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**Description**

The invention relates to the technical area of the extrusion of food and feeds for animals.

In the case of the extrusion of food and/or the extrusion of feeds for animals, a so-called wet texturing is frequently effected where fibre-like structures are formed. This is the case, for example, when products which contain animal or vegetable proteins are extruded. A fibre-like structure is not always simple to achieve as an extrudate expands typically at the exit of the extruder, which is detrimental to a dense, compact, fibre-like product structure. Consequently, for such purposes the prior art uses cooling nozzles which are arranged at the exit of the extruder and which are to reduce or, if desired, to suppress the expansion of the extrudate in an almost complete manner. However, there is still considerable room for improvement with the structural design of such cooling nozzles. For example, the cooling is frequently insufficient and irregular, the design too complex and cleanability unsatisfactory.

The most varied realizations of cooling dies are disclosed in the prior art, all of which are subject to disadvantages.

On the one hand, realizations with a continuously ring-shaped extrudate flow duct are known, for example in DE 24 06 146 and US 3,925,566. The fastening of the inner lateral surface poses problems in this connection. It is realized, for example, by webs which, however, disturb the product flow. Even if the webs are arranged in the inlet region of the cooling die, for example in the distributor, strands of, in particular protein-containing, extrudate that have been separated once are not reconnected in a homogeneous manner, which has a negative impact on the appearance and the texture. Even webs in the end region of the cooling die are disadvantageous as they have to be realized in a bulky manner for reasons of strength but consequently constrict the cross section of the product duct considerably and also have a negative impact on the appearance and the texture of the product.

On the other hand, flat cooling dies are known, for example in US 4,910,040, WO 96/36242, WO 99/13735 and EP 1 059 040. Above all in the case of a high throughput, such flat cooling dies, however, have to be configured in a really wide manner, substantially wider than the outlet opening(s) of the extruder. This has a negative effect on the homogeneity of the speed of flow in the cooling die, which, in turn, has a negative effect on the appearance and the texture of the product. In addition, such cooling dies are structurally disadvantageous as the force resulting from the product pressure generates a bending torque on the flat wall, which makes it necessary to build the wall in a more solid manner.

In addition, realizations with multiple specific extrudate flow ducts are known. Such structures are overly complex in design and the cooling of multiple specific extrudate flow ducts is also expensive and liable to error during maintenance and operation.

It is consequently an object of the invention to overcome the aforenamed disadvantages and to provide a cooling nozzle which can ensure marvellous cooling characteristics and, at the same time, is simple in design and easy to clean.

The object is achieved by a cooling nozzle according to the invention according to independent Claim 1. Advantageous designs of the invention are to be found in the subclaims.

A cooling nozzle according to the invention for a food- or feed extruder has an inlet end, which is able to be fastened to a food or feed extruder (2) and at which the extrudate is introducible into the cooling nozzle. The fastening, in this case, is preferably designed so as to be releasable so that the cooling nozzle is easily able to be exchanged or disassembled for maintenance or cleaning purposes. The fastening is preferably effected with screws (for example hexagon head screws), clamping levers or snap locks, with which a defined pressing force is able to be achieved in a manner known per se.

The cooling nozzle additionally has an outlet end, at which cooled extrudate is able to be discharged. The cooled extrudate can be packaged in the region of the outlet end, as will be explained further below.

A, in particular one single, extrudate flow duct extends substantially between the inlet end and the outlet end of the cooling nozzle. The extrudate flow channel, in this case, is configured substantially as a ring sector. Within the framework of the invention, the ring of the ring sector can be formed, in particular, in a circular, oval, polygonal manner, as a spline curve or also from combinations thereof. A realization of the ring sector as a circular ring sector is preferred.

In addition, the cooling nozzle has at least one coolant flow duct, to which the extrudate flow duct is connected for heat transfer. The heat transfer takes place preferably as heat transfer through convection.

In a cross section to the main direction of flow, the extrudate flow duct is configured substantially as a ring sector, preferably as a circular ring sector. As a result of the realization of the ring sector, a particularly uniform product distribution, uniform flow speed and uniform cooling is able to be realized. In addition, it has been shown that structures with thinner walls than in the prior art are possible as substantially only tensile forces are generated from the product pressure but only practically negligible bending forces.

In addition, in a cross section to the main direction of flow, the outer wall of the extrudate flow duct is formed at least from a first segment and a second segment.  Two segments are particularly preferred but a design of three, four or more segments is also possible. The segments are connected together, in this case, by mechanical connecting elements. Screws (for example hexagon head screws), clamping levers or snap closures are suitable once again as mechanical connecting means; particularly preferred are screw connections. As a result of the design of the outer wall from segments that can be disassembled, the extrudate flow duct and the entire cooling die are able to be cleaned in a particularly simple and reliable manner.

With a cooling nozzle of this type, capacities within the range of between 125 and 2,000 kg/h (in particular between 175 and 1,500 kg/h, further particularly between 225 and 1,000 kg/h) extrudate are able to be realized with only a small size cooling nozzle with a typical length of between 0.5 and 2.5 m (in particular between 0.75 and 2.25 m, further particularly between 1 and 2 m) and a diameter of between 100 and 800 mm (in particular between 200 and 600 mm, further particularly between 300 and 400 mm).

In the regions which come into contact with the food or feed, that is to say in particular the extrudate flow duct, the cooling nozzle is formed of stainless steel (for example variety numbers 1.43xx or 1.44xx according to EN 10088). Said materials are characterized by high-grade food quality. The roughness of preferred materials is within the range of between $R_a$ 1.6 and $R_a$ 0.8 (according to DIN EN ISO 4287:1998).

In a preferred embodiment, the extrudate flow duct is configured in cross section to the main direction of flow substantially as a ring sector, in particular as a circular ring sector, the sector covering at least 300°, preferably at least 325°, particularly preferably at least 350°.

In a preferred manner, in the region of the cross section that is not covered by the ring sector of the extrudate flow duct, a supporting structure, extending substantially along the entire length of the cooling die, for the inner wall of the extrudate flow duct is arranged. In a preferred manner, the supporting structure is a profile element.

In preferred embodiments of the cooling nozzle, the inner wall of the extrudate flow duct is formed in a substantially cylindrical, in particular hollow cylindrical, manner. Such realizations are able to be produced in a particularly simple manner from a manufacturing point of view.

In a quite especially preferred manner, the inner wall of the extrudate flow duct is formed in one piece. As a result, simple production and good cleanability are ensured.

In preferred embodiments, the outer wall of the extrudate flow duct is formed in a cylindrical, in particular hollow cylindrical, manner in the operating state. The outer wall of the extrudate flow duct is assembled, in this connection, from segments, as described above.

In preferred embodiments, the first segment and the second segment of the outer wall of the extrudate flow duct (and, where applicable, also further segments) are fastened to the afore-described supporting structure by mechanical connecting elements. The fastening can be realized, for example, with screws (for example hexagon head screws), clamping levers or snap closures. The segments are additionally connected together in the circumferential direction at a further position, preferably on the side located opposite the supporting structure. The connection is also able to be realized in said position with mechanical connecting means as described above. The seal is realized in a purely mechanical sealing manner, formed preferably by pressing contact between the segments. In alternative embodiments, the seal can be brought about or supported by an elastomer seal that is placed, in particular, into an indentation.

In further preferred embodiments, the first segment and the second segment of the outer wall of the extrudate flow duct (and, where applicable, also further segments) are hinged and/or fastened in a pivotable manner to the supporting structure, for example by means of hinges. As a result of such hinging or pivotability, the extrudate flow duct is able to be cleaned in a particularly simple manner with minimum time and money spent on disassembly. In this connection, the seal can be configured once again as stated above.

