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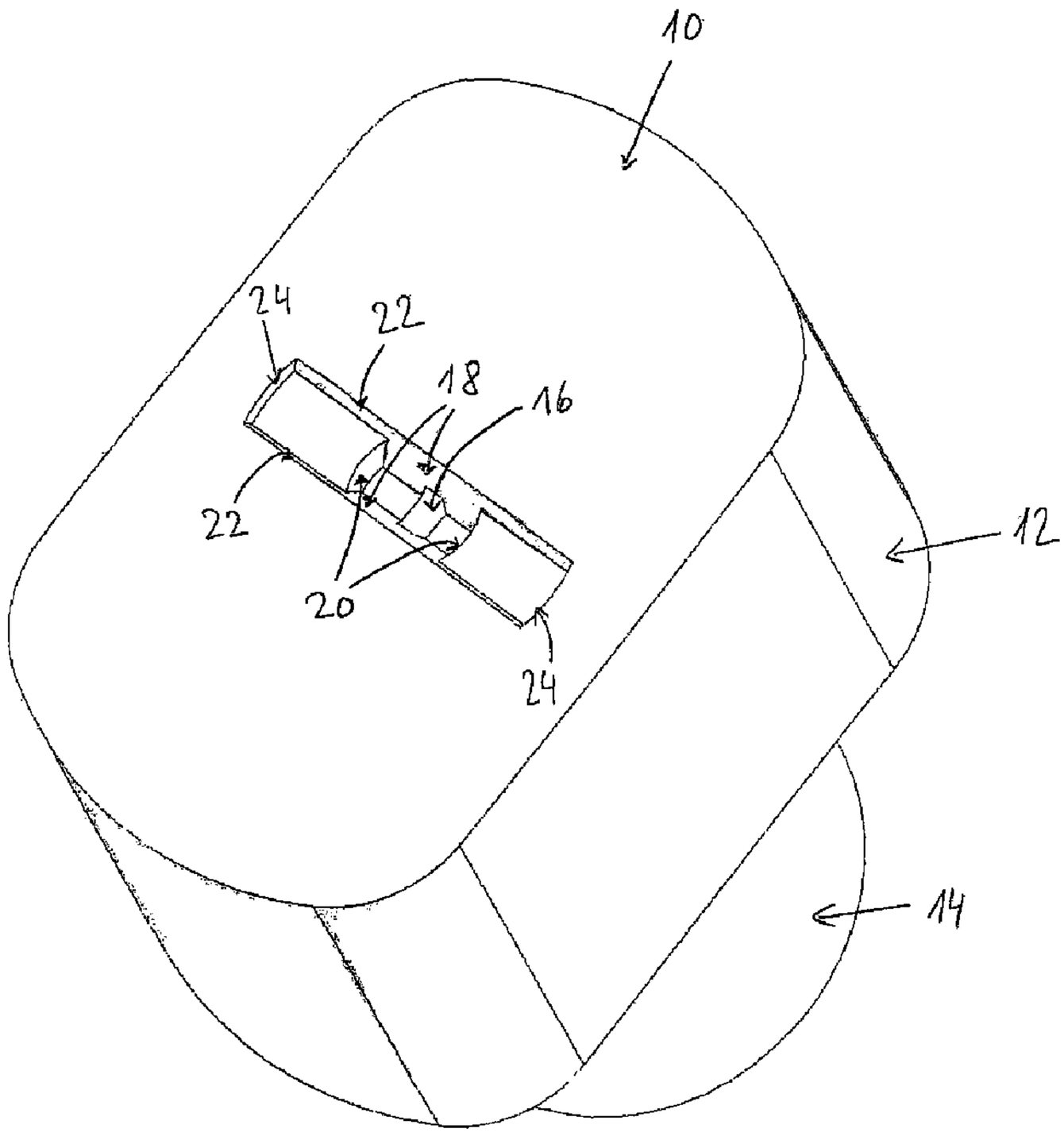

(57) Abrégé/Abstract:
A spray nozzle assembly for atomizing a medium through a nozzle channel, comprising: a first channel portion which is tapered by two lateral surfaces facing each other to form an elongate narrow cross-sectioned surface; a passage orifice disposed in the

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(57) Abrégé(suite)/Abstract(continued):
narrow cross-sectioned surface the cross-sectional area of which is smaller than is the narrow cross-sectioned surface; and a second channel portion adjoining the passage orifice in the direction of medium flow which has two opposed lateral surfaces separating from each other with an increase in distance from the passage orifice, whose edges facing the passage orifice extend crosswise to the longitudinal direction of the narrow cross- sectioned surface, characterized in that the nozzle channel having the two channel portions and the passage orifice are configured inside an integrally formed plastic componen

ABSTRACT

A spray nozzle assembly for atomizing a medium through a nozzle channel, comprising: a first channel portion which is tapered by two lateral surfaces facing each other to form an elongate narrow cross-sectioned surface; a passage orifice disposed in the narrow cross-sectioned surface the cross-sectional area of which is smaller than is the narrow cross-sectioned surface; and a second channel portion adjoining the passage orifice in the direction of medium flow which has two opposed lateral surfaces separating from each other with an increase in distance from the passage orifice, whose edges facing the passage orifice extend crosswise to the longitudinal direction of the narrow cross-sectioned surface, characterized in that the nozzle channel having the two channel portions and the passage orifice are configured inside an integrally formed plastic componen

TITLE OF THE INVENTION

A SPRAY NOZZLE ASSEMBLY

The invention relates to a spray nozzle assembly for atomizing a medium through a nozzle channel.

Such spray nozzle assemblies serve for atomizing a medium, e.g. a perfume, varnish or other liquid. The medium requiring atomization is introduced into the nozzle channel of the spray nozzle assembly by means of a propellant or pumping mechanism here. Because of the peculiar geometry of the nozzle channel, the medium first undergoes condensation, flows through a small passage orifice, and escapes in the form of small droplets on the other side of the nozzle channel. The geometry of the nozzle channel is decisive for the spraying characteristics of the spray nozzle assembly here. Depending on use, very different properties regarding the droplets and their distribution in the spray jet may be desired, e.g. a flat spraying fan which concentrates the droplets in the fan centre or distributes them across the extent of the spraying fan in another, predetermined manner.

A spray nozzle assembly for atomizing a medium through a nozzle channel has been known from the U.S. Patent 4,646,849. The known spray nozzle assembly is composed of a spraying nozzle and a holder. The two components are made of a metal and are brazed to each other. In particular, a very hard material which preferably is sintered tungsten carbide, is utilized for the spraying nozzle. The spraying nozzle is manufactured from a small cylindrical portion of this material by grinding a wedge-shaped groove into the pressure-end circle area of the cylinder and a trapezoidal groove, which extends perpendicularly to the wedge-shaped groove, into the opposed circle area of the cylinder. The two interengaging grooves form a passage orifice in the middle. The spraying nozzle is then inserted into a holder, which is also made of a metal, and is brazed thereto. The holder has formed therein a cylinder-shaped channel which leads to the wedge-shaped groove of the spraying nozzle. The known spraying nozzle, which is also called a cross-recessed nozzle, helps achieve beneficial spraying characteristics even though the known spray nozzle assembly is very expensive in manufacture.

