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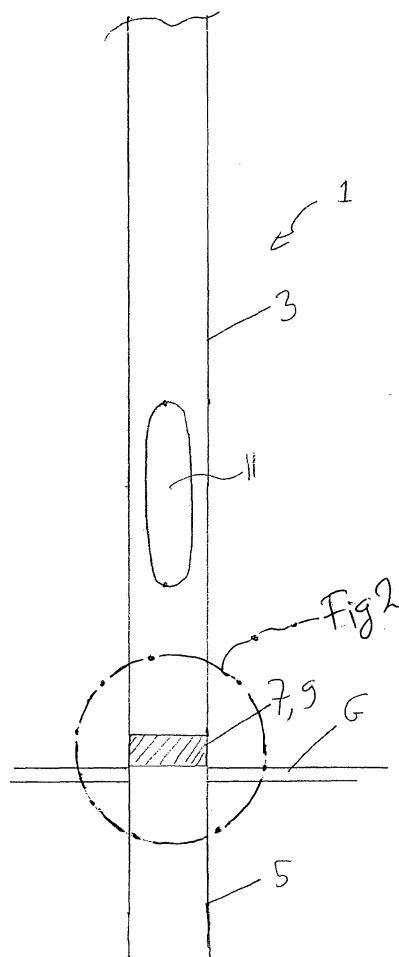
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(54) **Utility Pole with frangible tube section**

(57) A utility pole is provided which includes a column for carrying a utility member such as a traffic light, a traffic sign, a luminaire, a flag or the like, and a base for anchoring the pole to the ground and a frangible tube section connecting the column and the base and the frangible section of the pole is of an aluminium alloy being brittle and having good fracture properties and having an elongation value as measured and expressed by the elongation $A_{50_{mm}}$ index of equal to or less than 2% and an $R_{p0.2}$ strength value of at least 180 Mpa.



Description

[0001] The present invention relates to a utility pole such as a pole for traffic lights, a pole for traffic signs, a lighting column or flag pole or the like that includes a frangible tube section.

[0002] The utility pole of the invention includes a mast or column to which the luminaire, traffic light, traffic sign or the like is mounted, a base to anchor the pole in the ground and an intermediate frangible tube section connecting the column to the base.

[0003] The purpose of the frangible tube section is to provide a passive safety feature to the pole in that upon impact by a vehicle the damage to the vehicle will be reduced and the occupants will run less risk of being hurt.

[0004] Levels of safety are defined in defined in the European Standard EN12767. This standard defines tests to assign safety levels for occupants in a passenger vehicle for three categories of types of utility poles, high energy absorbing (HE), low energy absorbing (LE) and non energy absorbing (NE). The occupant safety levels per category range from lowest 1 to highest 3 with an additional level 4 (very safe) for the non energy absorbing poles. The EN 12767 features an obligatory qualification test in which a car that moves with 35km/hour is impacted upon the utility pole that is tested. The collision test measures an ASI (acceleration severity index) and THIV (theoretical head impact value). For example for non energy absorbing poles to get an occupant safety level rating of 1 in the obligatory qualification test the THIV is allowed to be 27 km/hour at the most and the ASI has a maximum value of 1,0.

[0005] It is of course desirable for manufacturers of utility poles to get a good safety rating for the poles. This can be done by designing a pole to disengage the column from the base after impact by breaking a bolt-like connection and sliding it off, known e.g. from - EP2014850 or US5535555. Alternatively the pole is designed to collapse by deforming the pole after impact while the pole is to remain attached to the base, known from e.g. EP0156158. Or the pole is designed to break upon impact such that after impact the column is severed from the base completely or for the most part, known from e.g. US 6,516,573, US20080250752, EP146401.

[0006] The choice for each one of these types of poles will bring with it special designing challenges. Since the opinion today is that the safety ratings are more important than having to replace the pole after impact, the poles that are to break upon impact have become a commercially interesting choice for the policy makers and manufacturers. Most poles that break upon impact fall in the non-energy absorbing category of EN 12767.