In preferred realizations of the cooling nozzle, an in particular exchangeable distributor is arranged in the region of the inlet end. The distributor is configured such that extrudate is able to be fed from the outlet duct (typically not configured in a ring-shaped manner or as a ring sector) of a food or feed extruder via a single distribution duct to the extrudate flow duct configured as a ring sector.

It has proved to be advantageous in this connection when the distribution duct has a constant cross sectional area over at least 50%, preferably at least 70%, particularly preferred at least 90% of the length (from the outlet of the extruder to the inlet into the extrudate flow duct). A uniform flow speed is able to be obtained in this way, which has proved to be advantageous.

In contrast to known finger distributors, which are typically 10 cm and more in length (in particular 20 cm and more, frequently even 40 cm and more), with a distributor designed in such a manner no disadvantageous phenomena are seen in the product image and the texture which, in the prior art, are probably based on extrudate strands that are separated in the finger distributors and are not re-connected homogeneously along the cooling section. The ease of disassembling and cleaning is also improved significantly compared to finger distributors.

In a particularly preferred manner, the distributor is configured so as to be able to be exchanged, for example able to be screwed on.

As a result of exchanging the distributor, product characteristics are able to be influenced in a targeted manner.

It has been shown that a certain fibrousness is able to be achieved in the product in particular as a result of constrictions which bring about an inner shearing of the product, as a result of which energy is input into the product.

In a preferred manner, the distributor comprises a distribution element which is preferably configured as a cone. The design as a circular cone is particular advantageous. The design as a cone frustum, in particular a circular cone frustum, is obviously also possible. In the case where it is realized as a cone frustrum or circular cone frustrum, the distributor can also be realized with a spherical-segment -shaped tip, as a result of which the flow behaviour is able to be influenced and adapted to the extrudate in a targeted manner. It is possible to influence the back pressure in the extruder and to influence the extent of the shearing of the product. The distributor element is preferably inserted in an indentation and is held in position in said indentation by the pressure of the product streaming against the distributor element; the exchangeability is realized in a particularly simple manner in this way.

In further preferred embodiments, in the region of the end of the distributor that faces away from the extruder and/or that faces the extruder, a diaphragm is arranged or able to be arranged, with which the distribution duct is constricted or able to be constricted. Product characteristics, in particular the fibrousness, can once again be influenced in a targeted manner with such types of diaphragms; long fibrousness and short fibrousness can be obtained but also amorphous or homogenous structures. The density of the diaphragms in the main direction of flow is within the range of between 0.1 and 1.0 cm, preferably between 0.15 and 0.9 cm, particularly preferably between 0.2 and 0.8 cm. The known disadvantages of finger distributors are not seen in the case of diaphragms (with constrictions) with such small lengths.

In preferred embodiments of the distributor, said distributor is formed with one or more cooling ducts for cooling the distribution duct from the outside and/or inside. As a result of cooling the distribution duct, local overheating in said region is able to be prevented. It has been shown that precisely in said region of the distributor the extrudate is able to be exposed to higher heating than in other regions. This is able to be countered effectively with targeted cooling. For determining the temperature of the extrudate in the region of the distributor, it is possible to provide a temperature sensor which is preferably inserted into the wall in such a manner that it does not obstruct the flow of the extrudate in a substantial manner. The cooling can be controlled and/or regulated in dependence on the measured temperature, for example by adapting the coolant temperature and/or the speed of flow of the coolant.

In a preferred manner, at least one coolant flow duct, which is connected to the extrudate flow duct for heat transfer, is present on the inner side of the extrudate flow duct; and/or on the outer side of the extrudate flow duct. On the inner side of the extrudate flow duct, the coolant flow duct is preferably formed circulating completely in a helical manner. On the outer side of the extrudate flow duct, the coolant flow ducts are each formed in a meander-shaped manner in both segments. The coolant flow duct or ducts are preferably completely closed, preferably sealed, and, even during disassembly for exchange or maintenance purposes, are only accessible via the inlets and outlets for the coolant. As a result, product contamination is able to be avoided in a simple structural manner. The inlets and outlets can preferably be designed as supporting pieces and the coolant is guided upstream, counter the main direction of flow of the product.

In a particularly preferred manner, the at least one coolant flow duct on the inner side of the extrudate flow duct is able to be supplied with coolant via the supporting structure. As a result, it is possible to ensure a particularly reliable supply which does not have to be opened or removed for example for the purpose of cleaning the extrudate flow duct even in the case of disassembly.

In a further preferred embodiment, cutting webs are arranged in the region of the extrudate flow duct at the outlet end of the cooling nozzle so that the cooled extrudate is able to be divided into strands immediately it exits. The cutting webs can be arranged on a cutting plate which is mounted upstream of the extrudate flow duct at the outlet end of the cooling nozzle. In addition, another cutting device, which divides the strands lengthwise, is also able to be provided downstream of the cutting webs. This can be realized, for example, by a rotating blade.

In preferred embodiments of a cooling nozzle (not only as described above and within the framework of the exemplary embodiments but, in principle, of any cooling nozzle for a food or feed extruder) a diaphragm is arranged in the region of a distribution duct, wherein the diaphragm constricts the distribution duct and is configured, preferably, as a perforated diaphragm or as a diaphragm with slits, which are in the form of circle segments. In this connection, the circle or ring segments can be configured as segments of one single circle or ring or as segments of various circles or rings, as is described in more detail below within the framework of the exemplary embodiments.

With the cooling nozzles disclosed up to now, first and foremost chicken-breast-like textures can be obtained, i.e. a predominantly long-fibered structure. With diaphragms, in contrast, in particular with cooling nozzles according to the invention, a broadening of the fibre structure spectrum is able to be obtained so that other animal type muscular structures are also able to be imitated, for example beef, pork, lamb and fish, shell fish and crustaceans, etc. Structures which are similar to beef are thus able to be generated, for example, with perforated diaphragms. In contrast, structures which are similar to fish or chicken are able to be generated with slitted diaphragms. It is assumed that first fibres are formed in the extruder which are then oriented in the cooling nozzle. The influence on the quality of the fibres takes place in an advantageous manner as a result of diaphragms in the region of the distributor between the extruder and the actual extrudate flow duct of the cooling nozzle.

The diaphragms can be formed as metal rings or metal discs which have a defined pattern of perforations or slits, and they can be placed either at the inlet or outlet of the distributor. The pattern of perforations or slits can be symmetrical or asymmetrical and can be formed, in principle, in many geometries. Straight and curved slits and perforations are preferred but star forms, crosses, and ornamental forms are also possible. Curved slits, in particular as configured in the exemplary embodiments, result in exceptionally long fibre structures with great resistance, whilst straight slits promote cross-linking of the product. Perforations, in turn, divide the product into fibrillar filaments.

The product reaches the diaphragm, as a rule, in a pre-texturized state, i.e. first fibres and filaments have been formed. The diaphragm provides short-term acceleration of the flow, subsequent braking when leaving the diaphragm and resultant re-orientation of the fibres or filaments.

The advantage of above-described diaphragms is, in particular, in the process variability. Along with the chicken-breast-fillet structure that is popular everywhere, other textures such as pork, beef, lamb and fish, etc. are also able to be obtained using diaphragms without incurring a large amount of expenditure.

A further aspect of said description relates to a food or feed extruder, provided with at least one cooling die as described above.

A further aspect of said description relates to a method for extruding a wet-texturized product, comprising the step of channelling a protein-containing extrudate through a cooling die that is arranged at the outlet of a food or feed extruder as described above.

