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(54) **ELECTRICAL TERMINAL.**

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FR-A- 2 287 827
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(73) Proprietor: **THE WHITAKER CORPORATION**
Suite 450, 4550 New Linden Hill Road
Wilmington, Delaware 19808(US)

(72) Inventor: **BOTS, Wilhelmus, Josephus, Aloysius, Maria**
Linelaan 12
NL-5076 CS Haaren(NL)
Inventor: **VAN LAARHOVEN, Antonius, Petrus, Henricus, Maria**
Spilmanstraat 1
NL 5645 JE Eindhoven(NL)

(74) Representative: **Warren, Keith Stanley et al**
BARON & WARREN 18 South End Kensington
London W8 5BU (GB)

Rank Xerox (UK) Business Services
(3.10/3.5x/3.0.1)

Description

The invention relates to electrical terminals having posts with compliant anchoring portions for force fitting in through-holes in printed circuit boards to connect electrically the terminals to the conductive paths on the printed circuit boards.

The use of such terminals is becoming increasingly widespread as they provide a reliable electrical connection to a plated through-hole without a requirement for soldering and securely anchor the terminal in the printed circuit board.

An example of a widely used terminal of this type is described in U.S. Patent document 4655537 and comprises a post, a portion of which is split longitudinally by shearing to form two limbs which are pushed out in opposite directions parallel to the plane of the shear with their sheared surfaces in partially overlapping condition so that during insertion into the through-hole, the limbs are resiliently forced towards each other with progressive sliding engagement of the sheared surfaces across each other in the plane of the shear further into overlapping engagement.

Terminals having compliant portions described above have a very high retention force which is desirable when, for example, connection is to be made to the post subsequently by a wire wrapping technique.

However, for many applications, the very high retention force for subsequent wire wrapping is not necessary and the associated disadvantages such as a high insertion force and the problem of distortion of the through-holes together with the manufacturing difficulties arising as a result of the close tolerances to be maintained should be avoided. In addition, the sheared surfaces may be undesirably rough and irregular, providing an uneven frictional resistance.

The present invention provides an electrical terminal including a metal post for receipt in an aperture in a printed circuit board and having a compliant portion comprising first and second limbs fixed together at respective opposite ends, having opposed surfaces extending partially overlapping in face-to-face engagement, remote edges of the respective limbs being engageable with the internal periphery of the aperture, during insertion therein, to flex the limbs further together with progressive sliding engagement of the opposed surfaces across each other further into overlapping engagement, characterised in that the limbs are constituted by strip portions with planar, rolled metal, opposed surfaces.

The resulting insertion forces are lower than with the prior version as the rolled surfaces have a lower coefficient of friction resisting movement of the limbs together during insertion than the sheared surfaces which are relatively rough. In addition, the limbs undergo essentially plastic deformation rather than the resilient deformation of the prior version maintaining the connection by a wedging action, both factors reducing substantially the risk of damage to through-holes. Furthermore, effective connection may be produced without any deformation of the through-hole.

The opposite ends of the strip portions may be fixed together by clinching or welding.

In a more specific construction, the limbs of the compliant portion are formed by bending a metal strip through 180 degrees about a transverse axis extending in its plane to bring the rolled surfaces of the strip portions into the partially overlapping relation and fixing the free ends of the strip portions together by clinching or welding thereby retaining the overlapping surfaces in mutual engagement.

The remote edges of respective strip portions may be coined to present a smooth radius to the through-holes, facilitating receipt therein.

The remote edge portions are located in mutually parallel relation, offset in laterally opposite directions from a longitudinal medial axis of the strip and extend laterally beyond overlapping portions of the limbs adjacent the fold, being joined thereby to divergent lead-in edges.

In order to control and limit the flexure together of the limbs and therefore the resistance to insertion, interengageable abutment surfaces are provided on the respective strip portions at locations, for example, on overlapping portions between the fold and the divergent lead-in edges.

The abutment surfaces may be formed by splitting the individual strip portions in aligned locations along a longitudinal, preferably medial, axis as by shearing, the stock portions on at least one side of the slit of one strip portion and on at least the opposite side of the slit of the other strip portion being pushed in opposite directions towards each other out of the planes of their respective strip portions to present a pair of opposed severed edges which will abut to resist movement together of medial portions of the strip portions.

