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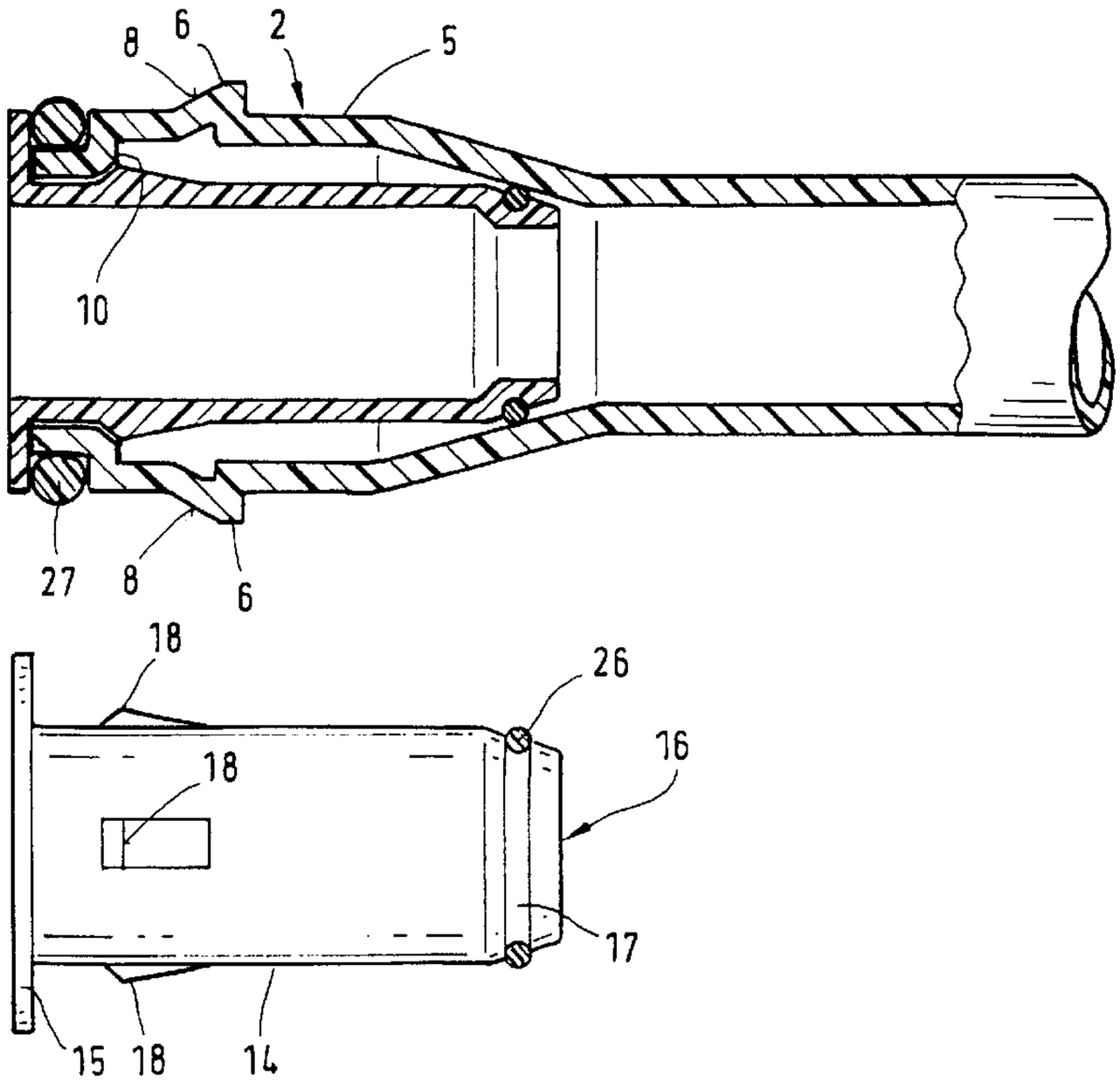
(54) Titre : TUYAU POUR FLUIDE DE REFROIDISSEMENT DESTINE A UN MOTEUR A COMBUSTION INTERNE, ET SON PROCEDE DE PRODUCTION

(54) Title: COOLANT TUBE FOR INTERNAL COMBUSTION ENGINES AND METHOD OF PRODUCING THE SAME



(57) Abrégé/Abstract:
The invention concerns a coolant pipe for motor vehicle engines, which comprises thermoplastic material, wherein the pipe is provided at least at one end with at least one part of a detent or snap-action coupling which was formed in one piece on the pipe in the production thereof.

Abstract

The invention concerns a coolant pipe for motor vehicle engines, which comprises thermoplastic material, wherein the pipe is provided at least at one end with at least one part of a detent or snap-action coupling which was formed in one piece on the pipe in the production thereof.

Coolant pipe for an internal combustion engine and a process for the production of such a pipe

Coolant pipes or hoses, on motor vehicle engines, have hitherto frequently been in the form of metal pipes or metal hoses which are respectively provided at their ends with coupling elements for quick-action coupling purposes, in the form of a detent or snap-action coupling. The coupling elements are in the form of metal sleeves, for example comprising aluminum sheet, and are pressed or clamped on to the respective end of the hose or pipe. They comprise for example an outer sleeve and an inner sleeve of sheet metal, wherein the hose or pipe is fitted into the annular space between the outer sleeve and the inner sleeve. Fixing on the hose or pipe is effected by cold deformation of the outer sleeve, for example by folding over a crimping edge. The outer sleeve is peripherally provided with retaining or detent projections co-operable with corresponding retaining or detent openings and retaining or detent springs of a counterpart coupling portion, for example on a motor vehicle radiator unit. The inner sleeve forms an annular flange for bearing against a corresponding counterpart surface in the counterpart coupling portion. A peripherally extending groove serving as a sealing seat for an O-ring seal is formed between the annular flange of the inner sleeve and the outer sleeve.

Coupling portions of that kind are comparatively expensive to produce and in particular the procedure involved in mounting the coupling portions on the hoses or pipes, that is to say producing a connection between the coupling portions and the hoses or pipes which affords adequate sealing integrity and which is non-releasable, is complicated and expensive.

DE 195 43 318 A1 describes by way of example the connection between a fluid conduit of plastic material and a tubular coupling element also of plastic material, with the coupling element being injection-molded to the conduit. For that purpose, the end portion of the conduit or pipe when already in a finished condition is put on to a cylindrical part of a molding

(continued from page 1 line 32 of the translation of the original PCT text)

a molding

tool core and then, in a separate working operation, the coupling element is injection-molded around the part of the molding tool core, which is disposed outside the pipe.

The production of such a pipe assembly are extremely complicated and expensive.

WO 89/04755 discloses a pipe as set forth in the classifying portion of claim 1, which was produced by extrusion suction blow molding. The pipe described therein is provided at one or both ends with coupling elements which were formed in one piece on the pipe during production thereof.

In regard to a large number of conceivable uses for such a pipe, for example as a coolant pipe on motor vehicle engines, it is desirable to provide at the connections of the pipe or hose, sealing means for different temperature ranges in respect of the medium flowing through the pipe.

The present invention is therefore based on the problem of improving a pipe or hose as set forth in the classifying portion of claim 1 in terms of the possibility of using it when major fluctuations in temperature are involved.

That problem is solved by the features of claim 1.

The pipe in accordance with the present invention can obviously also be used in other ways, for example in cooling units or in other drive concepts.

