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The invention relates to a foundation for a wind power plant, the foundation having substantially prefabricated elements, preferably made of reinforced concrete, with a first, vertically extending portion of pedestal-like configuration, on which a tower of the wind power plant can be arranged, and with a second, substantially horizontally extending portion as foundation body, which is in contact with the ground, the first portion being arranged above the second portion and having at least one closed, preferably sleeve-shaped, pedestal element which is of annular or polygonal configuration, and the second portion being formed of at least two horizontal elements which have in each case at least one pedestal portion, the at least one pedestal element of the first portion and the pedestal portion of the horizontal element of the second portion having substantially vertical apertures, which are flush with one another in a mounted state and in which substantially vertical bracing elements, preferably threaded rods, are arranged.

Foundations for wind power plants are substantially embodied as in-situ concrete foundations. For this purpose, a pit is excavated at the erection site, which is provided with a blinding layer. The formwork and the reinforcement are subsequently erected, and the whole structure is filled in situ with concrete. In this case, a planar body, possibly with a pedestal, is erected; see for example US 20160369520 A1 or WO 2008/036934 A2. In addition to the transport outlay as a result of the delivery of the concrete, of the formwork and of the reinforcement, this is very labour-intensive in situ. Quality assurance is also laborious, and, depending on weather conditions, even problematic. Furthermore, the dismantling operation after the end of the service life of the wind power plant is expensive and very laborious.

There is therefore a fundamental need to erect foundations of wind power plants out of prefabricated elements, whereby the aforementioned problems could be reduced or eliminated. In principle, it is advantageous that, during prefabrication, the components can be produced in a standardized manner under defined conditions. The in-situ work effort is also reduced. For this purpose, various approaches have been described in the state of the art.

For example, WO 2008/036934 A2 discloses a combination of prefabricated elements and conventional formwork/reinforcement construction. As a result, the disadvantages mentioned above are reduced only to an insignificant extent.

Further approaches for the production of foundations for wind power plants out of prefabricated components are disclosed in the state of the art as follows:

EP 1058787 B1 discloses the preamble of claim 1.

EP 1 074 663 A1 discloses a foundation for a wind power plant, with a central body as pedestal with laterally extending ribs/projections/carriers, which are arranged in a star-shaped manner, screwed thereto. Ribs and central body are screwed to one another horizontally in situ. The parts are, inter alia, prefabricated out of concrete and are delivered by means of truck to the construction site, are arranged using a crane and are connected to one another horizontally in situ by way of flanges and screw connections. Furthermore, anchors are required on the outer side of the ribs in order to ensure an adequate dissipation of load.

A disadvantage here is that considerable costs and considerable work effort are also in this case necessary for connecting the elements and producing the statically loadable foundation. Furthermore, additional anchorings are required.

WO 2004/101898 A2 discloses a foundation for a wind power plant from prefabricated individual concrete parts, wherein either a central body is provided, to which planar bodies are screwed horizontally, or the foundation is composed exclusively of components which have both a planar portion and a pedestal-like portion, wherein these are then connected to one another horizontally by means of screw connection to flanges.

A disadvantage here is that considerable costs and considerable work effort are also in this case necessary for connecting the elements and producing the statically loadable foundation.

EP2182201A1 discloses two different foundations for a wind power plant.

In both cases, a foundation is erected from prefabricated concrete parts after a corresponding delivery in situ. Both contain a planar portion and a pedestal-like portion. In variant 1, a central body is provided. The ribs/planar elements are positioned thereon. When assembled, the ribs form a polygonal body. The central body has a projection, which is encompassed by a corresponding set-back portion on the ribs. The ribs are additionally locked against the central body by means of a lashing ring. Anchor rods for the assembly of the tower are provided on the planar bodies. In the second variant, the ribs have horizontally projecting anchor elements which, in the assembled state, extend radially into the centre of the foundation. Plates are provided below and above the anchors. The

in-situ concrete is introduced into the cavity thus formed in order to connect the anchors to one another and to form a central body. In both variants, the horizontal connection is simplified. However, both the ribs and the central body have dimensions and masses which make transport complicated.

WO 2017/141095 A1 and WO 2017/141098 A1 likewise disclose a foundation for a wind power plant. This foundation is formed of prefabricated ribbed bodies which, at their inner end, have a pedestal portion on which the tower of the wind power plant is arranged. The ribs extend radially outward. In a further embodiment, the portions between the ribs are filled with plate elements, which are screwed with flanges to the ribs, in order to produce a plate. In the centre, instead of a central body, a steel sleeve is provided, which is connected to reinforcements provided in the interior of the ribs and to reinforcing bars provided in the inner cavity. The ribs have a base plate. A diagonal reinforcing element and the pedestal portion are arranged in one piece thereon. The pedestal portions are connected to one another horizontally by way of tongue and groove elements. Furthermore, the pedestal portions have horizontal openings, in which tensioning elements for the horizontal connection of the pedestal portions are provided. Furthermore, anchor rods for the connection of the tower to the foundation are cast in the pedestal portions. Furthermore, external ground anchors are likewise disclosed.

A disadvantage here is that considerable costs and considerable work effort are also in this case necessary for connecting the elements and producing the statically loadable foundation.

It is therefore an object of the invention to overcome the aforementioned disadvantages and to make it possible to erect foundations for wind power plants out of prefabricated elements in an economical manner.

This object is achieved by the combination of the features of claim 1.

Specifications of the invention are set out in the dependent claims.

Surprisingly, it has been shown that it is thus possible to dispense with horizontal connecting means in a simple manner.

A teaching provides that above or within the first portion, an abutment is provided against which the substantially vertical bracing elements are arranged and tensioned, wherein the upper abutment is preferably a flange of the tower of the wind power plant. In this way, it is possible to ensure reliable bracing or pre-loading in a simple manner.

A further teaching provides for the closed pedestal element of the first portion to be composed of at least two segments. In this way, it is possible to facilitate simple transport even in the case of large sizes, which would be possible only with special transport or would not be possible at all.

The invention provides that the segments overlap in a connecting region, wherein the apertures also overlap in the overlap region. In this way, a simple and reliable connection can be provided.

The invention provides that the segments, in a connecting region, border one another with substantially vertical abutment surfaces. In this way, a simple and reliable connection can be provided.

A further teaching provides that, in a connecting region, substantially horizontal reinforcement elements exit from the segments which overlap in the connecting region. In this way, a simple and reliable connection can be provided.

A further teaching provides that, in the connecting region, the segments taper in terms of the height of the segments and/or the width of the segments, wherein apertures are preferably provided in the tapered portions. A further teaching of the invention provides that the horizontal reinforcement elements overlap in the tapering portions. A further teaching of the invention provides that the tapering region is filled with a mortar. Surprisingly, it has been shown that this provides a particularly loadable and cost-effective connection when segments are provided.

A further teaching provides for a stiffening element to be provided in the first portion. Surprisingly, it has been shown that, as a result of the provision of a stiffening element in particular in the pedestal portion, it is possible, with a segmented construction of the foundation, to achieve a disproportionate increase in stability in the foundation in a simple manner.

A further teaching provides that the stiffening element has no apertures and/or is arranged free of fastening means in the first portion. A further teaching of the invention provides that the stiffening element is embodied as a sleeve whose clear internal diameter preferably corresponds substantially to the clear internal diameter of the first and/or second portion.

A further teaching provides that the stiffening element is enclosed, with substantially the same or a greater height, by a pedestal element, such that the enclosing

pedestal element and the stiffening element preferably have substantially the same wall thickness as the pedestal elements arranged there above and/or there below.

A further teaching provides for a stiffening element to be provided in the second portion. Surprisingly, it has been shown that, as a result of the provision of a stiffening element in particular in the second portion, it is possible, with a segmented construction of the foundation, to achieve a disproportionate increase in stability in the foundation in a simple manner.

A further teaching provides that the stiffening element has no apertures and/or is arranged free of fastening means in the second portion. A further teaching of the invention provides that the stiffening element is embodied as a sleeve whose clear internal diameter preferably corresponds substantially to the clear internal diameter of the first and/or second portion.

A further teaching provides that the stiffening element is enclosed, with substantially the same or a greater height, by the pedestal portions of the at least two horizontal elements.

A further teaching that the vertical and horizontal gaps between the elements are present by arranging vertical and/or horizontal spacers between the elements. A further teaching of the invention relating to all solutions of the invention provides that vertical and/or horizontal gaps between the elements are at least partially filled with a mortar. This supports the stability of the foundation, since the remaining measures are supported by the provision of a monolithic connection.

Below, the invention will be explained in more detail on the basis of exemplary embodiments in conjunction with a drawing. In the figures:

Figs. 1 to 6b show views and details relating to a first embodiment of a foundation according to the invention,

Figs. Figs. 7 to 14b show views and details relating to a second embodiment of a foundation according to the invention,

Figs. 15 to 20b show views and details relating to a third embodiment of a foundation according to the invention, and

Figs. 21 to 26 show views and details relating to a fourth embodiment of a foundation according to the invention.

Figs. 1 to 6b show a first embodiment of a foundation 10 according to the invention. In Fig. 1, in a sectioned view, said foundation is arranged on a blinding layer 102 in a pit 101 in the ground 100. It has a first portion 11 and a second portion 12. Furthermore, a third portion 13 is also provided, which is provided in a recess 103.

The first portion 11 is constructed as a pedestal 20 composed of closed pedestal elements 14 (see Figs. 4a to 4d), which are preferably embodied here as circular rings, such that the pedestal portion 11 has an interior space 15. The pedestal elements 14 have vertical apertures 18 in which, after the foundation 10 has been assembled, anchor rods 19 are provided in order to brace or pre-load the foundation 10.

The pedestal elements 14 are formed of segments 16. In this embodiment, the segments have an overlap region 17 which is realized in such a way that step portions 21 are provided, which engage in one another. Apertures 18 are likewise provided in the step portions 21, such that bracing or pre-loading also acts in the step portions 21.

The second portion 12 is of planar embodiment. As an alternative, however, it is also possible to realize a star shape. Fig. 2 shows a plan view of the foundation 10. Fig. 3 shows a three-dimensional view of the foundation 10. The second portion is formed of horizontal elements 22 in the form of ribbed elements. These are illustrated in Figs. 5a to 5d. These extend radially outward, as seen from the interior space 15. They have a base plate 23 which is of trapezoidal embodiment, such that all of the assembled base plates form a polygonal surface (see Fig. 2) which approximates a circular shape.

At the inner end 24 of the base plate 23, a pedestal portion 25 is provided which corresponds to the pedestal 20 of the first portion 11. Apertures 18 are likewise provided in the pedestal portion 25. At a right angle to the base plate, there is arranged a stiffening wall 26 whose height decreases for example toward the outer end 27 of the base plate 23. An upwardly open cavity 28, into which backfill 104 can be introduced, is formed between two adjacent stiffening walls 26, as a result of which an applied load can be applied to the second portion 12 of the foundation 10.

At the inner end 24 pedestal portions 25 of the horizontal elements 22, two projections 29 are provided, between which a stiffening element 30 (see Figs. 1 and 6a, 6b) can be arranged. As a result of the projections, a vertical movement of the stiffening element 30 is avoided. These projections 29 are only one possible embodiment for this purpose. As an alternative, they can also be omitted, and the stiffening element 30, which then has a height □the height of the pedestal portion, is then arranged only loosely at the

inner end 24 of the pedestal portion 25. A further alternative would be for only one projection 29 to be arranged on the pedestal portion 25, at the top or at the bottom.

The stiffening element 30 is embodied as a one-piece component. Here, it is preferably provided in the form of a sleeve with an interior space 15. As an alternative, a solid body is also possible. The dimensions thereof should in this case preferably be provided such that it is possible to transport the stiffening element 30 using a standard truck.

According to the invention, a third portion is provided below the second portion 12.

This likewise serves for the stiffening of the foundation 10. Furthermore, here it is also simultaneously an abutment for the fastening elements 31 of the anchor rods 19. Here, a pedestal element 14 is provided, which is formed of segments 16. Here, they in turn have overlap regions 17 and apertures 18. As an alternative, it is also possible for a plurality of pedestal elements 14 to be provided. Below the third portion 13, a cavity 105 is provided, wherein the anchor rods/threaded rods 19 or other alternative fastening means (cables, etc.) lead into it and are screwed onto the, for example, nuts as fastening means 31 in the form of locking and pre-loading means. To protect the fastening means against corrosion, the cavity 105 is filled with in-situ concrete.

Spacers (not illustrated) can be arranged between the elements 14, 16, 22, 30 in order to facilitate/simplify the filling of the gaps with mortar. Figs. 7 to 14b show a second embodiment of a foundation 10 according to the invention. In Fig. 7, in a sectioned view, it is arranged on a blinding layer 102 in a pit 101 in the ground 100. It has a first portion 11 and a second portion 12. Furthermore, a third portion 13 is also provided, which is provided in a recess 103.

The first portion 11 is constructed as a pedestal 20 composed of closed pedestal elements 14 (see Figs. 10a to 10f), which are preferably embodied here as circular rings, such that the pedestal portion 11 has an interior space 15. The pedestal elements 14 have vertical apertures 18 in which, after the foundation 10 has been assembled, anchor rods 19 are provided in order to brace or pre-load the foundation 10.

