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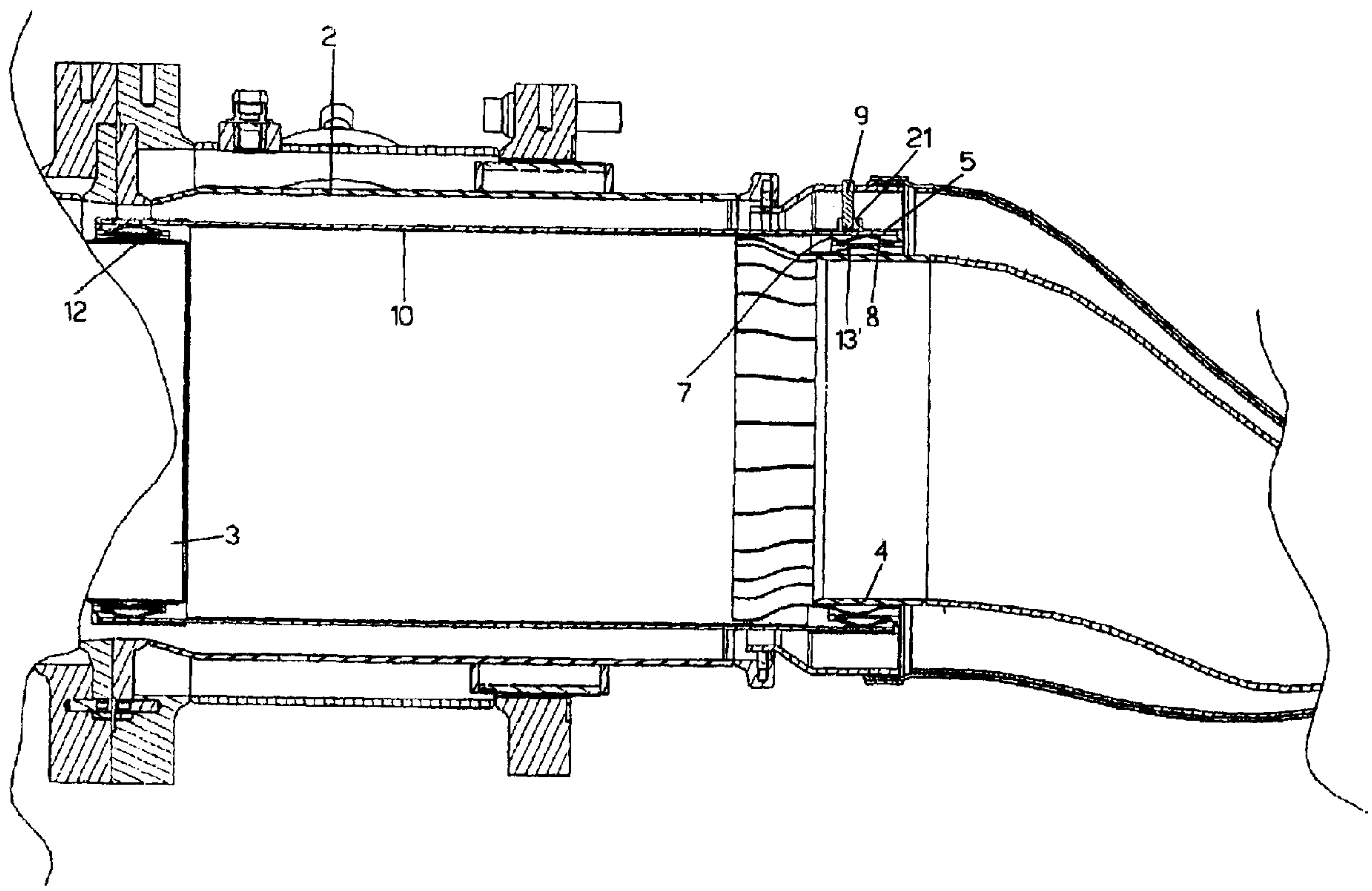

(57) Abrégé/Abstract:
Fixing system (1), inside the combustion chamber of a gas turbine with low polluting emissions, of a liner or flame pipe equipped with two cylindrical elastic heads (5) each wedged at the end of the flame pipe (10) to allow its thermal expansion by lowering the thermal tensions due to the different expansion coefficient with the combustion chamber.

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FIXING SYSTEM OF A FLAME PIPE OR LINER

ABSTRACT

Fixing system (1), inside the combustion chamber of a gas turbine with low polluting emissions, of a liner or flame pipe equipped with two cylindrical elastic heads (5) each wedged at the end of the flame pipe (10) to allow its thermal expansion by lowering the thermal tensions due to the different expansion coefficient with the combustion chamber.

FIXING SYSTEM OF A FLAME PIPE OR LINER

The present invention relates to a fixing system for a flame pipe or liner, in particular a system for fixing a flame pipe or liner inside a combustion chamber of a gas turbine with low polluting emissions.