Such a pipe which is produced integrally with coupling elements at one or both ends thereof eliminates the need for the separate production of coupling elements and the operation for securing same to the pipe in sealing and non-losable relationship, thereby affording a considerable saving in terms of manufacturing time and cost. Particularly when the pipe is produced in accordance with the invention by extrusion blow molding and the detent means of the detent coupling are provided in the external contour of the respective end of the pipe, manufacture of the pipe with at least one part of the detent coupling can be implemented in a single tool. Finally, producing the pipe from thermoplastic material affords advantages in consideration of the saving in weight and material that this entails. Plastic

material is a comparatively light and inexpensive material whose elasticity and toughness as well as its resistance to acid and temperature can be easily adjusted by virtue of choosing the appropriate composition of material. There is also the possibility of producing pipes or hoses which have different moduli of elasticity or degrees of stiffness over their length, whereby it is possible to produce parts whose handleability is optimised in terms of final assembly for example in a motor vehicle.

It will be apparent to the man skilled in the art that the terms pipe and hose at any event denote a tubular element for which depending on the respective diameter and stiffness one term or the other is preferably used, so that hereinafter only the term pipe will be employed.

In accordance with the preferred embodiment of the invention the pipe is produced by suction blow molding, in particular by extrusion suction blow molding. That process has proven to be particularly advantageous for the production of pipes which are not of a rotationally symmetrical configuration, that is to say for example which have a curved configuration in space, in respect of their longitudinal axis. Producing the pipe by a suction blow molding process also affords the advantage that it does not involve any welded seam.

The pipe is provided with at least one insert pipe connection as a separate component which has a flange for bearing against a counterpart surface in a counterpart coupling portion or on a connection component. The insert connection portion is advantageously non-losably inserted into the respective end of the pipe. A particularly advantageous feature provides that the insert connection portion is non-releasably latched to the respective end of the pipe. For that purpose, it may be provided at its external periphery with retaining or detent projections co-operable with a peripherally extending bead or ridge as a detent or retaining recess or a peripherally extending step in the internal wall of the pipe.

The insert connection portion can be produced for example from thermoplastic material in one working operation by blow molding or suction blow molding with the pipe, but in that case, when using such a production

process, forming the flange for bearing against a counterpart surface on a counterpart coupling portion or a connection component is found to be difficult. It is therefore particularly advantageous for the insert connection portion to be produced by injection molding of thermoplastic material. This can involve the same composition of material as the pipe.

In the preferred embodiment of the pipe the respective end forming the detent coupling is expanded, and the insert connection portion is sealed in relation to the internal wall of the pipe, preferably in the region of the regular cross-section of the pipe.

The respective end of the pipe forming the detent coupling can have an inwardly disposed collar which with the flange of the insert connection portion forms a peripherally extending sealing seat, for accommodating an O-ring seal.

The end of the insert connection portion which is remote from the flange may also have a peripherally extending groove for accommodating an O-ring, which bears sealingly against the inside wall of the pipe substantially in the region of the regular diameter of the pipe.

A two-part coupling element which is formed in that way and of which the part of the detent coupling, which is formed integrally with the pipe, forms the actual part that co-operates with the counterpart coupling portion, affords the possibility of involving various sealing means for different temperature ranges in respect of the medium which flows through the pipe. For example, the seal between the insert connection portion and the pipe may be in the form of a seal for a low-temperature range whereas the seal between the flange of the insert connection portion and the end of the pipe can be designed in the form of a high-temperature seal. The reverse configuration is also possible, according to the circumstances of installation involved.

Preferably the pipe according to the invention comprises polyamide, a particularly preferred embodiment comprising glass fiber-reinforced polyamide.

The process according to the invention for the production of a pipe or hose of thermoplastic material by extrusion suction blow molding, in particular as a coolant pipe for internal combustion engines, wherein at least at one end of the pipe at least one part of a detent coupling or snap-action coupling is formed on the pipe in one piece therewith in one working operation, wherein detent means of the detent coupling are formed in the outside contour of the respective pipe end, is distinguished by the production of at least one insert connection portion of thermoplastic material as a separate component, wherein the insert connection portion is provided with a flange for sealingly bearing against a counterpart surface of a counterpart coupling portion or a connection component, and by the non-losable connection of the insert connection portion to an end of the pipe.

It is not necessary from a technical point of view for the insert connection portion to be non-losably or non-detachably connected to the pipe, in regard to the effectiveness of the coupling formed on the pipe, but such a non-detachable connection affords advantages in terms of delivery, stockkeeping and preparation of the pipes for assembly.

As an alternative to production of the insert connection portion as a separate component, it can be provided that an insert connection portion is produced together with the pipe in one working operation by suction blow molding, and the insert connection portion is separated from the pipe in a further working operation in order to be non-losably inserted into an end of the pipe.

The invention is described hereinafter by means of an embodiment illustrated in the drawings in which:

(continue on page 5, line 26 of the translation of the original PCT text)

Figure 5 is a perspective view of a counterpart coupling portion provided on a connection component, and

Figures 6 to 9 are diagrammatic views showing various steps in the process of extrusion suction blow molding for a pipe according to the invention.

Figures 1 and 2 show the pipe 1 in accordance with the invention, in the form of a coolant pipe for an internal combustion engine. The pipe 1 was produced by extrusion suction blow molding and comprises glass fiber-reinforced polyamide. Formed at each end of the pipe 1 is a detent coupling 2 which was produced in one working operation during the procedure for molding of the pipe 1. The detent couplings 2 are of a complementary configuration to a counterpart coupling portion 3 which is illustrated in Figure 5 and into which the detent couplings 2 can be engaged in sealing relationship by a latching action.

The longitudinal axis of the pipe 1 is of a configuration which is curved in space and the pipe 1 is overall of an asymmetrical nature. The ends of the pipe 1 are somewhat conically enlarged in the region of the detent couplings 2. Adjoining the enlargement portions 4 is a cylindrical portion 5, over the outside periphery of which are distributedly arranged a plurality of detent projections 6. The detent projections 6 are of a semi-trapezoidal cross-sectional contour and, in the direction of the mouth opening 7 of the pipe, form a respective inclined run-on surface 8.

In the region of the mouth opening 7 the pipe 1 is provided with an inwardly disposed collar 9; the diameter step between the cylindrical portion 5 and the collar 9 forms a peripherally extending step or shoulder 10 in the internal wall of the pipe 1, by virtue of the pipe 1 being produced in the form of a blow-molded component. Further reference will be made hereinafter to the step or shoulder 10.

The external contour of the detent coupling 2, which was obtained by extrusion suction blow molding, approximately corresponds to the external contour of the known multi-part coupling elements made from sheet metal, which co-operate with the counterpart coupling portion which is indicated in

Figure 5 but which is not subject-matter of the present invention. The detent coupling 2 is fitted into the counterpart coupling portion 3 in such a way that the detent projections 6 are fitted into groove passages 11 which extend in the counterpart coupling portion 3, in the direction of insertion of the detent coupling 2. Disposed transversely with respect to the insertion direction, in the groove passages 11, are detent spring slots 12. Detent springs 13 pass through the slots 12. The detent springs 13 are urged radially outwardly by way of the inclined run-on surfaces 8 of the detent projections 6, and spring back into their initial position behind the detent projections 6, whereby the detent coupling 2 of the pipe 1 is latched non-detachably to the counterpart coupling portion 3.

The pipe 1 illustrated by way of example herein has a total of two detent projections 6. It will be apparent to the man skilled in the art that the detent coupling may comprise more than two detent projections or even a peripherally extending detent protrusion.

In order to achieve adequate sealing integrity for the detent coupling 2 in the counterpart coupling portion 3, the assembly includes an insert connection portion which is identified by reference 14 and which was produced from polyamide by an injection molding process. The insert connection portion 14 is substantially in the form of a hollow-cylindrical plug-in element which is provided at one end with an annular flange 15. As can be seen from Figure 4 the insert connection portion 14 forms a part of the coupling on the pipe 1 and is inserted into the pipe 1 in such a way that the annular flange 15 forms the end face of the mouth opening 7. The annular flange 15 is comparatively thin-walled so that it is flexible within certain limits upon being inserted into the counterpart coupling portion 3.