The pedestal elements 14 are formed of segments 16 which are arranged in an abutting manner relative to one another. In this case, pedestal elements 14a, 14b and 14c of different height are provided here, by way of example. Further pedestal elements 14, which can also have further alternative heights, are possible. A flat abutment pedestal

element 14a is provided in an uppermost position. Pedestal element 14b is embodied to be taller and less wide, such that a stiffening element 30 can be arranged in the interior thereof (see Fig. 7). Its height should be <= the height of the stiffening element 30.

The stiffening element 30 (Figs. 11a, 11b) is embodied as a one-piece component. Here, it is preferably provided in the form of a sleeve with an interior space 15. As an alternative, a solid body is also possible. The dimensions thereof should in this case preferably be provided such that it is possible to transport the stiffening element 30 using a standard truck.

As height compensation or for stiffening purposes, for example, a further pedestal element 14c is then provided.

The second portion 12 is of planar embodiment. As an alternative, however, it is also possible to realize a star shape. Fig. 8 shows a plan view of the foundation 10. Fig. 9 shows a three-dimensional view of the foundation 10. The second portion is formed of horizontal elements 22 in the form of ribbed elements. These are illustrated in Figs. 12a to 12d. These elements extend radially outward, as seen from the interior space 15. They have a base plate 23 which is of trapezoidal embodiment, such that all of the assembled base plates form a polygonal surface (see Fig. 8) which approximates a circular shape.

At the inner end 24 of the base plate 23, a pedestal portion 25 is provided which corresponds to the pedestal 20 of the first portion 11. Apertures 18 are likewise provided in the pedestal portion 25. At a right angle to the base plate, there is arranged a stiffening wall 26 whose height decreases for example toward the outer end 27 of the base plate 23. An upwardly open cavity 28, into which backfill 104 can be introduced, is formed between two adjacent stiffening walls 26, as a result of which an applied load can be applied to the second portion 12 of the foundation 10.

In order to further in particular vertically reinforce the second portion, plates 33 (see Fig. 7 and Figs. 13a, 13b) can be provided at the outer ends 34 of the pedestal portions 25, which, for example, are fixed in place with mortar against the pedestal portion. These plates 33 extend between two stiffening walls 26 of two adjacent horizontal elements 22. Furthermore, these plates preferably extend as far as the base plate 23 and terminate at the top flush with the pedestal portion 25.

According to the invention, a third portion 13 is provided below the second portion 12. These third portion likewise serves for the stiffening of the foundation 10. Furthermore, here, with its lowermost pedestal element 14d, it is also simultaneously an

abutment (see also Figs. 14a, 14b) for the fastening elements 31 of the anchor rods 19. Here, for example two pedestal elements 14 are provided, which are formed of segments 16 which are here, in turn, arranged in an abutting manner. As an alternative, it is also possible for further pedestal elements 14 to be provided. In the lowermost pedestal element 14d, a recess 32 is provided, into which the fastening elements 31 can engage or in which abutment elements (not illustrated) can be arranged.

Below the third portion 13A, a cavity 105 is provided, in which the anchor rods/threaded rods 19 or other alternative fastening means (cables, etc.) lead into and are screwed onto, for example, the nuts as fastening means 31 in the form of locking and pre-loading means. To protect the fastening means against corrosion, the cavity 105 is filled with in-situ concrete.

Spacers (not illustrated) can be arranged between the elements 14, 16, 22, 30 in order to facilitate/simplify the filling of the gaps with mortar.

Figs. 15 to 20b show a third embodiment of a foundation 10. In Fig. 15, in a sectioned view, it is arranged on a blinding layer 102 in a pit 101 in the ground 100. It has a first portion 11 and a second portion 12. Furthermore, a third portion 13 is also provided, which is provided in a recess 103.

The first portion 11 is constructed as a pedestal 20 composed of closed pedestal elements 14, which are preferably embodied here as circular rings, such that the pedestal portion 11 has an interior space 15. The pedestal elements 14 have vertical apertures 18 in which, after the foundation 10 has been assembled, anchor rods 19 are provided in order to brace or pre-load the foundation 10. The pedestal elements 14 are formed of segments 16 (see Figs. 19a, 19b) which are arranged in an abutting manner relative to one another.

The second portion 12 is of planar embodiment. As an alternative, however, it is also possible to realize a star shape. Fig. 16 shows a plan view of the foundation 10. Fig. 17 shows a three-dimensional view of the foundation 10. The second portion 12 is formed of horizontal elements 22 in the form of ribbed elements. These are illustrated in Figs. 18a to 18d. They extend radially outward, as seen from the interior space 15. They have a base plate 23 which is of trapezoidal embodiment, such that all of the assembled base plates form a polygonal surface (see Fig. 16) which approximates a circular shape.

At the inner end 24 of the base plate 23, a pedestal portion 25 is provided which corresponds to the pedestal 20 of the first portion 11. Apertures 18 are likewise provided

in the pedestal portion 25. At a right angle to the base plate, there is arranged a stiffening wall 26 whose height for example decreases toward the outer end 27 of the base plate 23. An upwardly open cavity 28, into which backfill 104 can be introduced, is formed between two adjacent stiffening walls 26, as a result of which an applied load can be applied to the second portion 12 of the foundation 10.

According to the invention, a third portion 13 is provided below the second portion 12. It serves for the stiffening of the foundation 10. It has been shown that it is possible, in particular with large pedestal diameters, to provide merely the third portion 13 in order to achieve an adequate dissipation of load.

Furthermore, here, the third portion 13, with its lowermost pedestal element 14d, is also simultaneously an abutment (see also Figs. 20a, 20b) for the fastening elements 31 of the anchor rods 19. Here, for example two pedestal elements 14 are provided, which are formed of segments 16 which are here, in turn, arranged in an abutting manner. As an alternative, it is also possible for further pedestal elements 14 to be provided. In the lowermost pedestal element 14d, a recess 32 is provided, into which the fastening elements 31 can engage or in which abutment elements (not illustrated) can be arranged.

Below the third portion 13, a cavity 105 is provided, wherein the anchor rods/threaded rods 19 or other alternative fastening means (cables, etc.) lead into it and are screwed onto the, for example, nuts as fastening means 31 in the form of locking and pre-loading means. To protect the fastening means against corrosion, the cavity 105 is filled with in-situ concrete.

Spacers (not illustrated) can be arranged between the elements 14, 16, 22, 30 in order to facilitate/simplify the filling of the gaps with mortar.

Figs. 21 to 26 show a fourth embodiment of a foundation 10 according to the invention, similar to the third embodiment. In Fig. 21, in a sectioned view, it is arranged on a blinding layer 102 in a pit 101 in the ground 100. It has a first portion 11 and a second portion 12. Furthermore, a third portion 13 is also provided, which is provided in a recess 103.

The first portion 11 is constructed as a pedestal 20 composed of closed pedestal elements 14, which are preferably embodied here as circular rings, such that the pedestal portion 11 has an interior space 15. The pedestal elements 14 have vertical apertures 18 in which, after the foundation 10 has been assembled, anchor rods 19 are provided in order to brace or pre-load the foundation 10. The pedestal elements 14 are formed of

segments 16 (see Figs. 25a, 25b) which are arranged in an abutting manner relative to one another.

A most preferred connection of the segments 16 is illustrated in Fig. 26. The segments are arranged in an abutting manner relative to one another. However, the segments 16 taper in a connecting region 38. In the tapering region 35, reinforcement elements 36 exit horizontally from the segments 16. In the state arranged for assembly, the reinforcement elements 36 of the adjacent segments 16 are aligned and overlap one another in the connecting region 38 /tapering region 35. These are connected to one another with connecting means 37, which are illustrated merely schematically in Fig. 26. Also in the tapering regions 35, the segments 16 have apertures 18 (see Figs. 25a, 25b), which are, however, not illustrated in Fig. 26. After the reinforcement elements 36 have been connected, the tapering regions 35 are filled with mortar 39, as a result of which the segments are additionally connected to one another in a monolithic/materially bonded manner, which leads to a particularly stable connection of the segments 16. In this case, it is particularly advantageous for the overlapping region to be able to turn out significantly shorter due to the provision of the tapering. Furthermore, the required amount of mortar 39 is considerably reduced. This makes the use of faster-setting mortars economical, as a result of which foundation assembly can be carried out more rapidly.

The second portion 12 is of planar embodiment. As an alternative, however, it is also possible to realize a star shape. Fig. 22 shows a plan view of the foundation 10. Fig. 23 shows a three-dimensional view of the foundation 10. The second portion 12 is formed of horizontal elements 22 in the form of ribbed elements. These are illustrated in Figs. 24a to 24d. These elements extend radially outward, as seen from the interior space 15. They have a base plate 23 which is of trapezoidal embodiment, such that all of the assembled base plates form a polygonal surface (see Fig. 22) which approximates a circular shape.

At the inner end 24 of the base plate 23, a pedestal portion 25 is provided which corresponds to the pedestal 20 of the first portion 11. Apertures 18 are likewise provided in the pedestal portion 25. At a right angle to the base plate, there is arranged a stiffening wall 26 whose height for example decreases toward the outer end 27 of the base plate 23. An upwardly open cavity 28, into which backfill 104 can be introduced, is formed between two adjacent stiffening walls 26, as a result of which an applied load can be applied to the second portion 12 of the foundation 10.

According to the invention, a third portion 13 is provided below the second portion 12. It serves for the stiffening of the foundation 10. It has been shown that it is possible, in particular with large pedestal diameters, to provide merely the third portion 13 in order to achieve an adequate dissipation of load.

Furthermore, here, the third portion 13, with its lowermost pedestal element 14d, is also simultaneously an abutment for the fastening elements 31 of the anchor rods 19. Here, for example two pedestal elements 14 are provided, which are formed of segments 16 which are here, in turn, arranged in an abutting manner. As an alternative, it is also possible for further pedestal elements 14 to be provided. In the lowermost pedestal element 14d, a recess 32 is provided, into which the fastening elements 31 can engage or in which abutment elements (not illustrated) can be arranged.

Below the third portion 13, a cavity 105 is provided, wherein the anchor rods/threaded rods 19 or other alternative fastening means (cables, etc.) lead into it and are screwed onto the, for example, nuts as fastening means 31 in the form of locking and pre-loading means. To protect the fastening means against corrosion, the cavity 105 is filled with in-situ concrete.

Between the elements 14, 16, 22, 30, spacers (not illustrated) can be arranged in order to facilitate/simplify the filling of the gaps with mortar.

List of reference numerals

10	Foundation
11	First portion/pedestal portion
12	Second portion
13	Third portion
14	Pedestal element
14a	Abutment pedestal element
15	Interior space
16	Segment
17	Overlap region
18	Aperture
19	Anchor rods
20	Pedestal
21	Step portion
22	Horizontal element/rib element
23	Base plate
24	Inner end
25	Pedestal portion
26	Stiffening wall
27	Outer end
28	Cavity
29	Projection
30	Stiffening element
31	Fastening element
32	Recess
33	Plate
34	Outer end
35	Tapering region
36	Reinforcement element
37	Connecting means
38	Connecting region
39	Mortar

100	Ground
101	Construction pit
102	Blinding layer
103	Recess
104	Backfill
105	Cavity

Patentkrav

1. Fundament til en vindmølle, hvilket fundament (10) har i det væsentlige præfabrikerede elementer, med et første sokkelagtigt udformet afsnit (11), der strækker sig lodret, og på hvilket et tårn tll vindmøllen kan anbringes, og et andet afsnit (12), der i det væsentlige strækker sig vandret, som fundamentbasis, der befinder sig i kontakt med jorden (100), idet det første afsnit (11) er anbragt over det andet afsnit (12) og har mindst et lukket sokkelelement (14), som er udformet ringformigt eller mangekantet, og idet det andet afsnit (12) er dannet af mindst to vandrette elementer (22), der hver især har mindst et sokkelafsnit (25), idet det første afsnits (11) mindst ene sokkelelement (14) og det andet afsnits (12) vandrette elements (22) sokkelafsnit (25) har i det væsentlige lodrette åbninger (18), der i monteret tilstand flugter med hinanden, og i hvilke i det væsentlige lodrette opspændingselementer (19) er anbragt, idet der er tilvejebragt et yderligere sokkelagtigt udformet afsnit (13), der strækker sig lodret, og som er anbragt under det andet afsnit (12) og har mindst et lukket sokkelelement (14), og idet det yderligere afsnit (13) er nødvendigt til overføring af vindmøllens belastning, **kendetegnet ved, at** det yderligere afsnits (13) lukkede sokkelelement (14) er sammensat af mindst to segmenter (16), at segmenterne (16) overlapper hinanden i et forbindelsesområde (38), idet også åbningerne (18) overlapper hinanden i overlapningsområdet, eller at segmenterne (16) grænser op til hinanden i et forbindelsesområde med i det væsentlige lodrette stødflader.

2. Fundament til en vindmølle ifølge krav 1, **kendetegnet ved, at** det første afsnits (11) lukkede sokkelelement (14) er sammensat af mindst to segmenter (16).

3. Fundament til en vindmølle ifølge krav 1 eller 2, **kendetegnet ved, at kendetegnet ved, at** i det væsentlige vandrette armeringselementer (36) i et forbindelsesområde (38) udtræder af de segmenter (16), der overlapper hinanden i forbindelsesområdet (38).