As is known, gas turbines are machines consisting of a compressor and a turbine with one or more phases, wherein the compressor and turbine are connected to each other by a rotating shaft and wherein, between the compressor and the turbine, there is a combustion chamber.

Air from the outside environment is fed to the compressor to bring it under pressure.

The pressurized air passes through a duct, terminating with a convergent portion, inside which a series of injectors feeds fuel which is mixed with the air to form an air-fuel mixture to be burnt.

The fuel necessary for producing combustion, which causes an increase in the temperature and enthalpy of the gas, is therefore introduced into the combustion chamber by means of one or more injectors, fed by a pressurized network.

Finally, the high temperature and high pressure gas reaches the various phases of the turbine, through specific ducts, which transforms the gas enthalpy into mechanical energy available for a user.

It is known that in the engineering of combustion chambers for gas turbines, the main considerations are dedicated to flame stability and control of the excess air to bring the combustion under ideal conditions and minimize the production of polluting substances.

More specifically, the known art envisages the use of a flame pipe or liner inside the combustion chamber, which has two main functions.

In the first place, the flame is contained inside the pipe to prevent its contact with the outer parts of the combustion chamber, in order to avoid overheating.

Secondly, the pipe slows down and diffuses the flow of combustion products preventing the flame from being extinguished.

The flame pipe according to the known art is made of a metallic material, thus making it easy to fix inside the chamber and making it compatible, with respect to the tensional states generated by the thermal expansion, with the other structural components of the combustion chamber also made of metallic material.

As a result of their limited mechanical characteristics under heat, however, the traditional liners or flame pipes have limits in reaching high combustion temperatures and require a high quantity of cooling air passing through them. The high quantity of cooling air required by metallic liners negatively influences the separation of the exhaust emissions.

In order to overcome these drawbacks, liners or flame pipes made of a composite material with a ceramic matrix, such as silicon carbide, have been proposed.

These liners allow the following results to be obtained: an increase in the combustion temperature and consequently in the yield of gas turbines, a decrease in the cooling air in the combustion area thus facilitating the production of low emissions and, finally, an increase in the useful life of the components subjected to high temperatures.

These liners or flame pipes are installed inside the combustion chamber, through sleeves made of a metallic material, situated at the ends of the liner and in turn, fixed, by means of welding or other known means, to metallic portions of the combustion chamber.

The different thermal expansion coefficient between the ceramic material and metal can, however, cause dangerous tensional states in the thermal expansion phase, which can jeopardize the resistance of the ceramic material and its duration with time.

Furthermore, the fixing means so far envisaged, do not protect the ceramic material of the liner from the damaging scratching thereon of the metallic connecting portions of the combustion chamber.

An objective of the present invention is therefore to provide a fixing system for flame pipes inside the combustion chamber, which overcomes the problems of traditional fixing systems.

A further objective of the present invention is to provide a fixing system which allows tensional states due to different thermal expansion coefficients between the liner and contact portions of the combustion chamber to be eliminated or in any case reduced.

Another objective of the present invention is to prevent the liner made of ceramic material from being harmfully scratched on the metallic portions of the combustion chamber.

Yet another objective of the present invention is to provide a fixing system for liners which is simple, functional and at reduced production and maintenance costs.

Substantially, a fixing system inside the combustion chamber of a gas turbine with low polluting emissions of a liner or flame pipe, according to the present invention, comprises at least two cylindrical elastic heads, each wedged at the end of the flame pipe to allow its thermal expansion by lowering the thermal tensions due to the different expansion coefficient between the liner and the combustion chamber.

According to the present invention, the two cylindrical heads are advantageously situated, one between the burner and flame pipe and the other between the flame pipe and flow conveyor, respectively.

According to another aspect of the present invention, the cylindrical elastic heads comprise at least two parallel notches, arranged longitudinally with respect to the flame pipe, and at least one ring-shaped housing connectable to an end of the flame pipe.

According to another aspect of the present invention, the cylindrical elastic heads comprise first circumferential springs situated inside the ring-shaped housing.

According to one aspect of the present invention, there is provided a fixing system for fixing a liner inside a combustion chamber of a gas turbine including a liner being situated between and fixed to a burner at one end and a flow conveyor at an opposite end, by a cylindrical elastic head at each end of the liner. Each head further includes a ring-shaped housing having first and second pluralities of radially spaced, axially extending teeth with a groove between said first and second pluralities of teeth. Each end of the liner is received within the groove of each head. Each cylindrical elastic head may include a first circumferential spring situated inside the groove.

According to an alternative aspect of the invention, each cylindrical head may include at least one spike which is inserted into at least one radial hole of the heads for locking the liner.

According to yet another aspect of the invention, the system may include at least two second cylindrical springs which act in a radial direction, of which the first is situated between the burner and the liner and the second is situated between the liner and the flow conveyor and the two second cylindrical springs contact an outer surface of the head. The second spring may have a sinusoidal form.

