(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 423 897 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification : **09.08.95 Bulletin 95/32**

(51) Int. Cl.[6] : **H01H 85/175,** H01H 85/157

(21) Application number : **90202757.2**

(22) Date of filing : **16.10.90**

(54) **Fuse.**

(30) Priority : **17.10.89 NL 8902572**

(43) Date of publication of application : **24.04.91 Bulletin 91/17**

(45) Publication of the grant of the patent : **09.08.95 Bulletin 95/32**

(84) Designated Contracting States : **BE CH DE FR GB IT LI LU NL**

(56) References cited :
**EP-A- 0 199 401**
**FR-A- 1 364 445**
**GB-A- 706 206**
**GB-A- 1 474 695**
**GB-A- 1 562 485**
**NL-C- 59 893**
**US-A- 4 563 809**
**US-A- 4 646 053**

(73) Proprietor : **Littelfuse B.V.**
**Kanonstraat 36**
**NL-3531 BM Utrecht (NL)**

(72) Inventor : **de Kler, Dirk**
**Koninginneweg 196**
**NL-2411 XW Bodegraven (NL)**
Inventor : **van Rietschoten, Pieter Johan**
**Voornsloot 24**
**NL-3993 TA Houten (NL)**

(74) Representative : **Smulders, Theodorus A.H.J., Ir. et al**
**Vereenigde Octrooibureaux**
**Nieuwe Parklaan 97**
**NL-2587 BN 's-Gravenhage (NL)**

**EP 0 423 897 B1**

## Description

The invention relates to a fuse comprising a fuse element arranged in a substantially cylindrical envelope or housing between two terminals, said fuse element essentially consisting of or being built up from a suitable electrically conductive material and being on opposite ends in contact with the respective terminals, said substantially cylindrical housing comprising a central, substantially cylindrical portion, which central portion, at opposite ends thereof in the vicinity of, but spaced away from said ends, merges with end portions.

Such a fuse is known from European Patent Application No. 0.199.401. In the known fuse the envelope or housing is practically completely cylindrical exteriorly, except for a pair of grooves provided round about at a minor distance from the end, to be engaged by the inwardly turned edges of the terminals formed as end caps. In fuses of this type, in particular those where, as is described in the publication mentioned above, ablative material is used in the housing, it is desirable that the terminals are mounted over the ends of the housing to form a perfect seal fit and that, further, the attachment is such that when the fuse is interrupted, which may involve great forces, inter alia as a result of an onset of arcing, the terminals are not released or even "popped" from the housing. Although the known construction already possesses a high degree of solidity, it is not sure that all wishes mentioned are satisfied under all conditions.

It is an object of the invention to provide a fuse wherein, more than in the known fuse, the wish of gas-tightness and solidity of the attachment to the terminals is satisfied. This object is accomplished according to the invention by providing a fuse wherein each of said end portions has an at least initially greater outer diameter than the diameter of the central portion, and wherein each of said end portions of said at least initially greater outer diameter has, seen in the direction from the central portion towards the end, a first portion which is of cylindrical configuration or forms an outward ridge and a remaining portion of substantially conical configuration, said first portion having a length that is substantially less than the length of said remaining portion.

The particular construction of the ends of the otherwise substantially cylindrical housing of the fuse according to the invention enables the terminals to be mounted even better than in the known fuse.

In a suitable embodiment of the fuse according to the invention, the terminals have the shape of end caps, known per se, for instance from the publication mentioned hereinabove, which end caps are each fitted over the corresponding end portion of the housing of at least initially greater outer diameter and extend at least in part above the central portion of the housing and have that portion extending above the central portion folded or turned in the direction of the axis of the housing. Such turning or folding, for that matter, need not satisfy many requirements. A 4-point bead, for instance, is already sufficient. Turning or folding the edge of the end cap provides an improved solidity of the attachment, which makes it virtually impossible for the cap to be "popped" under any conditions. To further strengthen the construction, a plate of a suitable material may be mounted on the bottom of each cap to substantially cover said bottom.

Preferably, in the fuse according to the invention, the cylindrical or ridge-shaped portion of the end portions of the housing of at least initially greater outer diameter has a length of approximately 10% of the total length of the end portion. The cylindrical or ridge-shaped portion of the externally at least initially thicker end portion of the housing should have at least a certain length in order that the terminals can be fitted over the thicker end portion to form a perfect seal.

