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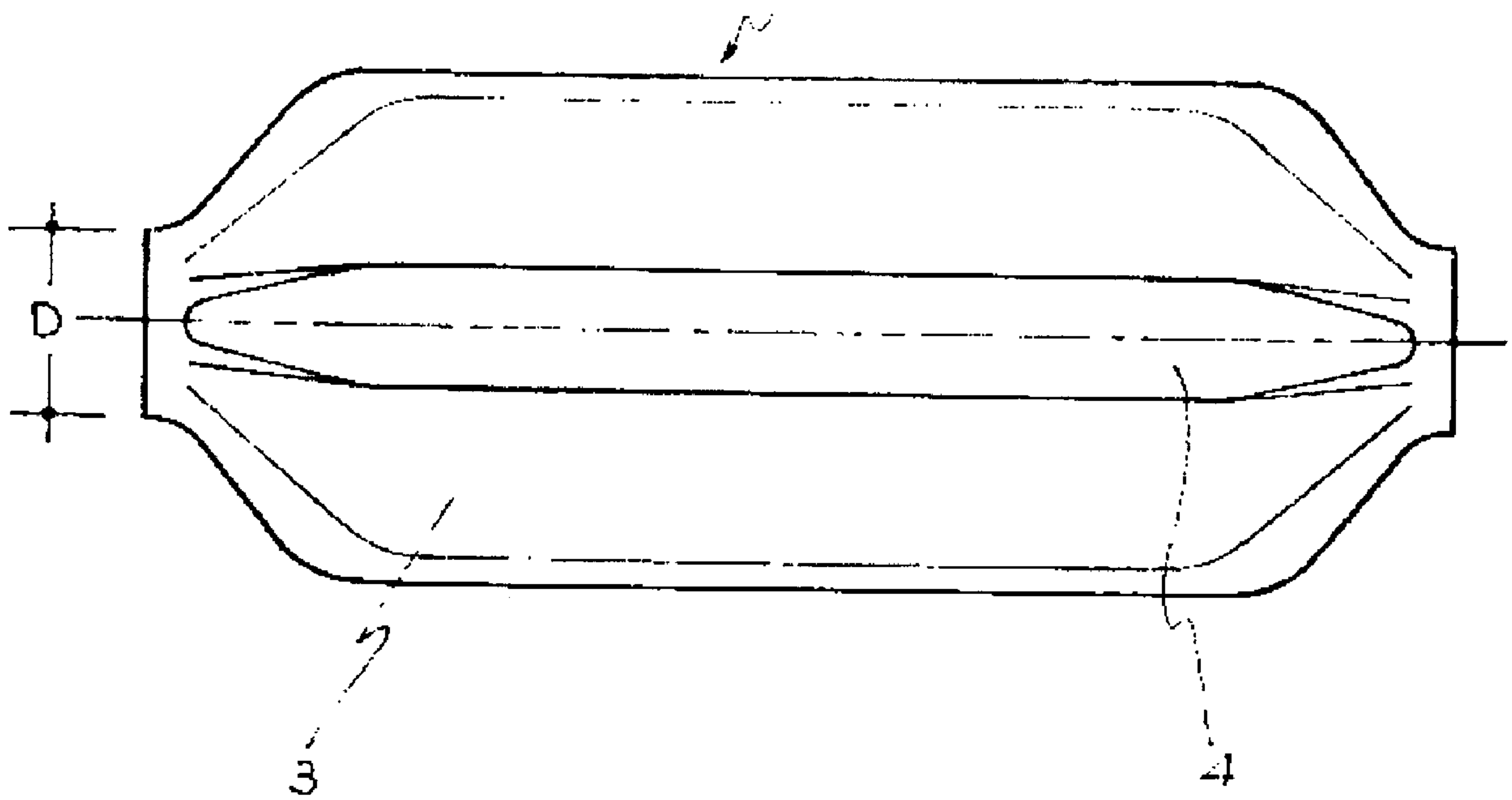
(54) Titre : CENTREUR POUR ELEMENTS TUBULAIRES FABRIQUES A PARTIR DE DEUX MATERIAUX ET PROCEDE DE FABRICATION CONNEXE
(54) Title: A CENTRALIZER FOR TUBULAR ELEMENTS MANUFACTURED FROM TWO MATERIALS AND A PROCESS OF MANUFACTURING SAID CENTRALIZER



(57) Abrégé/Abstract:
A centralizer (1,1') for tubular elements comprising: - an inner part (2,2') formed by a first material having high mechanical performance and chemical stability; - an outer part (3,3') arranged on said inner part (2,2'), formed by a second material, said second material being autolubricant, and with low coefficient of friction and having lower mechanical performance and chemical stability than those of said first material. A process of manufacturing the centralizer is also disclosed.