4. Fundament til en vindmølle ifølge et af kravene 1 til 3, **kendetegnet ved, at** segmenterne (16) i forbindelsesområdet (38) indsnævres med hensyn til

segmenternes (16) højde og/eller segmenternes (16) bredde.

5. Fundament til en vindmølle ifølge krav 4, **kendetegnet ved, at** der er tilvejebragt åbninger (18) i de indsnævrede afsnit.

6. Fundament til en vindmølle ifølge et af kravene 3 til 5, **kendetegnet ved, at** de vandrette armeringselementer (36) overlapper hinanden i indsnævringsafsnittene (35).

7. Fundament til en vindmølle ifølge et af kravene 3 til 6, **kendetegnet ved, at** indsnævringsområdet er udfyldt med en mørtel (39).

8. Fundament til en vindmølle ifølge et af kravene 1 til 7, **kendetegnet ved, at** det første afsnits (14) mindst ene sokkelelement (14) og det andet afsnits (12) mindst to vandrette elementer (22) er forspændt således med hinanden af de i det væsentlige lodrette forspændingselemente (19), at ingen yderligere fastgørelsesmidler, især vandrette fastgørelsesmidler, er nødvendige til overføringen af vindmøllens belastning.

9. Fundament til en vindmølle ifølge krav 8, **kendetegnet ved, at** der under eller i det andet afsnit (13) er anbragt mindst et vederlag (14a), mod hvilket de i det væsentlige lodrette opspændingselementer (19) er anbragt og spændt, og/eller at der over eller i det første afsnit (11) er anbragt et vederlag, mod hvilket de i det væsentlige lodrette opspændingselementer (19) er anbragt og spændt.

10. Fundament til en vindmølle ifølge et af kravene 1 til 9, **kendetegnet ved, at** der i det første afsnit (11) og/eller i andet afsnit (12) er anbragt et afstivningselement (30).

11. Fundament til en vindmølle ifølge krav 10, **kendetegnet ved, at** afstivningselementet (30) ikke har nogen åbninger og/eller er anbragt i det første eller det andet afsnit (11, 12) uden fastgørelsesmidler.

12. Fundament til en vindmølle ifølge krav 10 eller 11, **kendetegnet ved, at** afstivningselementet (30) er udformet som manchet, hvie frie indvendige

diameter i det væsentlige stemmer overens med det første og/eller det andet afsnits (11, 12) frie indvendige diameter.

13. Fundament til en vindmølle ifølge et af kravene 10 til 12, **kendetegnet ved, at** afstivningselementet (30) er omsluttet af et sokkelelement (14) med i det væsentlige samme eller større højde, således at det omsluttende sokkelelement (14) og afstivningselementet (30) har i det væsentlige samme vægtykkelse som de derover og/eller derunder anbragte sokkelelementer.

14. Fundament til en vindmølle ifølge et af kravene 1 til 13, **kendetegnet ved, at** de præfabrikerede elementer (16, 22) består af armeret beton.

15. Fundament til en vindmølle ifølge et af kravene 1 til 14, **kendetegnet ved, at** det første og/eller yderligere afsnits (11, 12) lukkede sokkelelement (14) er udformet manchetformigt.

16. Fundament til en vindmølle ifølge et af kravene 1 til 15, **kendetegnet ved, at** de lodrette opspændingselementer (19) er gevindstænger.

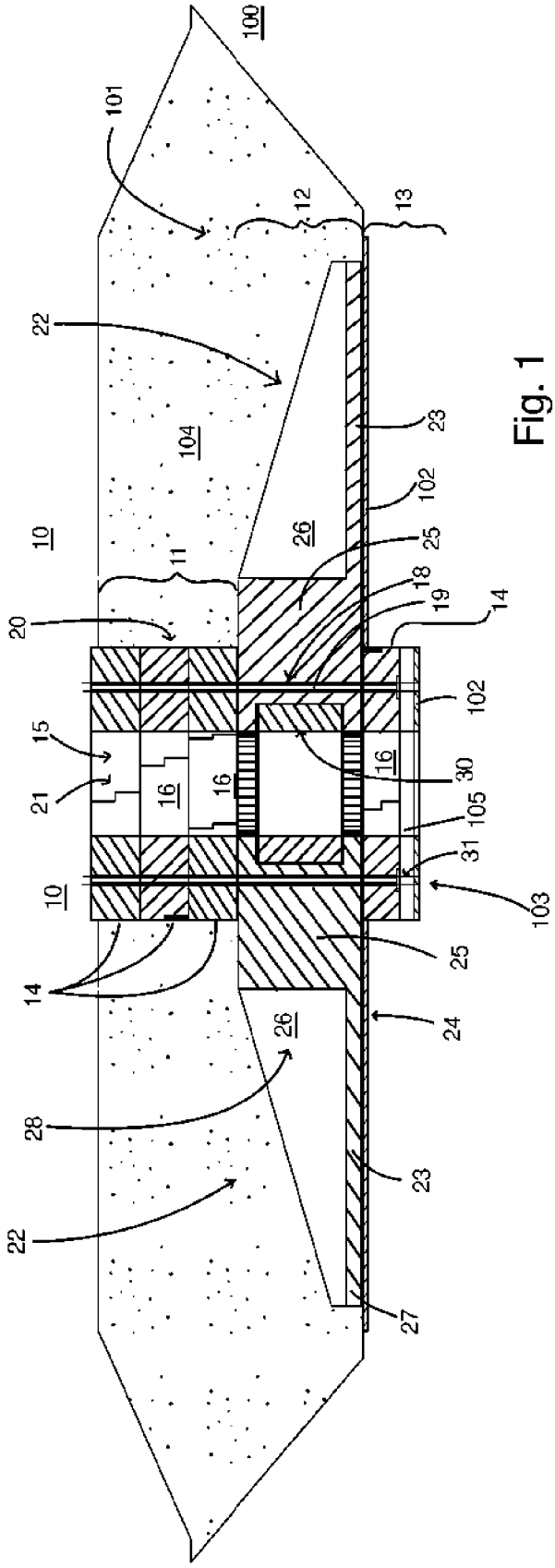
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Fig. 1