Accordingly, it is the object of the invention to provide a spray nozzle assembly which has favourable spraying characteristics and can also be manufactured economically in large numbers.

The object is attained by a spray nozzle assembly having the features of claim 1. The inventive spray nozzle assembly for atomizing a medium through a nozzle channel comprises

- a first channel portion which is tapered by two lateral surfaces facing each other to form an elongate narrow cross-sectioned surface,
- a passage orifice disposed in the narrow cross-sectioned surface the cross-sectional area of which is smaller than is the narrow cross-sectioned surface, and
- a second channel portion adjoining the passage orifice in the direction of medium flow which has two opposed lateral surfaces separating from each other with an increase in distance from the passage orifice, whose edges facing the passage orifice extend crosswise to the longitudinal direction of the narrow cross-sectioned surface, wherein the nozzle channel having the two channel portions and the passage orifice is configured inside an integrally formed plastic component.

The first channel portion is tapered by two lateral surfaces facing each other to form an elongate narrow cross-sectioned surface. The narrow cross-sectioned surface my have any shape here, specifically a curvature or a line-up of differently oriented portions. The tapering cross-section of the first channel portion causes a medium which streams in to be condensed initially. After flowing through the passage orifice, the medium passes into the adjoining second channel portion which has two opposed lateral surfaces separating from each other with an increase in distance from the passage orifice. Therefore, the cross-section of the second channel portion widens in the direction of flow, which makes well-defined atomization easier. The edges facing the passage orifice extend crosswise to the longitudinal direction of the narrow cross-sectioned surface. Hence, the two cross-sections formed each by the two lateral surfaces of the first and second channel portions will cross each other at right angles, for example. Since the entire spray nozzle assembly is manufactured as a plastic element it may be produced integrally in an injection moulding process, for example. As compared to the known spray nozzle

assembly, it thus becomes unnecessary to work the spray nozzle individually and place it in a separate holder.

The invention relies on the finding that using a particularly hard material for the spray nozzle as is provided for wear reduction according to the state of the art is unnecessary for many applications. It is specifically for equipping sprayers or atomizers, which are intended for a single fill, with a spraying head that an inventive spray nozzle assembly completely made from a plastic will meet the requirements as well.

An example of application is to spray non-diluted olive oil in the airless process by using a spraying head comprising an inventive spray nozzle assembly, e.g. for spraying oil onto salads.

In a preferred aspect of the invention, the second channel portion is limited, between its two lateral surfaces, by two bordering surfaces disposed to be approximately perpendicular to the plane of the passage orifice which are at a lateral distance from the passage orifice. Those additional bordering surfaces allow to further control and efficiently act on the spray jet. In a particularly preferred aspect of the invention, the bordering surfaces are arranged approximately on the jacket of an imaginary cylinder the longitudinal axis of which extends perpendicularly to the plane of the passage orifice. It has been shown that this helps in bringing about a particularly favourable spraying behaviour.

According to a further preferred aspect of the invention, the nozzle channel comprises a third channel portion adjoining the second channel portion which has two lateral surfaces each of which extends in the plane of one of the two lateral surfaces of the second channel portion, and which is limited by two bordering surfaces disposed to be approximately perpendicular to the plane of the passage orifice between the two lateral surfaces of the third channel portion which are disposed at a lateral distance from the bordering surfaces of the second channel portion and are farther remote from the passage orifice than those are. The third channel portion creates a further portion of the nozzle channel the expansion of which in the direction of flow in one direction corresponds to the expansion of the second channel portion while a step is formed in the direction perpendicular thereto between the second and third channel portions. The geometrical

configuration of the second and third channel portions, particularly that of the step that forms, further allows to efficiently take an influence on the spraying behaviour.

It is preferred that the nozzle channel comprises a fourth channel portion which is disposed in front of the first channel portion in the direction of flow and adjoins the first channel portion and which is cylindrical in cross-section. This fourth channel portion allows introducing the medium to be sprayed into the spray nozzle assembly. It is notable that even this channel portion is formed as a single piece with the integrally formed plastic element. This permits to configure the spray nozzle assembly in such a way that a smaller number of components are needed for an installation in a spraying head.

According to a further preferred aspect of the invention, the narrow cross-sectioned surface, on either side of the passage orifice, has a portion disposed substantially in the plane of the passage orifice. Preferably, the narrow cross-sectioned surface has two further portions which adjoin the two portions of the narrow cross-sectioned surface disposed laterally of the passage orifice, and which are inclined towards the first channel portion from the plane of the passage orifice. An accurate design of the channel portion directing the medium to the passage orifice is of particular significance for the flow conditions of the medium and also for the resultant spraying behaviour. It has been shown that the so-called configuration of the narrow cross-sectioned surface helps achieve a particularly advantageous spraying behaviour.

According to a further preferred aspect of the invention, two webs project from the narrow cross-sectioned surface adjacent to the passage orifice, which extend into the first channel portion. Preferably, the webs extend in the direction of the lateral surfaces of the second channel portion. The webs cause a beneficial vortex of the flow immediately before it passes through the passage orifice. This helps achieve a particularly advantageous spraying behaviour.

According to a further preferred aspect of the invention, the spray nozzle assembly is manufactured from polyoxymethylene (POM), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), polyamide (PA) and/or polypropylene (PP). The plastics mentioned excel in having particular beneficial properties in processing and use.

According to an embodiment of the present invention there is provided a spray nozzle assembly for atomizing a medium through a nozzle channel. The assembly comprises a first channel portion which is tapered by two lateral surfaces facing each other

to form an elongate, narrow-cross-sectional surface, an ejection orifice which is disposed in the narrow-cross-sectional surface and whose cross-sectional area is smaller than that of the narrow-cross-sectional surface, and a second channel portion adjoining the ejection orifice in the direction of medium flow. The second channel portion has two opposite lateral surfaces that veer away from each other with increasing distance from the ejection orifice whose edges facing the ejection orifice run perpendicular to the longitudinal direction of the narrow-cross-sectional surface. The nozzle channel with its two channel portions and the ejection orifice are configured inside an integrally formed plastic component. Between its two lateral surfaces, the second channel portion is confined by two bounding surfaces which are disposed to be approximately perpendicular to the plane of the ejection orifice and which are spaced laterally from the ejection orifice.

The invention will be described in more detail below with reference to two embodiments illustrated by seven figures.