Abstract

A centralizer (1,1′) for tubular elements comprising:

- an inner part (2,2′) formed by a first material having high mechanical performance and chemical stability;
- an outer part (3,3′) arranged on said inner part (2,2′), formed by a second material, said second material being autolubricant, and with low coefficient of friction and having lower mechanical performance and chemical stability than those of said first material.

A process of manufacturing the centralizer is also disclosed.

"A centralizer for tubular elements manufactured from two materials and a process of manufacturing said centralizer"

Field of the Invention

The main objective of the present invention is providing a centralizer for tubular elements. More specifically, it refers to a centralizer for tubular elements such as both solid and hollow mechanical pumping rods, wherein movement of the string is alternatively upwards and downwards, such as the PCP type, wherein movement of the string is rotative; the body of the centralizer being formed by two materials, one of them is arranged within the inner part of said body, and the other one within the outer part of said body.

Brief description of the prior art

Currently available centralizers are manufactured from a unique material, generally a plastic material. The material is injected on the tubular element to be centralized, more specifically on a both hollow and solid pumping rod, it is arranged by means of a two-piece fitting joint, or it is assembled by other means.

In those cases wherein the material is injected on the tubular element, there is obtained a centralizer having a molecular framework and an attachment level to the tubular element significantly varying on the basis of the injecting conditions. However, under normal production conditions, the molecular framework of the centralizer can be adjusted as crystalline as possible, increasing the attachment thereof to the tubular element. Generally, either surface modification (such as sandblasting) or else slot machining for improving attachment of the centralizer is used.

When the centralizer is arranged by assembling multiple pieces, the attachment thereof is much weaker than using injection. Even more, some additional insertions may be added, such as pivots, screws, etc. to allow for positioning of the parts. On the other hand, assembling centralizers is advantageous because they can be more easily fitted in either position which may be desired.

Regarding the material properties, plastic is generally highly hard, and resistant to deterioration and corrosion. “Engineer polymers” are those which meet the necessary requirements to operate in oil wells. The most popular engineer polymers are polyphenylene sulphide (PPS), high temperature polyamides (PA), polyphthalamide (PPA), polyphenylene ether (PPE), usually modified by aggregates such as glass, minerals or aramid fibers. Ceramic enhancers are necessary for maintaining mechanical properties at high temperatures. Base polymers provide chemical resistance and use while the enhancing elements provide resistance to creep (“creep resistance”). The composite material improves the properties of the base polymer, which should be achieved in order to ensure the expected performance in very hard environments.

Although these materials have shown excellent performance in hard environments, they are expensive and some of them cause deterioration of the metallic piece against which they move. Examples of metallic damage due to the employment of a PPS centralizer in some oil wells have been reported. The presence of glass fiber as enhancer in the above mentioned centralizer has increased erosion and damage of the metallic surface, and has resulted in significant thickness reduction. Therefore, the materials of the centralizer of the invention should be those having a low coefficient of friction and low tendency to eroding the metallic surface. Polyamides belong to the family of polymers ensuring optimum movement conditions as they have a low coefficient of friction and they are capable of diminishing while exposed to long term duration with high temperature environments. However, it is such long term contact with high temperature environments that also deteriorates the mechanical properties, resulting in detachment.

It could be assumed that each possibility of having a unique material for manufacturing a centralizer has a clear disadvantage and a related problem as well, which in the end causes early extraction and replacement of the piece.

Documents US 2006/231250, US 6585043, WO 98/50669, CA 2101677, US 3963075, RU 2211911, US 2005/0241822, US 2004/0112592, US 2003/0070803, US 4793412, US 7156171, US 7182131, US 7140432 and US 6484803 disclose centralizers made from a unique material, including rollers or blades.

The centralizer of the present invention solves the two most important problems related to the performance of centralizers during operation: resistance to detachment of the tubular element, and a low coefficient of friction together with low deterioration and damage to the metallic piece.

It is therefore proposed a two-material centralizer, having an inner part manufactured from a strong, rigid material with high detachment strength, and an outer part manufactured from an autolubricant, and non-erosive material with a low coefficient of friction. Said centralizer is manufactured by a double injection process. Firstly, the inner part is injected. Then, the remaining volume is filled with the outer material. Within the interface, no chemical attachment is needed between both materials, to allow the outer part rotate around the inner part when torque is applied. The possibility of rotating around a core reduces the friction between the centralizer and the metallic surface. Additionally, the blades of the centralizer no longer move along a straight line during alternative movement of the centralizer but rather during contact with the whole inner tubular surface. Therefore, erosion of the metallic surface is not localized and total damage of the tubular piece is reduced.