In the region of its insertion end 16 the insert connection portion 14 is provided with a peripherally extending annular groove 17 which accommodates an O-ring seal 26. In the region of the annular flange 15 of the insert connection portion 14, which forms a collar, provided on the outside periphery of the cylindrical tubular body part of the insert connection portion 14 there are also detent projections 18 which are co-

operable with the peripherally extending shoulder 10 in the inside wall of the pipe 1. The detent projections 18 also form inclined run-on surfaces which are inclined in the direction of the insertion end 16 of the insert connection portion 14. The detent projections 18 and the shoulder 10 are of such a configuration or co-operate in such a way that the insert connection portion 14 can be non-losably fitted into the respective end of the pipe by a snapping engagement or a detent retaining engagement. The insert connection portion 14 can be released or pulled out of the pipe 1 again only by applying substantial forces. It will be apparent to the man skilled in the art that there is no need for the insert connection portion 14 to be secured in position when the detent coupling 2 is inserted into the counterpart coupling portion 3.

When the insert connection portion 14 is in the condition of being snap-fitted into the pipe 1 the annular flange 15 together with the inwardly disposed collar 9 of the pipe 1 forms a peripherally extending sealing seat for accommodating a further O-ring seal 27. The O-ring seal 27 provides for sealing integrity as between the pipe 1 and the counterpart coupling portion 3. When the detent coupling 2 and the counterpart coupling portion 3 are fitted one into the other, the annular flange 15 bears against a counterpart surface or sealing surface provided by the counterpart coupling portion 3.

The O-ring seal 27 which is provided in the region of the insertion end 16 of the insert connection portion 14 bears against the inside wall of the pipe 1 approximately in the region of its regular diameter and thereby seals off the insert connection portion 14 in relation to the pipe 1.

The process for production of the pipe according to the invention is diagrammatically shown in Figures 6 to 9.

Reference numeral 19 therein denotes an extrusion head and which is provided with a blowing bar or tube 20. The extrusion head 19 extrudes a tubular portion of softened thermoplastic material into a closed two-part tool 21, whose mold cavity 22 corresponds to the contour of the finished pipe to be molded. As shown in particular in Figure 6 a suction device 23 at the lower end of the mold cavity 22 promotes the movement of the

extruded tubular portion through the cavity 22, the tubular portion 24 or extrudate being acted upon with pre-blowing air from the blowing tube 20. After the tubular portion 24 has filled with the cavity 22 over the preselected length, the ejection of material from the extrusion head 19 is terminated. The tubular portion 24 is clamped off at the upper and lower ends of the tool 21, by means of slider members 25 which close off. Both the suction air and the blowing air are shut off. The slider members 25 and the tool 21 are then opened so that the finished article can be removed from the mold.

The advantages of the process described hereinbefore in regard to the pipe according to the invention, will be readily apparent. The pipe can be produced without any seam. Controlling the reduced pressure generated by the suction device 23 means that the extrudate can be drawn over the desired length even into molds entailing a spatially complex structure. A closing force for the tool is required only for holding it closed in opposition to the blowing pressure.

It will be appreciated that the pipe according to the invention can also be produced in the form of a conventional blow-molded article.

Coolant pipe for an internal combustion engine and a process for the production of such a pipe

List of references

1 pipe
2 detent coupling
3 counterpart coupling portion
4 enlargement
5 cylindrical portion
6 detent projections
7 pipe mouth opening
8 inclined run-on surface
9 collar
10 step
11 groove passage
12 detent spring slots
13 detent springs
14 insert connection portion
15 annular flange
16 insertion end
17 annular groove
18 detent projections
19 extrusion head
20 blowing bar
21 tool
22 cavity
23 suction device
24 tubular portion
25 slider member
26 O-rings
27 O-rings

PCT/DE00/02284

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CLAIMS

1. A pipe or hose which was obtained by blow molding from thermoplastic material, in particular as a coolant pipe for internal combustion engines, which is provided at at least one end with at least one part of a detent or snap-action coupling which in production of the pipe was formed thereon in one piece, wherein detent means of the detent coupling (2) are provided in the external contour of the pipe end in question, characterised in that at least one insertion connection portion (14) as a separate component, which has a flange (15) for sealing bearing against a counterpart surface in a coupling portion (3) or against a connection component is inserted into the respective pipe end and is non-releasably latched therein and that the insert pipe connection (14) is sealed off in relation to the pipe internal wall.

2. A pipe according to claim 1 which was produced by suction blow molding, in particular by extrusion suction blow molding.

3. A pipe according to one of claims 1 and 2 characterised in that the insertion connection portion (14) has at its external peripheral surface detent projections (18) which co-operate with a peripherally extending ridge as a detent recess or a peripherally extending step (10) in the internal wall of the pipe (1).

4. A pipe according to one of claims 1 to 3 characterised in that the insert connection portion (14) comprises thermoplastic material and was produced by injection molding.

5. A pipe according to one of claims 1 to 4 characterised in that the respective end of the pipe forming the detent coupling (2) is expanded and the insert connection portion (14) is sealed in relation to the internal wall of the pipe substantially in the region of the regular cross-section of the pipe (1).

6. A pipe according to one of claims 1 to 5 characterised in that the respective end of the pipe forming the detent coupling (2) has an inwardly disposed collar (9) which with the flange (15) of the insert connection portion (14) forms a peripherally extending sealing seat, preferably for accommodating an O-ring (27).

7. A pipe according to one of claims 1 to 6 characterised in that the end of the insertion connection portion (14), which is remote from the flange (15), has a peripherally extending groove (17) for receiving an O-ring (26) which bears sealingly against the inside wall of the pipe (1) substantially in the region of the regular pipe diameter.

8. A pipe according to one of claims 1 to 7 characterised in that it comprises polyamide.

9. A pipe according to one of claims 1 to 8 characterised in that it comprises glass fiber-reinforced polyamide.

10. A process for the production of a pipe or hose of thermoplastic material by extrusion suction blow molding, in particular as a coolant pipe for internal combustion engines, characterised in that at at least one end of the pipe at least one part of a detent or snap-action coupling is formed in one piece with the pipe in a working operation, wherein detent means are formed in the external contour of the respective pipe end, characterised by the production of at least one insert connection portion of thermoplastic material as a separate component, wherein the insert connection portion is

provided with a flange for sealing bearing against a counterpart surface of a counterpart coupling portion or a connection component, and by non-releasable latching of the insert connection portion in the end of the pipe.

11. A process according to claim 10 characterised in that an insert connection portion having a flange for bearing against a counterpart coupling portion or a connection component is produced together with the pipe in one working operation by suction blow molding, and that the insert connection portion is separated from the pipe in a further working operation in order to be non-losably inserted into an end of the pipe.