Preferably, both of the stock portions on respective sides of the resulting slits are pushed out of the planes of the respective strip portions in respective opposite directions so that a sheared edge of one strip portion on one side of the slit is located opposite the sheared edge on the other side of the slit in the other strip portion, the pushed-out portion of the one strip portion protruding into an aligned recess in the other strip portion defined by the respective pushed-out portion.

Examples of other terminals having compliant portions which are relatively difficult to manufacture are illustrated in U.S. 4324451 and U.S. 4066326.

EP 45153 discloses a terminal in which interengageable camming portions are provided on opposed folds of a pair of legs for insertion into an aperture in a printed circuit board, while Japanese U.M. 58-14683 discloses a terminal with another different compliant portion.

An example of an electrical terminal including a compliant portion according to the invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a front elevation of the compliant portion;

Figure 2 is a side elevation;

Figure 3 is a cross-sectional view prior to insertion in a through-hole;

Figure 4 is a similar view after insertion in a plated through-hole;

Figure 5 is a view of a strip of blanks from which the compliant portions are formed;

Figure 6 is a perspective view of a second example of the compliant portion; and

Figure 7 is a transverse cross-sectional view of the second example.

The electrical terminal 11 comprises first and second limbs constituted by strip portions 12 and 12', respectively, with respective rolled surfaces 13 and 13', and joined together in face-to-face engagement at respective opposite ends by an integral fold 14 and a pair of ears 15 extending laterally from each edge of one strip portion 12 and clinched along opposite edges of the other strip portion 12'. Medial parts 16,16' of respective strips 12,12' are offset in opposite directions in the planes of the strips from the longitudinal medial axis so that their remote edge portions 19,19' respectively extend in mutual parallel relation, and laterally beyond, parts 17,17' of the strip portions adjacent the fold 14 to which they are joined by mutually divergent strip parts 18,18', providing remote lead-in edges 20,20', respectively. This results in the rolled surfaces of the medial parts being partially overlapping and in engagement.

The terminals are formed from a strip of blanks shown in Figure 5. It will be understood that whilst only the compliant sections are shown in this Figure, various different forms of contact elements may also be incorporated adjacent the carrier 21 according to the desired application of the terminal.

During insertion, fold first, into a plated through-hole 22 in a printed circuit board, engagement of the remote edge portions 20,20' of the respective strip portions with the edge of the through-hole urges the strip portions further into overlapping engagement by progressive siding movement of the rolled surfaces 13,13' across each other. This provides a desirable controlled dynamic frictional characteristic providing an insertion force which progressively increases as the area of contact increases. The strip portions undergo progressive plastic deformation during insertion so that the residual spring force on the through-hole is relatively small, but progressive collapse and the resulting wedging action produces and maintains intimate engagement of the rolled edges 19,19' with the through-hole ensuring a reliable electrical connection without distortion of the through-hole.

As the terminals can be produced from thin metal stock by a simple stamping and forming technique without the high degree of precision required for accurately shearing a metal post, the terminals are economic to manufacture and, in view of their lower insertion force, economic to assemble with the circuit board.

In a second example, shown in Figures 6 and 7, the strip blank is formed with creases 30 or waisted at locations adjacent but spaced from the fold, hardening the material to enable the blank to be folded about a predetermined radius to bring the surfaces of the folded portions into engagement without cracking at the fold. Abutment surfaces 36,37' for controlling the flexure together, and therefore the insertion force, of the strip portions 32,32' are provided by splitting the individual strip portions in aligned locations along a longitudinal, medial, axis as by shearing, and the stock portions 34,35', 34'35 on both of the respective sides of the resulting slits 33,33' are pushed out of the planes of the respective strip portions 32,32' in respective opposite directions so that a sheared edge 36 of one strip portion 32 on one side of the slit 33 is located opposite the sheared edge 37' on the other side of the slit 33' in the other strip portion 32', the pushed-out portion 34 of one strip portion protruding into an aligned recess 38' in the other strip portion 32' defined by the respective pushed-out portion 34'.

Claims

1. An electrical terminal (11) including a metal post for receipt in an aperture (22) in a printed circuit board and having a compliant portion comprising first and second limbs (12,12'; 32,32') fixed together at respective opposite ends, having opposed surfaces (13,13') extending partially overlapping in face-to-face engagement, remote edges (19,19') of the respective limbs (12,12') being engageable with the internal periphery of the aperture (22), during insertion therein, to flex the limbs (12,12') further together with progressive sliding engagement of the opposed surfaces (13,13') across each other further into overlapping engagement, characterised in that:

the limbs (12,12') are constituted by strip

portions (12,12') with planar, rolled metal, opposed surfaces (13,13').