The characteristics and advantages of a fixing system of a flame pipe or liner according to the present invention, will appear more evident from the following illustrative and non-limiting description referring to the enclosed schematic drawings, in which:

figure 1 is a longitudinal sectional view of a flame pipe or liner fixed in a combustion chamber for gas turbines with the fixing system according to the present invention;

figure 2 is a longitudinal sectional view of an alternative embodiment of a flame pipe or liner according to the present invention;

figure 3 is a perspective view of a cylindrical elastic head according to the present invention;

figure 4 shows another partially sectional perspective view of the cylindrical elastic head of figure 3; and

figure 5 is an enlarged detail taken from figure 1.

With reference to figures 1 and 2, these illustrate a combustion chamber, indicated as a whole with 2, of a gas turbine, inside which a flame pipe or liner 10, according to the present invention, is fixed. The flame pipe 10 has a cylindrical structure and is connected at one of its ends to the burner 3 and at the other end to a flow connector or conveyor 4 for the turbine.

More specifically, in order to allow an increase in the internal combustion temperature, the flame pipe 10 is made of a composite material with a ceramic matrix.

The flame pipe 10 according to the present invention is preferably made of silicon carbide.

The insertion of a flame pipe or liner made of composite material, such as that described above, requires a specific fixing system suitable for allowing the liner 10 to thermally expand without creating tensional states which could jeopardize the resistance of the ceramic material and its duration over a period of time. A similar fixing system must also eliminate harmful scratching between the ceramic material and the metallic components of the combustion chamber 2.

For this purpose, the fixing system is equipped with two cylindrical elastic heads 5 whose dimensions are such as to allow them to be wedged or frictionally engaged, as shown in figures 1, 2 and 5, onto the opposite ends of the liner 10.

In particular, the cylindrical elastic heads 5 are wedged onto the opposite ends of the liner 10 thanks to appropriate ring-shaped housings provided with grooves 7 whose size corresponds to that of the end of the liner 10 on which they are inserted.

The two cylindrical elastic heads 5, normally made of a metallic material, are equipped along their circumference, as shown in figures 3 and 4, with a series of notches 6 arranged in parallel to define an inner and an outer series of teeth 15, attached at an end to the ring-shaped housing. The radially spaced inner and outer series of teeth form the groove 7 in which the end of the liner 10 is received, while the notches 6 allow the expansion of the liner 10, in a radial direction.

Spikes or beads 9 which fit into pass-through radial holes 21 of the head 5 are provided for locking the heads 5 onto the liner 10, in order to prevent an angular sliding between the head 5 and liner 10.

The cylindrical elastic heads 5, more clearly visible in figures 3, 4 and 5, are each equipped with a cylindrical spring 8 capable of attenuating, during the thermal expansion, the tensions due to the different material between the metallic head 5 and liner 10 and exerting pressure on the internal surface of the liner 10, capable of locking the head 5 on the liner 10.

More specifically, there is a cylindrical elastic spring 8 for each head 5, situated inside the ring-shaped housing provided with grooves 7, which protrudes on the internal surface of the liner 10.

The spring 8 is produced as a part of an internal surface of the housing.

In order to avoid scratching in an axial direction between the liner 10 of composite material with a ceramic matrix and the connecting metallic components of the combustion chamber, such as the flow conveyor 4 and burner 3, the fixing means comprise second cylindrical springs 12, 13.

More specifically, the cylindrical spring 12 is situated in correspondence with an end of the liner 10, between the burner 3 and the liner 10, so as to rest, in order to exert its fixing action, on the outer surface of the cylindrical head 5, creating a metal-metal contact.

The other cylindrical spring 13, on the other hand, is situated in correspondence with the other end of the liner 10, between the flow conveyor 4 and the liner 10, so as to rest, in order to exert its fixing action, on the outer surface of the cylindrical head 5, also in this case creating a metal-metal contact.

Figure 2 illustrates an alternative embodiment of the flame pipe or liner 10 according to the present invention completely analogous to that described above except for the fact that it has a section with a constant diameter and requires, for fixing it onto the flow conveyor 4, a particular cylindrical spring 13' with a sinusoidal profile.

The description clearly indicates the characteristics of an improved fixing system of a flame pipe or liner for a combustion chamber of a gas turbine with low polluting emissions, object of the present invention, as also the relative advantages, among which the following can be mentioned:

- possibility of installing liners made of composite material having a different thermal expansion coefficient with respect to the combustion chamber;

- attenuation of the tensional states;

- elimination of harmful scratching between the connection parts of the combustion chamber and the liner made of ceramic material;

- simple and reliable use;

- relatively low production and maintenance costs, with respect to the known art.

Finally, numerous modifications and variations can obviously be applied to the fixing system thus conceived, all included within the scope of the invention.

Furthermore, all the details can be substituted by technically equivalent elements.

In practice the materials used, as also the forms and dimensions can vary according to the technical demands which arise each time.

The protection scope of the invention is therefore defined by the enclosed claims.