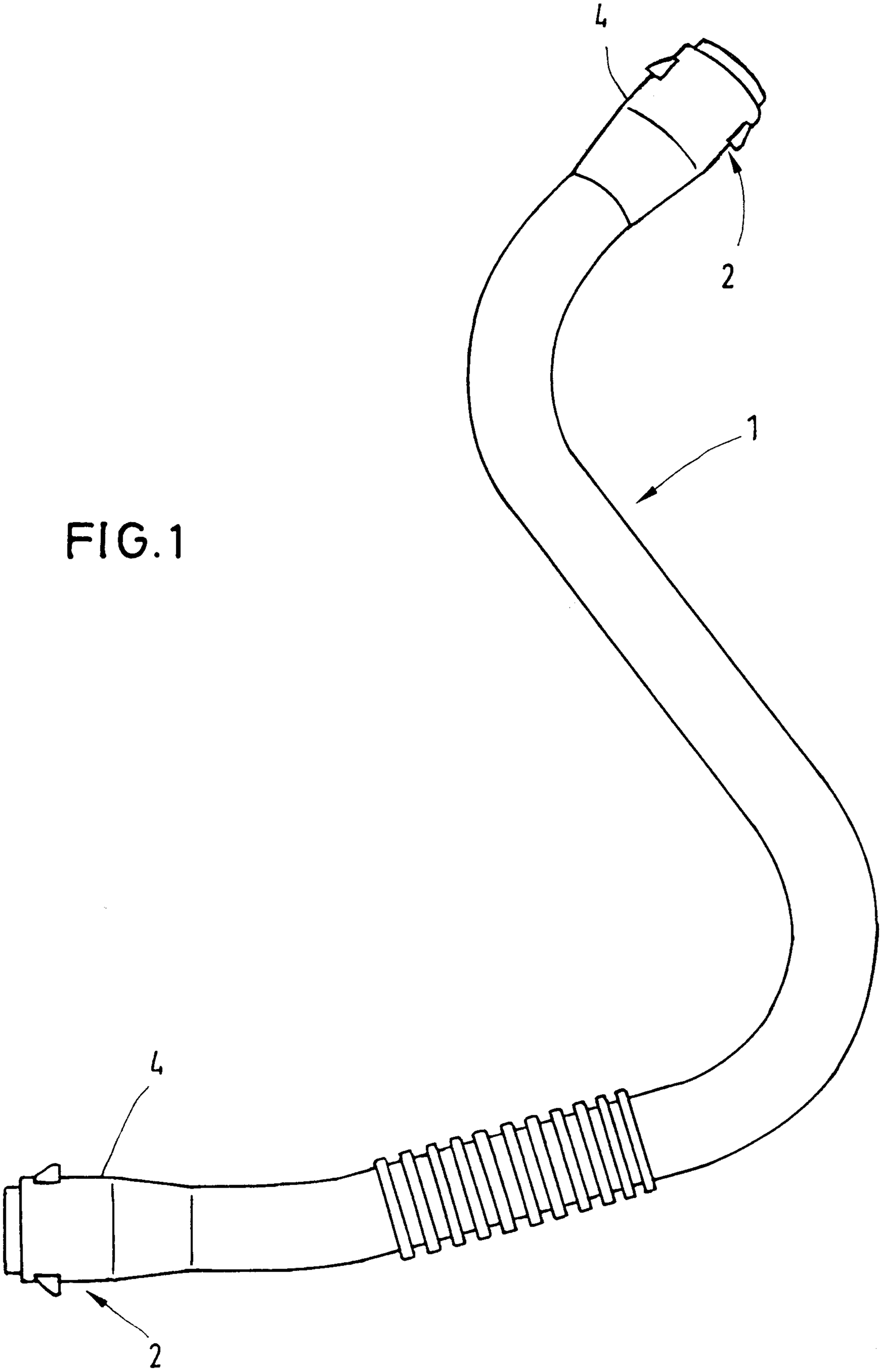


FIG.1

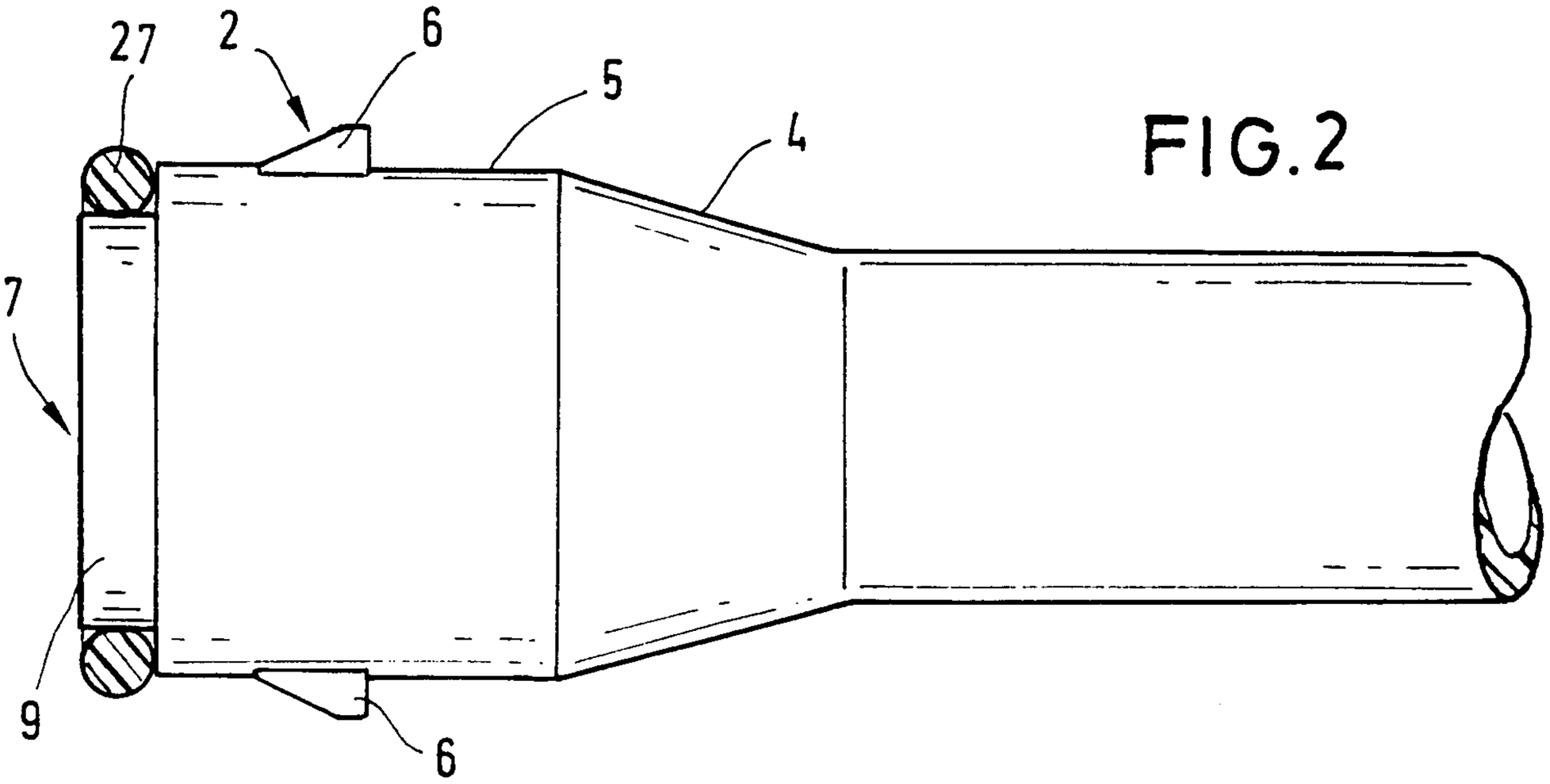


FIG.2

