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[33]		**Switzerland**
[31]		**7490/68**

[54] **MOUNTING FOR ADJUSTABLY HOLDING A GUIDE VANE CARRIER IN A MULTISTAGE GAS TURBINE**
6 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **415/137**

[51] **Int. Cl.** **F01d 9/00,** F01d 25/26

[50] **Field of Search** 415/136, 219, 137, 138; 60/39.32, 39.16, 39.31

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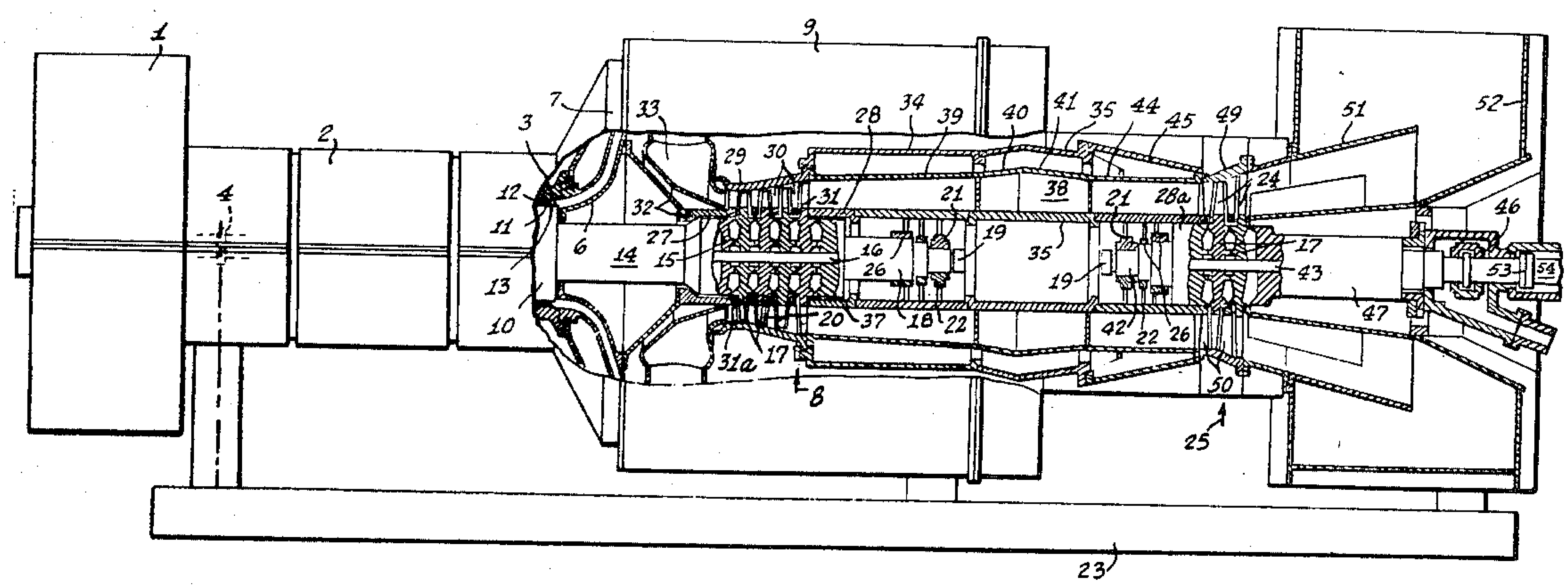
ABSTRACT: The guide vane carrier is slidably mounted by means of a flange in the groove of the turbine intermediate part while the eccentrically placed adjustable supports are mounted so as to effect a horizontal and/or vertical adjustment of the guide vane carrier on the intermediate part upon rotation of the eccentrically formed bolts.



