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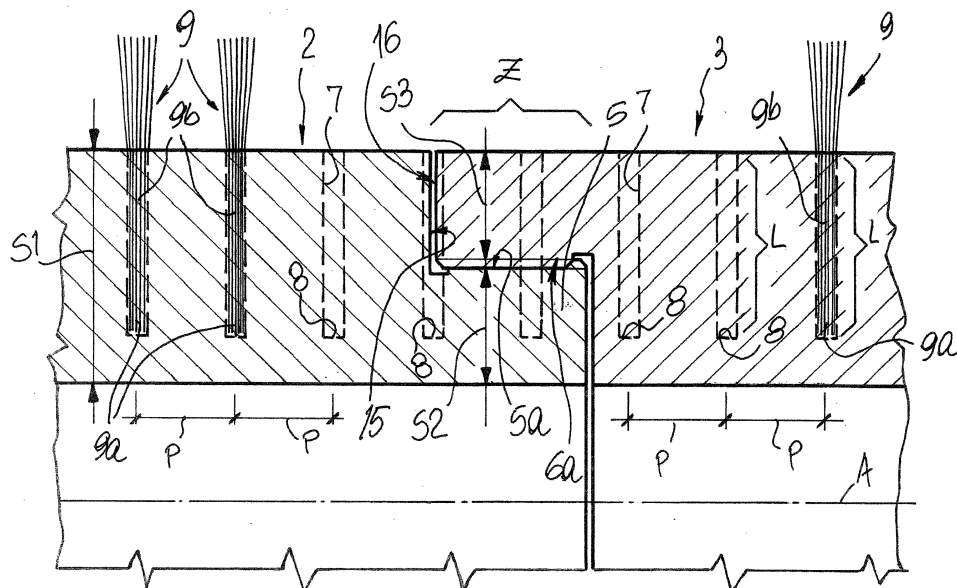
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• **Dondi, Andrea****41043 Casinalbo di Formigine (IT)**• **Dondi, Roberto****41043 Casinalbo di Formigine (IT)**(30) Priority: **21.06.2018 IT 201800002834 U**(74) Representative: **GCA S.R.L.****Via Scaglia Est 144****41126 Modena (IT)**(54) **CYLINDRICAL BRUSH**

(57) The cylindrical brush (1) comprises: a central core of predetermined length, at least two modular elements (2, 3) assembled together in succession, and each having a cylindrical body which has an axial cavity (4), an external surface (2a, 3a) and a first thickness (S1) defined between the axial cavity (4) and the external surface; a cylindrical tang (5) passed through by the cavity (4), which has a second thickness (S2) and extends from a first end of the cylindrical body; a hollow seating (6) which is obtained in a second end of the cylindrical body

opposite the first, which can be coupled mating with a tang of an adjoining modular element and which has a third thickness (S3) defined between the hollow seating and the external surface; a plurality of transverse holes (7) obtained in the modular elements and which have a bottom and an axial length (L); a plurality of tufts of bristles (9) inserted in the holes and protruding from the bottom toward the outside; in the assembled modular elements the axial length (L) of the holes is greater than or equal to the third thickness (S3).

**FIG. 5**

Description

Field of the invention

[0001] The invention concerns a cylindrical brush, generally usable to clean industrial and/or domestic surfaces with machinery on which it is intended to be mounted.

Background of the invention

[0002] Cylindrical brushes are known which have predetermined lengths as a function of the use for which they are intended.

[0003] Typically, these cylindrical brushes are mounted on machines that are used to clean surfaces that have significant sizes, such as, for example, floors of industrial buildings or large civil buildings.

[0004] Typically, these cylindrical brushes have a predetermined length which is a function of the width of the cleaning front they have to offer and of the sizes of the machines on which they are to be mounted.

[0005] Currently, these brushes are made by assembling together an adequate number of cylindrical modular elements, provided with radial bristles, which are each fitted and clamped next to each other on a central support tube which forms the supporting structure thereof, and with which they are coaxial.

[0006] At the free ends of the assembly of these modular elements, terminal elements are provided which are typically suitable to tighten them together, packing them and immobilizing them so that they cannot rotate independently of one another.

[0007] Typically, to avoid relative rotations, all the modular elements are clamped on the central tube by means of glues which, after they have set, make them monolithic to each other and to the central tube.

[0008] From patent US2012/0311799 a cylindrical brush is known, particularly suitable to clean solar panels.

[0009] According to this patent, the brush is formed by a coaxial succession of modular elements which have been previously provided with bristles disposed radially and which have threads at their respective ends, made so as to make their reciprocal screwing possible, until a brush of desired length is formed.

[0010] The brush according to the patent is also provided with a series of passages for a washing fluid, intended to wet the bristles and to clean the surface of the solar panels to be cleaned.

[0011] The state of the art has some disadvantages.

[0012] A first disadvantage is that when forming the brush it is not possible to obtain a completely homogeneous distribution of the bristles along its entire length, for the reason that in correspondence with the joining zones between the modules that comprise it, it is not possible to plant tufts of bristles which remain blocked therein in a stable way.

[0013] The reason for this problem is that normally the tufts of bristles that form the brushes are planted with

automatic machines that form a general production line of cylindrical brushes and that in a first step create a programmed distribution of holes on the perimeter surfaces of each modular element, and in a second step plant in a forced way the tufts of bristles into the holes previously prepared for them.

[0014] The holes have a depth that extends in a centripetal direction, but which is limited in the thickness of the material with which the external surfaces of each modular element are made.

[0015] For this reason, the surface distributions of the holes, and therefore of the tufts of bristles, are dependent upon the condition that one or more holes cannot coincide with the joining zones between adjoining modular elements, that is, in the facing zone between two ends of adjoining modular elements, as it would not be possible to clamp in any way every corresponding tuft of bristles intended to be accommodated in these particular holes.

[0016] Therefore, the interdistances between holes, called pitches, which should be constant in order to have a uniform distribution of the bristles and at the same time such as to exclude the possibility of positioning one or more holes in correspondence with the joining zones, are conditioned by the presence of the joining zones between the modular elements.

[0017] This conditioning determines alternatively the need to provide distributions of holes with non-constant pitches at least in proximity to joining zones between the modular elements, or to provide the distribution of holes with sufficiently wide pitches to avoid the disadvantage described above, that is, ensure that no hole can coincide with the joining zones.

[0018] A further disadvantage is that known brushes made by assembling together various modular and non-modular pieces, require maintaining warehouse stocks of these pieces, above all of the non-modular ones, in order to always have them always available.

[0019] Another disadvantage of known cylindrical brushes is that when the central cores have considerable lengths in the order of 2.5-3.00 meters, it is very difficult to make the axial hole which runs for their entire length, and is intended to accommodate a drive shaft of a cleaning machine, especially when this axial hole has to have a small diameter, because the tools and machinery used have to make the hole on a core that tends to bend in the central zone due to its own weight.

[0020] Another disadvantage of the state of the art is that the modules which are used to form a complete brush of predetermined length have to be attached to each other in order to avoid relative rotations, as previously stated, and for this reason, the modules are rendered integral with each other with glues that on the one hand make them practically a single piece, but on the other hand do not allow disassembly and replacement of individual modules if needed, for example when there is an abnormal wear of part of the bristles of the cylindrical brush, due to impacts thereof against particular obstacles encountered during the cleaning of surfaces to be cleaned.

Purposes of the invention

[0021] One purpose of the invention is to overcome the disadvantages of the state of the art.

[0022] Another purpose of the invention is to provide a cylindrical brush that has a uniform distribution of bristles along its entire length, even in the zones where the modular elements that comprise it are close to each other.

[0023] A further purpose of the invention is to provide a cylindrical brush which is formed by a predetermined number of modular elements, all integral with one another and without the possibility of rotating one with respect to the other when the brush is formed.

[0024] Another purpose of the invention is to provide a cylindrical brush that allows, if required, to replace one or more of the modular elements that comprise it without necessarily having to throw away the entire brush.

[0025] A further purpose of the invention is to provide a cylindrical brush which allows to reduce the warehouse stock of the modular elements which comprise it.

[0026] A further purpose of the invention is to provide a cylindrical brush which allows to make axial holes even with a small diameter and on considerable lengths, without the working being conditioned by bending of the modular elements.

[0027] According to one aspect of the invention, a cylindrical brush is provided, according to the characteristics of claim 1.

[0028] The invention allows to obtain the following advantages:

- make a cylindrical brush of the desired length;
- make a cylindrical brush that has a uniform distribution of the bristles on the entire external surface, even in the zones where the junctions between the modular elements that comprise it are located;
- make a cylindrical brush in which relative rotations between the modular elements that comprise it are prevented;
- make a cylindrical brush that, if necessary, for example in the case of asymmetrical wear, allows to replace even just one or more of the modules that comprise it, without having to throw away the entire brush;
- make a cylindrical brush that allows to make axial holes in an easy and precise way.

Brief description of the drawings

[0029] Other characteristics and advantages of the invention will become apparent from the detailed description of some preferred, but not exclusive, embodiments, of a cylindrical brush, given as a non-restrictive example with reference to the attached drawings wherein:

Fig. 1 is an interrupted schematic view of a portion of the central core of a cylindrical brush according

to the state of the art, without bristles;

Fig. 2 is an interrupted schematic view of a portion without bristles of a cylindrical brush according to the invention, in a first possible embodiment;

Fig. 3 is an overall view of a cylindrical brush according to the invention;

Fig. 4 is a schematic view of a portion that is considered the front portion of the cylindrical brush according to the invention, without the tufts of bristles so as to observe the distribution of holes which are intended to house them;

Fig. 5 is a schematic and considerably enlarged scale view of a portion of a connection zone between two modular elements which form the cylindrical brush according to the invention;

Fig. 6 is a schematic view of the connection zone of fig. 5, in which the transverse forces which retain the tufts of bristles are indicated;

Fig. 7 is a schematic view of a connection zone between two modular elements which comprise the cylindrical brush according to the invention, in a first embodiment in which the tufts of bristles are directed perpendicularly to the modular elements which comprise the cylindrical brush;

Fig. 8 is a schematic view of a connection zone between two modular elements that comprise the cylindrical brush according to the invention, in a second embodiment in which the tufts of bristles are directed obliquely to the modular elements which comprise the cylindrical brush;

Fig. 9 is a schematic perspective and interrupted view of a connection zone between two modular elements to comprise the cylindrical brush, in a second possible embodiment;

Fig. 10 is a longitudinal section view of the connection zone of fig. 9 with the two modular elements connected to each other;

Fig. 11 is a schematic lateral view of a modular element that comprises the cylindrical brush;

Fig. 12 is a front view of a hollow seating which the modular element of fig. 11 is provided with;

Fig. 13 is a considerably reduced scale perspective view of the modular element of fig. 11.

Detailed description of a preferred embodiment

[0030] With reference to the above drawings, 1 indicates a cylindrical brush according to the invention.

[0031] The brush 1 comprises at least two modular elements 2 and 3 assembled together with assembly means, each of which has a cylindrical body which defines an external surface, respectively 2a and 3a, and which, in the preferred embodiment described below, is axially passed through by an axial cavity but which, if required, could also be solid.

[0032] According to the invention, the number of modular elements can also be greater than two, because this number is determined as a function of the overall length

of the cylindrical brush 1 to be made.

[0033] The overall length of each modular element can also vary to make the cylindrical brush 1 with a desired length.

[0034] A first thickness S1 is defined between the external surfaces 2a and 3a of each modular element 2 and 3 and the axial cavity 4, which is common to both.

[0035] Each modular element 2 and 3 has a central axis of symmetry A and, at a first end, a cylindrical tang 5 which is passed through by the axial cavity 4 and which has a second thickness S2 and, at a second end opposite the first end, a hollow seating 6 which can be coupled mating with a tang 5 of an adjoining modular element and which has a projecting edge which has a third thickness S3 defined between the hollow seating 4 and the external surface 2a or 3a.

[0036] According to the invention, both the external surface of the tang 5 and also the internal surface of the hollow seating 6 are provided with respective threads 5a and 6a which can be reciprocally engaged by screwing, so as to connect the two modular elements 2 and 3 together, screwing one to the other.

[0037] The tang 5, the hollow seating 6 and the respective threads 5a and 6a form the assembly means mentioned above.

[0038] A plurality of holes 7 is made in the modular elements 2 and 3, which are generally oriented in a transverse direction, for example toward the central axis of symmetry A, that is, in a centripetal direction, and which have an axial length L and a bottom 8.

[0039] With reference to the drawings, it should be noted that the holes 7 are obtained at reciprocal distances, called pitch P which are substantially constant, regardless of the fact that some of the holes 7 are in correspondence with the joining zones between the two modular elements 2 and 3, indicated with Z, that is, more precisely in this specific case, in the zone Z in which the tang 5 of the modular element 2 is screwed into the seating 6 of the modular element 3.

[0040] More in detail, as can be seen more clearly in fig. 5, the axial length L of each hole 7 is such as to completely pass through the third thickness S3 of the hollow seating 6, until it also partially penetrates the second thickness S2 of the tang 5, positioning the bottom 8 within the latter, however without passing through it.

[0041] However, a person of skill understands that the length L could also be just equal to the thickness S3, in the specific case of couplings between conical profiles between the tang 5 (male) and the hollow seating 6 (female).

[0042] Each of the holes 7 is intended to receive the insertion, typically in a forced manner, of a tuft 9 of bristles which protrude substantially from the bottom 8 toward the outside, that is, beyond the external surfaces 2a, 3a, of the two modular elements 2 and 3, and that all together form the cleaning surface of the cylindrical brush 1.

[0043] Fig. 6 indicates in particular the transverse forces which retain the tufts of bristles 9 inside the respective

holes 7.

[0044] More precisely, the forces F1 are those which retain a median zone 9b of the tufts of bristles 9 while the forces F2 are those which retain a base zone 9a of the bristles 9.

[0045] With reference to fig. 8, a second possible embodiment is shown of the cylindrical brush 1, according to which the holes 7 are obtained with an orientation inclined with respect to the central axis of symmetry A.

[0046] With reference to fig. 10, an alternative embodiment of the assembly means is shown which, in this case, comprise a cylindrical sleeve 11 which is externally equipped with a thread 11a to be screwed in the thread 6a of the hollow seating 6 of one of the two modular elements 2 or 3.

[0047] The assembly of the cylindrical brush 1 occurs as follows: at least two cylindrical elements 2 and 3 are assembled together screwing the tang 5 of one of them into the hollow seating 6 of the other.

[0048] However, a person of skill understands that in order to make a cylindrical brush 1 of greater length, it is possible to assemble more than two modular elements 2 and 3 together, until the desired overall length is reached.

[0049] After completing the screwing and in practice creating the core of the cylindrical brush 1, the core is put on an automatic drilling machine which, according to a predetermined work program, in a drilling station automatically makes a plurality of perimeter holes 7 on the surfaces 2a and 3a, directed proceeding from the outside toward the inside, normally in a centripetal direction, in the direction of the axis of symmetry A, that is, more generally, toward the axial cavity 4, and for a predetermined length L.

[0050] The length L is such that each hole 7 penetrates into the thickness S1 without passing through it, and also preferably completely passes through the thickness S3 in the zones Z joining a tang 5 and a hollow seating 6, and extends to within the thickness S2, however without passing through it.

[0051] It should be noted that the pitch P with which the automatic machine makes the holes 7 is such as to allow to obtain a distribution of the holes 7 on the surfaces 2a and 3a both according to a known pattern of rows and columns, for example as indicated in fig. 1, and also a checkered pattern, as shown by way of example in figs. 2 and 3.

[0052] The checkered distribution allows to make the distribution of the tufts 9 of bristles thicker than known cylindrical brushes.

[0053] After completing the drilling step, the automatic machine, according to the work program, transfers the perforated core of the cylindrical brush 1 to a second work station in which tufts of bristles 9 are forcibly inserted in the holes 7, until the bottom 8 thereof is reached.

[0054] It should be noted in particular that in the joining zones Z the tufts of bristles 9 are forcibly held in the respective holes 7 in their base portion 9a by the forces

F2, when the holes 7 lie between the facing transverse surfaces, indicated for clarity with 15 and 16 in figs 5 and 6; the facing transverse surfaces 15 and 16 can be both perpendicular to the central axis of symmetry A, as in the drawing, and also inclined with respect thereto.

[0055] On the contrary, when a hole 7 falls between the tang 5 and the hollow seating 6, the tufts of bristles 9 are held in their median portion 9b by the forces F1: in both cases, the retention force F1 or F2 exerted transversely by the walls of the holes 7 even only partially in the portions 9a or 9b is sufficient to guarantee the stability of the tufts of bristles 9 in the respective holes 7 also in the joining zones Z.

[0056] It should also be added to the above that the tufts of bristles 9 occupying the holes 7 obtained in the joining zones Z, act as a transverse clamping key between the two modular elements 2 and 3, preventing relative rotation movements.

[0057] When the work step relating to the insertion of the tufts of bristles 9 is completed, and therefore the cylindrical brush 1 is complete, if required, two end elements can be applied at the ends thereof, shaped so as to allow them to be assembled onto the members of a cleaning machine of the known type and suitable for this function.

[0058] In practice it has been found that the invention achieves the intended purposes.

[0059] The invention as conceived is susceptible to modifications and variants, all of which come within the scope of the inventive concept.

[0060] Furthermore, all the details can be replaced with other technically equivalent ones.

[0061] In practice, any materials, equipment and quantities can be used, according to requirements, without departing from the field of protection of the following claims.

Claims

1. Cylindrical brush comprising:

- A central core which has a predetermined length (L), a central axis of symmetry (A), and which comprises at least two modular elements (2, 3) which in an assembled configuration are reciprocally constrained in succession defining joining zones (Z), each modular element having:
 - A cylindrical body that has an external surface (2a, 3a) and a first thickness (S1);
 - A cylindrical tang (5) which has a second thickness (S2) and which extends coaxially to said central axis of symmetry from a first end of said cylindrical body;
 - A hollow seating (6) which is obtained in a second end of said cylindrical body opposite said first end, which can be coupled mating with a tang (5) of an adjoining modular element and

which has a perimeter edge which has a third thickness (S3);

- A plurality of transverse holes (7) obtained in said modular elements and which have a bottom (8) and an axial length (L);

- A plurality of tufts of bristles (9) inserted in said transverse holes (7) protruding from said bottom (8) toward the outside beyond said external surface (2a, 3a); **characterized in that** in said assembled configuration said axial length (L) is equal to or greater than said third thickness (S3).

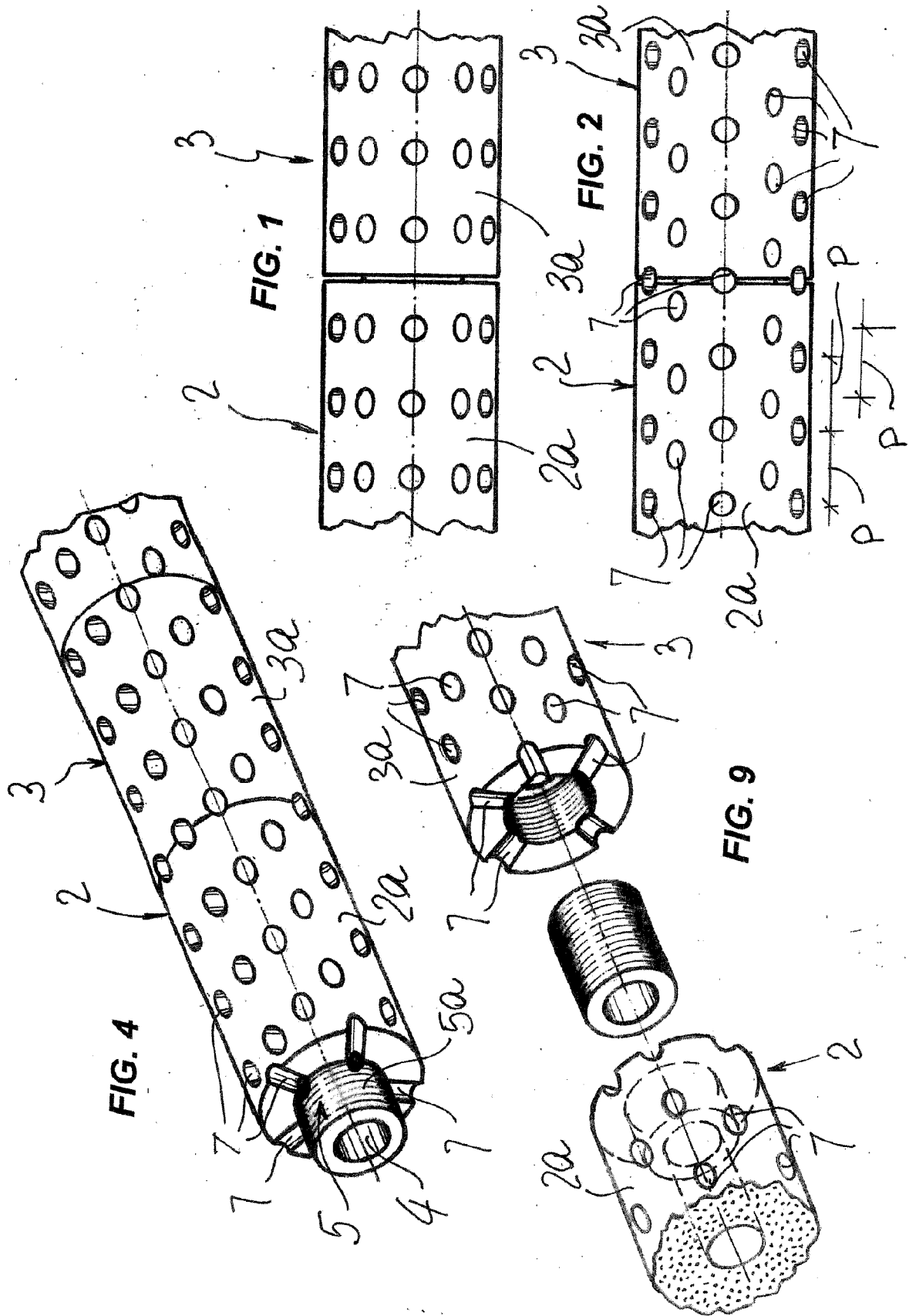
2. Brush as in claim 1, wherein said cylindrical body has an axial cavity (4) and wherein said first thickness (S1) is defined between said axial cavity (4) and said external surface (2a, 3a), said third thickness (S3) is defined between said axial cavity (4) and said external surface (2a, 3a).

3. Brush as in claim 1, wherein in said assembled configuration said axial length (L) is comprised between said first thickness (S1) and said third thickness (S3).

4. Brush as in claim 1, wherein said bottom (8) is obtained in said second thickness (S2).

5. Brush as in claim 1, wherein said tang (5) and said hollow seating (6) have screwing threads (5a, 6a) engageable with threads (5a, 6a) of adjoining modular elements (2, 3), so as to comprise said central core with a predetermined length.

6. Brush as in any claim hereinbefore, wherein said transverse holes (7) are obtained in said cylindrical bodies and in said joining zones (Z).



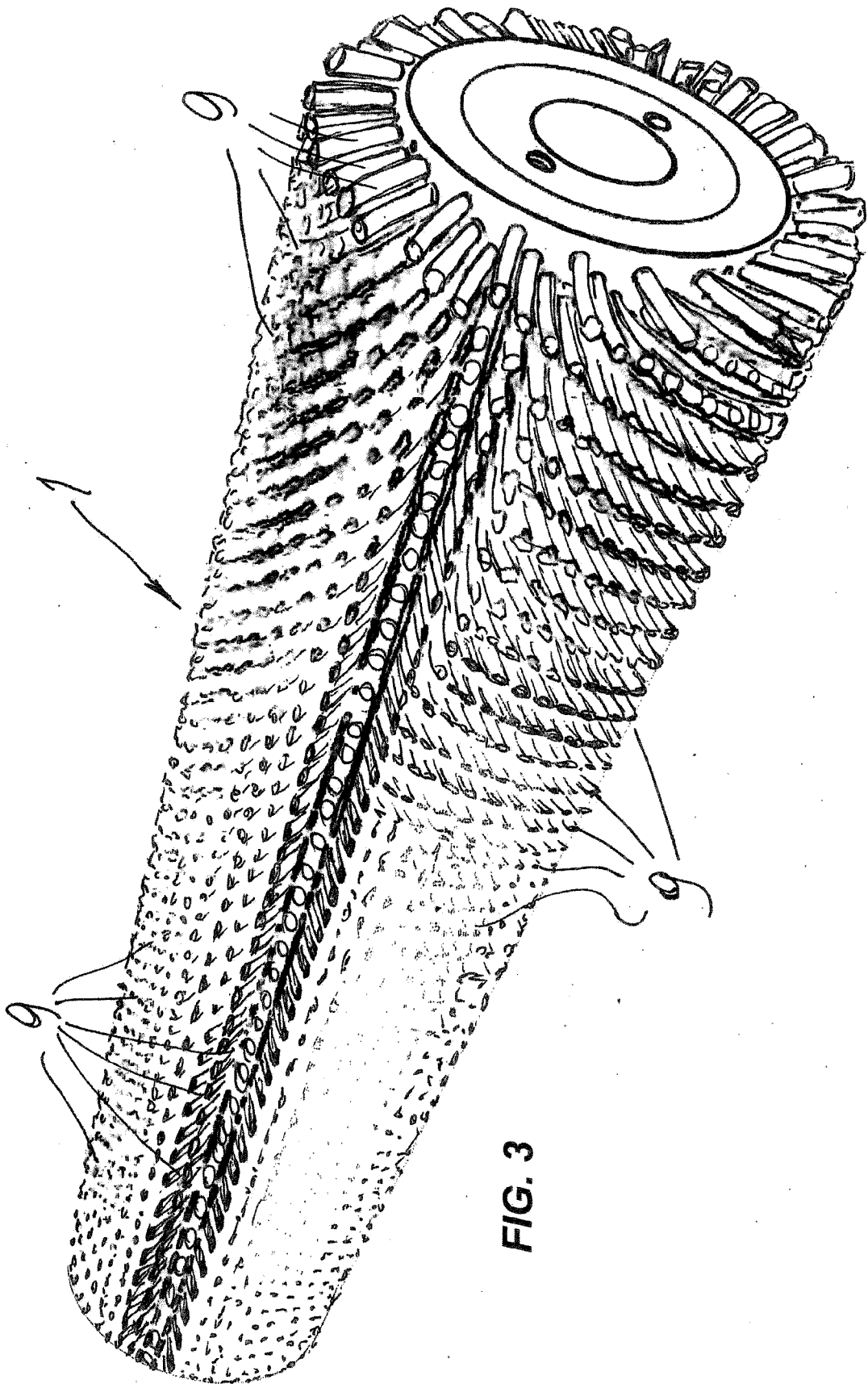


FIG. 3

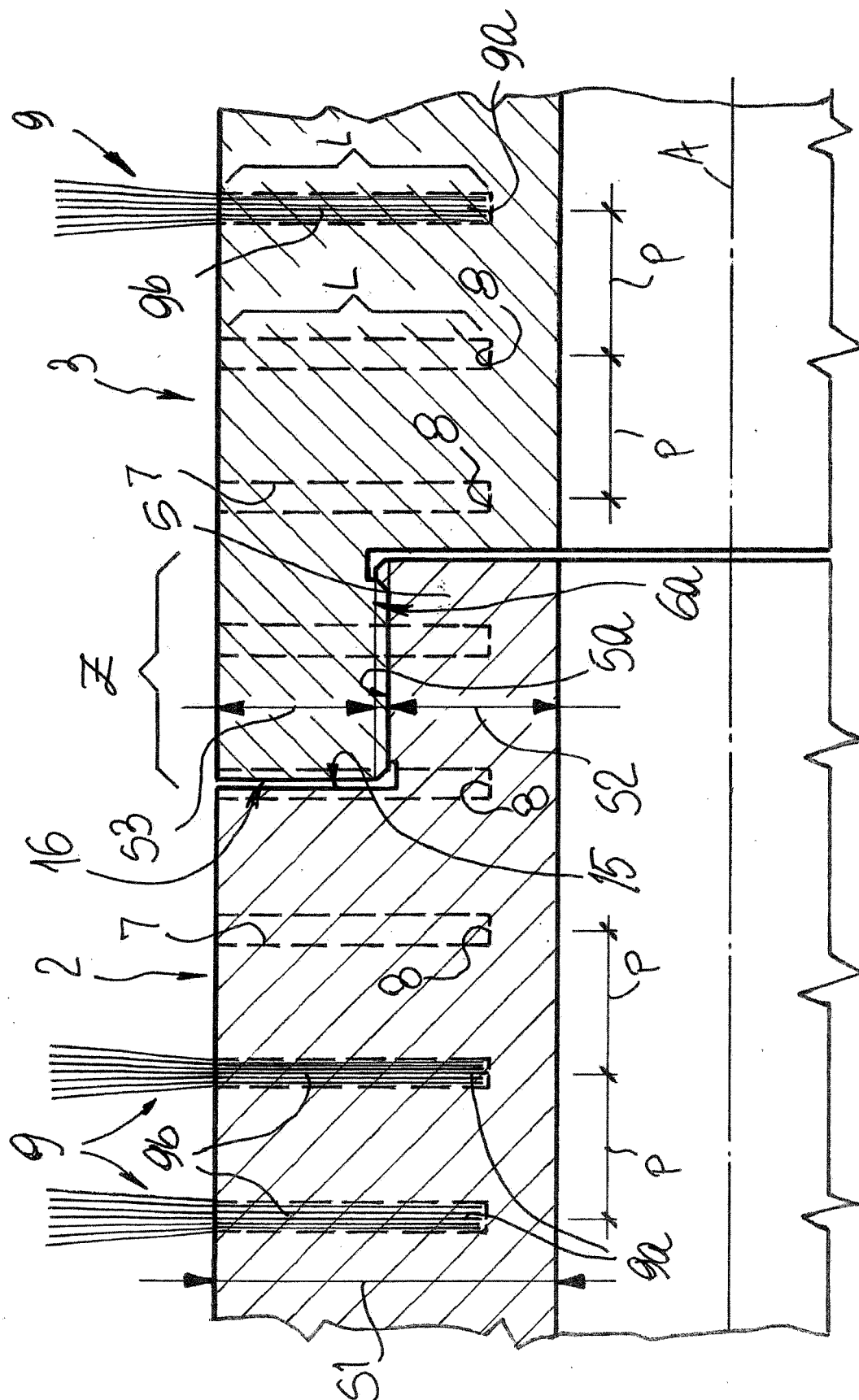


FIG. 5

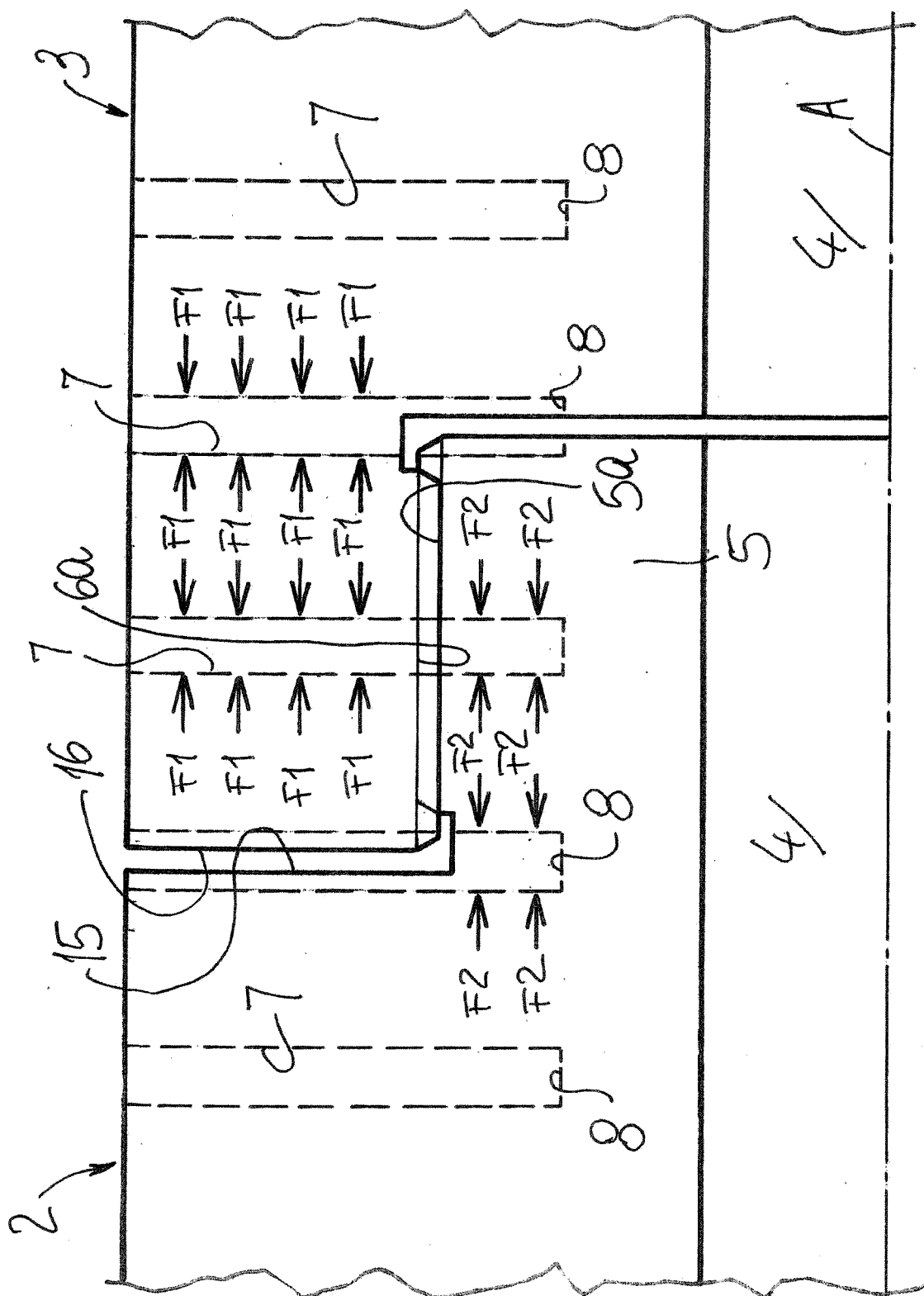


FIG. 6

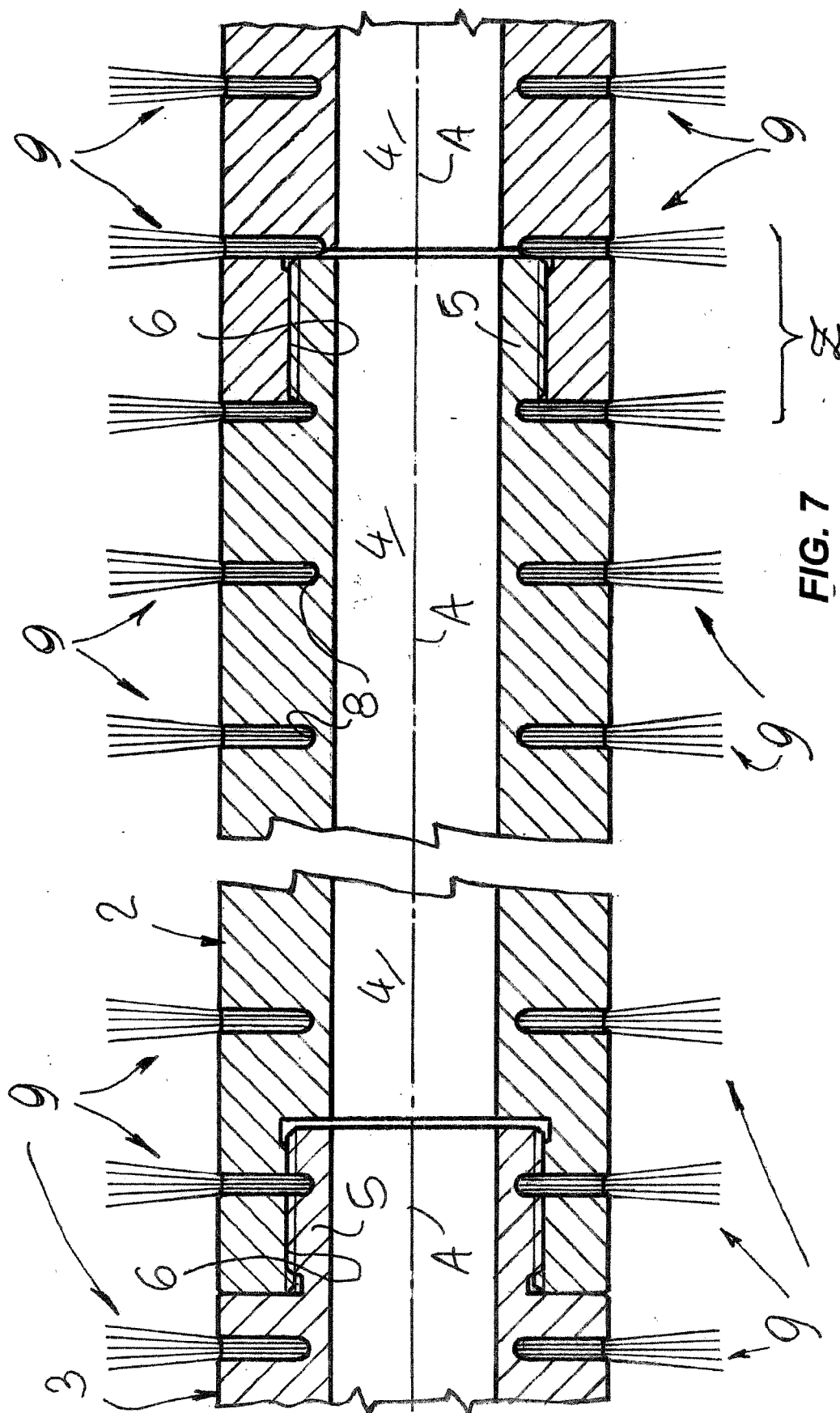


FIG. 7

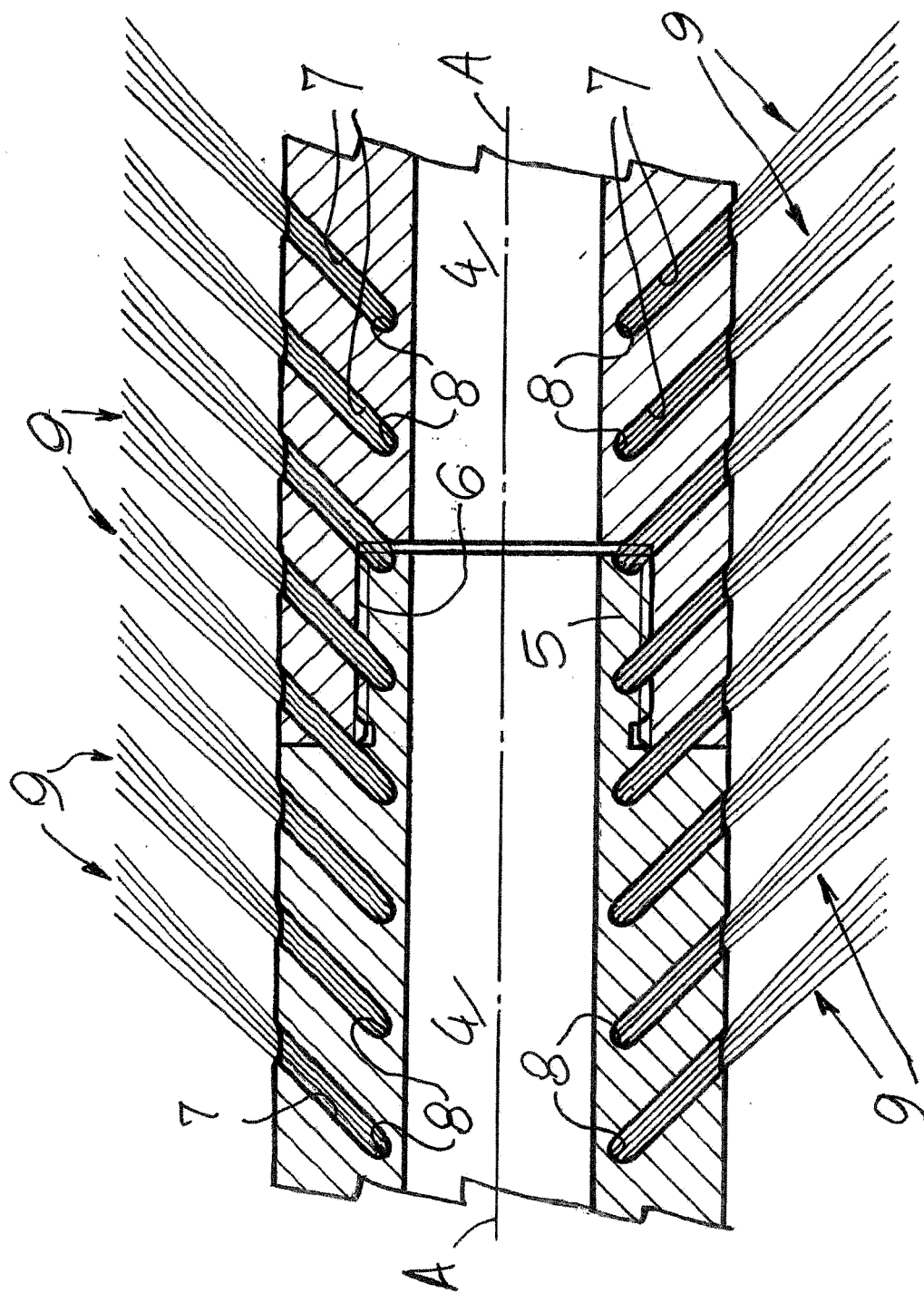


FIG. 8

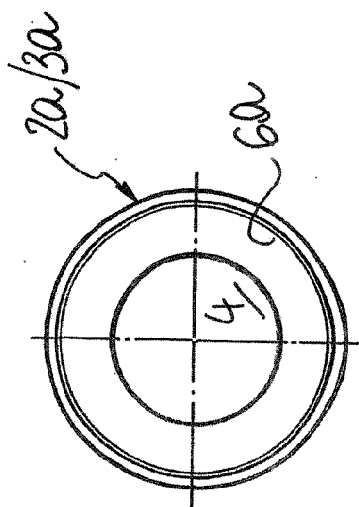


FIG. 12

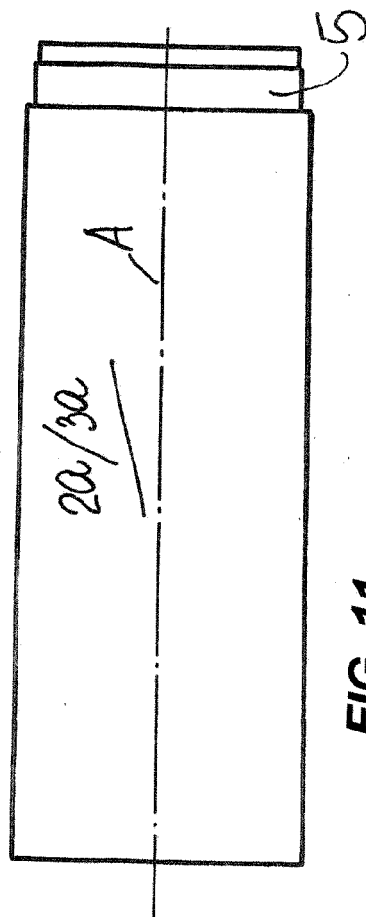


FIG. 11

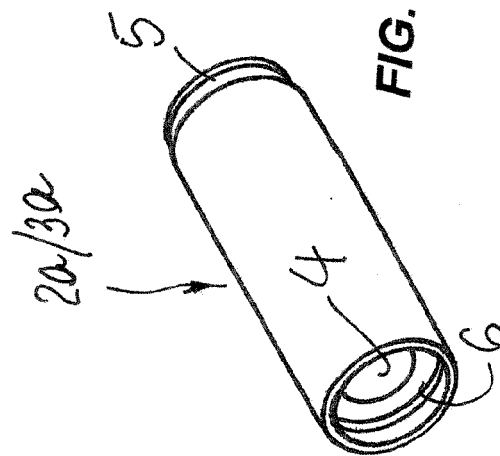


FIG. 13

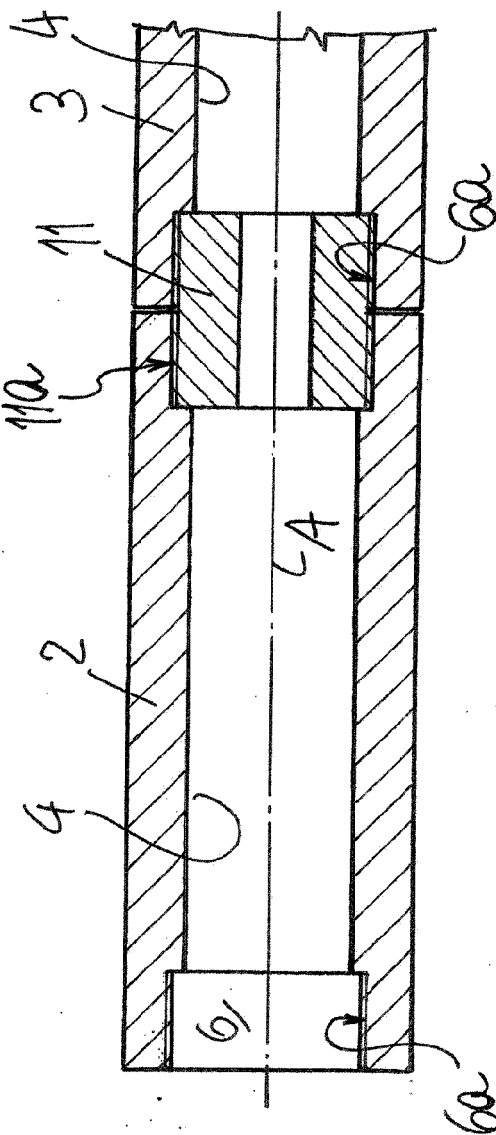


FIG. 10



EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 13 November 2019	Examiner Raybould, Bruce
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