In the drawings:

Fig. 1 shows a perspective view of an inventive spray nozzle assembly,

Fig. 2 shows a perspective view of the spray nozzle assembly of Fig. 1 as sectioned along its longitudinal axis,

Fig. 3 shows a perspective view of the spray nozzle assembly of Fig. 1 as sectioned along its longitudinal axis with the sectional plane extending perpendicularly to that of Fig. 2,

Fig. 4 shows a bottom plane view of the spray nozzle assembly of Fig. 1,

Fig. 5 shows a perspective view of a second embodiment of the inventive assembly as sectioned along the longitudinal axis of the nozzle channel,

Fig. 6 shows a perspective view of the second embodiment of a spray nozzle assembly as sectioned along the longitudinal axis of the nozzle channel, with the sectional plane extending perpendicularly to that of Fig. 5,

Fig. 7 shows a schematic representation of the spray nozzle assembly of Figures 5 and 6 in a perspective view.

Components which match each other in the different figures and both embodiments are given like reference figures.

Fig. 1 shows an inventive spray nozzle assembly in a perspective view from top. The spray nozzle assembly which has the nozzle channel extending in the middle terminates in a level, approximately rectangular outer surface 10 having two rounded sides and intensely rounded corners. An approximately ashlar block 12 and a cylindrical portion 14 extend adjacent to the outer surface 10.

The nozzle channel, the passage orifice 16 of which can be seen in the view of Fig. 1, extends inside the spray nozzle assembly and along the longitudinal assembly thereof. A medium to be sprayed is led through a first, invisible channel portion and through the passage orifice 16. Adjacent to the passage orifice 16, there is a second channel portion which is confined by two lateral surfaces 18 which are opposed to each other and withdraw from each other with an increasing distance from the passage orifice, and two bordering surfaces disposed to be approximately perpendicular to the plane of the passage orifice 16. The two bordering surfaces 20 are arranged on the jacket of an imaginary

cylinder the longitudinal axis of which extends perpendicularly to the plane of the passage orifice 16.

Adjacent to the second channel portion, there is a third channel portion which is confined by two lateral surfaces 22 which smoothly pass over into a lateral surface 18 each of the second channel portion, and two bordering surfaces 24 which are disposed to be approximately parallel to the bordering surfaces 20 of the second channel portion, but are disposed at a lateral distance therefrom and are offset outwardly. Because of the described arrangement of the lateral and bordering surfaces, the nozzle channel continuously widens in the area of the second and third channel portions, proceeding from the passage orifice 16 in the direction of flow. The third channel portion opens into the level outer surface 10 so that the nozzle channel terminates altogether on this outer surface.

The two bordering surfaces 20 of the second channel portion define a step between the second and third channel portions.

The lateral surfaces 22 of the third channel portion are substantially wider than are its bordering surfaces 24 so that the third channel portion is of an approximately rectangular, extended cross-section. The lateral surfaces 22 of the third channel portion extend perpendicularly to the longer edge of the level outer surface 10.

The perspective sectional representation of Fig. 2 shows the spray nozzle assembly of Fig. 1 wherein the sectional plane extends along the longitudinal axis of the nozzle channel, i.e. centrally through the passage orifice 16, and in the direction of the longer edge of the level outer surface 10.

This view allows to recognize the lateral surfaces 18 and 22 and the bordering surfaces 20 and 24 of the second and third channel portions. An edge of the passage orifice 16 can be identified at 30. This edge is joined by a flat bottom surface 32 of the second channel portion that is disposed in parallel with the outer surface 10. Another flat bottom surface 34 is located between the bordering surfaces 20 and 24 of the second and third channel portions. A first channel portion 26 is located in the direction of flow below the passage orifice 16. The channel has two lateral surfaces facing each other, one of which can be seen having the reference figure 28. Because of the two lateral surfaces facing each other, the first channel portion tapers up to a narrow cross-sectioned surface 36 of which Fig. 2 only allows to see the central line extending along the elongate, narrow cross-

sectioned surface. The narrow cross-sectioned surface extends at either side of the passage orifice 16 in parallel with the outer surface 10. Unless defined by the lateral surfaces 28, the wall of the first channel portion 26 is cylindrical.

Also provided with a cylindrical cross-section is a fourth channel portion 38. This fourth channel portion 38 serves for introducing the medium to be sprayed and smoothly passes over into the first channel portion.

The spray nozzle assembly of Figs. 1 and 2 is illustrated in a further view in the representation of Fig. 3 where the sectional plane also extends along the longitudinal axis of the spray nozzle assembly, but is perpendicular to the sectional plane used in Fig. 2. Like in Fig. 2, it can be seen in Fig. 3 that the edges of the lateral surfaces 28 and lateral surfaces 18 that face the passage orifice 16 are perpendicular to each other so that the cross-sectional surfaces of the first and second channel portions which are approximately rectangular in the area of the passage orifice form a cross.

This cruciform arrangement can also be recognized in Fig. 4 where the spray nozzle arrangement is illustrated in a view from below, i.e. in the direction of the streaming medium. This view makes it particularly easy to identify the two portions of the narrow cross-sectioned surface 36 that are disposed at either side of the passage orifice 16. Shown in a phantom line are the two flat bottom surfaces 32 which also adjoin the passage orifice 16 and extend in a direction perpendicular to the narrow cross-sectioned surface 36. The two first flat bottom surfaces 34 and the bordering surfaces 20 disposed in a circle segment fashion can be seen as well.

The circle designated 40 indicates the inner circumference of the cylindrical fourth channel portion 38.

In Fig. 5, a further embodiment of the invention is shown where the view and sectional plane roughly match with those of Fig. 2. Except for the design of the channel portions arranged around the passage orifice 16, the second embodiment is identical to that of Fig. 1. In contrast to the first embodiment, the narrow cross-sectioned surface 36 which is confined by the two converging lateral surfaces 28 of the first channel portion does not run completely in a plane, however. On either side of the passage orifice 16, the narrow cross-sectioned surface 36 rather has a first portion 42 which extends approximately in the plane of the passage orifice 16 and in parallel with the outer surface 10, and a second

portion 44, which adjoins the first portion 42 and is inclined towards the first channel portion 26 from the plane of the passage orifice 16.

As a further particularity, on either side of the passage orifice 16, there is a web 46 projecting from a first portion 42 of the narrow cross-sectioned surface 36 which extends into the first channel portion. Each web 46 runs in the direction of one of the two lateral surfaces 18 of the second channel portion.

Because of the specific configuration of the narrow cross-sectioned surface with the webs and inclined portions 44, a vortex is achieved for the medium to be sprayed in the area of the first channel portion before it flows through the passage orifice 16.

The view of Fig. 6, the sectional plane of which extends perpendicularly from that of Fig. 5, allows recognizing the lateral surfaces 18 and 22 of the second and third channel portion and one side of the closely adjoining web 46 which marks off the passage orifice 16.