[0007] Poles that are designed to break upon impact generally comprise of a column connected to a base by an intermediate frangible section. The frangible tube section thus needs to be strong enough to carry the utility column but needs to break upon impact. The known frangible tube sections all are weaker than the column and

base or include a weakened portion. E.g. US 6,516,573 discloses a series of dimples or perforations in the sleeve that ensures that the sleeve will break, EP 146401 proposes to make the sleeve of a weaker material with an optional line of weakness e.g. by perforations. US20080250752 introduces a weld which forms a break-away joint between the column and the base, and optionally introduces a backer ring such that a pair of spaced apart circumferential breakaway weld joints may be formed.

[0008] All these solutions have in common that one way or another a weakened portion is present in the pole, i.e. by weakening the sleeve by holes or grooves or by having a thinner portion, or by having a weaker weld joint, or by the weld locally weakening the pole.

[0009] It is an object of the invention to provide a utility pole having a frangible tube section that can be easily connected between the column and the base and presents a strength that is at least equal to that of the column.

[0010] It is a further object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art. It is also an object of the present invention to provide alternative structures, which are less cumbersome in assembly and which moreover, can be made relatively inexpensively. Alternatively it is an object of the invention to at least provide the public with a useful choice.

[0011] In accordance with this invention, a utility pole is provided, in which

the utility pole includes a column for carrying a utility member such as a traffic light, a traffic sign, a luminaire, a flag or the like, and a base for anchoring the pole to the ground and a frangible tube section connecting the column and the base wherein, the frangible section is of a brittle aluminium alloy having an elongation value as measured and expressed by the elongation A50_{mm} index of equal to or less than 2% and an Rp0,2 strength value of at least 180 Mpa.

[0012] Advantageously the frangible tube section includes a top and bottom portion insertable into respectively the column and the base.

[0013] Advantageously the frangible tube section further includes an intermediate portion and this intermediate portion remains exposed between the column and the base.

Further advantageously the intermediate portion is a shoulder portion flush with or projecting outward with respect to the column.

Also further advantageously the frangible tube section is connected to the column and the base by adhesive.

Again advantageously the pole is rated according to European standard EN 12767 as being in non energy absorbing category and having an occupant safety level rating of 1, 2 or 3

Most advantageously the aluminium alloy is a cast aluminium alloy.

[0014] Further aspects and advantages of the inven-

tion will be apparent from the detailed description below of particular embodiments and the drawings thereof, in which:

- Figure 1 is a schematic frontal view of a first embodiment of a utility pole of the invention showing a portion of the pole indicating the position of the frangible tube section in relation to the column, the base and the ground in which the pole is placed,
- Figure 2 is a cross section of the portion of the utility pole of the first embodiment showing the frangible tube section in connection with the column and the base
- Figure 3 is a cross section of the frangible tube section of the pole of the first embodiment showing the intermediate shoulder portion between top and bottom sections.
- Figure 4 is a cross-section of the second embodiment of the utility pole of the invention, showing the frangible tube section in connection with the column and the base
- Figure 5 is a cross-section of a third embodiment of the utility pole of the invention, showing the base section of the column to have a thicker wall than the column and the frangible tube section

[0015] The utility pole 1 as shown in figure 1 has a column 3, a base 5 and a frangible tube section 7. The base 5 is anchored in the ground (G). The frangible section 7 has a visible shoulder portion 9 between column 3 and base 5. The sleeve 7 is at ground level. A utility hatch 11 is present in the column 3 just above the visible portion 9 of the breakaway sleeve 7.

[0016] In figure 2 a cross-section of a portion of utility pole 1 is shown, and in Figure 3 a cross-section of the frangible tube 7 is shown by itself.

Figures 2 and 3 clearly show the top and bottom portions 13, 15 of the breakaway sleeve and its intermediate shoulder portion 9. As can be seen in these figures, the top and bottom portions 13, 15 of the sleeve are chamfered to allow insertion in the hollow column and base. The top and bottom portions 13, 15 of the frangible tube section are radially inward from the intermediate shoulder portion 9. Thus a top and bottom rim 13A, 15A is present onto which the column lower end 3A and base upper end 5A abuts. The shoulder 9 of the frangible tube 7 and the column 3 and base 5 together form a smooth outer surface of the utility pole. The top and bottom portions of the sleeve are connected to the column and base by adhering with a suitable adhesive, such as an epoxy resin. Thus a top adhesive bond 17 is formed between the upper sleeve portion 13 and the column section in contact with

the upper sleeve portion. Likewise a lower adhesive bond 19 is formed between the lower tube portion 15 and the base portion that is in contact with the lower sleeve portion 15. The strength of the adhesive bonds is determined by the shear strength factor of the adhesive and the adhesive bond area.

