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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Container for welding wire with two superimposed retainers**

(57) A container for packaging a coil of welding wire, comprising a hollow body (1) with a peripheral wall (2) and a bottom part (3), said hollow body (1) further comprising a first retainer (4), said first retainer (4) having a first diameter (D1) and being axially mobile in said hollow body (1). Further, it comprises a second axially mobile retainer (5) positioned on the first retainer (4), said first and second retainers (5) having each a flat ring-shape with a central opening (14, 15), the second retainer (5) having a second diameter (D2) less than the first diameter (D1).

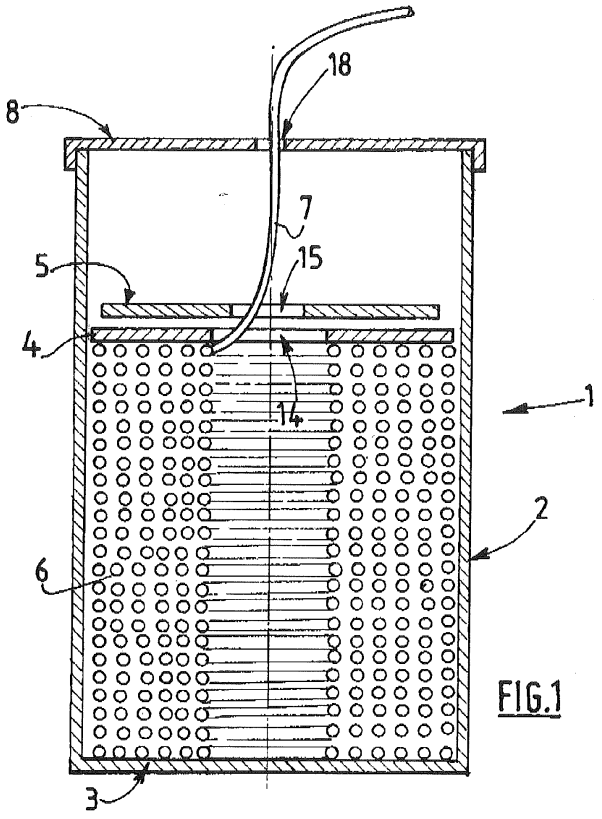

FIG.1

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Description

[0001] The present invention relates to a container or a drum for packaging, storing, transporting and unwinding a coil or spool of welding wire with two internal mobile rings or retainers for holding the wire spool.

[0002] A major well-known problem in automatic and robotic welding, when using a welding wire that comes out of a drum and that is delivered to a welding torch or similar, are the twists of the wire that are created by the coil spooling process. Indeed, twists often appear when a wire is extracted from a drum or similar by the welding machine comprising the welding torch to which the wire is fed.

[0003] Actually, when a welding wire is packed in a round container, such as a cylindrical-shaped drum, the wire is always twisted. Afterwards, the twists are released, when the wire leaves the drum during the unwinding of the wire coil, i.e. when the wire is progressively consumed by a welding device.

[0004] However, twists in wire are a serious concern as they lead to subsequent welding defects and quality problems in the welding joints thus obtained. Indeed, the twists involve wire distortions leading to oscillations of the wire in the contact tip of the welding equipment, i.e. the welding torch or similar, and to an irregular distribution of the wire during the welding operation.

[0005] In an attempt to solve this problem, document EP-A-519424 proposes a container with a retainer device placed on the top of the coil and having an outer periphery matching the diameter of the inner wall of the container and an inner bell-mouthed portion defining a wire extraction opening.

[0006] Another proposed solution is disclosed in EP-A-636098 which teaches the use of a square box with an internal flat cover, arranged on the wire coil and having a peripheral square border that matches the internal shape of the box.

[0007] Another proposed solution is disclosed in EP-A-1053189 which discloses a polygonal box-like body for accommodating a circular coil of wire and a retainer device arranged inside the body on the coil for preventing accidental entanglement of the wire, and a wire conduit device for the guidance of the wire out from the body during the unwinding. The retainer device described in EP-A-1053189 is however too complicated and expensive to manufacture commercially.

[0008] EP-A-1693139 discloses a drum for a welding wire coil comprising a wire holding device positioned on the coil for holding it. The holding device has a rigid central disc and a flexible cover with a dimension greater than an inner diameter of the drum so that corner portions of the cover slightly rise along an inner wall of the drum.

[0009] EP-A-1693140 discloses a drum with a conical, tapered or pyramidal inner wall formed of oblique pieces and comprising a rigid central disc with a central orifice positioned on the coil and across which the wire passes, and further with flexible and deformable peripheral expansions projecting beyond the edge of the disc to maintain the wire loops.

[0010] However, these devices using a disk-shape retainer or more complicated devices arranged on the top of the wire spool are not ideal because they are not able to correctly maintain the spirals of wire and/or do not permit a smooth unwinding of the wire spool during a welding operation. In other words, the above disclosed retainers or similar devices do not retain the welding wire and/or avoid or limit the twists in a satisfying manner when used in an industrial environment, i.e. when the wire is progressively consumed by a welding apparatus, such as a welding robot or similar device.