Preferably, in the fuse according to the invention, each terminal is pressed-fitted in the form of an end cap over the cylindrical or ridge-shaped portion of the corresponding portion of greater outer diameter of the housing, said greater outer diameter of the cylindrical or ridge-shaped portion being greater than the inner diameter of the corresponding end cap. Thus, mounting the end cap causes a slight distortion of the thicker cylindrical or ridge-shaped portion. The length of the thicker portion should be such that said distortion can occur with controllable forces. In a fuse built up in this manner, at any rate the desired sealing is obtained.

It is observed that using at the end of a fuse an end portion of conical configuration onto which a beaded contact cap is mounted, is known per se, for instance from Netherlands Patent Specification 59,893. That specification, however, concerns the "large-size" fuse as used in households, having a housing of porcelain or suchlike material. It does not involve a thicker cylindrical or ridge-shaped portion behind the conical portion, followed by a "thinner" central cylindrical portion.

It is further observed that GB patent specifications 1,474,695 and 1,562,485 disclose a fuse whose ends of the housing are tapered to facilitate mounting an end cap.

Mounting the fuse element in the fuse according to the invention can be accomplished, as in the case of the fuse known from European Patent Application 0,199,401, in virtue of the fact that the ends of the wire or wires which form the fuse element are folded about the edge of the housing before the end cap is fitted over it, so that those ends are kept clamped between the end cap and the housing.

It has been found that with the construction according to the invention a very reliable fuse can be realized, which, also after aging, undergoing temperature cycli and the like, does not exhibit any, at least no noticeable, change of properties. It has further

been found that the construction and the conventional techniques for automatic fabrication go together very well.

The invention will now be further explained and illustrated with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view of the housing of an embodiment of the fuse according to the invention;

Fig. 2 is a sectional view of an embodiment of the fuse according to the invention; and

Fig. 3 is a sectional view of the housing of another embodiment of the fuse according to the invention.

In the drawings, like or comparable parts are indicated by the same reference numerals.

Fig. 1 shows the housing 1 of an embodiment of the fuse according to the invention. The housing 1, which for instance consists of a suitable plastic material, has a substantially cylindrical shape. In this embodiment the inner diameter of the housing 1 is substantially constant throughout the length of the housing, but this is not a prerequisite. Optionally, the inner diameter may vary along the length of the housing, both in shape and in size. The housing 1 comprises a central cylindrical portion 2 with an outer diameter that is substantially constant throughout, which central cylindrical portion 2 spans more than half the length of the housing 1. On opposite ends in the vicinity of the ends of the housing 1 the central cylindrical portion 2 merges with thicker cylindrical portions 3 and 4. The cylinder portions 3 and 4 have a substantially constant outer diameter throughout and span a relatively small part of the length of the housing 1. The transition of the central cylindrical portion 2 to the thicker cylindrical portions 3 and 4 is more or less stepped. Adjacent to the cylinder portion 3 is the conical end portion 5 extending towards the end of the housing 1 and adjacent to the cylinder portion 4 is the conical end portion 6 extending towards the opposite end of the housing 1. The outer diameter of the conical end portions 5 and 6 at the end of the housing is for instance equal to the outer diameter of the central cylindrical portion 2 of the housing 1.

A housing as shown in Fig. 1 is particularly suitable for a fuse of the miniature or subminiature type, as described in the above-mentioned European Patent Application 0,199,401. The housing may likewise consist of a plastic material with ablative properties, as is explained in said publication for the fuse described therein. As to the dimensions of the fuse according to the invention, it can be stated that in a housing 1 as shown in Fig. 1 and serving as an example, the total length of the housing 1 was approximately 18 mm, while the length of the central cylindrical portion was approximately 10 mm. The thicker cylindrical portions 3 and 4 each had a length of approximately 0.4 mm and the length of each of the conical end portions 5 and 6 was approximately 3.6 mm. The inner diameter of the housing 1 was 3.0 mm, the outer diameter of the cylindrical central portion 1 was 4.0 mm and the outer diameter of the thicker cylindrical portions 3 and 4 was 4.57 mm. A housing of such dimensions is suitable for a fuse of the type 5 x 20 mm.