2. A terminal according to claim 1, characterised in that the limbs (12,12'; 32,32') of the compliant portion are formed by bending a metal strip through 180 degrees about a transverse axis extending in its plane to bring the rolled surfaces (13,13') of the strip portions (12,12'; 32,32') into partially overlapping relation and fixing the free ends of the strip portions (12,12'; 32,32') together.

3. A terminal according to claim 1 or claim 2, characterised in that ends of the strip portions (12,12') are fixed together by clinching.

4. A terminal according to claim 1 or claim 2, characterised in that ends of the strip portions (12,12') are fixed together by welding.

5. A terminal according to any one of the preceding claims, characterised in that the remote edge portions (19,19') are located in mutually parallel relation offset in laterally opposite directions from a longitudinal medial axis of the strip and extend laterally beyond overlapping portions of the limbs (12,12'; 32,32') adjacent the fold (14), being joined thereto by divergent lead-in edges (20).

6. A terminal according to any one of the preceding claims, characterised in that abutment surfaces (36,37') are provided on the respective strip portions (12,12'; 32,32') on overlapping portions between the fold (14) and the divergent lead-in edges (20), such surfaces being interengageable to limit the flexure together of the limbs (12,12'; 32,32').

7. A terminal according to claim 6, characterised in that the abutment surfaces (36,37') are formed by splitting the individual strip portions (32,32') in aligned locations along a longitudinal axis, stock portions (34,34') on at least one side of the slit (33) of one strip portion (32) and on at least the opposite side of the slit (33') of the other strip portion (32') being pushed in opposite directions towards each other out of the planes of their respective strip portions (32,32') to present a pair of opposed severed edges (36,37') which will abut to resist movement together of medial portions of the strip portions (32,32').

8. A terminal according to claim 7, characterised in that both of the stock portions (34,35'; 34',35) on respective sides of the resulting slits (33,33') are pushed out of the planes of the respective strip portions (32,32') in respective opposite directions so that a sheared edge (36) of one strip portion (32) on one side of the slit (33) is located opposite the sheared edge (37') on the other side of the slit (33') in the other strip portion (32'), the pushed-out portion (34) of one strip portion (32) protruding into an aligned recess (38') in the other strip portion (32') defined by the respective pushed-out portion (34').

9. An electrical terminal according to any one of claims 1 to 8, characterised in that medial parts (16,16') of respective strips (12,12' or 32,32') are offset in opposite directions in the planes of the strips from the longitudinal medial axis so that the remote edge portions (19,19') respectively extend laterally beyond parts (17,17') of the strip portions.

Patentansprüche

1. Elektrischer Anschluß (11) mit einem Metallstift zur Aufnahme in einer Öffnung (22) in einer gedruckten Schaltungsplatte und mit einem federnd nachgiebigen Bereich mit einem ersten und einem zweiten Schenkel (12, 12'; 32, 32'), die an jeweiligen einander gegenüberliegenden Enden aneinander befestigt sind und einander gegenüberliegende Oberflächen (13, 13') aufweisen, die sich in teilweise überlappendem Seite-auf-Seite-Eingriff erstrecken, wobei äußere Ränder (19, 19') der jeweiligen Schenkel (12, 12') beim Einführen in die Öffnung (22) mit dem inneren Umfang derselben in Eingriff bringbar sind, um die Schenkel (12, 12') bei dem zunehmenden Gleiteingriff der einander gegenüberliegenden Oberflächen (13, 13') aufeinander in zunehmenden überlappenden Eingriff weiter aufeinander zu zu biegen,
dadurch gekennzeichnet, daß die Schenkel (12, 12') durch Streifenbereiche (12, 12') mit planaren, einander gegenüberliegenden, gewalzten Metalloberflächen (13, 13') gebildet sind.

2. Anschluß nach Anspruch 1,
dadurch gekennzeichnet, daß die Schenkel (12, 12'; 32, 32') des federnd nachgiebigen Bereichs gebildet sind durch Biegen eines Metallstreifens um 180° um eine sich in dessen Ebene erstreckende, querverlaufende Achse, so daß die gewalzten Oberflächen (13, 13' der Streifenbereiche (12, 12'; 32, 32') in teilweise Überlappung gebracht werden, sowie durch Befestigen der freien Enden der Streifenbereiche (12, 12'; 32, 32') aneinander.