[0017] A second embodiment of the utility pole of the invention is shown in figure 4 where for like parts the same reference numerals as in Figures 1-3 are used greater by 100. The utility pole 101 is shown with column 103 and base 105 interconnected by a frangible tube section 107. The column 103 abuts with one free end 103A a free end 105A of the base 105. The frangible tube section 107 is encompassed within the column and base. Half of the frangible tube section 107 is inside the column 103 and the other half is inside the base section 105. The frangible tube section 107 is adhesively bonded to the column and base of the utility pole.

[0018] A third embodiment of the utility pole of the invention is shown in figure 5 where for like parts the same reference numerals are used as in Figures 1-3 greater by 200.

The utility pole 201 is shown with column 203 and base 205 interconnected by frangible tube section 207. The base 205 has thicker walls than the column 203. The advantage of the thicker walls of the base is that upon impact of a car onto the utility pole the impact energy will not or only slightly deform the base and will thus be guided more completely to the frangible tube section. Thus a base with thicker walls will improve the breaking properties of the frangible tube section of the utility pole. The base 205 is anchored in the ground such that the bottom rim 215A of the shoulder of the frangible tube section, which is atop the upper end 205A of the base 205 is at or adjacent ground level, similar as indicated in figure 1.

[0019] The frangible tube section (7, 107, 207) is formed from a cast aluminium alloy being brittle and having good fracture properties and having an elongation value as measured and expressed by the elongation $A_{50_{mm}}$ index of equal to or less than 2% and an $R_{p0.2}$ strength value of at least 180 Mpa. Preferably the $A_{50_{mm}}$ value is 1,5% or less. This type of aluminium is brittle and has good fracture properties, in that it breaks upon being impacted by a mass.

[0020] To this end an aluminium alloy for the frangible tube section (7, 107, 207) is selected from alloys within the range starting with the EN AC-41xxx alloys and ending with the EN AC-47xxx alloys groups denoted according to EN1780-1, where xxx denotes numerical values defining specific alloy compositions. E.g. including EN AC-43000 T6 and EN AC-43100 T6.

EN 1780-1 is the European standard for the designation of aluminum and aluminum alloys. The European Standard (EN) and International Aluminum Association (UNS) for wrought products use the same numerical designations with the prefix EN or AW respectively.

The designation is constituted successively by prefix EN (European Standard) followed by a blank space, followed

by letter A representing aluminum, followed by a letter representing the form of the product, i.e. letter C which represents castings alloys, followed by a hyphen and five figures representing the alloy composition limits. The first of the five figures indicates the major alloying elements as follows: copper: 2XXXX, silicon: 4XXXX, magnesium: 5XXXX and zinc: 7XXXX. The second of the five figures indicates the alloy group as follows: Thus as indicated in the range above, the cast aluminium alloys that are preferably selected are alloyed with Silicon, thus the first of the five figures is "4". and optionally also with Magnesium and/or Copper, as can be seen by the second of the five figures in which 41XXX stands for AlSiMgTi; 42XXX stands for AlSi7Mg; 43XXX stands for AlSi10Mg; 44XXX stands for AlSi; 45XXX stands for AlSi5Cu; 46XXX stands for AlSi9Cu and 47XXX stands for AlSi(Cu). The third figure of the five figures is arbitrary and it indicates various alloys inside the given group, the differences in chemical compositions are minimal. The fourth figure is generally zero, as is the fifth figure.

[0021] This type of material is necessary in order to be able to reach the desired strength of the complete utility pole. The actual strength of the frangible tube section will then be obtained by choice of diameter and/or thickness thereof. Preferably the pole will be designed to have a uniform strength in column, frangible tube section and base. Alternatively the frangible tube section can be designed to be even stronger than the column and/or base of the pole. This may be desirable in order for the complete utility pole to comply with normal use requirements, i.e. resistance to wind loads or the like.

[0022] Typically to get a utility pole of a certain category i.e. non energy absorbing, of a certain type i.e. with traffic signs and of a certain height i.e. 20 meters, classified in one of the safety ratings of the EN 12767 standard, the cast aluminium frangible tube section will be made with a certain wall thickness and/or height in order to obtain the desired resistance to breaking as well as the required strength for normal use conditions.