Fig. 2 shows an embodiment of the fuse according to the invention, wherein a housing 1 as described with reference to Fig. 1 is used. Arranged in the housing 1 is a fuse element 7, here in the form of a simple fuse wire, extending diagonally across the housing 1. The ends 8 and 9 of the fuse wire 7 are bent around the ends of the housing 1 and, at the outer side of the housing 1, clamped between (at one end) the conical end portion 5 and the end cap 10 of a suitable metal press-fitted onto the end portion 5 and the thicker cylindrical portion 3, and (at the other end) the conical end portion 6 and the end cap 11, likewise of a suitable metal, press-fitted onto the conical end portion 6 and the thicker cylindrical portion 4. A gas-tight sealing is accomplished in virtue of the fact that the end caps 10 and 11 are press-fitted over the thicker cylindrical portions 3 and 4.

The edge 12 of the end cap 10 is folded or turned towards the central cylindrical portion 2 beyond the thicker cylindrical portion 3. Similarly, the edge 13 of the end cap 11 is folded or turned towards the central cylindrical portion 2 beyond the thicker cylindrical portion 4. Thus, the end caps 10 and 11 are very securely mounted on the housing 1 and there is no or hardly any risk of those end caps coming loose during operation by whatever cause and particularly not as a result of internal gas formation or the like when the fuse melts.

At the bottom of the end cap 10 a plate 14 of a suitable material, for instance metal, may be arranged for strengthening the construction. Similarly, a suitable plate 19 may be provided at the bottom of the end cap 11.

Suitable materials which can be used for the housing 1, the end caps 10 and 11 and the fuse element 7 are the same materials as those mentioned in the above-mentioned European Patent Application 0,199,401, and others.

Fig. 3 shows the housing 1 of another embodiment of the fuse according to the invention. This housing 1 consists for instance of a suitable plastic material and has a substantially cylindrical form. The inner diameter of the housing 1 is substantially constant throughout the length of the housing, although this is not a requisite, as has already been explained in the discussion of Fig. 1. In this embodiment, too, the housing 1 comprises a central cylindrical portion 2 with an outer diameter that is substantially constant throughout, which central cylindrical portion 2 spans more than half the length of the housing 1. On opposite ends of the central cylindrical portion 2 of the housing 1 grooves 17 and 18, extending all round, are provided in portion 2. Directly adjacent the grooves

17 and 18, the cylindrical portion 2 merges with an initially thicker portion of the housing 1, formed (on the side of the groove 17) by the convex ridge 15 and the conical portion 5, and (on the side of the groove 18) by the convex ridge 16 and the conical portion 6. In the embodiment shown, only ridges 15 and 16 have a greatest outer diameter, which is greater than the outer diameter of the cylindrical portion 2 of the housing 1. The outer diameter of the conical end portions 5 and 6 varies, for instance, from a diameter that is equal to that of the portion 2 at the ridges 15 and 16 to a smaller diameter at the end.

In a housing of the shape as shown in Fig. 3, as in the embodiment shown in Fig. 2, the end caps can be press-fitted over the conical ends, enabling a gas-tight sealing to be accomplished. Preferably, the inner diameter of the end caps to be used will to that end be smaller than the greatest diameter of the ridges 15 and 16. When the end cap is being mounted, a slight plastic deformation of the convex ridge of greater diameter will occur, particularly when that diameter is slightly greater than the inner diameter of the end cap. In a miniature fuse of a length of approximately 20 mm and a cross-section of 4.5 mm, a difference in diameter of 0.07 mm, for instance, is enough to yield good results. The edge of the end caps can be folded or turned beyond the convex ridges 15 and 16 into the grooves 17 and 18 This yields a construction wherein it is substantially impossible for the end caps to come loose off the housing.

## Claims

1. A fuse comprising a fuse element (7) arranged in a substantially cylindrical envelope or housing (1) between two terminals (10,11), said fuse element (7) essentially consisting of or being built up from a suitable electrically conductive material and being on opposite ends in contact with the respective terminals (10,11), said substantially cylindrical housing (1) comprising a central substantially cylindrical portion (2), which central portion (2), at opposite ends thereof in the vicinity of, but spaced away from the ends, merges with end portions (3,15,5; 4,16,6),

   characterized in that each of said end portions (3,15,5; 4,16,6) has an at least initially greater outer diameter than the diameter of the central portion (2), and in that each of said end portions of said at least initially greater outer diameter has, seen in the direction from the central portion towards the ends, a first portion (3,4,15,16) which is of cylindrical configuration (3,4) or forms an outward ridge (15,16) and a remaining portion (5,6) of substantially conical configuration, said first portion having a length that is substantially less than the length of said remaining portion.