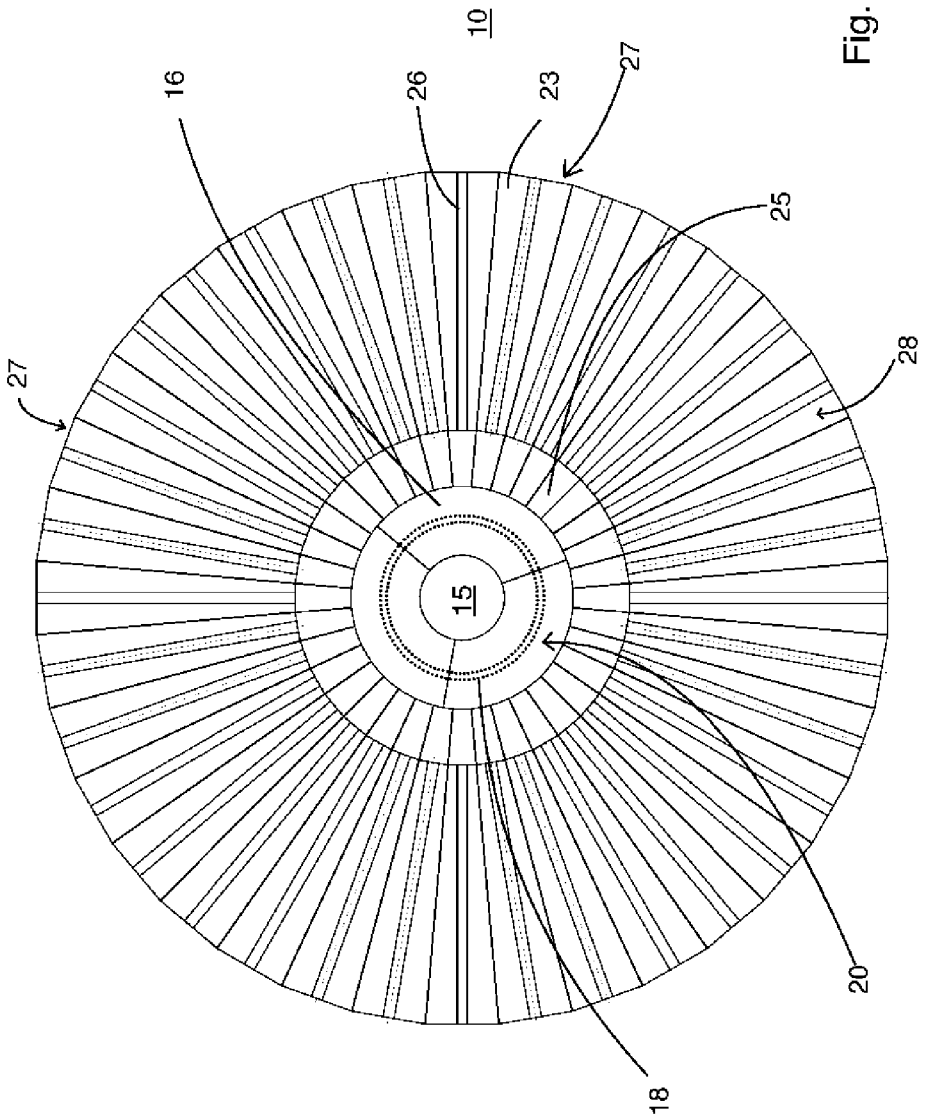

Fig. 2

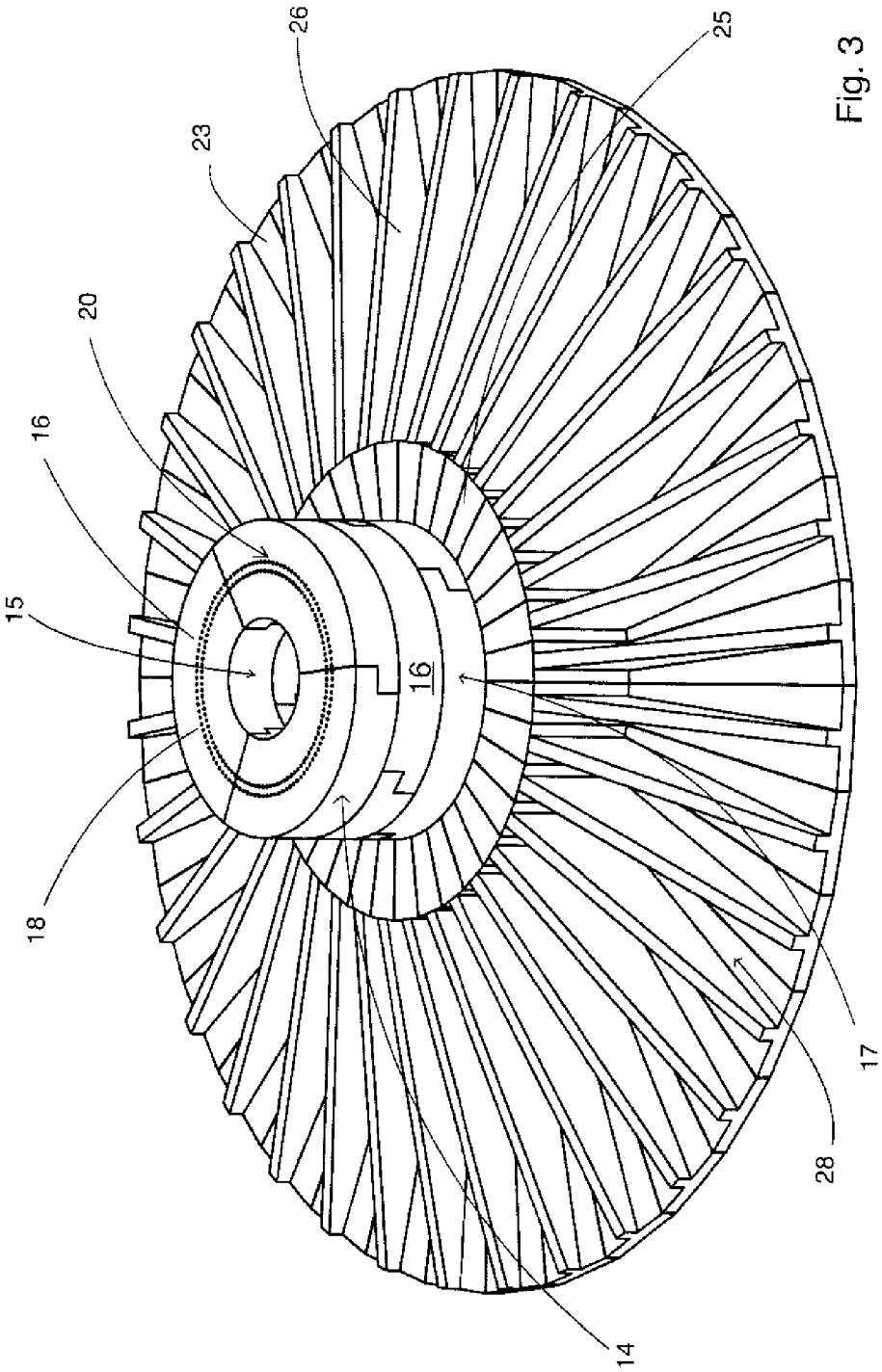

Fig. 3

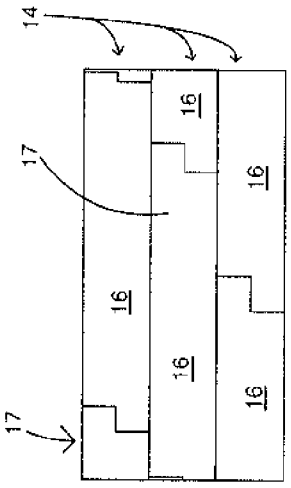

Fig. 4b

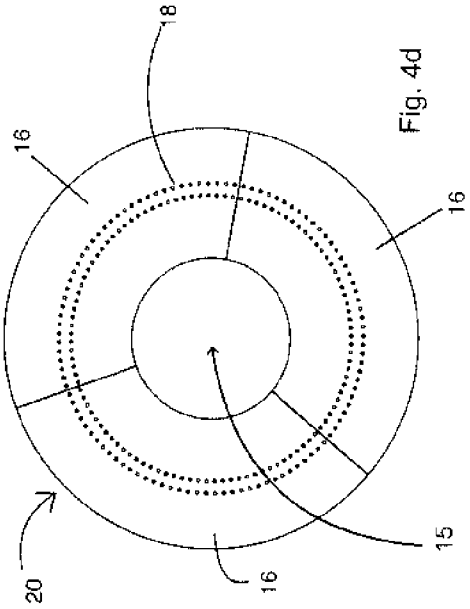

Fig. 4d

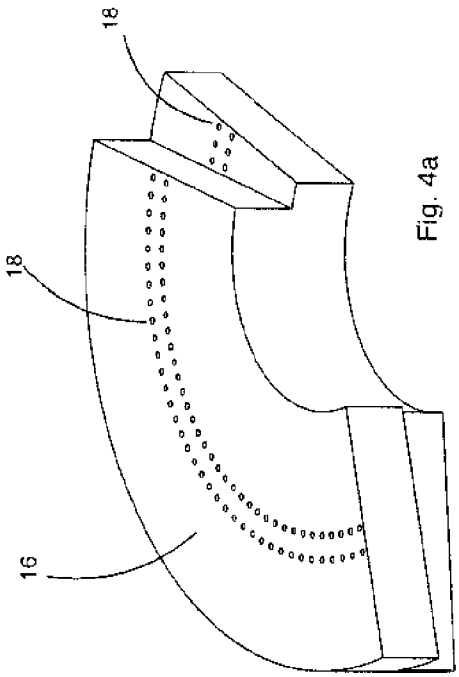

Fig. 4a

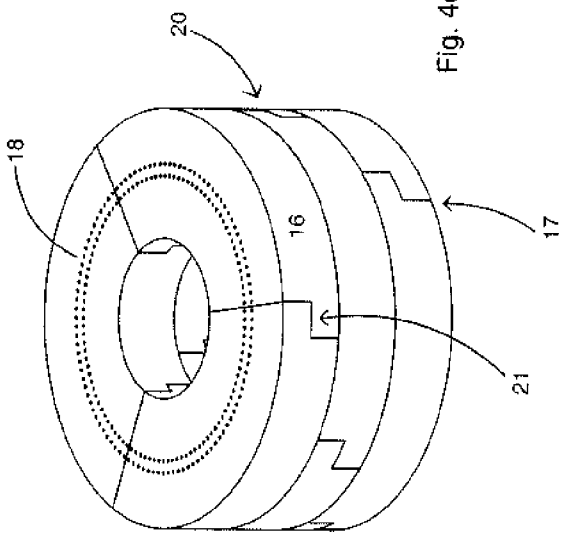

Fig. 4c

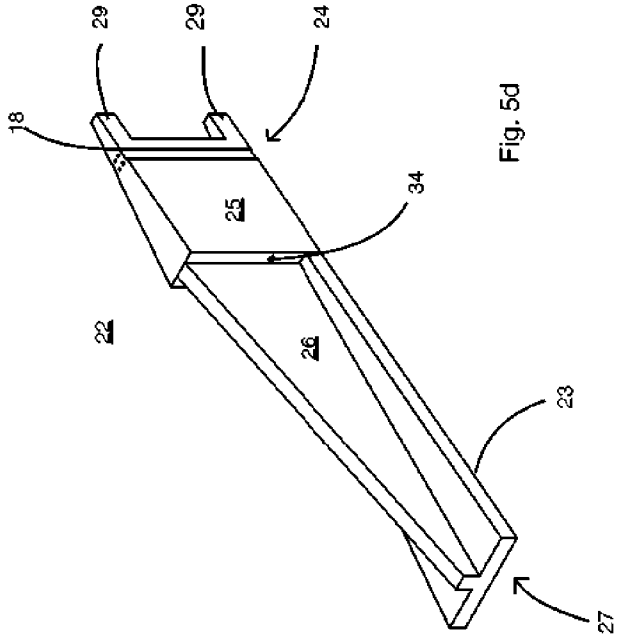

Fig. 5d

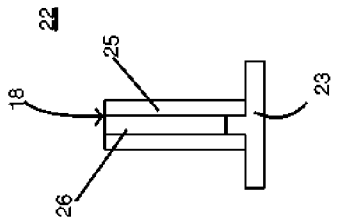

Fig. 5b

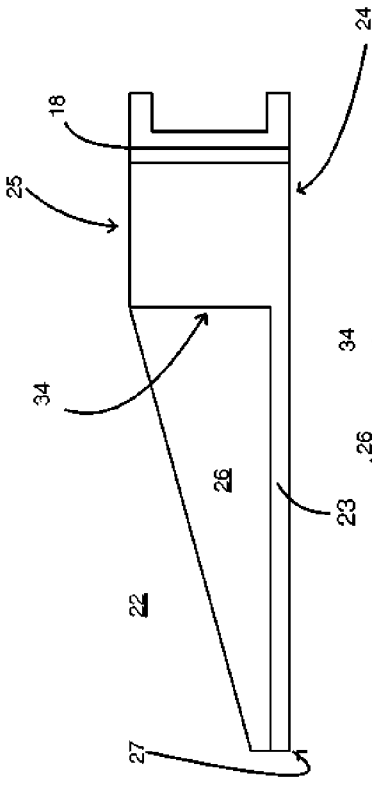

Fig. 5a

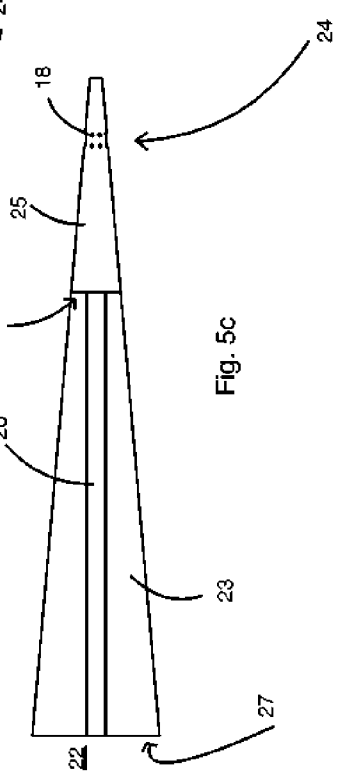

Fig. 5c

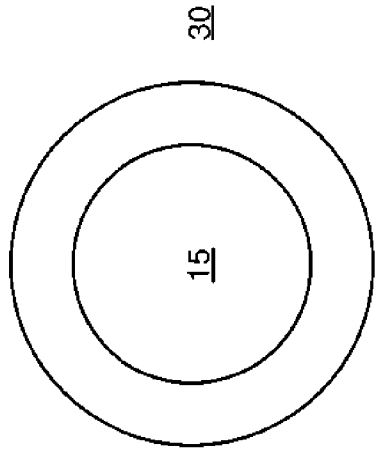

Fig. 6b

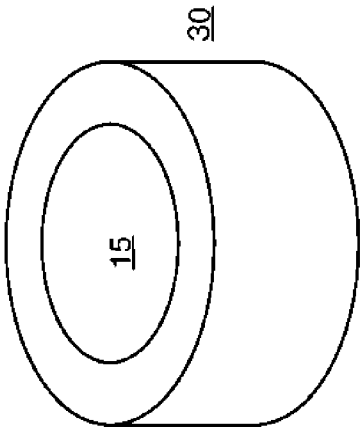

Fig. 6a

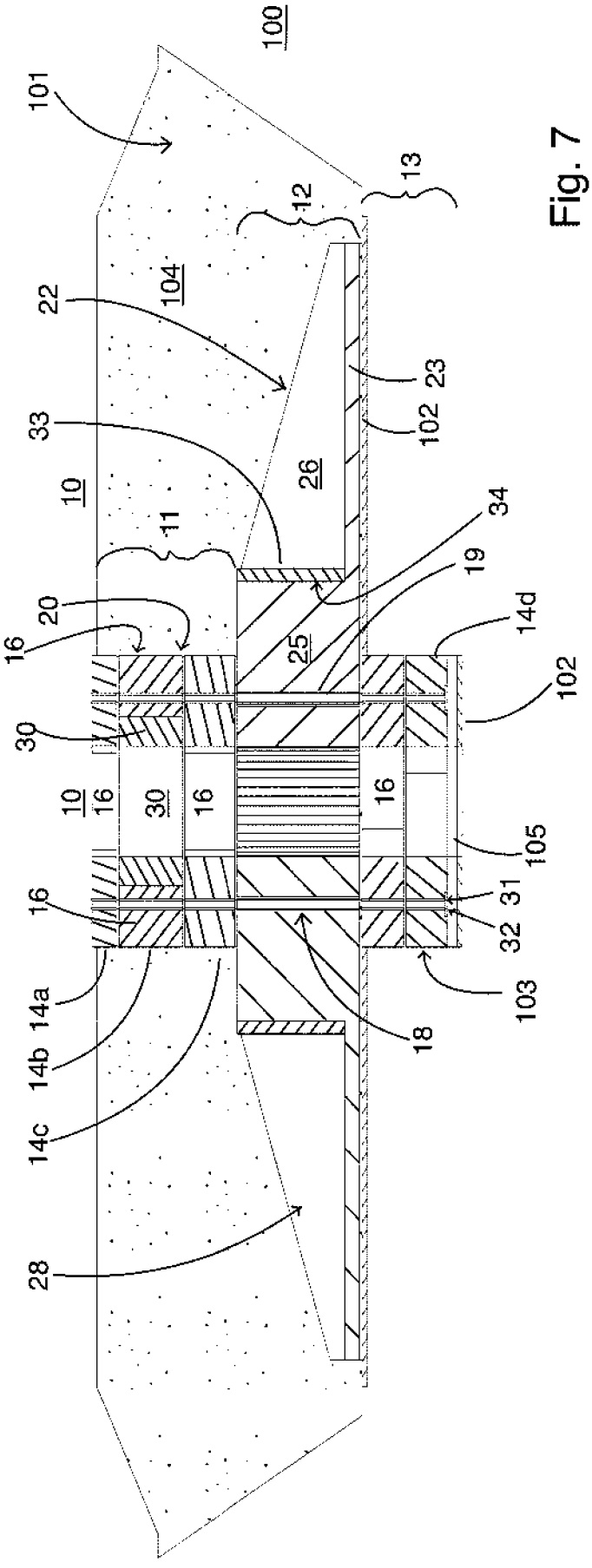
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Fig. 7

