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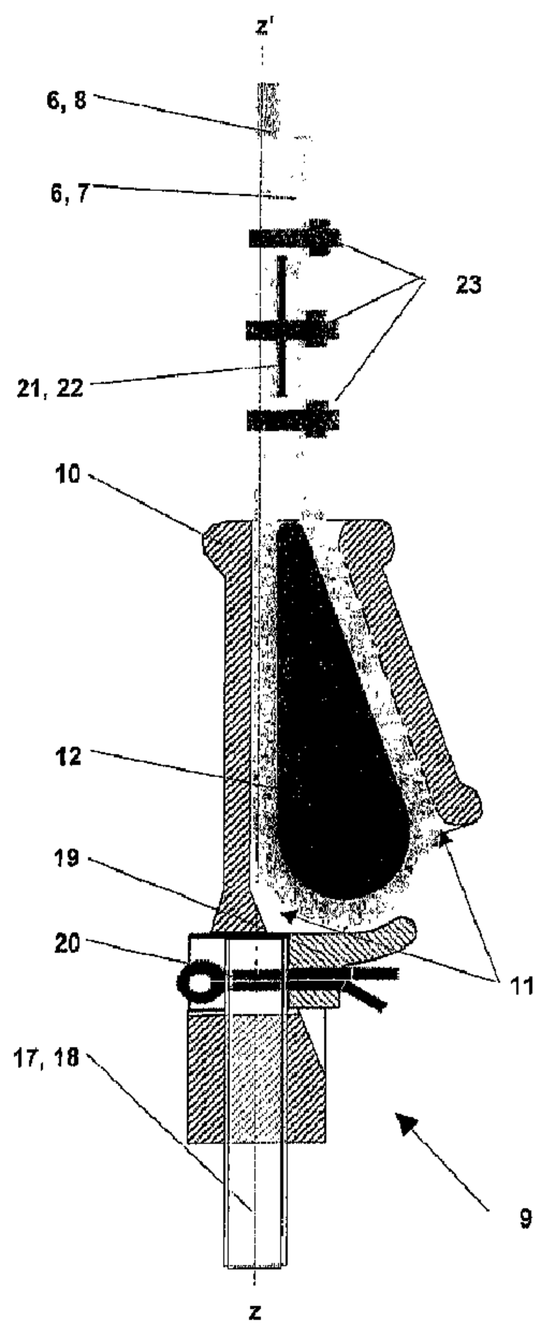
(72) Inventeur/Inventor:
ACH, ERNST, CH

(73) Propriétaire/Owner:
INVENTIO AG, CH

(74) Agent: RICHES, MCKENZIE & HERBERT LLP

(54) Titre : RACCORD POUR FIXER UNE EXTREMITE DE COURROIE DANS UNE INSTALLATION DE LEVAGE, ET METHODE POUR PROTEGER ET VERIFIER UN RACCORD D'EXTREMITE DE COURROIE DANS UNE INSTALLATION DE LEVAGE

(54) Title: BELT END CONNECTION FOR FASTENING A BELT END IN A LIFT INSTALLATION, AND METHOD FOR PROTECTING AND CHECKING A BELT END CONNECTION IN A LIFT INSTALLATION



(57) Abrégé/Abstract:
The invention relates to a belt end connection for fastening a belt end in a lift installation and to a method for protecting and checking a belt end connection in a lift installation. In that case twisting protection means (21) prevents twisting of the belt end

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(57) Abrégé(suite)/Abstract(continued):
connection (9) about the longitudinal axis (zz') thereof. Moreover, a wedge (12) which retains a support belt (6) in a wedge pocket (11), is secured by way of loss protection means (19) against slipping out of the wedge pocket (11). Twisting protection means and/or loss protection means enables or enable efficient protection of the support belt (6) or of the belt end connection (9) against damage and make possible efficient checking and control of the belt end connection.

Abstract

The invention relates to a belt end connection for fastening a belt end in a lift installation and to a method for protecting and checking a belt end connection in a lift installation. In that case twisting protection means (21) prevents twisting of the belt end connection (9) about the longitudinal axis (zz') thereof. Moreover, a wedge (12) which retains a support belt (6) in a wedge pocket (11), is secured by way of loss protection means (19) against slipping out of the wedge pocket (11). Twisting protection means and/or loss protection means enables or enable efficient protection of the support belt (6) or of the belt end connection (9) against damage and make possible efficient checking and control of the belt end connection.

Belt end connection for fastening a belt end in a lift installation, and method for protecting and checking a belt end connection in a lift installation

This application is a division of Canadian Patent Application Serial No. 2,518,660, filed 09 September 2005.

The present invention relates to a belt end connection for fastening a belt end in a lift installation and to a method for protecting and checking a belt end connection in a lift installation.

A lift installation usually consists of a cage and a counterweight, which are moved in opposite sense in a lift shaft. Cage and counterweight are connected together and supported by means of support belts. One end of the support belt in that case is fastened by a belt end connection to the cage or counterweight or in the lift shaft. The location of the fastening is oriented to the form of construction of the lift installation. The belt end connection accordingly has to transfer the force, which acts in the support belt, to the cage or to the counterweight or to the lift shaft. It thus has to be designed in such a manner that it can securely transfer the allowable load-bearing force of the belt. The direction of mounting of the belt end connection is oriented to the location of the fastening. If the belt end connection is mounted at the cage or counterweight a direction of tension of the support belt is usually oriented upwardly, but in the case of mounting of the belt end connection in the lift shaft the direction of tension of the support belt is usually oriented downwardly.

In known constructions the support belt is usually fixed in a wedge pocket by means of a wedge. A first wedge pocket surface is in that case constructed in correspondence with the direction of tension of the support belt. This first wedge pocket surface is arranged in the direction of withdrawal of the support belt. A second bridge pocket surface is constructed to be displaced relative to the first wedge pocket surface in correspondence with a wedge angle of the wedge. The support belt is now arranged between wedge pocket surfaces and wedge and it draws the belt, by virtue of the friction conditions, into the wedge pocket, whereby the support belt is fixedly clamped.