2. A fuse according to claim 1, characterized in that the terminals (10,11) have the shape of known per se end caps, which end caps (10,11) are each fitted over the corresponding end portion (3,5; 4,6) of the housing of at least initially greater outer diameter and extend at least partly above the central portion (2) of the housing (1) and have said portion (12) extending above the central portion (2) folded or turned in the direction of the axis of the housing (1).

3. A fuse according to claim 2, characterized in that at the bottom of each end cap (10,11) a plate (14,19) of a suitable material, which substantially covers the bottom, is mounted for strengthening the construction.

4. A fuse according to any one of claims 1-3, characterized in that the cylindrical or ridge-shaped portion (3,4,15,16) of the end portions of the housing (1) which have an at least initially greater outer diameter has a length of approximately 10% of the total length of the end portion.

5. A fuse according to any one of claims 1-4, characterized in that each terminal (10,11) in the form of an end cap, is press-fitted over the cylindrical or ridge-shaped portion (3,4,15,16) of the corresponding portion of greater outer diameter of the housing (1), said greater outer diameter of the cylindrical or ridge-shaped portion (3,4,15,16) being greater than the inner diameter of the corresponding end cap (10,11).

## Patentansprüche

1. Schmelzsicherung, versehen mit einem Schmelzelement (7), das zwischen zwei Endanschlußelementen (10,11) in einem im wesentlichen zylindrischen Mantel oder Gehäuse (1) angeordnet ist, welches Schmelzelement (7) im wesentlichen aus geeignetem, elektrisch leitendem Material besteht oder aufgebaut ist und sich an gegenüberliegenden Seiten mit den jeweiligen Endanschlußelementen (10,11) berührt, welches im wesentlichen zylindrische Gehäuse (1) mit einem zentralen, im wesentlichen zylindrischen Abschnitt (2) versehen ist, welcher zentrale Abschnitt (2) an gegenüberliegenden Seiten in der Nähe der, jedoch im Abstand von den Enden in Endabschnitte (3,15,5; 4,16,6) übergeht,

   dadurch gekennzeichnet, daß jeder der Endabschnitte (3,15,5; 4,16,6) einen wenigstens anfangs größeren Außendurchmesser als der Durchmesser des zentralen Abschnittes (2) auf-

weist und daß jeder der Endabschnitte mit wenigstens anfangs größerem Außendurchmesser, in Richtung vom zentralen Abschnitt zu den Enden gesehen, mit einem ersten Abschnitt (3,4,15,16), der eine zylindrische Gestalt (3,4) aufweist oder einen Außenrücken (15,16) bildet, und einem übrigen Abschnitt (5,6) mit im wesentlichen konischer Gestalt versehen ist, welcher erste Abschnitt eine Länge aufweist, die im wesentlichen geringer als die Länge des übrigen Abschnittes ist.

2. Schmelzsicherung nach Anspruch 1, dadurch gekennzeichnet, daß die Endanschlußelemente (10,11) die Form von an sich bekannten Endkappen aufweisen, welche Endkappen (10,11) je über den zugeordneten Endabschnitt (3,5; 4,6) des Gehäuses mit wenigstens anfangs größerem Außendurchmesser geschoben sind und sich wenigstens teilweise bis oberhalb des zentralen Abschnittes (2) des Gehäuses (1) erstrecken und mit diesem sich bis oberhalb des zentralen Abschnittes (2) erstreckenden Abschnitt (12) in Richtung auf die Achse des Gehäuses (1) umgebogen oder umbördelt sind.

3. Schmelzsicherung nach Anspruch 2, dadurch gekennzeichnet, daß zur Verstärkung der Konstruktion am Boden jeder Endkappe (10,11) eine den Boden im wesentlichen bedeckende Platte (14,19) aus geeignetem Material angeordnet ist.

4. Schmelzsicherung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der zylindrische oder rückenförmige Abschnitt (3,4,15,16) der Endabschnitte des Gehäuses (1) mit wenigstens anfangs größerem Außendurchmesser eine Länge von annähernd 10% der Gesamtlänge des Endabschnittes aufweist.