Further advantages of the present invention are produced below from the following description of exemplary embodiments with reference to the Figures. Identical reference symbols designate identical elements in the Figures, in which:

Fig. 1 shows (schematically) an arrangement of a cooling nozzle on a food or feed extruder;

Fig. 2 shows a cross section through a cooling nozzle along the plane X-X in Fig. 3;

Fig. 3 shows a longitudinal section through a cooling nozzle according to the invention along the plane Y-Y in Fig. 2;

Fig. 4a/b show a cooling nozzle with segments of the outer wall folded-down or folded together;

Fig. 5 shows a longitudinal section of the distributor and inlet region of the cooling nozzle;

Fig. 6a/b show a perforated diaphragm and product texturized with the same;

Fig. 7a/b show a slitted diaphragm and product texturized with the same;

Fig. 8 shows a slitted diaphragm, the slits being configured as ring sections which are offset with respect to one another.

Fig. 1 shows a schematic representation of an extruder E which is formed from segments (1-7). A raw material V is supplied via the gravimetric metering means B. Water or steam is added via a feeder S. The cooling nozzle is characterized with the reference 1. The coolant is supplied in a preferred manner on the downstream side of the cooling nozzle and is discharged on the upstream side of the cooling nozzle. The direction of flow of the coolant is consequently counter to the direction of flow of the extrudate. The tempering of the coolant is able to be adjusted (controlled or regulated) via a temperature control; this is illustrated by the controller C. In a particularly preferred manner, the temperature regulation is configured in such a manner that the expansion of the cooled extrudate is able to be suppressed in a controlled manner, preferably substantially completely. It can, however, also be sensible and made possible for certain products to allow a certain expansion of the cooled extrudate. This can be desired, for example, in the case of products that are to be subsequently marinated as the marinade adheres better in this way. The sensor characteristics can also be influenced so that, for example, a texture such as in the case of “pulled pork” or the like is the result. This can also be made possible in a controlled or regulated manner as a result of temperature regulation.

Fig. 2 shows the cross section through a cooling nozzle 1 along the plane X-X which is marked (with viewing direction) in Fig. 3. It is possible to see the flange 21 in the region of the inlet end of the cooling nozzle. Feedthroughs 22, in which mechanical connecting elements 12 can be arranged, are situated in said flange 21 for the mounting of the distributor 15 (shown in detail in Figures 3 and 5). The supporting structure 13 is shown in the bottom region. The extrudate flow duct 6 adjoins the supporting structure on both sides and forms a ring sector which is only interrupted by the supporting structure 13. Mechanical connecting elements 12, with which the first segment 10 and the second segment 11 are fastened to the outer wall of the extrudate flow duct 6, are arranged through the supporting structure 13. The outer wall 9 is configured as a hollow wall; coolant flow ducts 7b and 7b’, which are configured in a meander-shaped manner, are situated in said outer wall. The inner wall 14 is also realized as a hollow wall; a helical coolant flow duct 7a is also situated in said hollow wall. The coolant flow ducts 7a of the inner wall 14 and the coolant ducts 7b and 7b’ of the outer wall 9 can preferably be provided with coolant independently of one another and the temperatures of the respective coolant can be controlled and/or regulated independently from one another. However, they are also able to be supplied together with coolant, in a particularly preferred manner via the supporting structure 13, as indicated by a dotted line in the bottom region of the Figure.

Fig. 3 shows the longitudinal section through a cooling nozzle along the plane Y-Y which is marked in Fig. 2. It is possible to see the inlet 23 and the outlet 24 for the coolant in the bottom region. Both the inner coolant flow duct 7a and the outer coolant flow ducts 7b and 7b’ are supplied via the inlet 23, as indicated by the dotted line in Fig. 2. The distributor 15 with the distributor element 15a is arranged in the left-hand region of the Figure, the inlet end 3 of the cooling nozzle 1. Extrudate passes from an outlet duct 16 (not shown) of an extruder into the distributor 15 and is then conducted into the distribution duct 17 which subsequently merges into the extrudate flow duct 6 of the cooling nozzle 1. The main direction of flow is designated with the reference 8; the outlet end 5 of the cooling die is arranged correspondingly in the right-hand region of the Figure. A pressure sensor 27 and a temperature sensor 26 are additionally arranged in the distributor 15. The pressure or temperature values determined can be used advantageously for controlling or regulating operating parameters (for example of the extruder, and/or of the coolant temperature(s) of the cooling nozzle and/or of the distributor), and/or also for monitoring the process and/or for ensuring reproducibility.

Fig. 4a shows a cooling nozzle 1 with the segments 10 and 11 of the outer wall folded down; the inlet region 3 is arranged in the rear part of the image, the outer region in the front part of the image. The distributor 15 with the temperature sensor 26 and the pressure sensor 27 can be seen on the distributor. The two segments 10 and 11 are fastened to the supporting structure 13 with hinges so that, on a suitable support, such as for example a maintenance and transport car 25, they can simply be folded out once their connection to one another in the region of the cooling nozzle 1 that is located opposite the supporting structure 13 has first been released. The entire extrudate flow duct 6 is then exposed and is accessible in an ideal manner for cleaning purposes. The supporting structure is screwed to the transport car 25. The arrangement on the transport car 25 advantageously also persists during operation. The transport car 25 does not require a great deal of space and always makes uncomplicated adaptations and modifications possible. Fig. 4b shows the cooling nozzle 1 with segments 10 and 11 assembled. The segments 10 and 11 are mounted with gas-filled shock absorbers, which ensures simple maintenance. With the segments 10 and 11 assembled, the extrudate flow duct 6 in the outlet region can be seen in the outlet region 5.

Fig. 5 shows an enlarged longitudinal section of the distributor 15 and of the inlet end 3 of the cooling nozzle 1 along the plane Y-Y which is marked in Fig. 2. The distributor 15 is arranged in the left-hand part of the image, with a distributor cone 15a, the tip of which is aligned counter the main direction of flow. Said distribution cone 15a is held by a simple plug-in fastening. A diaphragm 35 (at a position also designated as position II), which is configured as a slitted diaphragm, is arranged at the tip of the distributor cone 15a. A further diaphragm 32 (at a position also designated as position II), which is configured as a perforated diaphragm, is arranged downstream of the distributor cone. The perforations or slits of the diaphragms 32 and 35 constrict the distribution duct 17 and serve for texturizing the product. A further diaphragm 33 (at a position designated also as position I), which is configured here as a slitted diaphragm and also serves for texturizing the product, is arranged in the region of the transfer to the cylindrical region of the cooling nozzle 1. The distributor is cooled via a coolant chamber 29; inlet and outlet are designated with references 30 and 31, these advantageously being hose clips. In the distributor 15, a pressure sensor 27 and a temperature sensor 26 are guided on or into the distribution duct 17, through the coolant chamber 29. A wedge 34 can be seen in the bottom region. Said wedge transfers the ring-shaped distribution duct 17 into an extrudate flow duct 6 that is configured as a ring sector. In the bottom region of the cooling nozzle 1, the extrudate flow duct 6 is not configured continuously (see Fig. 2 in this connection). The coolant outlet 24 can be seen in the bottom region; the helically formed, inner coolant flow duct 7a can be seen in the right-hand part of the image.