[0023] It has been found that proper connection of the frangible tube section to the column and base will 'isolate' the frangible tube section and its fracture-properties from the rest of the utility pole. Thus the bond between the frangible tube section and the column or base must be 'stronger' than the resistance to breaking of the frangible tube section in order for the frangible tube section to break instead of the column or the base disengaging by sliding away from the frangible tube section upon impact. The strength can be expressed as values V_{column} , V_{base} or $V_{\text{tube-section}}$ calculated by multiplying thickness of the material of the column, base or tube by the length of the column, base or tube and by the $R_{p0.2}$ value of alloy used in the column, base or frangible tube section. Similarly such a value V_{adhesive} for the adhesive can be calculated and depends on the surface area of the adhesive and the shear strength value of the adhesive (S) that was used.

This value V_{adhesive} has to be equal or higher than the

values V_{column} , V_{base} or $V_{\text{tube-section}}$ in order for the bond to hold upon impact and 'isolate' the fracture properties of the frangible tube section.

[0024] The surface area for the adhesive bond between e.g. the column 3 and upper portion 13 of the frangible tube section 7 is determined by diameter (D_{column}) (inner diameter of the column multiplied by the height ($L_{\text{adhesive-column}}$) of the column along which the adhesive is applied and which is in contact with both the column and the frangible tube section.

Thus $V_{\text{adhesive}} = D_{\text{column}} * L_{\text{adhesive-column}} * S$.

[0025] In order to reach a desired strength value for a column the diameter, thickness and alloy are chosen. Thus in order to optimize the adhesive bond the only readily 'available' variables are the adhesive or the $L_{\text{adhesive-column}}$.

So in order to calculate the minimum height of overlap between column and frangible tube section $L_{\text{adhesive-column}}$ can be calculated as follows:
 $L_{\text{adhesive-column}} = V_{\text{column}} / (S * D_{\text{column}})$ Similarly the calculation can be done for the adhesive bond between the base 5 and the lower portion 15 of the frangible tube section.

[0026] The utility pole can have a height of between 2 and 20 meters. The position of the frangible tube section is preferably at the ground level and can also be further above the ground level but is generally never more than 60cm above the ground. The thickness of the frangible tube section is preferably between 2 and 100 mm. The height of the intermediate shoulder portion (9, 209) of the frangible tube section is preferably between 5 and 400 mm.

[0027] It is thus believed that the operation and construction of the present invention will be apparent from the foregoing description. The invention is further limited by the terms of the claims and not limited to the embodiment herein described, as such it will be clear that the cross-sectional shape of in particular the pole's column and base is not limited to a cylindrical cross-section and oval, but that multi-gonal cross-sections are equally possible.

Although the utility pole is preferably an all aluminium pole, the column and the base can be made of other materials including steel, iron, plastics or fiber reinforced composites.

Claims

1. A utility pole (1) including

- a column (3) for carrying a utility member such as a traffic light, a traffic sign, a luminaire, a flag or the like, and
- a base (5) for anchoring the pole to the ground and
- a frangible tube section (7) connecting the column and the base wherein, the frangible section (7) is of a brittle aluminium

alloy having an elongation value as measured and expressed by the elongation $A_{50_{mm}}$ index of equal to or less than 2% and an $R_{p0,2}$ strength value of at least 180 Mpa.

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2. The pole of claim 1 wherein the frangible tube section includes a top and bottom portion (13,15) insertable into to respectively the column (3) and the base (5).
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3. The pole of claim 2 wherein the frangible tube section further includes an intermediate portion (9) and this intermediate portion remains exposed between the column and the base.
- 15
4. The pole of claim 2 or 3 wherein the intermediate portion (9) is a shoulder portion flush with or projecting outward with respect to the column.
- 20
5. The pole of claim 1, 2, 3 or 4 wherein the frangible tube section is connected to the column and the base by an adhesive.
- 25
6. The pole of any of the claims 1-5 wherein the pole is rated according to European standard EN 12767 as being in non energy absorbing category and having an occupant safety level rating of 1,2 or 3
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7. The pole of any of the preceding claims wherein the aluminium alloy is a cast aluminium alloy.