5. Schmelzsicherung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß jedes Endanschlußelement (10,11) in Form einer Endkappe mit Preßpassung über den zylindrischen oder rückenförmigen Abschnitt (3,4,15,16) des zugeordneten Abschnittes mit größerem Außendurchmesser des Gehäuses (1) befestigt ist, wobei dieser größere Außendurchmesser des zylindrischen oder rückenförmigen Abschnittes (3,4,15,16) größer als der Innendurchmesser der zugeordneten Endkappe (10,11) ist.

## Revendications

1. Fusible comprenant un élément fusible (7) disposé dans une enveloppe ou boîtier (1) essentiellement cylindrique entre deux bornes (10, 11), ledit élément fusible (7) se composant ou étant constitué essentiellement d'un matériau électriquement conducteur approprié et se trouvant à ses extrémités opposées en contact avec les bornes respectives (10, 11) , ledit logement (1) essentiellement cylindrique se composant d'une partie centrale essentiellement cylindrique (2), laquelle partie centrale (2), à ses extrémités opposées et à proximité mais à distance des extrémités, rejoint les parties d'extrémité (3, 15, 5; 4, 16, 6), caractérisé en ce que chacune desdites parties d'extrémité (3, 15, 5; 4, 16, 6) possède un diamètre externe plus grand, du moins initialement, que le diamètre de la partie centrale (2) et en ce que chacune desdites parties d'extrémité dudit diamètre externe plus grand, du moins initialement, possède, dans la direction de la partie centrale vers les extrémités, une première partie (3, 4, 15, 16) qui est de configuration cylindrique (3, 4) ou forme une nervure externe (15, 16) et une partie résiduelle (5, 6) de configuration essentiellement conique, ladite première partuie possédant une longueur qui est essentiellement inférieure à la longueur de ladite partie résiduelle.

2. Fusible selon la revendication 1, caractérisé en ce que les bornes (10, 11) ont la forme de bouchons connus en soi, lesquels bouchons (10, 11) sont ajustés chacun sur la partie d'extrémité correspondante (3,5; 4,6) du logement d'un diamètre extérieur plus grand du moins initialement et s'étendent du moins en partie au-dessus de la partie centrale (2) du logement (1) et ont ladite partie (12) s'étendant au-dessus de la partie centrale (2) pliée ou tournée dans la direction de l'axe du logement (1).

3. Fusible selon la revendication 2, caractérisé en ce qu'au fond de chaque bouchon (10, 11) est montée une plaque (14, 19) d'un matériau approprié qui recouvre essentiellement le fond pour renforcer la construction.

4. Fusible selon l'une quelconque des revendications 1 à 3, caractérisé en ce que la partie cylindrique ou en nervure (3, 4, 15, 16) des parties d'extrémité du logement (1) qui ont un diamètre externe supérieur du moins initialement possède une longueur d'environ 10 % de la longueur totale de la partie d'extrémité.

5. Fusible selon l'une quelconque des revendications 1 à 4, caractérisé en ce que chaque borne (10, 11) en forme de bouchon est ajustée de manière serrée sur la partie cylindrique ou en forme de nervure (3, 4, 15, 16) de la partie correspondante de diamètre externe plus grand du logement (1), ledit diamètre externe plus grand de la

partie cylindrique ou nervurée (3, 4, 15, 16) étant supérieur au diamètre interne du bouchon correspondant (10, 11).

