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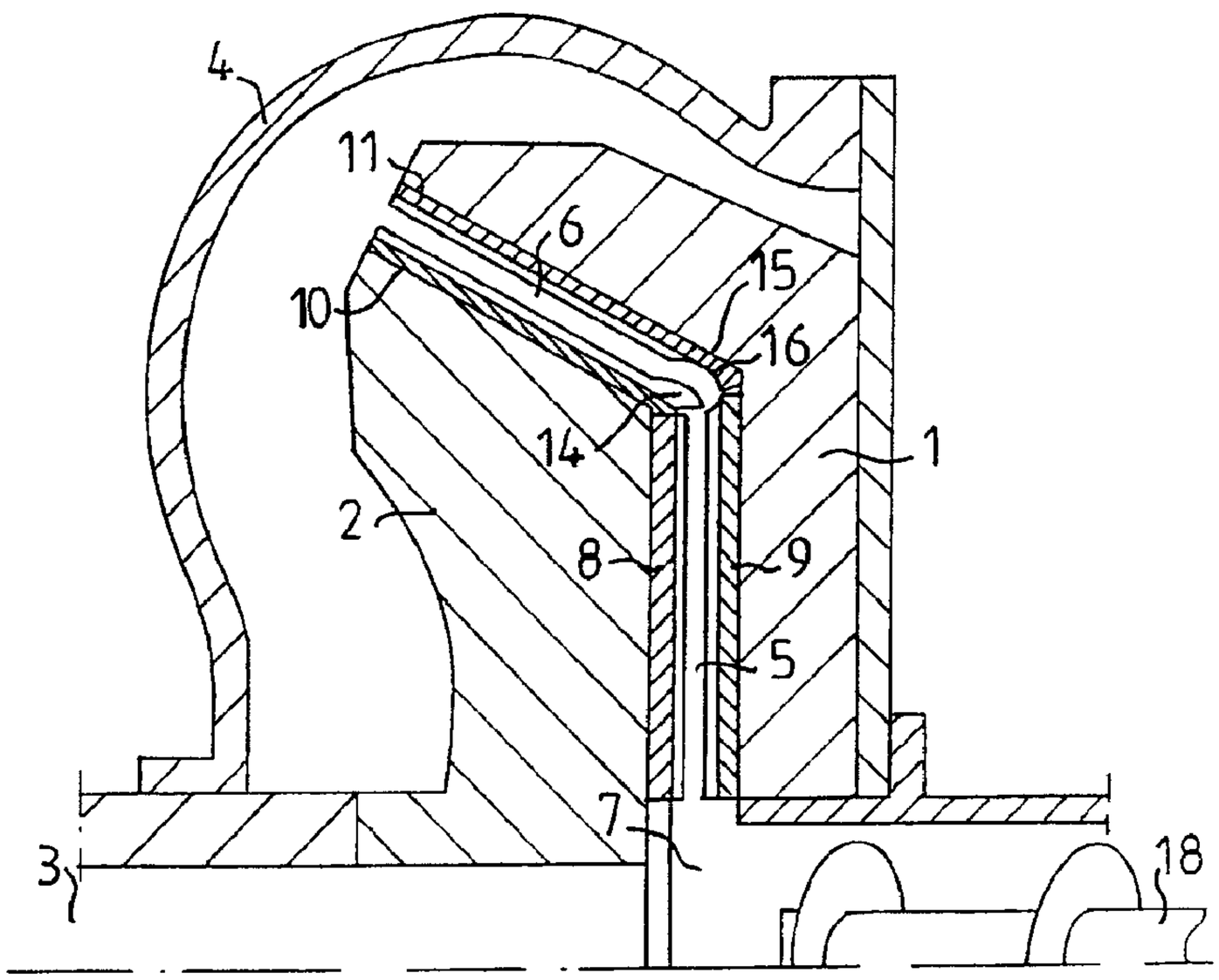

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A pair of co-operating refining elements (10, 11) intended for a disc refiner for finely disintegrating and refining lump-shaped lignocellulosic material in a refiner gap (5, 6) between two opposed refining discs (1, 2). The outer portion (6) of the refiner gap is angular in relation to the radial plane, and the refining disc (2) located outside the outer portion (6) of the refiner gap is rotary. The refining elements (10, 11) are intented to be placed directly in front of each other on opposed refining discs in this outer portion (6) of the refiner gap. The refining element (10) located inside is provided with at least one wing (14) freely projecting in the direction to the inner portion (5) of the refiner gap. The refining element (11) located outside has an inlet portion (15) located directly in front of the wing (14) which is formed with a concavely curved surface (16). The wing is provided to throw the material against the curved surface (16) for changing the direction of movement of the material into the outer angular portion (6) of the refiner gap.