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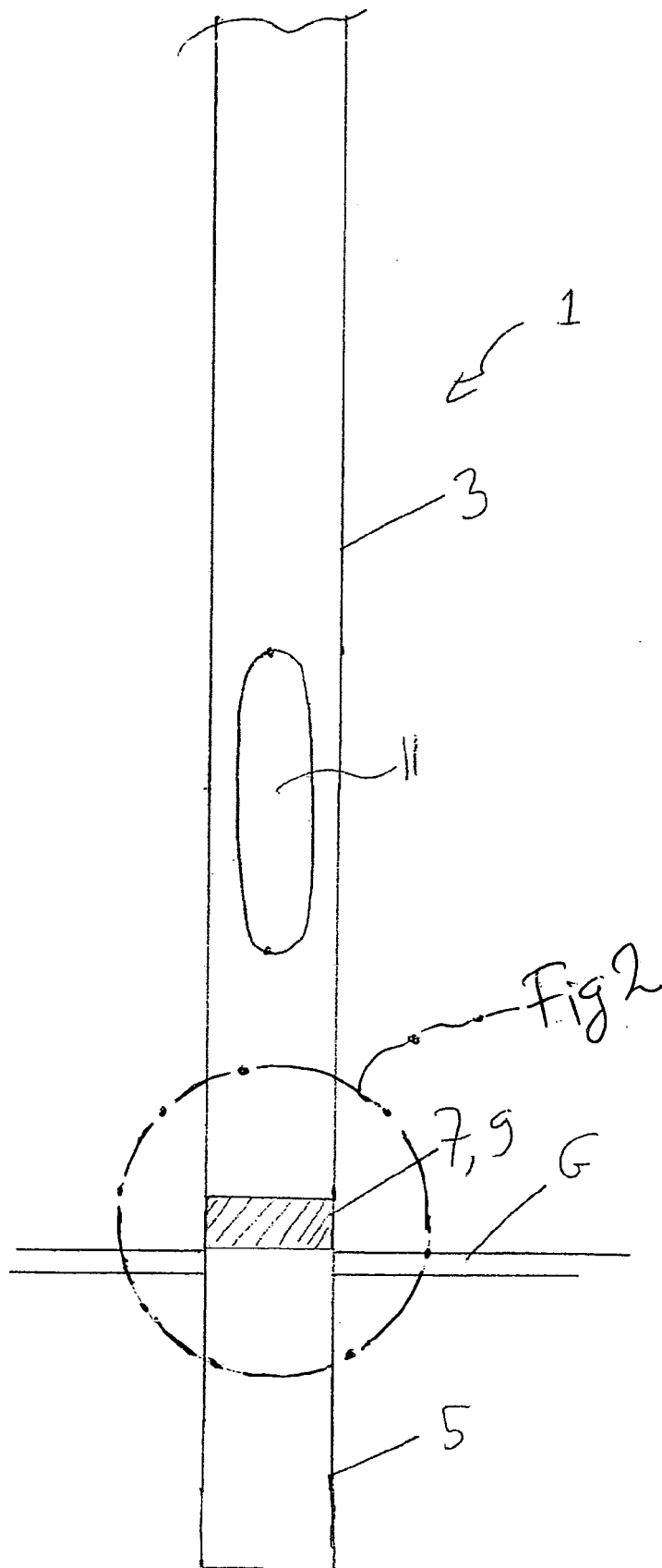