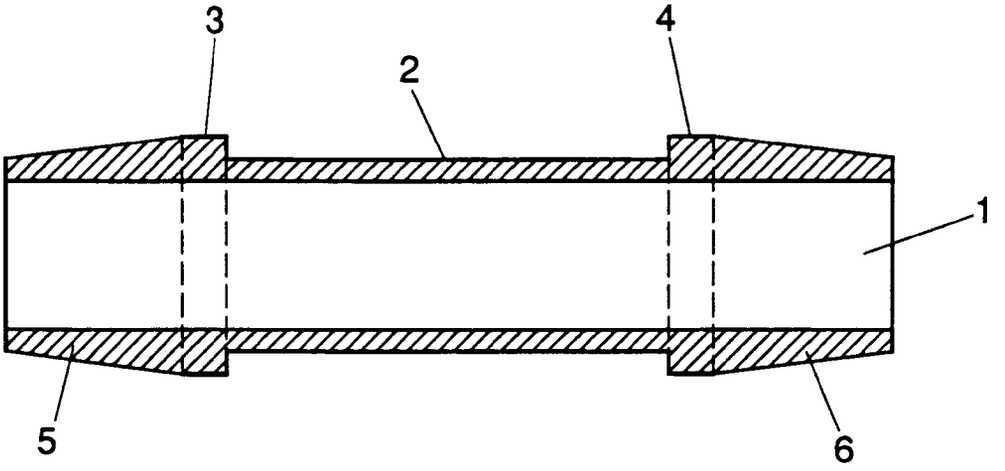


FIG. 1

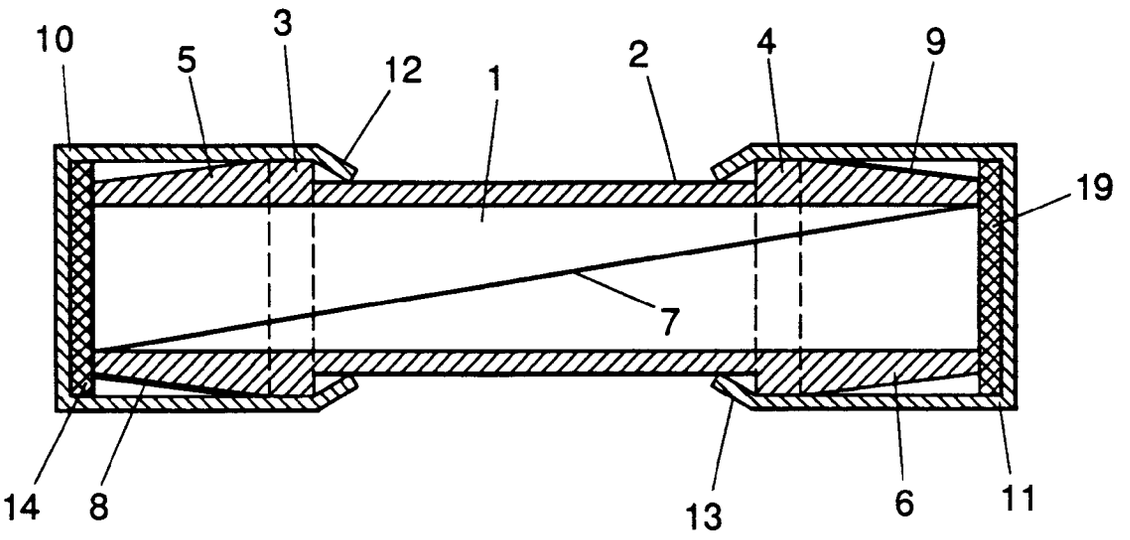


FIG. 2

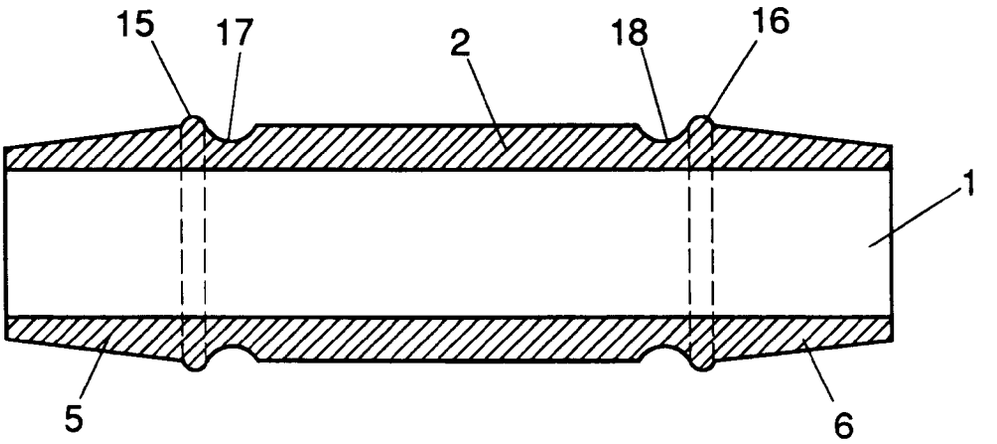


FIG. 3