3. Anschluß nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Enden der Streifenbereiche (12, 12') durch Festpressen aneinander befestigt sind.

4. Anschluß nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Enden der Streifenbereiche (12, 12') durch Schweißen aneinander befestigt sind.

5. Anschluß nach einem der vorausgehenden Ansprüche, dadurch gekennzeichnet, daß die äußeren Randbereiche (19, 19') parallel zueinander in einander seitlich entgegengesetzten Richtungen von einer Längsmittenachse des Streifens versetzt angeordnet sind und sich seitlich über überlappende Bereiche der Schenkel (12, 12'; 32, 32') in der Nähe des Faltbereichs (14) hinauserstrecken, mit denen sie durch divergierende Einführkanten (20) verbunden sind.

6. Anschluß nach einem der vorausgehenden Ansprüche, dadurch gekennzeichnet, daß Anlageflächen (36, 37') an den jeweiligen Streifenbereichen (12, 12'; 32, 32') an einander überlappenden Bereichen zwischen dem Faltbereich (14) und den divergierenden Einführkanten (20) vorgesehen sind, wobei diese Flächen zum Begrenzen des Zusammenbiegens der Schenkel (12, 12'; 32, 32') miteinander in Eingriff bringbar sind.

7. Anschluß nach Anspruch 6, dadurch gekennzeichnet, daß die Anlageflächen (36, 37') gebildet sind durch Spalten der einzelnen Streifenbereiche (32, 32') an miteinander ausgerichteten Stellen längs einer Längsachse, wobei Materialbereiche (34, 34') wenigstens auf der einen Seite des Schlitzes (33') des einen Streifenbereichs (32) sowie wenigstens auf der gegenüberliegenden Seite des Schlitzes (33') des anderen Streifenbereichs (32) in entgegengesetzten Richtungen aufeinander zu aus den Ebenen ihrer jeweiligen Streifenbereiche (32, 32') derart herausgedrückt sind, daß sie ein Paar einander entgegengesetzter Trennkanten (36, 37') bilden, die aneinander in Anlage kommen, um einer Zusammenbewegung von Mittelbereichen der Streifenbereiche (32, 32') entgegenzuwirken.

8. Anschluß nach Anspruch 7, dadurch gekennzeichnet, daß beide Materialbereiche (34, 35'; 34', 35) auf den jeweiligen Seiten der resultierenden Schlitze (33, 33') aus den Ebenen der jeweiligen Streifenbereiche (32, 32') in jeweils entgegengesetzten Richtungen derart herausgedrückt sind, daß eine Scherkante (36) des einen Streifenbereichs (32) auf der einen Seite des Schlitzes (32) entgegengesetzt zu der Scherkante (37') auf der anderen Seite des Schlitzes (33') in dem anderen Streifenbereich (32') angeordnet ist, wobei der herausgedrückte Bereich (34) des einen Streifenbereichs (32) in eine in dem anderen Streifenbereich (32') befindliche, damit ausgerichtete Vertiefung (38') hineinragt, die durch den jeweiligen herausgedrückten Bereich (34') gebildet ist.

9. Elektrischer Anschluß nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß Mittelteile (16, 16') der jeweiligen Streifen (12, 12' oder 32, 32') in entgegengesetzten Richtungen in den Ebenen der Streifen von der Längsmittenachse versetzt angeordnet sind, so daß sich die äußeren Randbereiche (19, 19') jeweils seitlich über Teile (17, 17') der Streifenbereiche hinauserstrecken.

Revendications

1. Borne électrique (11) comprenant une broche métallique destinée à être reçue dans un trou (22) d'une plaquette à circuit imprimé et ayant une partie souple comprenant des première et seconde branches (12,12' ; 32,32') fixées entre elles à des extrémités opposées respectives, ayant des surfaces opposées (13,13') s'étendant en chevauchement partiel et en engagement face à face, des bords éloignés (19,19') des branches respectives (12,12') pouvant être engagés avec la périphérie intérieure du trou (22), durant une insertion dans celui-ci, pour approcher davantage par flexion les branches (12,12') avec un engagement progressif de glissement des surfaces opposées (13,13') l'une sur l'autre afin d'accroître l'engagement de chevauchement, caractérisée en ce que :

   les branches (12,12') sont constituées par des parties de bande (12,12') ayant des surfaces opposées planes (13,13') en métal roulé.