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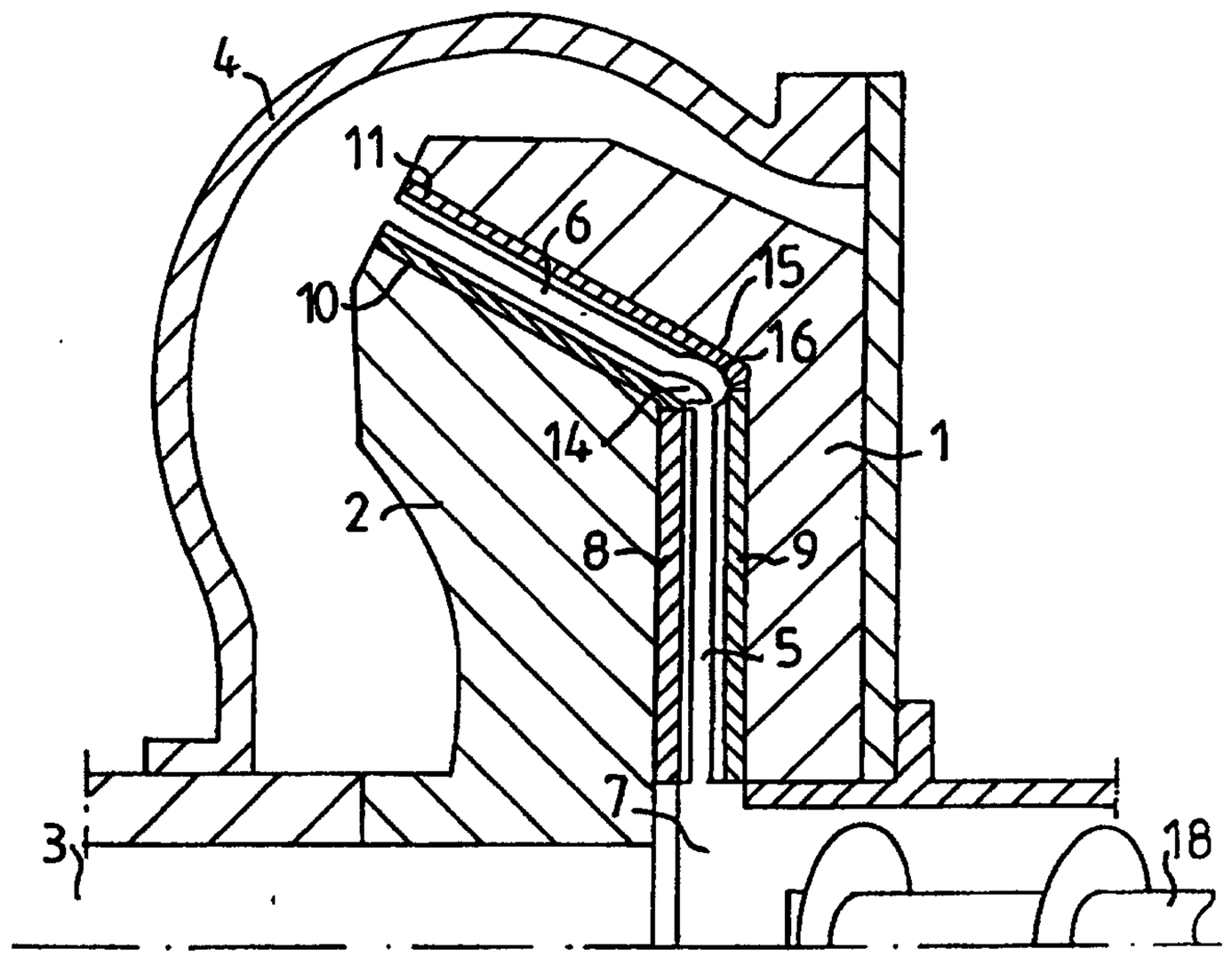
(57) Abstract

A pair of co-operating refining elements (10, 11) intended for a disc refiner for finely disintegrating and refining lump-shaped lignocellulosic material in a refiner gap (5, 6) between two opposed refining discs (1, 2). The outer portion (6) of the refiner gap is angular in relation to the radial plane, and the refining disc (2) located outside the outer portion (6) of the refiner gap is rotary. The refining elements (10, 11) are intented to be placed directly in front of each other on opposed refining discs in this outer portion (6) of the refiner gap. The refining element (10) located inside is provided with at least one wing (14) freely projecting in the direction to the inner portion (5) of the refiner gap. The refining element (11) located outside has an inlet portion (15) located directly in front of the wing (14) which is formed with a concavely curved surface (16). The wing is provided to throw the material against the curved surface (16) for changing the direction of movement of the material into the outer angular portion (6) of the refiner gap.