For a better comprehension, the second embodiment is schematically illustrated once more in a perspective view in Fig. 7 where concealed lines are shown by dots. This view permits to see the two portions 42 and 44 of the narrow cross-sectioned surface 36 and the cross-section of the passage orifice 16 in a particularly distinct way.

CLAIMS:

1. Spray nozzle assembly for atomizing a medium through a nozzle channel, comprising

- a first channel portion which is tapered by two lateral surfaces facing each other to form an elongate, narrow-cross-sectional surface,
- an ejection orifice which is disposed in the narrow-cross-sectional surface and whose cross-sectional area is smaller than that of the narrow-cross-sectional surface, and
- a second channel portion adjoining the ejection orifice in the direction of medium flow, said second channel portion having two opposite lateral surfaces that veer away from each other with increasing distance from the ejection orifice, whose edges facing the ejection orifice run perpendicular to the longitudinal direction of the narrow-cross-sectional surface,
- the nozzle channel with its two channel portions and the ejection orifice being configured inside an integrally formed plastic component, wherein
- between its two lateral surfaces, the second channel portion is confined by two bounding surfaces which are disposed to be approximately perpendicular to the plane of the ejection orifice and which are spaced laterally from the ejection orifice.

2. Spray nozzle assembly according to claim 1, wherein the bounding surfaces are arranged approximately on the curved surface of an imaginary cylinder, the longitudinal axis of which runs perpendicular to the plane of the ejection orifice.

3. Spray nozzle assembly according to claim 1 or 2, wherein the nozzle channel includes a third channel portion adjoining the second channel portion and having two lateral surfaces, each of which extends in the plane of one of the two lateral surfaces of the second channel portion, said third channel portion being bounded by two bounding surfaces disposed between the two lateral surfaces of the third channel portion such as to be approximately perpendicular to the plane of the ejection orifice, said bounding surfaces being spaced laterally from the bounding surfaces of the second channel portion and being located further away than these from the ejection orifice.

4. Spray nozzle assembly according to any one of claims 1 to 3, wherein the nozzle channel includes a fourth channel portion of cylindrical cross-section, which, as seen in the direction of flow, is disposed in front of the first channel portion and which adjoins said first channel portion.

5. Spray nozzle assembly according to any one of claims 1 to 4, wherein, on each side of the ejection orifice, the narrow-cross-sectional surface has a portion disposed substantially in the plane of the ejection orifice.

6. Spray nozzle assembly according to claim 5, wherein the narrow-cross-sectional surface has two further portions which adjoin the two portions of the narrow-cross-sectional surface that flank the ejection orifice, and which are inclined away from the plane of the ejection orifice towards the first channel portion.

7. Spray nozzle assembly according to any one of claims 1 to 6, wherein two slender projections adjacent to the ejection orifice extend from the narrow-cross-sectional surface and protrude into the first channel portion.

8. Spray nozzle assembly according to claim 7, wherein each of the slender projections runs in the direction of a lateral surface of the second channel portion.

9. Spray nozzle assembly according to any one of claims 1 to 8, wherein the spray nozzle assembly is manufactured from polyoxymethylene (POM), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), polyamide (PA), polypropylene (PP) or combinations thereof.