A belt end connection of that kind is known from EP 1252086. A disadvantage of this construction is that the belt end connections are susceptible to damage, particularly since the wedge can, for example in the case of belt slack, slip out of the wedge pocket, whereby the support belt can be damaged or the belt end connection can be twisted, whereby higher levels of support belt loading result. Support belt damage and/or higher

levels of loading can lead to failure of the support belt or to reduced serviceability of the lift installation. Belt slack can result if, for example, the cage or the counterweight is braked strongly or is braked to a stop, which can take place, for example, in the case of a test of safety brakes or in the case of travel of cage or counterweight onto travel limiting devices. Twisting of the belt end connection can take place if the support belt experiences a twisting moment as a consequence of, for example, production tolerances of the support belt itself or as a consequence of arrangements of fastening and deflecting points. This torque causes twisting about a longitudinal axis of the belt end connection. The longitudinal axis corresponds with an effective direction of the support force acting in the support belt.

The object of the present invention is accordingly to provide a belt end connection which is less susceptible to damage. Moreover, the belt end connection shall be favourable in costs, handling thereof in assembly and in maintenance shall be as simple as possible and it shall promote a high level of serviceability of the lift installation.

These objects are fulfilled by the invention according to the definition of the independent patent claims.

The invention relates to a belt end connection for fastening a belt end in a lift installation and to a method of protecting and checking a belt end connection in a lift installation according to the definition of the patent claims.

The lift installation consists of a cage and a counterweight, which are moved in opposite sense in a lift shaft. Cage and counterweight are connected together and supported by means of support belts. One end of the support belt is fastened by a belt end connection to the cage or counterweight or in the lift shaft. The location of the fastening is oriented towards the mode of construction of the lift installation. The support belt is retained in the belt end connection by means of a wedge, which fixes the support means in a wedge pocket.

According to a first part of the invention there is provided twisting protection means which prevents twisting of the belt end connection about the longitudinal axis thereof. The longitudinal axis in that case corresponds with the direction defined by the effective direction of the supporting force in the support belt.

The advantage of this invention resides in the fact that the susceptibility of the belt end connection to damage is reduced, since the support belt is not twisted even when the support belt is slack. The twisting protection means can be provided economically and can be mounted in simple manner.

This solution represents an effective method for being able to protect the belt end fastening and the associated support belt against damage. In addition, the twisting protection means enables efficient checking of correct installation of the belt end fastening and it thus simplifies checking of the belt end fastening within the scope of maintenance of the lift installation.

According to a second part of the invention the wedge which fixes the support belt in the wedge pocket of the belt end connection is secured by way of loss protection means against slipping out of the wedge pocket.

The advantage of this invention resides in the fact that the susceptibility of the belt end connection to damage is reduced, since the wedge cannot slip out of the wedge pocket and no damage of the support belt as a consequence of a loose wedge thereby results. The solution is economic and it can be quickly mounted without requiring special tools.

This solution represents an effective method of being able to protect the belt end fastening and the associated support belt against damage. In addition, the loss protection means enables sufficient checking and control of correct installation of the belt end fastening.

Accordingly, in one aspect the present invention resides in a method of protecting a belt end connection used for fastening an end of a support belt in an elevator installation, the end of the support belt being fastened to one of an elevator car suspension point, a counterweight suspension point and a shaft suspension point, and the support belt, including the end of the support belt, being aligned in a substantially vertical direction and being arranged in parallel with at least another support belt, comprising the steps of attaching a belt end connection to the end of the support belt; attaching a twisting prevention device to the support belt adjacent the belt end connection; preventing twisting of the belt end connection and the support belt about a longitudinal axis thereof by attaching the twisting prevention device to one of the another support belt adjacent another belt end connection attached to the another belt and a part of the elevator installation; and checking for an unequal tensile stress in the support belts by observing a position of the

twisting prevention device when the twisting prevention device is attached to the another support belt.

In another aspect, the present invention resides in a method of fastening a belt end connection to an end of a support belt in an elevator installation comprising the steps of forming a wedge pocket in the belt end connection; inserting the end of the support belt with a wedge in the wedge pocket; providing a support bolt for transmission of a supporting force of the support belt from the belt end connection to one of a car, a counterweight and an elevator shaft; attaching a loss prevention device to the belt end connection to prevent the wedge from slipping out of the wedge pocket wherein said loss prevention device is attached to the support bolt of said belt end connection with a support bolt securing means securing the support bolt against rotation; and attaching a twisting prevention device to the belt adjacent the belt end connection and to another support belt and checking for an unequal tensile stress in the support belts by observing a position of the twisting prevention device.

Further advantageous embodiments are described in the dependent claims.

The invention is explained in detail in the following on the basis of forms of embodiment, by way of example, according to Figs. 1 to 8, in which:

Fig. 1 shows a lift installation, with underslinging, with belt end fastening fastened in the lift shaft,

Fig. 2 shows a directly suspended lift installation with belt end fastening fastened to a cage or to counterweight,

Fig. 3 shows a belt fastening, which is fastened to a cage or counterweight, with upwardly acting support belt force,

Fig. 4 shows a belt fastening, which is fastened to a lift shaft, with downwardly acting support belt force,

Fig. 5 shows a detail sectional view of a belt end fastening,

Fig. 5a shows a cross-section of a support means in the region of twisting protection means,

Fig. 6 shows a detail of an alternative belt end fastening,

Fig. 6a shows a cross-section of a form of embodiment of a support means in the region of twisting protection means,

Fig. 7 shows a belt end fastening, which is connected with twisting protection means to form a further belt end fastening, in the case of an example of two support belts (front view and sectional illustration),

Fig. 8 shows a belt end fastening, which is connected with twisting protection means to form a further belt end fastening, in the example of four support belts.

The lift installation 1 consists, as illustrated in Figs. 1 and 2, of a cage 3 and a counterweight 4, which are moved in opposite sense in the lift shaft 2. Cage 3 and counterweight 4 are connected together and supported by means of support belts 6. One end of the support belt 6 is fastened by a belt end connection 9 to the cage 3 or counterweight 4, according to Fig. 2, or in the lift shaft 2, according to Fig. 1. The location of the fastening is oriented towards the mode of construction of the lift installation 1. In Figs. 3 and 4 it is apparent how the support belt 6 is retained in the belt end connection 9 by means of a wedge 12, which fixes the support belt in a wedge pocket 11. The belt end fastening is connected with the cage 3 or counterweight 4 or with the lift shaft 2.