Figs. 6a/b, 7a/b show various geometries of diaphragms and products texturized with such diaphragms. The procedure, in this connection, was in each case as follows:

The dry components, for example soya protein concentrate, were metered into the extruder (40% at 500 kg/h) and there mixed with water (60% at 500 kg/h) to form a dough. The addition of other components such as salts, dyes and flavourings, acids, leaches, etc. is possible but not absolutely necessary. In dependence on the protein source, the raw material mix is heated in the extruder to 120 - 160°C, in particular to 135- 145°C, by means of mechanical energy (rotation of the extruder screw) and thermal energy (controlling the temperature of the extruder housing). The protein structures unfold, re-orientate and form new fibre structures. A diaphragm is installed in each case in the region of the distributor at the transition from the extruder into the cooling nozzle 1; however, it is also possible within the framework of the invention to install multiple, sequentially arranged diaphragms. The extrudate was cooled in the cooling die from, for example, ≈ 140°C to 60 - 120°C, in particular 85 - 110°C and can then be processed further.

Fig. 6b shows such a product which has been conducted in the region of the distributor through a cooling nozzle according to the invention with a perforated diaphragm (33, arranged at position I; cf. Fig. 5) which is illustrated as a cutout in Fig. 6a. The perforations occupy 490 mm$^2$, at a production throughflow of 500 kg/h. The texture of the product obtained shows a filament structure which imitates roast beef.

Fig. 7b shows such a product which has been conducted in the region of the distributor through a cooling die according to the invention with a slitted diaphragm (35, arranged at position III; cf. Fig. 5) which is illustrated in Fig. 7a. The texture of the product obtained shows a fish structure with fine/short fibres.

Fig. 8 shows a diaphragm where the slits are configured as ring sectors, the start and end of the ring sectors (in the circumferential direction) being arranged at a different distance to the centre point of the diaphragm. As a result, regions which do not have slits can be largely avoided in the circumferential direction. A structure that is similar to fish and has fine or short fibres can be obtained with such a diaphragm.

Patentkrav

1. Køledyse (1) til nærings- eller fodermiddelekstruder med
i) en indløbsende (3), der kan fastgøres på en nærings- eller fodermiddelekstruder (E), og ved hvilken der kan indføres ekstrudat i køledysen (1);
ii) en udløbsende (5), ved hvilken afkølet ekstrudat kan bortledes;
iii) en ekstrudatstrømningskanal (6), der strækker sig i det væsentlige fra indløbsenden til udløbsenden;
iv) i det mindste en kølemiddelstrømningskanal (7), med hvilken ekstrudatstrømningskanalen (6) står i varmeoverføringsforbindelse;
hvor i tværsnittet (X-X) i forhold til hovedstrømningsretningen (8)
v) ekstrudatstrømningskanalen (6) er udformet i det væsentlige som ringudsnit; og
vi) en ydervæg (9) på ekstrudatstrømningskanalen (6) er udformet af i det mindste et første segment (10) og et andet segment (11), hvor det første segment og det andet segment er forbundet med hinanden via mekaniske forbindelseselementer (12).

2. Køledyse (1) ifølge krav 1, hvor ekstrudatstrømningskanalen (6) i tværsnittet (X-X) i forhold til hovedstrømningsretningen (8) er udformet i det væsentlige som ringudsnit, især som cirkulært ringudsnit, på i det mindste 300°, fortrinsvis på i det mindste 325°, særligt foretrukket på i det mindste 350°.

3. Køledyse (1) ifølge et af kravene 1 eller 2, hvor der i det område af tværsnittet (X-X), der ikke er dækket af ekstrudatstrømningskanalens (6) ringudsnit, er anbragt en støttestruktur (13) for en indervæg (14) af ekstrudatstrømningskanalen (6), hvilken støttestruktur strækker sig i det væsentlige over hele længden af køleværktøjet (1).

4. Køledyse (1) ifølge et af kravene 1 til 3, hvor en indervæg (14) af ekstrudatstrømningskanalen (6) er udformet i det væsentlige cylindrisk, især hulcylindrisk.

5. Køledyse (1) ifølge krav 4, hvor ekstrudatstrømningskanalens (6) indervæg (14) er udformet i ét stykke.

6. Køledyse (1) ifølge et af kravene 1 til 5, hvor ekstrudatstrømningskanalens (6) ydervæg (9) i driftstilstanden er udformet cylindrisk, især hulcylindrisk.

7. Køledyse (1) ifølge et af kravene 3 til 6, hvor det første segment (10) og det andet segment (11) af ekstrudatstrømnings-kanalens (6) ydervæg (9) er fastgjort på støttestrukturen (13) med mekaniske forbindelseselementer (12).

8. Køledyse (1) ifølge krav 7, hvor det første segment (10) og det andet segment (11) af ekstrudatstrømningskanalens (6) ydervæg (9) er hængslet og/eller fastgjort svingbart på støttestrukturen (13).

9. Køledyse (1) ifølge et af kravene 1 til 8, hvor der i indløbsendens (3) område er anbragt en især udskiftelig fordeler (15), der er udformet sådan, at der kan tilføres ekstrudat fra en udløbskanal på nærings- eller fodermiddelekstruderen (E) via en eneste fordelingskanal (17) til den som ringudsnit udformede ekstrudatstrømningskanal (6).

10. Køledyse (1) ifølge krav 9, hvor fordeleren (15) omfatter et fordelingselement (15a), der er udformet som kegle, især cirkulær kegle; keglestub, især cirkulær keglestub.

11. Køledyse (1) ifølge et af kravene 9 eller 10, hvor der i fordelerens område, især i et område af den fra ekstruderen bortvendte ende og/eller i et område af den mod ekstruderen vendte ende af fordeleren (15) kan anbringes eller er anbragt en blænde (18,18'), med hvilken blænde (18,18') fordelingskanalen (17) kan indsnævres eller er indsnævret.

12. Køledyse (1) ifølge et af kravene 9 til 11, hvor fordeleren

(15) er udformet med en eller flere kølekanaler (19) til køling af fordelingskanalen (17) udefra og/eller indefra.

13. Køledyse (1) ifølge et af kravene 1 til 12, hvor i det mindste en kølemiddelstrømningskanal (7a,7b,7b'), der står i varmeoverførselsforbindelse med ekstrudatstrømningskanalen (6), er til stede

- på ekstrudatstrømningskanalens (6) inderside; og/eller
- på ekstrudatstrømningskanalens (6) yderside.

14. Køledyse (1) ifølge krav 3 og 13, hvor den i den mindste ene kølemiddelstrømningskanal (7a,7b,7b') på ekstrudatstrømningskanalens inderside via støttestrukturen (13) kan forsynes med kølemiddel.

15. Køledyse (1) især ifølge et af kravene 11 til 14, med en blænde i en fordelingskanals område, hvor blænden indsnævrer fordelingskanalen og især er udformet som hulblænde eller som blænde med segmenterede slidser, der er udformet som cirkelsegmenter.