[0011] As a consequence, there is still a need for a new container for storing and transporting welding wire coil that is easy and cost effective to manufacture, that allows a efficient maintaining of the coil and/or at least limits the problem of twists and non uniform unwinding of the wire coil.

[0012] Further, the container should preferably be configured so as to prevent the wire from passing between the peripheral border of the retainer ring and the inner surface of the drum while the welding machine is pulling out the wire through the central hole of the retainer device. This serves to prevent the wire from laying on a portion of the retainer device and being blocked from further pulling..

[0013] The retainer device should also preferably be able to exercise a constant pressure on the spool without becoming blocked by the walls of the drum, while the spool unwinds downwardly in the drum.

[0014] Furthermore, the container should preferably also be easy to transport and to handle, stable during utilization and preferably made of recycle material, such as cardboard.

[0015] A solution according to the invention is a container for packaging a coil of welding wire formed of a hollow body which comprises a peripheral wall and a bottom part, said hollow body further comprising a first retainer, said first retainer 4 having a first diameter D1 and being axially mobile in said hollow body 1, characterized that it comprises a second axially mobile retainer positioned on the first retainer 4, said first and second retainers each having a flat ring-shape with a central opening, the second retainer having a second diameter D2 less than the first diameter D1, i.e. D2 < D1.

[0016] Depending on the embodiment, a container or drum according to the present invention can comprise one or several of the following additional features:

- the retainer arranged on the top of the welding wire coil maintains the wire spirals of the spool.
- the first retainer has a first diameter D1 that matches the internal diameter D of the peripheral wall of the hollow body.
- the first retainer has a first diameter D 1 that is slightly less than the internal diameter D of the peripheral wall of the hollow body, i.e. the space E between the peripheral border of the first retainer and the inner wall of the container

is less than 5 mm, preferably less than 3 mm.

- the first diameter D1 of the first retainer is of between 50 and 100 cm, preferably between 50 and 70 cm, for example of between about 50 to 55 cm.
- the second diameter D2 of the second retainer is of between 49 and 99 cm, preferably between 49 and 69 cm, for example of between about 49 to 54 cm.
- the first dimension d1 of the first central opening of the first retainer is greater than the second dimension d2 of the second central opening of the second retainer.
- the first dimension d1 of the first central opening of the first retainer is of between 30 and 79 cm, preferably between 35 and 50 cm, for example of between about 36 to 37 cm.
- the second dimension d2 of the second central opening of the second retainer is of between 29 and 78 cm, preferably between 30 and 45 cm, for example of between about 33 to 34 cm.
- the wire contained in the container can be any type of wire including submerged arc welding wires, solid wires, flux cored wires, metal cored wires or any other types of welding wires.
- the wire contained in the container has a surface coating, such as a copper surface layer, the surface coating preferably having a thickness of between 0,1 to 1,5 μm.
- the wire contained in the container has no surface coating.
- the first and second retainers are arranged on the top of the welding wire coil.
- the first and second retainers are made of cardboard or of any other suitable material, such as polymer, wood, composite, metal....
- the first retainer and the second retainer are superimposed and in direct contact one another.
- the first retainer and the second retainer can move one with respect to the other during unwinding, thereby creating a space between them. This results in a better control of the wire unwinding process, and eliminates or at least strongly limits wire deformation during unwinding.
- the first retainer and/or the second retainer have a general circular shape.
- a circular coil of welding wire is disposed on the bottom part in said hollow body.
- The hollow body comprises a cover for closing the container. Preferably, the cover comprises a central outlet or orifice for the wire to be pulled through.
- the peripheral wall of the hollow body is made of cardboard material.
- the container has a generally cylindrical shape.
- alternatively, the container has a generally polygonal shape, i.e. square, pentagonal, hexagonal, octagonal or similar shape.
- the peripheral wall of the hollow body is made of a multi-layer cardboard material, preferably a three or more layer cardboard.
- the hollow body is made of one rectangular piece of cardboard that is bent so as to obtain a circular hollow body and having two opposite parallel edges attached one to the other.
- the internal diameter of the hollow body is from between 45 cm and 120 cm, preferably from between 30 and 70 cm.
- the height of the hollow body is of between 65 and 130 cm, preferably from between 75 and 110 cm.

[0017] A container according to the present invention can be used in a robotic or automatic welding operation, preferably an electric arc welding process, such as a MIG or MAG welding process.

[0018] The present invention will be better understood thanks to the following description of several possible embodiments of a container according to the present invention, which is made in references to the accompanying figures among which:

- Figure 1 represents a view in cross-section of an embodiment of a container according to the present invention,
- Figures 2 represents (view in cross-section) the retainers of the container of Figure 1,
- Figure 3 shows (view from the top) the retainers and container of Figures 1 and 2,
- Figures 4 and 5 show two alternative embodiments (view from above) of the retainers and container of Figures 1 and 2,
- Figure 6 shows comparative shapes of two wires extracted from a container according to the present invention and from another container according to the prior art.

[0019] Figure 1 shows an embodiment of a container or drum for packaging a coil or spool 6 of welding wire 7, such as a flux cored wire or a metal cored wire, according to the present invention.

[0020] The welding wire container comprises a unique hollow body 1, which comprises a peripheral wall 2 and a bottom part 3 at its lower end, said bottom part 3 is integral with the peripheral wall 2.