According to the invention, as illustrated in Fig. 5, twisting protection means 21 is used for securing of the belt end connection 9 against twisting. The twisting protection means 21 prevents twisting of the belt end connection and of the support belt 6 about the longitudinal axis zz' thereof. The longitudinal axis zz' corresponds with the effective direction of the support force in the support belt 6.

Twisting of the belt end connection 9 and the associated support belt 6 is effectively protected by the illustrated twisting protection means 21. An unequal loading of the support belt 6 or damage of the support belt 6 is effectively precluded. The twisting protection means 21 is economic and it can be mounted in simple manner. It enables efficient checking of the state of the belt end connection 9 and thus improves the serviceability thereof.

In an advantageous embodiment the twisting protection means 21 is a flat profile member 22, as illustrated by way of example in Figs. 5, 7 and 8. The flat profile member is, for example, a steel sheet metal strip. The flat profile member 22 is arranged, in the illustrated example, in the vicinity of the belt end connection 9, in area contact with the support belt 6.

The advantage of this embodiment is the particularly economic production of the twisting protection means 21 and the entire belt end connection 9. Parts of simple design can be used, which do not oblige specific production knowledge.

As apparent in Fig. 5, the twisting protection means 21 is fastened between a load-bearing run 8 of the support belt 6 and idle run 7 of the support belt 6. This embodiment is advantageous, since protection against twisting is achieved merely by a simply shaped twisting protection means 21. This is advantageous with regard to costs.

Alternatively, as illustrated in Fig. 6 the twisting protection means 21 can be arranged outside the load-bearing and/or idle run 7, 8 of the support belt 6. With this embodiment, for example, retrofitting of twisting protection means in an existing lift installation 1 is possible in simple manner. Obviously, a specially shaped twisting protection means 21 can also embrace the support belt 6. Special adaptations to the local fastening possibilities are thus made possible.

The twisting support means 21 can connect two support belts 6 together and/or it can connect one or more support belts 6 with a part of the lift installation. The belt end connection 9 is thus connected, directly or indirectly, with at least one further belt end connection and/or with a part of the lift installation. A direct connection can be effected in that the twisting protection means is arranged at, for example, a wedge housing 10 enclosing the wedge pocket 11. An indirect connection can be effected in that the twisting protection means 21 is arranged at, for example, the support belt 6.

The connecting arrangements allow selection of the respective arrangement which is most economic and/or most space-saving. The connection of two support belts 6 is in that case particularly efficient, since no further parts or connecting points are needed.

In a special embodiment the twisting connection means 21 is shaped. It thereby enables connection with a part of the lift installation or enclosure of a lift part, such as, for example, a beam or a guide rail 5. An example is illustrated in Fig. 7 in which twisting protection means 21 in the form of a flat profile member 22 of steel sheet metal connects together two mounting connections 9 and thereby prevents twisting of the two belt end connections 9. The twisting protection means 21 is in that case shaped in such a manner that it surrounds the guide rail 5.

In Fig. 8 there is illustrated a further, particularly simple twisting protection means, which protects four belt end fastenings 9 against twisting in that each instance two belt end fastenings 9 are connected together. The illustrated embodiments take into consideration the special arrangements of the lift installation. They are particularly simple and economic, since with one twisting protection means 21 several belt end fastenings 9 can be secured or particularly simple forms of twisting protection means 21 are usable.

As illustrated in Figs. 5 to 8 as advantageous solutions, a respective cable connector 23 is used for fastening the twisting protection means 21. The cable connector 23 in this connection is guided through an opening in the twisting protection means 21. Further cable connectors 23 are used in the illustrated embodiments in order to fix the idle run 7 of the support means 6.

Cable connectors 23 are economic components which can be produced in simple manner. The illustrated embodiment is accordingly economic and simple to provide. In addition, the

illustrated embodiment enables slight displacements between several interconnected belt end connections 9, as can result, for example, in the case of different degrees of stretching of the support belt 6.

According to a further part of the invention the wedge 12, which fixes the support belt 6 in the wedge pocket 11 of the belt end connection 9, is, as shown in Fig. 5, secured by way of loss protection means 19. The loss protection means 19 is, in case of need, removable in simple manner.

The loss protection means 19 effectively prevents the wedge 12 from being able to slip out in the case of a loose support belt 6. Loose support belts 6 can result if the cage 3 or the counterweight 4 is strongly braked or is braked to a stop, which can take place in the case of, for example, a test of safety brakes or in the case of movement of cage 3 or counterweight 4 onto travel limiting devices, for example run-up buffers. Damage of the support belt 6, or of the belt end connection 9, by displacement or jamming or slipping out of the wedge 12 is thereby effectively precluded. The illustrated loss protection means 19 can, in addition, be mounted and demounted in simple manner.

In an advantageous embodiment the loss protection means 19 is fastened together with a support bolt securing means 20. As support bolt securing means 20 there is in that case used, for example, a splitpin. A support bolt securing means 20 is usually required in order to prevent rotating out of a support bolt 17. The support bolt 17 transmits the supporting force of the support belt 6 from the wedge housing 10 to the cage 3 or counterweight 4 or to the lift shaft 12. Two requirements - protection against slipping out of the wedge and prevention of untwisting of the support bolt - can be conjunctively fulfilled by the illustrated solution. This is particularly economic and favourable in assembly.

The support bolt 17 is advantageously executed as a threaded bolt 18. Thus, a secure and economic introduction of the supporting forces into the lift shaft, the cage 3 or the counterweight 4 can be achieved.