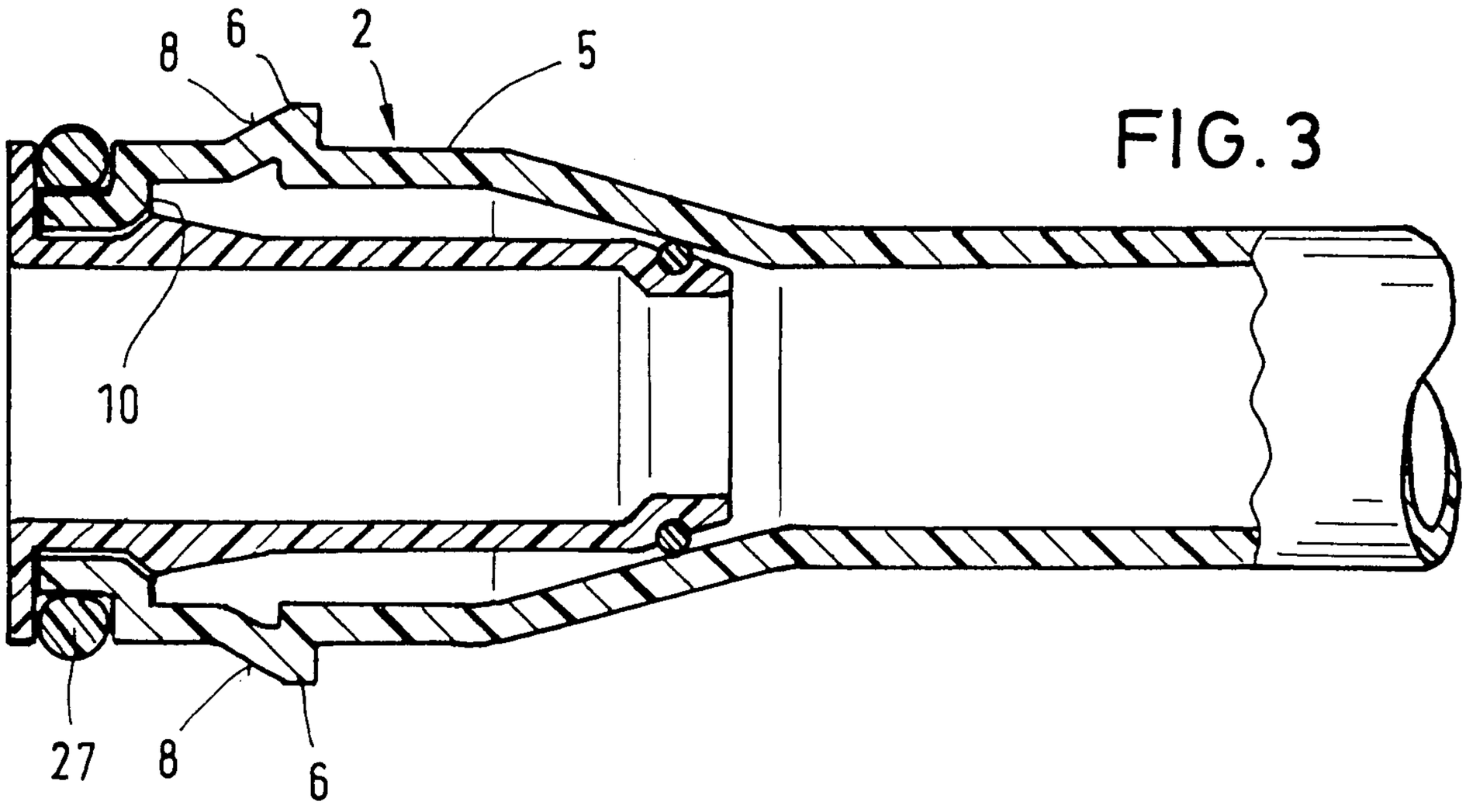


FIG.3

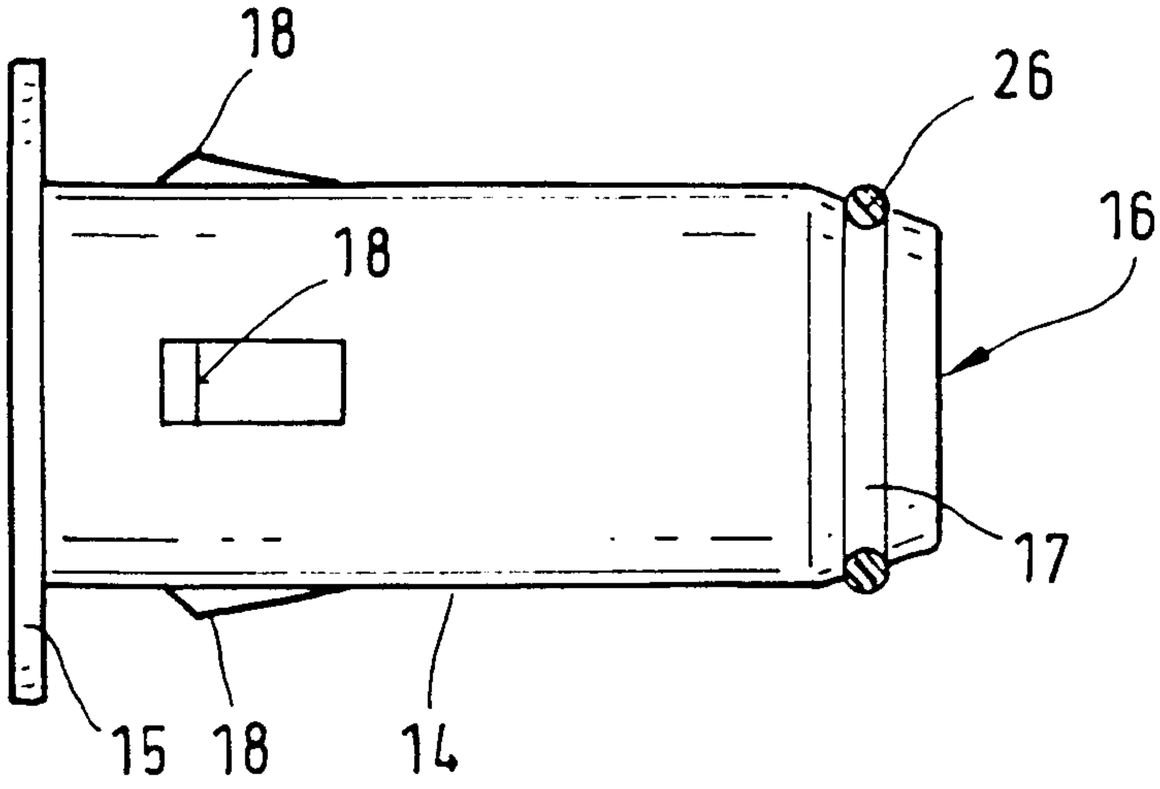


FIG.4

FIG.5

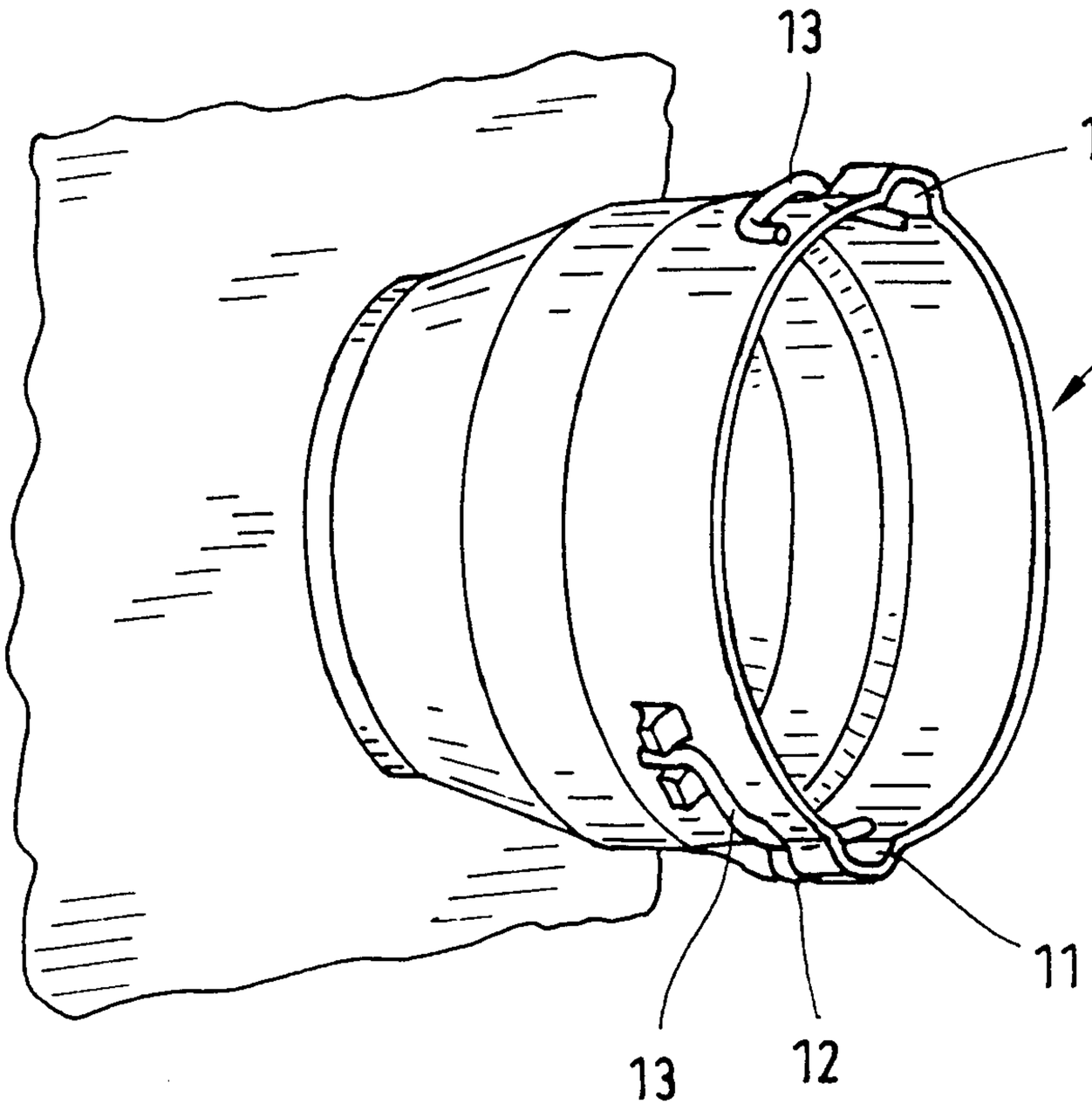