WHAT IS CLAIMED IS:

1. A fixing system for fixing a liner inside a combustion chamber of a gas turbine comprising:

a liner (10) being situated between and fixed to a burner (3) at one end and a flow conveyor (4) at an opposite end, by a cylindrical elastic head (5) at each end of said liner (10), each said head (5) further comprising a ring-shaped housing having first and second pluralities of radially spaced, axially extending teeth (15), with a groove (7) between said first and second pluralities of teeth (15), wherein each end of said liner (10) is received within said groove (7) of each said head (5).

2. The fixing system according to claim 1, characterized in that each said cylindrical elastic head (5) comprises a first circumferential spring (8) situated inside said groove (7).

3. The fixing system according to claim 1 or 2, characterized in that each said cylindrical head comprises at least one spike (9) which is inserted into at least one radial hole (21) of said head (5) for locking said liner (10).

4. The fixing system (1) according to claim 3, characterized in that it further comprises at least two second cylindrical springs (12, 13, 13'), which act in a radial direction, of which the first (12) is situated between said burner (3) and said liner (10) and the second (13, 13') is situated between said liner (10) and said flow conveyor (4), and said two second cylindrical springs contact an outer surface of said head (5).

5. The fixing system (1) according to claim 4, characterized in that said second spring (13') has a sinusoidal form.