FIG. 1:

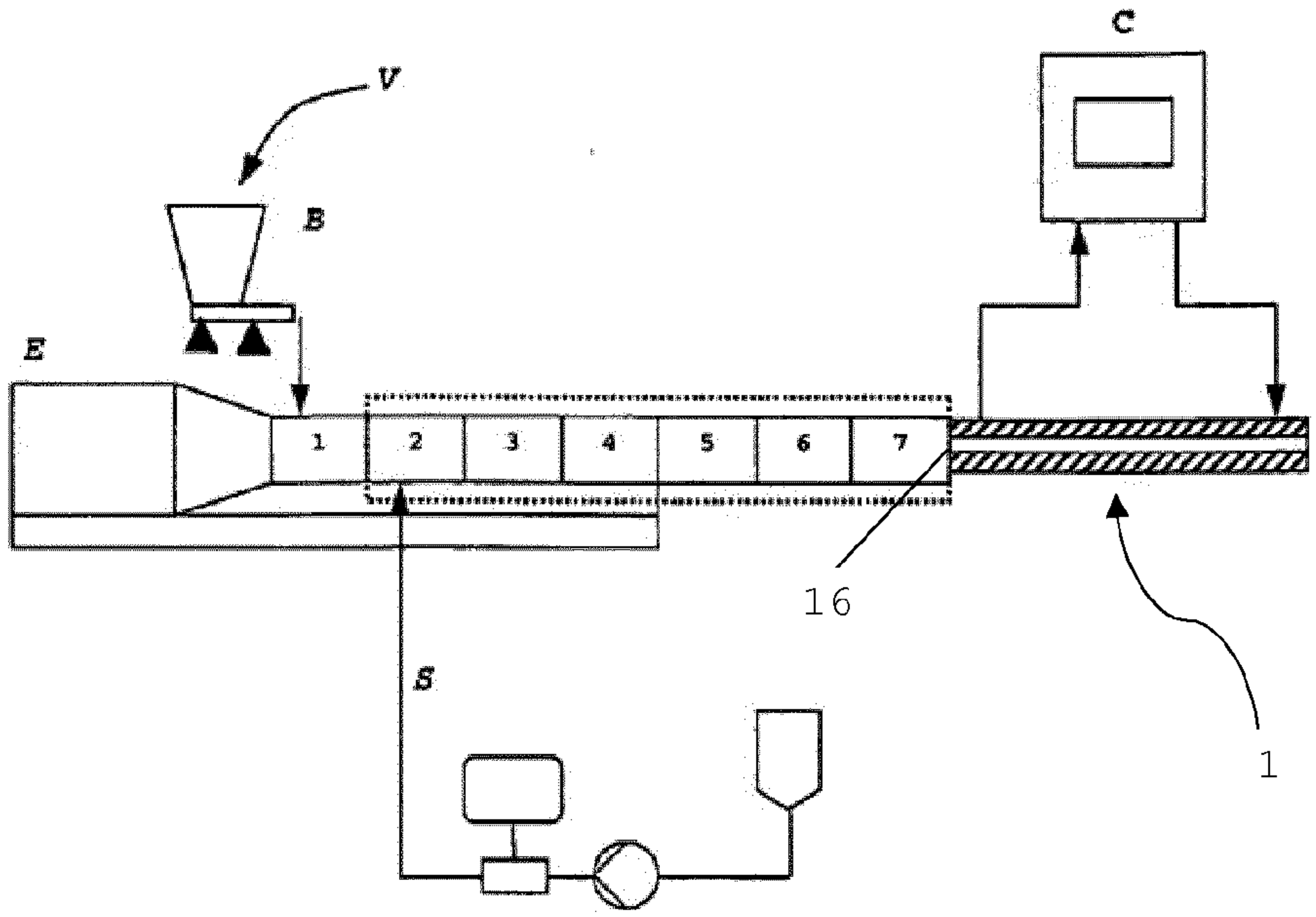


FIG 2:

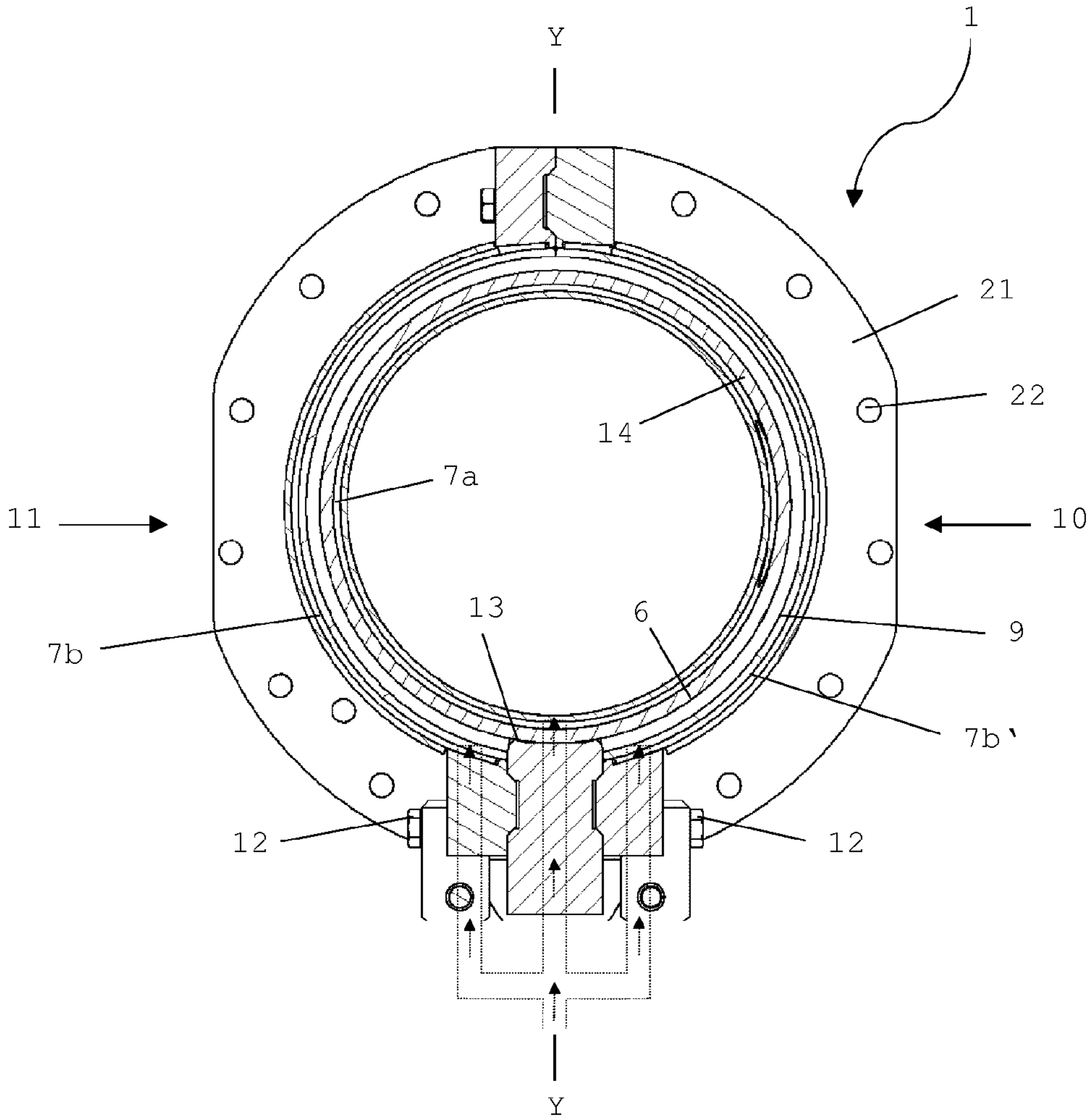

FIG. 3:

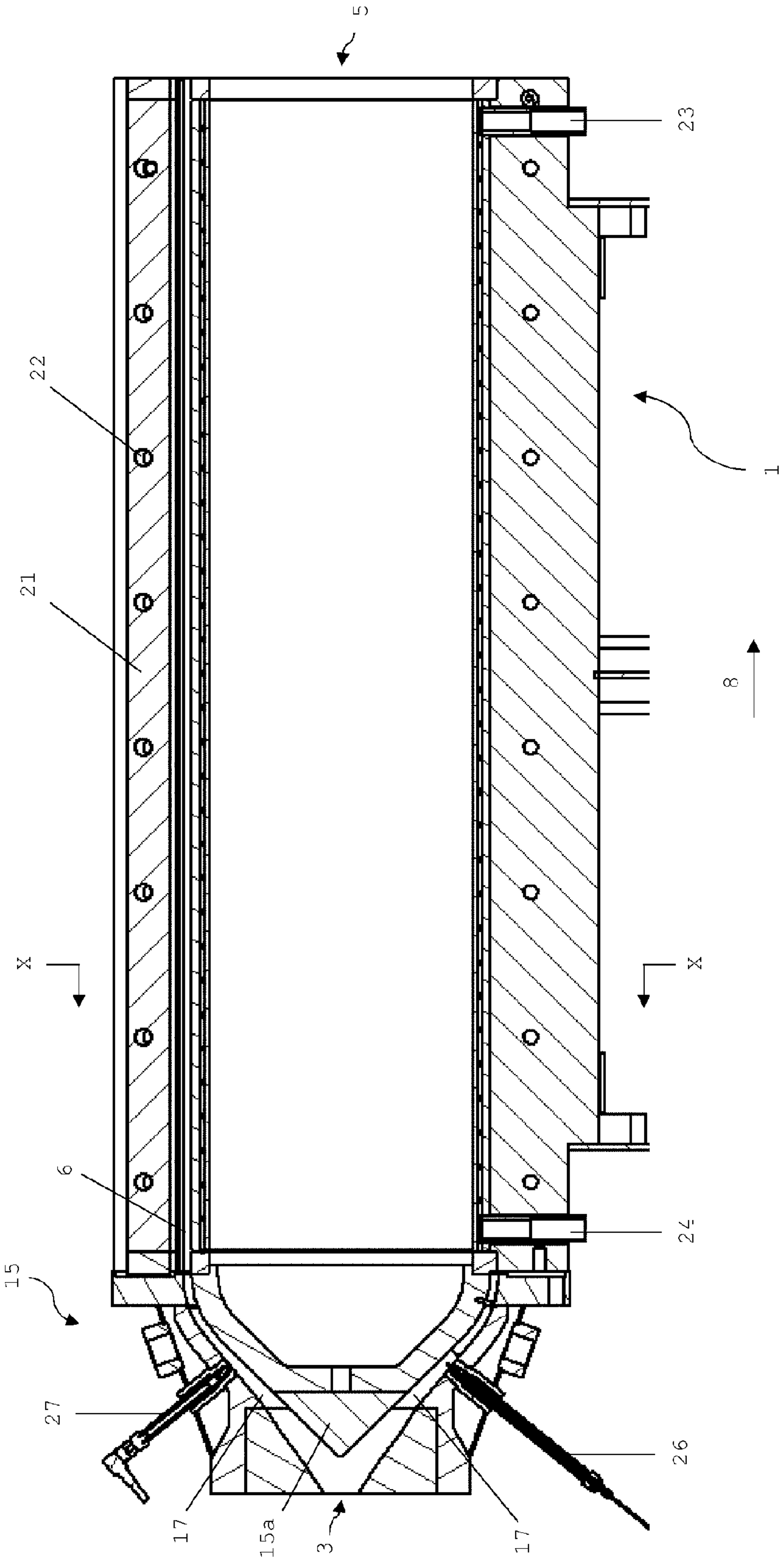

**FIG. 4a:**

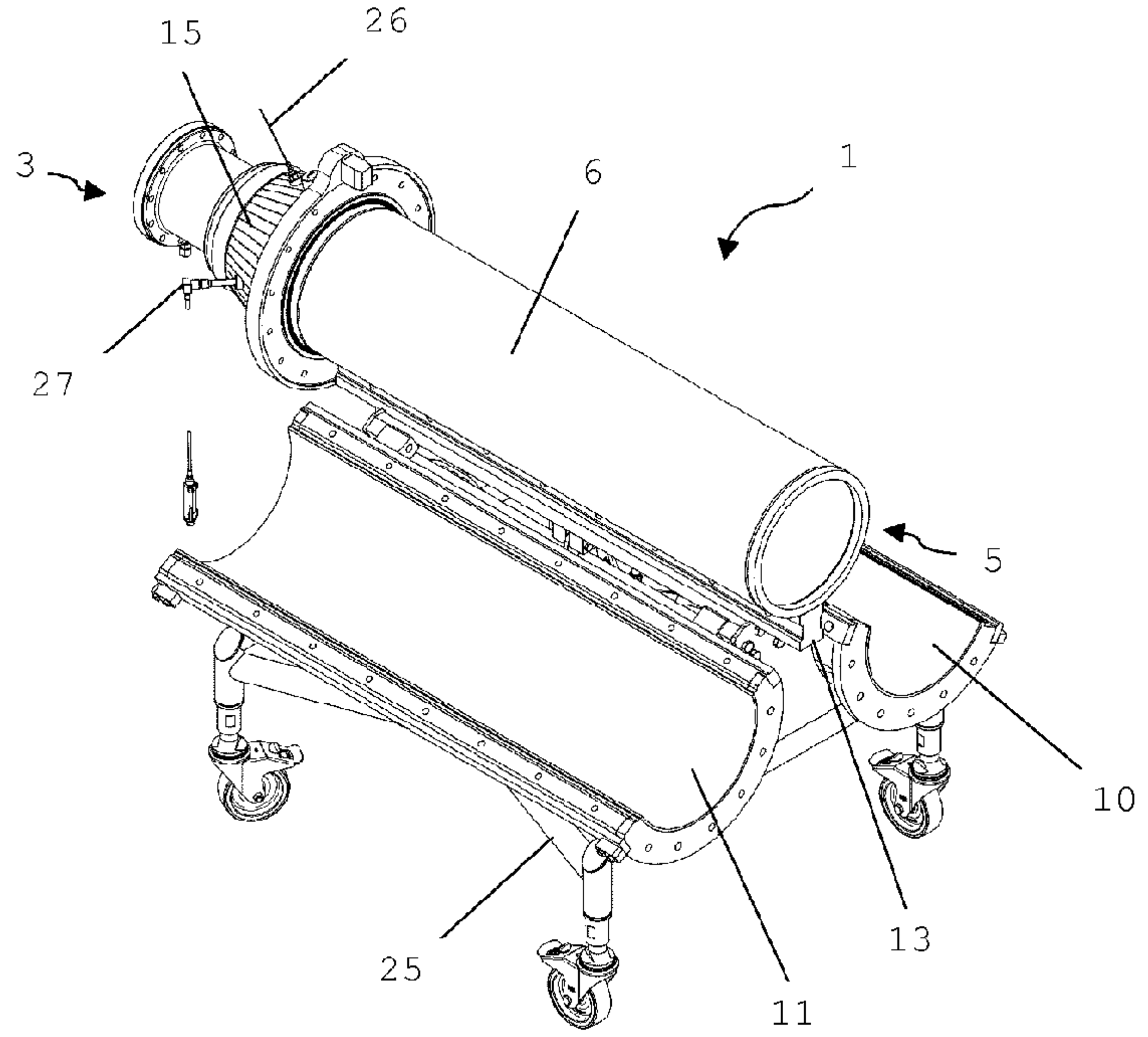