2. Borne selon la revendication 1, caractérisée en ce que les branches (12,12' ; 32,32') de la partie souple sont formées par pliage d'une bande métallique sur 180 degrés autour d'un axe transversal s'étendant dans son plan afin d'amener les surfaces roulées (13,13') des parties de bande (12,12' ; 32,32') dans une disposition de chevauchement partiel, et par fixation entre elles des extrémités libres des parties de bande (12,12'; 32,32').

3. Borne selon la revendication 1 ou la revendication 2, caractérisée en ce que les extrémités des parties de bande (12,12') sont fixées entre elles par agrafage.

4. Borne selon la revendication 1 ou la revendication 2, caractérisée en ce que les extrémités des parties de bande (12,12') sont fixées entre elles par soudage.

5. Borne selon l'une quelconque des revendications précédentes, caractérisée en ce que les parties de bords éloignés (19,19') sont placées dans une disposition mutuellement parallèle, décalées dans des directions latéralement opposées à partir d'un axe longitudinal médian de la bande, et elles s'étendent latéralement au-delà des parties en chevauchement des branches (12,12' ; 32,32') à proximité immédiate du pli (14), étant reliées à celui-ci par des bords d'entrée divergents (20).

6. Borne selon l'une quelconque des revendications précédentes, caractérisée en ce que des surfaces de butée (36,37') sont prévues sur les parties de bande respectives (12,12' ; 32,32') sur des parties en chevauchement entre le pli (14) et les bords d'entrée divergents (20), ces surfaces pouvant être engagées l'une contre l'autre pour limiter le rapprochement par flexion des branches (12,12' ; 32,32').

7. Borne selon la revendication 6, caractérisée en ce que les surfaces de butée (36,37') sont formées par fendage des parties de bande individuelles (32,32') en des emplacements alignés suivant un axe longitudinal, des parties de matière (34,34') sur au moins un côté de la fente (33) d'une partie de bande (32) et sur au moins le côté opposé de la lente (33') de l'autre partie de bande (32') étant poussées dans les directions opposées, l'une vers l'autre, hors des plans de leurs parties de bande respectives (32,32') pour présenter deux bords sectionnés opposés (36,37') qui viennent en butée afin de résister au mouvement de rapprochement de portions médianes des parties de bande (32,32').

8. Borne selon la revendication 7, caractérisée en ce que les deux parties de matière (34,35' ; 34',35) sur des côtés respectifs des fentes résultantes (33,33') sont repoussées des plans des parties de bande respectives (32,32') dans des directions opposées respectives afin qu'un bord cisaillé (36) d'une partie de bande (32) sur un côté de la fente (33) soit placé en opposition au bord cisaillé (37') sur l'autre côté de la fente (33') de l'autre partie de bande (32'), la partie repoussée (34) d'une partie de bande (32) faisant saillie dans un évidement aligné (38') dans l'autre partie de bande (32') définie par la partie repoussée respective (34').

9. Borne électrique selon l'une quelconque des revendications 1 à 8, caractérisée en ce que des portions médianes (16,16') des bandes respectives (12,12' ; 32,32') sont décalées dans des directions opposées dans les plans des bandes à partir de l'axe longitudinal médian afin que les parties de bords éloignés (19,19') s'étendent respectivement latéralement au-delà de portions (17,17') des parties de bande.