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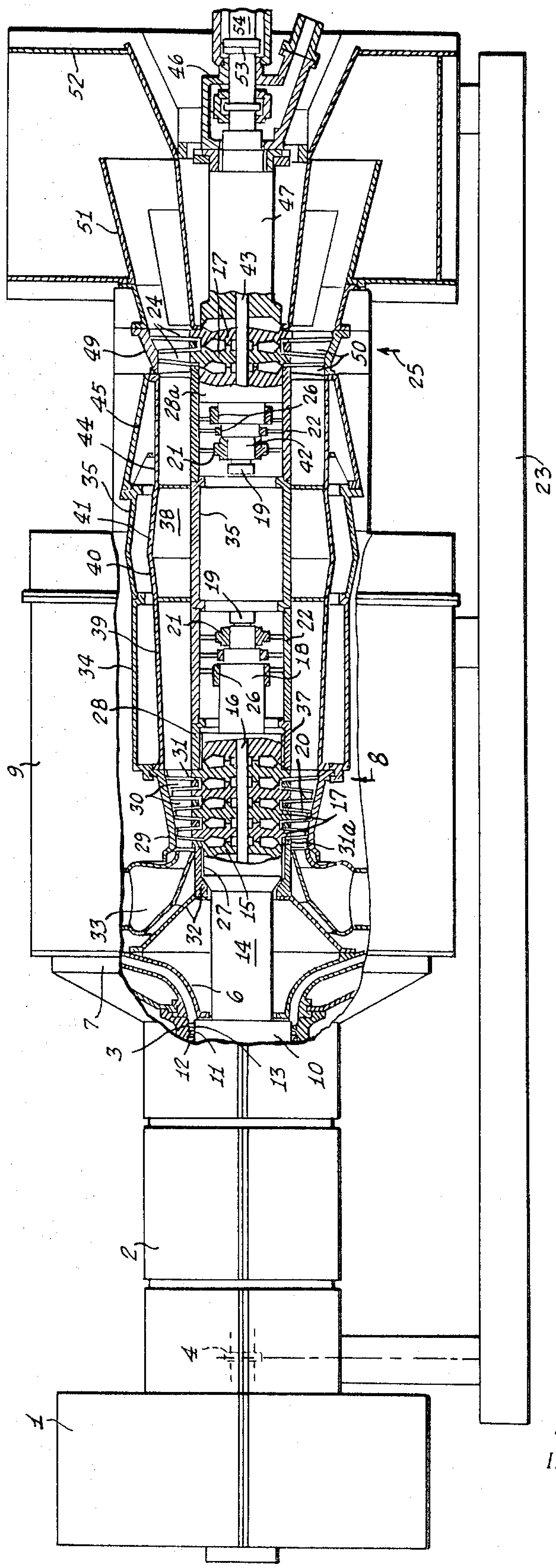

FIG. 1.

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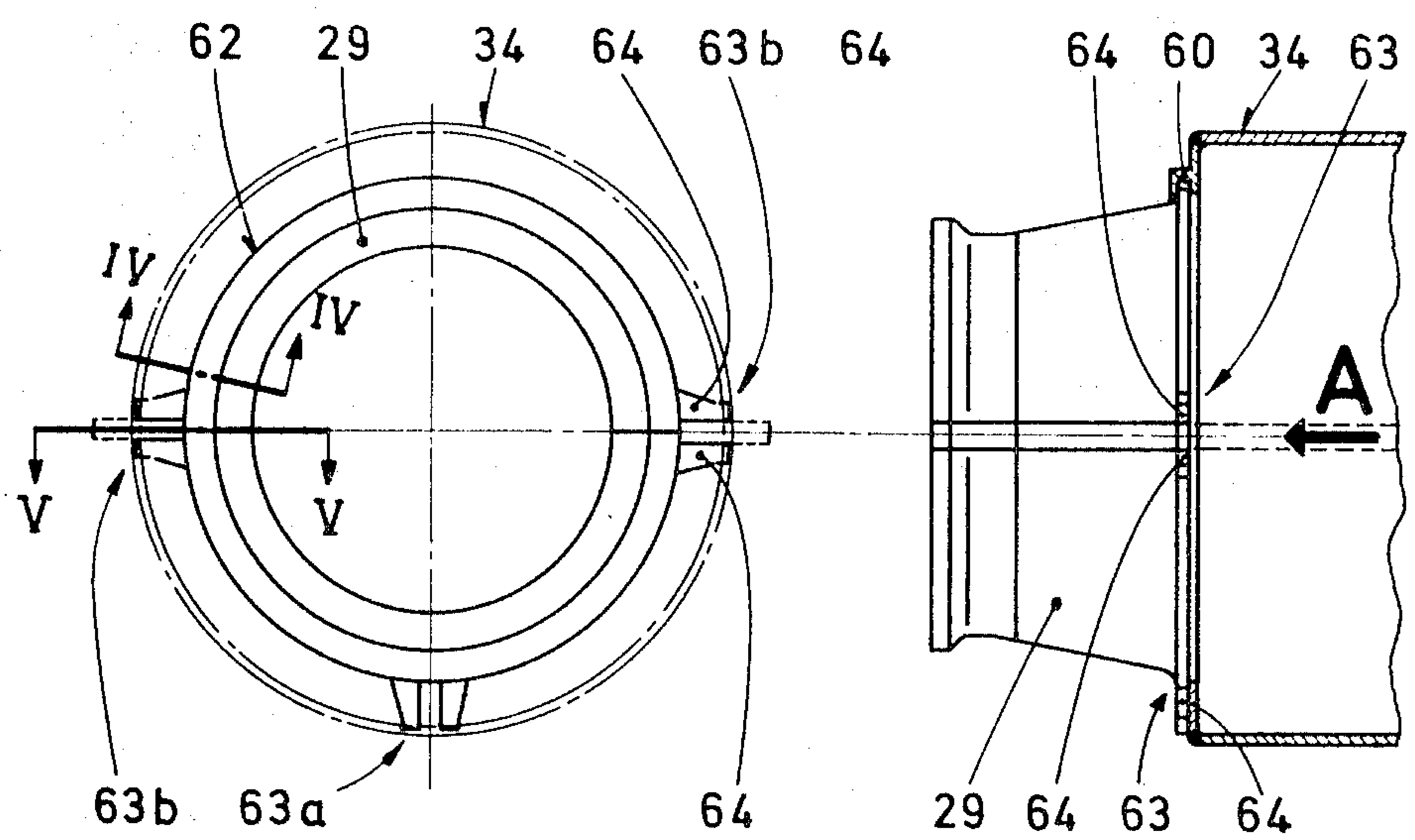