Another advantage of the present invention is that the rotative outer part diminishes the strength detaching the centralizer. This is due to the fact that, even if the volume covered by the stronger material is lower than an eventual unique material centralizer, it does not deteriorate the resistance to detachment.

The invention makes the centralizer bear operation conditions with no detachment of the tubular part to which it is attached, and with no damage to the metallic surface to which it is in contact during movement.

The two-material centralizer also reduces the torque applied to the interface between the centralizer and the tubular element to which it is attached. This can be reached through a rotative outer part, which rotates around the inner part.

The rotating movement has an additional advantage: the blades of the centralizer can continuously rotate, preventing localized erosion of the metallic surface.

As a consequence, the present invention provides a solution for the above mentioned problems, namely:

- usage of two materials, mainly manufactured by injection-casting of polymeric materials, one over the other, the geometries of both parts being compatible based on the fact that the outer part is allowed to rotate around the inner part, and that the outer part has helicoidal blades;
- the inner material has a more elevated elasticity modulus as well as improved mechanical properties, even at high temperatures;
- the outer material has a low coefficient of friction and it is autolubricant, providing an optimum interface for continuous operation in contact with the tubular element walls;
- the rotative outer part allows for reduction of net torque, increasing the service life of the centralizer; and
- the centralizer may rotate 360° when in contact to the metallic surface, reducing localized erosion and the damage borne by the metallic surface.

Moreover, the process of localizing the centralizer consists in firstly injecting on the tubular element the inner material having high mechanical performance and chemical stability, for example PPS. Later, it is injected on the core the outer material, for example polyamide, having a low friction index but with better mechanical performance and chemical stability than the inner material.

Therefore, a PPS core is formed, which may be useful as an anchor to prevent the polyamide from detaching from the axial position taken by the device within the tubular element. In both cases, the grip is adjusted by means of a tighting effect on the plastic around the tubular element and the centralizer core. This effect is achieved by the volumetric contraction of the materials upon cooling after the injection process.

The outer material may not rotate around the core, depending on the application.

As a result, it is possible to manufacture centralizers meeting both options:
- rotative: in the case of elevated torque for which the first injection does not have longitudinal locks, and
- fixed: the first injection does have longitudinal locks.

Moreover, and depending on the application of the pumping rod, two geometric types for centralizers may be defined. One of them is geometrically straight, with longitudinal blades for the case of mechanical pumping rods; the other one is geometrically helicoidal, with helicoidal blades, for the PCP pumping rods, as previously described herein.

Object of the invention

As a consequence, it is an objective of the present invention to provide a centralizer for tubular elements characterized by comprising:
- an inner part formed by a first material having high mechanical performance and chemical stability;
- an outer part arranged on said inner part, formed by a second material – said second material being autolubricant, and with low coefficient of friction - having lower mechanical performance and chemical stability than those of said first material.

A further object of the present invention is a process of manufacturing the centralizer, characterized by comprising the following steps:
- injecting a first material forming an inner part on a tubular element; and
- injecting a second material on said formed inner part.

Brief description of the drawings

The invention will be better understood on the basis of the following drawings, namely:

Figures 1A and 1B show, respectively, a side view and a front view of a geometrically straight rotative centralizer of the invention.

Figures 2A and 2B show, respectively, a side view and a front view of a geometrically helicoidal rotative centralizer of the invention.

Figures 3A and 3B show, respectively, a side view and a front view of the core of a fixed centralizer of the invention including locks within the inner part thereof.

Detailed description of the invention

Figures 1A and 1B show a geometrically straight rotative centralizer 1 for mechanical pumping rods, comprising an inner part or core 2 manufactured from a strong, rigid material having high detachment strength, and an outer part 3 manufactured from a material with a low coefficient of friction and which is autolubricant and non-erosive. The inner diameter D of said inner part or core 2 is cooperative with that of the tubular element to be centralized. Outer part 3 has longitudinally cast blades 4 contacting tubing C with a view to centralizing the tubular element. Within the interface between said inner part 2 and outer part 3 there is no chemical attachment whatsoever, so that the outer part 3 can rotate around the inner part 2 when torque is applied.