Figs. 5a and 6a show schematic cross-sections of support belts 6 by way of example. The support belt 6 is produced according to the load-bearing and drive capability requirements. It usually consists of at least two or more cable strands 6a arranged at a spacing relative to one another and a casing 6b, which separates the cable strands 6a from one another

and encloses them. In another variant the support belt 6 consists of two or more cables 6a, which are arranged at a spacing from one another, and a casing 6b, which separates individual cables 6a from one another and encloses them. Essentially thermoplastic materials or elastomers are used as casing material. A width of the corresponding support belt 6 corresponds with at least twice the height of the belt. The casing 6b of the support belt has a functionally appropriate shaping. It is, for example, as illustrated in Fig. 5a embossed in correspondence with the cable shape, whereby longitudinal grooves result, or it has a functional surface in the form of longitudinal or transverse grooves. The casing 6b is for this purpose designed for transmission of the driving forces, which are required for driving a lift, from a drive pulley to the supporting cables or cable strands 6a and it must, substantially within the cable end connection 9, transmit a supporting force, which acts in the support cable 6, from the cables or the cable strands 6a to the belt end connection 9. The cable or the cable strands 6a preferably consists of consist or metallic material, such as, for example, steel, or they consist of synthetic material fibres.

With knowledge of the present invention the lift expert can change the shapes and arrangements as desired. Thus, for example, the expert can use, instead of the cable connector 23, other fastenings such as a clamp or wire, etc. Further variations are possible.

We claim:

1. In an elevator installation including a car and a counterweight moving in opposite directions in an elevator shaft and connected together and supported by a support belt, the support belt having two ends, wherein each end is fastened by a belt end connection to one of the car, the counterweight or the elevator shaft, the belt end connection comprising:

a wedge housing including a wedge pocket for receiving a wedge and for fixing the support belt in said wedge pocket;

a support bolt disposed within said wedge housing and connecting said wedge housing to one of the car, the counterweight and the elevator shaft;

a loss prevention device preventing said wedge from slipping out of said wedge pocket, wherein the loss prevention device is removably positioned on the wedge housing and abuts the support bolt, and the loss prevention device is entirely removable from the wedge housing; and

a support bolt securing means disposed through the loss prevention device, the support bolt, and the housing, the support bolt securing means securing the loss prevention device directly to the support bolt, thereby preventing all substantial relative movement of said support bolt and said wedge housing.

2. The belt end connection according to claim 1 wherein said support bolt securing means is a splitpin, said splitpin adapted to fit through and connect together said support bolt and said loss prevention device, and to attach said loss prevention device to the belt end connection.

3. The belt end connection according to claim 1 wherein said support bolt is a threaded bolt, said threaded bolt disposed in a threaded hole of said wedge housing.

4. The apparatus according to claim 1 wherein said support bolt is a threaded bolt, said threaded bolt disposed in a threaded hole of said wedge housing, and wherein said support bolt securing means is a splitpin, said splitpin disposed through and connecting together said support bolt and said loss prevention device, and attaching said loss prevention device to the belt end connection.

5. The apparatus according to claim 1 wherein the support belt includes at least two strands spaced from one another and a casing separating said stands from one another

and enclosing said strands, said casing being formed of one of a thermoplastic material and an elastomer, and wherein a width of the support belt is at least twice a thickness of the support belt.

6. A method of fastening a belt end connection in an elevator installation comprising the steps of:

a. providing a wedge housing;

b. providing a support bolt for connecting the wedge housing to one of a car, a counterweight and an elevator shaft;

c. inserting an end of the support bolt and a wedge into the wedge housing;

d. providing a loss prevention device to prevent the wedge from slipping out of the wedge housing, wherein the loss prevention device is removably positioned on the wedge housing and abuts the support bolt; and

e. securing the loss prevention device and the support bolt together and to the wedge housing with a support bolt securing means disposed through the loss prevention device, the support bolt, and the housing, the support bolt securing means securing the loss prevention device directly to the support bolt, thereby preventing all substantial relative movement of said support bolt and said wedge housing.