Fig. 3 Fig. 2

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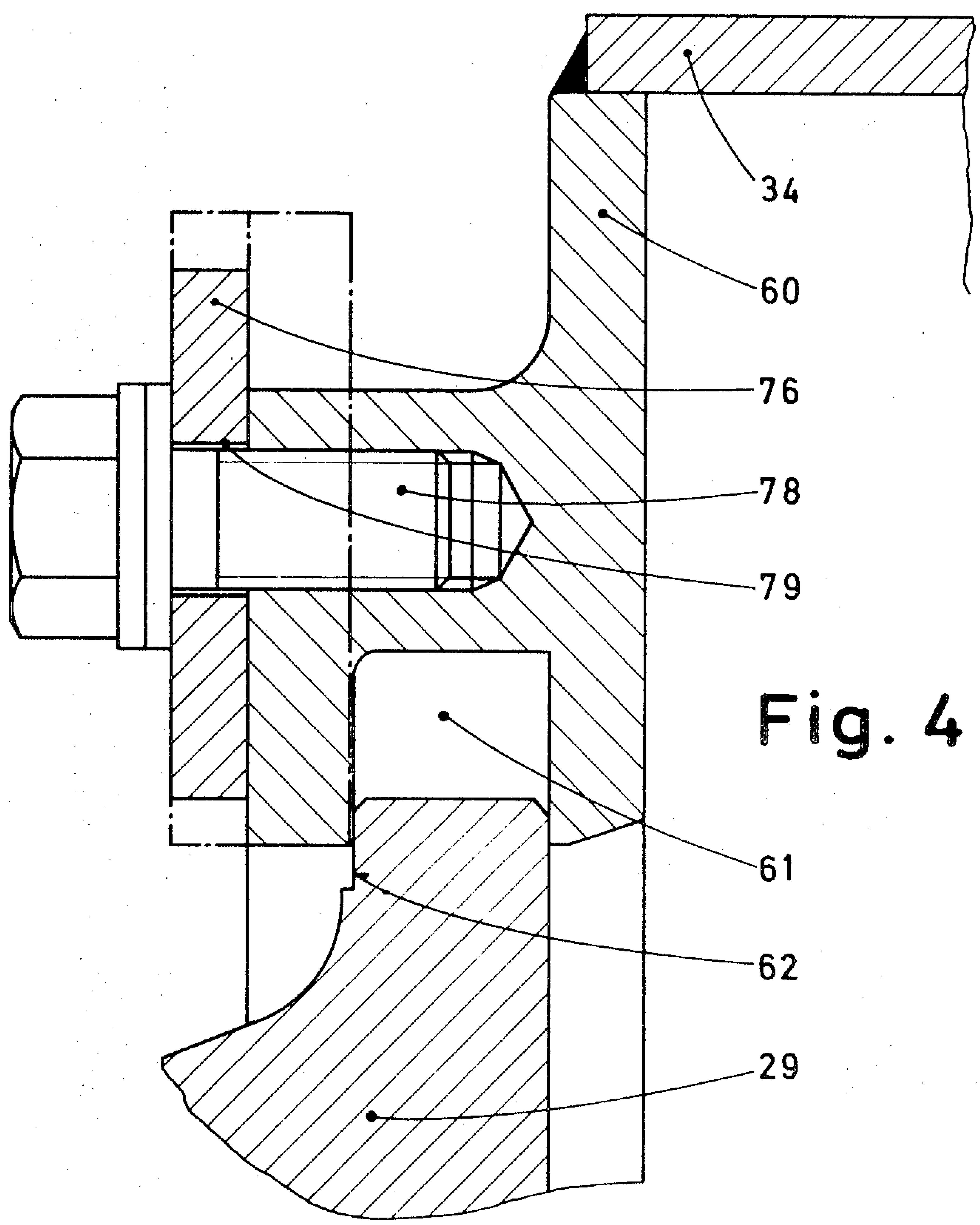