Figures 2 A and 2 B show a geometrically helicoidal rotative centralizer 1´ for PCP pumping rods comprising an inner part or core 2´ manufactured from a strong, rigid material having high detachment strength, and an outer part 3´ manufactured from a material with a low coefficient of friction and which is autolubricant and non-erosive. The inner diameter D´ of said inner part or core 2 is cooperative with that of the tubular element to be centralized. Outer part 3´ has longitudinally cast blades 4´ contacting tubing C´ with a view to centralizing the tubular element. Within the interface between said inner part 2´ and outer part 3´ there is no chemical attachment whatsoever, so that the outer part 3´ can rotate around the inner part 2´ when torque is applied.

Figures 3 A and 3 B show in detail the inner part or core 2,2´ of a fixed centralizer of the present invention. Within the periphery of said inner part 2,2´ a plurality of locks 5, of any kind of geometry is included. Said plurality of locks 5 fulfill the function of preventing the outer part (not shown) of a fixed centralizer from rotating around said inner part 2,2´. A preferred example would be arranging 16 equispaced locks both circumferentially and longitudinally on said periphery of said inner part 2,2´ such as observed on Figures 3A and 3B, having the same substantially prismatic configuration. Any other kind of geometry and/or arrangement of the locks will depend on the manufacturing criteria employed, being well-known to a person skilled in the art.

The process of localization of a centralizer 1,1´ consists of injecting firstly on the tubular element, the inner material forming the inner part or core 2,2´ having high mechanical performance and chemical stability, for example PPS. Later, it is injected on said inner part 2,2´ the outer material forming the outer part 3,3´, for example polyamide, said part having a low friction index but lower mechanical performance and chemical stability than the inner material.

An alternative to that mentioned above is that the outer part 3,3′ should not rotate around the inner part 2,2′, depending on the application of the pumping rod. Consequently, centralizers 1,1′ may be manufactured, said centralizers meeting both options:

- rotative: in the case of elevated torque, for which the inner part (2,2′) does not include any equispaced locks 5 circumferentially and longitudinally arranged on the periphery thereof; and
- fixed: said inner part 2,2′ including equispaced locks 5 circumferentially and longitudinally arranged on the periphery thereof.

Claims

1. A centralizer (1,1′) for tubular elements comprising:
- an inner part (2,2′,) formed by a first material having high mechanical performance and chemical stability;
- an outer part (3,3′) arranged on said inner part (2,2′), formed by a second material – said second material being autolubricant and with low coefficient of friction - having lower mechanical performance and chemical stability than those of said first material.

2. The centralizer according to claim 1, wherein there is no chemical attachment on the interface between both inner part (2,2′) and outer part (3,3′).

3. The centralizer according to claim 1, wherein a plurality of locks (5) are arranged within the periphery of said inner part (2,2′).

4. The centralizer according to claim 3, wherein said plurality of locks (5) are arranged in an equispaced fashion, both circumferentially and longitudinally on said periphery of said inner part (2,2′), adopting a substantially prismatic geometry.

5. The centralizer according to claim 1, wherein the inner diameter (D,D′) of said inner part (2,2′) is cooperative with that of the tubular element to be centralized.

6. The centralizer according to claim 1, wherein said outer part (3,3′) has cast blades (4,4′) contacting tubing C′ of the well with a view to centralizing the tubular element.

7. The centralizer according to claim 6, wherein said blades (4) are longitudinal for the case of mechanical pumping rods, wherein the string has an upwards and downwards movement.

8. The centralizer according to claim 6, wherein said blades (4′) are helicoidal, for the case of PCP pumping rods, and the string has a rotative movement.

9. A process of manufacturing the centralizer according to claim 1, said process comprising the following steps:
- injecting a first material forming an inner part on a tubular element; and
- injecting a second material on said formed inner part.

10. The process according to claim 9, wherein said first material is a polymeric material having high mechanical performance and chemical stability, such as for example, PPS.

11. The process according to claim 9, wherein said second material is a polymeric material having a low friction index but lower mechanical performance and chemical stability than the inner material, such as for example polyamide.

12. The process according to claim 9, wherein the grip between said inner part and said tubular element is adjusted by means of a tighting effect on the plastic around said tubular element and said inner part of the centralizer, resulting from the volumetric contraction of the materials upon cooling, after the injection process.

13. The process according to claim 9, wherein a plurality of locks (5) are arranged within the periphery of de said inner part (2,2´).

14. The process according to claim 13, wherein said plurality of locks (5) are arranged in an equispaced fashion both circumferentially and longitudinally on said periphery of said inner part (2,2´), adopting a substantially prismatic geometry.

