be laid in the groove or other recess and secured by the application of heat and pressure, or by an adhesive as appropriate for the particular material.

The invention further includes an electric plug which has at least one hollow electrically conductive pin substantially as hereinbefore described.

The invention is further illustrated, by way of example, by the accompanying drawings, in which:

Figure 1 is a pictorial view of a hollow electrically conductive plug pin in accordance with the invention;

Figure 2 is a diagrammatic view of a metal sheet having a recess;

Figure 3 is a diagrammatic view of the stages of forming a metal sheet into a hollow pin;

Figures 4 and 5 are alternative cross-sectional views on the line X—X in Figure 1.

The hollow electrically conductive pin 1 shown in Figure 1 has a covering 2 of PVC over the outer surface of a substantial part of its length. The pin 1 is formed from one of a plurality of metal strip preforms 3 as shown in Figure 2 which have a recess 4. A preformed strip 5 (Figure 3) of PVC is secured in the recess 4. The metal sheet 3 is then cut into preforms 6 as shown in Figure 3, in which PVC strip 5 is inlaid in the recess 4 on the underside of each preform 6. Each preform 6 is then folded into the hollow conductive pin 1 with the edges 7 and 8 of the preform 6 abutting, and with the edges 9, 10, (Figure 4) of that part of the folded metal sheet 11 carrying the covering of insulating material 2 turned inwardly, before it is detached from the metal sheet 3. An alternative arrangement is shown in Figure 5 where the inturned edges 9^1, 10^1 of that part of the folded metal sheet 11^1 carrying the covering of insulating material 2^1 of the pin 1^1 are contiguous.

A method of attaching an electrical conductor to the pin 1 in Figure 1 is by crimping. The fingers 12, 13 are cut and formed as an integral extension of the pin 1 when the pin is cut and folded. These fingers 12, 13 can be folded around a conductor to make a crimped connection.

One alternative method of attaching an electrical conductor to a hollow conductive pin is described and claimed in the specification of BICC-Burndy Limited's UK Patent Application No. 7901361.

Claims

1. A hollow electrically conductive pin (1, 1^1) for use in an electric plug, said pin being formed from sheet metal or metal alloy which has been folded or otherwise shaped to form the pin, characterised in that a substantial part of that surface of the folded sheet metal or metal alloy forming the outer surface of the pin carries a covering of electrically insulating material (2, 2^1, 5) which extends over a substantial part of that length of the pin which will project from the plug body, said covering having been applied to the sheet metal or metal alloy before the sheet has been folded or otherwise shaped to form the pin, and in that the sheet metal or metal alloy is so folded or otherwise shaped that the edges (9, 9^1, 10, 10^1) of that part of the folded sheet metal or metal alloy carrying the covering of electrically insulating material are turned inwardly.

2. A hollow electrically conductive pin (1, 1^1) as claimed in Claim 1, characterised in that the pin has a groove or other recess (4) in a substantial part of that surface of the folded sheet metal or metal alloy forming the outer surface of the pin, in that electrically insulating material (2, 2^1, 5) at least partially fills the groove or recess such that the electrically insulating material extends over a substantial part of that length of the pin which will project from the plug body, said electrically insulating material having been applied in the groove or recess in the sheet metal or metal alloy before the sheet has been folded or otherwise shaped to form the pin, and in that the pin is so folded or otherwise shaped that the edges (9, 9^1, 10, 10^1) of that part of the folded sheet metal or metal alloy carrying the covering of electrically insulating material are turned inwardly.

3. A hollow electrically conductive pin as claimed in Claim 1 or Claim 2, characterised in that the insulating material is a hardenable thermosetting synthetic resin.

4. A hollow electrically conductive pin as claimed in any one of Claims 1 to 3, charac-

terised in that the insulating material is a linear polymer.