Fig. 1

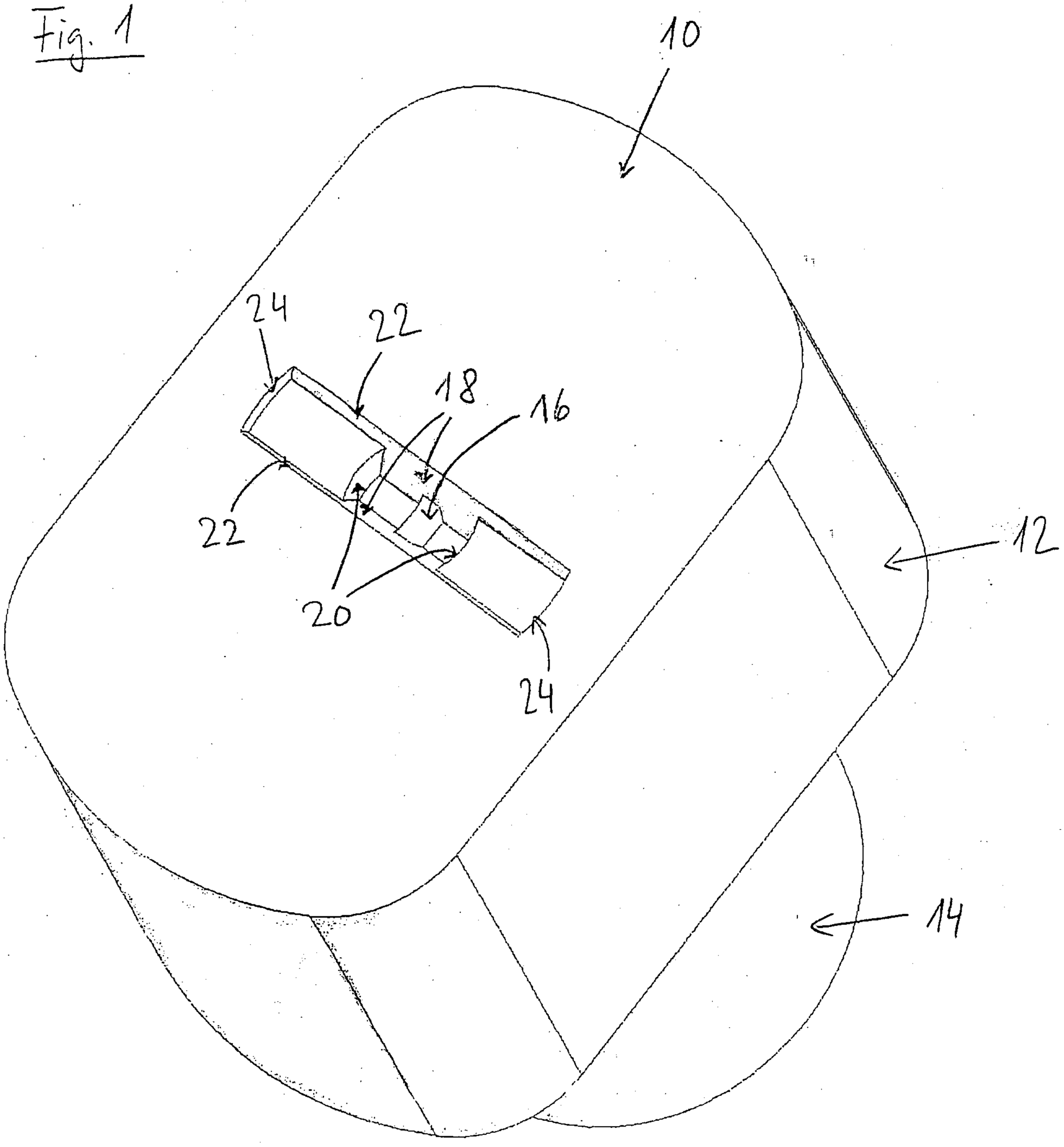


Fig. 2

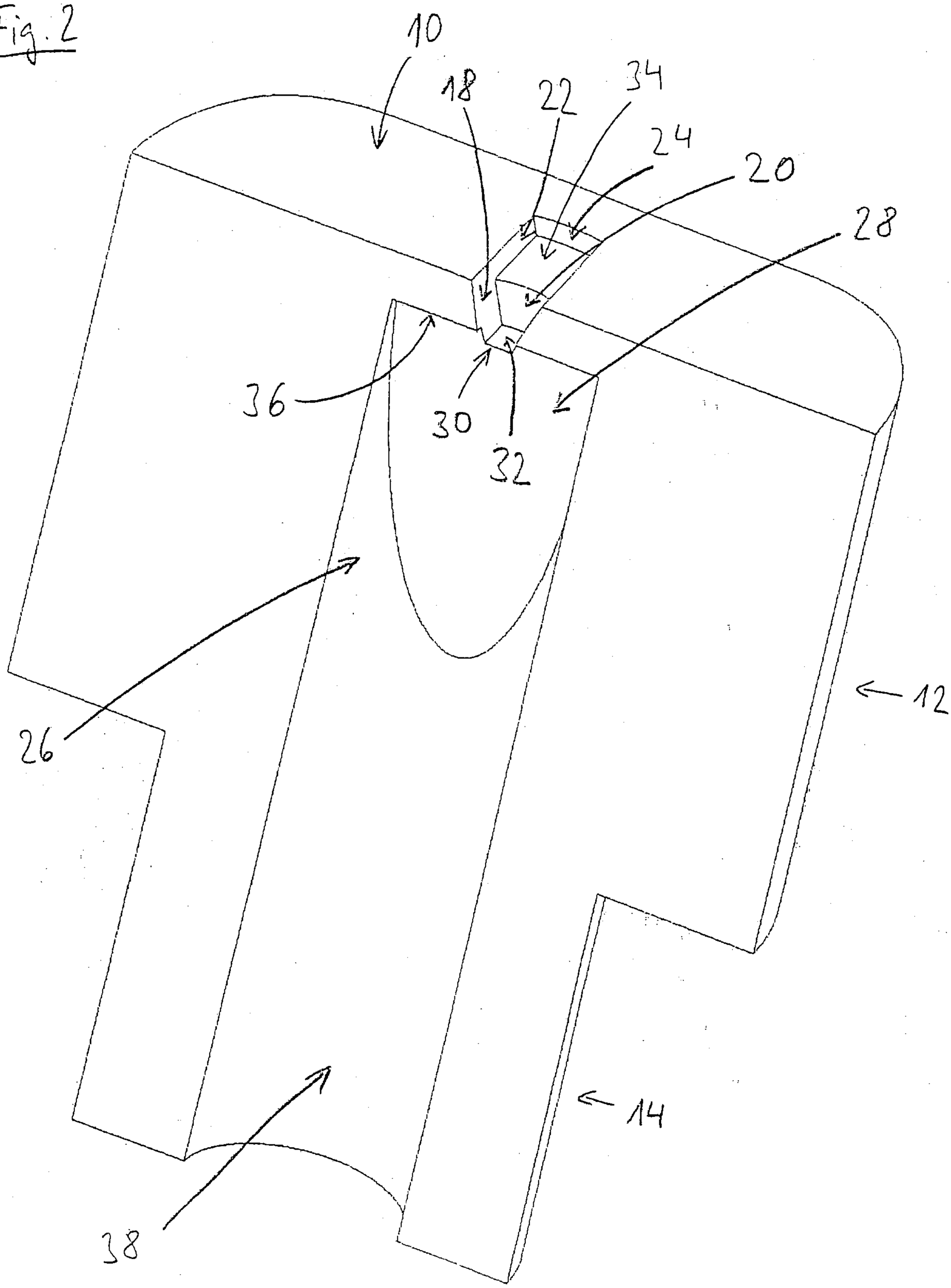


Fig. 3