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A PAIR OF CO-OPERATING REFINING ELEMENTS INTENDED FOR A DISC REFINER

This invention relates to refining elements for use in refiners of disc type for lump-shaped, preferably lignocellulosic material, of which refiner the refining means rotary relative to each other are provided with refining elements, which form a refiner gap between themselves. The outer portion of the refiner gap, spaced from the rotation centre, is angular in relation to the radial plane, so that it extends to a substantial degree in axial direction.

A particularly important field of application for the invention are refiners for making fiber- or papermaking pulp from wood chips or similar cellulosic material. Refiners of disc type are formed with a refiner gap extending in radial direction between the refining elements of the refining means, which gap starts from a central feed zone for the raw material where the centrifugal force is relatively low. The centrifugal force affecting the material to be refined increases then very strongly with increasing radius. In order to prolong the staytime in the outer portion of the refiner gap, the refiner gap in its outer portion can be formed so as to extend angularly in relation to the radial direction, so that only part of the centrifugal force is allowed to affect the material to be refined in the flow direction of the refiner gap. While, thus, steps have been taken in the radially outer portion of the refiner gap in order to limit the flow rate of the material to be refined in this outer portion, it applies also to this design that the effect of the centrifugal force in the central feed zone is low, so that the feed to the outer angular portion of the refiner gap is not as intensive as would be desired in order to achieve maximum capacity of the refiner. Attempts have been made to introduce mechanical devices to promote the discharge in the central feed zone, which, however, are not effective, because a.o. they must be exchanged relatively often due to their rapid wear.

The invention has the object to eliminate these problems and thereby bring about an effective feed of the material to be refined from the inner radial portion of the refining zone to the outer angular portion. This is achieved in that the refiner elements in the outer angular portion of the refining zone are designed so as defined in the attached claims.

According to the present invention, there is provided a pair of co-operating refining elements (10, 11) intended for a disc refiner for finely disintegrating and refining lump-shaped lignocellulosic material in a refiner gap (5, 6) between two opposed refining discs (1, 2) where the outer portion (6) of the refiner gap is angular in relation to the radial plane, and the refiner disc (1) located outside the outer portion (6) of the refiner gap is stationary, and the refining disc (2) located inside is rotary, and the refining elements (10, 11) are intended to be placed directly in front of each other on opposed refining discs in this outer portion (6) of the refiner gap, characterized in that the refining element (10) located inside is provided with at least one wing (14) freely projecting in the direction to the inner portion (5) of the refiner gap, and that the refining element (11) located outside has an inlet portion (15) located directly in front of the wing (14), which inlet portion is formed with a concavely curved surface (16), and the wing (14) is provided to throw the material against the curved surface (16) for changing the direction of movement of the material into the outer angular portion of the refiner gap.

By forming the co-operating refining elements with wings and, respectively, concavely curved surface, feed from the inner portion of the refining zone to the angular outer portion is ensured. The wings on the rotating refining elements, thus, throw the material to be refined against the concavely curved surface of the stationary refining elements, so that the material to be refined is caused to change its direction into the angular portion of the refiner gap.

By this arrangement both the capacity and the load can be increased substantially, and thereby also the energy consumption at the refining is reduced by 5-10% to the same pulp quality.

The invention is described in greater detail in the following, with reference to the accompanying drawings illustrating embodiments of the invention.

Fig. 1 shows schematically a refiner with an inner radial and an outer angular refiner gap portion,

Fig. 2 shows on an enlarged scale the two co-operating refining elements in the outer portion of the refiner gap in Fig. 1,

Figs. 3 and 4 show an alternative embodiment of a refining element for the rotary refining disc located inside the angular portion of the refiner gap,

Figs. 5 and 6 show an alternative embodiment of a refining element for the stationary refining disc located outside the angular portion of the refiner gap.

The refiner shown in Fig. 1 is formed with a stationary refining disc 1 and a rotary refining disc 2 mounted on a rotary shaft 3.

The refiner gap can be controlled by axial movement of the shaft 3. The refining discs are enclosed in an airtight refiner housing 4. Between the refining discs a refiner gap is formed, which consists of an inner radial portion 5 and an angular outer portion 6. The inclination angle to the rotary shaft should be less than 45^{o}, preferably between 10 and 30^{o}. The stationary refining disc 1 has a central opening 7, through which the material to be refined is fed.

Each of the refining discs is provided with wear portions in the form of refining elements 8-11 both in the inner radial portion of the refiner gap 5 and in the outer angular portion 6. The refining elements are provided with bars 12 and intermediate grooves 13 for working and refining the material to be refined.

In the outer angular portion 6 of the refiner gap, the stationary refining disc 1 is located outside the rotary refining disc 2. The refining elements 10,11 on these refining discs 1,2, thus, are located outside the outer angular portion of the refiner gap.