5. A method of forming a hollow electrically conductive pin (1, 1^1) for use in an electric plug, which method comprises punching or otherwise cutting a sheet (3) of metal or metal alloy to form a multiplicity of integral pin preforms (6) and, before or after detaching a pin preform from the sheet, folding or otherwise shaping the preform to form a hollow pin, characterised in that before or after the sheet has been punched or otherwise cut but before the preform is folded or otherwise shaped, electrically insulating material (2, 2^1, 5) is applied to a selected part of the surface of the sheet to cause a layer of electrically insulating material to adhere to said selected part of the surface to form a covering of electrically insulating material, the covered part of the sheet being such that, when each of said pin preforms is detached from the sheet before or after it has been folded or otherwise shaped to form a hollow pin, the pin has on the outer surface of a substantial part of the length of the pin that will project from a plug body, a covering of electrically insulating material, and characterised in that the pin is so folded or otherwise shaped that the edges (9, 9^1, 10, 10^1) of that part of the folded sheet metal or metal alloy carrying the covering of electrically insulating material are turned inwardly.

6. A method as claimed in Claim 5, characterised in that before or after the sheet (3) has been punched or otherwise cut but before the preform (6) is folded or otherwise shaped, the sheet is heated and electrically insulating material (2, 2^1, 5) is applied to the said selected part of a surface of the heated sheet in powdered form and is permitted or caused to coalesce, with or without pressure.

7. A method as claimed in Claim 5, characterised in that a groove or other recess (4) is formed in the said selected part of the surface of the sheet (3) before the sheet is folded, and in that, before or after the sheet has been punched or otherwise cut but before the preform (6) is folded or otherwise shaped, a preformed strip or other insert of insulating material (2, 2^1, 5) is laid in the groove or other recess and is secured by the application of heat and pressure or by an adhesive.

8. An electric plug characterised in that at least one of the pins is a hollow electrically conductive pin as claimed in any one of Claims 1 to 4.

Patentansprüche

1. Elektrisch leitender Hohl-Stift (1, 1^1) zur Verwendung in Elektrosteckern, welcher aus Blech, aus Metall oder einer Metall-Legierung geformt ist, das gefaltet oder in anderer Weise in Stift-Form gebracht ist, dadurch gekennzeichnet, daß ein wesentlicher Teil der jenigen Oberfläche des gefalteten Bleches, Metalls oder der Metall-Legierung, der die äußere Oberfläche des Stiftes bildet, eine Beschichtung aus elektrisch-isolierendem Material (2, 2^1, 5) trägt, welche sich über einen wesentlichen Längsabschnitt des Stiftes erstreckt, welcher vom Stecker-Körper vorsteht, wobei die Beschichtung auf das Metall oder die Metall-Legierung aufgetragen ist, bevor das Blach gefaltet oder auf andere Weise in Stift-Form gebracht ist, und daß das Metall oder die Metall-Legierung derart gefaltet bzw. geformt ist, daß die Kanten (9, 9^1, 10, 10^1) desjenigen Abschnittes des gefalteten Metalls oder der Metall-Legierung, welche die Beschichtung aus elektrisch isolierendem Material tragen, nach innen gerichtet sind.

2. Elektrisch leitender Hohl-Stift (1, 1^1) gemäß Anspruch 1, dadurch gekenzeichnet, daß der Stift eine Kerbung oder Ausnehmung (4) in einem wesentlichen Abschnitt derjenigen Oberfläche des gefalteten Bleches oder der Metall-Legierung aufweist, welche die äußere Oberfläche des Stiftes bildet, daß das elektrisch isolierende Material (2, 2^1, 5) zumindest teilweise die Kerbung oder Ausnehmung auffüllt, so daß die elektrisch isolierende Schicht sich über einen wesentlichen Abschnitt der vom Stecker-Körper vorstehenden Längserstreckung des Stiftes erstreckt, wobei das elektrisch isolierende Material in die Kerbung oder Ausnehmung im Blech oder in der Metall-Legierung eingegeben ist, bevor das Blech gefaltet oder auf andere Weise in Stift-Form gebracht ist, und der Stift derart gefaltet bzw. geformt ist, daß die Kanten (9, 9^1, 10, 10^1) desjenigen Abschnittes des gefalteten Bleches bzw. der Metall-Legierung, welche die elektrisch isolierende Beschichtung tragen, nach innen gerichtet sind.

3. Elektrisch leitender Hohl-Stift gemäß einem der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß das isolierende Material ein unter Hitze aushärtbares synthetisches Kunstharz ist.

4. Elektrisch leitender Hohl-Stift nach einem der Ansprüche 1—3, dadurch gekennzeichnet, daß das isolierende Material ein lineares Polymer ist.