[0021] The hollow body 1 can further comprise, at its upper end, a cover 8 for closing the container with a central orifice 18, such as a hole or a slot, through which the wire 7 passes during the unwinding of the spool 6 during a welding operation, so that the wire 7 is extracted from the hollow body 1 through the small outlet 18 arranged at the center of

the cover 18.

[0022] The hollow body 1, the bottom part 3 and the cover 8 are preferably made of cardboard, such as reinforced cardboard or similar.

[0023] In the present embodiment, the hollow body 1 has a cylindrical shape. However, it can have other shapes, including polygonal shapes such as square (See Figure 4), pentagonal, hexagonal or octagonal (see Figure 5).

[0024] Preferably, the retainers 4, 5 have peripheral profiles or shapes that can match the inner wall of the drum as visible in Figures 3 to 5. However, the first and second retainers 4, 5 may also have different shapes or profiles, for example one can be circular, whereas the other can be polygonal.

[0025] Peripheral wall 2 is preferably made of one rectangular piece of cardboard that is bent so as to obtain the desired shape forming the hollow body 1 and having its two opposite parallel edges attached one to the other, for instance stapled, glued or bonded together so as to obtain a closed body. The bottom part 3 is fixed to said peripheral wall 2 by any suitable connection means, for instance it can be stapled, glued, bonded or similar.

[0026] The internal diameter D of the hollow body 1 is typically between 45 cm and 120 cm, but preferably between 30 and 70 cm, whereas its height is generally between 65 and 130 cm, preferably between 75 and 110 cm.

[0027] A circular coil 6 of welding wire 7 is disposed on the bottom part 3 in said hollow body 1. Said wire spool 6 comprises a plurality of wire turns forming spirals.

[0028] According to the present invention, a pair of superimposed mobile retainers 4, 5 is arranged on the top of the welding wire coil 6. In other words, the retainers 4, 5 are place one on the other so as to be in contact one another.

[0029] The first 4 and second 5 retainers are used for maintaining the wire spirals of the coil 6 and for ensuring a smooth extraction of the wire 7 during unwinding, i.e. the wire exits with no or limited twists or knots.

[0030] The axially-mobile retainers 4, 5 both comprise a central opening 14, 15, respectively, through which passes the wire 7, before passing through the central orifice 18 of the cover 8, while being extracted/pulled by the welding machine, such as a welding robot or the like. The axially-mobile retainers 4, 5 maintain the wire spirals due to their top-to-bottom motion and weight, and thereby preventing accidental entanglement of the wire spirals forming the spool 6.

[0031] Each retainers 4, 5 consists in a perforated generally flat structure, typically a flat structure, such as a disc made of cardboard, wood or plastic or a combination of these materials. According to the invention, it is important that the first and second retainers 4, 5 have each a flat ring-shape with a central opening 14, 15.

[0032] The first and second retainers 4, 5 can have a same thickness and/or a same weight or have different thicknesses and/or weights, for example a thickness comprises between 0,5 and 20 mm and a weight comprised between 50 g and 5 kg preferably between 60 and 1 kg.

[0033] For example, good results have been obtained using a first and a second retainer 4, 5 having the characteristics given in the following Table 1, in a cylindrical drum having an inner diameter of 510 mm.

Table 1

	External diameter	Internal diameter	Thickness	Weight	Material
First retainer	507 mm	360 mm	0,8 mm	60 g	High density cardboard or paper
Second retainer	495 mm	340 mm	4 mm	400 g	High density cardboard or paper

[0034] According to the present invention, it is also important to carefully choose the dimensions, i.e. the diameters D1, D2, to avoid the wire passing between the peripheral border of the first retainer 4 and the inner surface of the peripheral wall 2 of the drum, and further the dimensions of the central opening 14, 15 of the retainer 4, 5 are also carefully chosen to allow a constant and continuous feeding of the wire 7 to a welding torch, at nearly constant drawing force, so that the spooled wire 6 is prevented from entangling and forming loops, as the wire is constantly kept under the axially-mobile retainers 4, 5.

[0035] As illustrated in Figure 1, the first and second retainers 4, 5 have both a smaller size, i.e. diameter D1, D2, than the internal diameter D of the container 1 so that they can freely descend in the container in contact with the coil as the height of said coil decreases as the wire 7 is being unwound from the coil 6.

[0036] However, in order to ensure an efficient maintaining of the spirals the first diameter D 1 of the first retainer 4 is slightly less than the internal diameter D of the container, i.e. the first diameter D1 of the first retainer 4 matches the inner shape and is almost equal to the internal diameter D of the container 1.

[0037] As represented in Figure 2 and 3, the second retainer 5 should have a second diameter D2 that is less than the first diameter D 1 of the first retainer 4 and than the internal diameter D of the container 1, i.e. $D2 < D1 < D$.

[0038] For example, the peripheral border of the first retainer 4 can be spaced from the inner wall 2 of the drum 1 of a distance E of about 1 to 3 mm, whereas the peripheral border of the second retainer 5 can be spaced from the inner

wall 2 of the drum 1 of a greater distance E', for example of about 15 to 30 mm.

[0039] In this way, wire spirals cannot bypass the retainers 4, 5 and be blocked inside the hollow body 1, when the welding machine is pulling out the wire 7 from the container.