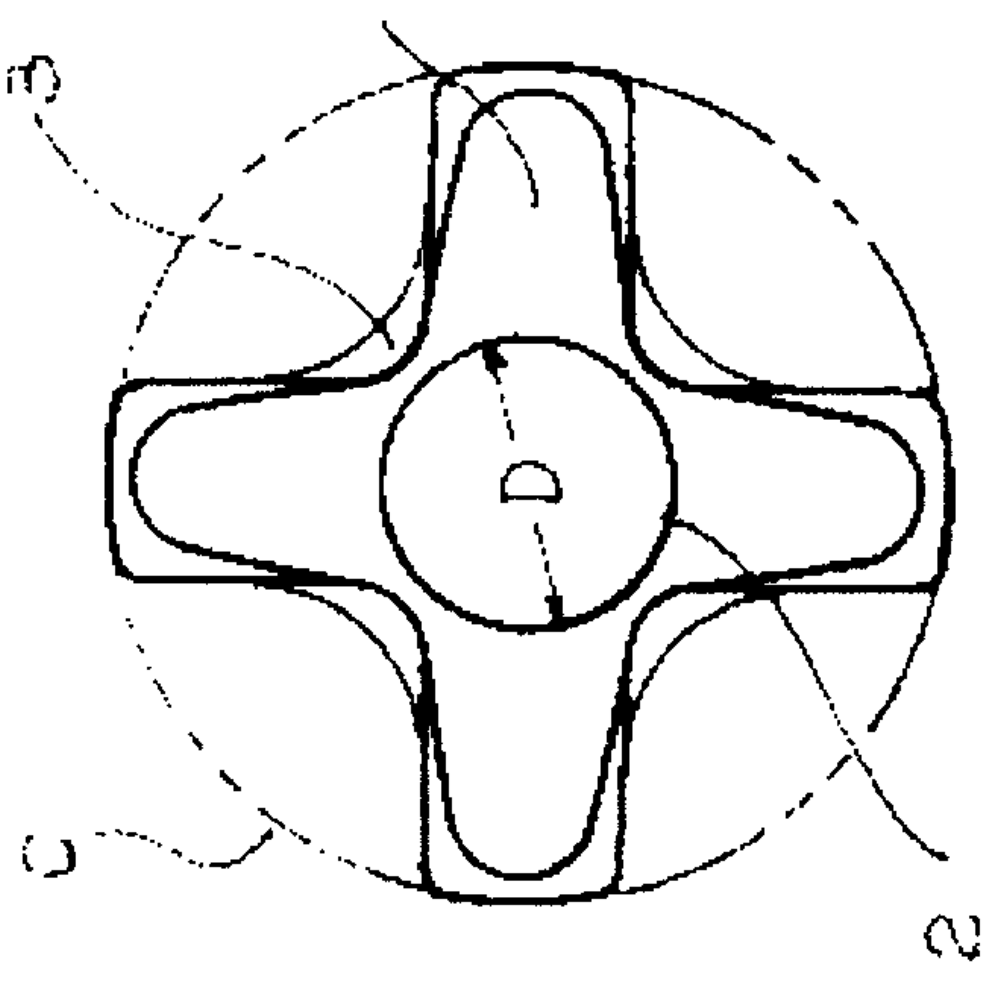


FIG.1B

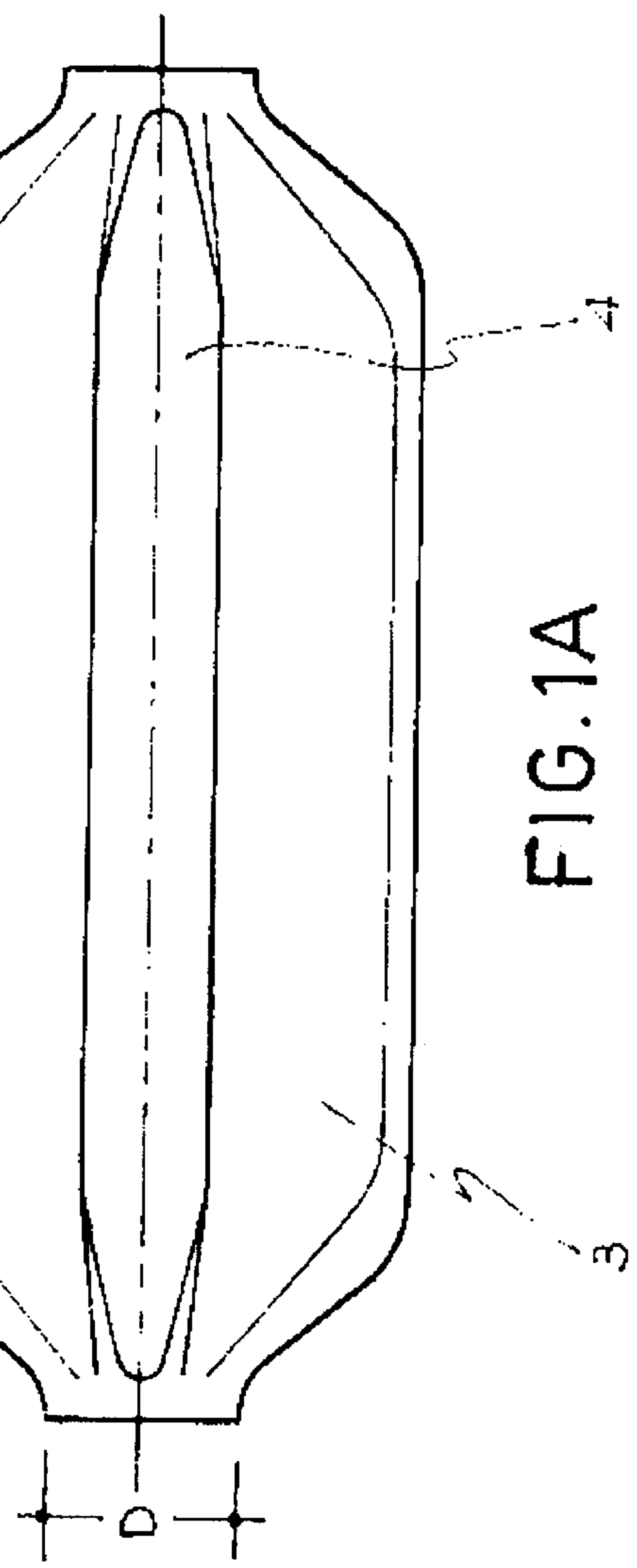


FIG.1A