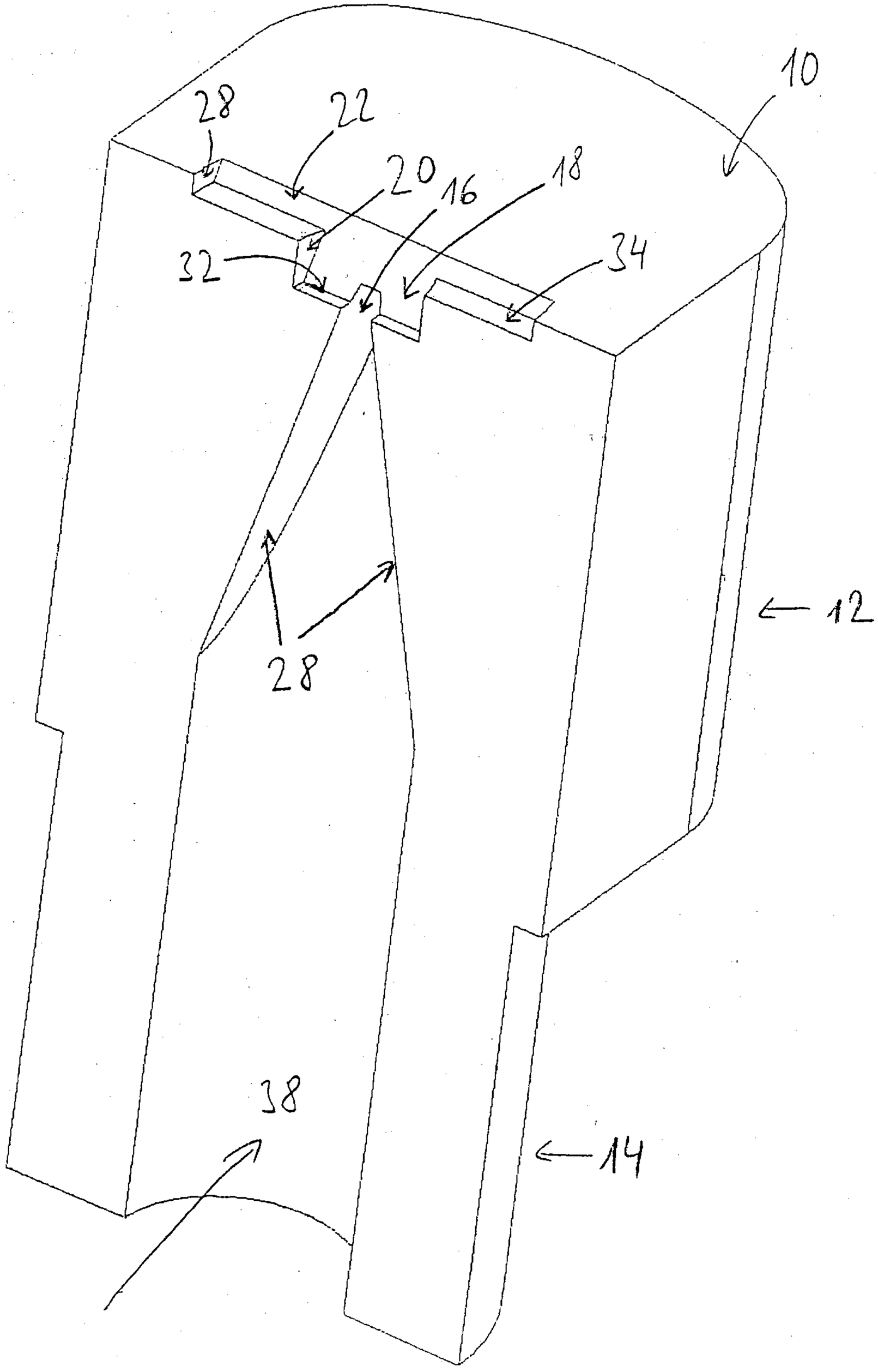


Fig. 4

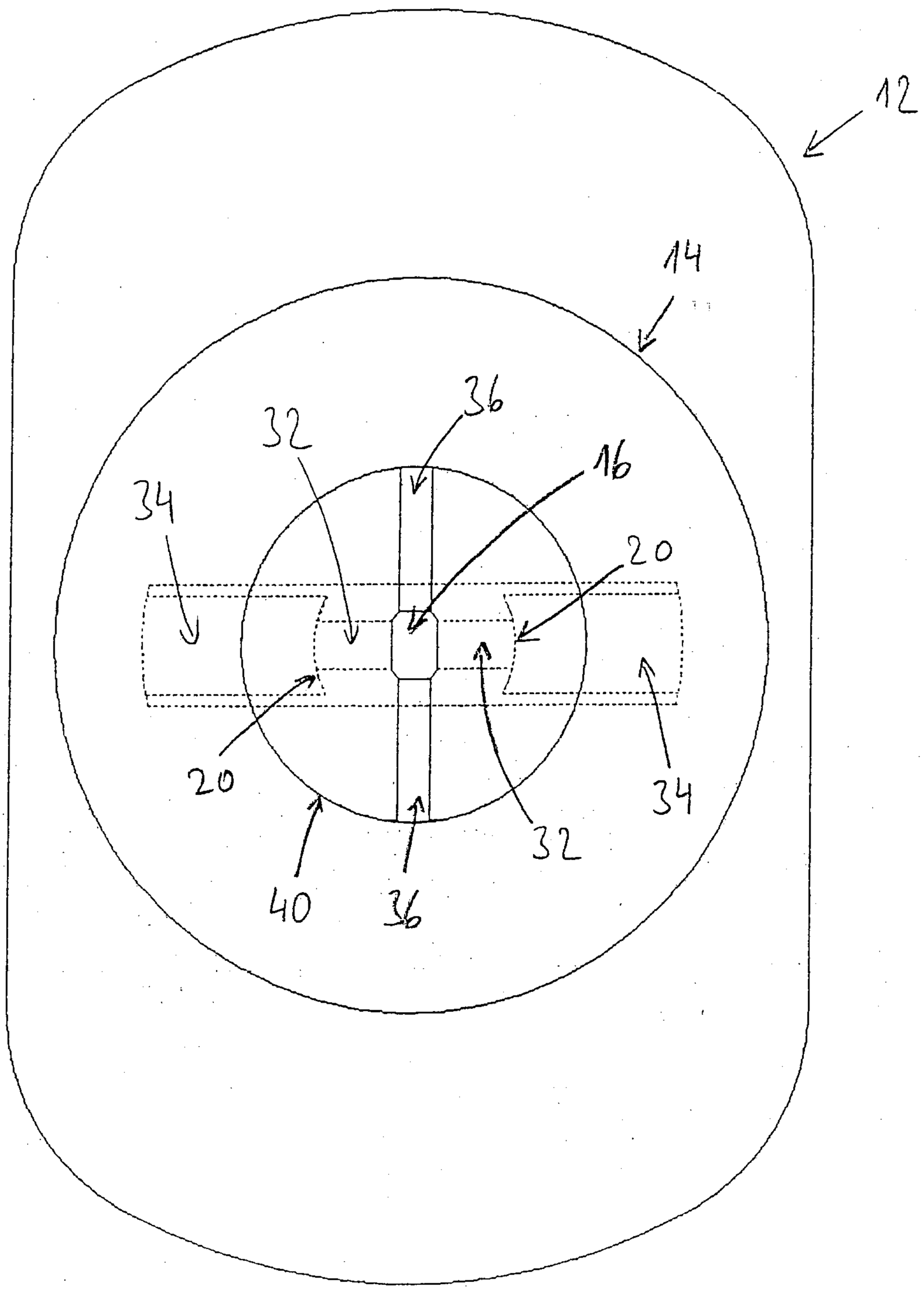


Fig. 5