Fig. 4

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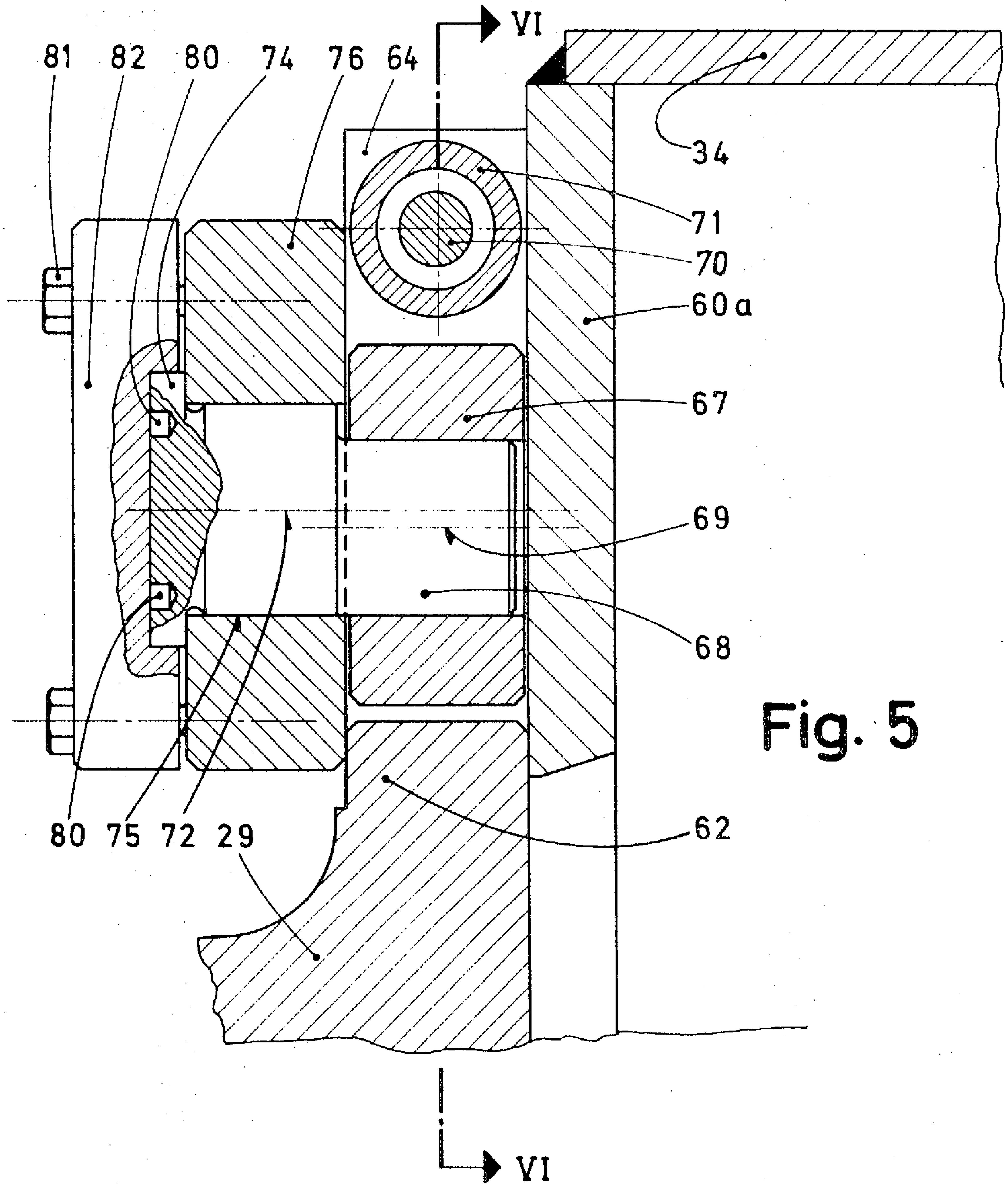