FIG.6

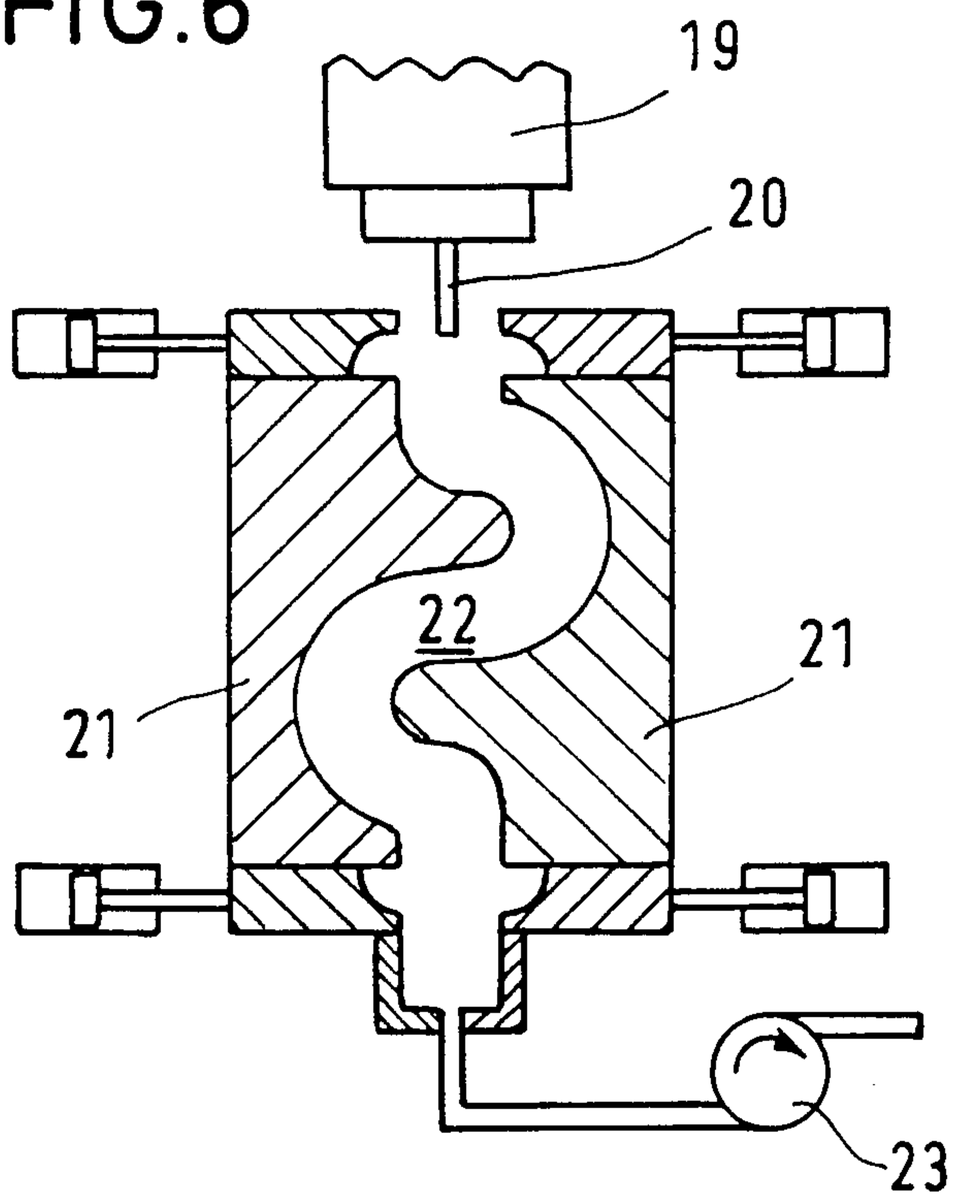


FIG.7

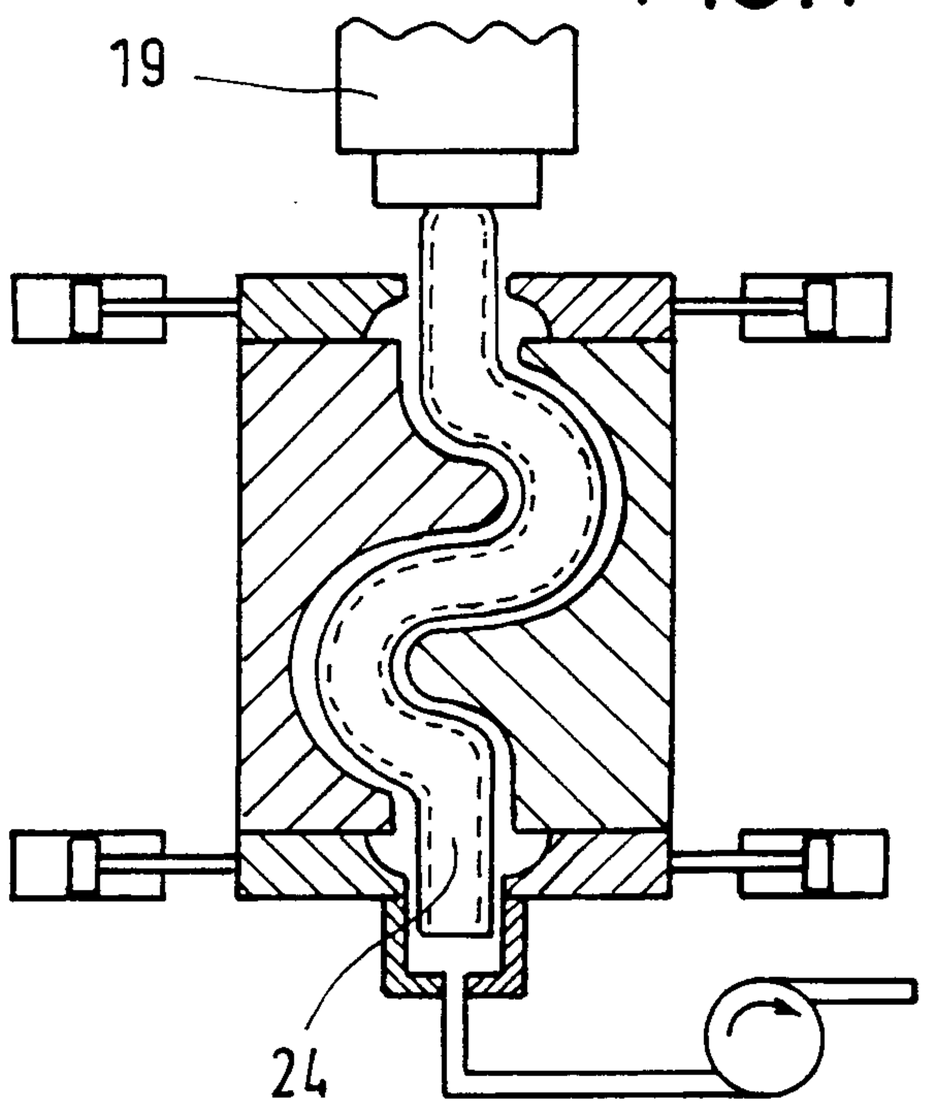


FIG.8

