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(54) Pilot lighter for burners

(57) A pilot lighter (6), which ensures immediate lighting of a burner (B) housed in a wind box (1), comprises a lighting end (8) positioned in the vicinity of the end section (2) of the burner (B), a nozzle (12) supplied by a fuel duct (11) of the pilot lighter (6) and a sparking head (16) of a spark generator (13). The spark generator (13) and the fuel duct (11) are housed inside a tubular casing (7) with a predefined axis (A-A) and having an intake section (26) positioned upstream of a register (31) of the wind box (1) which regulates the throughput of a combustion agent to the burner (B). Advantageously, the tubular casing (7) defines a channel (25) supplying the combustion agent of the pilot lighter (6) between said intake section (26) and the lighting end (8) of the pilot lighter (6), such that supplying of the combustion agent of the pilot lighter (6) to the lighting end (8) is independent of supplying of the combustion agent to the end section (2) of the burner (B).

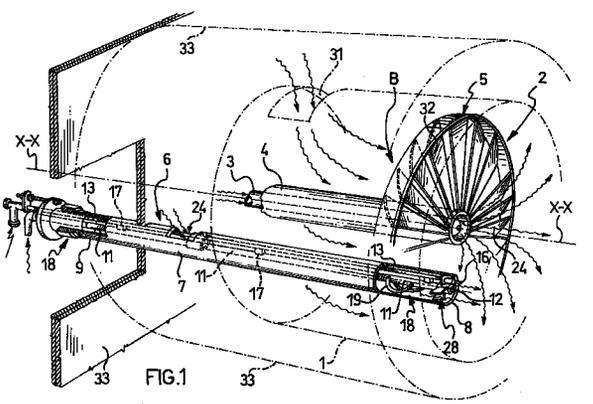

FIG.1

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Description

[0001] The present invention relates to a pilot lighter for burners having a lighting end positioned in the vicinity of a burner end section housed inside a wind box, of the type comprising a nozzle supplied by a fuel duct of the pilot lighter and a sparking head of a spark generator.

[0002] It is known that lighters of the type described are normally used in the boilers of thermal power plants for the production of electric energy.

[0003] The fuel used for supplying these boilers consists of gas, gas oil, fuel oil, coal dust and the like, while the pilot lighter is normally supplied with gas or gas oil.

[0004] The function of the pilot lighter is that of causing lighting of the burner and more precisely of a combustion mixture in which the fuel is supplied via a special duct and the combustion agent, generally consisting of air or vapour, enters the wind box via a register.

[0005] It is also known that the pilot lighter is exposed to severe operating conditions since, for reasons of constructional simplicity, the temperature, the speed and the quality of the air are not regulated and optimised in order to favour lighting thereof.

[0006] In order to facilitate lighting of the burner, the sparking head and the nozzle of the pilot lighter should be located in a position which is as far forwards as possible relative to the burner end section. It is obvious, however, that such a position would be the cause of rapid wear of the pilot lighter and in particular of the sparking head which is one of the most costly components of the lighting system. A consequence of this is that the pilot lighter is often located in a position which is offset with respect to the burner, at a distance from the burner end section which is greater than the optimum distance for favouring lighting of the burner.

[0007] It should be pointed out that the arrangement of the pilot lighter in a position which is set too far back from the burner end section hampers lighting of the burner itself, causing undesirable phenomena of excessive smoke generation from the chimney of the thermal power plant. Lighting of the burner is a particularly crucial operation since the thermal power plant must operate on the basis of the load which the users requires from the electric supply network. It is obvious that if lighting does not occur within the time-limits required, the electricity network must be supplied with different sources of electric energy, with a consequent increase in costs and the payment of penalties to the electricity board.

[0008] The technical problem underlying the present invention consists in devising a pilot lighter which has structural and functional characteristics such as to overcome the drawbacks mentioned above with reference to the known art.

[0009] This problem is solved by a pilot lighter of the type described, which is characterised in that the spark generator and the fuel duct are housed inside a tubular casing with a predefined axis and having an intake section, said tubular casing defining a channel supplying the combustion agent for the pilot lighter between said intake section and the lighting end of the pilot lighter, supplying of the combustion agent for the pilot lighter being independent of supplying of the combustion agent for the burner.

[0010] The idea underlying the invention is that of making supplying of the combustion agent for the pilot lighter entirely independent of supplying of the combustion agent to the burner end section.

[0011] Preferably, the intake section is positioned upstream of a register of the wind box which regulates the throughput of the combustion agent to the burner.

[0012] Preferably, the pilot lighter comprises flame stabilising means positioned inside the tubular casing at the lighting end and upstream of the nozzle with respect to the flow of the combustion agent.

[0013] One advantage of the pilot lighter according to the invention lies in the fact that it is able to remain lit even in precarious situations where there is a shortage of air and causes immediate lighting of the burner in any operating situation.

[0014] Further characteristic features and advantages of the pilot lighter according to the invention will emerge from the description of a preferred example of embodiment thereof, provided by way of a non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 shows a perspective and partially sectioned schematic view of a burner comprising a pilot lighter according to the invention;
- Figures 2 to 4 show a partially sectioned perspective view of some details of the pilot lighter according to Figure 1; and
- Figure 5 shows a longitudinally sectioned view of a portion of the pilot lighter according to Figure 1.

[0015] With reference to the abovementioned figures, B generally denotes the burner of a boiler comprising a pilot lighter 6 according to the invention, referred to below as lighter 6.

[0016] The burner B, which is known per se, is housed in a substantially concentric position inside a cylindrical wind box 1 with a predefined axis X-X, shown in Figure 1 by dot-dash lines, and open at one end.

[0017] The wind box 1 is provided with a register 31 by means of which the throughput of combustion air to be conveyed to an end section 2 of the burner B where combustion occurs, is regulated. The end section 2 of the burner B is positioned at the abovementioned open end of the wind box 1.

[0018] The wind box 1 and consequently the burner B as well are housed inside a burner casing denoted by 33.

[0019] At the end section 2 the burner B comprises a swirling device 5 intended to generate a high degree of

turbulence in the combustion air which strikes it. In the example considered, the swirling device 5 takes the form of a disc arranged perpendicularly with respect to the axis X-X and formed by a plurality of inclined vanes 32 which extend radially from a hub keyed onto the end of a tubular support element 4.

[0020] The hub of the swirling device 5 has coaxially inserted inside it an atomisation head 24 in fluid communication with a pipe 3 which extends inside the wind box 1 in the direction X-X and is coaxially located inside the tubular support element 4. The pipe 3 allows the supply of fuel, for example gas oil or fuel oil, to the end section 2 of the burner B and in particular to the atomisation head 24.

[0021] The stream of combustion air which enters the wind box 1 through the register 31 advances in the axial direction X-X towards the end section 2 of the burner B until it collides, at least partly, against the vanes 32 of the swirling device 5, becoming turbulent. At the same time, the fuel supplied via the duct 4 reaches the atomisation head 24 which sprays it. The abovementioned turbulence favours the mixing of the combustion air with the fuel and allows the flame to remain lit at the end section 2 of the burner B.

[0022] Advantageously, the pilot lighter 6 comprises a tubular casing 7 which is preferably rectilinear with an axis A-A and is contained inside the wind box 1 and the casing 33 of the burner so as to be substantially parallel to the direction X-X.

[0023] The tubular casing 7 extends between a lighting end 8, positioned at the end section 2 of the burner B, and a second end 9 located outside the wind box 1 and the burner casing 33.

[0024] The tubular casing 7 has housed inside it, in a substantially concentric position, a duct 11 for supplying a fuel, normally gas oil, fuel oil, natural gas or LPG, to a nozzle 12 located at the lighting end 8 of the pilot lighter. It should be emphasised that the fuel of the pilot lighter 6 may also differ from that used for supplying the burner B.

[0025] The tubular casing 7 contains a spark generator 13 comprising a sparking head 16 located at the lighting end 8, in the immediate vicinity of the nozzle 12. The sparking head 16 is supported by a protection tube 14 axially extending over the entire length of the tubular casing 7 and housing inside it a bipolar cable 15 comprising a pair of current conductors electrically isolated from one another. The two current conductors are connected to the sparking head 16 so that, by applying to them a suitable difference in potential, sparks are produced at the sparking head 16.

[0026] Alternatively, in the case where the protection tube 14 is made of conductor material, it is possible to employ a cable 15 of the single-wire type, using the conductor tube 14 itself as a second electric conductor, provided, obviously, that a suitable dielectric screen is inserted between the current conductor 15 and the tube 14 so as to prevent sparks being produced in zones other than the sparking head 16.

[0027] The protection tube 14 is integrally fixed to the duct 11 by means of a plurality of spacers 17 such that the spark generator 13 is integral with the duct 11.

[0028] Between the internal wall of the tubular duct 7 and the external walls, respectively, of the duct 11 and the protection tube 14 there is defined a channel 25 with a cross-section sufficient to allow the passage, inside the tubular duct 7, of the flow of combustion agent - in the example considered, air - necessary for supplying the pilot lighter during operation thereof. The combustion air is sucked in through an intake section which, in the example, takes the form of an opening 26 formed in the tubular casing 7 of the pilot lighter 6.

[0029] Preferably, the opening 26 is positioned inside the burner casing 33, but upstream of the register 31 of the wind box 1, i.e. in the section of the pilot lighter 6 outside the wind box 1. When the pilot lighter 6 is lit, this enables a pressure to be obtained at the opening 26 greater than at the lighting end 8 of the pilot lighter so as to ensure the flow inside the channel 25 of the required combustion air, without the need for using means such as fans, aspirators and the like.

[0030] The pilot lighter 6 comprises means 18 for slidably supporting and centring the duct 11 and the protection tube 14 inside the tubular casing 7.

[0031] The support means 18 comprise a plurality of sliding elements, which are two in number in the example and indicated by 19, extending along the abovementioned axis A-A. The sliding elements 19 are integral with the duct 11 and rest slidably on the internal wall of the tubular casing 7. Advantageously, the aforementioned sliding elements 19 are of the type with a reduced fluid resistance in order to limit the load losses of the combustion air inside the channel 25.

[0032] The abovementioned means 18 for slidably supporting the duct 11 and the protection tube 14 additionally comprise a piston 20 partially inserted inside the tubular casing 7, from the end 9 thereof, so as to form a sliding piston-and-cylinder combination. This piston-and-cylinder combination ensures the tightness of the tubular casing 7 upstream of the opening 26. The end 21 of the piston 20 has formed in it two openings, indicated by 22 and 23 (Figure 4), inside which the duct 11 and the protection tube 14 of the spark generator 13 are inserted, respectively. The piston 20 is rigidly connected to the duct 11 and to the protection tube 14 so as to be integral therewith during translation.

[0033] Actuating means not shown in the figures and known per se, for example of the pneumatic or hydraulic type, act on the piston 20 so as to move the piston 20 along the axis A-A with respect to the tubular casing 7. This allows the duct 11 and the spark generator 13 integral therewith to be translated between a retracted position where the sparking head 16 and the nozzle 12 are housed inside the tubular casing 7, protected from the flame and the radiation of the burner B, and an advanced position where the nozzle 12 is in the vicinity

of the lighting end 8 of the pilot lighter 6, while the sparking head 16 projects from the abovementioned lighting end 8 (Figure 5).

[0034] The abovementioned piston-and-cylinder combination ensures the tightness of the end 9 of the tubular casing 7 even during the displacements of the duct 11 and the spark generator 13 and at the same time helps ensure centring of them inside the tubular casing 7. Preferably, at the openings 22 and 23, the piston 20 is sealingly connected, for example by means of welding, to the duct 11 and to the protection tube 14 of the spark generator 13, respectively, so as to avoid any leakages.

[0035] The opening 26 has associated with it a shutter 27 sliding between an open position where it is completely retracted from the opening 26, allowing the entry of the combustion air inside the tubular casing 7 and a closed position where it constricts the opening 26. Preferably the shutter 27 constricts the opening 26 leaving free a portion equivalent to 20% of the total opening.

[0036] The shutter 27 is housed inside the tubular casing 7 and is integrally fixed, during translation, to the duct 11 so as to be in the aforementioned open and closed positions when the sparking head 16 and consequently the nozzle 12 are in the aforementioned advanced and retracted positions, respectively. The shutter 27 is in the form of a cylinder segment open at the ends so as not to obstruct the free passage of the air into the channel 25.

[0037] The pilot lighter 6 comprises a flame stabiliser 28 positioned inside the tubular casing 7 at the lighting end 8 so as to generate a high degree of turbulence in the combustion air of the pilot lighter 6 upstream of the nozzle 12.

[0038] Preferably the flame stabiliser 28 is formed by a plurality of inclined vanes, which are five in number in the example and indicated by 29 and which extend radially from a hub 10 towards the tubular casing 7, the hub 10 being keyed onto the end of the duct 11 immediately behind the nozzle 12. The flame stabiliser 28 is therefore integral, during translation, with the duct 11 and the spark generator 13.

[0039] The vane 29 located in correspondence with the protection tube 14 of the spark generator 13 has formed in it a hole 30 inside which the protection tube 14 is inserted.

[0040] With respect to a plane perpendicular to the axis A-A of the tubular casing 7, the vanes 29 are inclined at an angle a which preferably assumes a value of between 35° and 65°. In the present example of embodiment the angle a is about 45°.

[0041] When the burner B is off, the nozzle 12 and the sparking head 16, which constitute the most delicate and costly parts of the pilot lighter 6, are housed inside the tubular casing 7, in the abovementioned retracted position, while the shutter 27 is located in the closed position where the opening 26 is constricted.

[0042] During lighting of the burner B, actuation of the piston 20 causes displacement of the duct 11 and the spark generator 13 from the retracted position to the advanced position and the simultaneous displacement of the shutter 27 into the open position. In this way, the opening 26 is completely free, the nozzle 12 is positioned in the vicinity of the lighting end 8 of the pilot lighter 6 and the sparking head 16 projects from the abovementioned lighting end 8 (Figure 5). The nozzle 12 and the sparking head 16 are thus located in the vicinity of the end section 2 of the burner B.

[0043] Lighting of the pilot lighter 6 is achieved by generating a series of high-energy sparks at the sparking head 16 of the spark generator 13, while the fuel pumped to the nozzle 12 through the duct 11 is sprayed from said nozzle. Lighting of the pilot lighter 6 causes a continuous flow of combustion air into the channel 25 from the opening 26 towards the lighting end 8 of the tubular casing 7. Owing to the effect of the turbulence created by the vanes 29 of the flame stabiliser 28 in the combustion air which flows from the opening 26, the fuel sprayed from the nozzle 12 is finely dispersed in the combustion air, resulting in the formation of an optimum combustion mixture able to ensure prompt and reliable lighting of the pilot lighter 6.

[0044] Lighting of the pilot lighter 6 allows ignition of the combustion mixture of the burner B which is formed downstream of the swirling device 5 and composed of the combustion air sucked in through the register 31 of the wind box 1 and the fuel sprayed from the atomisation head 24, causing lighting of the burner B.

[0045] Once the burner B has been lit, the spark generator 13 and the duct 11 are brought into the abovementioned retracted position so that the sparking head 16 and the nozzle 12 inside the tubular casing 7 are protected from the flame and the radiation of the burner B.

[0046] At the same time the shutter 27 is brought into the closed position where it constricts the opening 26 without closing it completely. Advantageously this allows the flow, through the opening 26, of a quantity of combustion air sufficient to ensure continuous cooling of the sparking head 16 and the nozzle 12.

[0047] The degree of constriction of the opening 26 resulting from the closed position of the shutter 27 may be optimised depending on the type of sparking head and nozzle of the pilot lighter used and hence the throughput of combustion air necessary for ensuring cooling thereof.

[0048] As can be appreciated from the above description, the pilot lighter according to the invention allows the technical problem referred to in the introductory part of the description to be overcome. In particular it allows the combustion agent to be supplied to the lighting end of the pilot lighter entirely independently of the boiler burner, it being possible moreover to use for the pilot lighter a combustion agent different from that used for the burner.

[0049] One advantage of the pilot lighter according to the invention consists in the fact that it may be positioned in an optimum manner with respect to the end

section of the burner so as to ensure lighting of the burner, while being subject at the same time to less wear.

[0050] One further advantage of the pilot lighter according to the invention consists in the fact that it allows better monitoring of the flame produced using the conventional systems and allows a significant reduction in the amount of smoke produced upon lighting of the boilers.

[0051] A further advantage of the pilot lighter according to the invention consists in the fact that it allows the use of high-energy spark generators since the particularly delicate sparking head associated with them may be effectively protected and cooled inside the tubular casing as described further above. The protection of the sparking head and the nozzle is achieved not only by retraction of them with respect to the lighting end of the pilot lighter, but also by the effective cooling ensured by the combustion air which flows through the pilot lighter itself.

[0052] The pilot lighter described above, in order to satisfy additional and contingent requirements, may be subject to numerous modifications and variations carried out by a person skilled in the art, all of which, moreover, are included within the protective scope of the present invention, as defined by the claims below.

[0053] Thus, it is possible to envisage the use of mechanical means such as fans, aspirators and the like for conveying the necessary quantity of combustion agent inside the tubular casing of the pilot lighter. Moreover, the opening through which the combustion agent flows into the pilot lighter may be supplied by a dedicated circuit, if necessary using clean air at an optimum pressure and temperature so as to favour lighting thereof.

[0054] The shutter allowing constriction of the opening of the tubular casing may be operated independently of the spark generator and the nozzle of the pilot lighter.

[0055] Additionally or as an alternative to that described above, the retraction of the igniting head and the nozzle of the pilot lighter may also be obtained with a retraction of the entire tubular casing of the pilot lighter.

[0056] With suitable modifications, the pilot lighter according to the invention may be used as an aid for coal-fired burners, the pilot lighter being able to be adapted to the different types of burners.

Claims

1. Pilot lighter (6) for burners having one lighting end (8) positioned in the vicinity of an end section (2) of a burner (B) housed in a wind box (1), of the type comprising a nozzle (12) supplied by a fuel duct (11) of the pilot lighter (6) and a sparking head (16) of a spark generator (13), characterised in that the spark generator (13) and the fuel duct (11) are housed inside a tubular casing (7) with a predefined axis (A-A) and having an intake section (26), said tubular casing (7) defining a channel (25) for supplying the combustion agent of the pilot lighter (6) between said intake section (26) and the lighting end (8) of the pilot lighter (6), supplying of the combustion agent for the pilot lighter (6) at the lighting end (8) being independent of supplying of the combustion agent to the end section (2) of the burner (B).

2. Pilot lighter (6) according to Claim 1, in which said intake section (26) is positioned upstream of a register (31) of the wind box (1) which regulates the throughput of the combustion agent to the burner (B).

3. Pilot lighter (6) according to Claim 2, in which said intake section comprises an opening (26) positioned in a section of the tubular casing (7) outside the wind box (1) of the burner (B).

4. Pilot lighter (6) according to Claim 1 or 2, in which the intake section (26) has associated with it a shutter (27) movable between an open position and a closed position where said shutter (27) is not engaged and constricts the intake section (26), respectively.

5. Pilot lighter (6) according to Claim 1, comprising flame-stabilising means (28) positioned in the tubular casing (7) at the lighting end (8) and upstream of the nozzle (12) with respect to the flow of the combustion agent.

6. Pilot lighter (6) according to Claim 5, in which said flame-stabilising means (28) comprise a plurality of vanes (29) extending from a hub (10) keyed onto the fuel duct (11) towards the tubular casing (7) and inclined at a predetermined angle (a) with respect to a plane perpendicular to the axis (A-A) of the tubular casing (7).

7. Pilot lighter (6) according to Claim 6, in which said angle (a) assumes a value of between 35° and 65°.

8. Pilot lighter (6) according to Claim 1, comprising means (18) for slidably supporting and centring the fuel duct (11) and the spark generator(13) inside the tubular casing (7) and actuating means for moving along the axis A-A said sparking head (16) and said nozzle (12) between an advanced lighting position where they are close to said lighting end (8) and a retracted position where they are housed inside the tubular casing (7), protected from the flame and the radiation of the burner (B).

9. Pilot lighter (6) according to Claim 9, in which said means (18) for slidably supporting and centring the

fuel duct (11) and the spark generator (13) comprise a plurality of sliding elements (19) integral with the fuel duct (11) and the spark generator (13) and slidably resting on the internal wall of the tubular casing (7).

10. Pilot lighter (6) according to Claim 9, in which the sliding elements (19) of said plurality are of the type with reduced fluid resistance, in order to limit the load losses of the combustion agent in the channel (25).

11. Pilot lighter (6) according to Claims 4 and 8, in which the shutter (27) is integral, during translation, with the spark generator (13) and the fuel duct (11), the open and closed position of the shutter (27) corresponding to the advanced and retracted position of the spark generator (13) and the fuel duct (11), respectively.

12. Pilot lighter (6) according to Claim 8 or 9, in which said means (18) for slidably supporting and centring the fuel (11) and the spark generator (13) comprise a piston (20) inserted inside the tubular casing (7) at the opposite end to the lighting end (8) so as to form a piston-and-cylinder combination which ensures the tightness of the tubular casing (7) upstream of the intake section (26), the fuel duct (11) and the spark generator (13) being integral, during translation, with the piston (20) and being axially inserted inside the tubular casing (7) through respective openings (22, 23) formed in the end section (21) of the piston (20).

13. Pilot lighter (6) according to Claim 1, in which the intake section (26) is supplied via a dedicated circuit with a combustion agent at an optimum pressure and temperature for favouring lighting of the flame.

14. Pilot lighter (6) according to Claim 1, comprising mechanical means for conveying the combustion agent into the tubular casing (7) through the intake section (26).

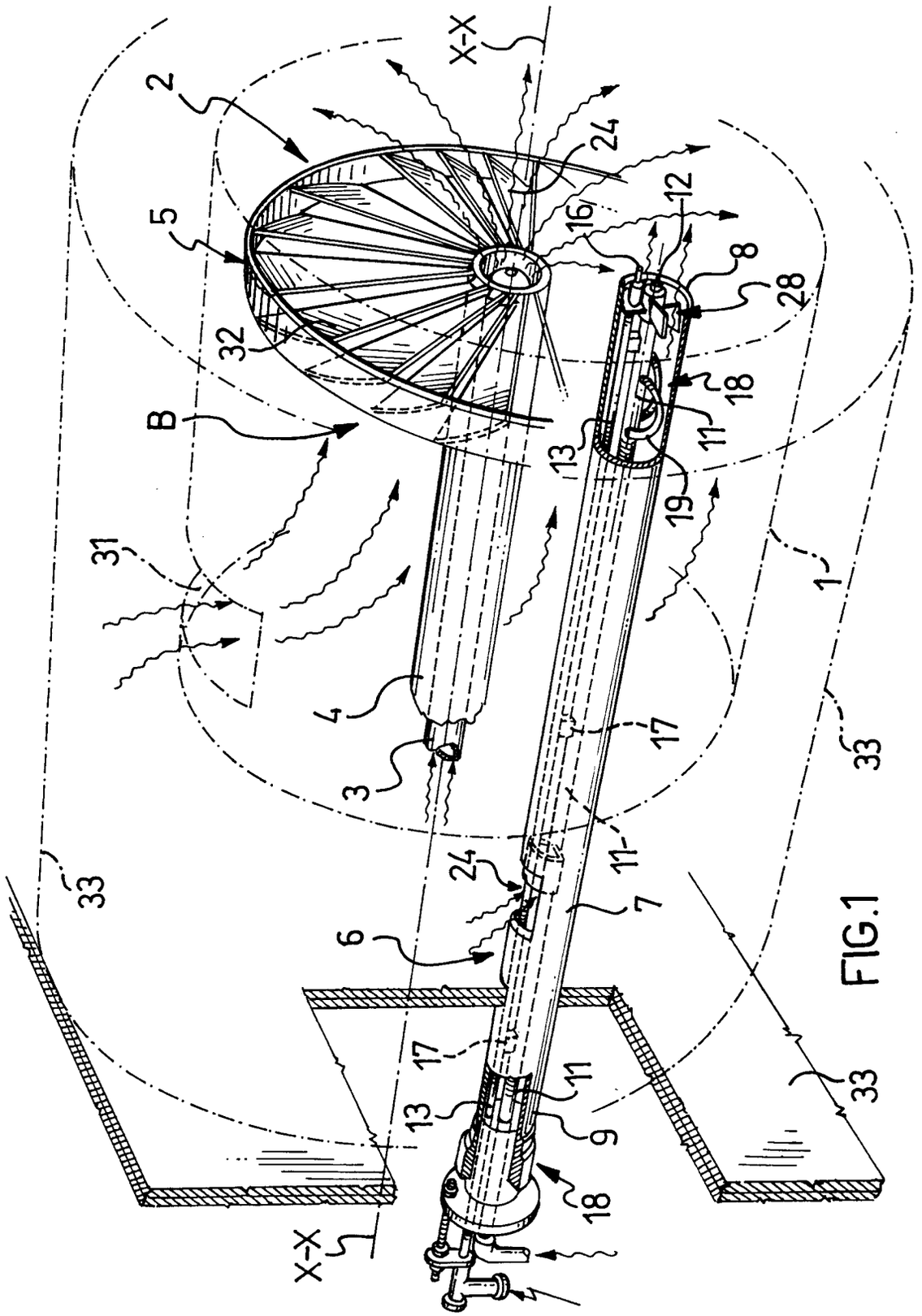
X-X
2
24
5
16
12
8
28
32
18
B
11
13
19
31
1
4
17
3
33
24
11
7
6
17
11
13
9
18
X-X
33

FIG.1

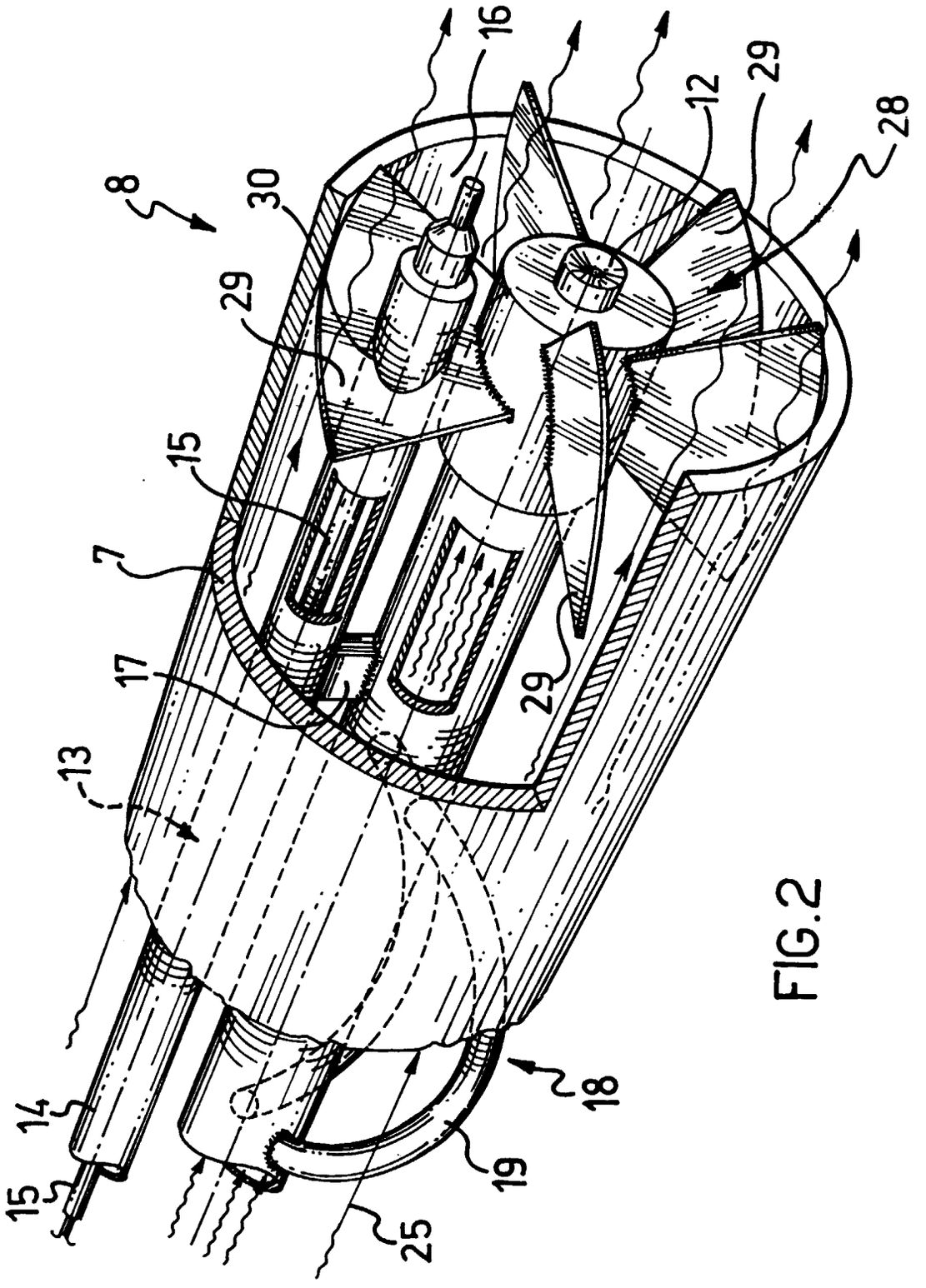

FIG.2

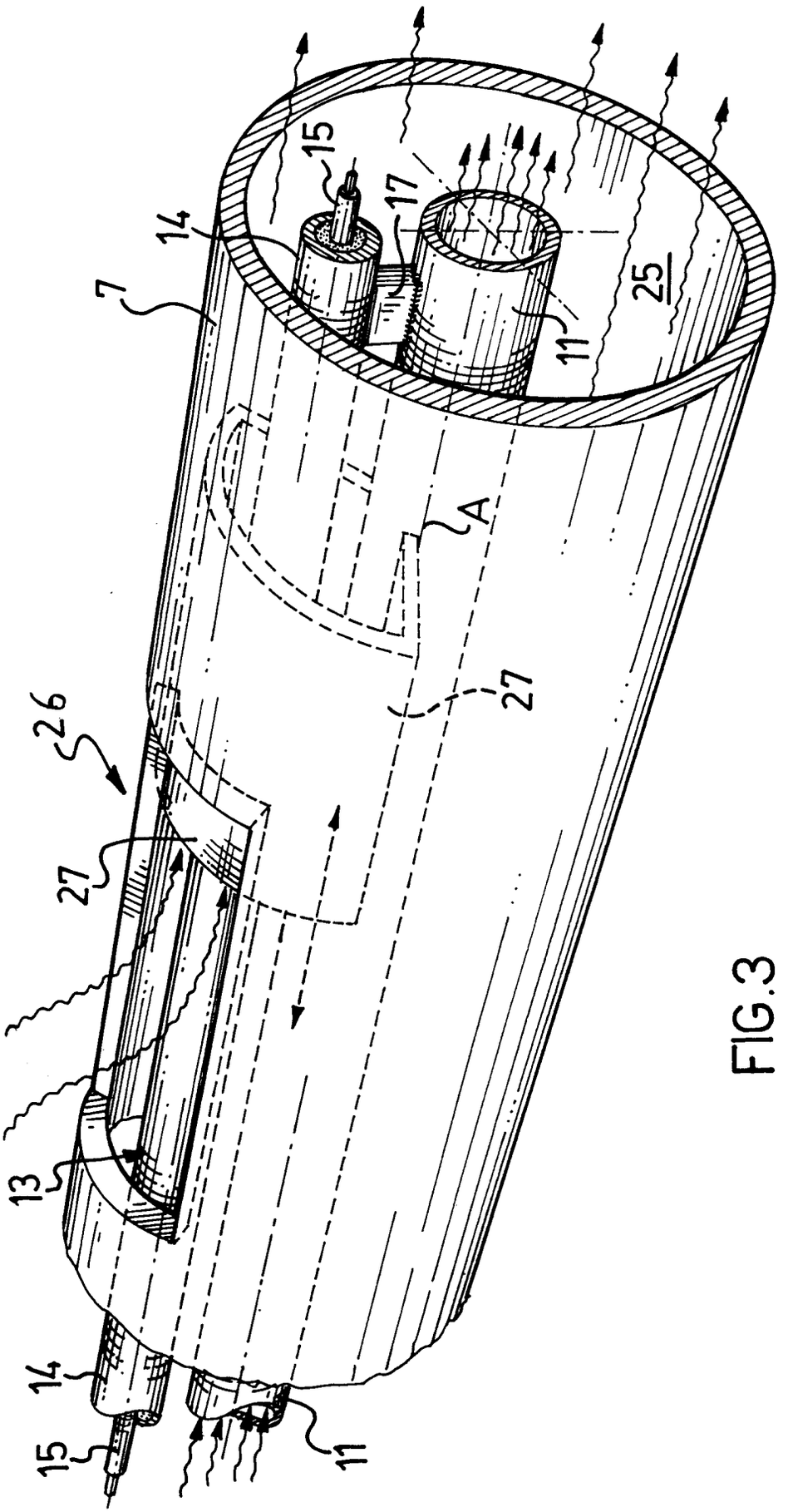

FIG.3

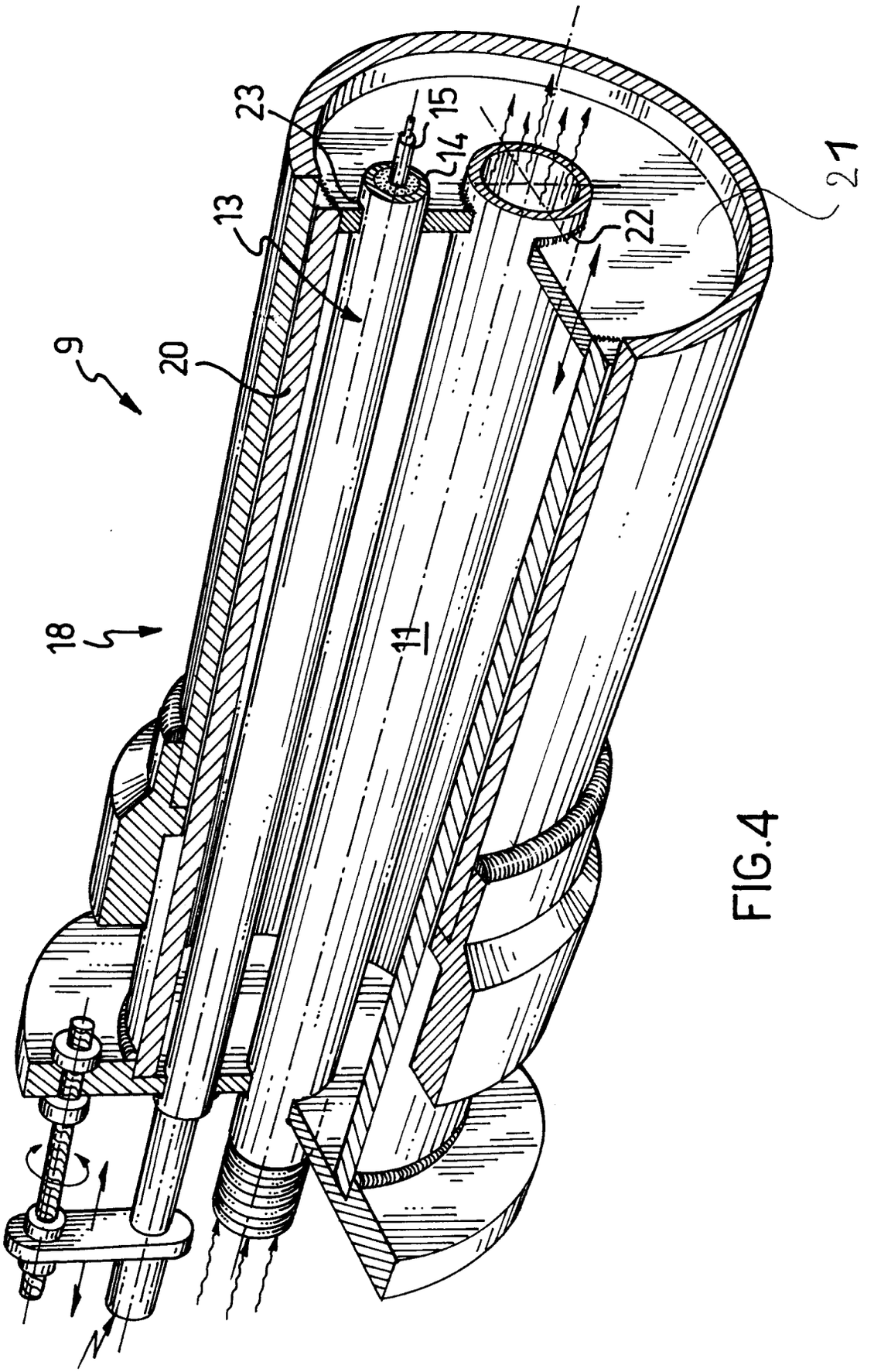

FIG.4

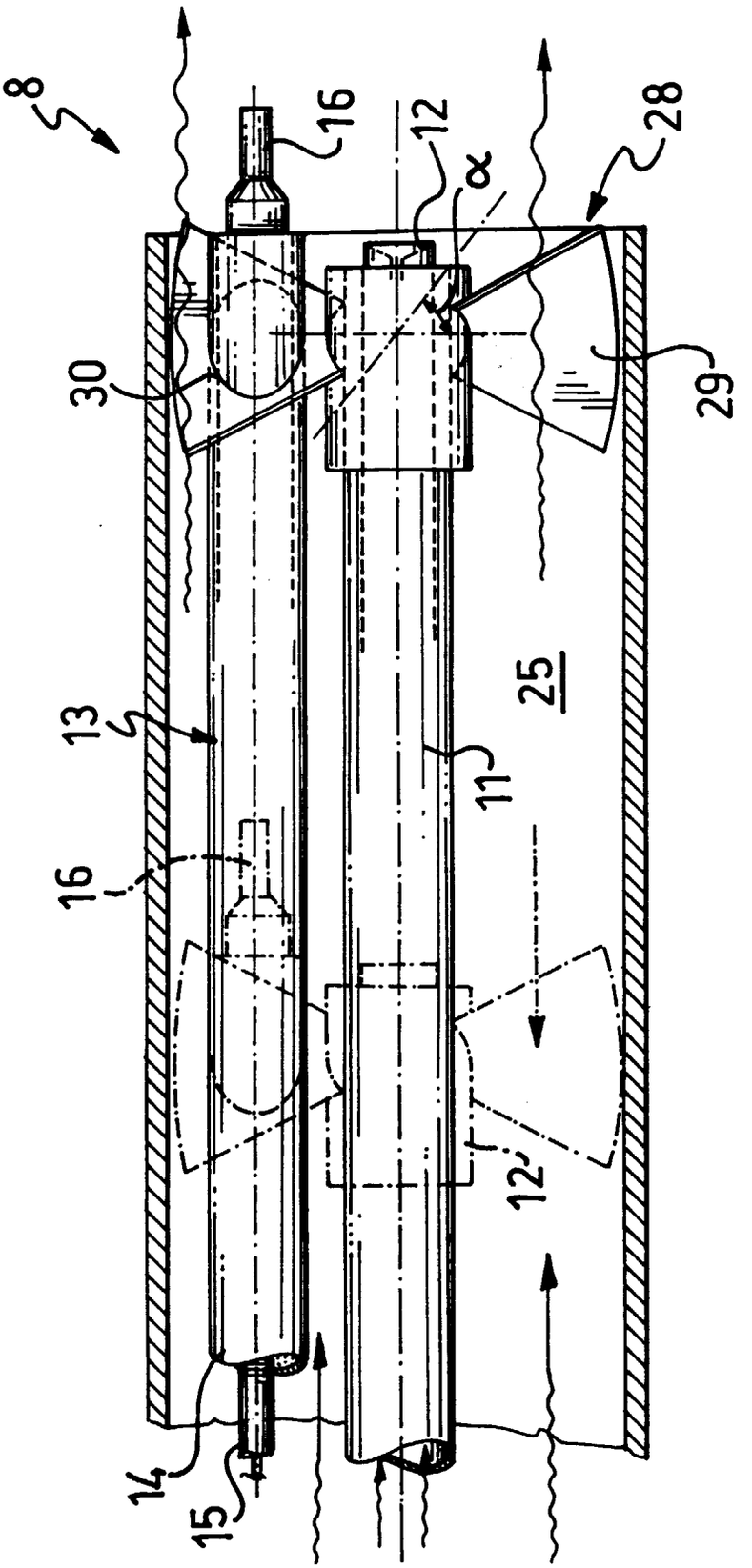

FIG.5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 83 0439

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB 751 217 A (BABCOCK & WILCOX) * the whole document *	1-3,8, 12,14	F23Q3/00 F23Q9/04 F23D23/00
X	US 2 689 000 A (MUSAT) * column 4, line 5 - line 69; figures 1-4 *	1-3,8,12	
X	US 3 168 133 A (ZOSCHAK) * the whole document *	1-3	
X	DE 11 37 163 B (KROMSCHRÖDER) * the whole document *	1	
A	US 4 595 355 A (GARRELFS) * column 3, line 10 - line 20; figure 2 *	5,6	
A	US 4 230 445 A (JANSSEN HERMANN J)		
A	US 4 610 625 A (BUNN RICHARD L)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F23Q
F23D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 February 1998	Vanheusden, J

CATEGORY OF CITED DOCUMENTS

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