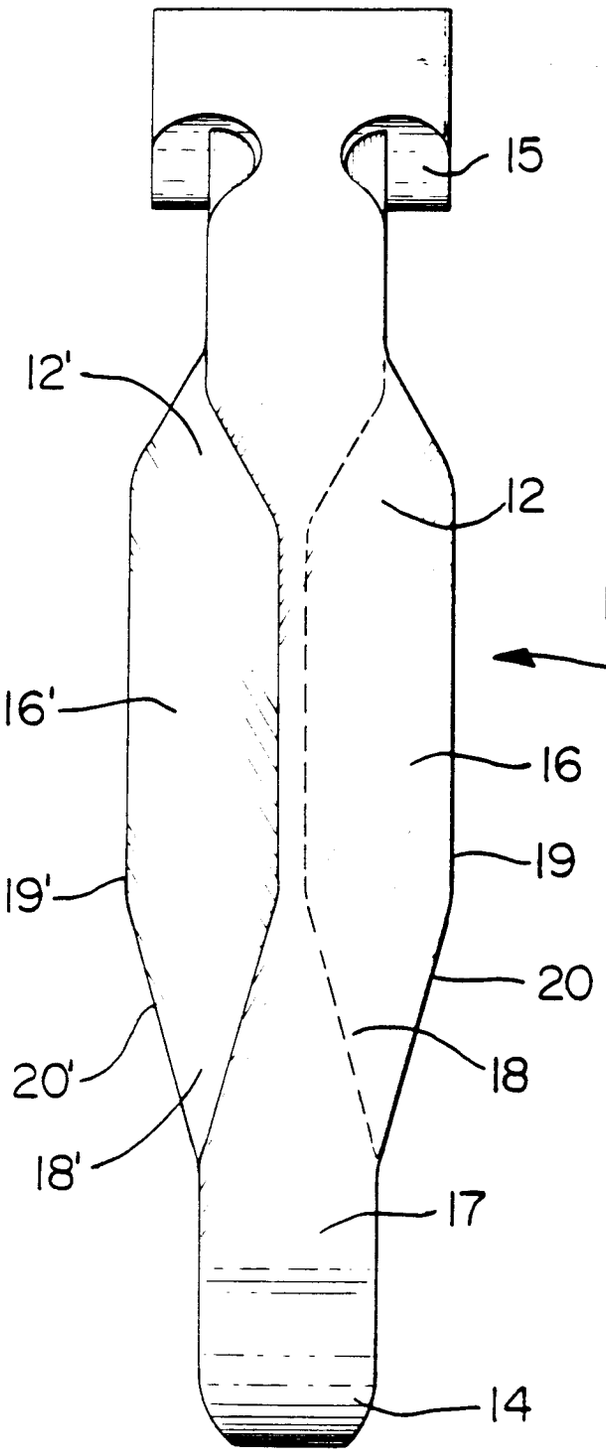
15
12'
12
11
16'
16
19
19'
20
20'
18
18'
17
14