5. Verfahren zum Herstellen eines elektrisch leitenden Hohl-Stiftes (1, 1^1) zur Verwendung in Elektrosteckern, bei dem durch Stanzen oder Schneiden eines Bleches (3) aus Metall oder einer Metall-Legierung eine Vielzahl von integral verbundenen Stift-Vorformlingen (6) gebildet wird und, vor oder nach dem Abnehmen der Stift-Vorformlinge von dem Blech, die Vorformlinge gefaltet oder auf andere Weise in die Form eines Hohl-Stiftes gebracht werden, dadurch gekennzeichnet, daß vor oder nach der Stanzung oder Schneidung des Bleches aber vor der Faltung bzw. Formung des Vorformlinges elektrisch isolierendes Material (2, 2^1, 5) auf einen ausgewählten Abschnitt oder Oberfläche des Bleches aufgetragen wird, um eine Schicht aus elektrisch isolierendem Material auf dem ausgewählten Abschnitt der Oberfläche anhaften zu lassen, um eine Abdeckung aus elektrisch isolierendem Material zu bilden, wobei der abge-

deckte Abschnitt des Bleches derart gewählt ist, daß beim Abnehmen eines jeden Stift-Vorformlings vom Blech vor oder nach dessen Faltung oder Formung in einen Hohl-Stift der Stift eine äußere Oberfläche aufweist, die über einen wesentlichen Abschnitt ihrer vom Stecker-Körper vorstehenden Längserstreckung eine Beschichtung aus elektrisch isolierendem Material aufweist, wobei das Verfahren weiterhin dadurch gekennzeichnet ist, daß der Stift derart gefaltet oder geformt ist, daß die Kanten (9, 9^1, 10, 10^1) desjenigen Abschnittes des gefalteten Bleches oder Metall-Legierung, welcher die Beschichtung aus elektrisch isolierendem Material trägt, nach innen gebogen ist.

6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß vor oder nach der Stanzung oder Schneidung des Bleches (3), aber vor dem Falten oder Formen des Vorformlings (6), das Blech erhitzt und das elektrisch isolierende Material (2, 2^1, 5) auf den genannten ausgewählten Abschnitt auf der Oberfläche des erhitzten Bleches in pulverisierter Form aufgetragen wird und unter Druckeinwirkung oder ohne Druckeinwirkung zum Verschmelzen gebracht wird.

7. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß eine Kerbung oder Ausnehmung (4) in dem genannten ausgewählten Abschnitt der Oberfläche des Bleches (3) vor der Faltung des Bleches ausgeformt ist, und daß vor oder nach der Stanzung oder Schneidung des Bleches aber vor der Faltung bzw. Formung des Vorformlinges (6) ein vorgeformter Streifen oder eine Einlage aus isolierendem Material (2, 2^1, 5) in die Kerbung oder Ausnehmung eingelegt und durch Hitzeeinwirkung und Druck oder durch einen geeigneten Klebstoff befestigt wird.

8. Elektrostecker, dadurch gekennzeichnet, daß zumindest einer seiner Stifte ein elektrisch leitender Hohl-Stift ist, wie er in einem der Ansprüche 1—4 beansprucht ist.

Revendications

1. Broche creuse conductrice de l'électricité (1, 1^1) destinée à une fiche électrique, ladite broche étant formée à partir d'une tôle de métal ou d'alliage métallique qui a été pliée ou mise en forme par tout autre moyen pour former la broche, caractérisée en ce qu'une partie substantielle de la surface de la tôle métallique ou alliage métallique pliée formant la surface extérieure de la broche porte un revêtement de matière isolante de l'électricité (2, 2^1, 5) qui sétend sur une partie substantielle de la longueur de la broche sortant du corps de la fiche, ledit revêtement ayant été appliqué sur la tôle de métal ou d'alliage métallique avant que la tôle soit pliée ou mise en forme par tout autre moyen pour former la broche, et en ce que la tôle de métal ou d'alliage métallique est plié ou mis en forme par tout autre moyen de manière que les bords (9, 9^1, 10, 10^1) de la partie de la tôle de métal ou d'alliage de métal pliée portant le revêtement de matière isolante de l'électricité soient tournés vers l'intérieur.