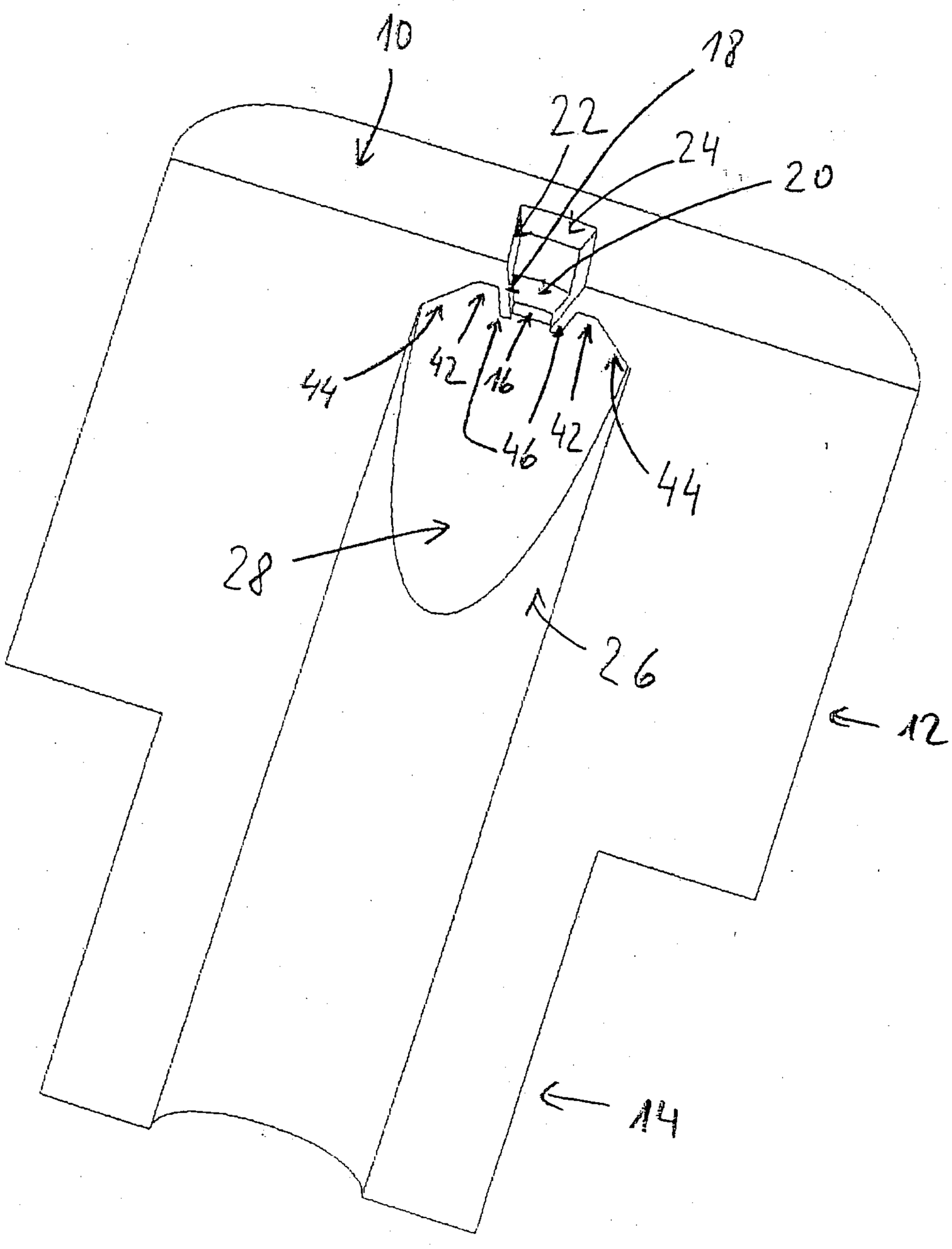


Fig. 6

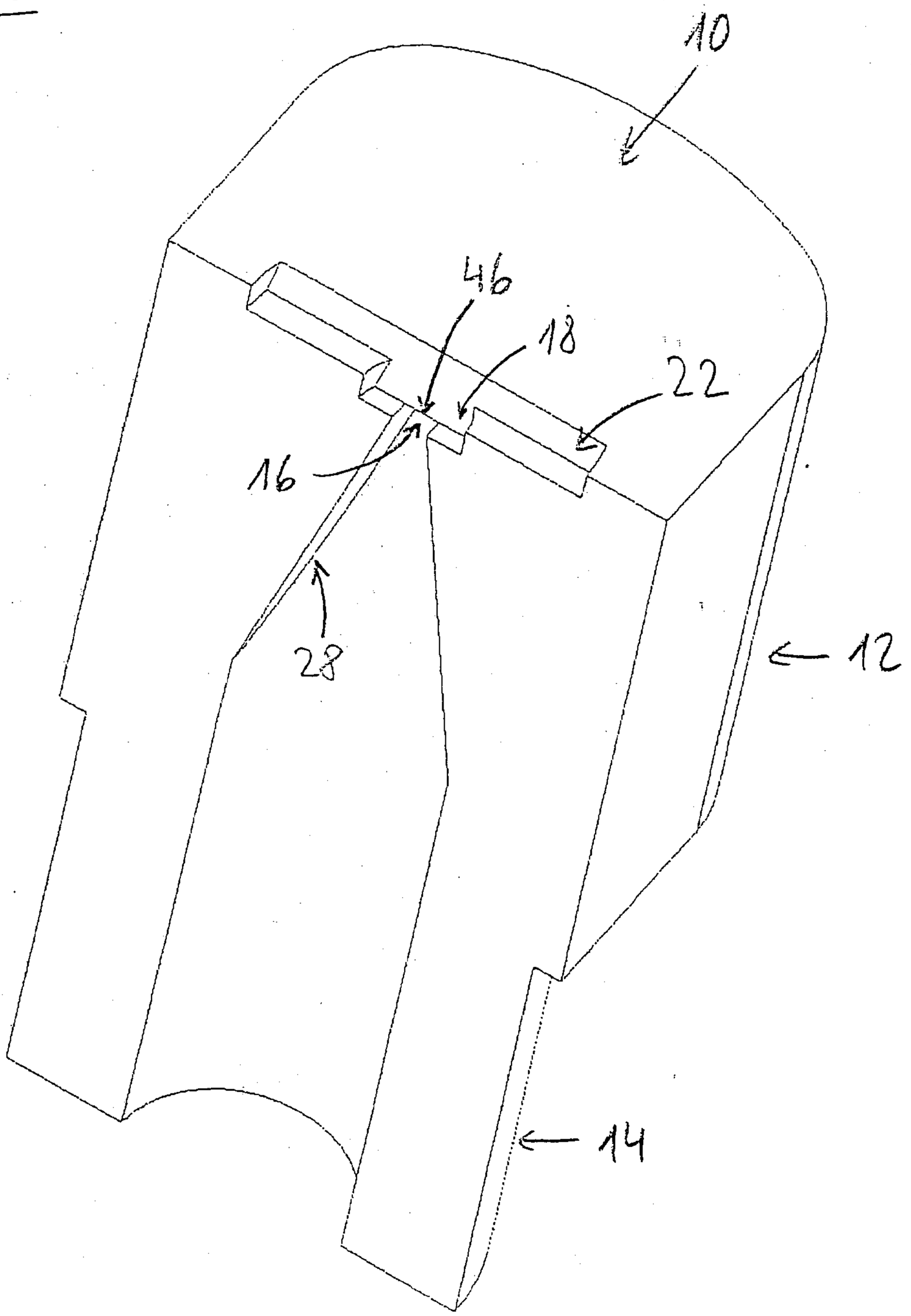
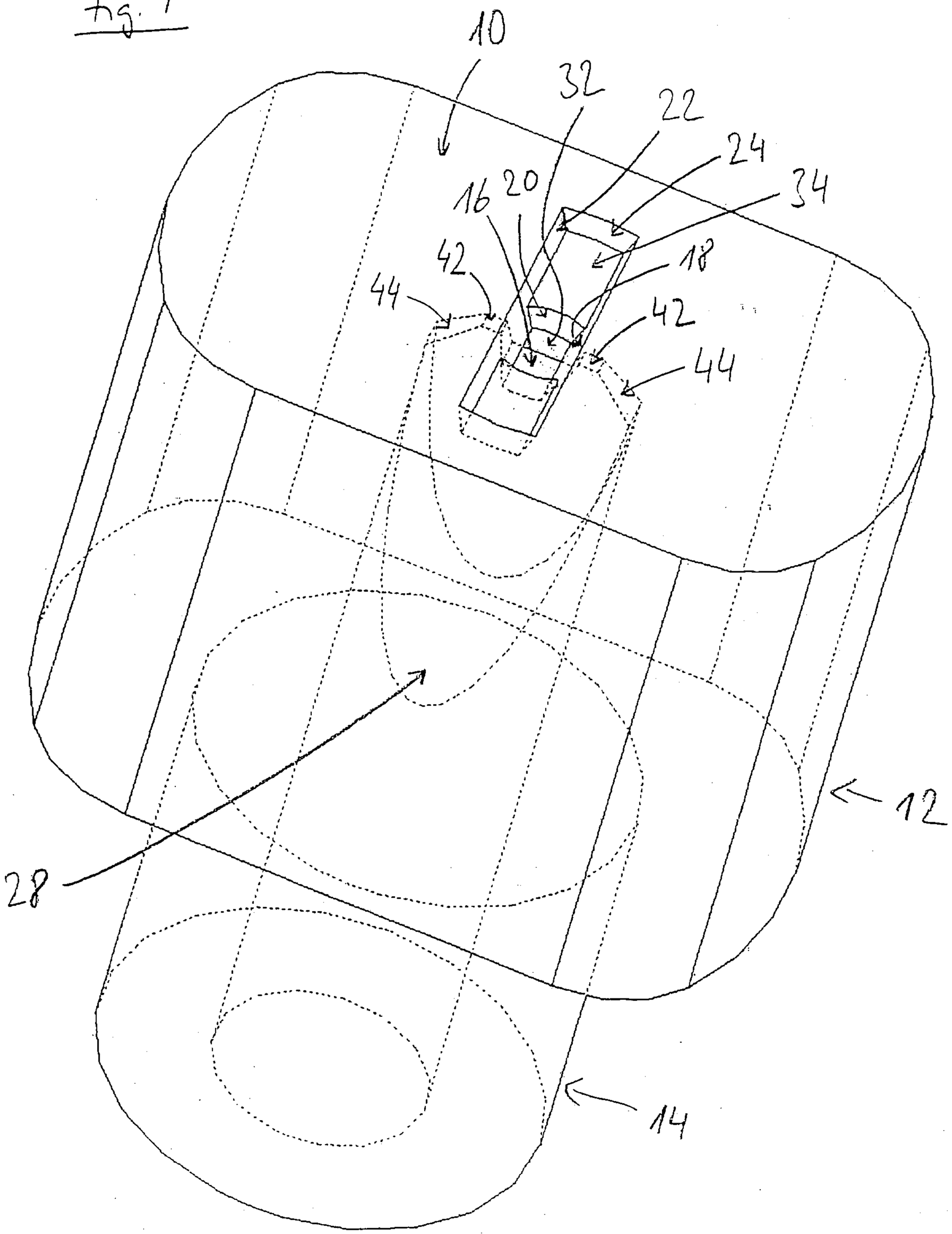