FIG 1

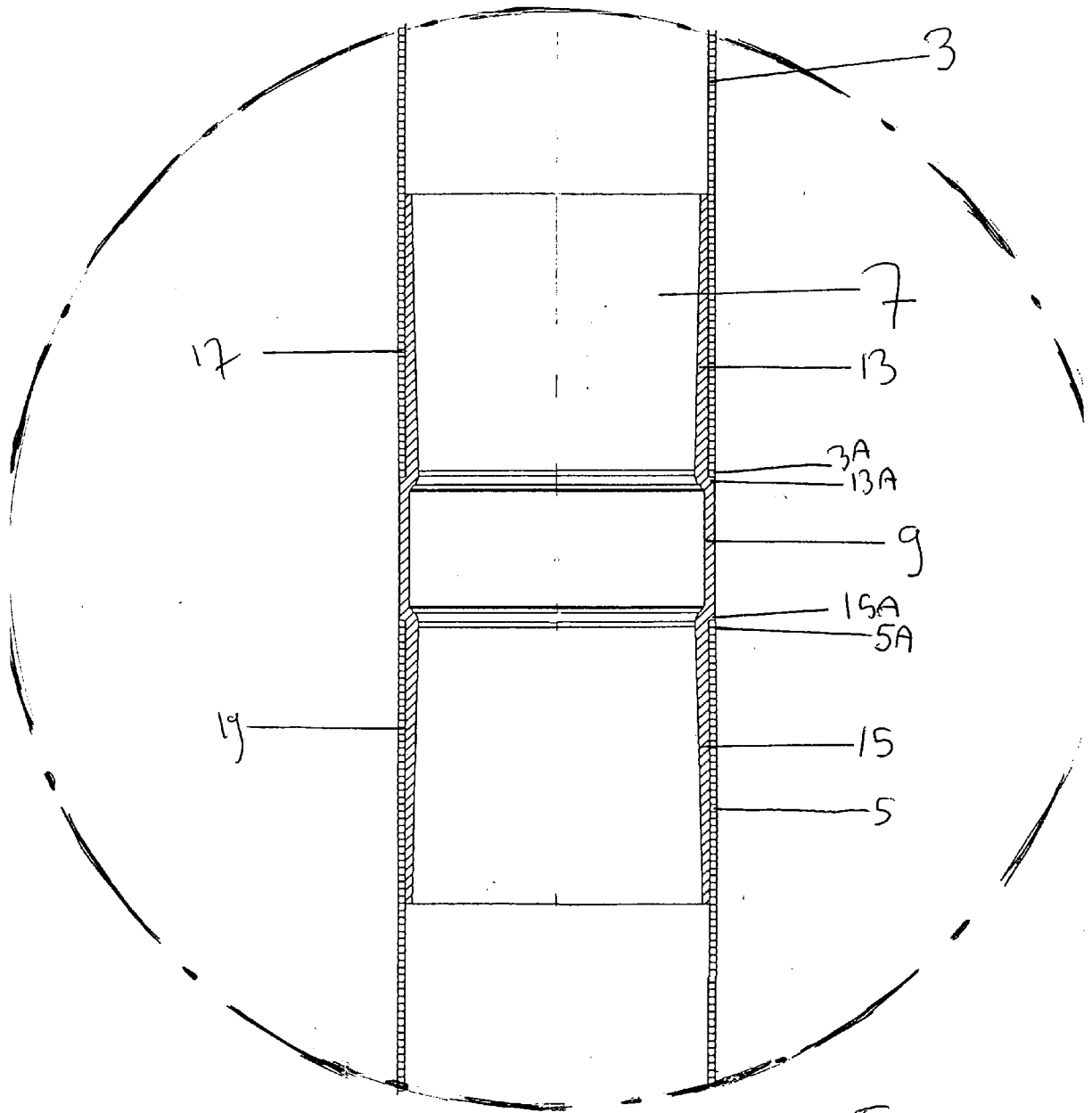


FIG. 2

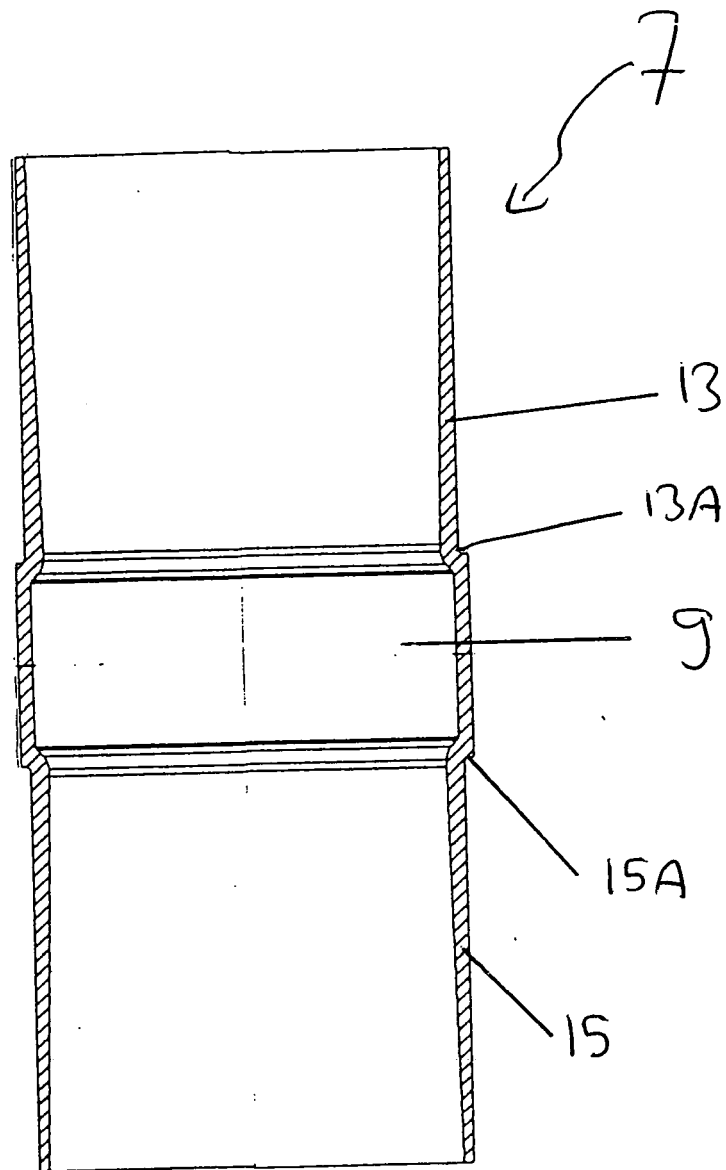


FIG. 3

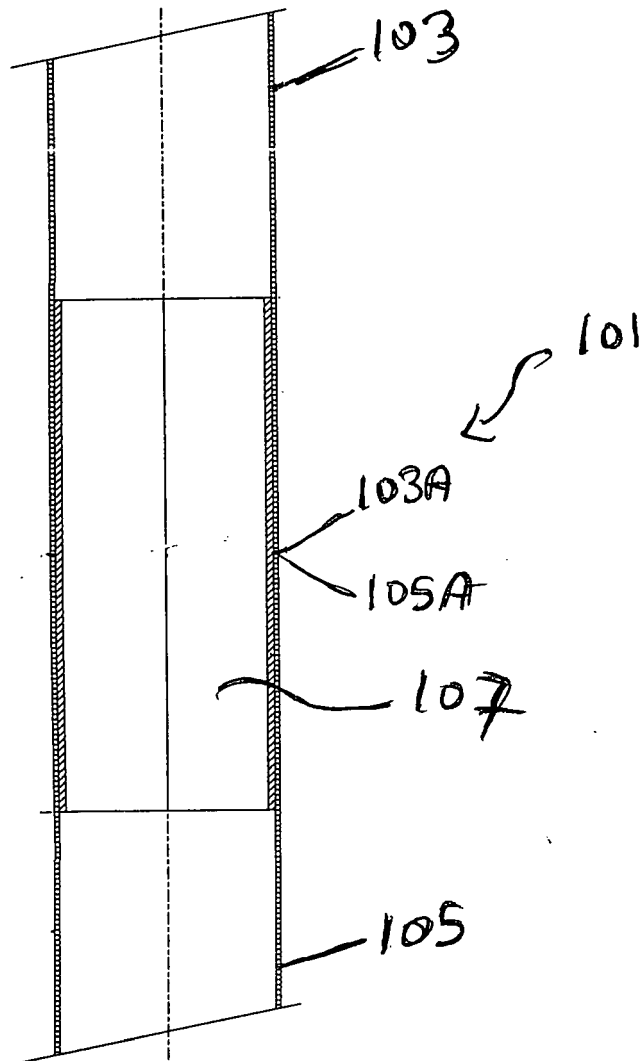


FIG. 4

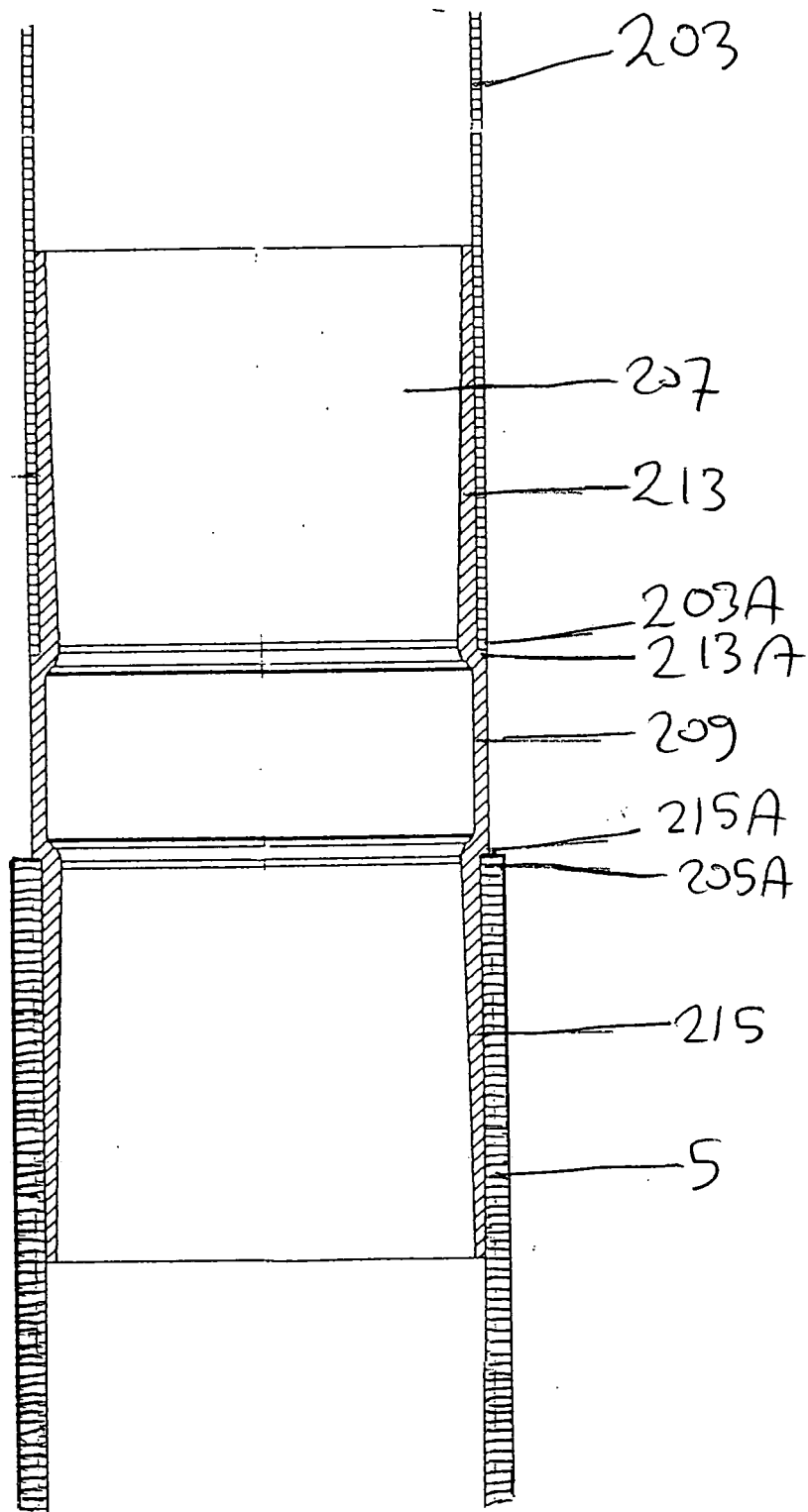


FIG 5



EUROPEAN SEARCH REPORT

Application Number
EP 10 25 1141

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CA 889 569 A (POWERLITE DEVICES LTD) 4 January 1972 (1972-01-04) * the whole document *	1	INV. E01F9/018
A,D	EP 2 014 850 A1 (SAPA PROFILES NL B V [NL]) 14 January 2009 (2009-01-14) * paragraph [0010]; figures 1,4 *	1	
A	US 6 457 895 B1 (SALMAN MARK T [US]) 1 October 2002 (2002-10-01) * column 5, lines 44-51; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			E01F E04H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 November 2010	Examiner Flores Hokkanen, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 25 1141

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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29-11-2010

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
CA 889569	A	04-01-1972	NONE		
EP 2014850	A1	14-01-2009	NL	2000744 C2	13-01-2009
US 6457895	B1	01-10-2002	CA	2417436 A1	28-07-2004

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2014850 A [0005]
- US 5535555 A [0005]
- EP 0156158 A [0005]
- US 6516573 B [0005] [0007]
- US 20080250752 A [0005] [0007]
- EP 146401 A [0005] [0007]