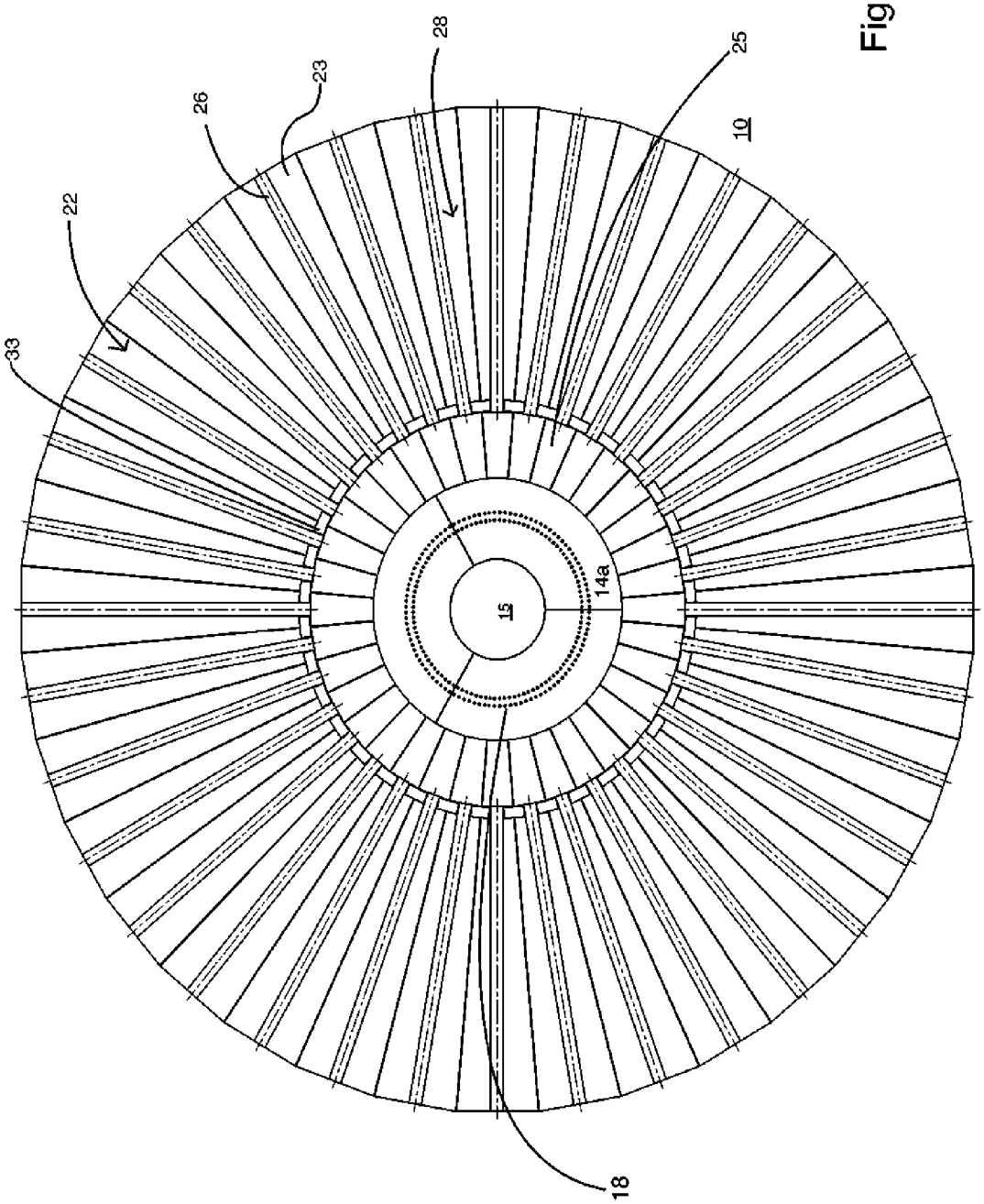

Fig. 8

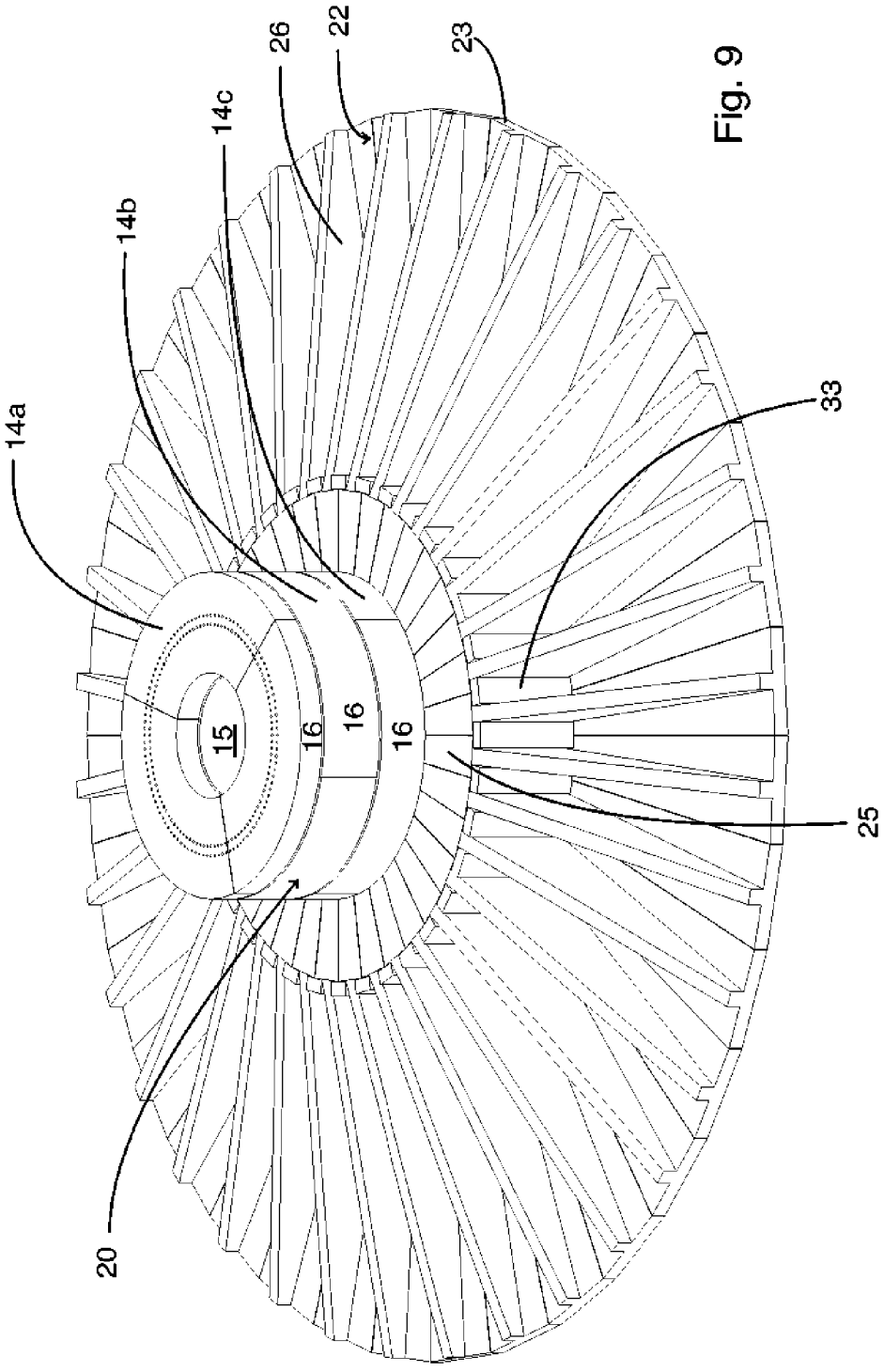

Fig. 9

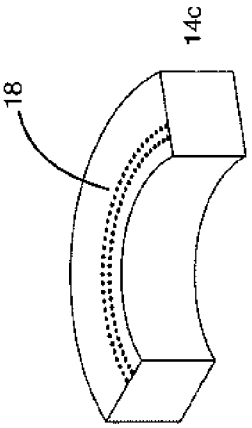

Fig. 10b

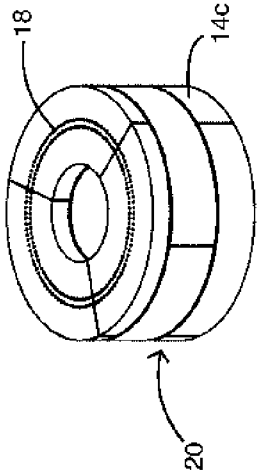

Fig. 10a

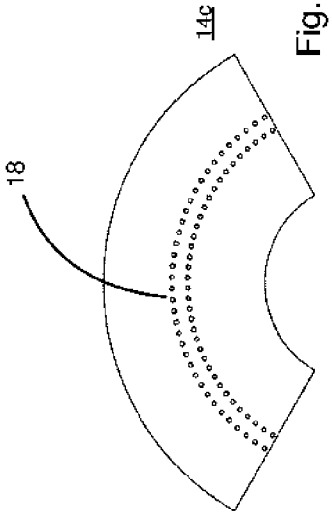

Fig. 10d

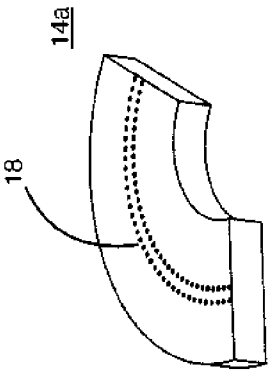

Fig. 10c

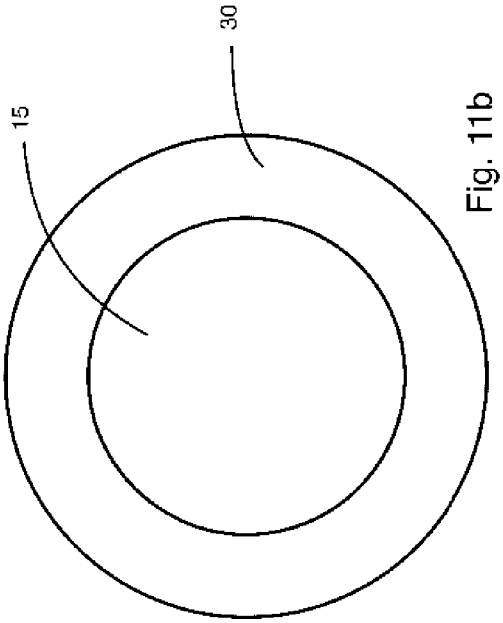

Fig. 11b

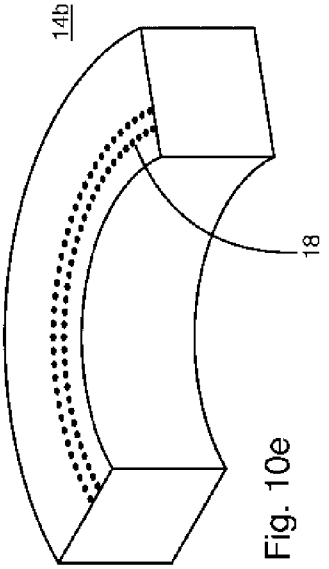

Fig. 10e

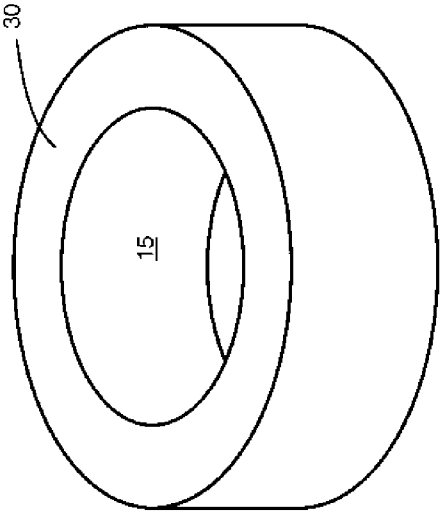

Fig. 11a

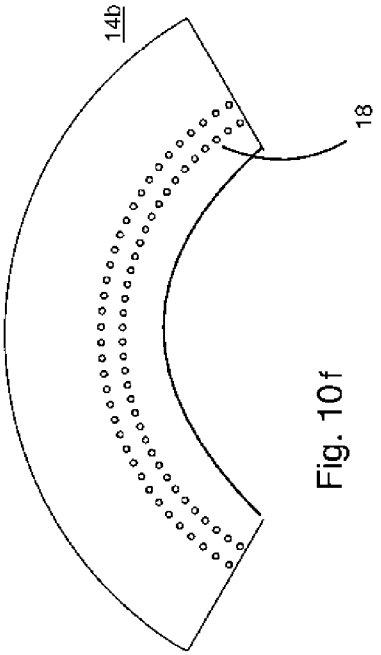