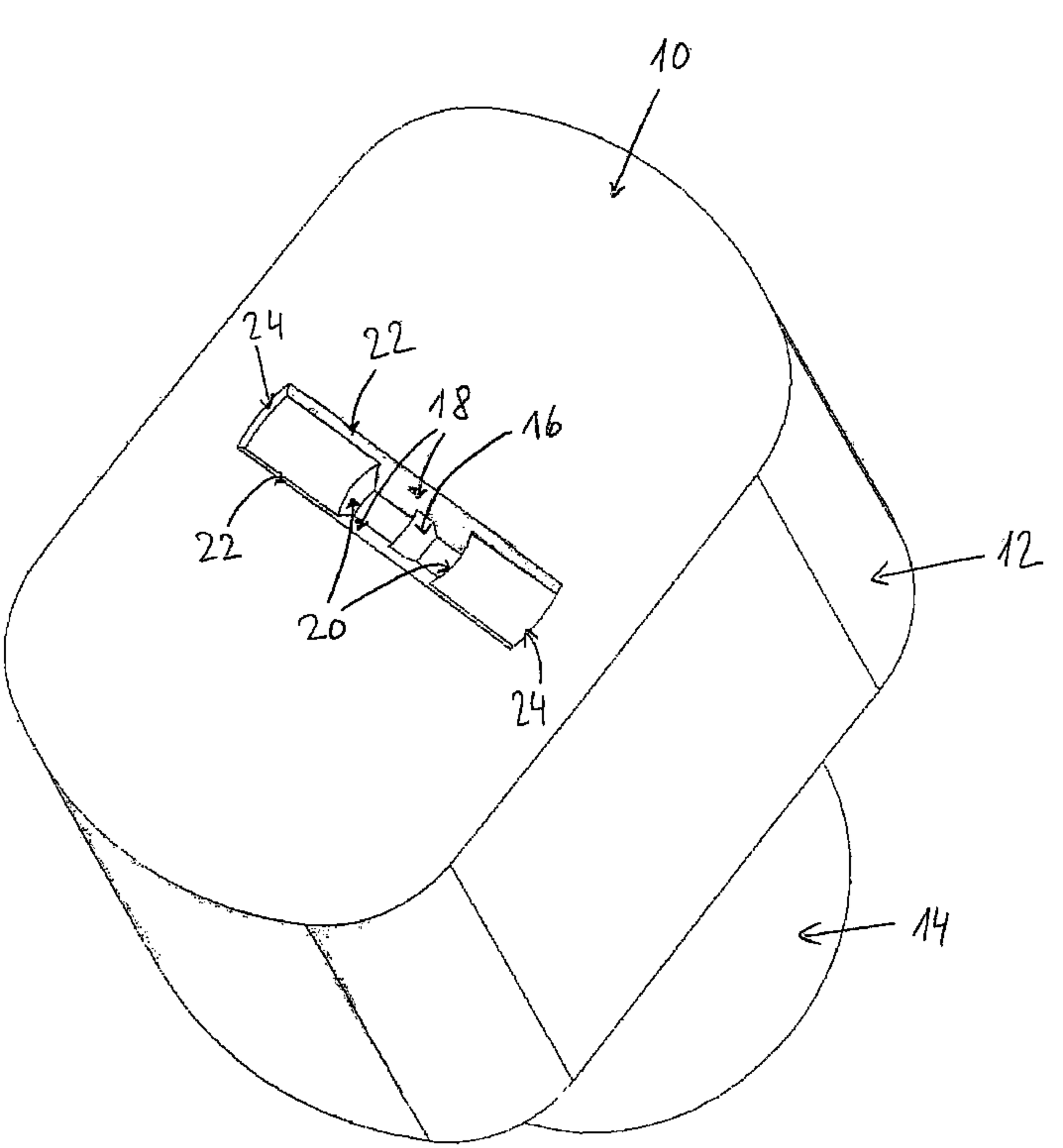


Fig. 7

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