The refining element 10 located inside is provided with at least one freely projecting wing 14 extending in the direction to the inner radial portion 5 if the refiner gap. Each wing 14 preferably is formed as an extension of one of the bars 12 on the refining element 10. The bars 12 can also be angular in relation to the radius, in order to increase the pumping effect. The wing, like the bars, is widest at the base and tapers upward. It can also be curved to the inner portion 5 of the refiner gap. According to the embodiment shown, the refining element 10 is provided with two wings 14. The refining element 11 located outside is provided with an inlet portion 15 located directly in front of the wings 14 and provided with a concavely curved surface 16. The inlet portion 15 can be curved to the inner portion 5 of the refiner gap, so that it partially encloses the wings 14. The upper edge of the wings 14 can have a curvature, which substantially corresponds to the curvature of the inlet portion 15, as shown in Fig. 2.

Owing to its design and the rotation of the refining disc 2, the wings 14 on the refining element 10 located inside throw the material to be refined obliquely outward to the inlet portion 15 on the refining element 11 located outside. When the material to be refined meets the concavely curved surface 16, the direction of movement of the material to be refined is changed into the outer angular portion 6 of the refiner gap.

According to the embodiments of the two co-operating refining elements shown in Figs. 3-6, the refining element 10 located inside is formed with projecting wings 14, as at the embodiment according to Figs. 1 and 2. The refining element 11 located outside, however, has been completed with a shoulder 17 in the concavely curved surface 16 in the inlet portion 15. The shoulder 17 preferably has a substantially triangular cross-section. The inclined flanks on the shoulder 17 are intended to additionally improve the feed of the material to be refined into the outer angular portion 6 of the refiner gap.

The material to be refined is fed into the central feed zone between the refining discs through the opening 7 in the stationary refining disc 1 by means of a feed screw 18 coaxial with the shaft 3. The material to be refined is thereby caused to move outward through the inner radial portion 5 of the refiner gap while simultaneously being worked by the radial refining elements 8-9. The feed from the inner radial portion 5 of the refiner gap to the outer angular portion 6 is promoted by the wings 14and opposite inlet portion 15. It was, thus, found that both the capacity and load could be increased considerably, by about 20%, by using this type of refining elements, compared with conventional ones. It also was found that it is possible to reduce the specific energy consumption by 5-10%. It should be noted, too, that these improvements were achieved with maintained pulp quality.

The invention, of course, is not restricted to the embodiments shown, but can be varied within the scope of the invention idea.

Claims

1. A pair of co-operating refining elements (10,11) intended for a disc refiner for finely disintegrating and refining lump-shaped lignocellulosic material in a refiner gap (5,6) between two opposed refining discs (1,2) where the outer portion (6) of the refiner gap is angular in relation to the radial plane, and the refiner disc (1) located outside the outer portion (6) of the refiner gap is stationary, and the refining disc (2) located inside is rotary, and the refining elements (10,11) are intended to be placed directly in front of each other on opposed refining discs in this outer portion (6) of the refiner gap, c h a r a c t e r i z e d i n that the refining element (10) located inside is provided with at least one wing (14) freely projecting in the direction to the inner portion (5) of the refiner gap, and that the refining element (11) located outside has an inlet portion (15) located directly in front of the wing (14), which inlet portion is formed with a concavely curved surface (16), and the wing (14) is provided to throw the material against the curved surface (16) for changing the direction of movement of the material into the outer angular portion of the refiner gap.

2. Refining elements as defined in claim 1, c h a r a c t e r i z e d i n that each wing (14) is curved to the inner portion (5) of the refiner gap.

3. Refining elements as defined in claim 1 or 2, c h a r a c t e r i z e d i n that the concavely curved surface (16) partially encloses the wing (14), the upper edge of which has a curvature substantially corresponding to the curvature of the curved surface (16).

4. Refining elements as defined in claim 1 or 2, c h a r a c t e r i z e d i n that the inlet portion on the refining elements (11) located outside is provided with a shoulder (17) with inclined flanks.