[0040] Furthermore, the first dimension d1 of the first central opening 14 of the first retainer 4, i.e. its internal diameter as shown in Figure 2, is greater than the second dimension d2 of the second central opening 15 of the second retainer 5, i.e. its internal diameter, i.e. d1 > d2. This is important for ensuring a smooth extraction of the wire 7.

[0041] A container according to the present invention leads to unexpected results in terms of the removal of wire twists or similar effects as shown in Figure 6.

[0042] Thus, wire A extracted from a container according to the present invention (see Figure 6) exhibits a rather straight-line shape, i.e. almost without any twists or waves, whereas wire B extracted from a container according to the prior art comprising a unique internal retainer, exhibits a rather wave-shape which is problematic for ensuring a smooth and regular automatic or robotic welding operation using said wire B.

[0043] The wire amplitude on the floor (as shown in fig. 6) and helix for wires A and B are given in Table 2 below.

Table 2

	Wire A	Wire B
Wire amplitude on the floor	< 10 cm	20 +/- 35 cm
Wire helix	< 0,5 cm	2 +/- 10 cm

[0044] As one can see, the wire amplitude and helix are both much less for wire A (invention) than for wire B (prior art), leading to a straighter and more linear wire after unwinding. This limits the wire oscillations in the contact tip of the welding torch or similar device, and subsequent welding defects.

[0045] These superior results are possible due to the 2-retainer arrangement according to the present invention because, during unwinding of the wire, a gap is created between the two retainers, both independently acting on the wire and guiding it while it is pulled out of the drum, thereby minimizing wire loop formations.

[0046] For transportation and storage, the container of the invention can be arranged on a pallet, for instance a pallet made of wood or of polymer material.

[0047] The container according to the invention is suitable for use in a robotic or automatic welding operation, such as laser or arc welding process, preferably an electric arc welding process, such as a MIG or MAG welding process. During such a welding process, the wire extracted from the container is fed to a welding torch that is either arranged on a welding machine or on a robotic articulated arm, said torch being used for progressively melting the welding wire and thus obtaining a welding joint.

Claims

1. Container for packaging a coil of welding wire, comprising a hollow body (1) with a peripheral wall (2) and a bottom part (3), said hollow body (1) further comprising a first retainer (4), said first retainer (4) having a first diameter (D1) and being axially mobile in said hollow body (1), characterized that said hollow body (1) further comprises a second axially mobile retainer (5) positioned on the first retainer (4), said first and second retainers (4, 5) each having a flat ring-shape with a central opening (14, 15), the second retainer (5) having a second diameter (D2) less than the first diameter (D1).

2. Container according to Claim 1, **characterized in that** the first retainer (4) has a first diameter (D1) that matches an internal diameter (D) of the peripheral wall (2) of the hollow body (1).

3. Container according to any one of the previous Claims, **characterized in that** a first dimension (d1) of the first central opening (14) of the first retainer (4) is greater than a second dimension (d2) of the second central opening (15) of the second retainer (5).

4. Container according to any one of the previous Claims, **characterized in that** the first and second retainers (4, 5) are arranged on the top of a welding wire coil (6) positioned inside the hollow body (1).

5. Container according to any one of the previous Claims, **characterized in that** the first and second retainers (4, 5) are made of cardboard.

6. Container according to any one of the previous Claims, **characterized in that** the first retainer (4) and the second retainer (5) are superimposed and in direct contact with one another.

7. Container according to any one of the previous Claims, **characterized in that** the first retainer (4) and the second retainer (5) have a generally circular shape.

8. Container according to any one of the previous Claims, **characterized in that** a circular coil (6) of welding wire (7) is disposed on the bottom part (3) in said hollow body (1).

9. Container according to any one of the previous Claims, **characterized in that** the container comprises a cover (8).

10. Container according to any one of the previous Claims, **characterized in that** the peripheral wall (2) of the hollow body (1) is made of cardboard material.

11. Container according to any one of the previous Claims, **characterized in that** the internal diameter (D1) of the hollow body (1) is between 45 cm and 120 cm and that the height of the hollow body (1) is between 65 and 120 cm.

12. Container according to any one of the previous Claims, **characterized in that** the hollow body (1) has a cylindrical shape.

13. Robotic or automatic welding process, wherein a welding wire is melted by an electric arc or a laser beam, **characterized in that** the wire delivered to the welding torch is extracted from a container according to any one of the previous Claims.

Amended claims in accordance with Rule 137(2) EPC.

1. Container for packaging a coil of welding wire, comprising a hollow body (1) with a peripheral wall (2) and a bottom part (3), said hollow body (1) further comprising a first retainer (4), said first retainer (4) having a first diameter (D1) and being axially mobile in said hollow body (1), and a second axially mobile retainer (5) positioned on the first retainer (4), said first and second retainers (4, 5) each having a flat ring-shape with a central opening (14, 15), the second retainer (5) having a second diameter (D2) less than the first diameter (D1), the first and second retainers (4, 5) being arranged on the top of a welding wire coil (6) positioned inside the hollow body (1), a first dimension (d1) of the first central opening (14) of the first retainer (4) being greater than a second dimension (d2) of the second central opening (15) of the second retainer (5),
characterized in that the first retainer and the second retainer can move one with respect to the other during unwinding, thereby creating a space between them and both independently acting on the welding wire and guiding it while it is pulled out of the container.