2. Broche creuse conductrice de l'électricité (1, 1^1) selon la revendication 1, caractérisée en ce que la broche comporte une rainure ou autre logement (4) dans une partie substantielle de la surface de la tôle de métal ou d'alliage de métal pliée formant la surface extérieure de la broche, en ce qu'une matière isolante de l'électricité (2, 2^1, 5) remplit au moins partiellement la rainure ou le logement de manière que la matière isolante de l'électricité s'étende sur une partie substantielle de la longueur de la broche qui sort du corps de la fiche, ladite matière isolante de l'électricité ayant été appliquée dans la rainure ou le logement de la tôle de métal d'alliage de métal avant que la feuille ne soit pliée ou autrement mise en forme pour former la broche, et en ce que la broche est pliée ou autrement mise en forme de manière que les bords (9, 9^1, 10, 10^1) de la partie de la tôle de métal ou d'alliage de métal pliée portant le revêtement de matière isolante de l'électricité soient tournés vers l'intérieur.

3. Broche creuse conductrice de l'électricité selon la revendication 1 ou la revendication 2, caractérisée en ce que la matière isolante est une résine synthétique thermodurcissable.

4. Broche creuse conductrice de l'électricité selon l'une quelconque des revendications 1 à 3, caractérisée en ce que la matière isolante est un polymère linéaire.

5. Procédé de formation d'une broche creuse conductrice de l'électricité (1, 1^1) destinée à une fiche électrique, ce procédé consistant à poinçonner ou découper par tout autre moyen une tôle (3) de métal ou d'alliage métallique pour former un grand nombre d'ébauches (6) de broches solidaires, et avant ou après de détacher une ébauche de broche de la tôle, à plier ou mettre en forme par tout autre moyen l'ébauche pour former une broche creuse, caractérisé en ce qu'avant ou après que la tôle a été poinçonnée ou découpée par tout autre moyen mais avant que l'ébauche soit pliée ou mise en forme par tout autre moyen, une matière isolante de l'électricité (2, 2^1, 5) est appliquée sur une partie sélectionnée de la surface de la tôle de manière qu'une couche de matière isolante de l'électricité adhèree sur ladite partie sélectionnée de la surface pour former un revêtement de matière isolante de l'électricité, la partie revêtue de la tôle étant teile que, quand chacune desdites ébauches de broche est détachée de la feuille avant ou après avoir été pliée ou mise en forme par tout autre moyen pour former une broche creuse, la broche comporte sur la surface extérieure d'une partie substantielle de sa longueur qui sort d'un corps de fiche, un revêtement de matière isolante de l'électricité, et caractérisé en ce que la broche est pliée ou mise en forme par toute autre autre manière pour que les bords (9, 9^1, 10, 10^1) de la partie de la tôle de métal ou d'alliage de métal

pliée portant le revêtement de matière isolante de l'électricité soient tournés vers l'intérieur.

6. Procédé selon la revendication 5, caractérisé en ce qu'avant ou après que la feuille (3) a été poinçonnée ou découpée par tout autre moyen mais avant que l'ébauche (6) soit pliée ou mise en forme par tout autre moyen, la tôle est chauffée et une matière isolante de l'électricité (2, 2^1, 5) est appliquée sur ladite partie sélectionnée d'une surface de la tôle chauffée, en forme de poudre laissée ou causée de se fondre avec ou sans pression.

7. Procédé selon la revendication 5, caractérisé en ce qu'une rainure ou autre logement (4) est formée à ladite partie sélectionnée de la surface de la tôle (3) avant que la tôle soit pliée et en ce que, avant ou après que la tôle soit poinçonnée ou découpée à tout autre moyen mais avant que l'ébauche (6) soit pliée ou mise en forme par tout autre moyen, une bande préformée ou autre élément encastré de matière isolante (2, 2^1, 5) est étalé dans la rainure ou autre logement et est fixé par l'application de chaleur et de pression ou parun adhésif.

8. Fiche électrique caractérisée en ce que l'une au moins des broches est une broche creuse conductrice de l'électricité comme revendiquée dans l'une des revendications 1 à 4.