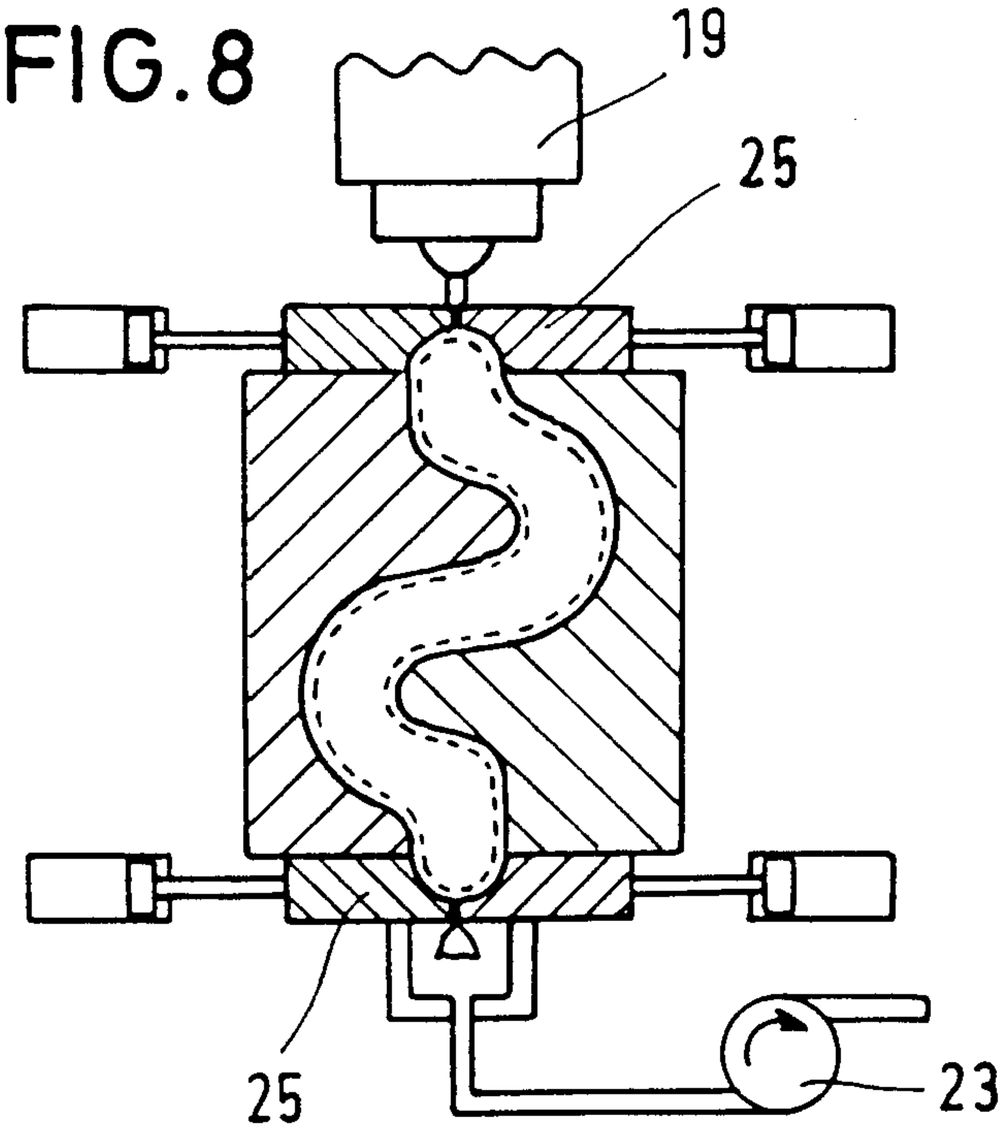
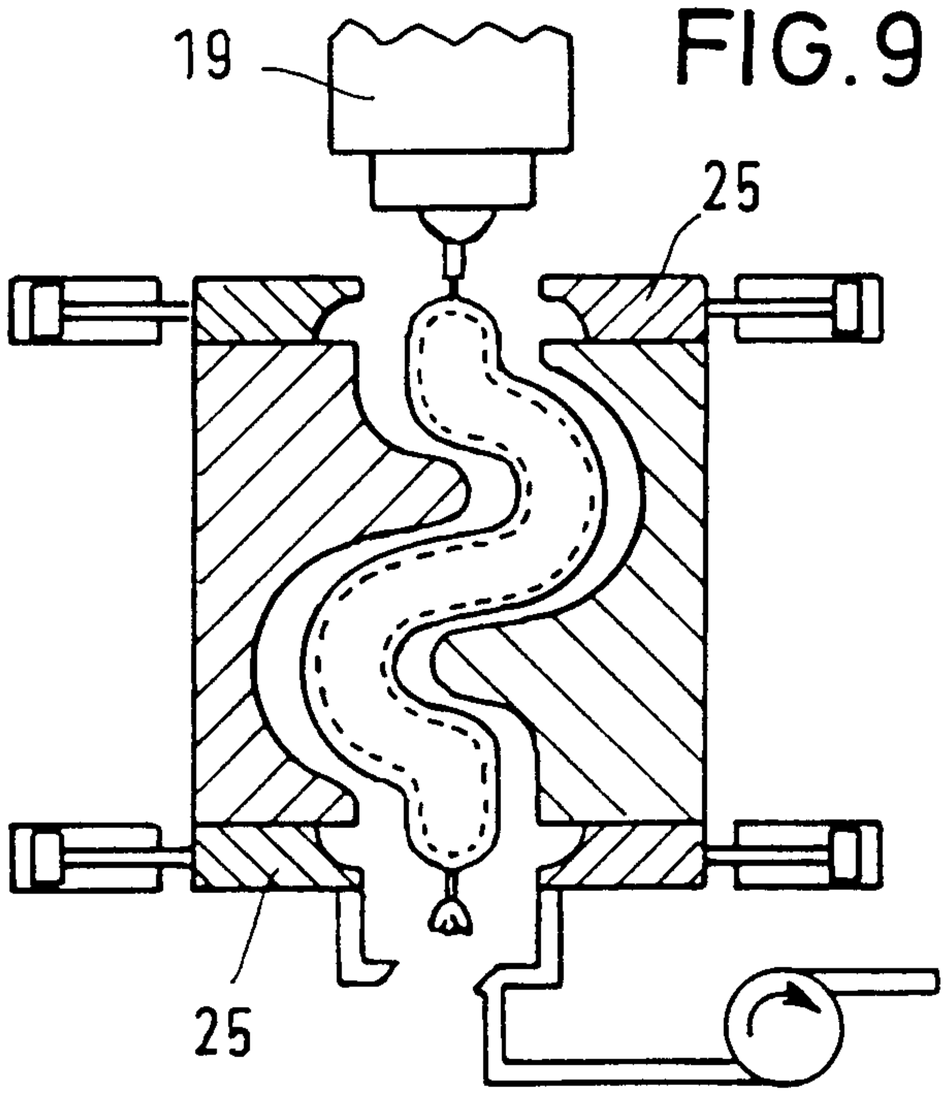
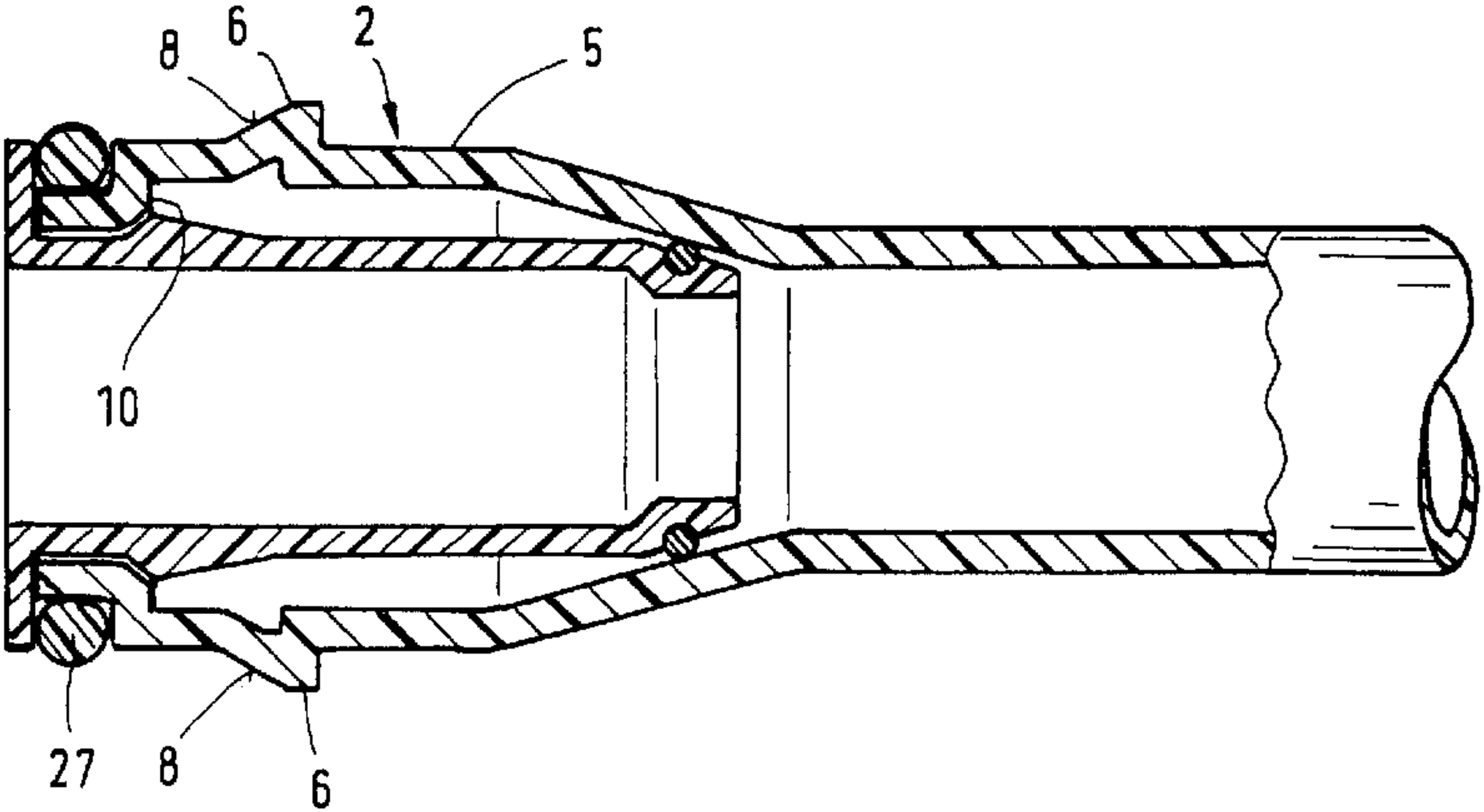