2. Container according to Claim 1, **characterized in that** the first retainer (4) has a first diameter (D1) that matches an internal diameter (D) of the peripheral wall (2) of the hollow body (1).

3. Container according to any one of the previous Claims, **characterized in that** the first dimension (d1) of the first central opening of the first retainer is of between 30 and 79 cm, and the second dimension (d2) of the second central opening of the second retainer is of between 29 and 78 cm.

4. Container according to any one of the previous Claims, **characterized in that** the peripheral border of the first retainer (4) is spaced from the inner wall (2) of the container (1) of a first distance (E) of about 1 to 3 mm, and the peripheral border of the second retainer (5) is spaced from the inner wall (2) of the container (1) of a second distance (E') of about 15 to 30 mm.

5. Container according to any one of the previous Claims, **characterized in that** the first and second retainers (4, 5) are made of cardboard.

6. Container according to any one of the previous Claims, **characterized in that** the first retainer (4) and the second retainer (5) are superimposed and in direct contact with one another.

7. Container according to any one of the previous Claims, **characterized in that** the first retainer (4) and the second

retainer (5) have a generally circular shape.

8. Container according to any one of the previous Claims, **characterized in that** a circular coil (6) of welding wire (7) is disposed on the bottom part (3) in said hollow body (1).

9. Container according to any one of the previous Claims, **characterized in that** the container comprises a cover (8).

10. Container according to any one of the previous Claims, **characterized in that** the peripheral wall (2) of the hollow body (1) is made of cardboard material.

11. Container according to any one of the previous Claims, **characterized in that** the internal diameter (D) of the hollow body (1) is between 45 cm and 120 cm and that the height of the hollow body (1) is between 65 and 120 cm.

12. Container according to any one of the previous Claims, **characterized in that** the hollow body (1) has a cylindrical shape.

13. Container according to any one of the previous Claims, **characterized in that** the retainers (4, 5) have a thickness comprised between 0,5 and 20 mm.

14. Container according to any one of the previous Claims, **characterized in that** the retainers (4, 5) have a weight comprised between 50 g and 5 kg.

15. Robotic or automatic welding process, wherein a welding wire is melted by an electric arc or a laser beam, **characterized in that** the wire delivered to the welding torch is extracted from a container according to any one of the previous Claims.