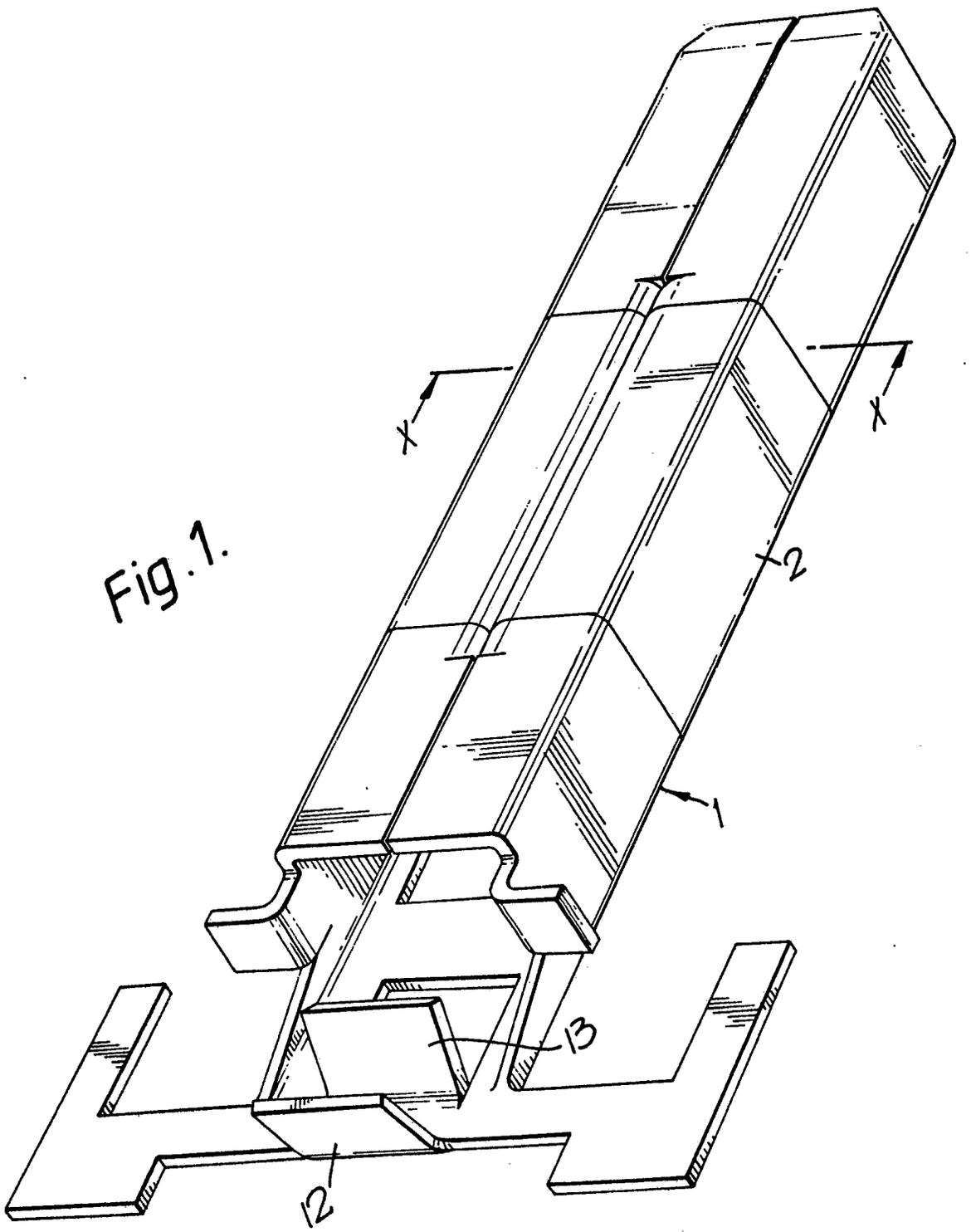

Fig.1.

Fig.2.