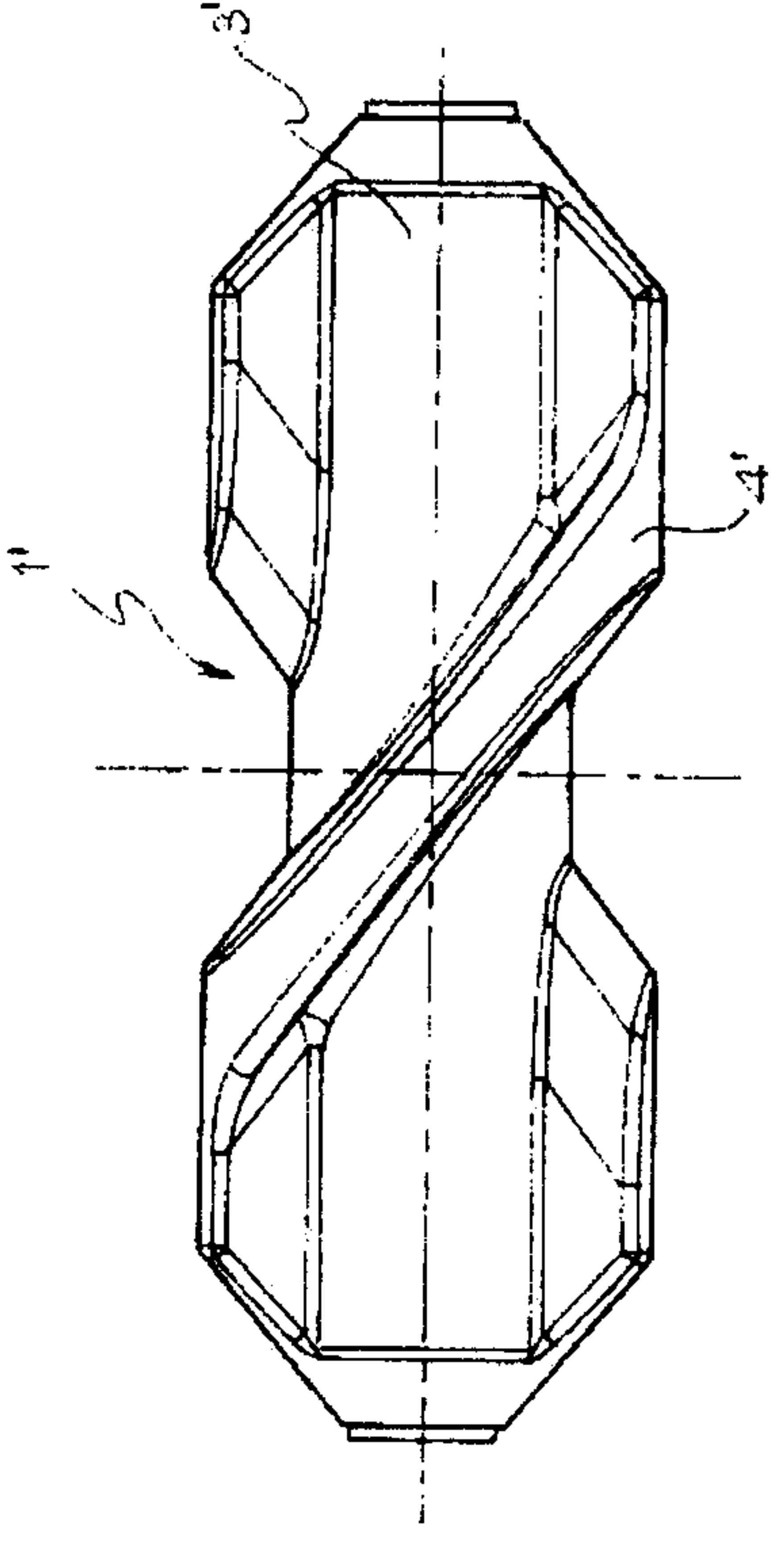


FIG.2A

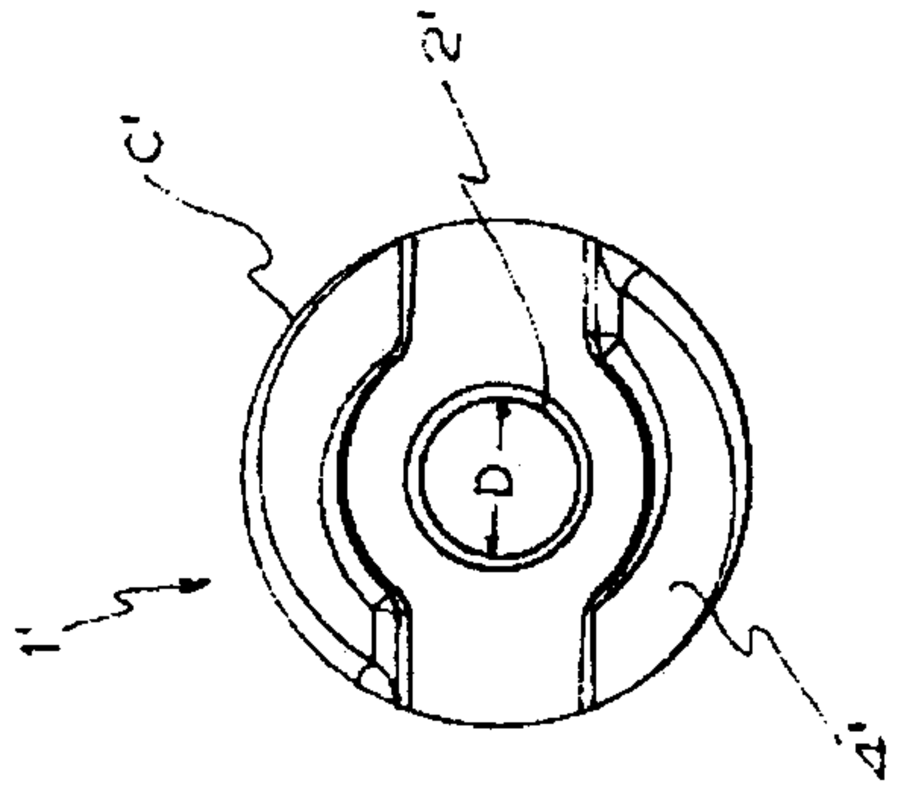