Fig. 5

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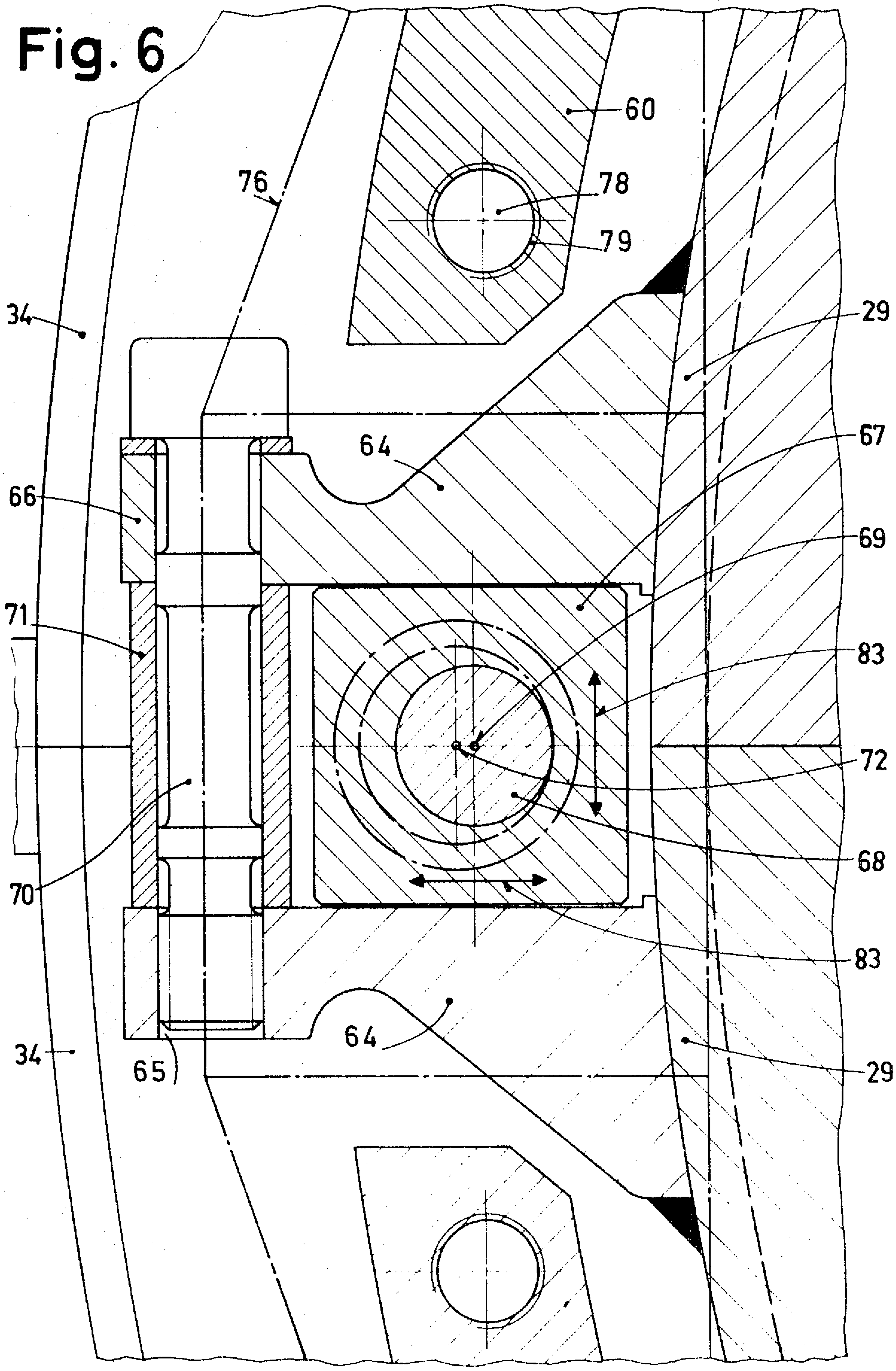
Fig. 6



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MOUNTING FOR ADJUSTABLY HOLDING A GUIDE VANE CARRIER IN A MULTISTAGE GAS TURBINE

This invention relates to a mounting for a guide vane carrier in a gas turbine and more particularly to an adjustable mounting.