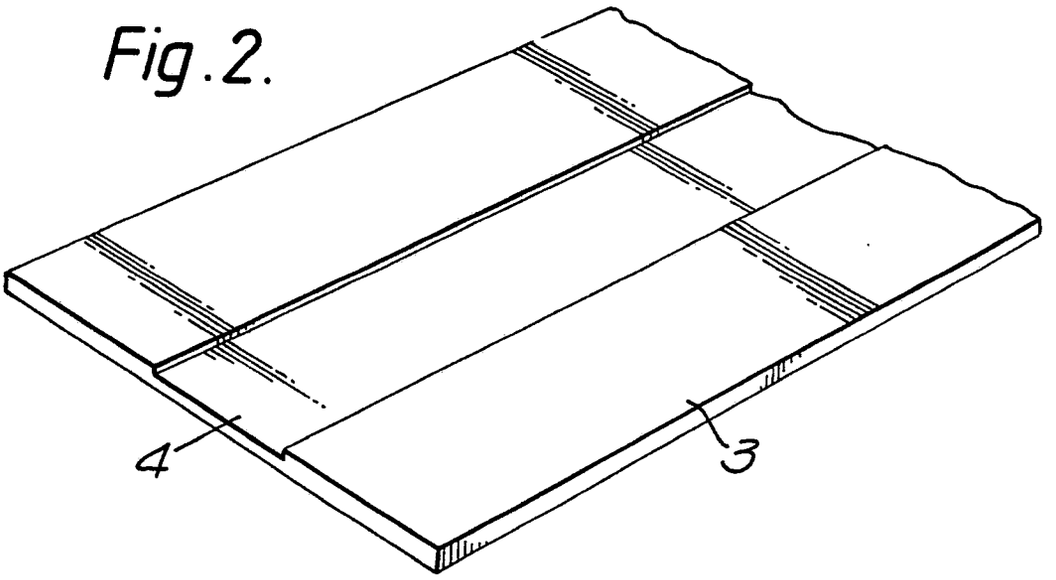

Fig.4.

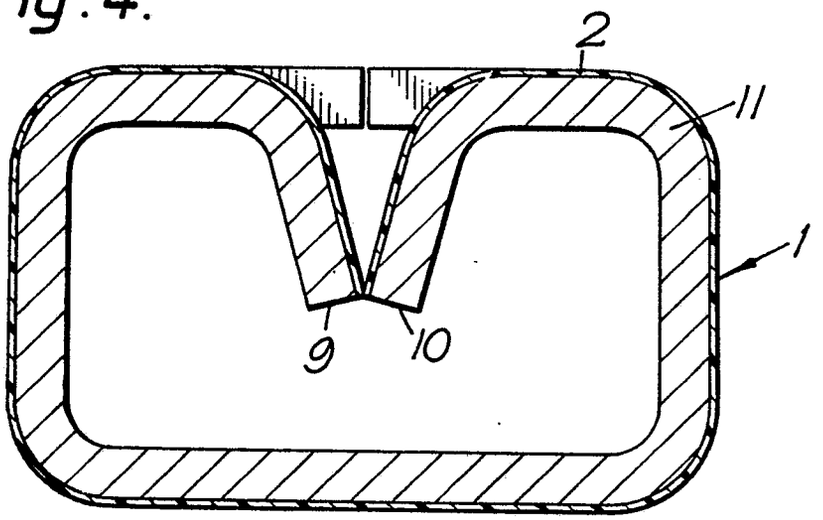

Fig.5.

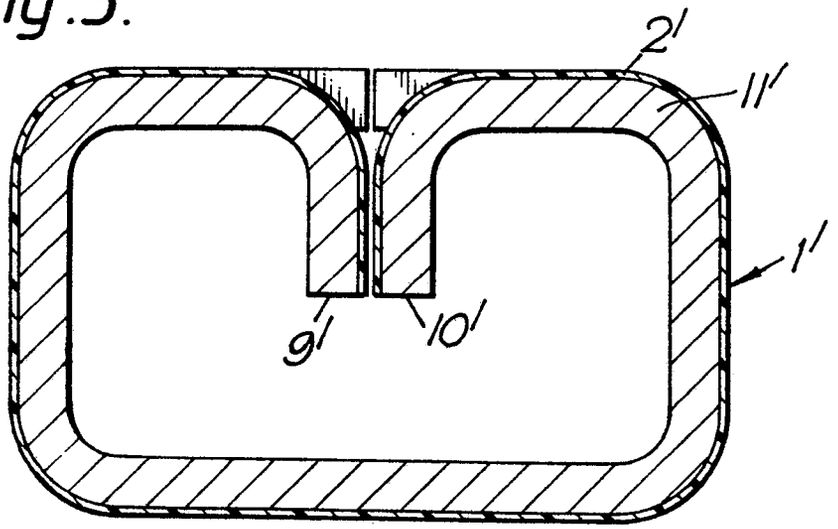

Fig.3.