Fig. 10f

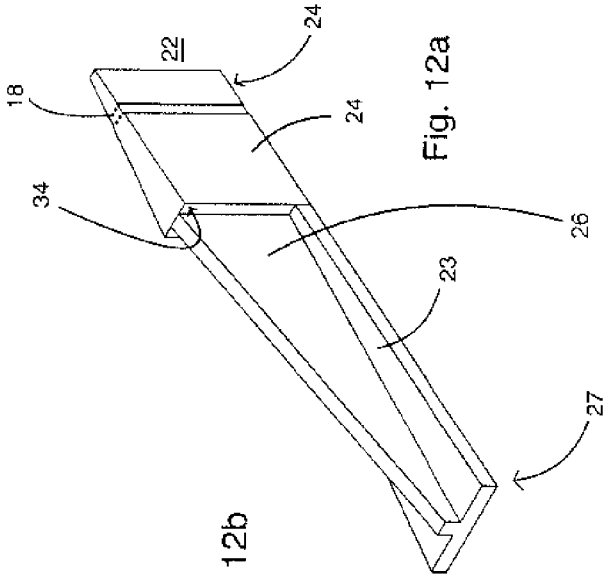

Fig. 12a

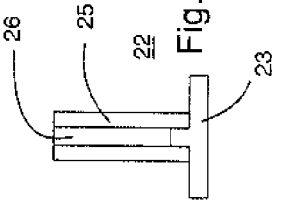

Fig. 12b

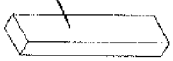

Fig. 13b

Fig. 13a

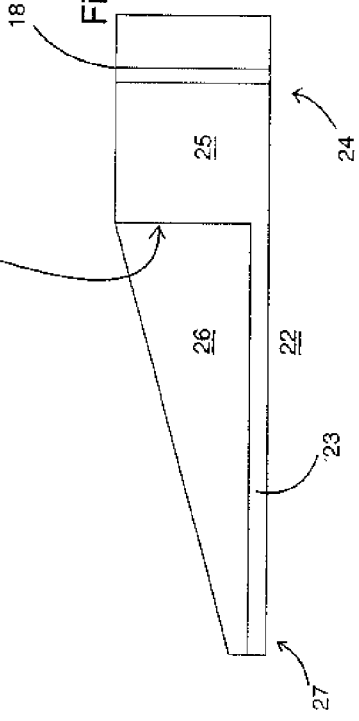

Fig. 12d

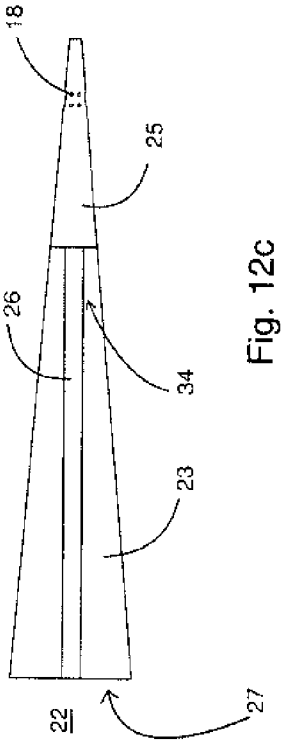

Fig. 12c

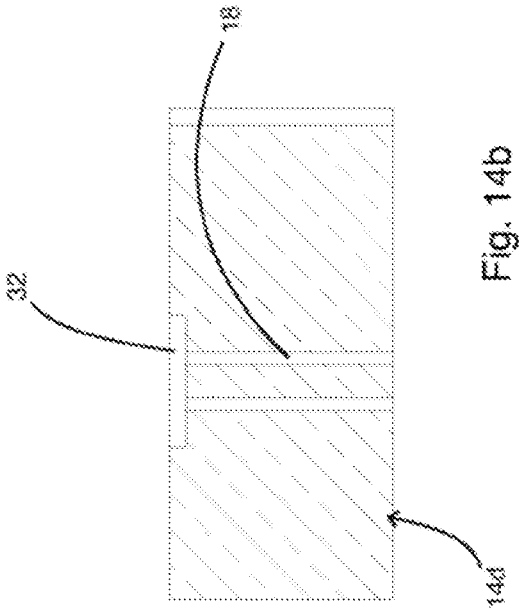

Fig. 14b

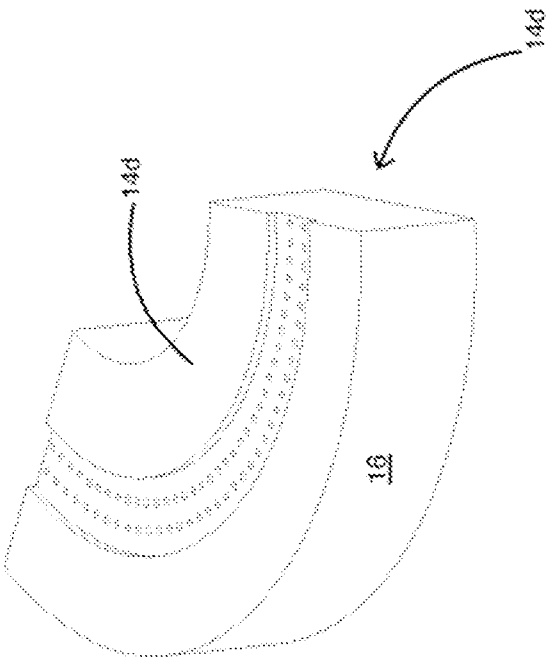

Fig. 14a

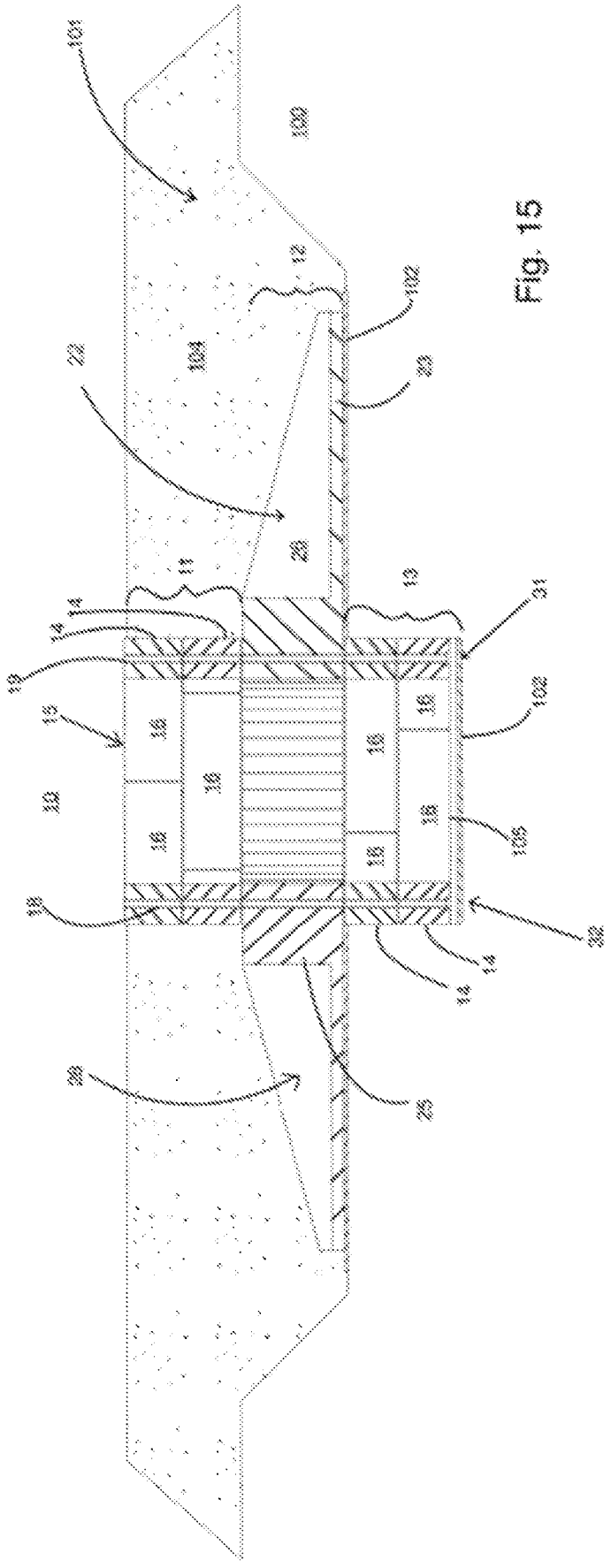
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Fig. 15