Heretofore, in the case of gas turbines, the mountings of guide vane carriers within the turbines have often caused difficulties in that as a result of the great differences that occur due to the hot operating gases in the turbine, large heat expansions and thermal stresses have occurred. Because of this, the guide vane carriers have sometimes been deformed relative to the cooperating rotors of the turbines or have been dislocated. When this has occurred, the possibility has arisen that the blade carrying rotor discs rotating within the guide vane carrier between the guide vane may graze the carrier or the guide vanes.

Accordingly, it is an object of the invention to avoid misalignment of the guide vane carrier and the blade carrying rotor discs of a gas turbine.

It is another object of the invention to mount a guide vane carrier in an adjustable manner within a turbine.

It is another object of the invention to provide a simple means for adjustably mounting a guide vane carrier in a turbine.

It is another object of the invention to provide a mounting which allows thermal expansion of a guide vane carrier without requiring adjustments to the vane clearances.

Briefly, the invention provides a mounting for a guide vane carrier of a gas turbine which permits the guide vane carrier to be adjusted and centered with respect to the axis of the turbine. The mounting provides for mounting of the guide vane carrier at one end in a casinglike intermediate piece which is secured to a central housing of the turbine at a downstream end while the opposite free end is centered relative to the rotor of the turbine in the region of the foremost guide vane ring, for example, by the aid of a centering support fastened upstream to a front housing of the turbine. By mounting the guide vane carrier to the intermediate part which is situated downstream of the inlet of the hot combustion gases and is thus in a region in which the housing is cooler, the above mentioned effects of the large temperature differences that occur are decisively mitigated. Consequently, heat expansions occur to a much smaller degree at the point of mounting.

The mounting of the guide vane carrier to the intermediate part is further formed so that the carrier is slidably received in the part and is secured to the part by a plurality of eccentrically mounted supports so as to permit adjusting of the blade clearance in the region of the last turbine stage.

These and other objects and advantages of the invention will become more apparent from the following detailed description and appended claims taken in conjunction with the accompanying drawings in which:

FIG. 1 schematically illustrates a turbine construction incorporating a mounting according to the invention;

FIG. 2 illustrates a partial cross-sectional view of the mounting of a guide vane carrier to a central housing of the turbine of FIG. 1 according to the invention;

FIG. 3 illustrates a view taken in the direction indicated by the arrow A in FIG. 2;

FIG. 4 illustrates a view taken on line IV–IV of FIG. 3;

FIG. 5 illustrates a view taken on line V–V of FIG. 3; and

FIG. 6 illustrates a view taken on line VI–VI of FIG. 5.

Referring to FIG. 1, the two-shaft multistage gas turbine is constructed with an induction housing **1**, a compressor **2**, a diffuser **6**, a compressor drive turbine **8** within a combustion chamber system **9**, a useful power turbine **25** within a housing **45**, and a waste-gas housing **52** in coaxial alignment.

The induction housing **1**, shown in outline and divided along a horizontal axial plane for simplicity, is connected in the direction of flow to the compressor **2**, also shown in outline for simplicity. In addition, the compressor **2** has a rotor bearing **4** on the induction housing side which is supported on a machine bed **23** in a suitable manner.

The compressor **2** has a housing which surrounds a guide vane support **3** and which merges into a front housing **7** surrounding the diffuser **6**. In addition, the compressor **2** includes a rotor **10** (the last stage **11** of the rotor **10** being shown between its last two guide vane stages **12, 13**) which ends in a connection part **14** and which is adjoined at the downstream face by a transition disc **15** within the combustion chamber system **9** to connect the compressor **2** to the drive turbine **8**. A tension-anchor or tie rod **16** is anchored in the connection part **14** so as to mount and hold together, with the aid of a tie rod head **19**, a plurality of rotor discs **17** and a shaft journal **18** of the drive turbine **8**. For purposes of clarity, the details of this anchorage is not shown; however, it is noted that any suitable anchorage as is known can be used.