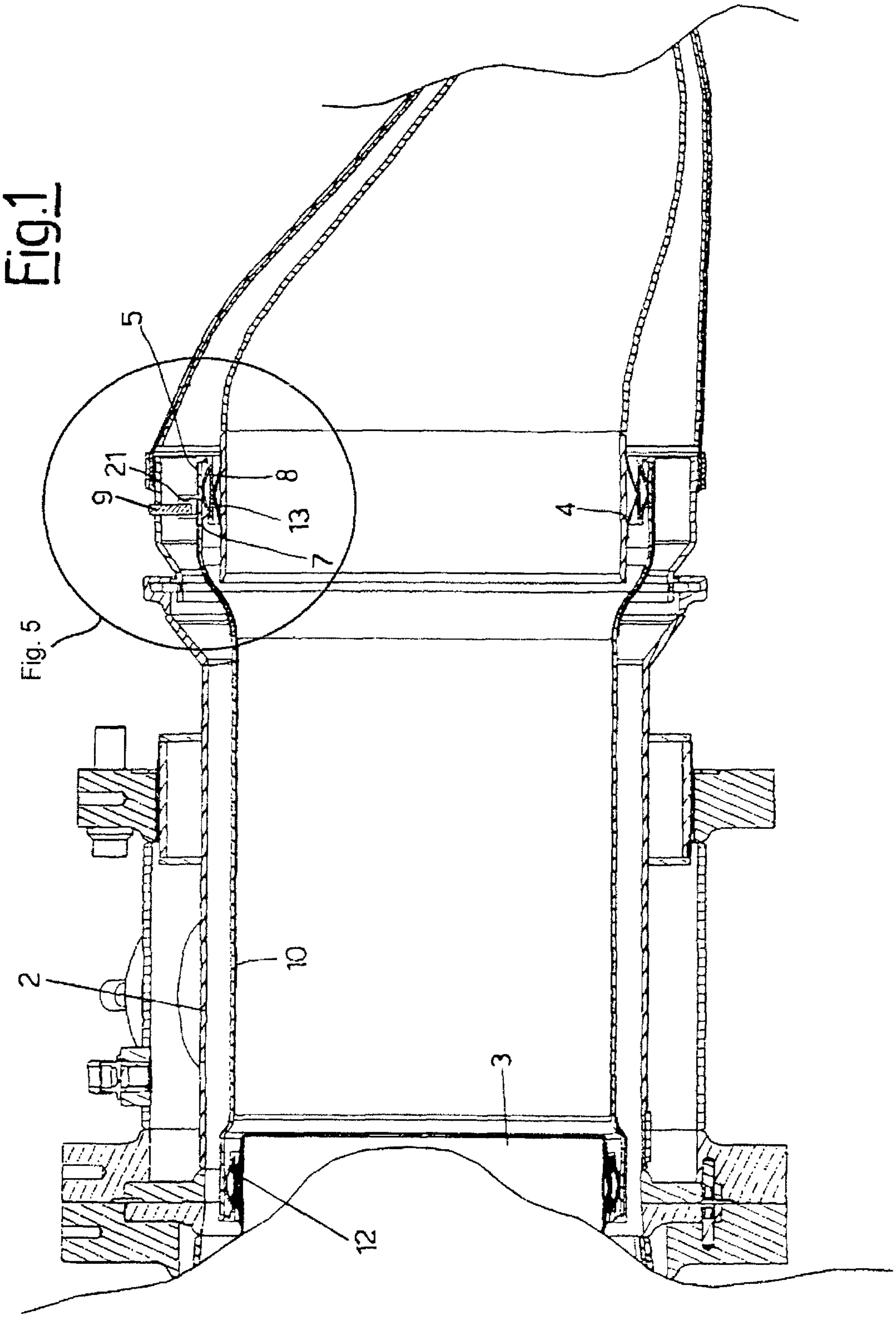


Fig.1
Fig. 5
5
21
9
8
13
7
4
2
10
3
12

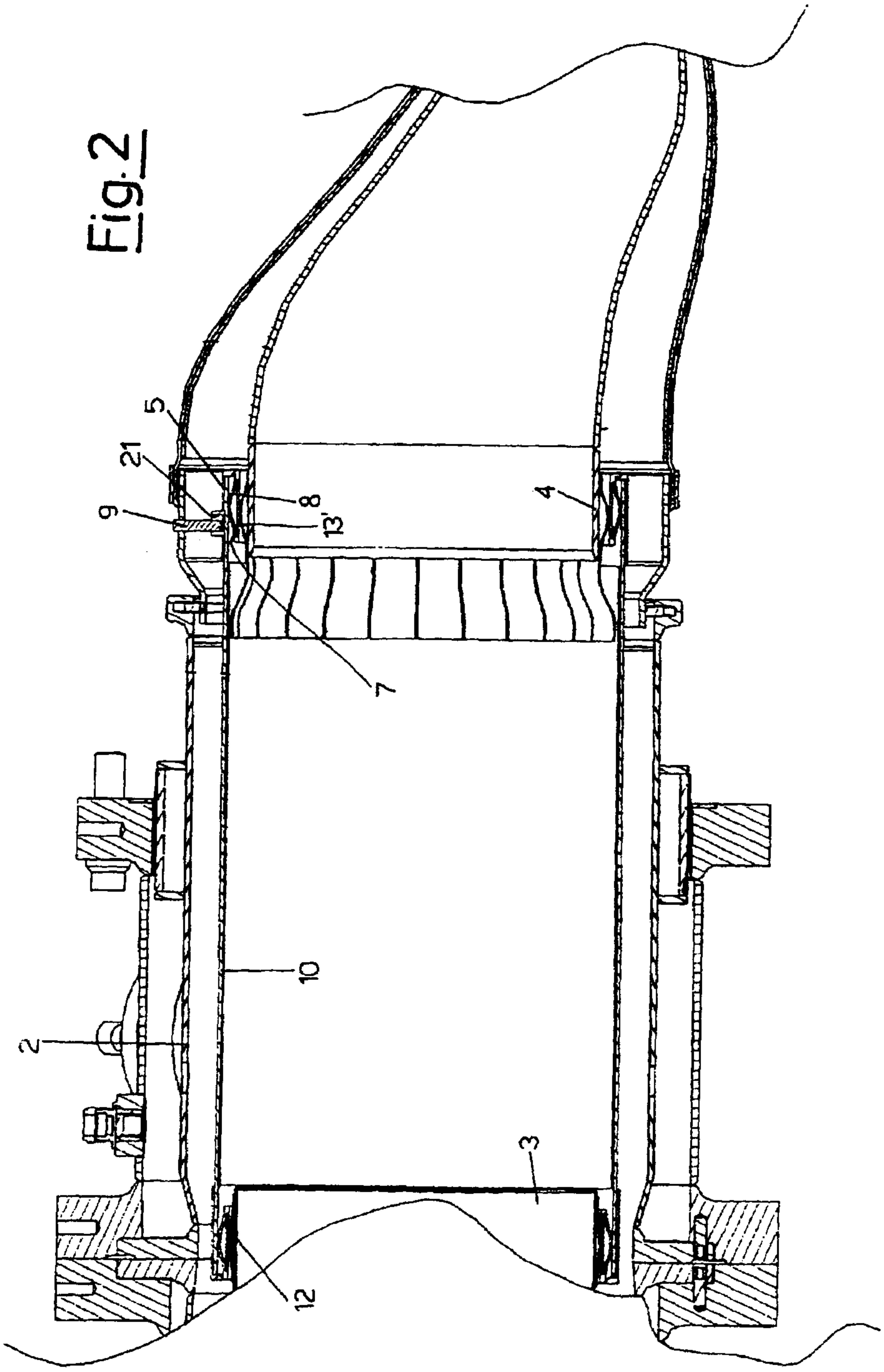


Fig.2

Fig.3

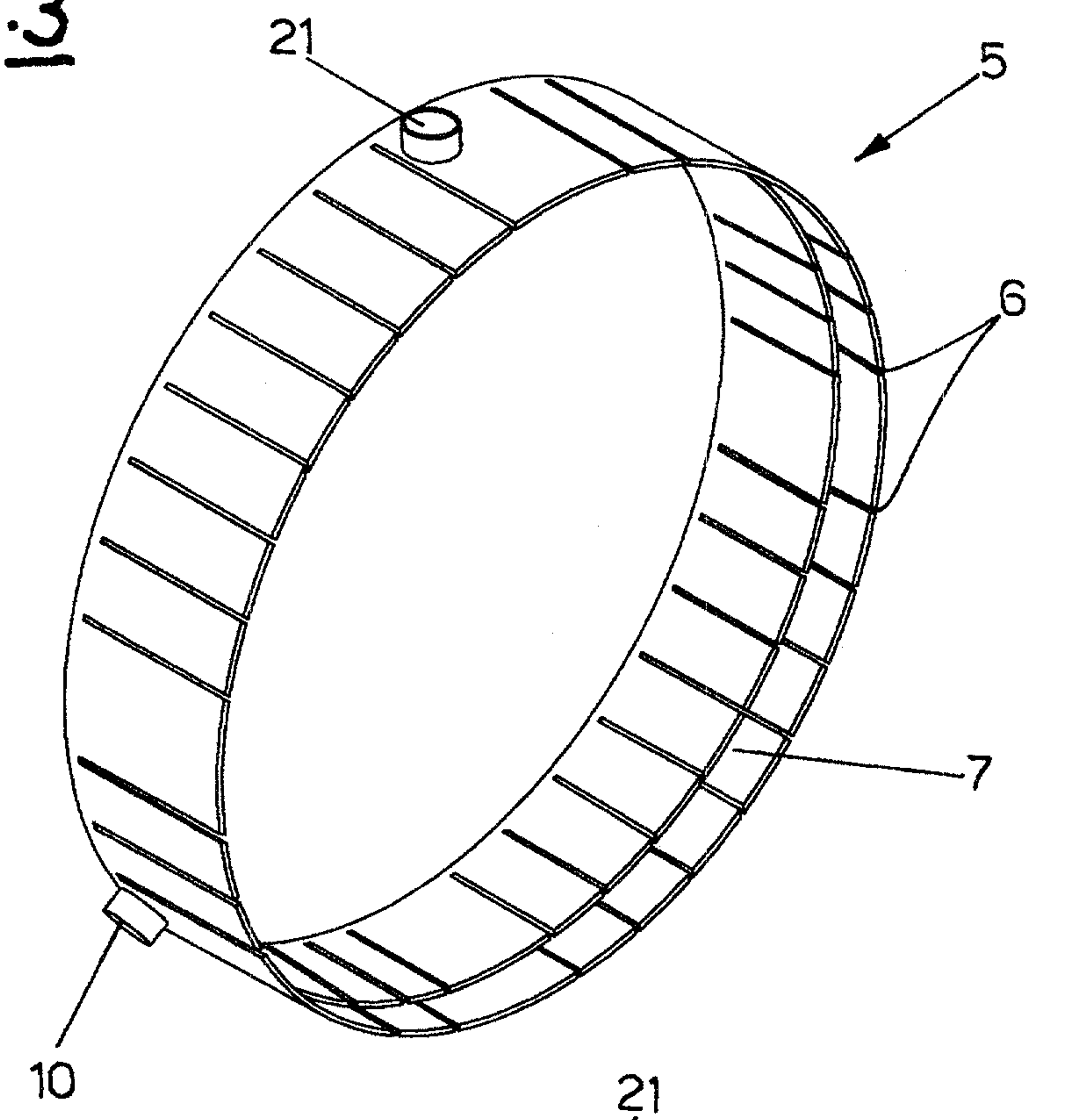


Fig.4

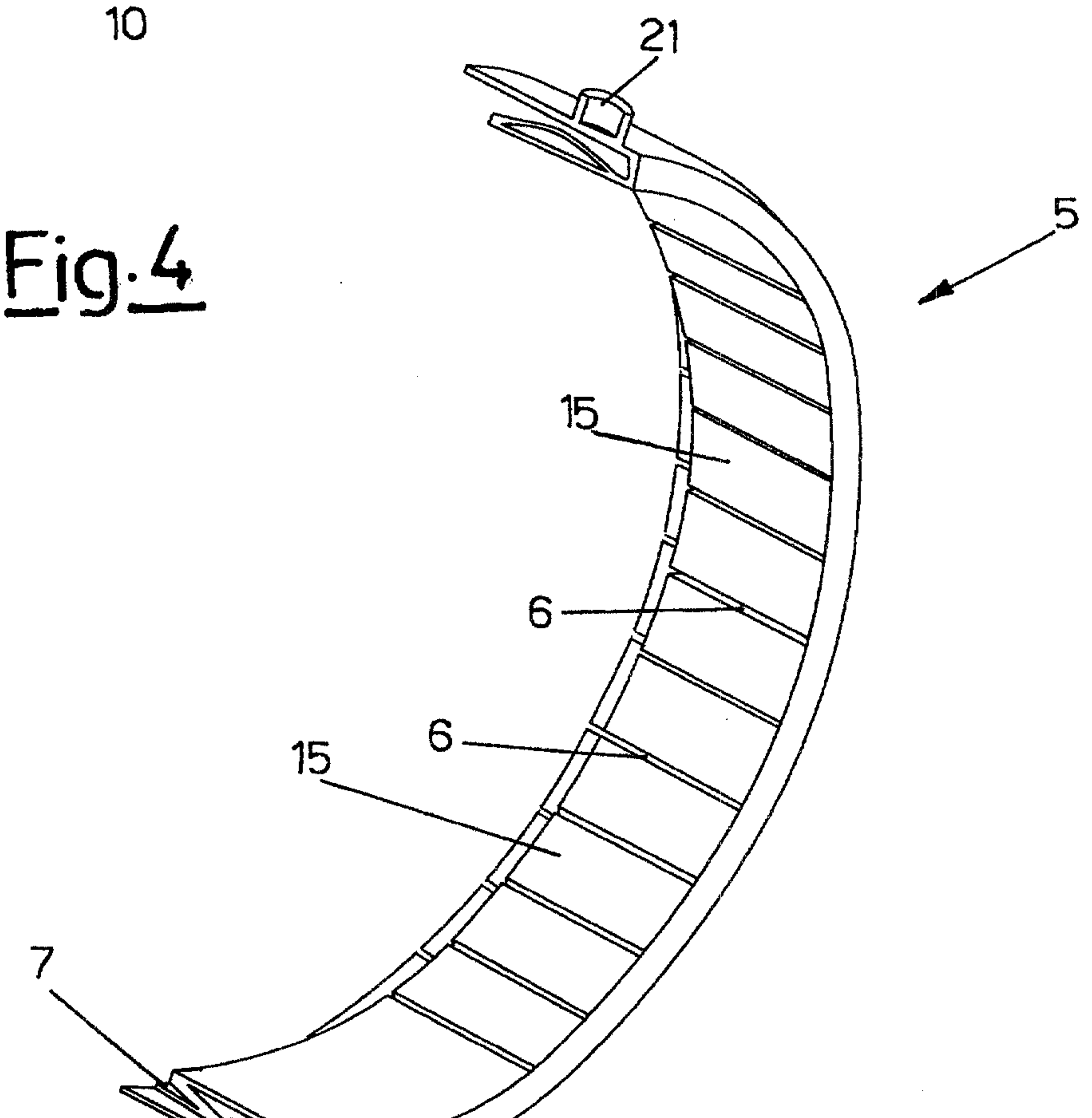
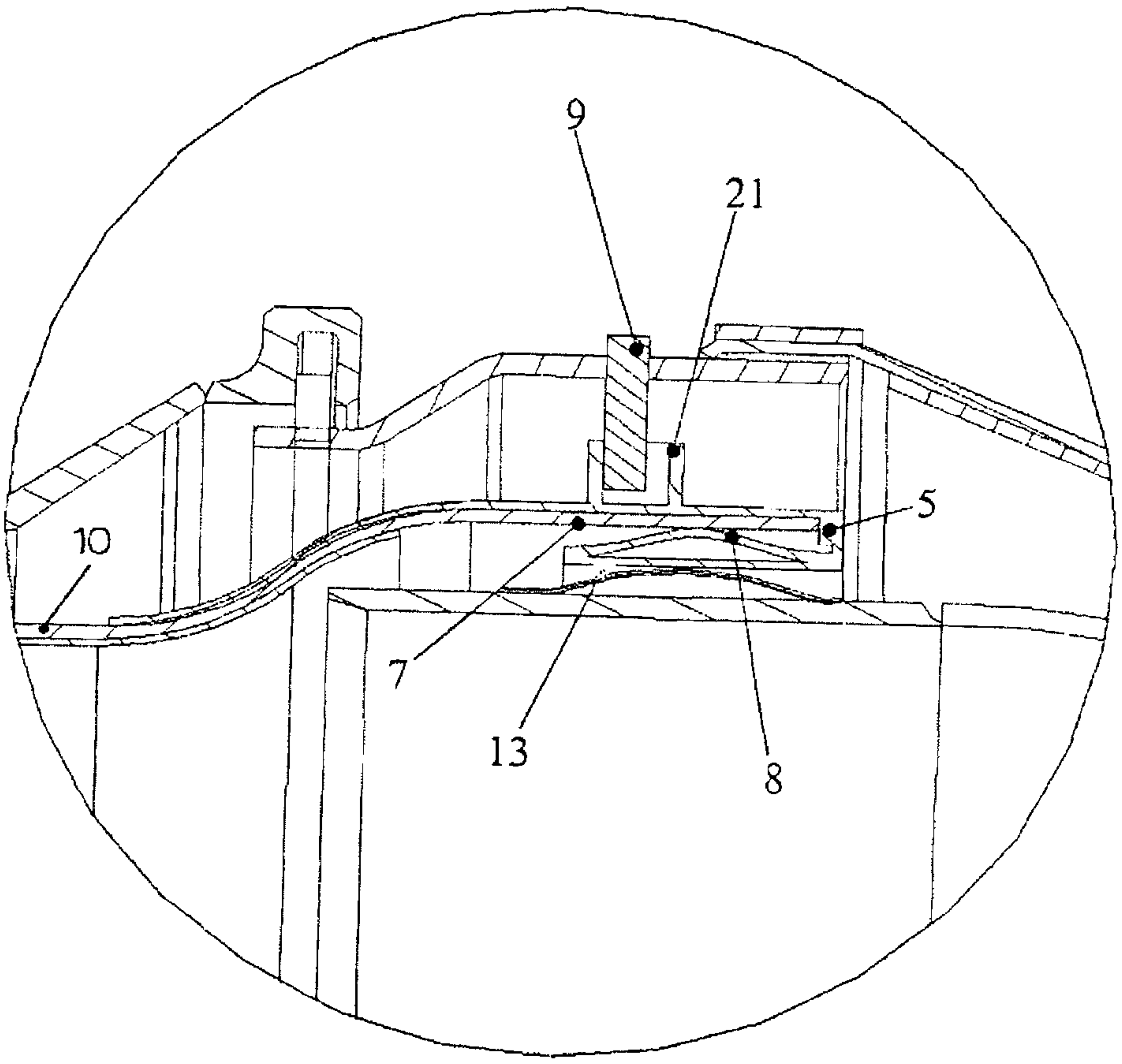
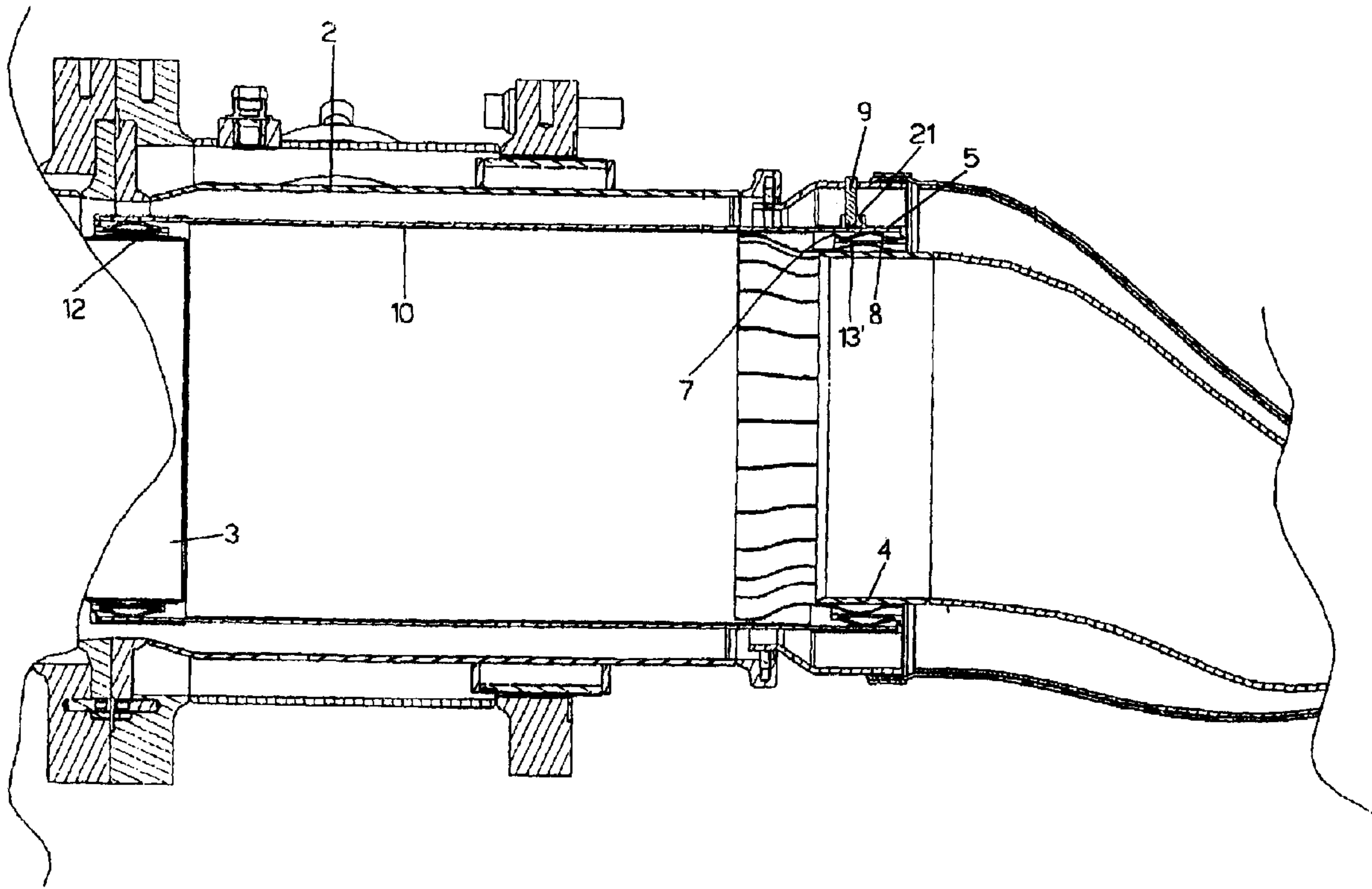


Fig.5




2
9
21
5
12
10
7
13'
8
3
4