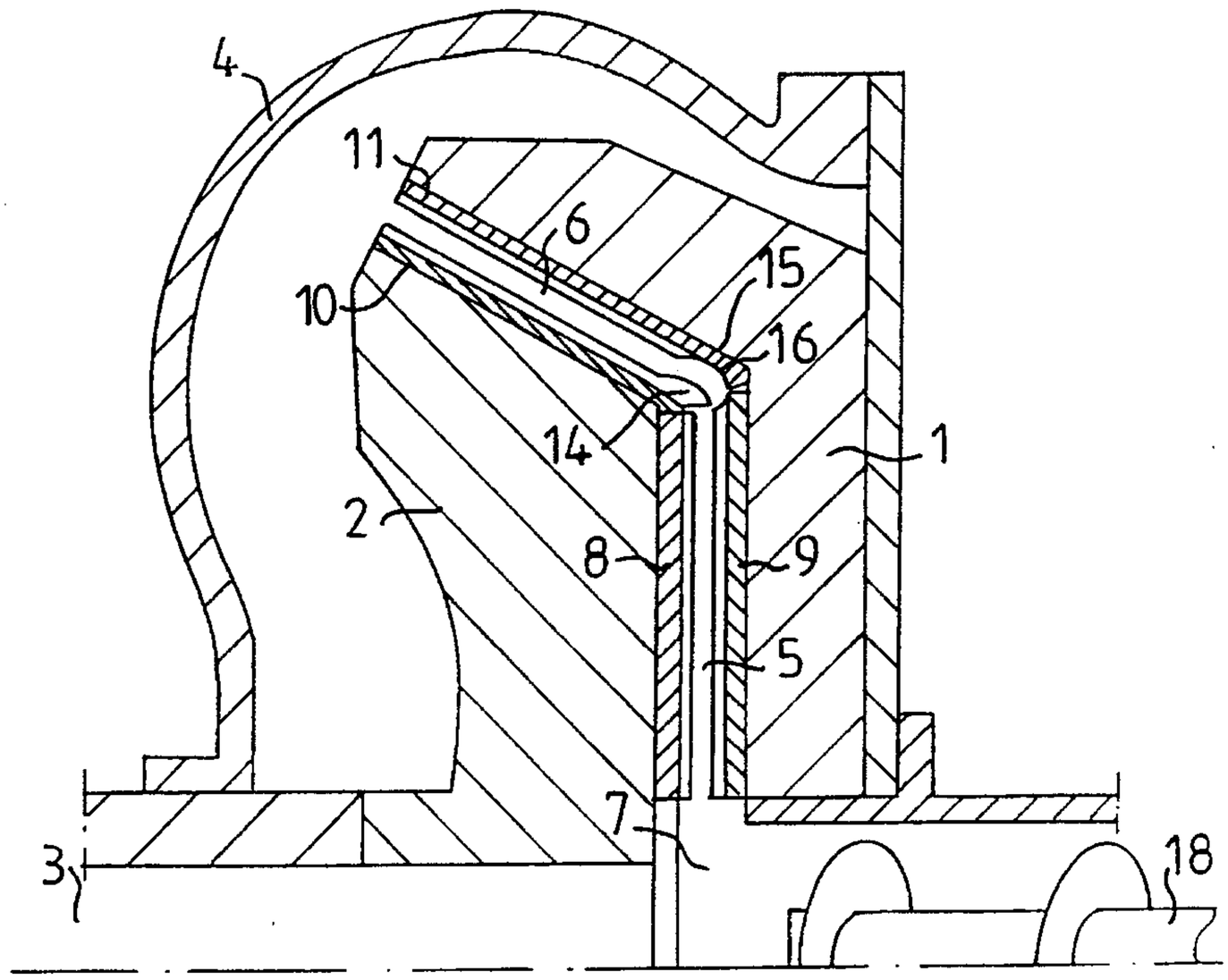


FIG.1

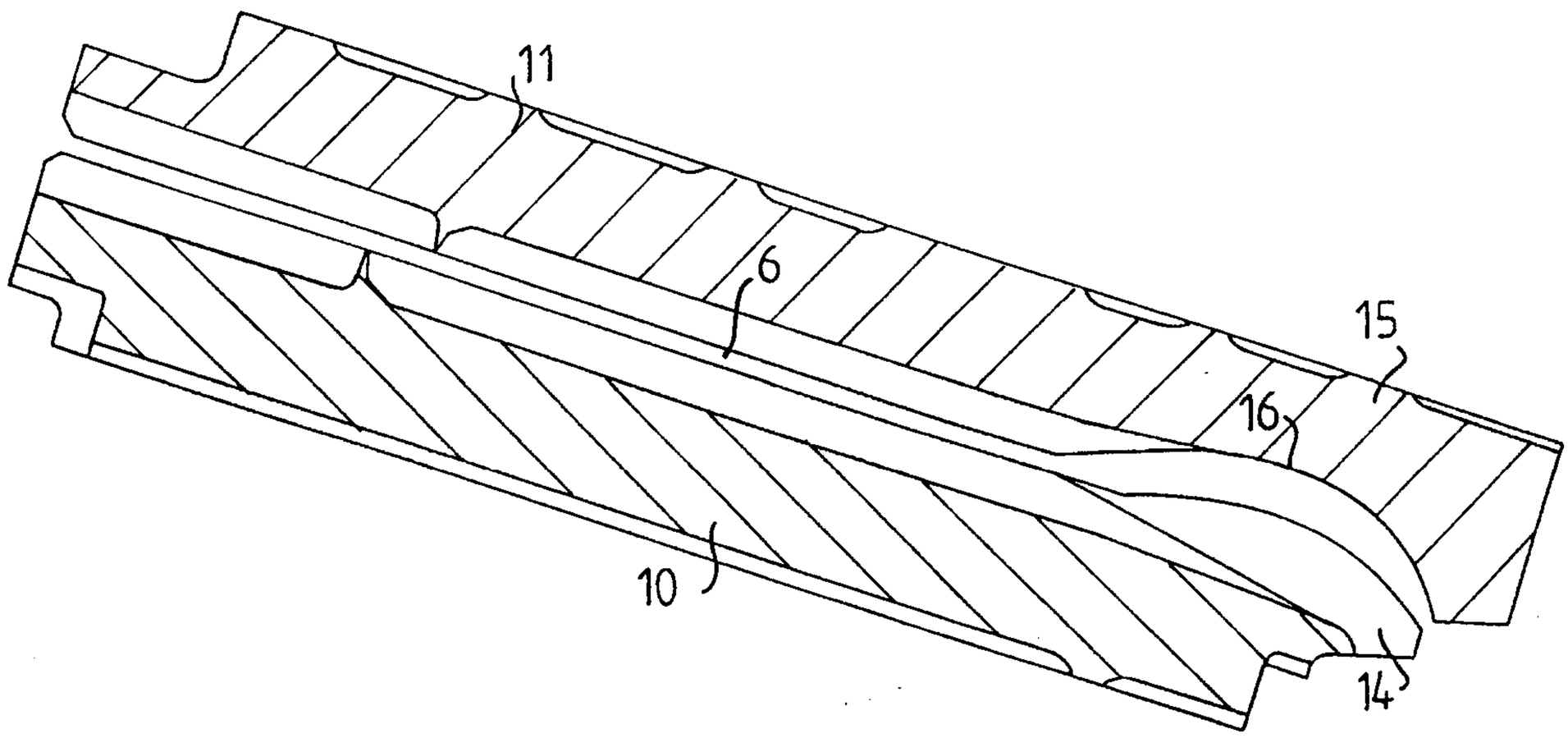


FIG.2