FIG. 1

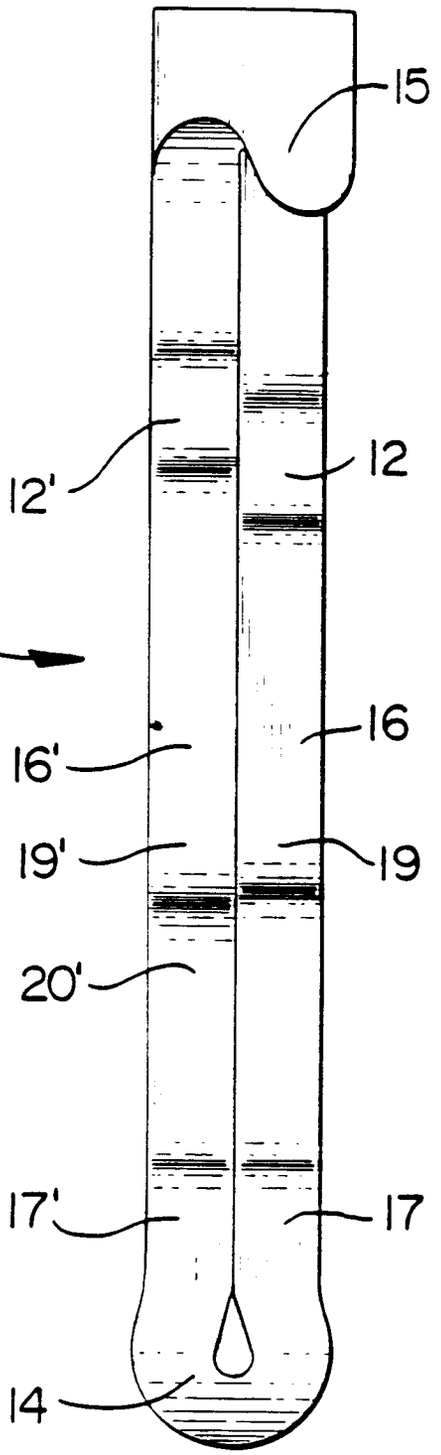
15
12'
12
16'
16
19'
19
20'
17'
17
14

FIG. 2

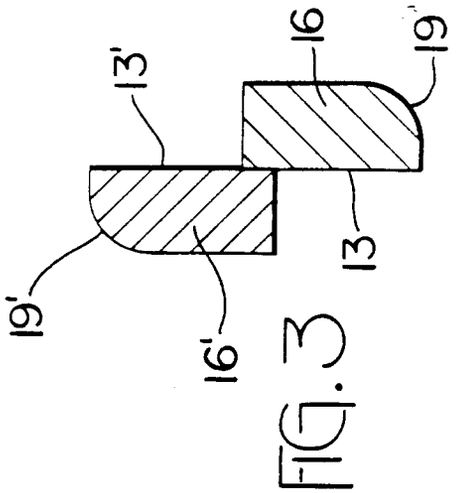

FIG. 3

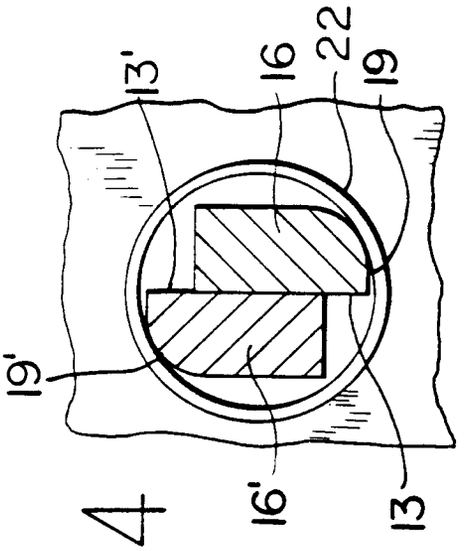