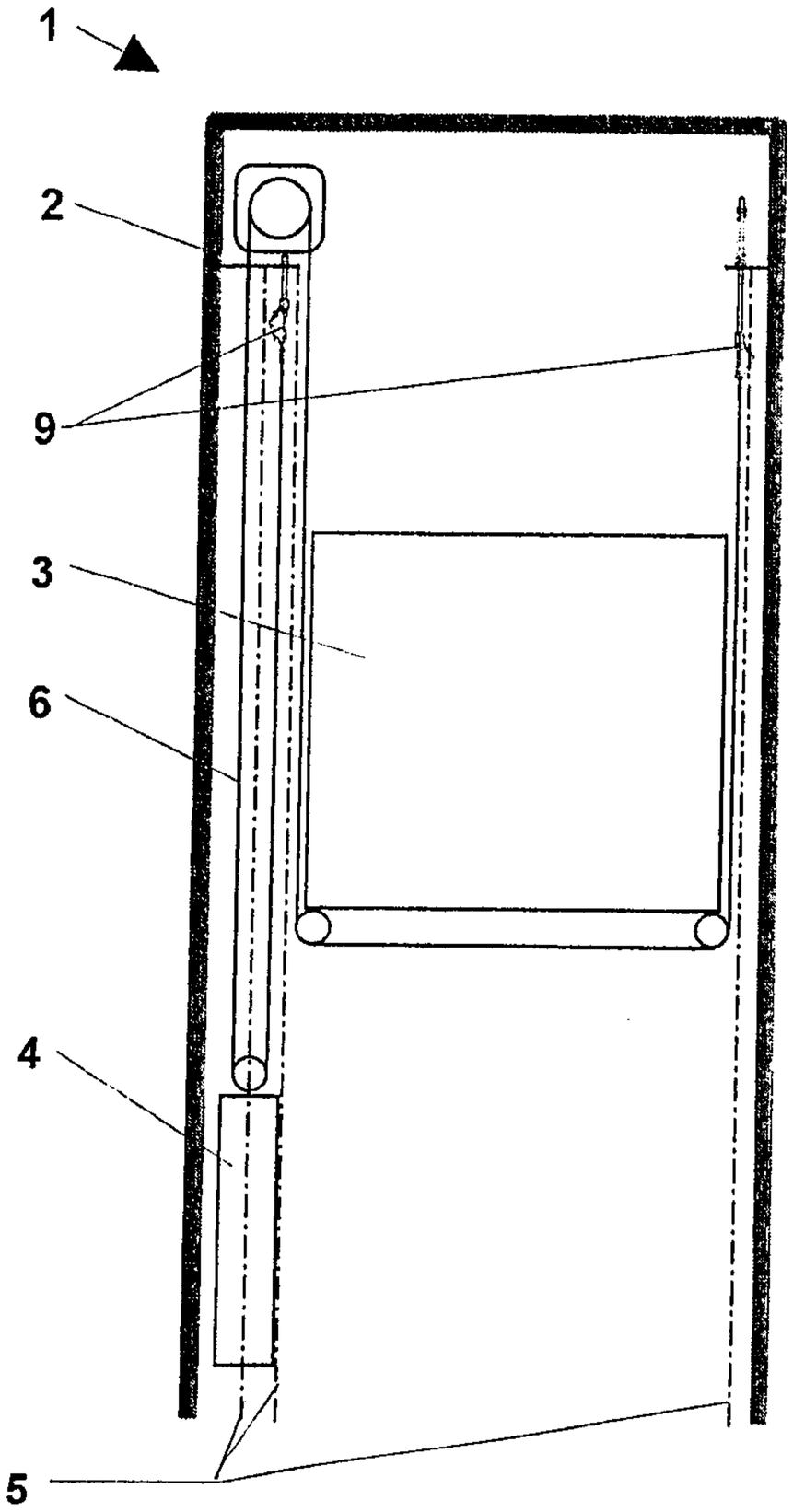


Fig. 1

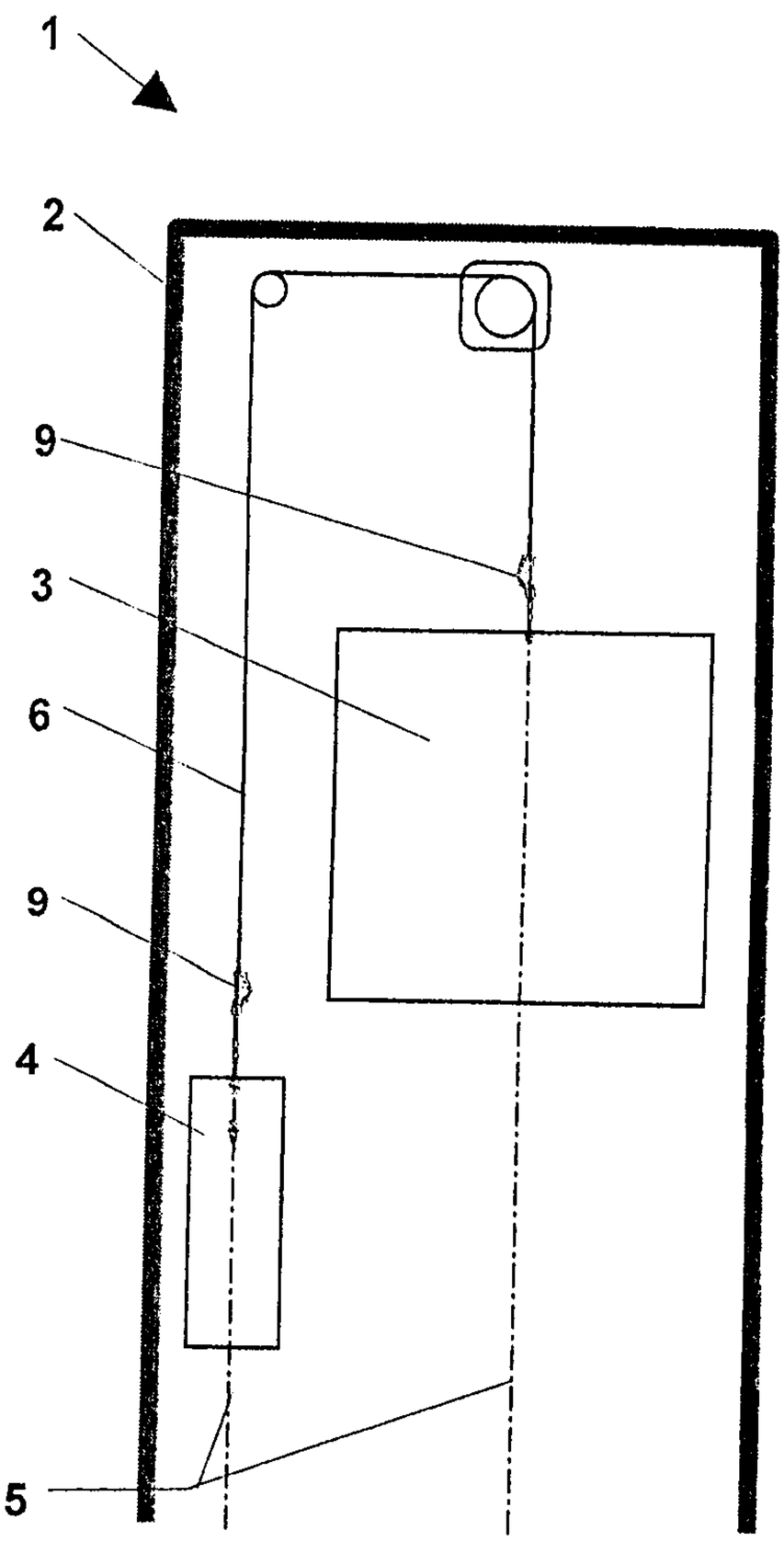


Fig. 2