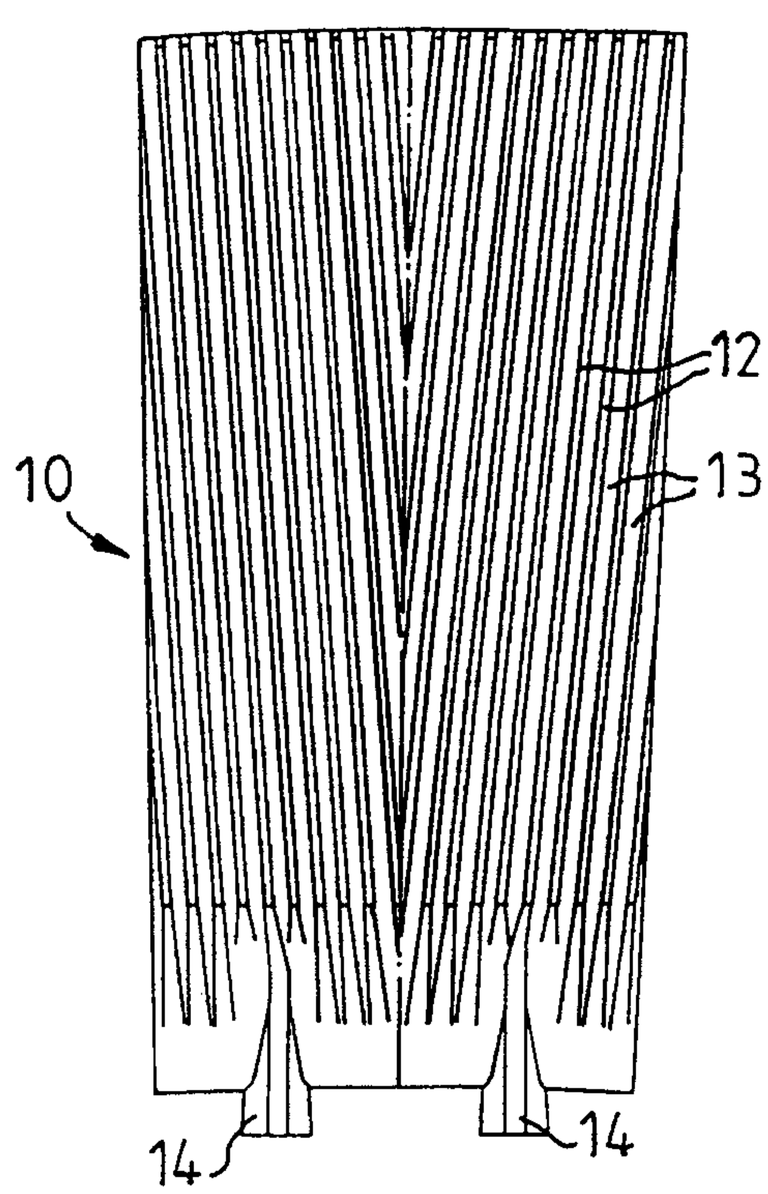


FIG. 3

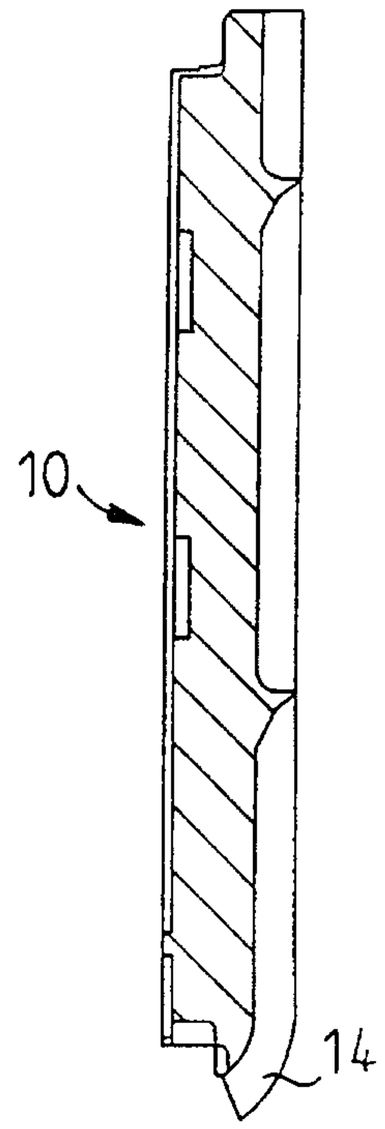