FIG.2B

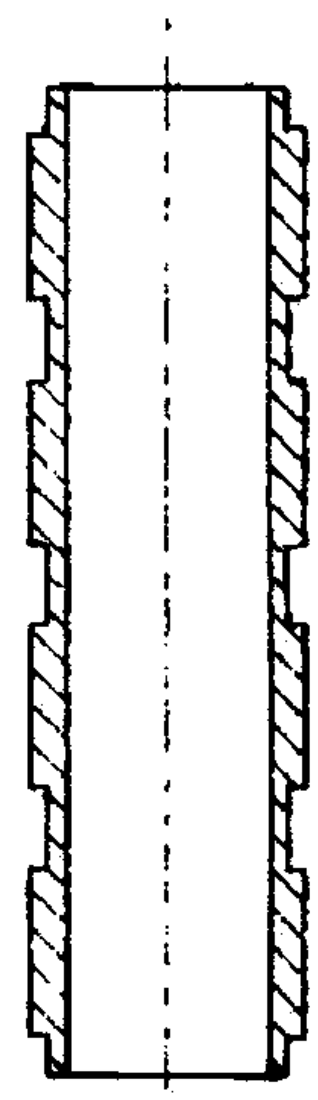


FIG.3A

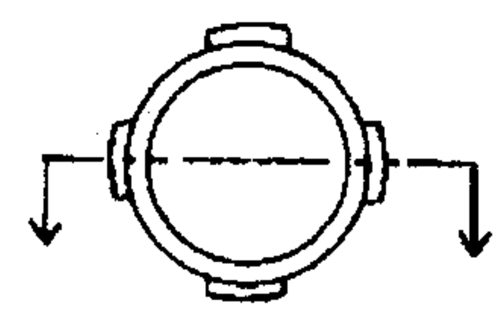