The individual rotor discs **17** are similar to one another and are fastened to one another and to the transition disc **15** and also to the shaft journal **18**, as is known, by radial serrations. The rotor discs **17** serve to carry rotor vanes or blades **20**.

The shaft journal **18** is mounted in shaft bearings **21** which are supported in a bearing housing **22**. The bearings **4, 21** are further supported in suitable mountings on a support bed **23**.

Each bearing housing **22** is also provided with two labyrinth seals **26** while additional labyrinth seals **27, 28** for sealing the rotor **10** are disposed between the transition disc **15** and a centering support **32** having a foremost conical portion, which is secured to the diffuser housing **7** and between the shaft journal **18** and an adapter piece **37**, respectively.

The rotor discs **17** of the turbine **8** are surrounded by a guide vane carrier **29** in which a plurality of guide vanes **30** are fastened. Each of the guide vanes ends in a guide vane ring **31** which is disposed between the individual rotor discs **17** and which forms the inner limit of the flow channel for the combustion gases in the region of the turbine **8**. Moreover, the first guide vane ring **31*a*** in the path of flow is connected with the adjacent hollow cylinder centering support **32**. The centering support **32** thus also serves to center the inflow end of the guide vane carrier **29** relative to the rotor **10**. Also, in order to direct the hot combustion gases coming out of the combustion chamber **9** into the turbine **8**, an inflow housing **33**, as is known, is disposed at the upstream end of the turbine.

The guide vane carrier **29** is further mounted at the downstream end to a casinglike intermediate part **34** which in turn is secured to a central housing **35** situated farther downstream.

The central housing **35** has internal parts which cooperate with the bearing housing **22** and an additional adapter piece **37** to define the inner limit of the flow channel **38** for the gases. The adapter piece **37** serves to bridge over the space between the bearing housing **22** and the last rotor disc **17** of the compressor turbine **8**. The flow channel **38** is delimited at the outside, as far as the central housing **35**, by a sheet metal casing **39** which is secured to and between the guide vane carrier **29** and the central housing **35**. In addition, a pair of conical casing parts **40, 41** which are disposed in opposite sign to each other extend from the casing **39** to further define the flow channel **38**.

By securing the guide vane carrier **29** to the relatively cool regions at the central housing **35** and at the front diffuser housing **7**, the heat expansion and heat stresses resulting from temperature differences are substantially decreased. Thus, the danger of deformation and of a dislocation of the guide vane carrier **29** relative to the rotor **10** is, at least, substantially diminished.

In this coaxial shaft turbine, a second bearing housing **22** adjoins the downstream end of the central housing **35**. This second bearing housing **22** mounts the inflow side of a rotor shaft journal **42** of the useful power turbine **25** and is surrounded by a casing **44** which serves to define the flow channel **38** as by a housing part **45**. The useful power turbine **25**, for example, a two-stage turbine, is composed of a rotor **47** mounted in a bearing **46**, rotor discs **17** which carry blades **24** similar to the blades **20** described above (at least having the same blade root and blade profile as above), and the shaft journal **42**. These components, as with the above turbine **8**, are held together by a tension-anchor or tie rod **43** which is anchored in the rotor part **47** and which has a tie rod head **19**. The turbine rotor **47** is surrounded by a guide vane carrier **49** which carries fixed guide vanes **50**.

In addition, a waste-gas diffuser **51** is disposed adjacent the guide vane carrier **49** to surround the rotor **47**. This diffuser **51** has an outlet which opens into the waste-gas housing **52**.

Finally, the rotor **47** is connected via a coupling **53** to a shaft **54** of a work machine (not shown).

Referring to FIGS. **2** and **3**, the guide vane carrier **29** is secured to the intermediate part **34** by means of three eccentric and adjustable supports **63** which permit exact adjustment to the correct clearance between the vanes of the carrier **29** and of the rotor. As shown, the intermediate part **34** which can be a hollow cylindrical or conical two part casing has an annular extension **60** at the free end which forms an annular groove **61** (FIG. **4**) over a wide range of its periphery. Also, the guide vane carrier **29** which is split along a horizontal axial plane has a flange **62** located on the end which is slidably received within the groove **61** of the extension **60**.