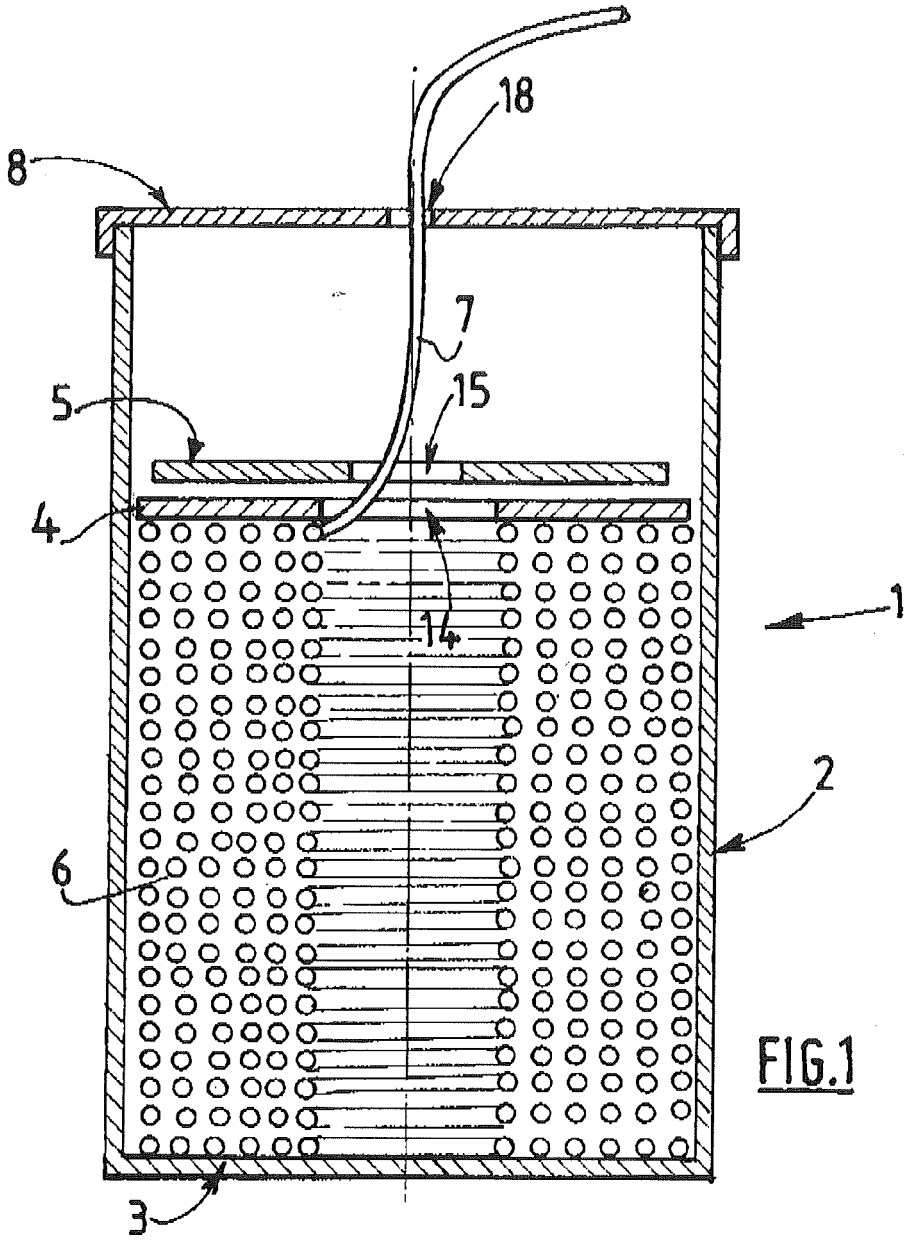

FIG.1

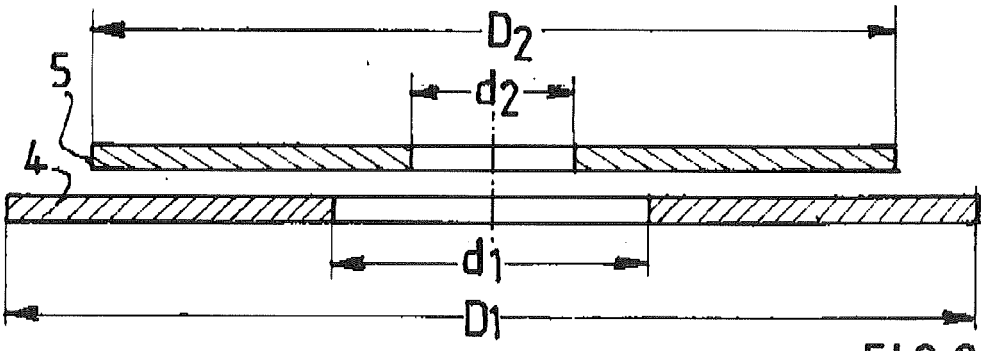

FIG.2

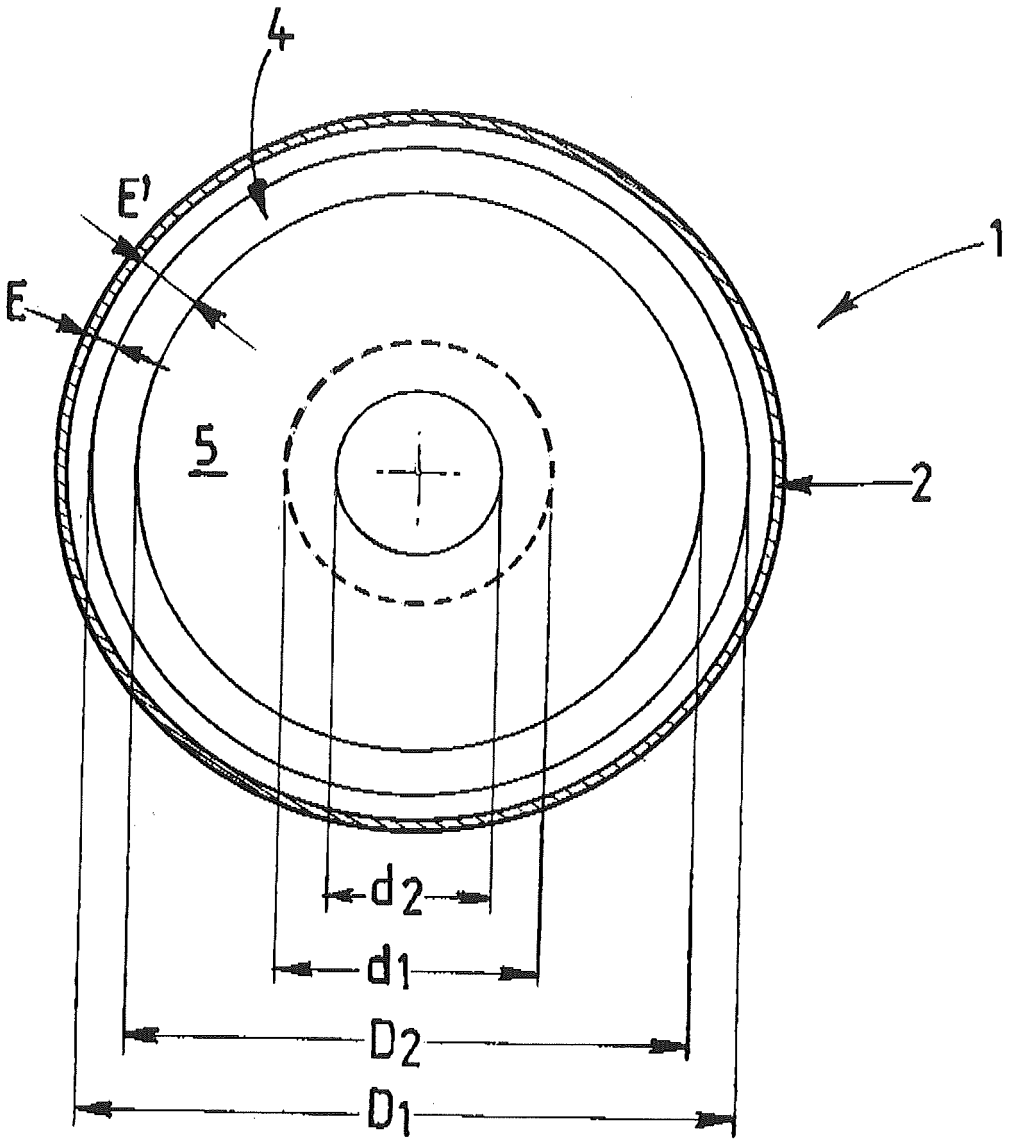

FIG. 3

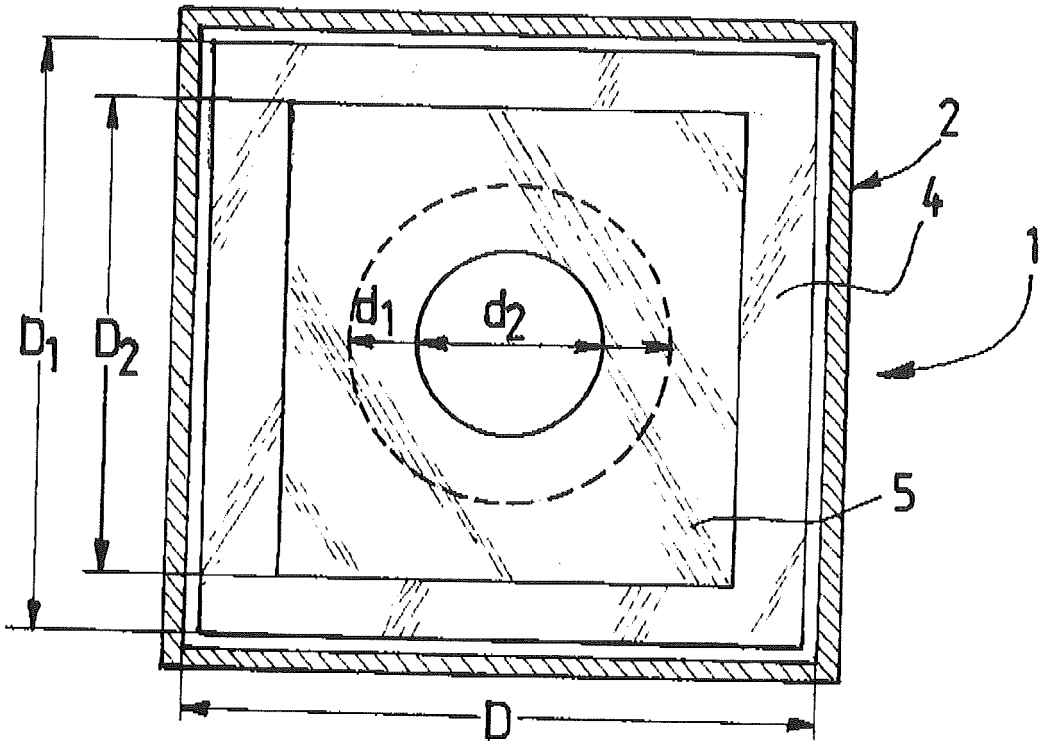

FIG.4

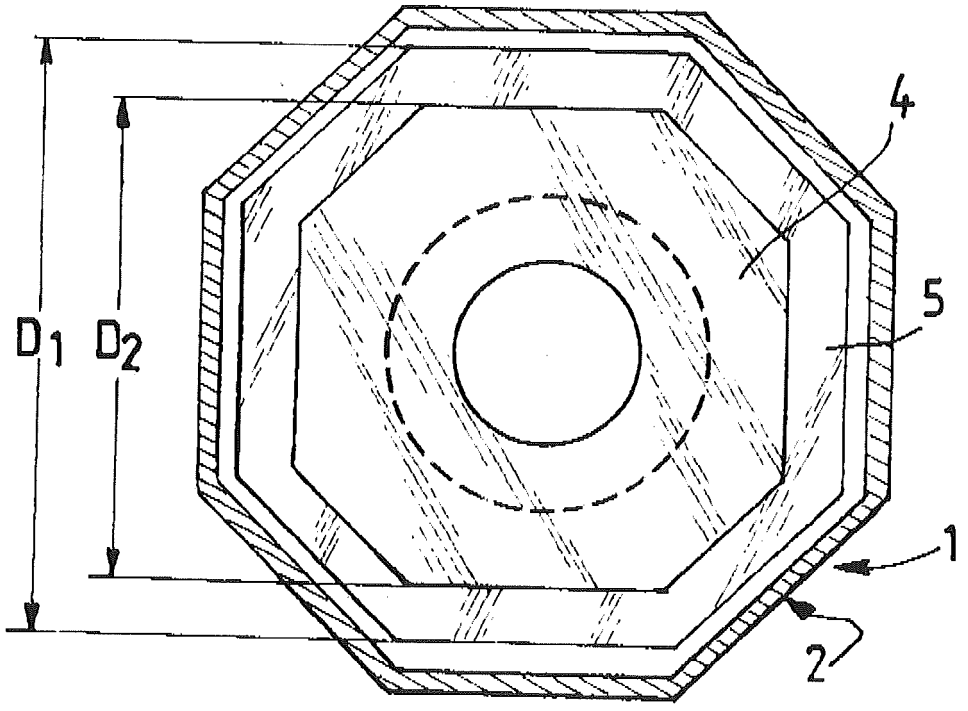

FIG.5

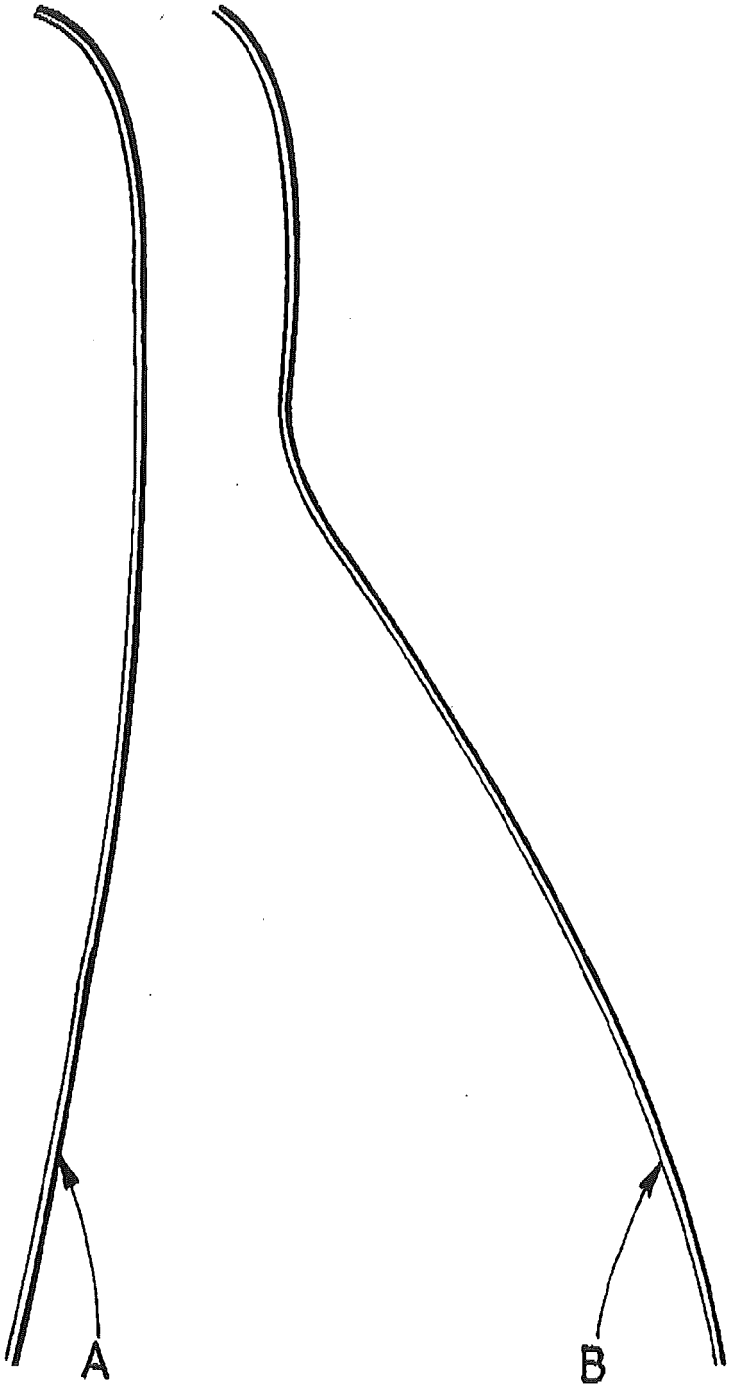

FIG.6

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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 3193

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	JP 61 092674 U (- NOT AVAILABLE -) 16 June 1986 (1986-06-16) * figures 1,2 * -----	1-13	INV. B65D85/04 B65H49/08
X	US 2008/142567 A1 (KIM YONG CHUL [KR] ET AL) 19 June 2008 (2008-06-19) * abstract; figures 3-5,7 * * paragraph [0038] - paragraph [0085] * -----	1,8,13	
X	US 2012/006802 A1 (BAE HYO YOUNG [KR]) 12 January 2012 (2012-01-12) * abstract; figures 2,3A-3C,6,12 * * paragraph [0080] - paragraph [0087] * * paragraph [0118] - paragraph [0133] * * paragraph [0146] - paragraph [0155] * -----	1,8,13	
A	EP 2 354 039 A1 (OERLIKON BUEHRLE SCHWEISSTECH [DE]) 10 August 2011 (2011-08-10) * abstract; figure 1 * * paragraph [0022] - paragraph [0034] * -----	1-13	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 2 256 064 A1 (ISAF S P A [IT]) 1 December 2010 (2010-12-01) * abstract; figure 1A * * paragraph [0020] - paragraph [0028] * -----	1-13	B65D B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 February 2013	Segerer, Heiko

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 18 3193

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