FIG. 4

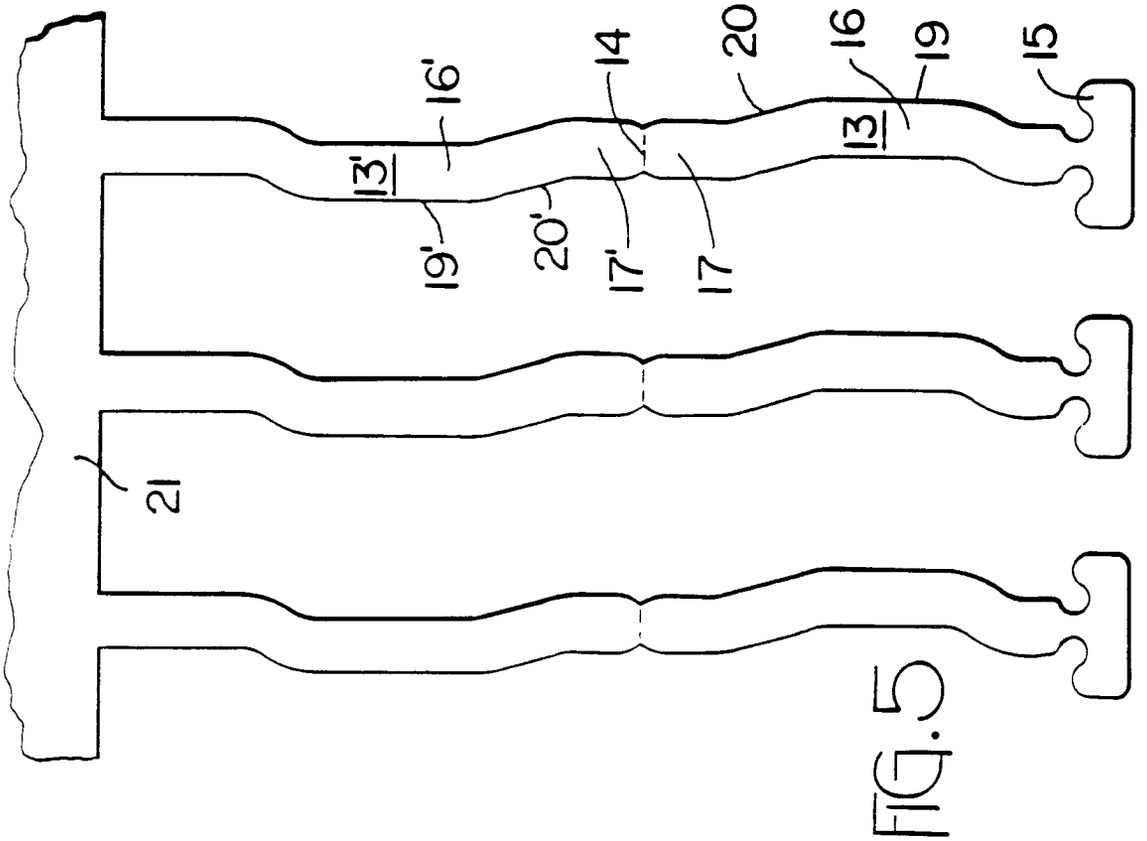

FIG. 5

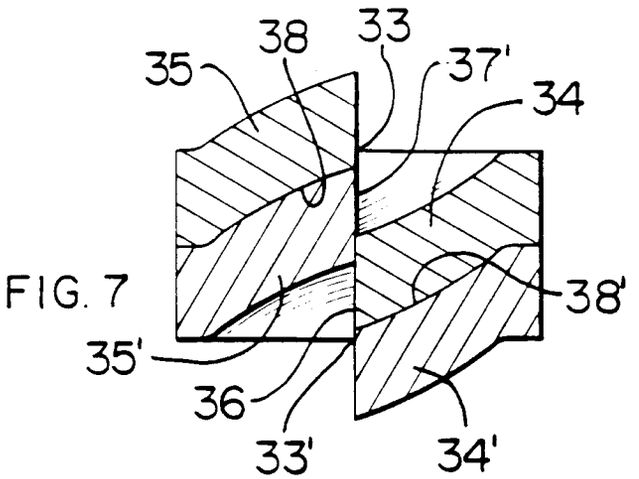

FIG. 7

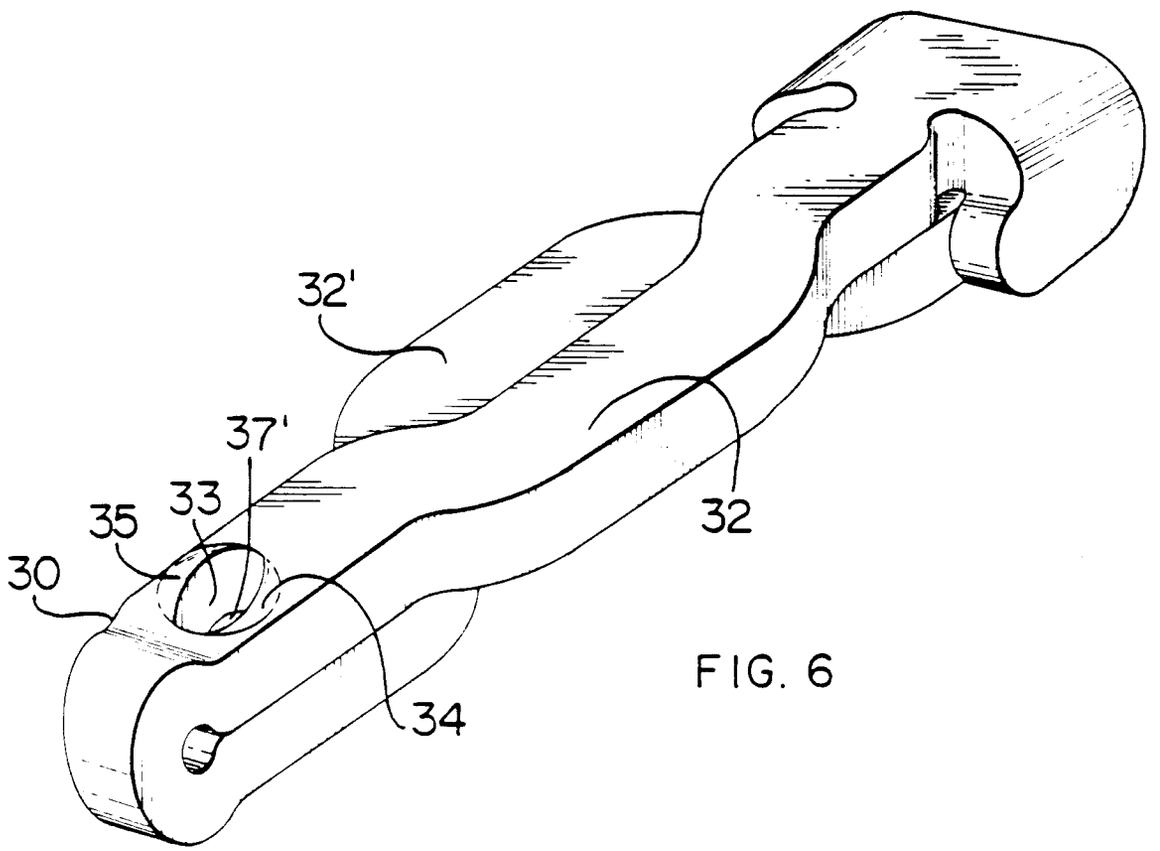

FIG. 6