FIG. 4

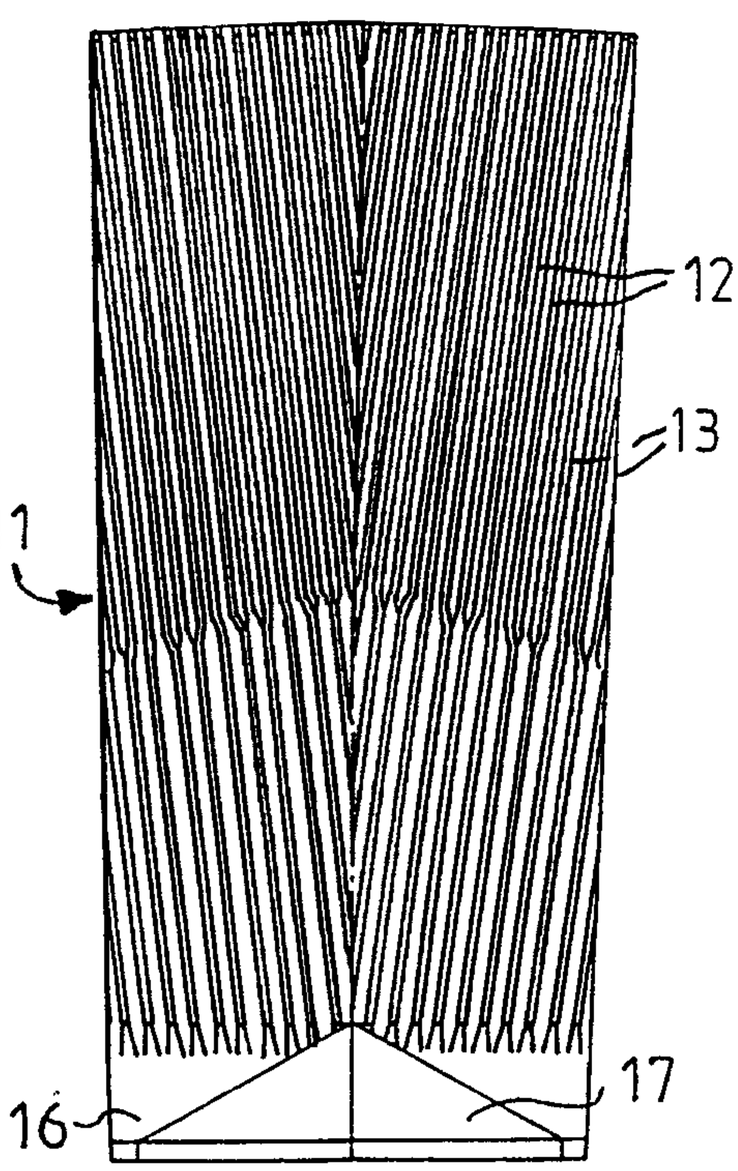


FIG. 5

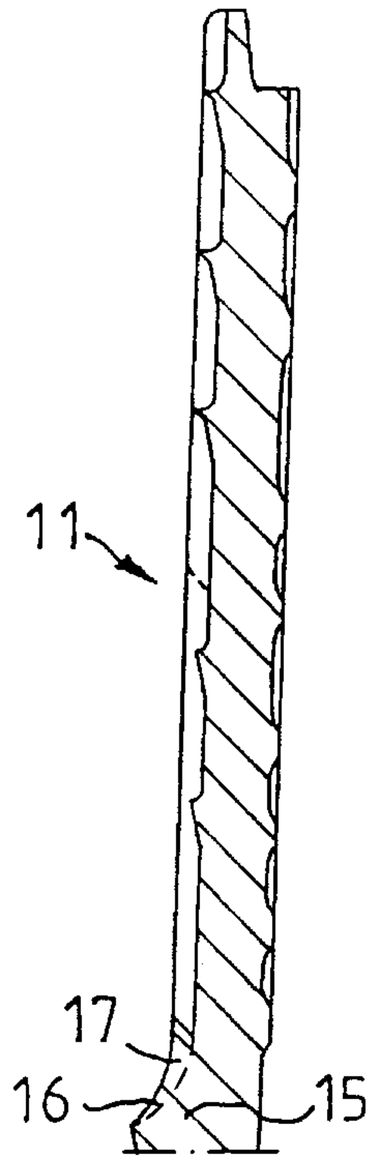