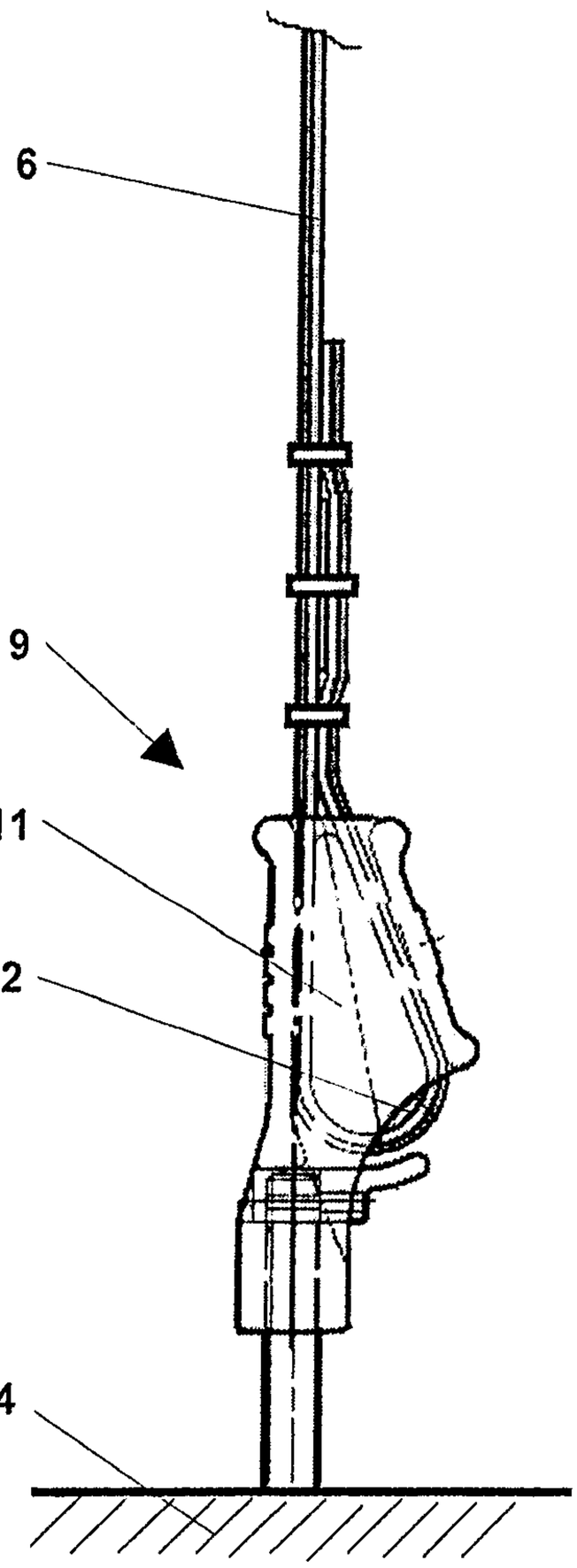


Fig. 3

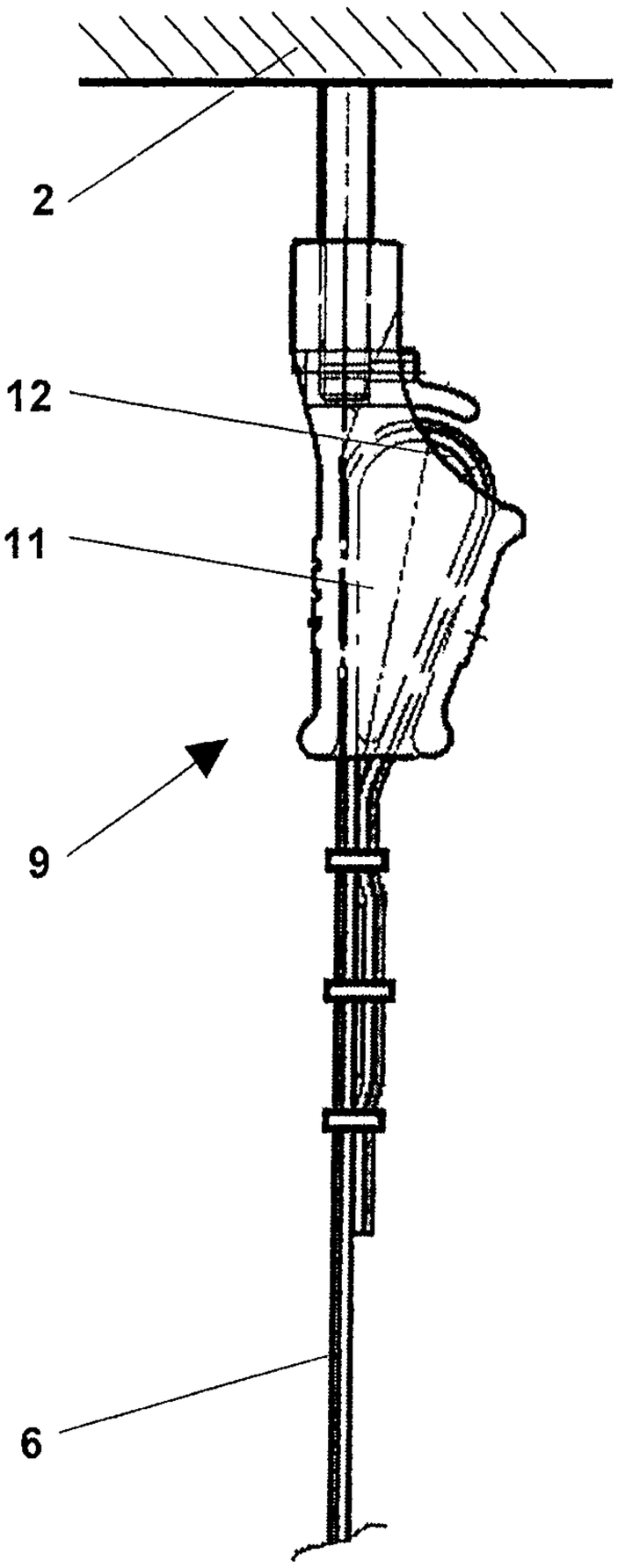


Fig. 4

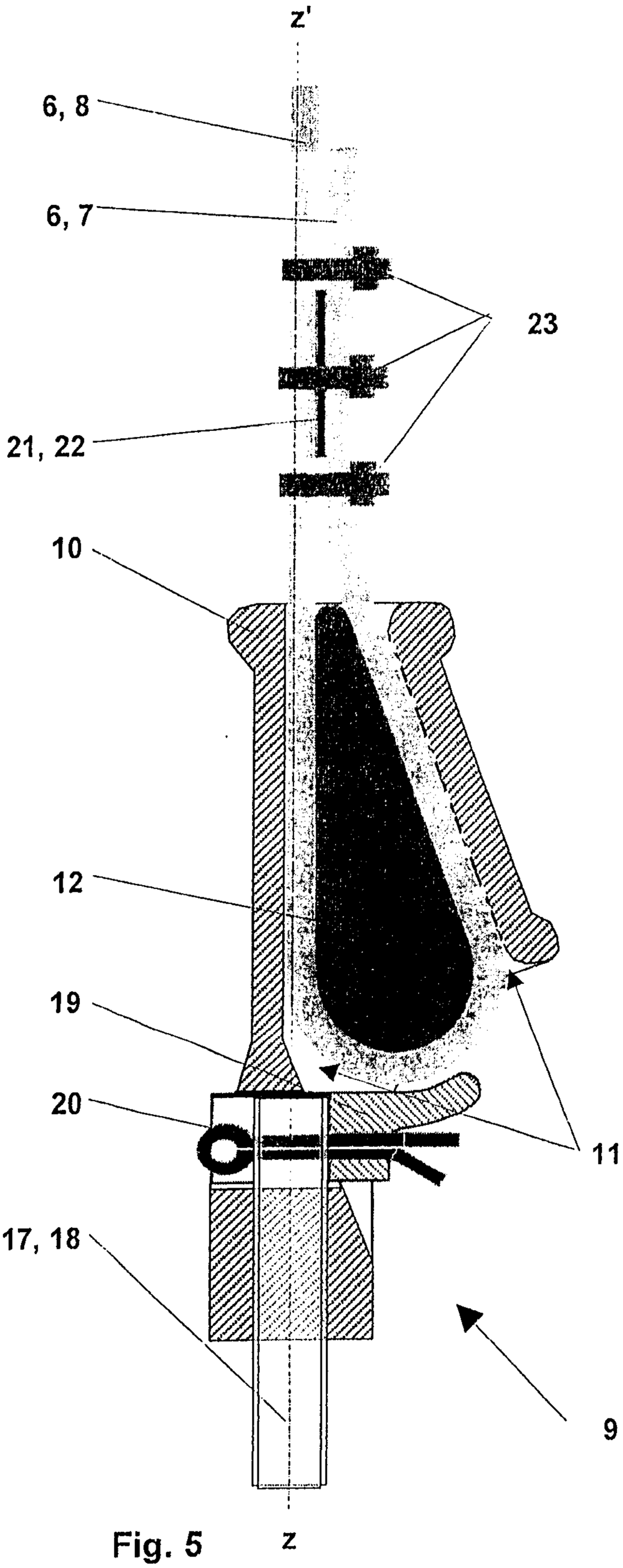