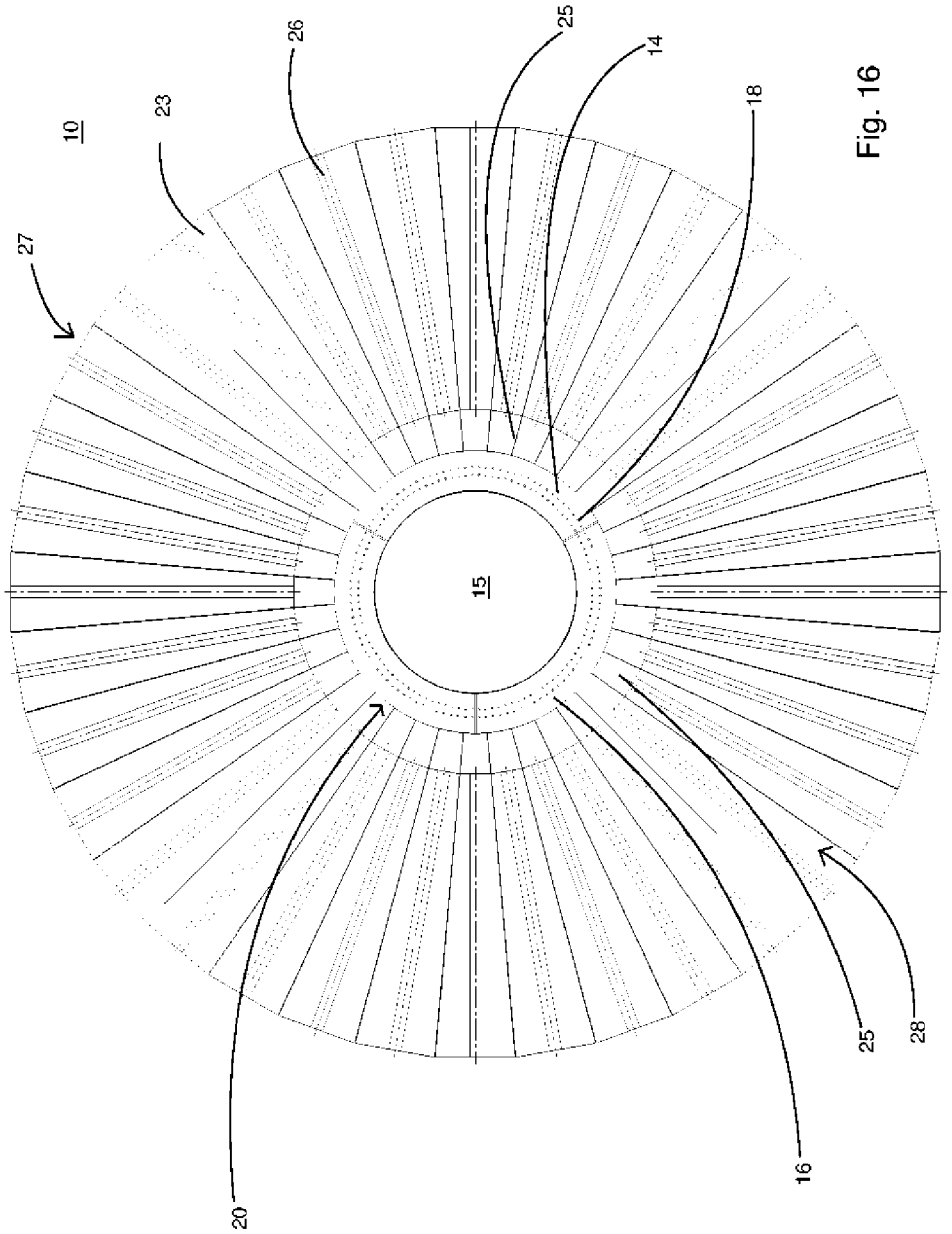

Fig. 16

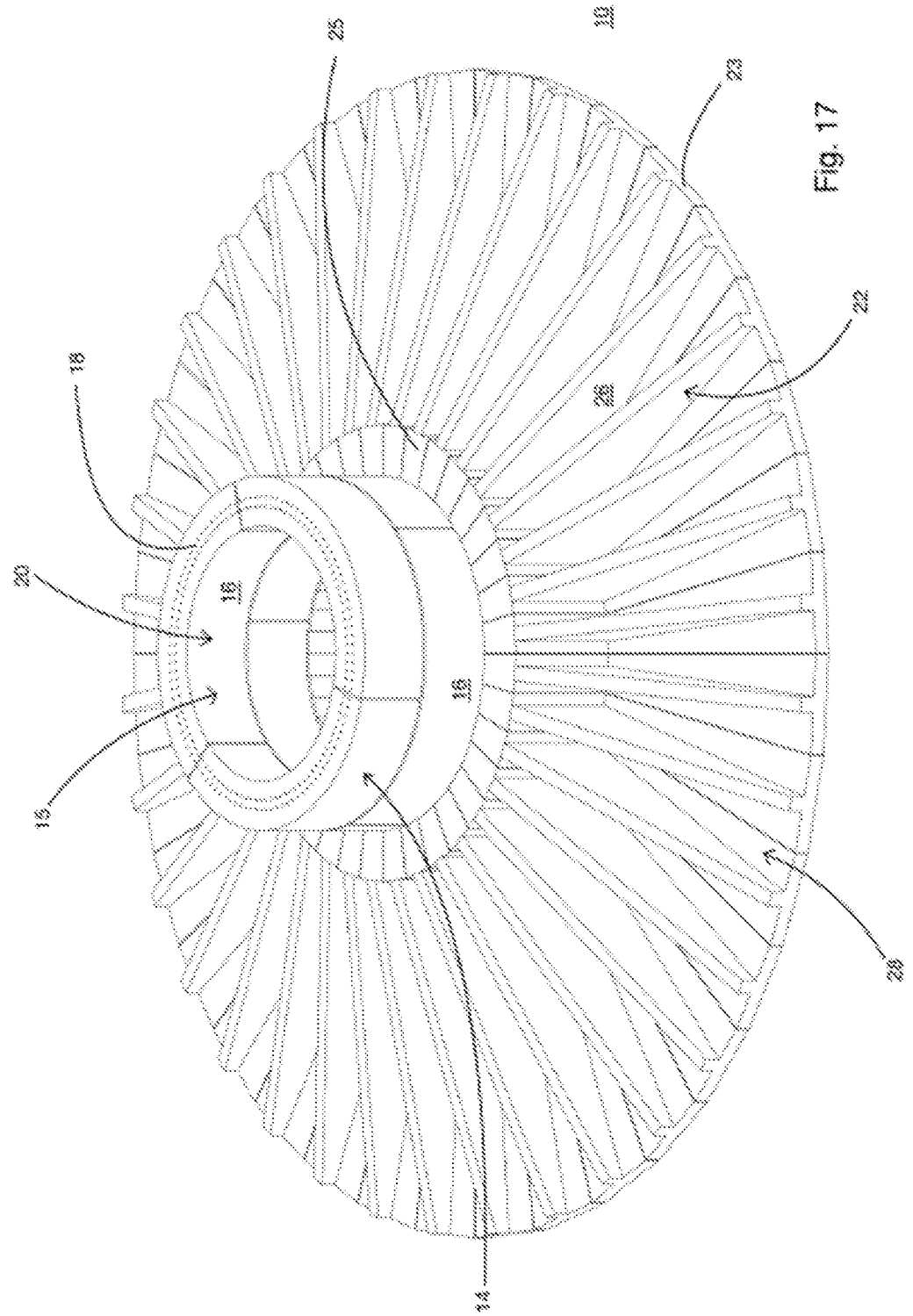

Fig. 17

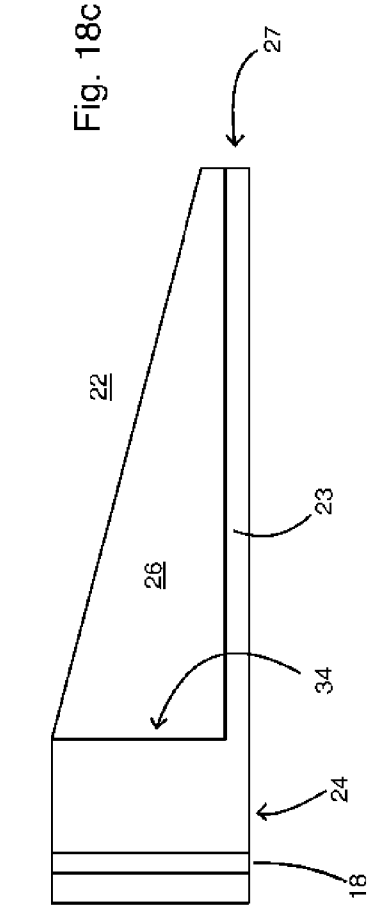

Fig. 18c

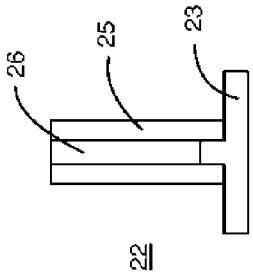

Fig. 18d

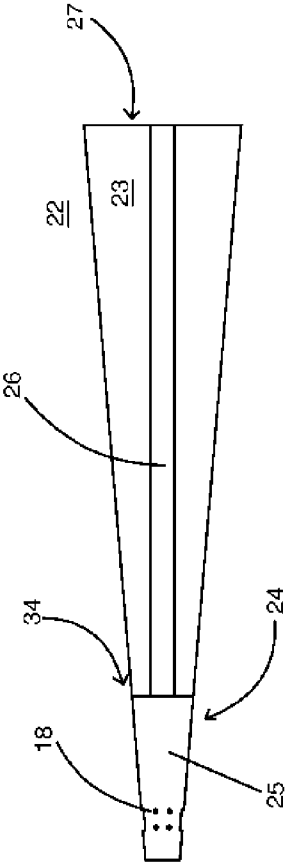

Fig. 18b

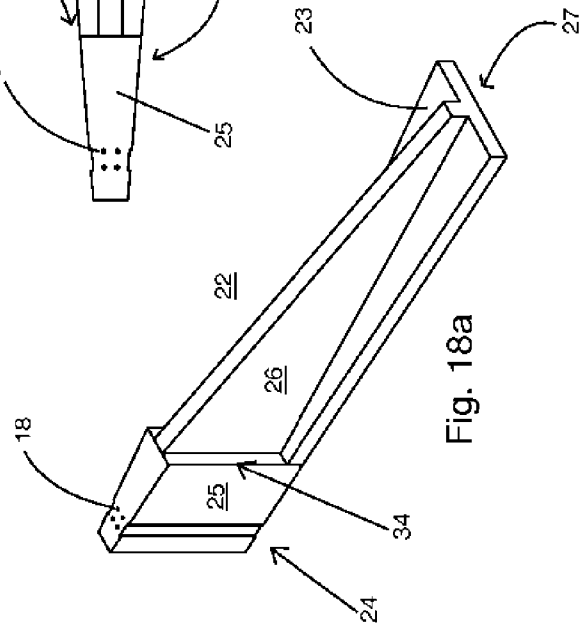

Fig. 18a

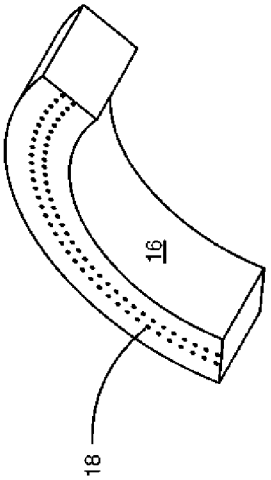

Fig. 19a

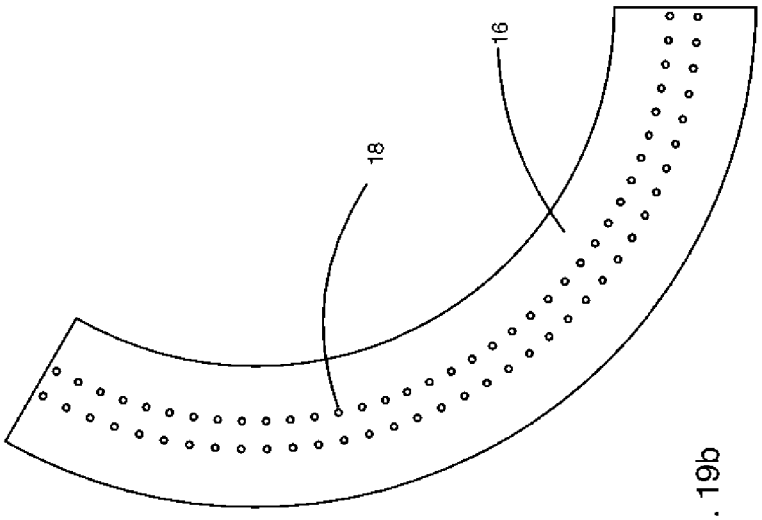

Fig. 19b

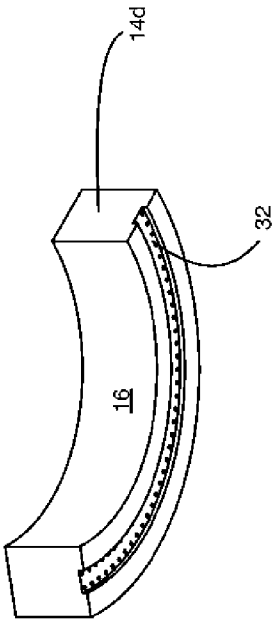

Fig. 20a

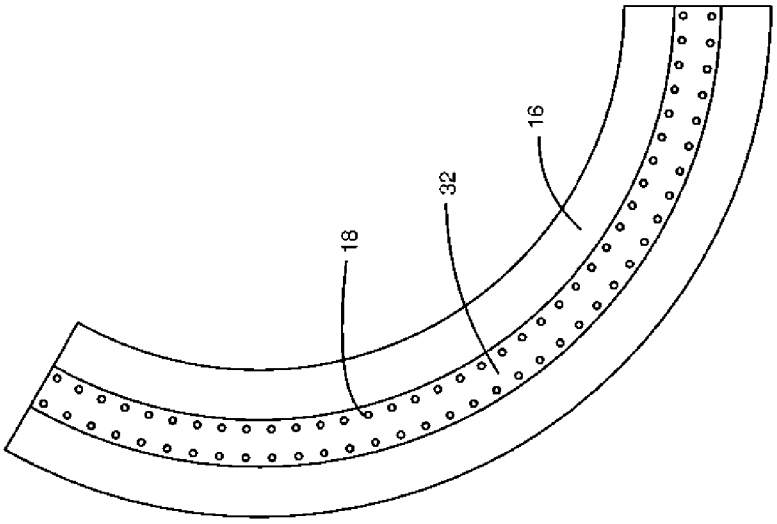

Fig. 20b

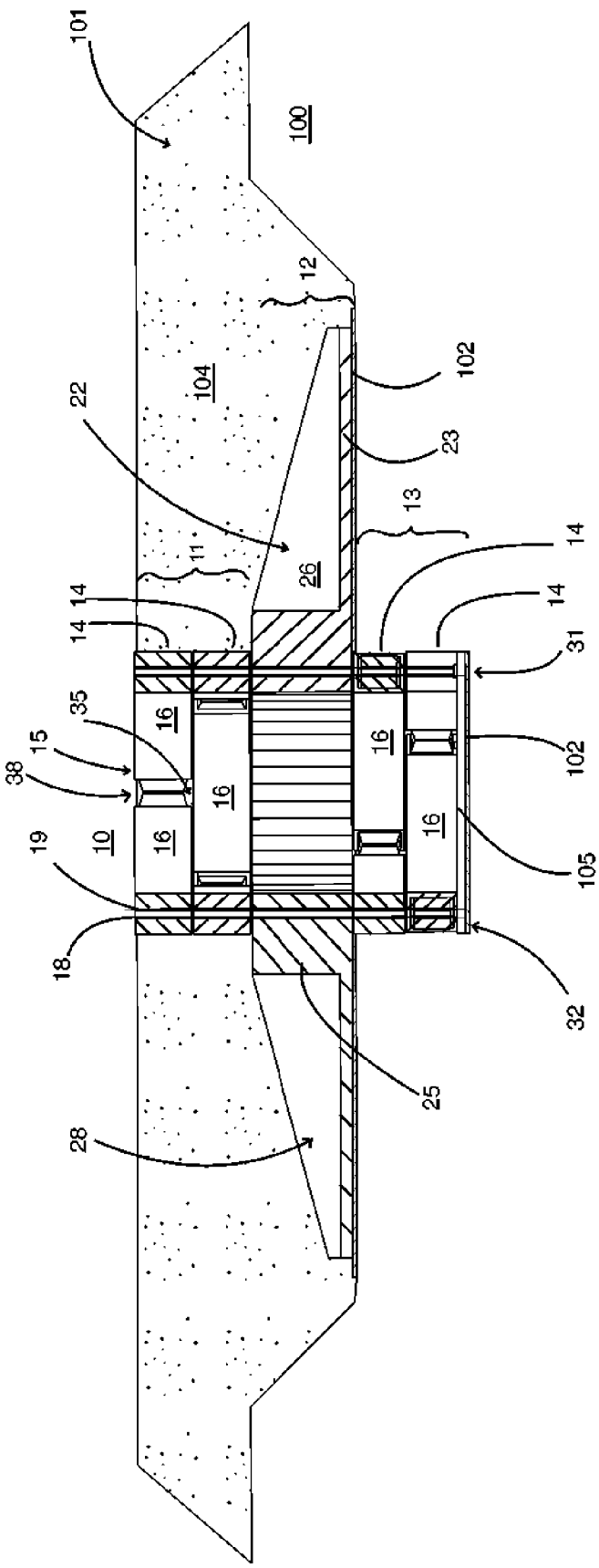
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Fig. 21