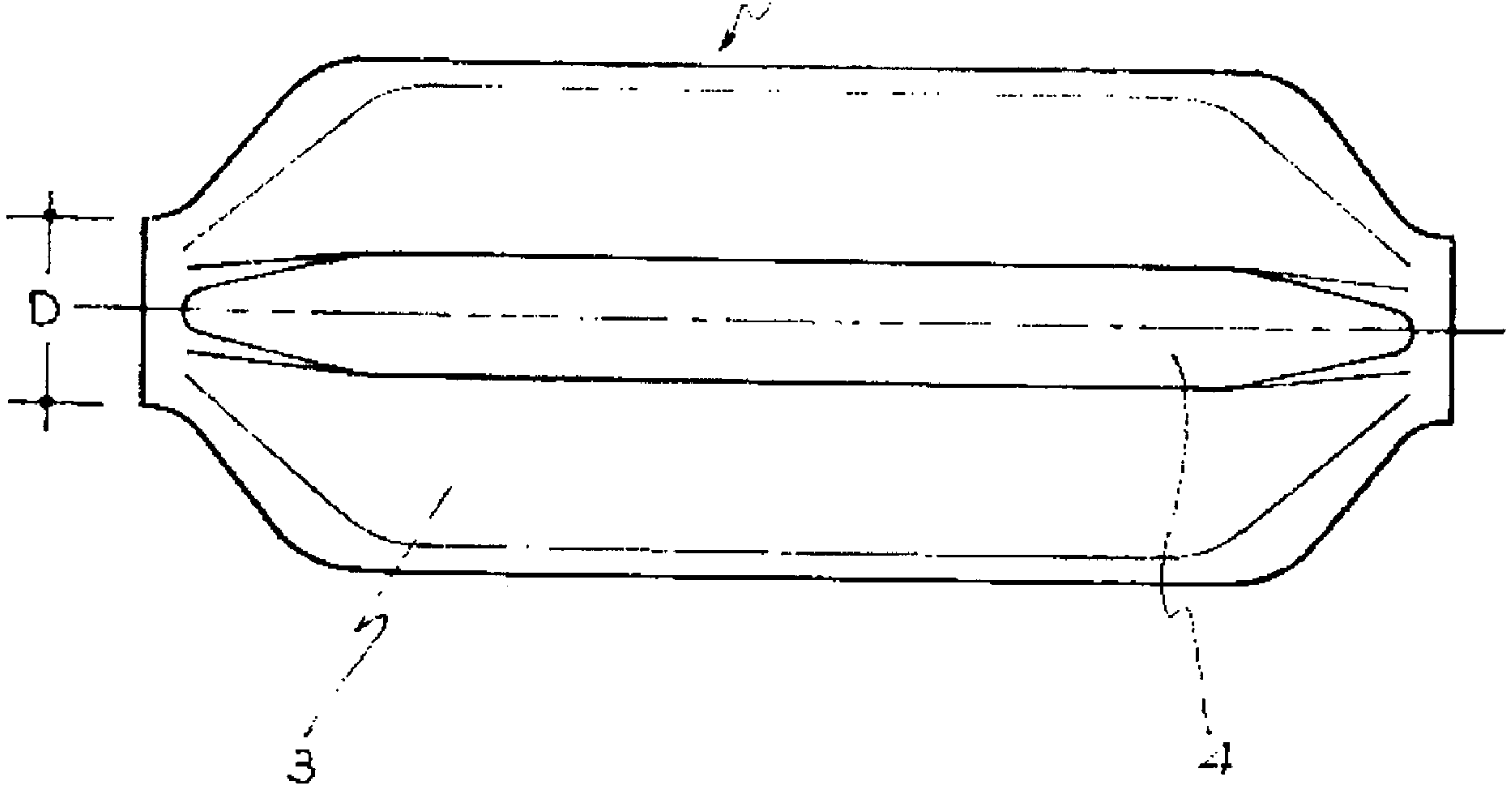


FIG.3B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