Fig. 5

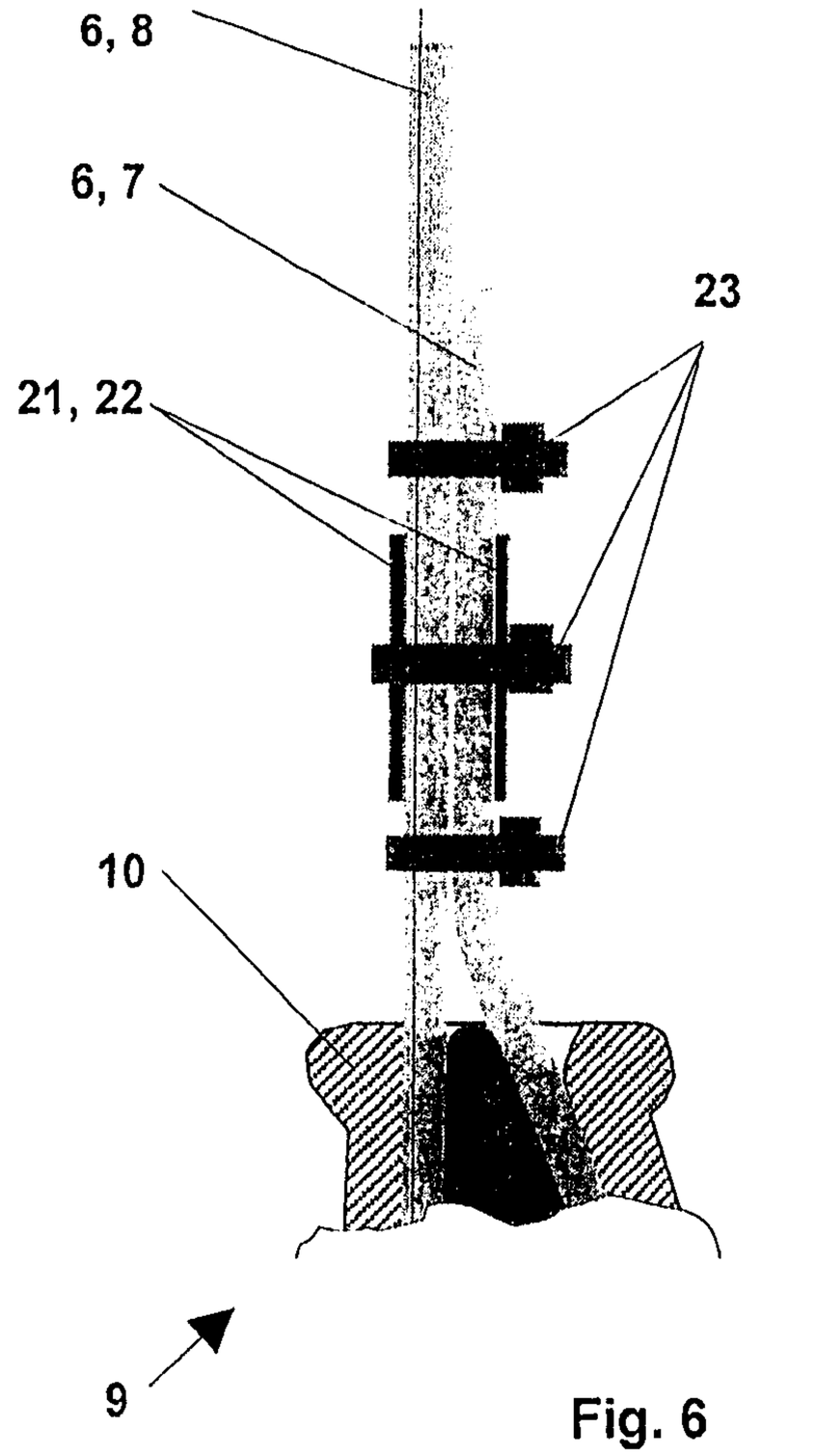


Fig. 6

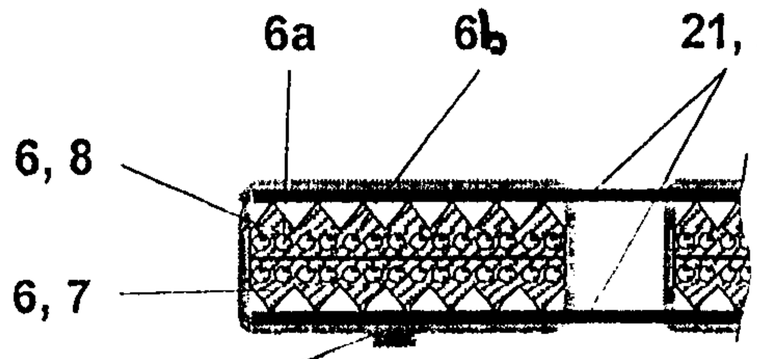