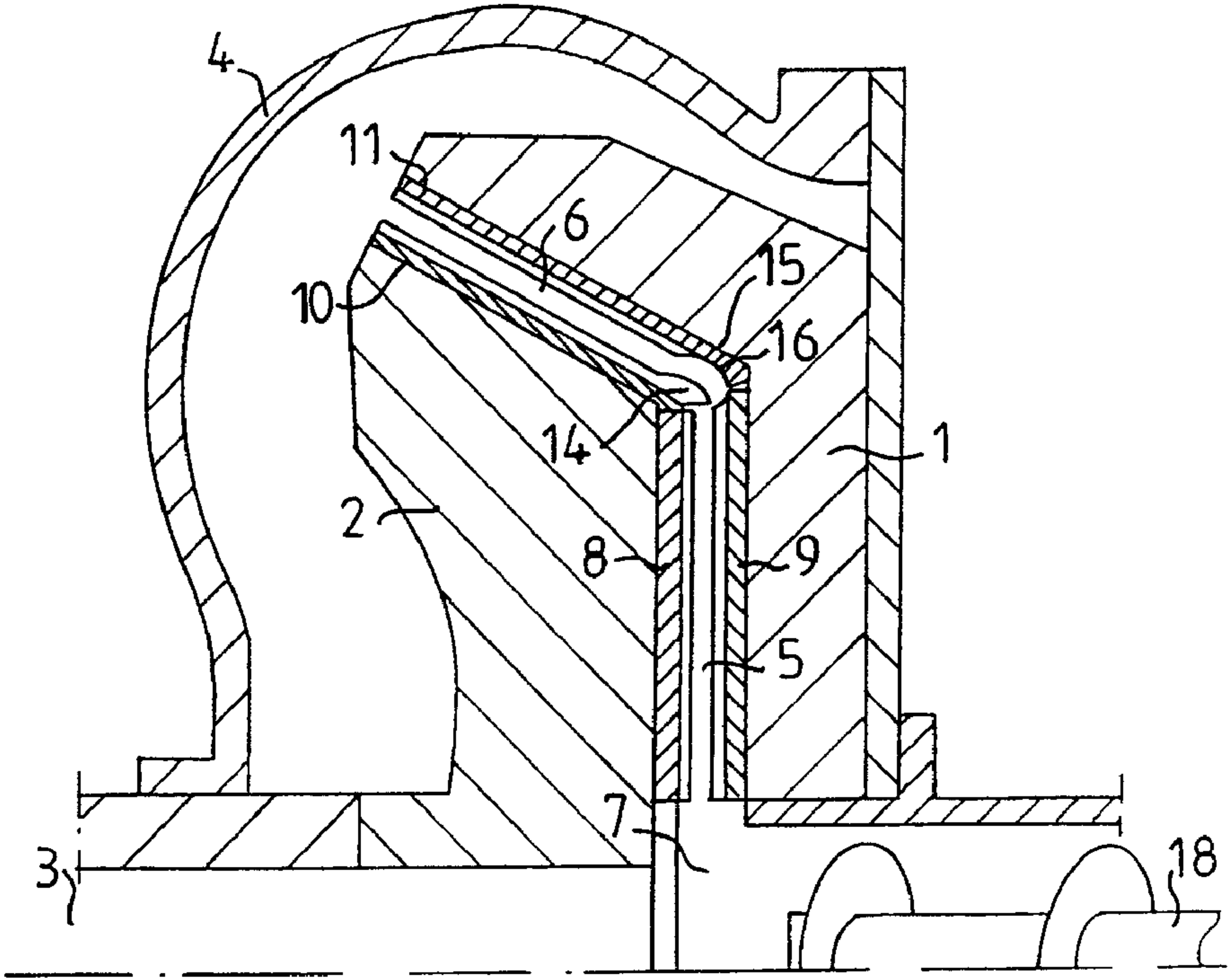


FIG. 6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