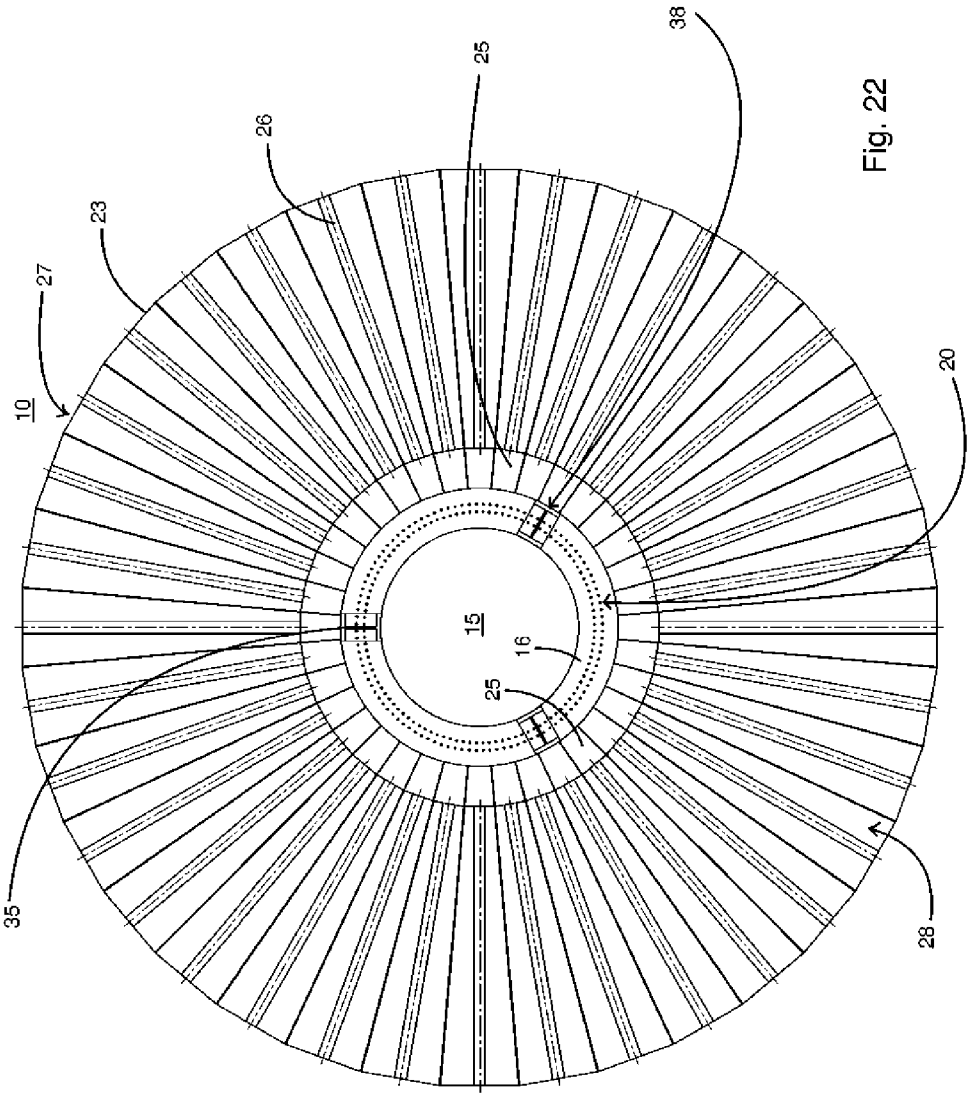

Fig. 22

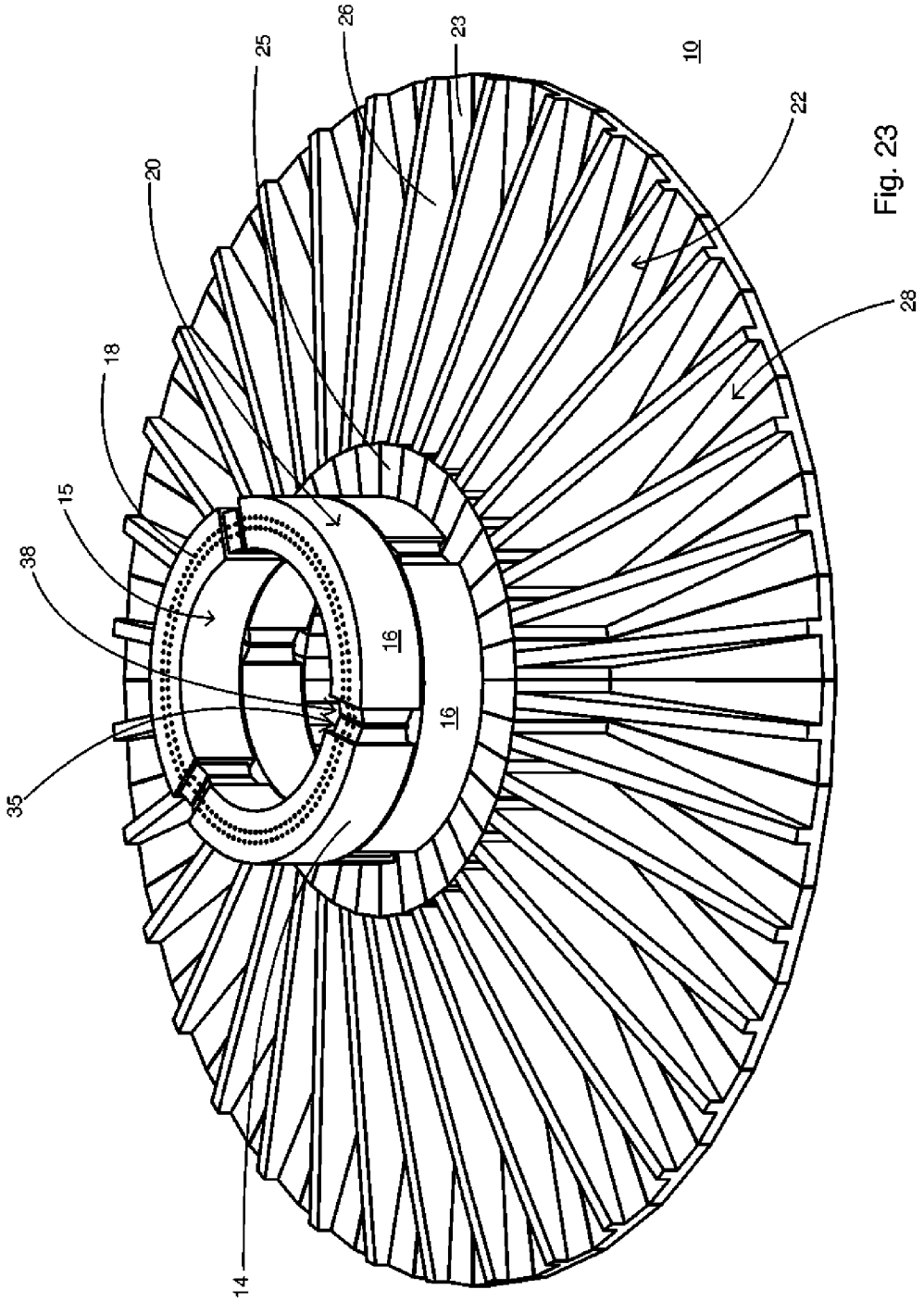

Fig. 23

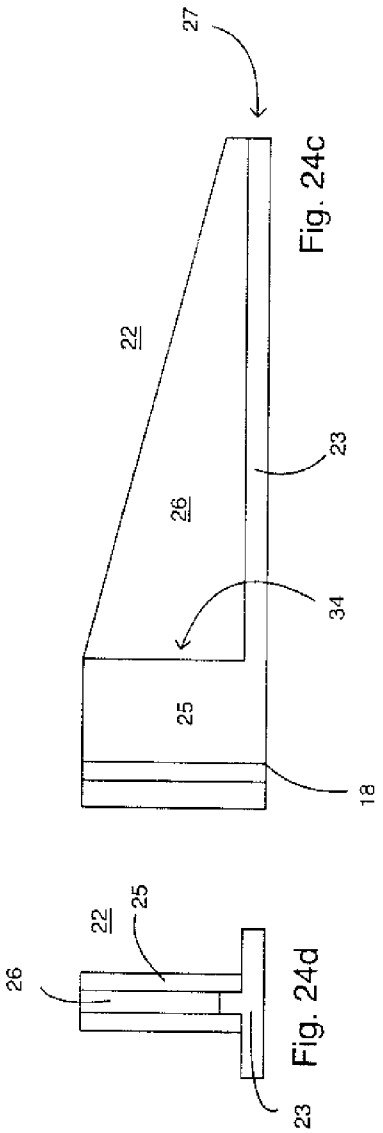

Fig. 24c

Fig. 24d

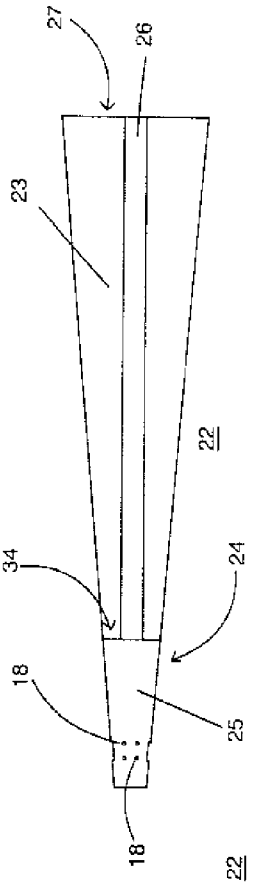

Fig. 24b

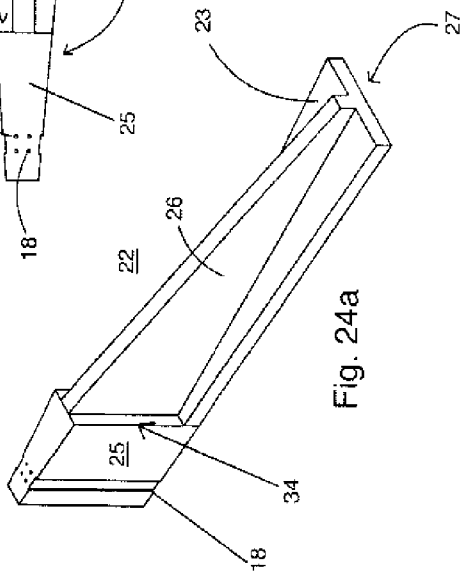

Fig. 24a

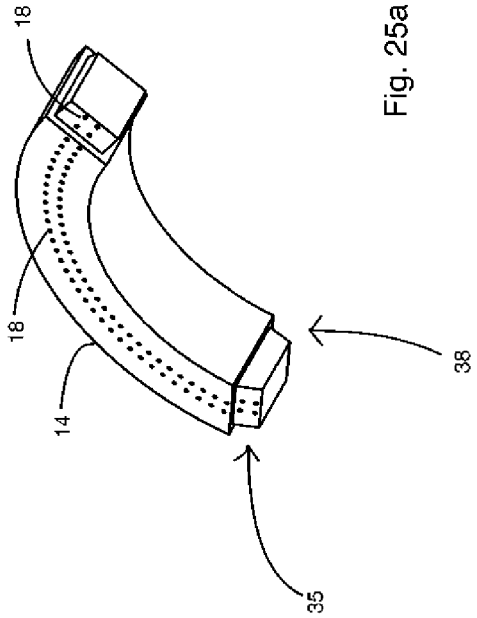

Fig. 25a

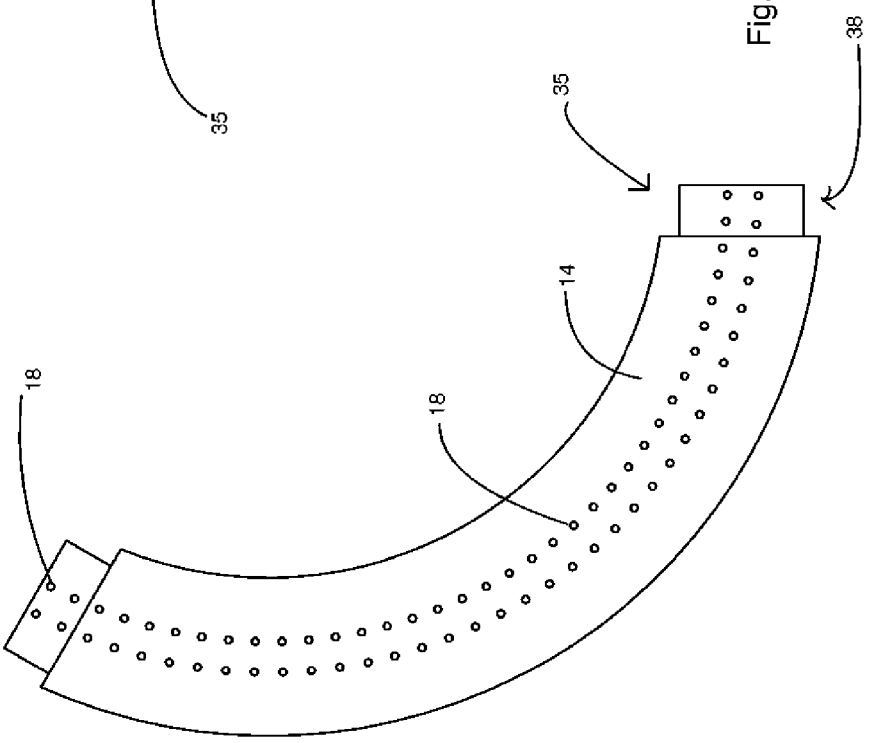

Fig. 25b

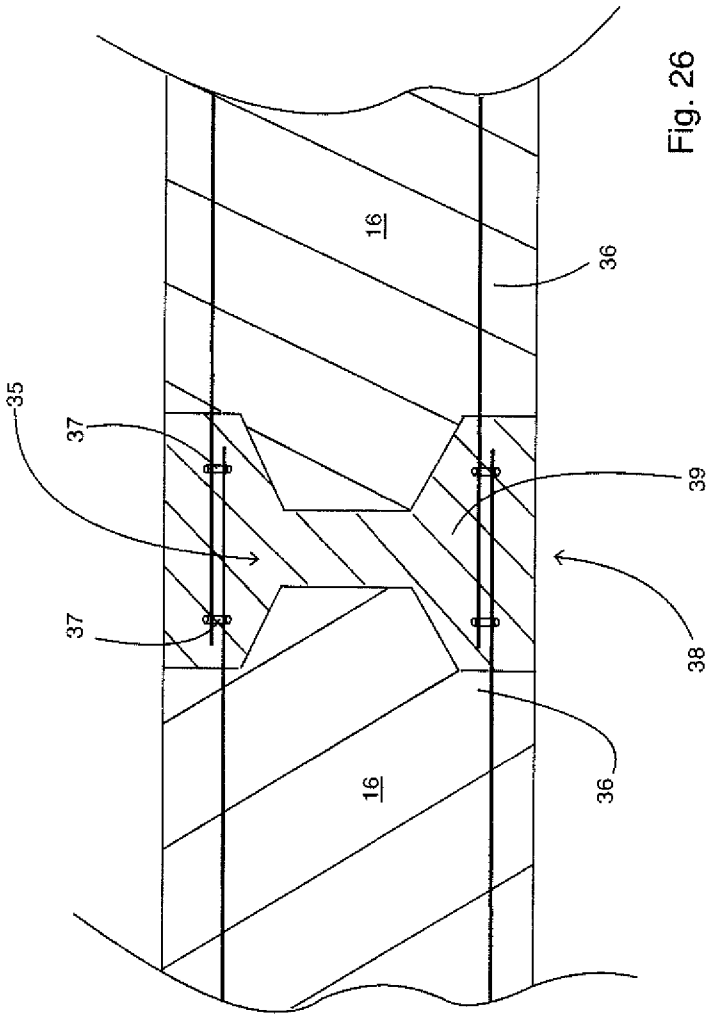

Fig. 26