FIG.9

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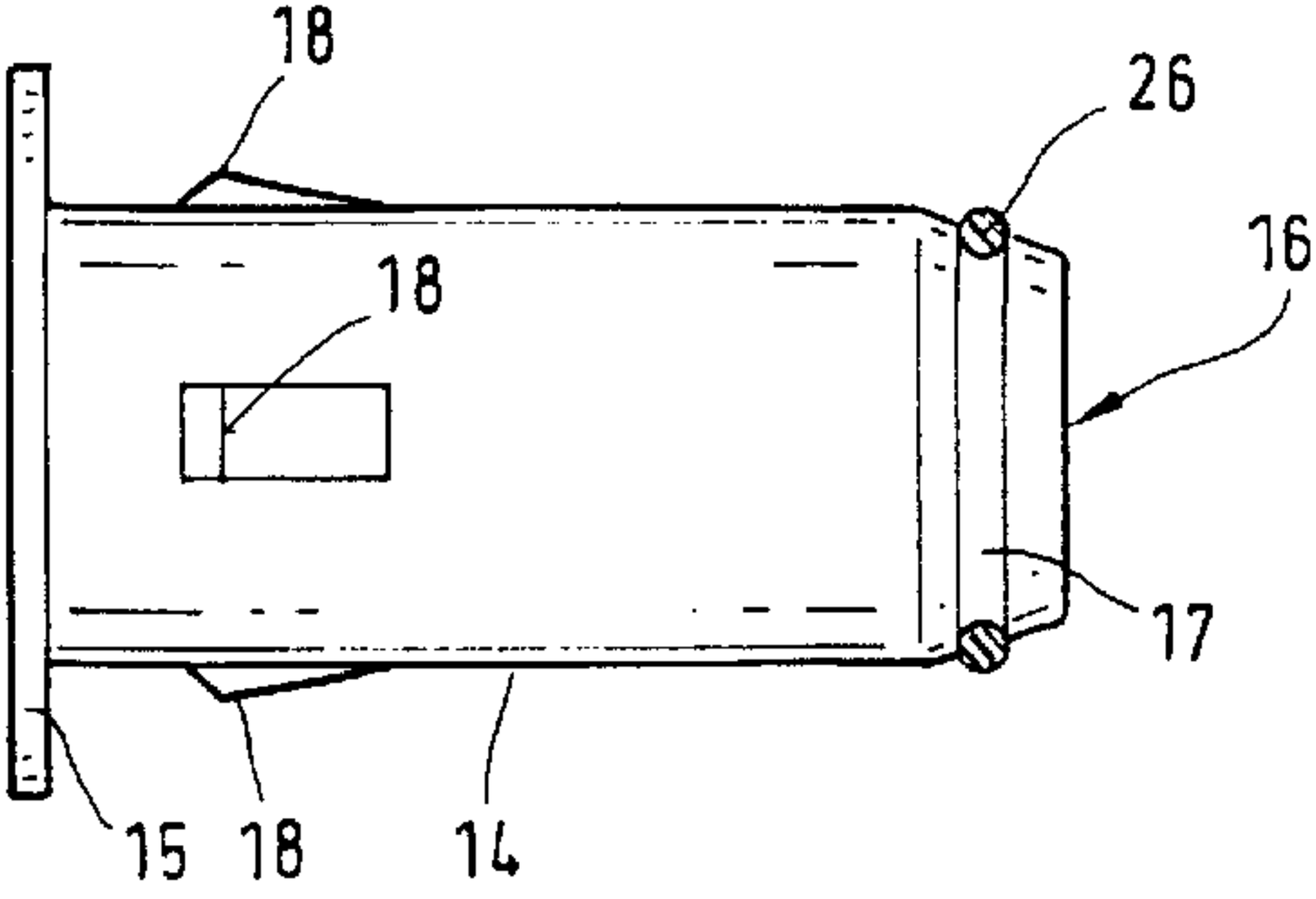
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