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(54) Duct for the escape of flue gas and intake of the combustion air

(57) A duct for the escape of flue gas and for the intake of combustion gas, particularly for boilers, or the like, which duct comprises two concentric tubular elements (1,2), means (103,504) being provided for connection therebetween at least at the outer end of the duct. The invention provides that the outer pipe (2) has means (103) for locking the inner pipe (1) at least axially, which means can be operated or disabled from the inner pipe.

The invention also provides a duct as described hereinbefore, whose length is telescopically adjustable.

Said characteristics may be also applied, individually or in combination, to one-pipe ducts.

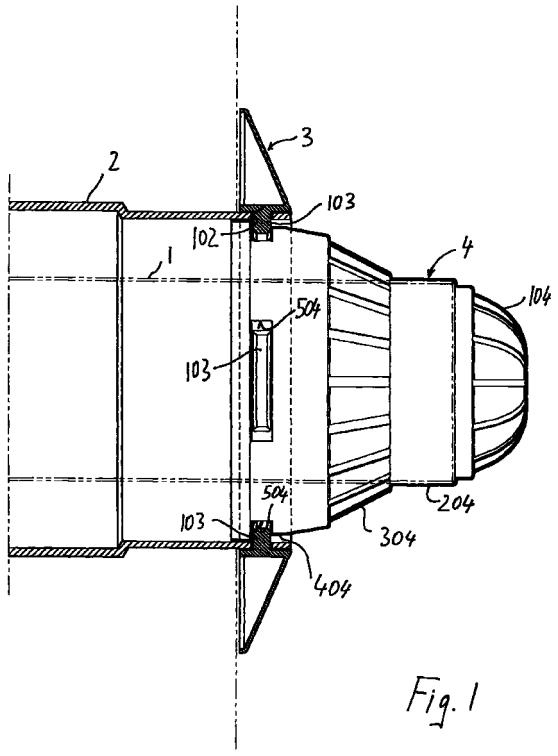

Fig. 1

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Description

[0001] The invention relates to a duct for the escape of flue gas and for the intake of combustion gas, particularly for boilers, or the like, which duct comprises two concentric tubular elements, means being provided for connection therebetween at least at the outer end of the duct.

[0002] Such ducts are widely known and used, particularly in the installation of boilers for independent heating, such as wall hung gas boilers, or the like.

[0003] Currently, such ducts are installed by forming an aperture in a peripheral wall or in a floor and by inserting and permanently walling therein the outer pipe, further fitting the inner pipe into the outer pipe. The outer pipe has insertion stop members which interact with insertion end-of-stroke abutments. The inner pipe has a wind cap fastened onto its outer end whose size allows it to be applied through the outer pipe. The abutment stops on the outer pipe consist of recesses or throats, whereas the insertion limiting abutments consist of flanges or radial shoulders, typically provided on the wind cap. All this is dimensioned so that, when the inner pipe is fully inserted, the outer end thereof axially protrudes to a predetermined extent, as defined by the standards in force, out of the outer end of the outer pipe, in order to prevent flue gas coming out of the inner pipe from being sucked into the annular chamber formed between the inner and the outer pipes, which defines the channel for the intake of combustion air. It is therefore very important for safety that the two pipes are effectively held in the full fitted condition. Currently, to this end, a pin, a screw or another stopping member is provided on the outer end of the outer pipe, to lock the inner pipe in the insertion end-of-stroke position. However, this lock is to be applied from the outside and typically requires the use of ladders, at moderate heights. Problems increase when installations are to be made at high floors, where the use of ladders is not sufficient.

[0004] Therefore, this lock often fails to be applied, so the risk remains that, when the duct is further connected to the boiler, the inner pipe is retracted inwards to a certain extent, thereby reducing the distance of the two outer ends of the two pipes.

[0005] The invention is based on the problem of providing a duct such as the one described hereinbefore, so that, by simple and less expensive arrangements, the above drawbacks may be obviated, while improving the performance, safety and features of the duct and while simplifying the installation operations.

[0006] The invention achieves the above objects by providing a duct such as the one described hereinbefore, wherein the outer pipe has means for locking the inner pipe at least axially, which means can be operated or disabled from the inner pipe.

[0007] Advantageously, these means consist of at least one radial tooth which is elastically deformable and/or elastically movable alternately into positions in which the abutments or joints provided on the inner pipe are engaged or disengaged.

[0008] In a variant embodiment, the outer pipe has, at its outer end, a plurality of radial inner teeth made of an elastically deformable material, such as rubber or the like, whereas the inner pipe and/or the wind cap have a corresponding number of housings, such as recesses or peripheral apertures, whose shapes are complementary to the radial inner teeth, said teeth being engaged in and disengaged from the housings of the inner pipe and/or of the wind cap by pushing and rotating them and by rotating and pulling them respectively.

[0009] Advantageously, the radial teeth consist of radial inner projections of an annular finishing rosette engaged on the outer pipe and project inside said outer pipe through corresponding apertures formed in the wall thereof.

[0010] A second embodiment of the invention provides one or more radial retaining teeth at least in the inner pipe slip off direction, which are applied on oscillating axial tongues. These tongues may be made of the same material as the pipe and, if this material has an insufficient elasticity, they may be provided in combination with elastic means which stabilize the active position of the teeth, wherein they are arranged inside the cavity of the outer pipe.

[0011] Advantageously, the teeth have, at least on the side turned towards the inner lead in end of the inner pipe, a face which is inclined as a guide surface. Preferably an inclined face, but typically advantageously steeper, is provided on the opposite face of the tooth or teeth.

[0012] The teeth advantageously extend at a predetermined distance from an inner stationary shoulder, against which the inner pipe or its wind cap abuts, in the fully fitted position thereof in the outer pipe, whereas an opposite rear abutment surface of the inner pipe and/or of its wind cap cooperates with the steeper inclined faces of the tooth or teeth.

Obviously, the two above arrangements may be also provided in combination with each other. The removable locks of the two pipes which secure them in the correct axial insertion end-of-stroke position may be obviously made in other manners, e.g. as sliding radial teeth, elastically stressed in a stable position inside the outer pipe, etc.

[0013] The invention also relates to a duct as described hereinbefore which has such characteristics as to facilitate the installation in terms of length thereof. The rectilinear pipe is to be jointed by its inner end by means of curved members to other pipe parts or to intake and/or exhaust outlets of the boiler, depending on its having a tight or an open combustion chamber. In order that these members can be jointed, the exhaust duct crossing the wall to come outside must be cut, typically to a certain size. This is due to the possible very different thicknesses of the peripheral walls. Typically, peripheral walls have a thickness ranging from 20 to 50

cm. Hence, the currently available ducts are long enough to be used in any standard condition.

[0014] The invention allows to avoid the cutting operation, by providing a duct composed of two telescopically sliding segments, whose length is such that they can be adapted, by their assembled length, to the most typical wall thicknesses.

[0015] Further, in case of even thicker walls, such as in very ancient buildings, there may be provided a longer second inner element, or a third element, also to be telescopically coupled to the second element.

[0016] The first arrangement might be preferable, because it provides a reduced number of sliding connections.

[0017] In the illustrated embodiment, which relates to a coaxial duct, having a central pipe for the escape of flue gas and an annular passage for the intake of combustion air, being provided between said inner pipe and an outer pipe, the invention advantageously provides that a first duct segment composed of the outer pipe and of the inner pipe, is embedded in the wall like traditional ducts, or with an arrangement as described hereinbefore, whereas the second duct segment has an inner pipe with a bell joint at its end for connection to the inner pipe of the first duct, said bell having a length corresponding to the telescopic sliding stroke of the two duct segments, and an outer pipe whose diameter is slightly smaller than the diameter of the outer pipe of the first duct segment, at least through an end portion at the end for connection thereto, and which is long enough to ensure the predetermined mutual sliding stroke. Obviously, the outer pipe of the first duct segment may alternatively have a radial expansion at the connecting end, through a length substantially corresponding to the sliding stroke.

[0018] According to a further advantageous characteristic, in order to ensure that a sealed sliding connection is safely established between the two inner pipes of the two duct segments, when the two connection ends of the outer pipes of said two duct segments are even slightly fitted one into the other, the invention provides that the bell joint of the inner pipe of the second duct segment projects axially to a predetermined extent, out of the connection end of the outer pipe of the second duct segment.

[0019] By this arrangement, the risk that the inner pipe for the escape of flue gas might not be correctly jointed, and the associated serious consequences, may be obviated.

[0020] The tightness of the bell joint between the two inner pipe segments is ensured by a seal, as required by the standards in force. The tightness between the two outer pipe segments, the inside diameter of the larger one being different from the outside diameter of the smaller one, so as to provide the necessary tolerances to enable mutual sliding, is ensured by at least one annular rib, or by a sequence of said annular ribs, which are provided on the outside perimeter of the outer pipe of the second duct segment, or project out of the inner surface of the pipe segment of the first duct segment.

[0021] The ribs are made with such a shape and/or from such a material as to reduce friction resistance to mutual sliding between the two segments of the outer pipe.

[0022] In accordance with a preferred embodiment, said rib/s taper towards the radial outer peripheral edge, and have a radial extension which is substantially equal to or slightly greater than the sliding tolerance of the two outer pipe segments.

[0023] The ribs may be made of one piece with the outer pipe segment/s. This arrangement proves to be particularly simple and advantageous in plastic pipes, where the annular ribs may be provided in the form of annular inner and/or outer seams.

[0024] However, when the outer pipe segments are made of metal, these ribs may be provided on an annular seal member, which may be accommodated on an annular narrower part on the connection end of the outer pipe of the second duct segment and/or in a radial expansion of the outer pipe of the first duct part, where said two inner pipe segments fit one into the other.

[0025] The inner pipe is typically made of metal, particularly of aluminum, which provides resistance to the heat of flue gas flowing therein.

[0026] The telescopic feature of the duct of the invention may be provided in combination with the characteristic as mentioned hereinbefore and either in coaxial exhaust and intake ducts, or in usual exhaust ducts.

[0027] The invention relates to further improvements, which form the subject of the dependent claims.

[0028] The characteristics of the invention and the advantages derived therefrom will appear more clearly from the following description of non limiting exemplary embodiments as shown in the accompanying drawings, in which:

Fig. 1 is an axial sectional view of the duct according to a first embodiment of the invention.

Figs. 2 and 3 are two views of the annular finishing rosette according to the embodiment of fig. 1.

Fig. 4 is an axial sectional view of the outer pipe according to the embodiment as shown in the previous figures.

Figs. 5 and 6 are two views of the wind cap according to the embodiment as shown in the previous figures.

Fig. 7 is a view like that shown in fig. 1, of a second embodiment of the invention.

Fig. 8 is an axial sectional view of the outer pipe according to the embodiment as shown in fig. 7.

Fig. 9 is an axial sectional view of a variant embodiment in which the duct has a telescopically adjustable length.

Fig. 10 shows a detail of the sliding seal between the two outer pipes of the two duct segments

according to the variant of fig. 9.

Figs. 11 and 12 show two embodiments for connection of a curve member to the duct as shown in the previous figures and to outlets of a boiler or of another duct.

Fig. 13 is a cross sectional view of a clamp for connecting an outer pipe made of plastic to an outer pipe made of metal of a curve member.

Fig. 14 is a side sectional view of a further embodiment of the coaxial exhaust and intake pipe of the invention.

Fig. 15 is a side view of the duct as shown in fig. 14.

Fig. 16 is an enlarged view of the duct as shown in the previous figures, at the end area where the outer wind cap is provided.

Fig. 17 is an enlarged view of the tight connection between the two telescopic members of the exhaust inner pipe.

Fig. 18 shows an enlarged detail of the sleeve for clamping the two telescopic pipes which form the exhaust inner duct.

Fig. 19 shows a further variant embodiment of the tight clamp device between the two telescopic pipes of the exhaust inner duct.

Figs. 20 and 23 show two further variant embodiments of the tight clap device between the two telescopic pipes of the exhaust duct.

[0029] The illustrated embodiment relates to a coaxial duct having a central passage for the escape of flue gas and an outer peripheral annular duct for the intake of combustion air. However, the invention principles may apply, at least partially and in the implementation of the main concepts, even to different types of ducts, wherefore the invention is not intended to be restricted to the particular illustrated duct. In fact the latter constitutes the highest technological evolution limit in the field.

[0030] Referring to figures 1 to 6, a duct for the escape of flue gas and for the intake of combustion air comprises an inner pipe 1, delimiting the passage of flue gas and a coaxial outer pipe 2, inwardly delimiting the annular passage of combustion air. The outer pipe 2 is designed to be embedded in the wall, with a predetermined length projecting out of the outer face of said wall, and a predetermined length inwardly projecting out of the inner face of said wall. On its outer end, the outer pipe 2 has radial inner teeth 103 made of an elastic material or radially yielding. Particularly, but not necessarily, said teeth 103 are made of an elastic material such as rubber, or the like, and are held by a ring nut or a peripheral annular seal 3, which is slipped on said end of the outer pipe 2. In this case, the radial teeth 103 project inside the outer pipe 2, through corresponding and coincident apertures 102 at the end of the outer pipe 2. The radial yielding teeth 103 have inclined faces on the circumferential end sides, which form a preferably isosceles trapezoid shape when seen in a plan view.

[0031] The outer pipe is laid as follows: The wall is drilled and the pipe is inserted from the inside towards the outside with the annular seal already applied thereon which, for its yielding capacity, can pass through an opening which is slightly bigger than the pipe but has a diameter which is smaller than the outside diameter of the seal. Then, the pipe is pulled back so that the annular seal abuts against the outer face of the wall thereby covering the gap between the pipe and the opening edge. Then, the outer pipe 2 is secured in position directly from the inside, with suitable materials for filling the gap between the pipe 2 and the opening edge.

[0032] The position of the slots 102 for holding the radial teeth 103 associated to the annular seal 3 is such that, in the installed position, the outer pipe projects beyond the outer face of the wall through a predetermined length, as compliant with relevant standards.

[0033] The inner pipe 1 has a wind cap 4 on its end designed to be outside the wall, which has a first part with apertures 104 associated to the mouth of the inner pipe, which part consists in the dome-shaped end of a bell joint 204 for connection of the inner pipe 1. A conical part 304, with apertures for air intake is jointed to the innermost end of the bell joint 204. The conical part widens until reaching a diameter which is slightly smaller than the inside diameter of the outer pipe 2 and greater than that formed by the radial yielding teeth 103 and has a cylindrical end portion 404 which has apertures or slots 504 for fitting the radial yielding teeth 103 therein. Said radial teeth 103 are simply force-fitted in the apertures 504 of the cylindrical end portion 404 of the wind cap 4 by axially outwardly compressing the inner pipe while possibly rotating it. When the radial teeth 103 are fitted in the apertures 504 of the wind cap 4, the latter is effectively locked in the outer pipe 2, being prevented from moving in either axial direction. Further, the different elements of the cap 4 and the fitted position of the radial teeth 103 in the cap 4 are dimensioned so that, in the locked condition of the inner pipe 1, any differences in terms of mutual staggering of the projecting parts of the outer and inner pipes comply with safety measures provided by the relevant standards for proper operation of the boiler.

[0034] The inner pipe may be easily removed and unlocked by following an inverse procedure with respect to that for fitting it in, i.e. a rotation about its axis and a subsequent pulling action.

[0035] Figs. 7 to 9 show a further embodiment of the invention, wherein the wind cap is locked with respect to axial motion in both directions, between an inner annular abutment 202 or annular inner teeth of the outer pipe 2, which are undeformable, and an elastically removable abutment 106. The two abutments 202 and 106 are axially spaced, and their distance corresponds to the axial distance of a flange or annular radial shoulders 604, 704, or annular segments, provided at the inner end of the wind cap.

[0036] In an advantageous embodiment, the rear

axial stops, preventing the inner pipe from being slipped off, consist of teeth 106, which are supported so as to be able to yield radially outwards under the action of an elastic force, which stably stresses them radially inwards. Advantageously, the radial teeth 6 may be provided on axial tongues which are made of one piece with the outer pipe, by making notches 206 therein. This may be provided by using the yielding properties of the material forming the outer pipe 2. When the material which forms the outer pipe does not ensure this, further elastic members shall be provided, such as springs or the like, which can also be fitted in the notches. Advantageously, the teeth 106 are conformed with a face inclined at least on the side facing towards the inner end of the duct. An inclined face may be also provided on the opposite side of the teeth 106, so as to also allow disengagement of the inner pipe to slip it off the outer pipe. Advantageously, in order to differentiate the engagement and disengagement forces the front and rear faces of the teeth 106 may have different inclinations. Particularly, in order to allow an easier engagement and a more difficult disengagement, to prevent undesired positioning of the two outer ends of the coaxial pipes 1 and 2, the face of the teeth 106, facing the outer part of the wall is steeper. By this arrangement, when jointing to the rest of the duct on the inner side of the wall is difficult, any force acting in the pull out direction is prevented from exceeding the retaining force of the teeth 106, and from moving the inner pipe inwards with respect to the safety position required by the relevant standards.

[0037] In plastic outer pipes, the shape of the tooth 106 may be formed in the thickness of the pipe wall and/or by a suitable deformation of the free end of the tongue 6, obtained by notching. This arrangement may be also applied to metal pipes. Alternatively, the teeth and the elastic support thereof may consist of separate members to be fitted in the apertures of the outer pipe 2.

[0038] This arrangement may be applied either separately from and alternatively to the previous one, or in combination thereto.

[0039] Hence, there may be provided either that the yielding teeth 103 are engaged in apertures 504 of the cap 4, or that said teeth 103 form the front and/or rear axial retaining abutments.

[0040] Particularly, the annular seal might hold at least two axially spaced annular crowns of teeth 103, which form the end-of-stroke axial abutments in the inner pipe insertion direction, and the axial stops in its slip off direction, with respect to the outer pipe 2.

[0041] A further intermediate crown of radial teeth 103 might be provided in combination with apertures for fitting them in, so that the two illustrated embodiments might be easily combined.

[0042] The embodiments as described above have the considerable advantage of not involving operations on the outer side of the wall. This is particularly advantageous in the installation of boilers at high floors of buildings, where the outlet of the duct cannot be reached from the outside without special means, generally relatively expensive to use, typically exceeding the installation cost or forming a considerable part thereof.

[0043] When the installation takes place at floors that may be easily accessed by conventional ladders, or the like, then a variant embodiment provides that the elastically deformable annular seal may be replaced by a seal made of a rigid material, such as plastic or the like.

[0044] With reference to a further characteristic of the invention, as shown in figs. 9 and 10, the duct is composed of two telescopically sliding segments A and B, each consisting of an outer pipe 2, 2' and of an inner pipe 1, 1'. The outer pipe 2' of the second segment B, which is provided at the end inside the wall of the fist segment A of the duct has a diameter which is slightly smaller than the inside diameter of the outer pipe 2 of the first segment A and has, at its periphery, an annular rib, preferably two, three or more annular outer ribs 302 whose radial extension is of the same order as or slightly greater than the gap between the two outer pipes 2, 2'. Typically, this gap is of the order of 0,5 mm, for a diameter difference of the order of 1 mm. The annular ribs 302 may be also possibly provided, alternatively to or in combination with those on the outer pipe 2' of the second duct segment B, on the inner side of the outer pipe 2 of the first duct segment A. The outer pipe 2' of the second duct segment B is fitted into the outer pipe of the first duct A to allow a wider mutual sliding movement of the two duct segments A and B, since the inner side of the wall wherein the outer pipe 2 of the first duct segment A is secured and walled would otherwise be a limitation to said sliding stroke.

[0045] The ribs 302 may be made of one piece, for instance in the form of seams, when the outer pipes 2, 2' or at least the outer pipe 2' are made of plastic. Alternatively, the ribs may be provided on an annular member which can be fitted onto or into the outer pipe 2' and 2 respectively, an annular recess being provided for accommodating it, which, for the outer pipe 2' of the second duct segment B, is situated on the outer side of the pipe 2', for example corresponding to an annular throat or thinning of the pipe wall 2', whereas, for the outer pipe 2 of the first duct segment A, said annular recess consists of a radial expansion on the inner side of the pipe, obtained either by deforming the pipe, or by reducing the thickness of its wall.

[0046] On the other hand, the inner pipe 1' of the second duct segment B has a radially widened bell 201 which is designed to be fitted onto the inner pipe 1 of the first duct segment A from the inner end thereof. The bell 201 has at least one annular seal 301. This bell 201 is long enough to ensure the mutual sliding stroke which the two duct segments A and B are designed to run. Further, in order that the highest connection safety between the two pipes 1, 1' may be obtained, the bell 201 extends beyond the connection end side of the

outer pipe 2' of the second duct segment B. This facilitates, amongst other things, assembly operations, allowing to fit the bell 201 properly onto the inner pipe 1 of the first duct segment A even when the two outer pipes 2, 2' of the two duct segments A and B have not come to contact yet. Moreover, the projecting portion of the bell 201 has such a length that the proper positioning of the bell 201 on the inner pipe 1 of the first duct segment A may be visually inspected, while the two outer pipes 2, 2' are still at a sufficient distance when the two inner pipes 1, 1' are connected.

[0047] The length of the two duct segments A and B and the mutual sliding stroke are generally selected so as to ensure that the overall duct length can be adapted to standard wall thicknesses, without requiring cutting operations. In case of thicker walls, as in old buildings, a longer second duct segment B may be provided, while maintaining the first segment A unchanged through all the options. Alternatively, a third duct element may be also provided, which may be telescopically connected to the inner side of the second duct segment B, for instance in the same manner as the latter is connected to the first duct segment A.

[0048] In accordance with a further characteristic of the invention (figs. 11 to 13), the duct described hereinbefore may be jointed to a curvilinear duct element C, for example for connection to the boiler outlets.

[0049] Here, the proposed arrangements may be again partly applied to the coaxial exhaust ducts as shown above.

[0050] There are different possible connection arrangements. In all these arrangements, the inner curve 1'' is jointed by a bell and a seal to the inner pipe 1, 1' of the rectilinear duct, and to the corresponding exhaust outlet of the boiler, and this curve 1'' is made of metal. On the other hand, the outer curve 2'', may only be jointed by one end by means of a bell or like in the sliding connection of the two telescopic segments of the two duct segments A and B as described above, whereas the other end is jointed by a clamping collar to the corresponding outer pipe 2, 2' of the rectilinear duct or to the corresponding boiler outlet.

[0051] While the outer pipe of the rectilinear duct may be made of plastic, the corresponding curve piece is typically made of metal, due to its intensive heat exposure for its proximity to the boiler. In order to prevent the contact between the curve 2'' and the outer pipe 2, 2' from causing heat transmission, the invention provides a clamp 10 for the two contacting ends of said parts 2 or 2' and 2'', which has an inner annular spacer, in the form of an annular rib 110, which, in the assembled condition, is interposed between the facing ends of the two pipe parts 2, or 2', and 2'' to be connected. This rib is made of a heat insulating material and may be applied on the inner side of the clamp or made integrally with an annular seal band, whereon the clamp 10 is superposed.

[0052] When the rectilinear duct is of the telescopic type, the use of connections by clamps 10 may be avoided, providing, both for the inner curve 1'' and for the outer curve 2'', a joint with or without bell at both ends.

[0053] In this case, on the side connecting to the boiler, standard bell joints may be provided both for the inner curve 1'' and for the outer curve 2''. The bells may be provided either on the boiler outlets or on the curve ends 1'', 2'' facing it. It is also possible to provide that, for one of the two inner or outer curves 1'', 2'', the bell is applied thereon, whereas for the other curve 2'', 1'', the bell is applied on the associated boiler outlet.

[0054] On the side jointed to the second duct segment B, the two curves 1'', 2'' may be made as described above as regards the sliding connection of the two telescopic duct segments A and B. Here, the outer curve 2'' may possibly have a bell on the faced end of the outer pipe 2' of the second duct segment B, since there are no wall limitations, as for telescopic sliding of the two segments.

[0055] Assembly operations are very simple. The second duct segment B is fitted into the first segment through a longer portion. The curve is mounted on the boiler outlets, then the second segment B is slipped off the first segment A, while the facing ends of the curve and of the second duct segment B are connected to each other.

[0056] Here again the bell of the inner curve 1'' may project beyond the end of the outer curve 2'', as described above for the telescopic duct segments A and B, so that the same possibility to check the safety of the connection to the inner pipe 1' can be obtained.

[0057] Any provided clamp would be used as means for securing in position and might even be unnecessary, as they might be replaced by simple radial pins, such as clamp screws or the like.

[0058] A variant embodiment may be provided, which allows the use of this embodiment even for non telescopic pipes according to the previous description. In this case, the curve part is not limited to the curve, but has, on the side jointed to the duct secured in the wall a rectilinear extension which has a predetermined length and is connected to the pipes of the duct like the duct segment B, as described above.

[0059] With reference to the variant embodiment of figs. 14 to 16, the wind cap 24 is composed of two separate parts, whereof one 124 is integral with the outer duct 22 and the other 224 is integral with the inner duct 21.

[0060] The wind cap part 124, associated to the outer duct 22 is integral therewith and has the form of an annular band with apertures, provided at the outer end of the outer duct 22. In a predetermined area, at a certain distance from the annular band with apertures, towards the inner end of the outer duct 22, the latter has an annular throat 122 holding an annular conical finishing seal for preventing the outer duct 22 from sliding inwards. This annular seal or annular finishing rosette 3

has, like in the previous example, the function to retain the outer pipe 22 and prevent it from slipping off inwards and is made of a non rigid, elastically flexible material, so that it is deformed when said duct 22 is inserted through the wall from the inside towards the outside.

[0061] On the outer peripheral end of the outer intake duct 22, a plurality, i.e. at least one, two, three or more elastic wings 30, oscillating radially with respect to the pipe are provided, and have teeth 130 for engagement in throats or apertures 31 provided in angular positions corresponding to the wings and to their respective teeth. The teeth 130 are preferably conformed as described in the previous embodiment, and profiled in such a way as to show, when seen in an axial view, a trapezoid shape, tapering towards the central axis of the duct, so as to form inclined lead-in surfaces, facilitating connection to and disconnection from the engagement throats or apertures 31, substantially by a relative rotation of the outer duct 22.

[0062] On the other hand, the inner duct for the escape of flue gas holds at its outer end the second cap part 224, which is fastened to the duct 21. The wind cap part 224 associated to the inner exhaust duct 21 has a plurality of apertures 31 for engagement of the radial teeth associated to the elastic wings 30 of the outer intake duct, which are provided in the same number as the retaining wings and have a shape corresponding to the engagement teeth.

[0063] Thanks to this characteristic, considerably large apertures for the intake of combustion air can be obtained, and the inner and outer pipes can be free from each other and dimensioned in such a way that they can keep the apertures associated to the air intake duct and to the flue gas exhaust duct far from each other.

[0064] All this may be provided by using the principle of the above examples.

[0065] With reference to an additional characteristic of the invention, as shown in figs. 14, 17 and 18, the two pipes 121 and 122, which are slidably engaged one into the other, and allow the flue gas exhaust duct 21 to be extended and/or shortened within a predetermined range can be fastened or secured by clamping. As a clamping device, as shown in figs. 14, 17, 18, a double clamp is provided with an individual clamping member for each pipe 121 and 221. The double clap 33 consists of two annular clamps 133 and 233, which are joined together along the facing ends for a certain angular width in the area which is diametrically opposite to the open area thereof. Each of these clamps fastens the corresponding pipe 121, 221 of the two telescopic pipes which form the exhaust duct 21, while remaining joined in a single element.

[0066] An advantageous embodiment of these clamps consists of a single open annular clamp, which has a notch 333 on both sides of the open area for a certain angular width towards the diametrically opposite side.

[0067] According to a further improvement, the clamp 33 is provided in combination with an annular elastic seal 34, consisting of a band having such an axial length as to be partly superposed to each of the two pipes 121, 122, fitted one into the other, an axial half, or anyway a first axial part of the seal having a smaller inside diameter or a narrowing step 134 with respect to the other part or axial half, which narrowing is such as to compensate the diameter difference between the two pipes 121 and 122, whereas the outside diameter of the two seal parts is equal for both said parts.

[0068] Obviously, alternatively, the two clamps may be clamps having a different inside diameter in accordance with the diameter difference between the two pipes 121 and 221 of the duct 21, which two clamps are always connected to each other for a certain angular width on the side opposite to the open area thereof. Here again, a single clamp with an annular narrowing step of a suitable size has a notch on both sides of the open area thereof, as described above.

[0069] Figs. 19 to 23 show different variant embodiments of the tight clamping means of the two telescopic pipes 121 and 221 which form the exhaust duct 21.

[0070] The arrangement as shown in fig. 19 provides that the end of the outer pipe 221 has a conical chamfer 321 and at least one, preferably several longitudinal notches 421. In an axially recessed position with respect to the chamfered end, the outer pipe 221 has an external thread. A ring nut 35, with a corresponding internal thread is fitted onto the pipe with the shorter diameter 121 and has, at the end opposite to the outer pipe 221, an inner conical taper 235, which is designed to interact with the outer conical chamfer 321 of the outer pipe 221. When the ring nut 35 is screwed, the end portion of the outer pipe 221 is clamped against the inner pipe, securing it in position and generating a sufficient sealing action.

[0071] With reference to the variant of figs. 20 and 21, the outer pipe has an inner conical chamfer 521 which, together with a facing annular conical expansion 335 of the ring nut 35 form a seat for a clamping and sealing ring 36. Said ring may be a closed ring of an elastically deformable material, such as an o-ring, or an open metal ring, as shown in fig. 20.

[0072] The ring nut 35 is fitted onto the pipe with the shorter diameter 121 and has an external thread whereby it can be screwed on the external thread 421 on the end of the outer pipe 221.

[0073] The variant as shown in figs. 22 and 23 differs from the embodiment of the previous example in that, in lieu of the o-ring, it has a biconical ring 37 which may be made of an elastically deformable material or of a rigid material and have the shape of an open biconical ring as shown in dashed lines in fig. 23. Obviously, the conical chamfer on the end side of the outer pipe 221 and the opposite one of the ring nut 35 have a shape and size complementary to the biconical ring, to allow the clamping action.

[0074] The illustrated embodiments in all the examples described herein may be provided in any combination, when this does not involve contradiction. So, for instance, the wind cap as shown in figs 1 to 10 can also be composed of two separate parts and the means for mutual seal and clamp of the telescopic pipes which form the exhaust and/or intake duct, as well as the means for tight clamp therebetween are not restricted to the specific embodiment, wherewith they have been described, but may be obviously used in combination with any embodiment as shown and described herein.

[0075] The invention is not limited to what has been described and illustrated herein, but may be greatly varied, especially as regards construction, without departure from the guiding principle disclosed above and claimed below.

Claims

1. A duct for the escape of flue gas and for the intake of combustion gas, particularly for boilers, or the like, which duct comprises two concentric tubular elements, means being provided for connection therebetween at least at the outer end of the duct, characterized in that the outer pipe has means for locking the inner pipe at least axially, which means can be operated or disabled from the inner pipe.

2. A duct as claimed in claim 1, characterized in that the removable locking means consist of at least one radial tooth which is elastically deformable and/or elastically movable alternately into positions in which the abutments or joints provided on the inner pipe are engaged or disengaged.

3. A duct as claimed in claim 1 or 2, characterized in that the outer pipe has, at its outer end, a plurality of radial inner teeth made of an elastically deformable material, such as rubber or the like, whereas the inner pipe and/or the wind cap have a corresponding number of housings, such as recesses or peripheral apertures, whose shapes are complementary to the radial inner teeth, said teeth being alternatively engaged in and disengaged from the housings of the inner pipe and/or of the wind cap by pushing and rotating them and by rotating and pulling them respectively.

4. A duct as claimed in one or more of the preceding claims, characterized in that the radial teeth consist of radial inner projections of an annular finishing rosette engaged on the outer pipe and project inside said outer pipe through corresponding apertures formed in the wall thereof.

5. A duct as claimed in one or more of the preceding claims, characterized in that it provides one or more radial retaining teeth which are applied on oscillating axial tongues and whose action is to retain the inner pipe and/or the wind cap at least in the inner pipe slip off direction.

6. A duct as claimed in one or more of the preceding claims, characterized in that the tongues associated to the teeth may be made of the same material as the pipe and, if this material has an insufficient elasticity, they may be provided in combination with elastic means which stabilize the active position of the teeth, wherein they are arranged inside the cavity of the outer pipe.

7. A duct as claimed in one or more of the preceding claims, characterized in that the teeth have, at least on the side turned towards the inner lead in end of the inner pipe, a face which is inclined as a guide surface.

8. A duct as claimed in one or more of the preceding claims, characterized in that, in combination with the first inclined face, an inclined, but steeper face is also provided, on the opposite part of the teeth, which faces the introduction direction of the inner pipe into the outer pipe of the duct.

9. A duct as claimed in one or more of the preceding claims, characterized in that the teeth extend at a predetermined distance from an inner stationary shoulder, against which the inner pipe or its wind cap abuts, in the fully fitted position thereof in the outer pipe, whereas an opposite rear abutment surface of the inner pipe and/or of its wind cap cooperates with the steeper inclined faces of the tooth or teeth.

10. A duct characterized in that it has a single pipe, whereon an annular finishing rosette is mounted, which is made of an elastically deformable material and engages with the pipe by fitting therein by means of radial teeth which penetrate complementary outer peripheral recesses or pass through complementary apertures formed in the outer end of the pipe.

11. A duct for the escape of flue gas and for the intake of combustion gas, particularly for boilers, or the like, which duct comprises two concentric tubular elements, said duct being designed to pass through a wall so as to project from the wall with an inner portion and an outer portion thereof, characterized in that the duct is composed of two telescopically sliding segments, whose lengths are such that they can be adapted, by their assembled length, to the most typical wall thicknesses.

12. A duct as claimed in one or more of the preceding claims, characterized in that a first duct segment is

designed to be secured in its through position in the wall and has an end which slightly projects out of the inner side of the wall, whereas the second segment is connected to said inner end of the first segment.

13. A duct as claimed in one or more of the preceding claims, characterized in that different second inner segments with different lengths, or at least a third duct segment, which can be also telescopically connected to the second segment may be provided.

14. A duct as claimed in one or more of the preceding claims, characterized in that it is a coaxial duct, having a central pipe for the escape of flue gas and an annular passage for the intake of combustion air, being provided between said inner pipe and an outer pipe, and that a first duct segment composed of the outer pipe and of the inner pipe, is embedded in the wall, whereas the second duct segment has an inner pipe with a bell joint at its end for connection to the inner pipe of the first duct, said bell having a length corresponding to the telescopic sliding stroke of the two duct segments, and an outer pipe whose diameter is slightly smaller than the diameter of the outer pipe of the first duct segment, at least through an end portion at the end for connection thereto, and which is long enough to ensure the predetermined mutual sliding stroke.

15. A duct as claimed in one or more of the preceding claims, characterized in that, in order to ensure that a tight sliding connection is safely established between the two inner pipes of the two duct segments, when the two connection ends of the outer pipes of said two duct segments are even slightly fitted one into the other, the bell joint of the inner pipe of the second duct segment projects axially to a predetermined extent, out of the connection end of the outer pipe of the second duct segment.

16. A duct as claimed in claim 15, characterized in that the axial projection of the bell joint of the inner pipe of the second segment out of the connection end of the associated outer pipe of said second duct segment is such that in the fitted condition of the bell of the inner pipe, the connection end of the associated outer pipe is at a distance from the facing end of the outer pipe of the first duct segment, such as to allow direct visual inspection of the connection condition of the inner pipes of the two duct segments.

17. A duct as claimed in one or more of the preceding claims, characterized in that the tightness in the bell joint between the two inner pipes of the two duct segments is ensured by a seal, as required by the standards in force.

18. A duct as claimed in one or more of the preceding claims, characterized in that the tightness between the two outer pipes of the two duct segments, the inside diameter of the larger one being different from the outside diameter of the smaller one, so as to provide the necessary tolerances to enable mutual sliding, is ensured by at least one annular rib, or by a sequence of said annular ribs, which are provided on the outside perimeter of the outer pipe of the second duct segment, or project out of the inner surface of the pipe segment of the first duct segment.

19. A duct as claimed in claim 18, characterized in that the ribs are made with such a shape and/or from such a material as to reduce friction resistance to mutual sliding between the two segments of the outer pipe.

20. A duct as claimed in claim 19, characterized in that said rib/s taper towards the radial outer peripheral edge, and have a radial extension which is substantially equal to or slightly greater than the sliding tolerance of the two outer pipe segments.

21. A duct as claimed in one or more of claims 18 to 19, characterized in that the ribs may be made of one piece with the outer pipe segment/s, for instance in plastic pipes or, like for instance in metal pipes, these ribs may be provided in an annular seal element which may be accommodated in an annular narrower portion on the connection end of the outer pipe of the second duct segment and/or in a radial expansion of the outer pipe of the second duct part, in the mutual penetration area of said two inner pipe segments.

22. A duct as claimed in one or more of the preceding claims, characterized in that the inner pipe is typically made of metal, particularly in aluminum or stainless steel, whereas the outer pipe may be both at least partly or wholly made of metal and at least partly or wholly made of plastic.

23. A duct as claimed in one or more of the preceding claims 12 to 22, characterized in that it has a single tubular element designed to form the passage for the escape of flue gas or the intake of combustion air.

24. A duct as claimed in one or more of the preceding claims, characterized in that it is provided in combination with a curve element to be connected to an end thereof, typically to the end on the inner side of the wall, which curve element may be connected to the duct by a bell joint as regards the inner pipe and by a clamp for the facing ends of the curve and pipe as regards the outer pipe, an annular interposing

element being provided between the two facing ends of the outer curve and of the outer pipe, which is made of a heat insulating material.

25. A duct as claimed in claim 24, characterized in that said annular interposing element is a separate element, or made of one piece with the clamp.

26. A duct as claimed in claim 24, characterized in that said heat insulating annular interposing element is a part of an annular seal which is superposed on the two facing ends of the outer pipe and of the outer curve and consists of an annular inner rib of said annular seal, whereas the clamp is externally superposed to said annular seal.

27. A duct as claimed in one or more of the preceding claims 1 to 23, characterized in that it is provided in combination with a curve element to be connected to an end thereof, typically to the end on the inner side of the wall, which curve element may be connected to the duct by a bell joint both as regards the inner curve and the outer curve, the end of the inner curve and of the outer curve for connection to the corresponding inner and outer pipes of the duct being as claimed in claims 13 to 23.

28. A duct as claimed in one or more of the preceding claims 24 to 28, characterized in that the curve is provided for connection thereof to intake and/or exhaust outlets of a boiler or of another duct element, where the inner curve element may be connected to the inner exhaust outlet by means of a bell joint, and the outer curve element may be connected to the intake outlet by a clamp or a bell or by force fitting.

29. A duct as claimed in one or more of the preceding claims, characterized in that the wind cap is made of one piece and comprises two axially spaced bands with apertures and having different diameters, substantially corresponding to the diameter of the inner exhaust pipe and to the diameter of the outer intake pipe, whereas the recesses, niches or means for engagement of the joint means associated to said intake pipe are associated to the area whose diameter substantially corresponds to the inside diameter of the intake pipe.

30. A duct as claimed in one or more of the preceding claims, characterized in that the wind cap is composed of two separate pieces which may be removably engaged by snap fitting, one part being stably associated to the outer intake pipe, and the other part being stably associated to the outer intake pipe, whereas the part associated to the outer intake pipe ha removable joint teeth and the cap part associated to the inner exhaust pipe has the recesses, notches or niches for engagement of said teeth.

31. A duct as claimed in one or more of the preceding claims, characterized in that the wind cap part associated to the outer intake pipe is integral therewith.

32. A duct as claimed in one or more of the preceding claims, characterized in that it has at least one telescopic duct formed by an outer pipe sliding on an inner pipe, there being provided a clamp superposed to both pipes and which may be clamped in a differentiated manner for each pipe, at least one axial part of said clamp associated to each of the two pipes being separated for a predetermined angular length astride of the open area of the clamp from the other axial clamp part associated to the other pipe.

33. A duct as claimed in one or more of the preceding claims, characterized in that the two axial clamp parts are separated by a notch having a predetermined angular width, lower than the whole circumferential extension of the clamp.

34. A duct as claimed in one or more of the preceding claims, characterized in that the clamp has, in each of its axial parts associated to their respective pipes, an inside diameter corresponding to the one of the pipe associated thereto.

35. A duct as claimed in one or more of the preceding claims, characterized in that the clamp has an annular narrowing step in the median axial area corresponding to the difference between the outside diameters of the two pipes.

36. A duct as claimed in one or more of the preceding claims, characterized in that the clamp has only one inside diameter for both parts and cooperates with an annular seal band which has two axial parts with different inside diameters due to an annular narrowing step corresponding to the difference between the outside diameters of the two pipes.

37. A duct as claimed in one or more of the preceding claims, characterized in that the outer pipe has a conically chamfered end, with axial notches, whereas a ring nut which may be screwed on the outer pipe is slipped onto the inner pipe and is provided with a conical taper complementary to the conical chamfer of the end of the outer pipe.

38. A duct as claimed in one or more of the preceding claims, characterized in that the end of the outer pipe and the one facing it have two opposite cooperating axial housings in which a closed or open

and radially elastically deformable or compressible annular member, like an o-ring or a conical or biconical bushing is axially compressed, while the ring nut and the outer pipe may be screwed to each other for clamping the compressible annular member against the pipe with the smaller diameter.

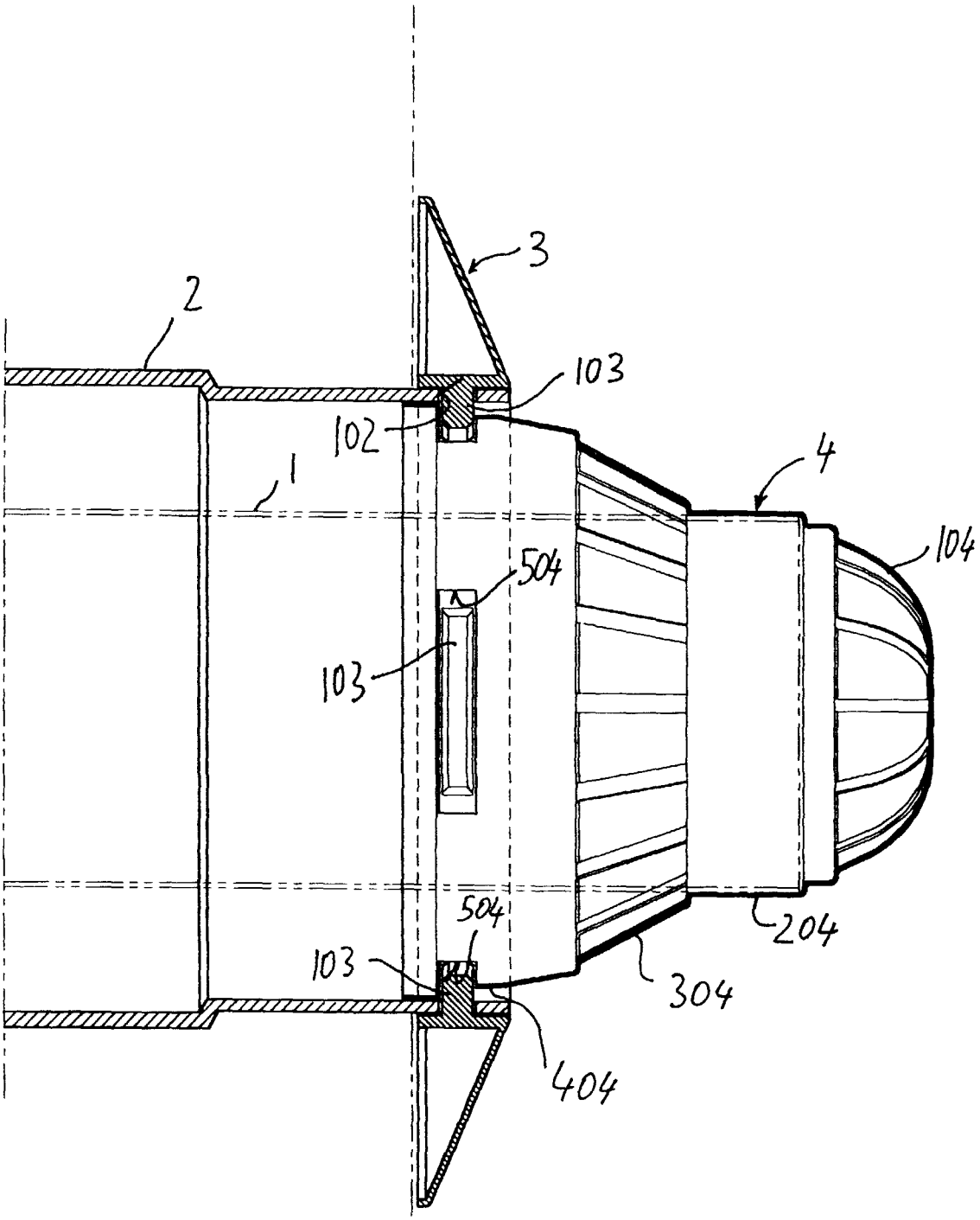

Fig. 1

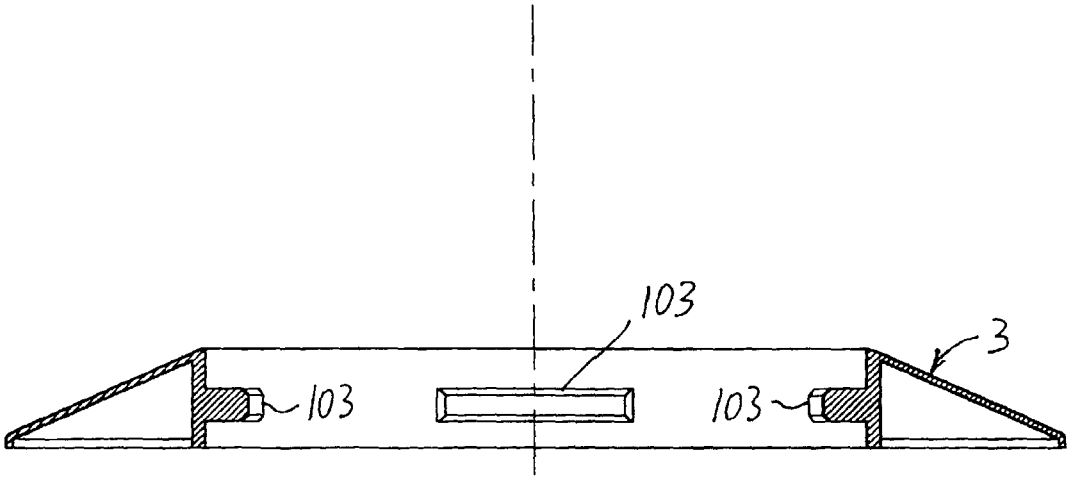

Fig. 2

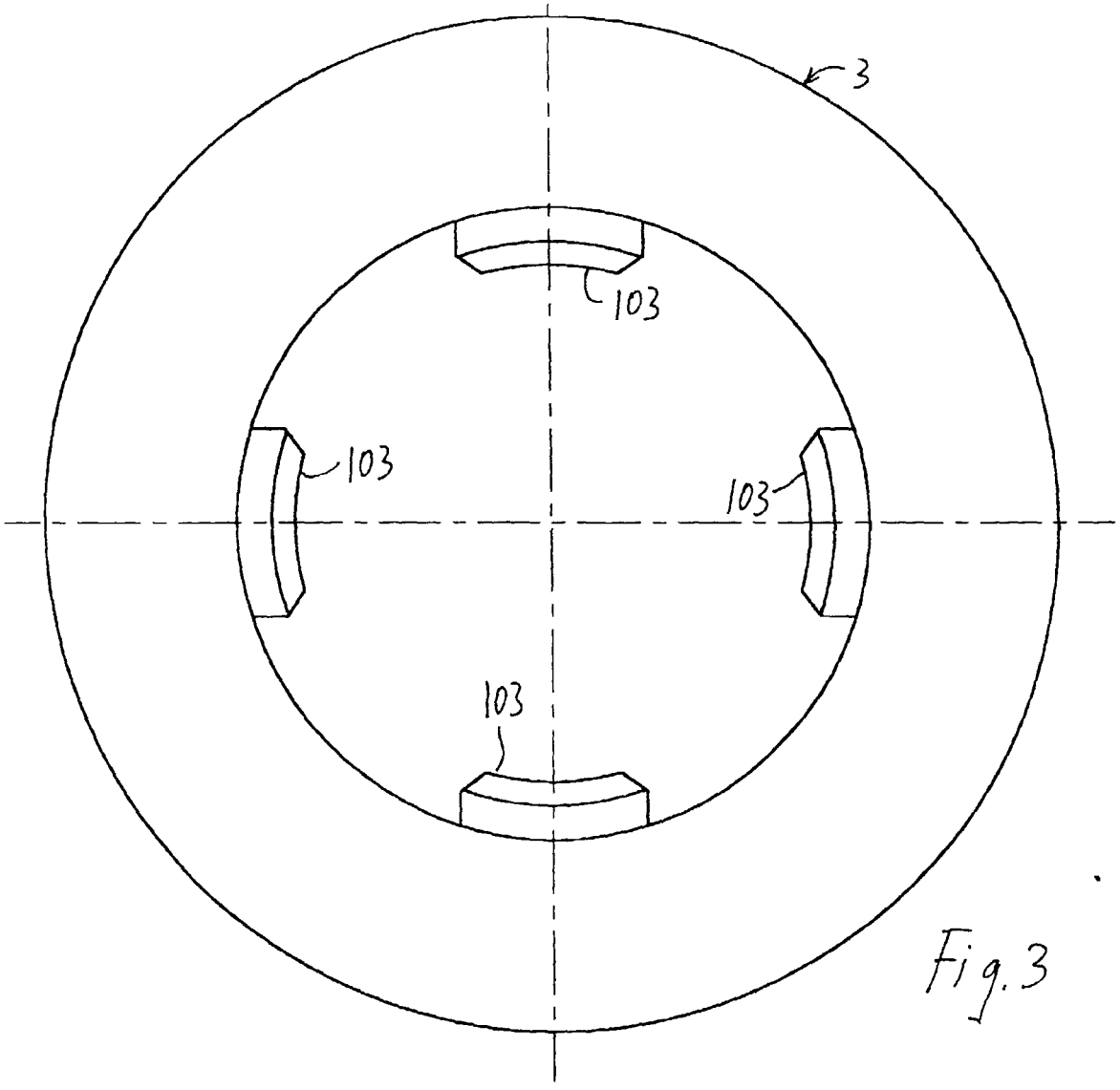

Fig. 3

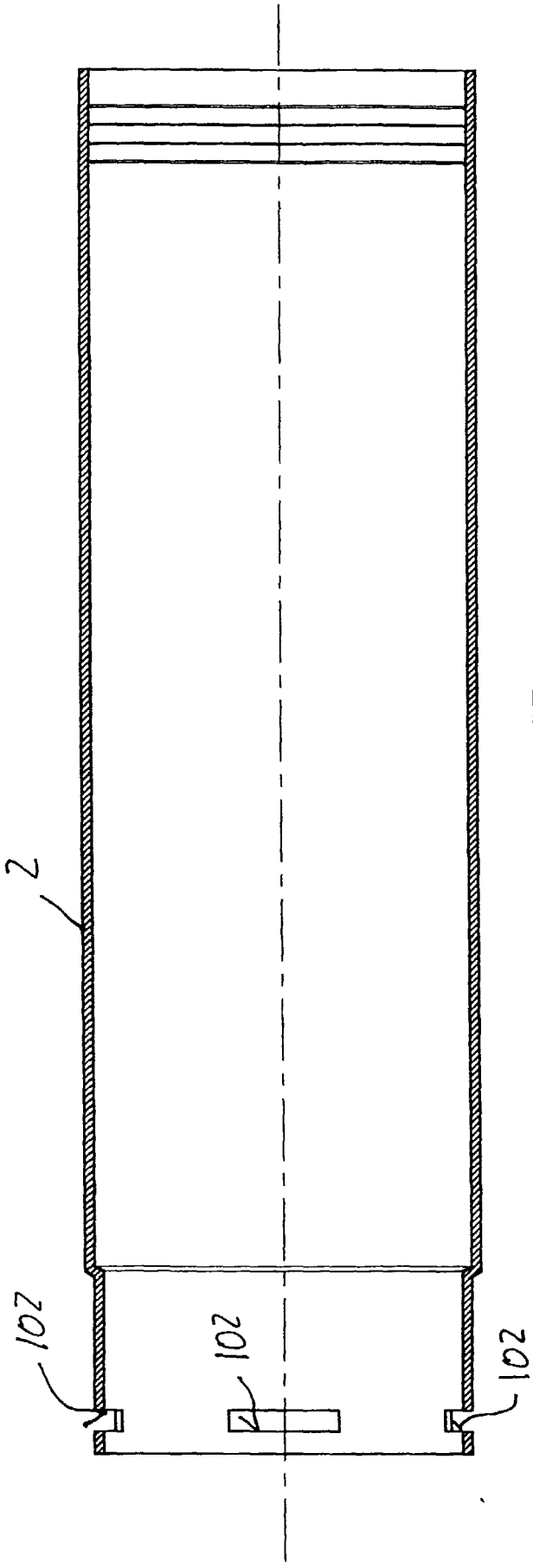

Fig. 4

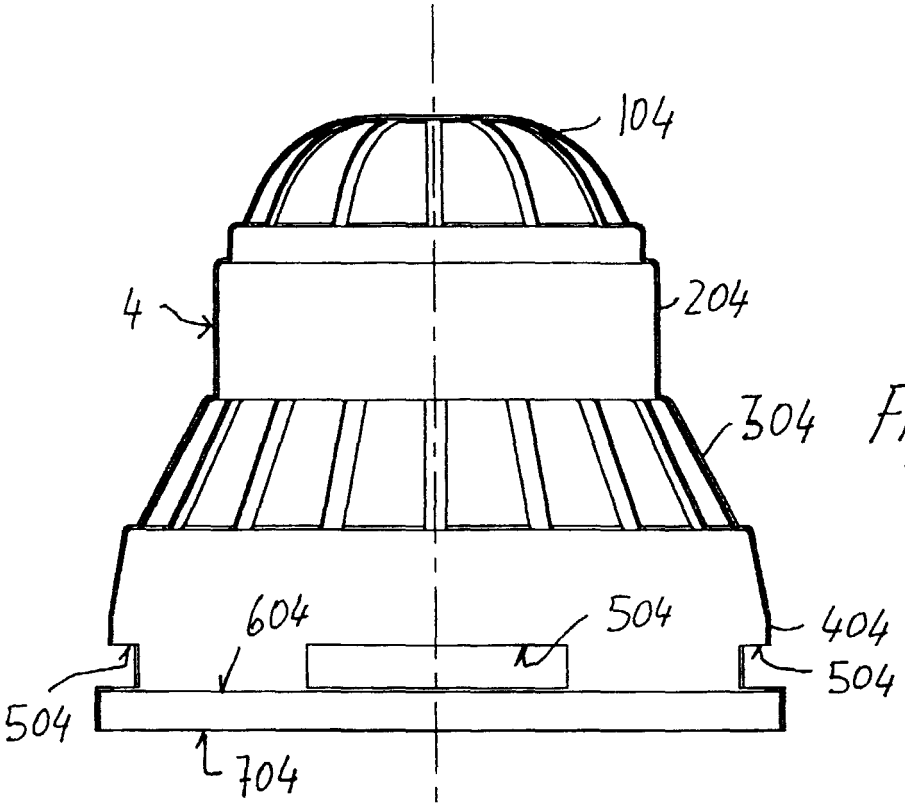

Fig. 5

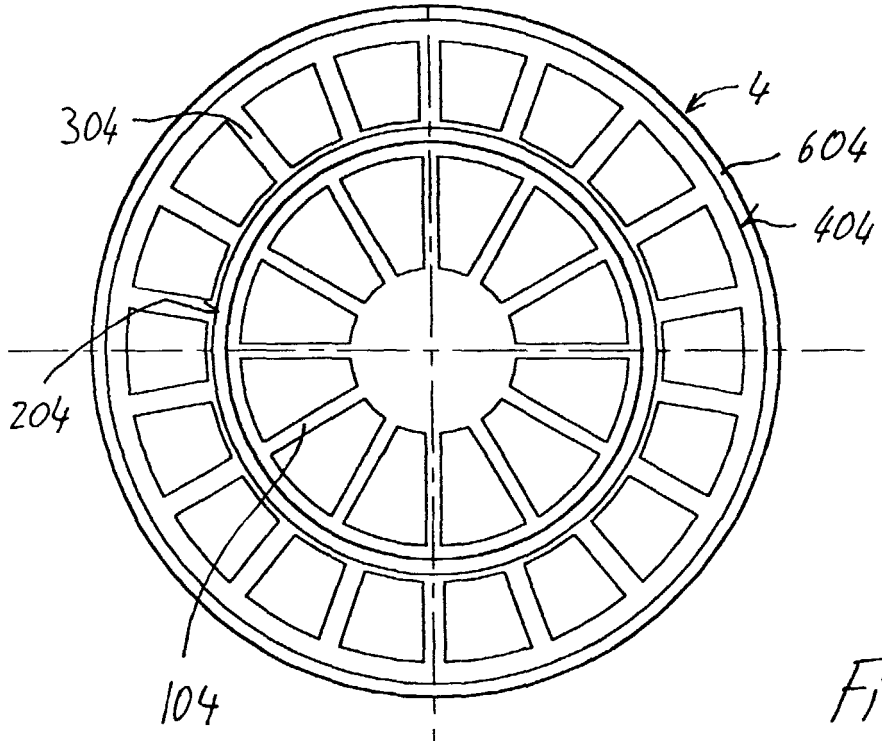

Fig. 6

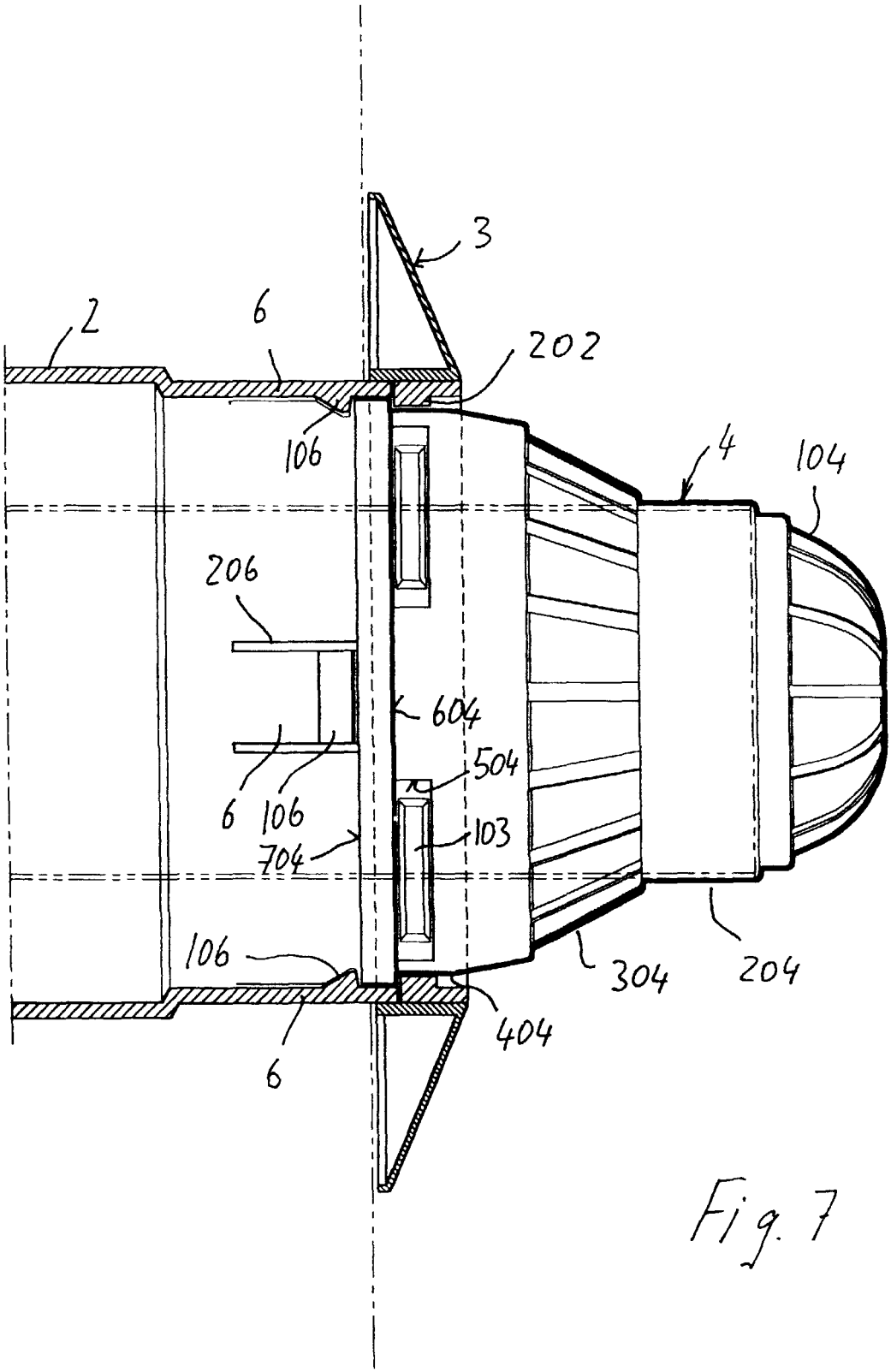

Fig. 7

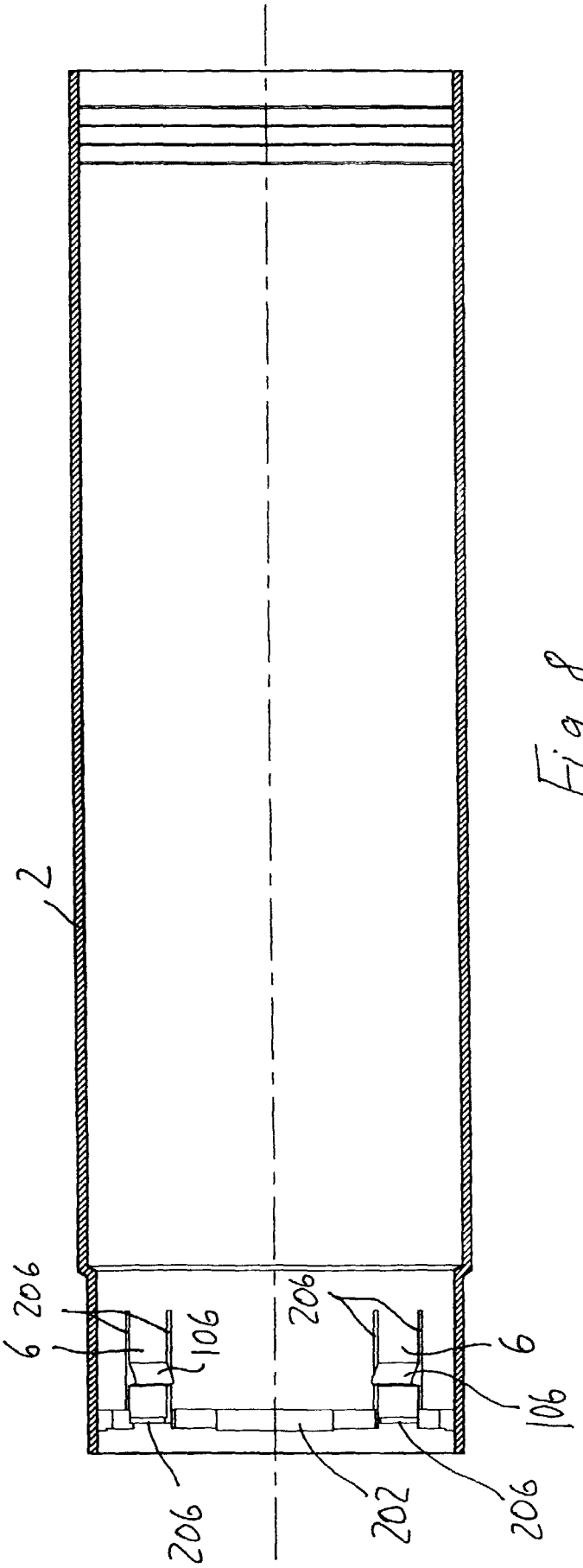

Fig. 8

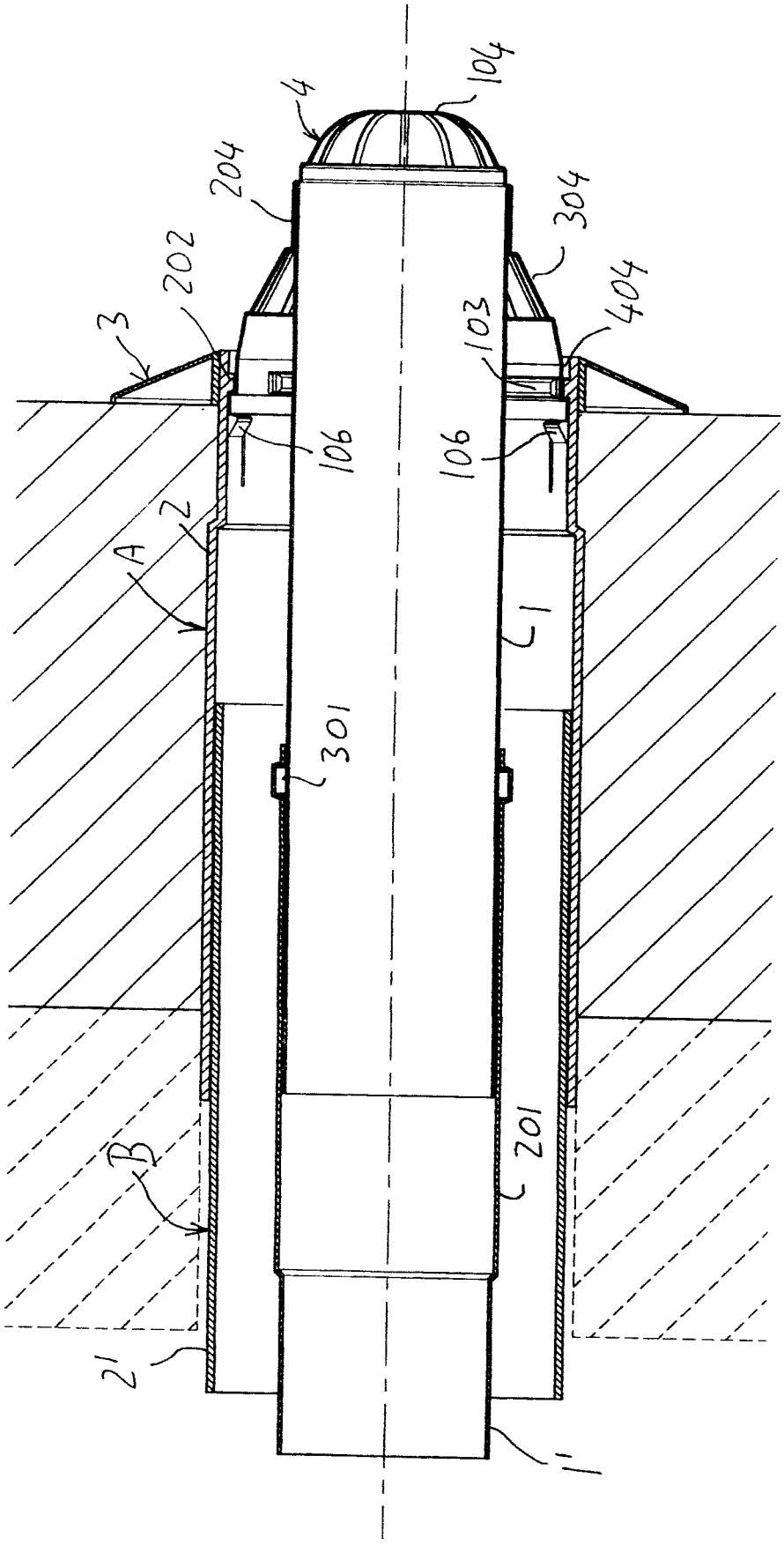

Fig. 9

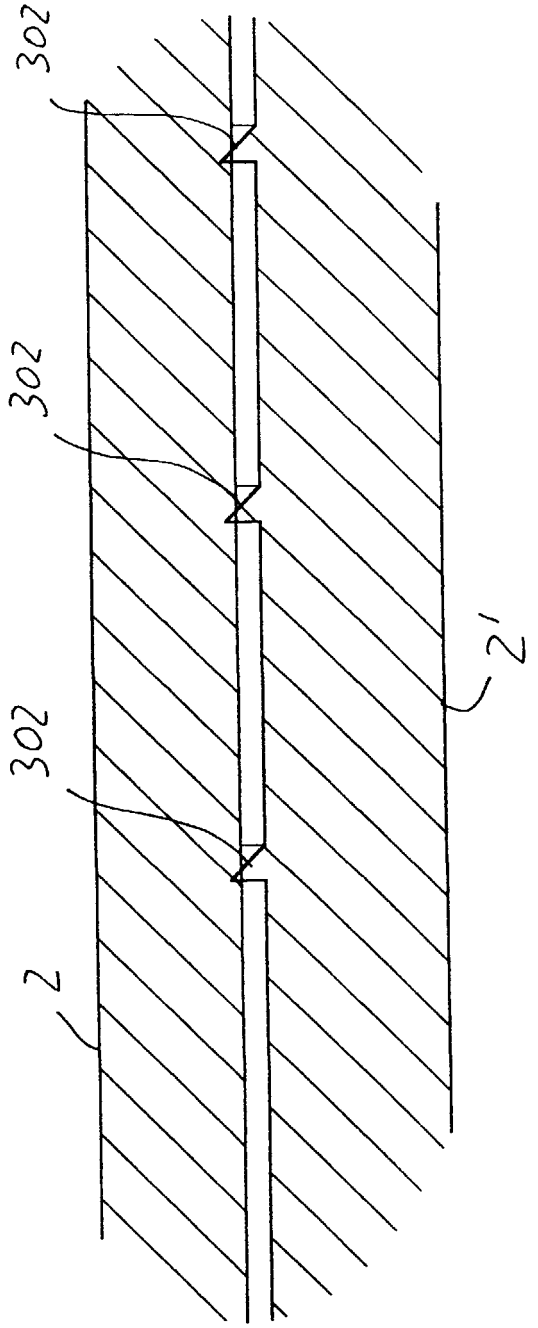

Fig. 10

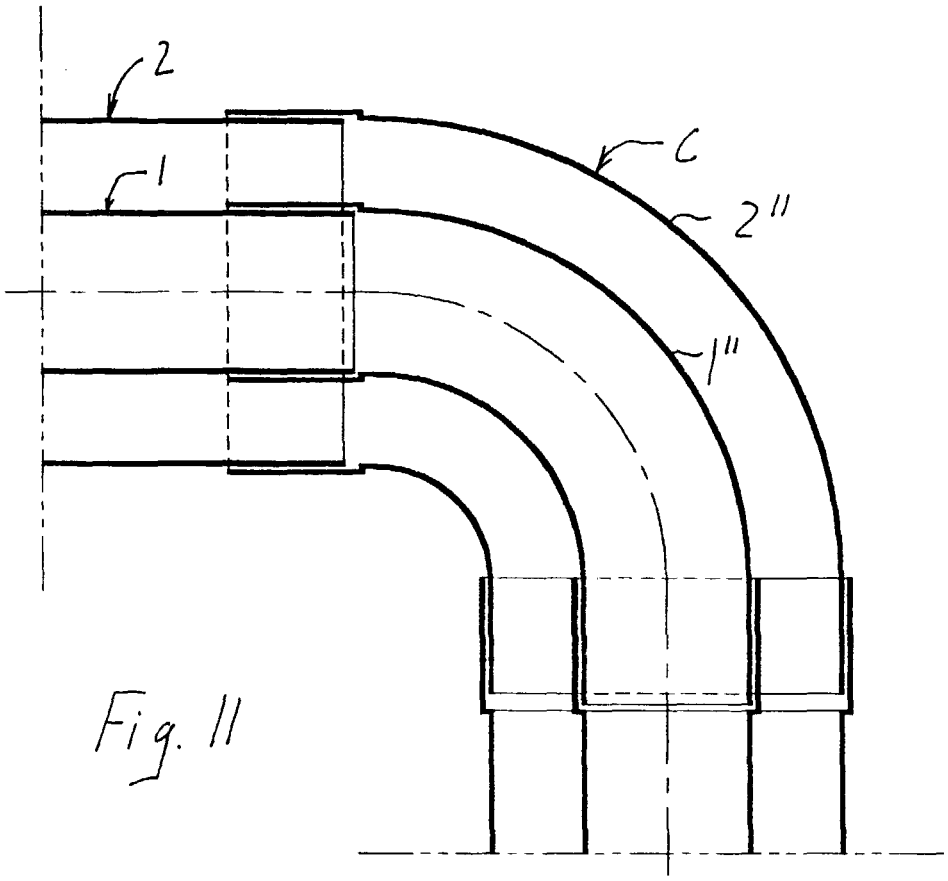

Fig. 11

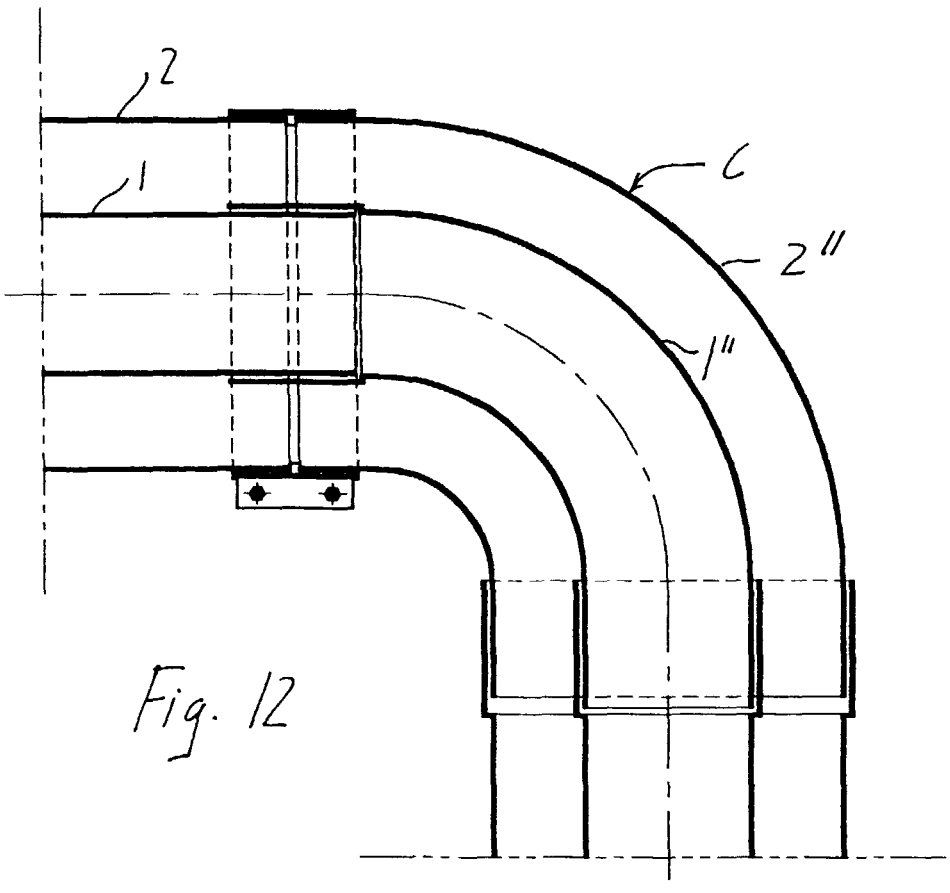

Fig. 12

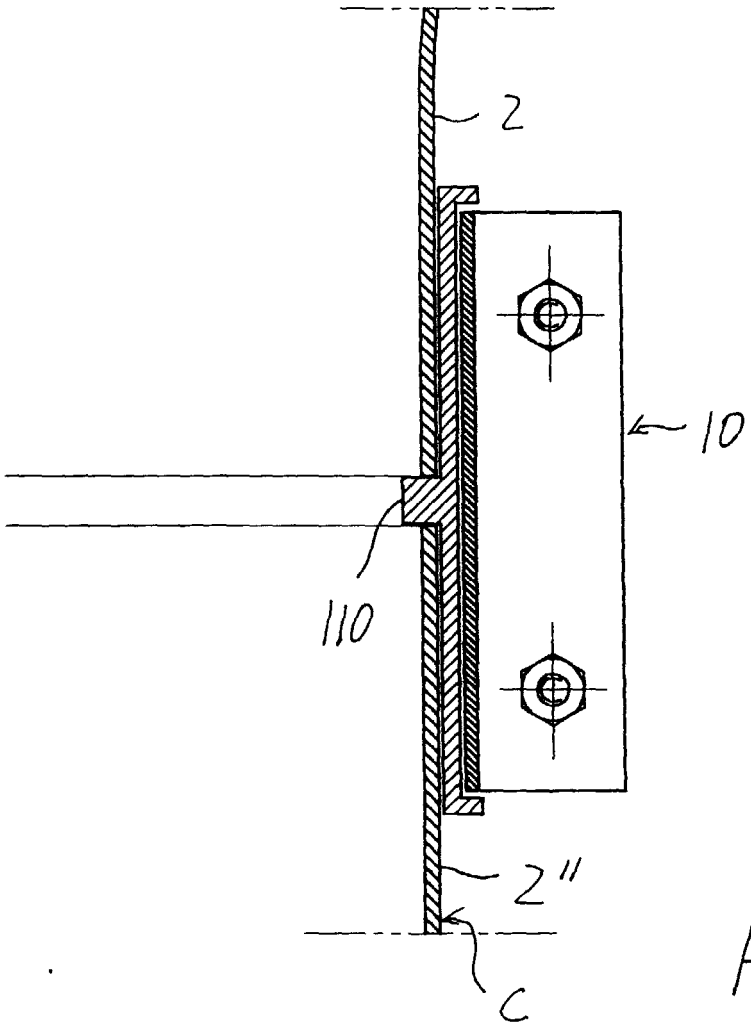

Fig.13

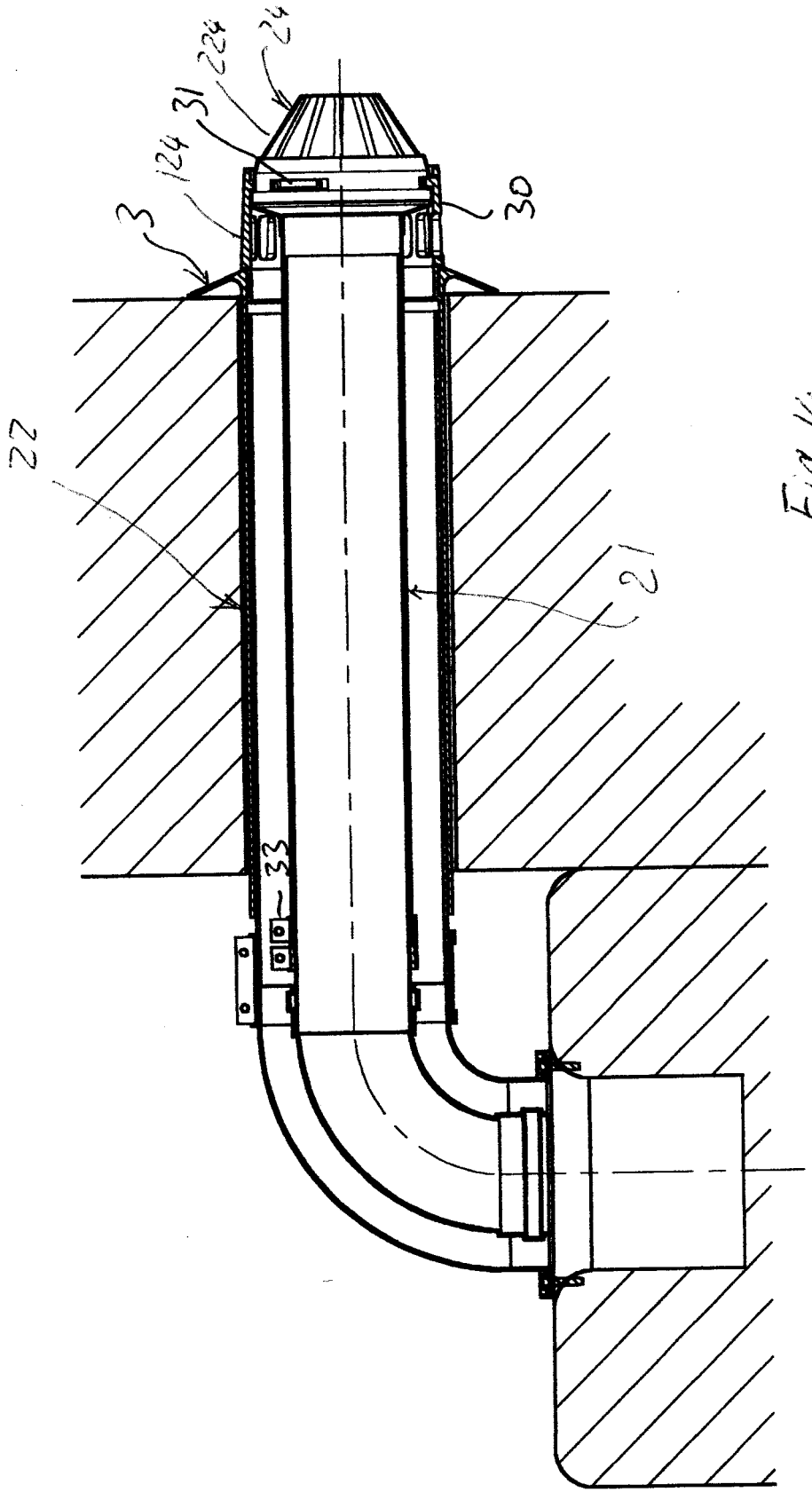

Fig. 14

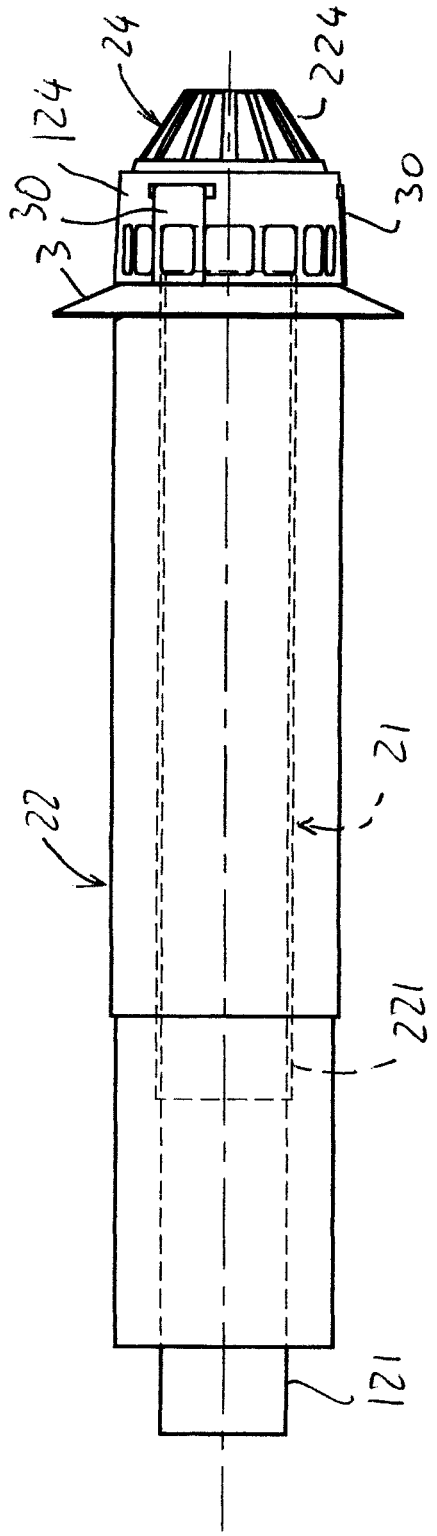

Fig 15

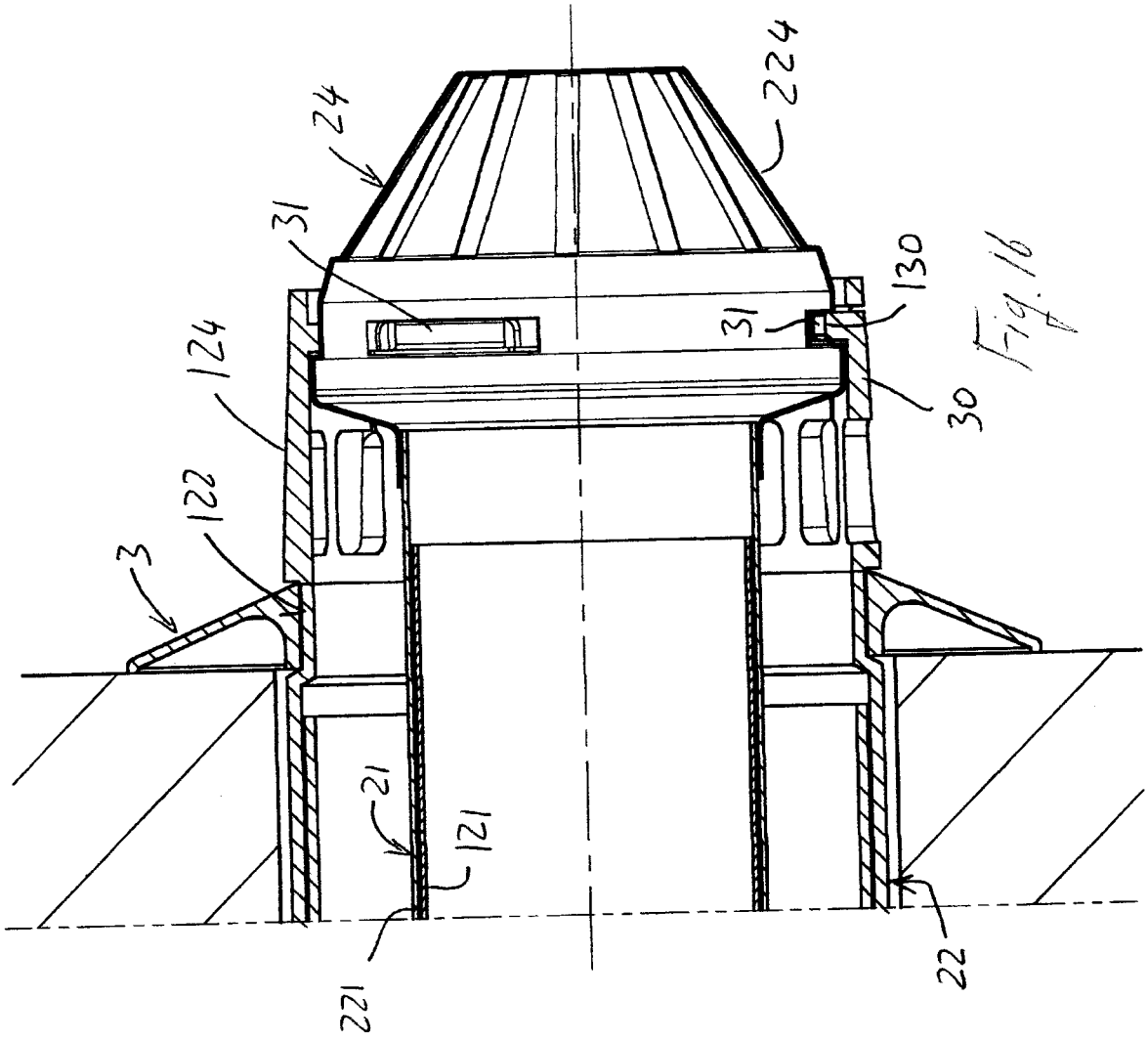

Fig. 16

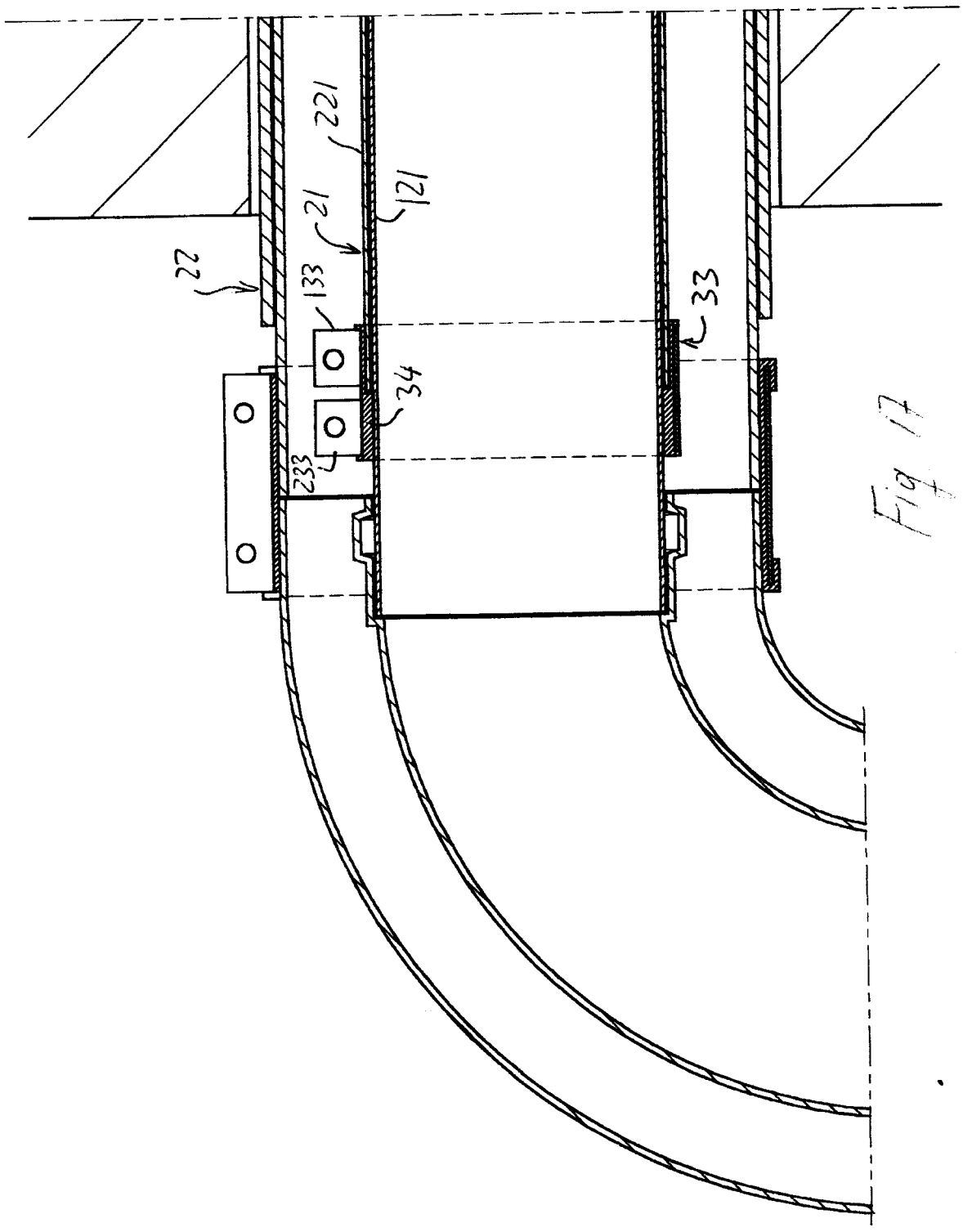

Fig 17

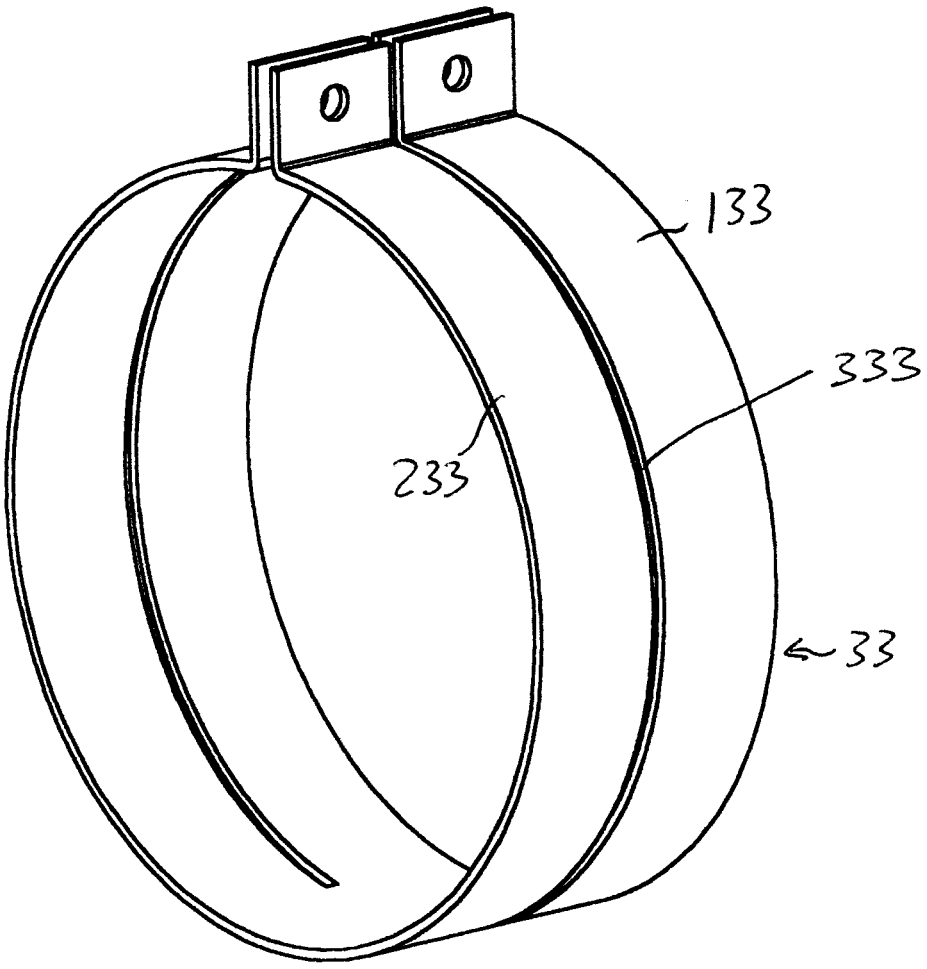

Fig 18

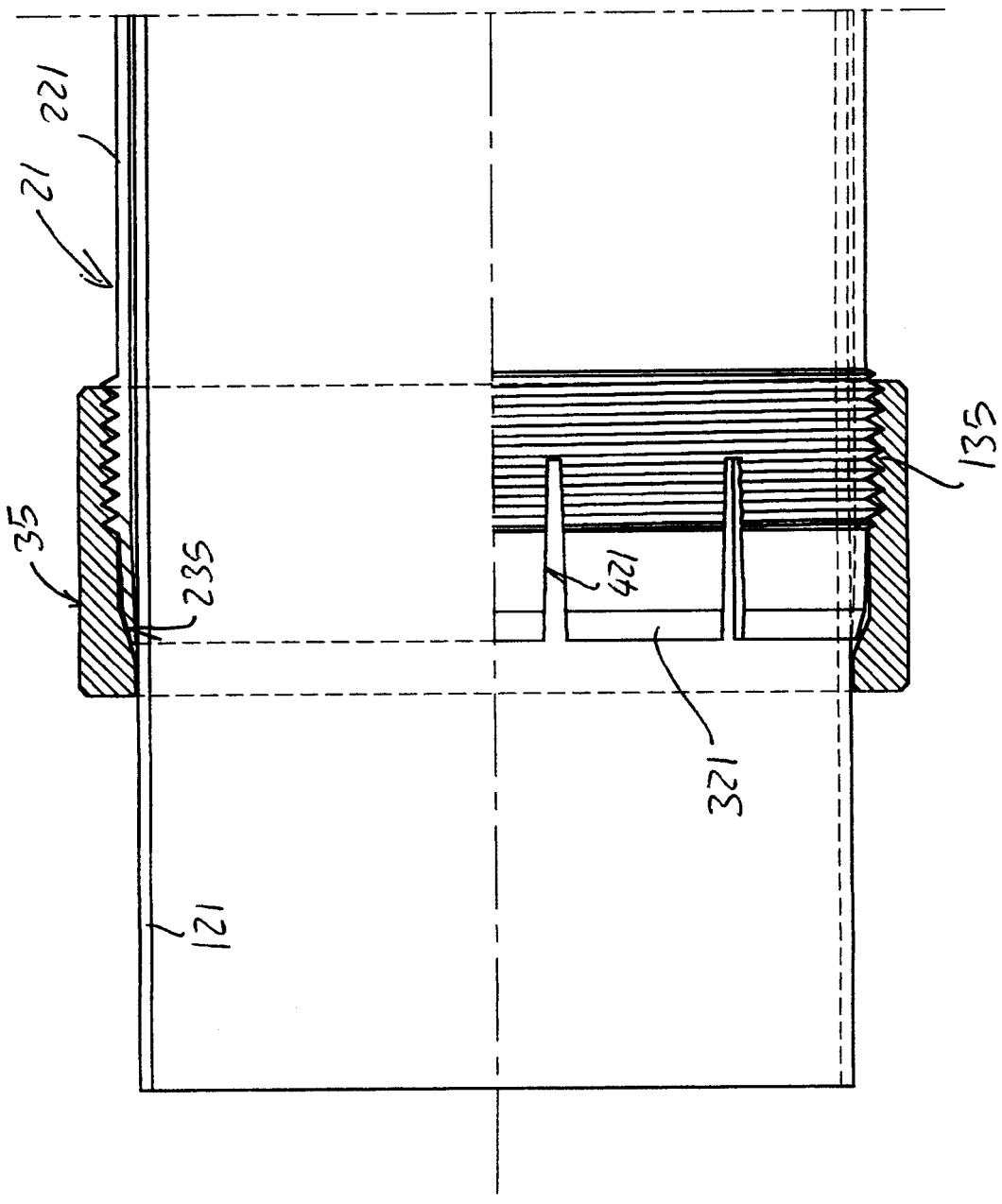

Fig 19

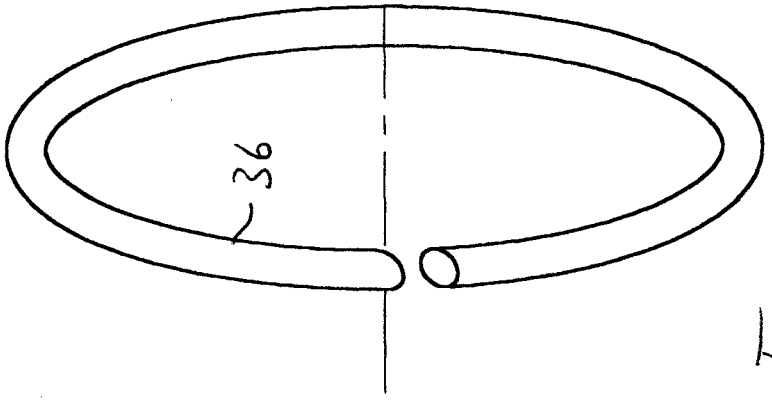

Fig 20

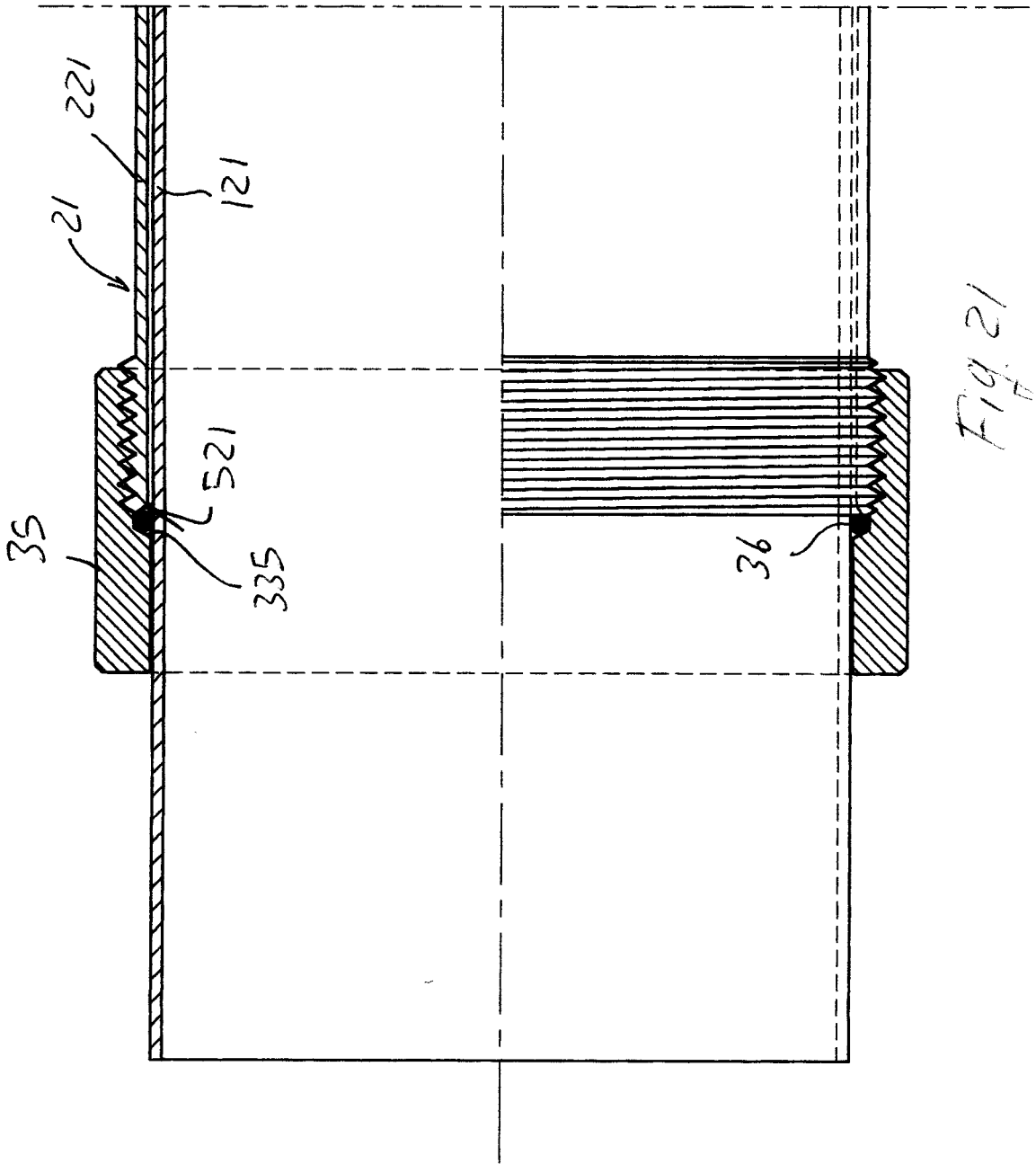

Fig 21

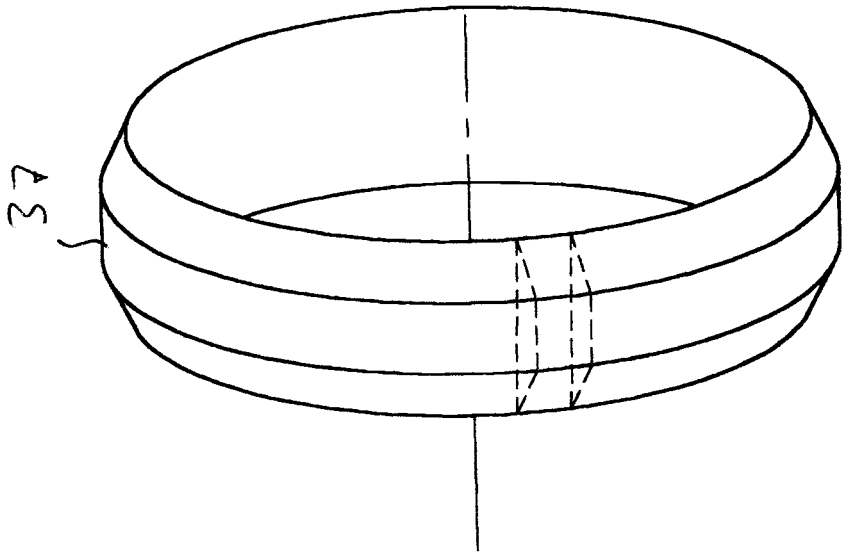

Fig 23

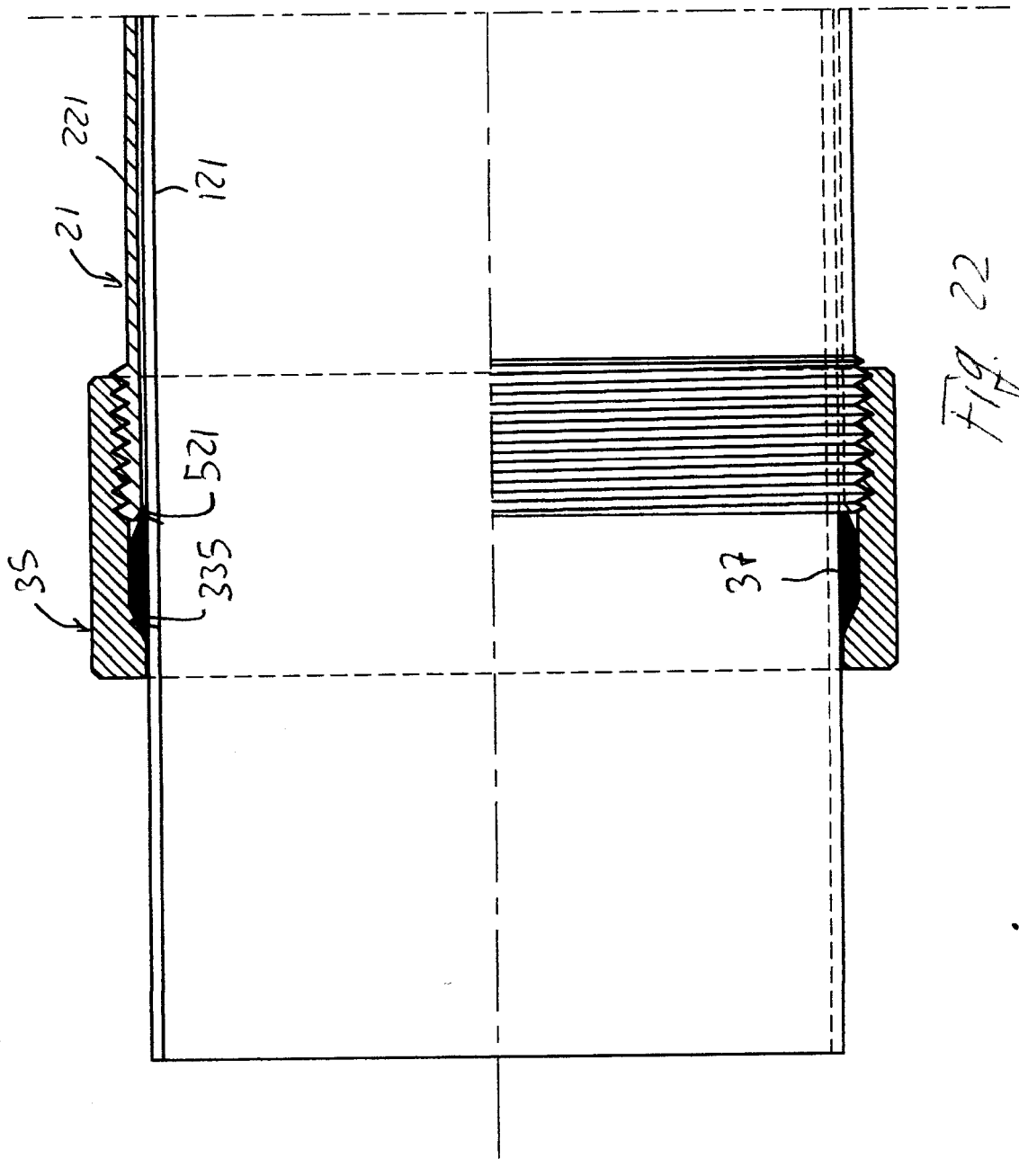

Fig 22