**FIG. 4b:**

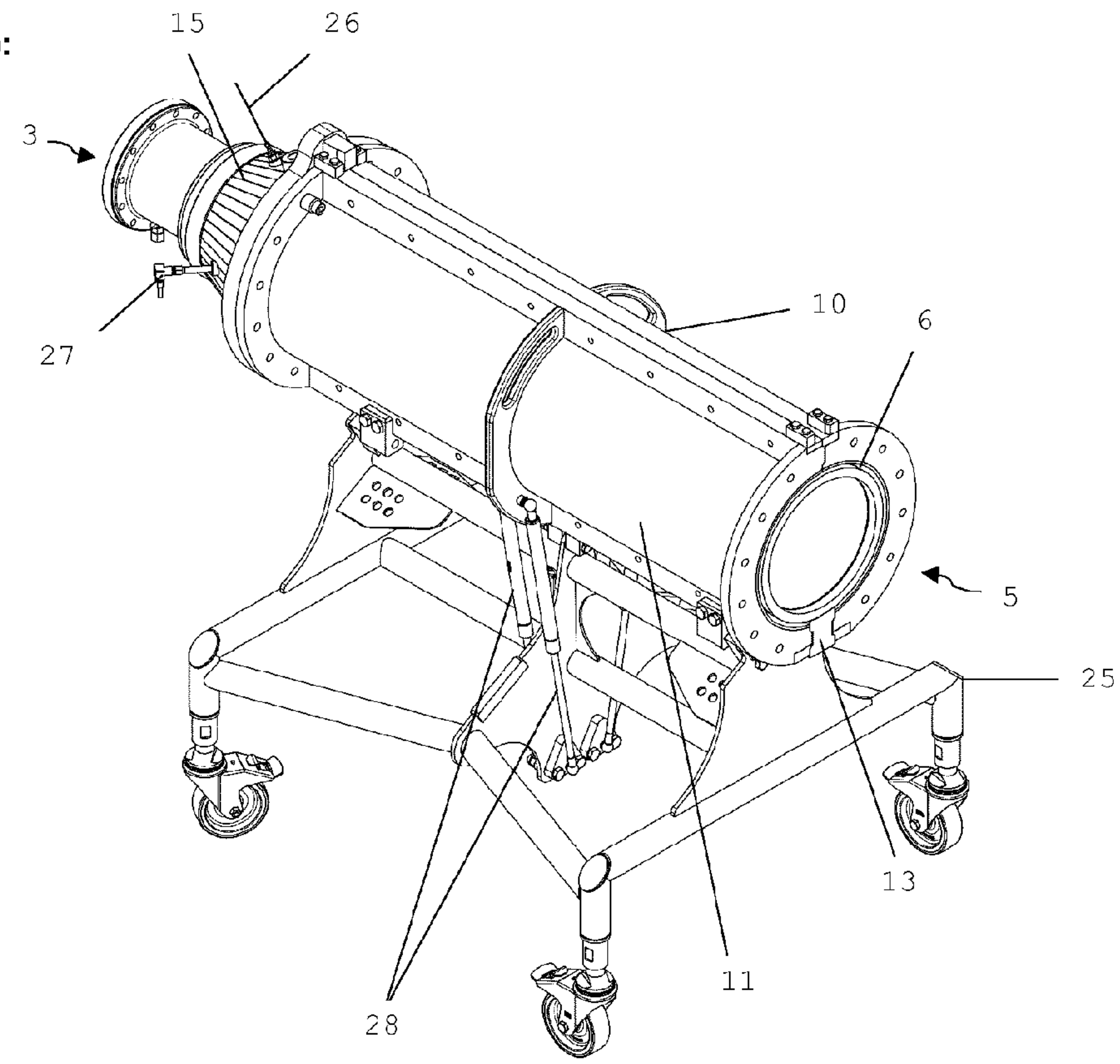

**FIG. 5:**

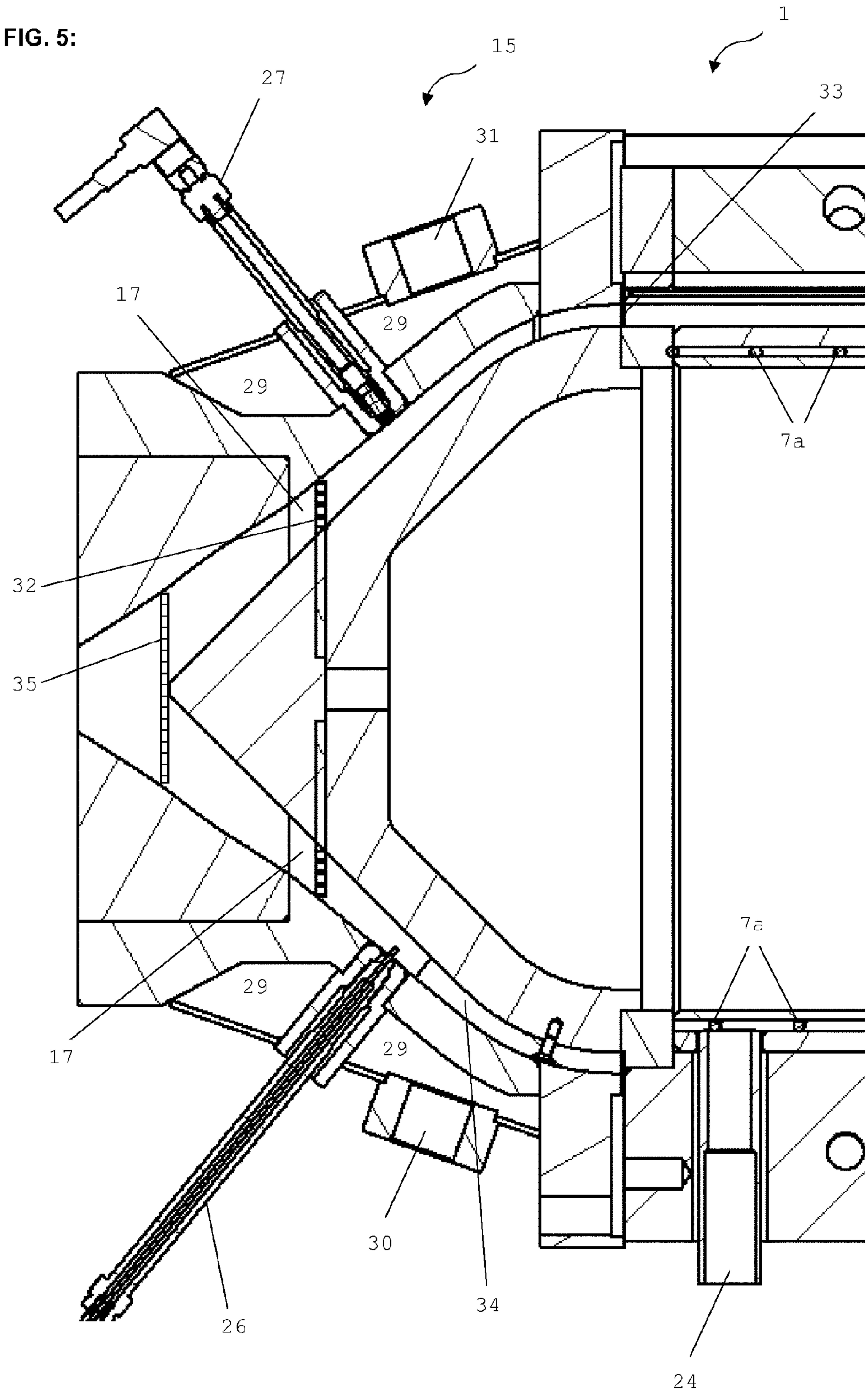

FIG. 6a:

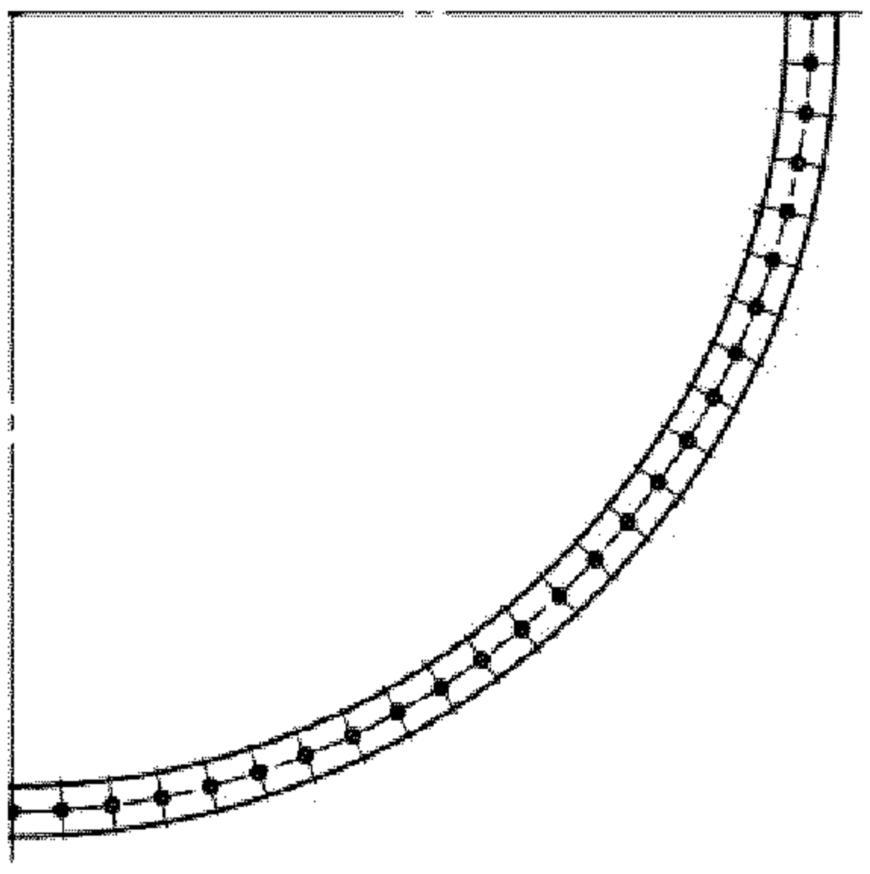

FIG 6b:

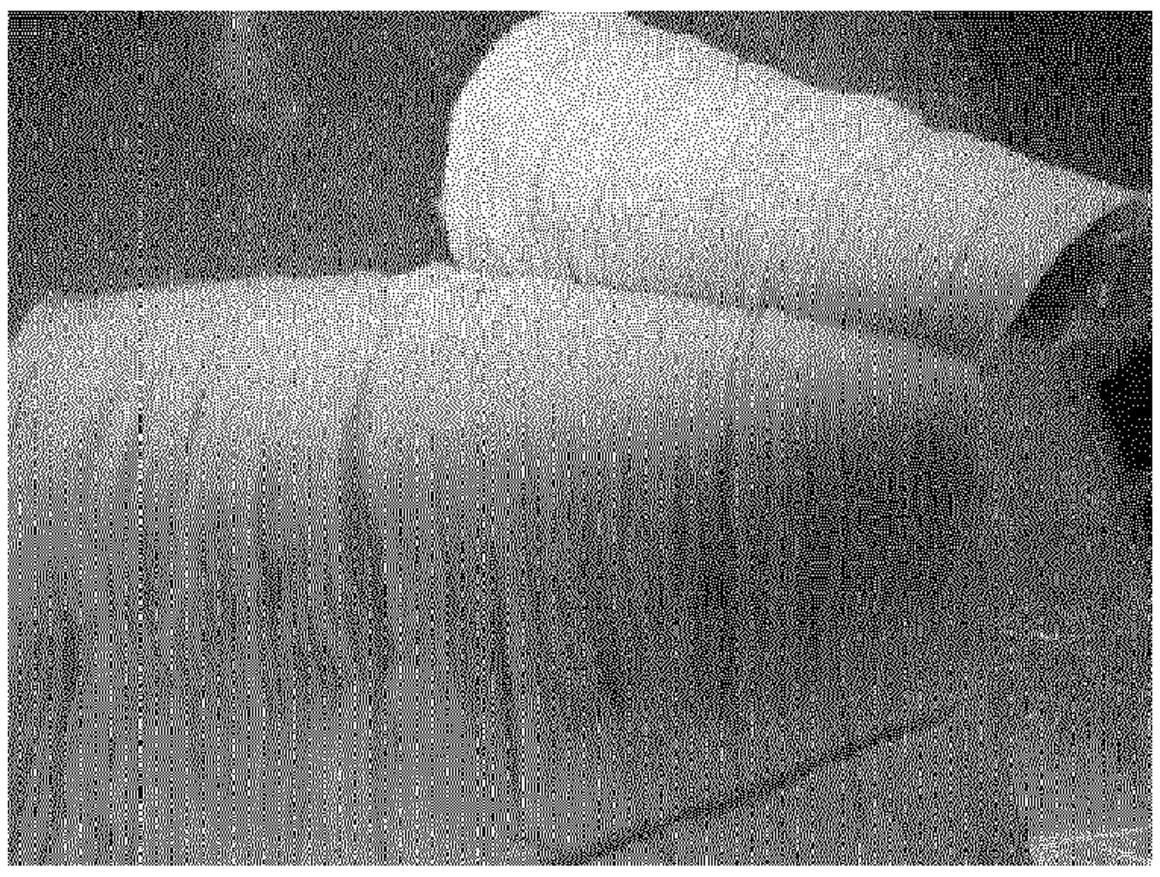

FIG. 7a:

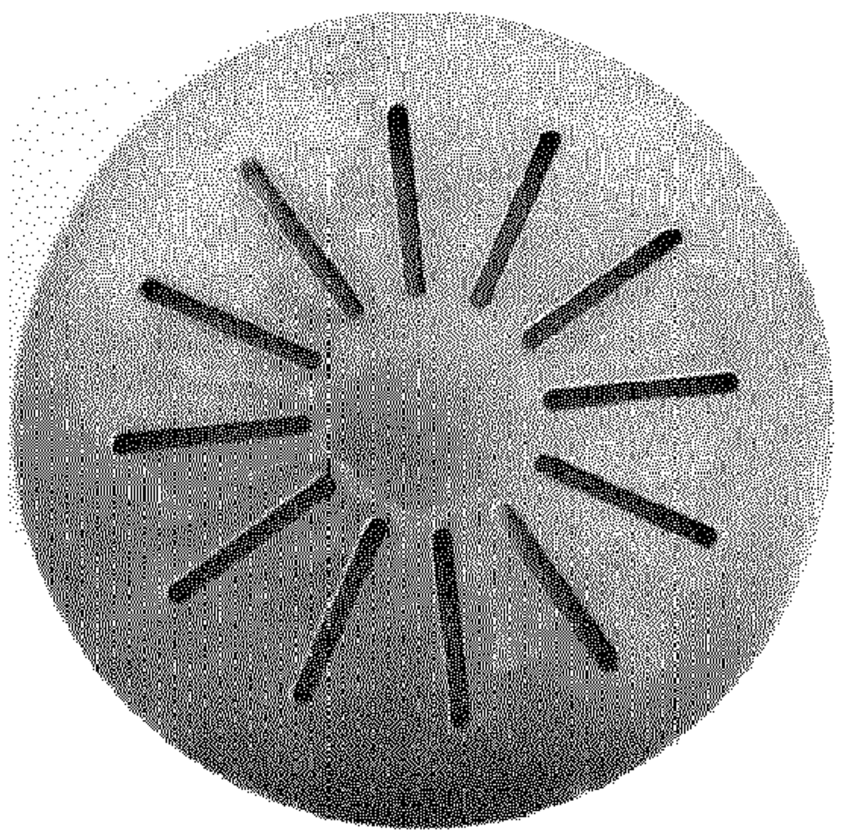

FIG. 7b:

FIG. 8: