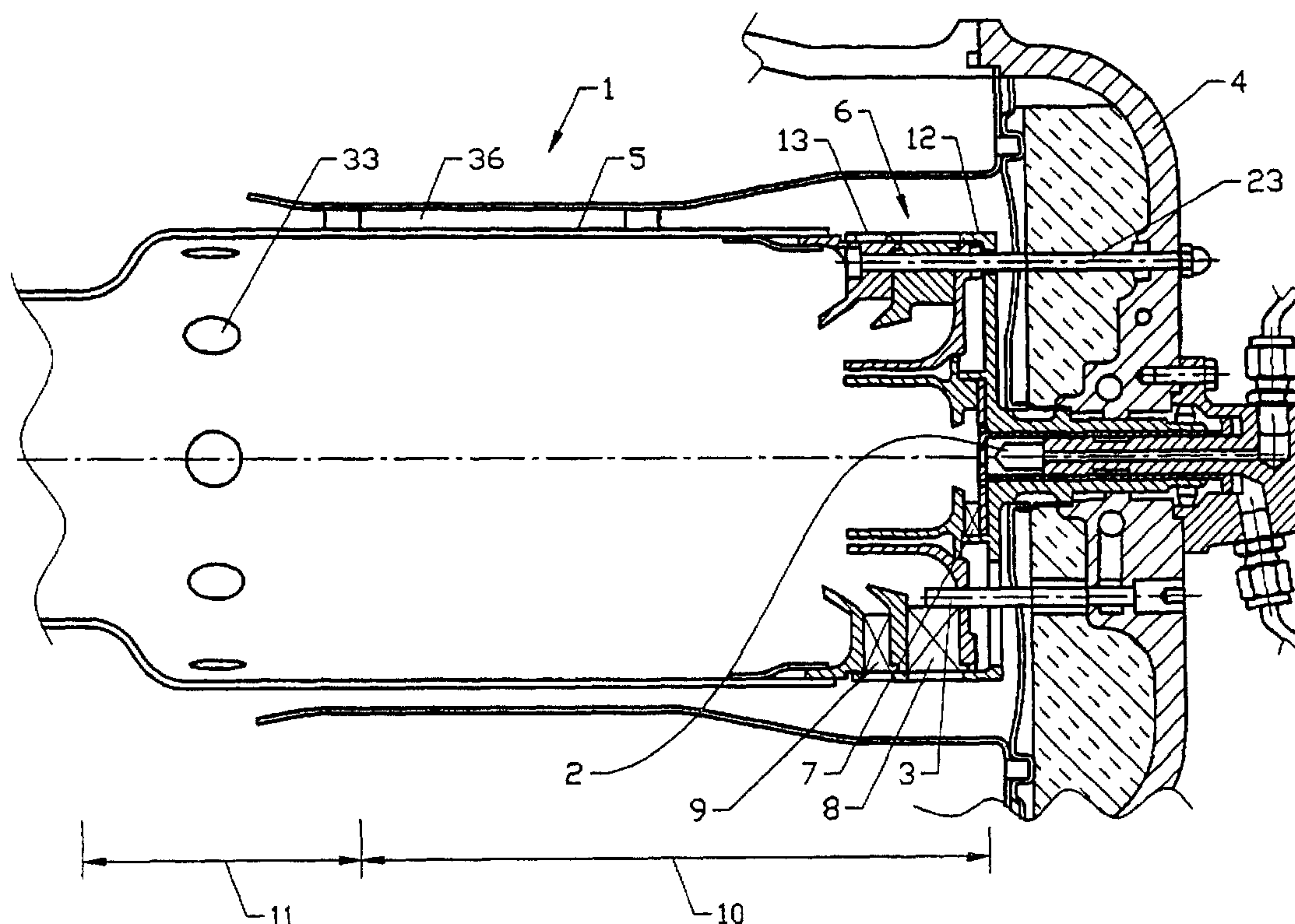




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(54) Titre : DISPOSITIF POUR LA CHAMBRE A COMBUSTION D'UNE TURBINE A GAZ
(54) Title: A DEVICE FOR A COMBUSTION CHAMBER OF A GAS TURBINE



(57) Abrégé/Abstract:

The invention relates to a device for a combustion chamber (1) in a gas turbine for controlling the intake of gas to the combustion zone (10, 11) of the combustion chamber. The device comprises a control element (12) which is arranged outside the combustion chamber and which in turn comprises a means (13) for covering at least one inlet to the combustion zone, the cover means being displaceable in relation to the combustion chamber. The device further comprises a means (16) connected to the cover means for supporting the control element. The means of support (16) is accommodated in a structure (4) at the rear of the combustion chamber (1).



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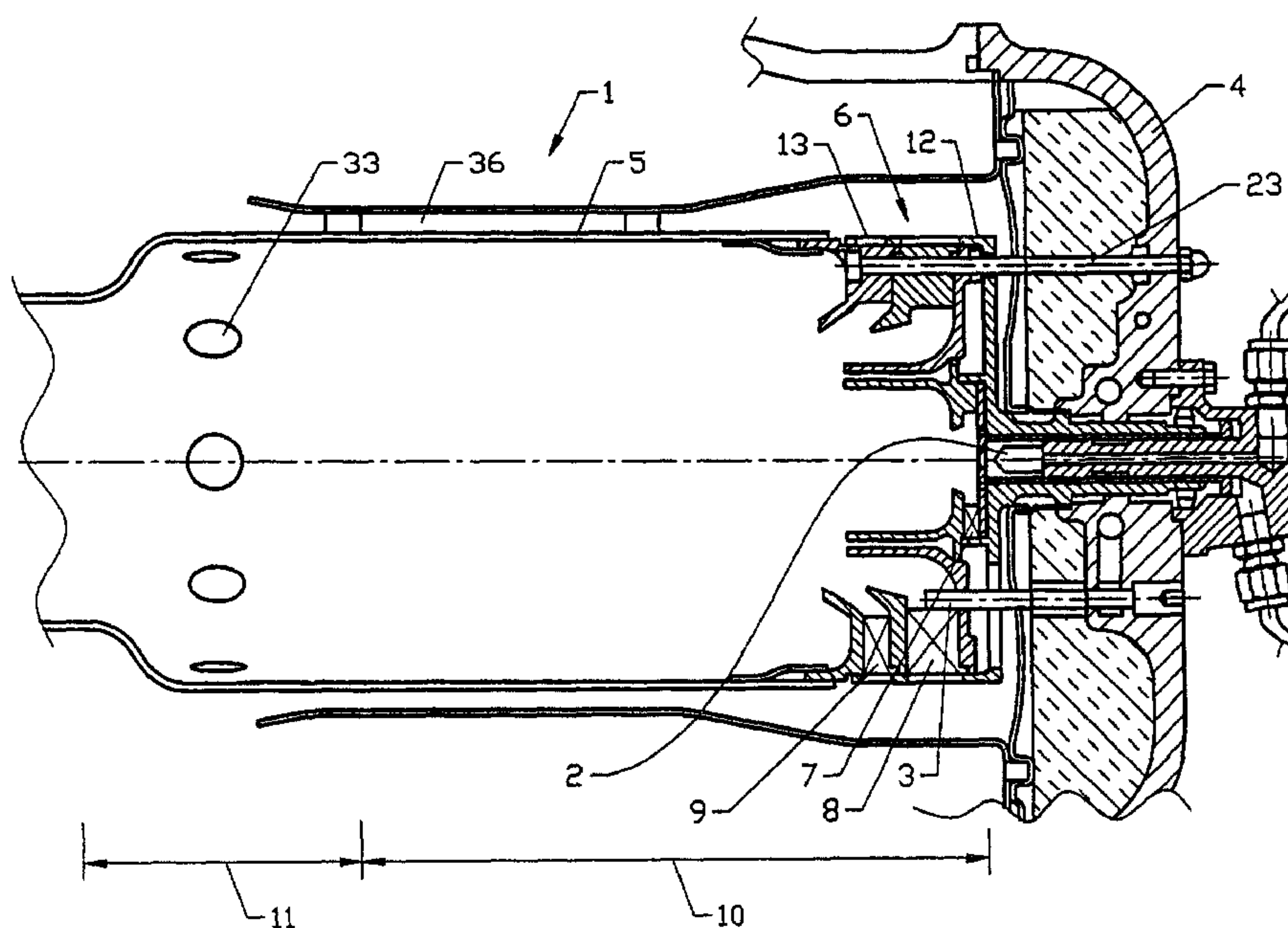
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(54) Title: A DEVICE FOR A COMBUSTION CHAMBER OF A GAS TURBINE



(57) Abstract: The invention relates to a device for a combustion chamber (1) in a gas turbine for controlling the intake of gas to the combustion zone (10, 11) of the combustion chamber. The device comprises a control element (12) which is arranged outside the combustion chamber and which in turn comprises a means (13) for covering at least one inlet to the combustion zone, the cover means being displaceable in relation to the combustion chamber. The device further comprises a means (16) connected to the cover means for supporting the control element. The means of support (16) is accommodated in a structure (4) at the rear of the combustion chamber (1).



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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A device for a combustion chamber of a gas turbine5 BACKGROUND OF THE INVENTION AND DESCRIPTION OF THE PRIOR
ART

The present invention relates to a device for a
combustion chamber of a gas turbine for controlling the
intake of gas into the combustion zone of the combustion
10 chamber, the device comprising a control element which
is arranged outside the combustion chamber and which in
turn comprises a first means of covering at least a
first inlet to the combustion zone, the said means being
displaceable in relation to the combustion chamber, and
15 a means of supporting the control element connected to
the cover means.

The term gas turbine relates to a unit which comprises
at least one turbine and a compressor driven thereby,
20 together with a combustion chamber. Gas turbines are
used, for example, as engines for vehicles and aircraft,
as prime movers for ships and in electricity-generating
power stations.

25 The gas delivered to the combustion chamber by way of
the inlet is usually air, but other gases are also
conceivable.

One or more fuel distributors or fuel injectors are
30 arranged in the combustion chamber. The term combustion
zone relates to a section in proximity to and at least
substantially in front of the fuel distributor(s) in the
longitudinal direction of the combustion chamber. The
combustion zone is in turn usually divided up into

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primary zone and dilution zone in the direction away from the fuel distributor.

In order to be able to bring about combustion with low
5 emissions, it is desirable to have the facility for
controlling the temperature in the primary zone of the
combustion chamber, so that it lies within a certain
range. This is achieved by using various types of
control device to control the air flow whilst it is
10 being delivered to the primary zone and/or the dilution
zone.

US 4,944,149 describes a device for a combustion chamber
for controlling the air intake to the dilution zone of
15 the combustion chamber, with the object of reducing NOx
emissions. The device comprises a rotatable ring, which
extends around the combustion chamber in the intended
dilution zone thereof. The ring has a plurality of
through-openings and the combustion chamber wall has
20 correspondingly shaped openings. By bringing the ring
openings over the openings in the combustion chamber
wall, ducts are formed for the air from the outside to
the inside of the combustion chamber. A temperature
sensor is provided for controlling the rotation of the
25 ring. Due to the very high temperature around the
combustion chamber, the constituent parts of the device
are subject to great stress, which means that the device
has a relatively short service life.

30 SUMMARY OF THE INVENTION

An object of the invention is to provide a device for
controlling the intake of air to a combustion chamber of
a gas turbine which creates the prerequisites for
greater operating reliability than in the state of the

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art. It is further intended to provide a device having an increased service life.

5 This object is achieved in that the means of support are accommodated in a structure at the rear of the combustion chamber. Such a construction means that the control element can be accommodated in a relatively cool part of the gas turbine.

10 According to a preferred embodiment of the invention the structure in which the means of support is accommodated forms part of the combustion chamber cover. When the gas turbine is in operation, the combustion chamber cover has a considerably lower temperature than the wall of
15 the combustion chamber or the flame tube. The temperature of the flame tube wall is usually 5 to 10 times higher than the temperature of the combustion chamber cover.

20 According to another preferred embodiment of the invention the means of support is accommodated in the said structure at least largely concentrically in relation to the center line of the combustion chamber. This creates the prerequisites for a simple and reliable
25 control of the control element.

According to another preferred embodiment of the invention the means of support is accommodated in the said structure radially outside a pilot distributor to
30 the combustion chamber. The pilot distributor is usually arranged so that it extends forwards from the combustion chamber cover into the combustion chamber, along a center line through the combustion chamber. The pilot distributor is therefore arranged in an opening through

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the combustion chamber cover in an extension of the combustion chamber center line and the said opening is therefore suitable for receiving the means of support.

5 According to another preferred embodiment of the invention the first cover means has at least one recess, which extends at least largely radially through the wall thereof. This creates the prerequisites for a simple and reliable control unit construction. The said recess
10 in the cover means is preferably designed, together with the said first inlet to the combustion chamber, to form a continuous duct for the gas from a position outside the combustion chamber to the inside of the combustion chamber.

15 According to a further embodiment, which is a development of the preceding embodiment, the first cover means comprises at least two sets of the said recesses, and a first set of the said sets of recesses is arranged
20 at a distance from the second set of recesses in the longitudinal direction of the combustion chamber. The prerequisites are thereby created for controlling the air intake to two sets of so-called swirls in the combustion chamber, which are arranged at a distance
25 from one another in the longitudinal direction of the combustion chamber. These swirls are a type of vortex generator for the air and are formed by a plurality of inclined vanes.

30 Further preferred embodiments of the invention and advantages thereof are set out in the following description and the patent claims.

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BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in more detail below with reference to the embodiments shown on the drawings attached, in which

- 5 FIG 1 shows a partially cut-away side view of the combustion chamber of the gas turbine with the control element in a first embodiment,
- FIG 2 shows an enlarged side view of the control element support on the combustion chamber cover,
- 10 FIG 3 shows a perspective view of the control element,
- FIG 4 shows a further side view of the control element and in particular the control unit mechanism, and
- FIG 5 shows a schematic representation of a second
- 15 embodiment of the control element.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

- Fig 1 shows a partially cut away side view of a combustion chamber 1. The combustion chamber represents
- 20 a so-called low-emission combustion chamber. The combustion chamber comprises a pilot distributor 2, which is arranged centrally, and a plurality, for example five main distributors 3 arranged around the pilot distributor 2. The inside of the combustion
- 25 chamber 1 is defined by a combustion chamber cover 4, a flame tube 5 and a section 6, arranged between the combustion chamber cover 4 and the flame tube 5, for the inlet of air to the inside of the combustion chamber 1.

30

The pilot distributor 2 and the main distributors 3 are arranged in the combustion chamber cover 4 and open out into the inside of the combustion chamber 1. Three so-called swirls 7-9 are arranged in the air inlet section

- 6 -

6. These swirls 7-9 are a type of vortex generator for the inlet air and are formed by a plurality of inclined vanes arranged in an annular shape. The swirls 7-9 are intended to force the inlet air to rotate, which means
5 that when it enters the inside of the combustion chamber it is impelled radially outwards. The hot combustion gases thereby recirculate towards the center and are responsible for a continuous re-ignition of the fuel. The air inlet section 6 more specifically comprises a
10 primary swirl 7, a secondary swirl 8 and a tertiary swirl 9. The primary swirl 7 is arranged centrally for guiding the air to or around the pilot distributor 2. The secondary swirl 8 is arranged around the main distributors 3 for guiding the air to or around the
15 latter. The tertiary swirl 9 is arranged in front of the secondary swirl 8 in the longitudinal direction of the combustion chamber 1.

The fuel to be used is in liquid form. Low emissions can
20 be achieved when the fuel is burnt in gaseous form, higher emissions occurring when the fuel is burnt in droplet form. The emissions are made up, for example, of CO, NOx and unburned HC.

25 The main distributors 3 are used in normal operation and are designed for combustion of the fuel in vaporized form. The pilot distributor 2 is designed to heat up the combustion chamber 1 when starting up a cold engine, so that it is then possible to produce a
30 working flame with the main distributors 3. The fuel from the pilot distributor 2, on the other hand, is burned in liquid form, in the form of droplets.

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The combustion zone of the combustion chamber 1 is usually divided into primary zone 10 and dilution zone 11 in the direction away from the fuel distributors.

5 A control element 12, see also figure 3, is arranged outside the combustion chamber 1 and interacting with the inlets to the said swirls 7-9 with the object of controlling the temperature inside the combustion chamber. The control element 12 is more specifically
10 designed to guide the air flow as it is being delivered to the primary zone and/or the dilution zone. The air flows in a space 36, or a duct, which is situated radially outside the combustion chamber 1. By means of the control element 12 the air can be guided to the
15 inlet to the swirls 7-9 and/or to a number of dilution holes 33 downstream.

The control element 12 comprises a first means 13 for covering at least a first inlet to the combustion zone,
20 see also figure 3. The first cover means 13 is in the shape of a ring or sleeve, which extends around the first inlets to the secondary and the tertiary swirls 8,9. The ring 13 is provided with two sets of recesses 14,15. Each of the sets 14,15 comprises a plurality of
25 recesses in the form of through-openings, which are arranged at a distance from one another in the circumferential direction of the ring. A first set of recesses 14 is arranged at a distance from the second set of recesses 15 in the axial direction of the ring.
30 The control element 12 is designed to be set to two limit positions corresponding to the inlet fully closed and inlet fully open, and to be continuously adjustable in positions between the limit positions for partial closure of the inlets.

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The control element 12 further comprises a means 16, connected to the ring 13, for supporting the control element, see also figure 2 and 3. The means of support
5 16 has a circular cross-sectional shape and more specifically the shape of a tube, or a sleeve. The center line of the circular means of support 16 and the center line of the annular, first cover means 13 coincide. The means of support 16 is further offset in
10 an axial direction in relation to the first cover means 13. The circular means of support 16 has a smaller outside diameter than the annular, first cover means 13 and they are connected to one another by a spoke structure 17. The spoke structure 17 extends in a plane
15 at right angles to the center line of the control element 12. The air to the primary swirl 7 is intended to flow in through the openings between the spokes of the spoke structure.

20 The control element 12 further comprises an annular section 18 having a smaller diameter than the ring 13, see also figure 3. The annular section 18 is arranged radially inside the ring 13. The annular section 18 is provided with a third set of recesses 19 and is intended
25 for controlling the inlets to the primary swirl 7.

The means of support 16 is accommodated in the combustion chamber cover 4, which is arranged at the rear of the combustion zone of the combustion chamber 1,
30 see figure 2. This means that the means of support is accommodated in a relatively cool part of the gas turbine. In a normal operating situation the temperature can reach 150° in the combustion chamber cover and 800° in the combustion chamber wall near the swirls 7-9. The

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control element 12 is more specifically accommodated radially outside the pilot distributor 2. The means of support 16 for the control element 12 extends around the pilot distributor 2 and is supported against the combustion chamber cover 4 by its radially outer surface 20. The support comprises slide or roller bearings 21. That is to say there is a gap between the means of support 16 and the pilot distributor 2.

10 The combustion chamber cover 4 contains a section 22 of insulating material. The fact that the insulating section 22 is arranged between the bearing 21 and the outlets of the fuel distributors 2, 3 means that the area of the support is relatively cool.

15

The swirls 7-9 are fixed to the combustion chamber cover by a fastener 23 in the form of a bolt, see figure 1. The fact that the control element 12 and the swirls 7-9 are respectively supported in and connected to the same structure (the combustion chamber cover) means that they can be centered in relation to one another with great accuracy and any thermal expansion problems can be minimized. This improves the facilities for highly accurate control.

25

A control mechanism 24 is shown in figure 4. The control mechanism 24 comprises a first rotatable arm 25, which extends through the combustion chamber cover 4. A second arm 26 is fixed to the first arm 25 at an inner end thereof and extends at right angles therefrom. The second arm 26 has a pin 27 at its free end. The said pin 27 is arranged in a groove 28, see also figure 3, in the control element 12 and more specifically in the spoke structure 17. The control

30

- 10 -

mechanism further comprises an adjusting device 29, which is coupled to the first arm 25 on a rear side of the combustion chamber cover 4 relative to the combustion chamber 1. The adjusting device 29 is
5 designed for turning the arm 25, so that the control element 12 is thereby also turned. Alternatively the turning function can also be achieved by means of a linkage system. The adjusting device 29 in this instance comprises an electric motor, but may also
10 consist of a hydraulic or pneumatic adjusting device.

Figure 5 shows a second embodiment of the control element 12', which is a variant of the first embodiment. The control element 12' according to the
15 second embodiment differs from the control element 12 according to the first embodiment in that the control element 12' comprises a further, second cover means 30 in the form of a ring or sleeve, see dashed marks. The second cover means 30 is arranged around the flame tube
20 5 of the combustion chamber 1 at a distance from the first cover means 13 in the longitudinal direction of the combustion chamber 1 and more specifically in the dilution zone 11 of the combustion chamber.

25 The annular cover means 30 has a set of through-openings 32, which are arranged at a distance from one another in the circumferential direction of the ring and are intended to interact with a number of other inlets 33 to the combustion chamber in the form of so-
30 called dilution holes.

The ring 30 is connected to the ring 13 by at least one link 31. Each of the rings 13, 30 has at least one extended section 34, 35, which extend towards one

- 11 -

another. These extended sections 34,35 are connected to one another by the linkage 31.

The second embodiment of the control element is particularly advantageous if it is intended to redistribute the air between primary and dilution zone with a slight variation in the overall pressure gradient. The openings in the rings 13,30 are offset in relation to their corresponding inlet in such a way that when control adjustment occurs the swirl inlets to the swirls 7-9 are exposed whilst the dilution holes 33 are covered over, and vice versa. The fact that the ring 30 is connected by the linkage 31 to the ring 13 furthermore means that the lower part of the flame tube 5 is permitted to move somewhat away from the center without the parts impinging on one another.

The invention must not be regarded as being limited to the exemplary embodiments described above, a number of further variants and modifications being feasible without departing from the scope of the following patent claims.

The means of support 16 described and the first cover means 13 comprise a ring or tube of continuous circumference, but the scope of the invention also encompasses those of broken circumference. Nor are any holes necessary in an axial direction for the means of support 16, which can also feasibly be formed by a solid shaft.

The control element 12 can also be arranged so that it is displaceable in an axial direction instead of being

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rotatable about the center line of the combustion chamber.

5 The spoke structure 17 of the control element 12 must only be regarded as one example and may be replaced, for example, by some other type of wall structure or framework having through-holes or openings.

10 Furthermore, the low-emission combustion chamber described above must only be regarded as an example of an application and in no way limits the scope of the invention.

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CLAIMS

1. A device for a combustion chamber (1) in a gas turbine for controlling the intake of gas to the combustion zone (10,11) of the combustion chamber, the device comprising a control element (12, 12') arranged outside the combustion chamber which in turn comprises a first means (13) for covering at least a first inlet to the combustion zone, which cover means is displaceable in relation to the combustion chamber, and a means (16) of support for the control element which is connected to the cover means,

characterized in that

the means of support (16) is accommodated in a structure (4) at the rear of the combustion chamber (1) and that the means of support (16) is accommodated in the said structure at least largely concentrically with the combustion chamber center line.

2. The device as claimed in claim 1,

characterized in that

the structure (4) in which the means of support (16) is accommodated forms at least part of the combustion chamber cover.

25

3. The device as claimed in claim 1 or 2,

characterized in that

the means of support (16) is accommodated in the said structure radially outside a pilot distributor (2) to the combustion chamber.

30

4. The device as claimed in claim 3,

characterized in that

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the means of support (16) extends around the pilot distributor (2) and that the means of support is supported against the structure by its radially outer surface (20).

5

5. The device as claimed in any of the preceding claims,
characterized in that

the means of support (16) has a circular cross-sectional shape.

10

6. The device as claimed in any of the preceding claims,
characterized in that

the first cover means (13) has at least one recess (14,15) which extends at least largely in a radial direction through the wall thereof.

15

7. The device as claimed in claim 6,

characterized in that

the said recess (14,15) in the first cover means (13) is designed, together with the said first inlet to the combustion chamber, to form a through-duct for the gas from a position outside the combustion chamber to the inside of the combustion chamber.

20

25 8. The device as claimed in claim 7,

characterized in that

the first cover means (13) comprises at least two sets of the said recesses and that a first set of the said sets of recesses (14) is arranged at a distance from the second set of recesses (15) in the longitudinal direction of the combustion chamber.

30

9. The device as claimed in any of claims 6 to 8,

- 15 -

characterized in that

the control element (12,12') comprises an annular cover section (18) for covering further inlets to the combustion zone of the combustion chamber (1), that the cover section (18) is arranged at a lesser distance from the center line of the control element than the first cover means (13), and that the cover section (18) is provided with at least one recess (19).

10 10. The device as claimed in any of claims 6 to 9,

characterized in that

the first cover means (13) is in the shape of a ring with the said recess (14,15) extending through the wall of the ring.

15

11. The device as claimed in any of the preceding claims,

characterized in that

the first cover means (13) is rotatable in relation to the combustion chamber wall.

20

12. The device as claimed in any of the preceding claims,

characterized in that

25 the means of support (16) and the first cover means (13) are fixed to one another.

13. The device as claimed in any of the preceding claims,

30 **characterized in that**

the control element (12,12') is rotatable in relation to the radially outer structure (4).

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14. The device as claimed in any of the preceding claims,

characterized in that

5 the first cover means (13) is arranged at a greater radial distance from a central axis through the control element (12,12') than is the means of support (16).

15. The device as claimed in any of the preceding claims,

10 **characterized in that**

the said first inlet in the combustion chamber wall, which the control element (12) is intended to control, forms a gas inlet to at least one swirl (8,9) arranged in the combustion chamber.

15

16. The device as claimed in any of the preceding claims,

characterized in that

20 the control element (12') comprises a second cover means (30), which is designed to cover at least a second inlet (33) to the combustion zone, the second inlet being arranged at a distance from the said first inlet in the longitudinal direction of the combustion chamber (1).

25 17. The device as claimed in claim 16,

characterized in that

the second cover means (30) has at least one recess (32) which extends at least largely in a radial direction through the wall thereof.

30

18. The device as claimed in claim 17,

characterized in that

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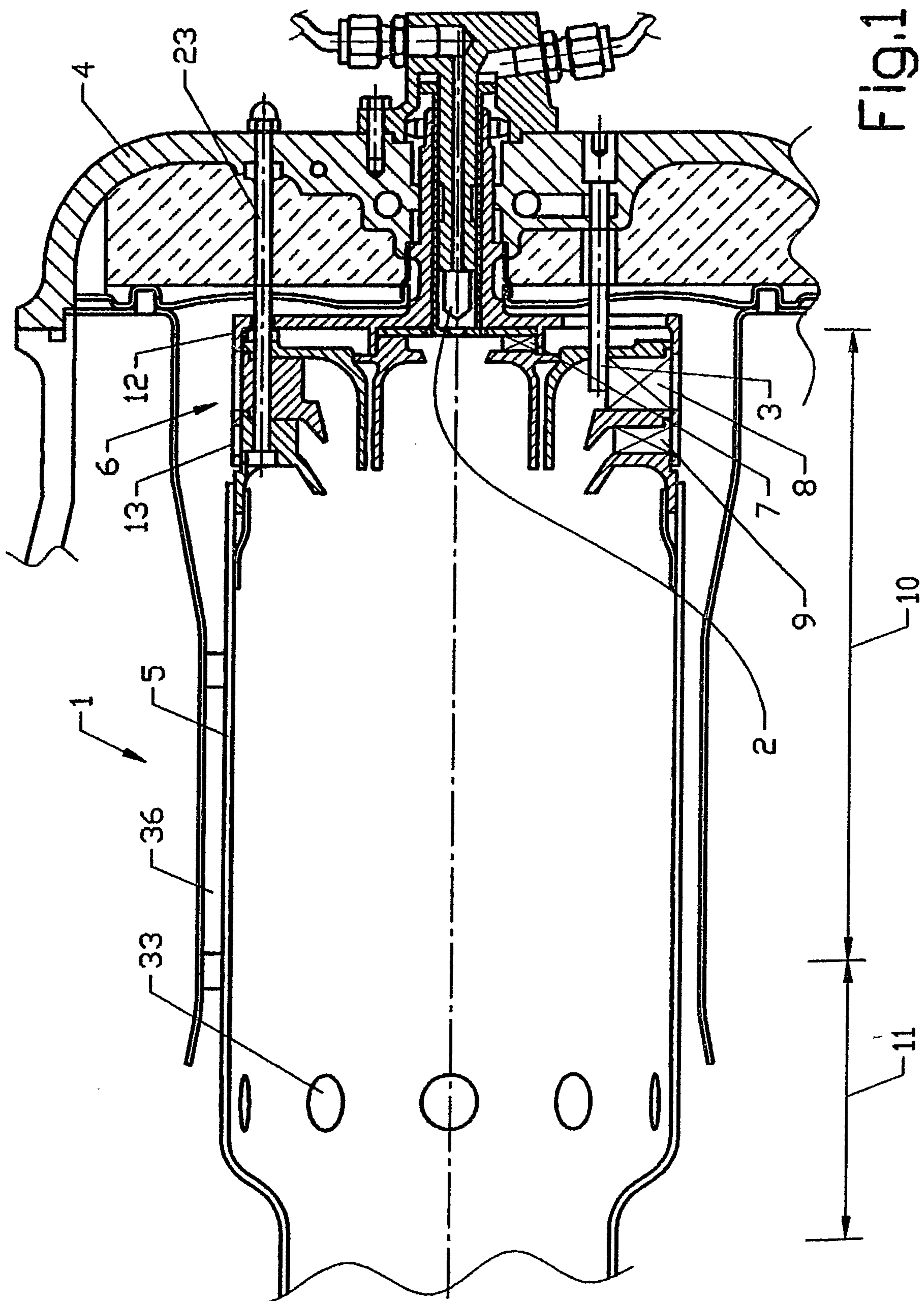
the said recess (32) in the second cover means (30) is designed, together with the said second inlet (33) to the combustion chamber, to form a through-duct for the gas from a position outside the combustion chamber to
5 the inside of the combustion chamber.

19. The device as claimed in claim 17 or 18,
characterized in that
the second cover means (30) is in the shape of a ring
10 with the said recess (32) extending through the wall of the ring.

20. The device as claimed in any of claims 16-19,
characterized in that
15 the second cover means (30) is rotatable in relation to the combustion chamber wall.

21. The device as claimed in claim 20,
characterized in that
20 the second cover means (30) is connected to the first cover means (13) by at least one arm (31,34,35).

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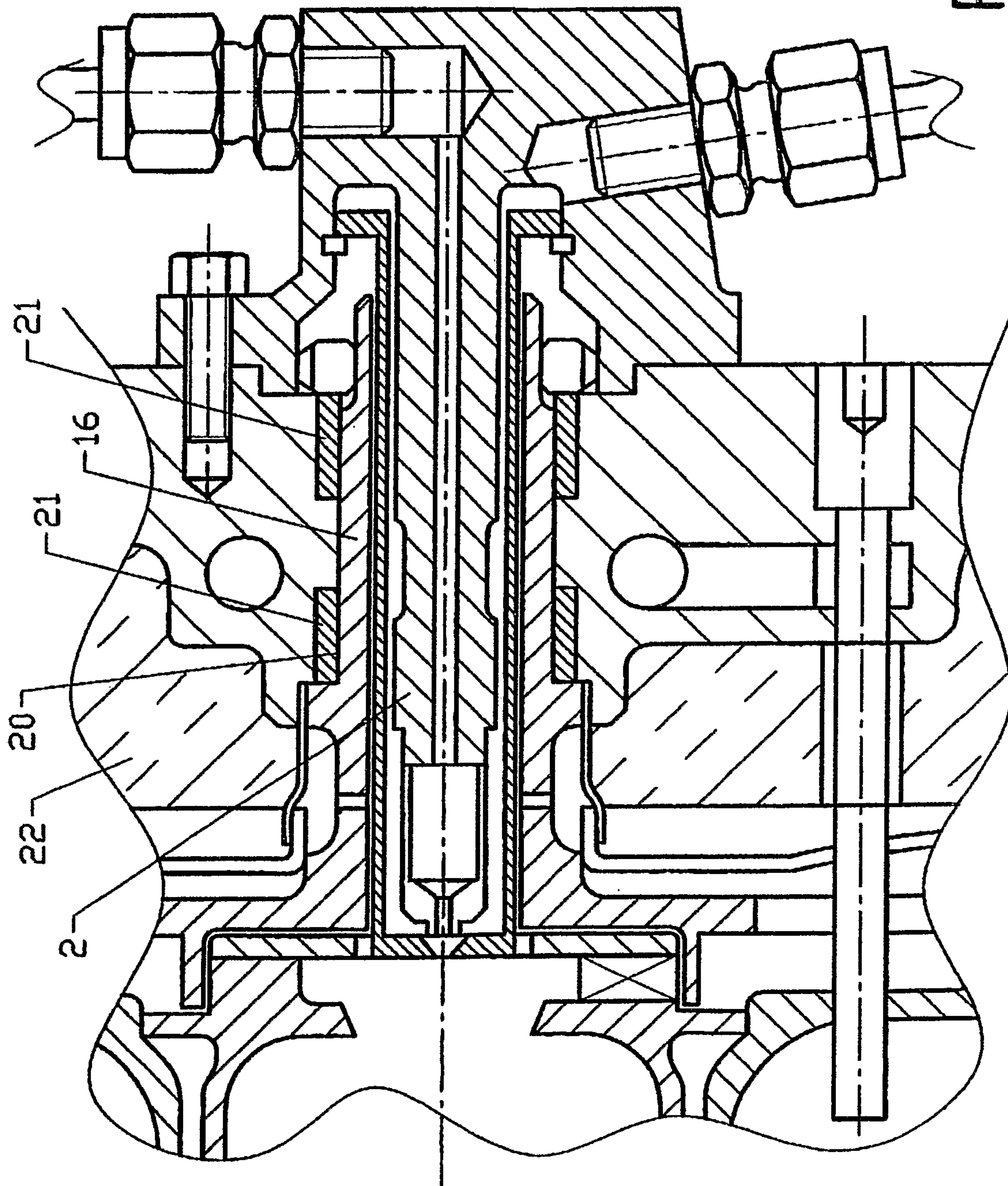
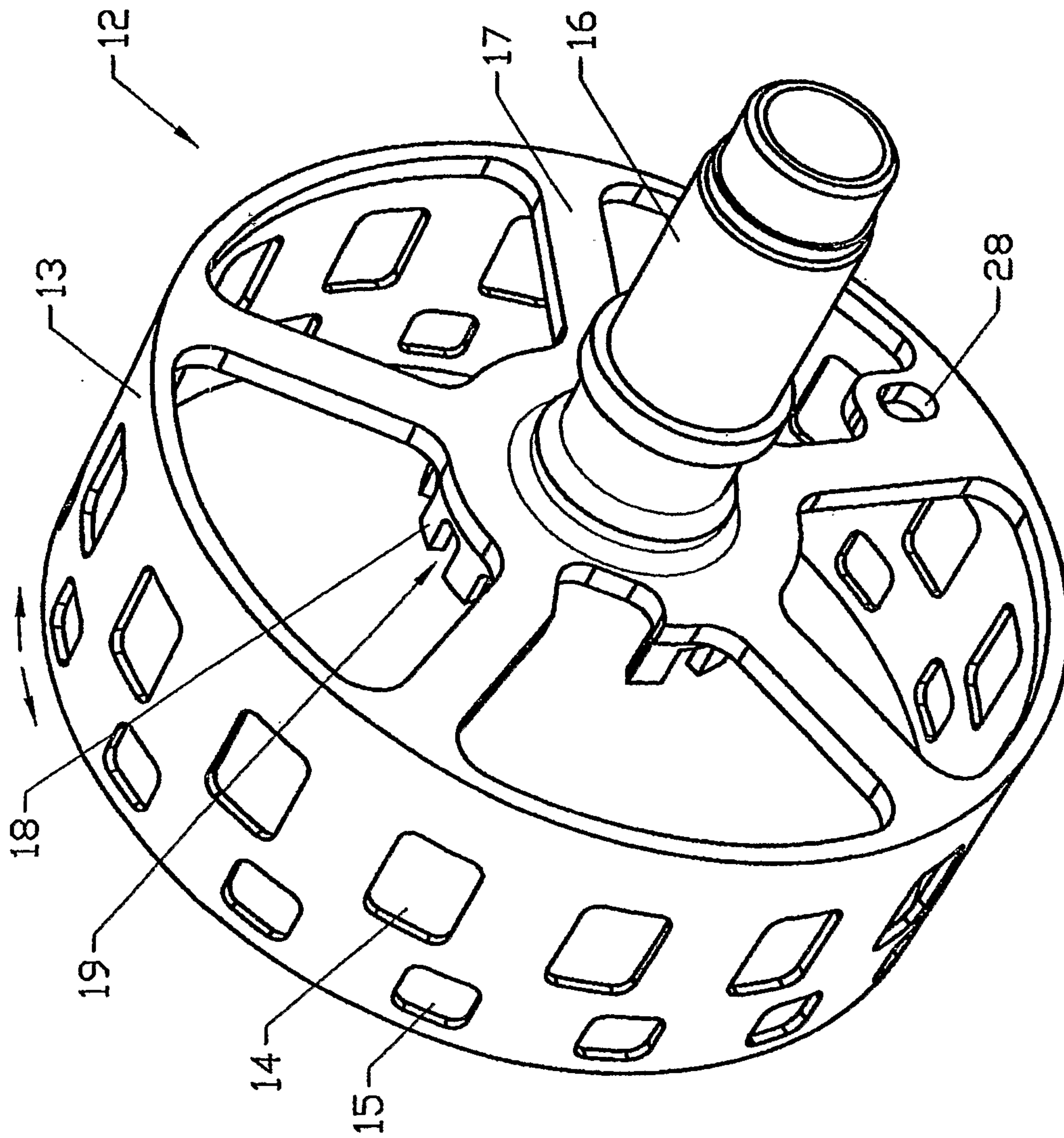


Fig. 2

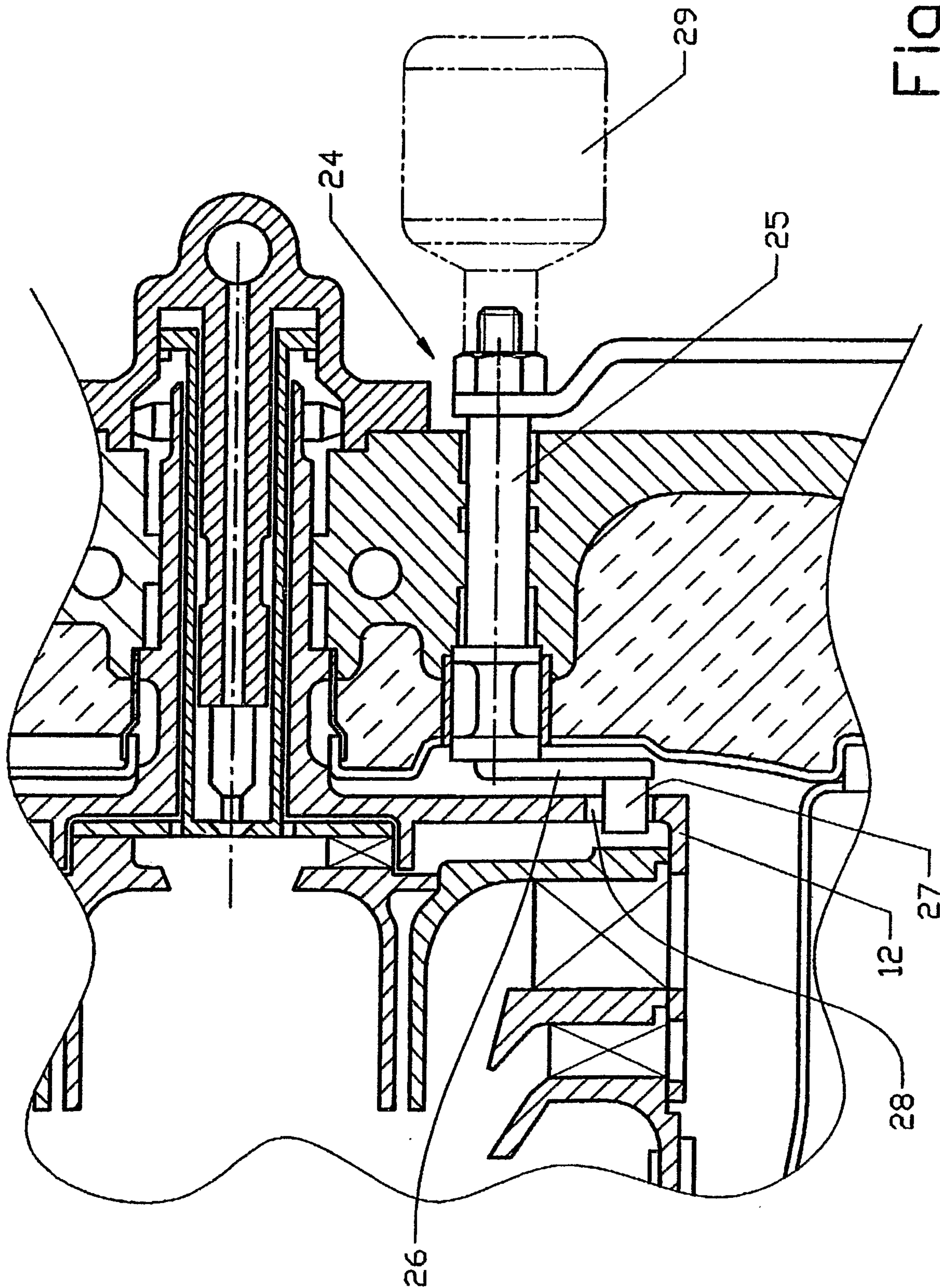
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Fig. 3



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Fig. 4



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