Referring to FIGS. **3**, **5** and **6**, the adjustable supports **63** are disposed in the horizontal plane of separation as well as in the middle of the lower half of the guide vane carrier **29**. In order to receive these supports **63**, the annular extension **60** is interrupted in these locations so as to form a simple abutment plate **60***a* (FIG. **5**). In addition, two webs **64** are welded to the guide vane carrier **29** at each support **63** to extend radially of the carrier in order to define a flange **66** having a bore **65**.

Referring to FIGS. **5** and **6**, a slide **67** of rectangular cross section is fitted between each pair of webs **64** to receive a bolt **68** having a central axis **69** which is substantially parallel to the carrier axis. The slide **67** is positioned between the webs **64** by means of a bolt **70** which is threaded into the bores **65** and a spacer sleeve **71** surrounding the bolt **70**. The spacer sleeve **71** is dimensioned so that the spacing between the flanges **66** of the webs **64** corresponds to the dimensions of the slide **67**.

The bolt **68** further has an eccentric head of larger diameter which has an axis **72** displaced from the central axis **69** and a flange **74** at the end. The eccentric head also fits into a bore **75** in a connection plate **76** which is fastened by threaded bolts **78** through respective bores **79** in the annular extension **60** at points spaced from the supports **63** (FIG. **4**).

Referring to FIG. **5**, the flange **74** of the bolt head is also provided with recesses **80** in which a suitable tool can engage in order to turn the bolt **68**. In order to prevent accidental turning of the bolt **68**, a cover plate **82** is secured over the flange **74** by means of screws **81** which press the plate **82** against the flange **74** and, in turn, press the flange **74** against the connection plate **76**.

In order to adjust the vane clearance, the bolts **68** of the respective supports **63** are turned so as to obtain a movement of the axes **69**, **72** of each bolt **68** relative to each other, for example, as indicated by the arrows **83** in FIG. **6**. Since the central axis **69** is able to move with the guide vane carrier **29** via the bolt **68**, slide **67** and webs **64** while the axis **72** remains in place relative to the intermediate part **34**, via the eccentric bolt head, connection plate **76** and bolts **78**, the carrier **29** is displaced relative to the intermediate part **34**.

An adjustment of the guide vane carrier **29** in the horizontal direction relative to the intermediate part **34** is obtained by adjustment of the support **63***a* (FIG. **3**) while an adjustment in the vertical direction is obtained by adjustment of the two supports **63***b* (FIG. **3**) in the horizontal plane of separation.

It is noted that in the event of a large heating up of the carrier **29**, the mounting permits uniform unhindered expansion of the carrier **29** in a radial direction. This allows the flange **62** to penetrate deeper i.e. expand radially into the annular groove **61** while the webs **64** at the supports **63** are allowed to shift on the slide **67** without changing the adjustment in the vane clearance.

What I claim is:

1. In combination,

a guide vane carrier of a multistage gas turbine,

a plurality of rows of guide vanes fastened within said carrier,

a casinglike intermediate part secured at one end to one end of said guide vane carrier,

a central housing of the multistage gas turbine secured to an opposite end of said intermediate part downstream of said guide vane carrier, and

means mounting the opposite end of said guide vane carrier for centering said guide vane carrier relative to a rotor passing therethrough.

2. The combination as set forth in claim **1** wherein said means includes a centering support mounted on a front housing of the gas turbine.

3. The combination as set forth in claim **1** which further comprises a plurality of peripherally mounted supports on said one end of said intermediate part slidably connecting said one end of said guide vane carrier to said intermediate part.

4. A mounting for securing a guide vane carrier having a flange at one end thereof to an intermediate part of a gas turbine having an interrupted extension on one end forming an annular groove slidably receiving said flange, said mounting comprising a plurality of supports, each support including a slide, means connected to said flange for guiding said slide radially of said carrier and means connected to said extension for moving said slide relative to said extension to displace said carrier relative to said intermediate part.

5. A mounting as set forth in claim **4** wherein said means for guiding said slide include a pair of radially extending webs on said flange, said slide being slidably mounted between said webs.

6. A mounting as set forth in claim **4** wherein said means for moving said slide includes a bolt having a central axis received in said slide and an eccentric head having an axis offset from said central axis, and a connection plate secured to said extension and having a bore receiving said eccentric head whereby turning of said bolt effects a relative movement of said carrier to said intermediate part.