Fig. 6a

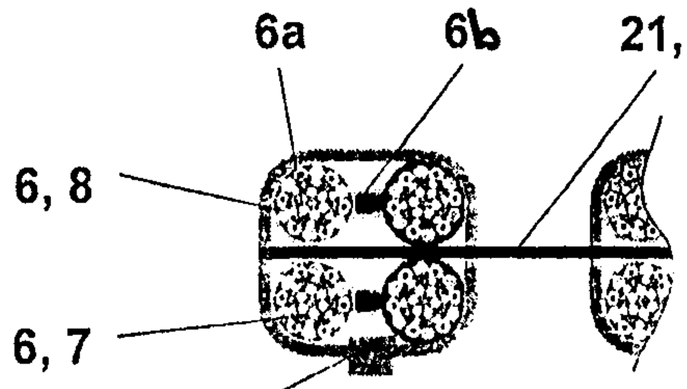


Fig. 5a

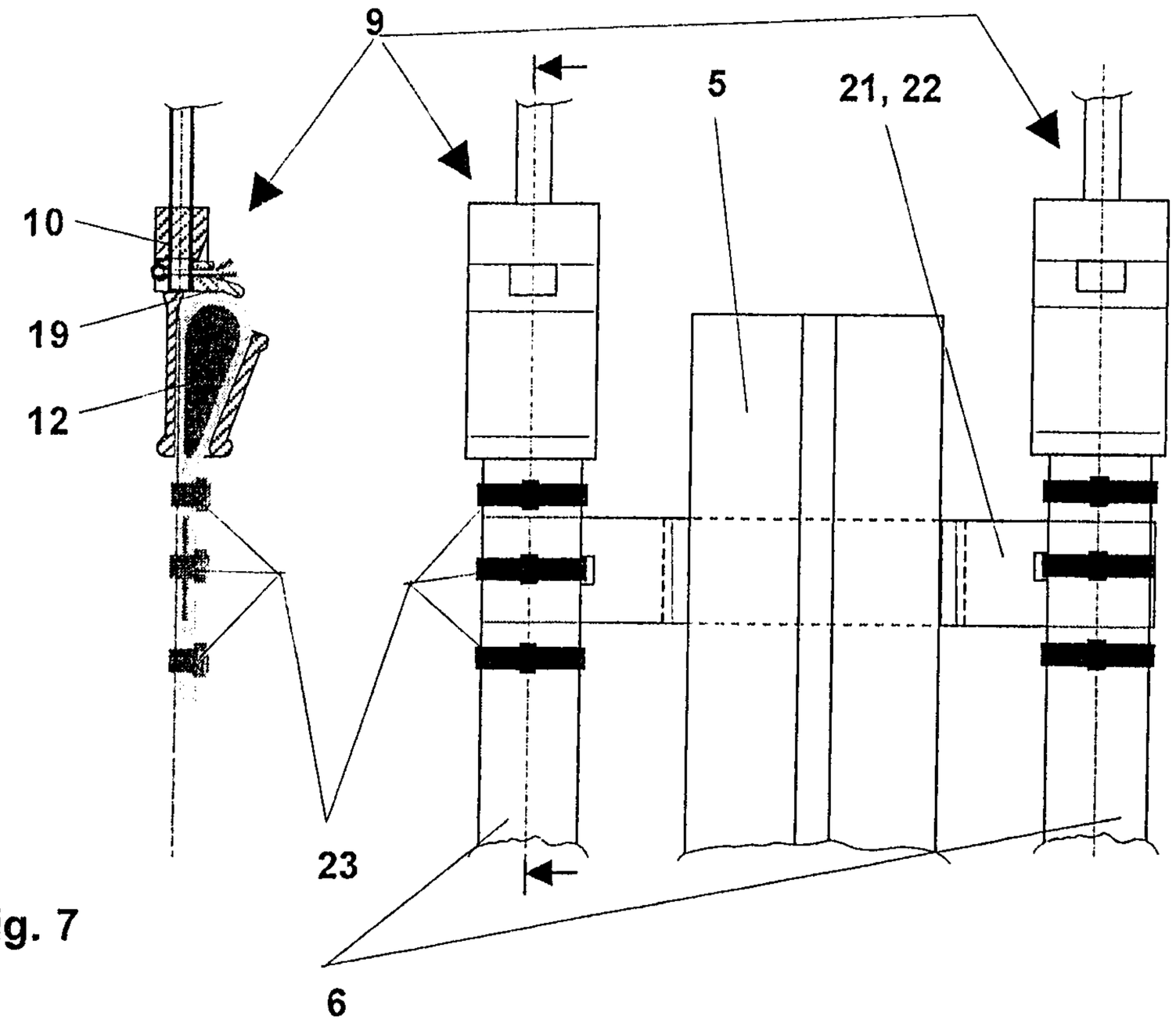


Fig. 7

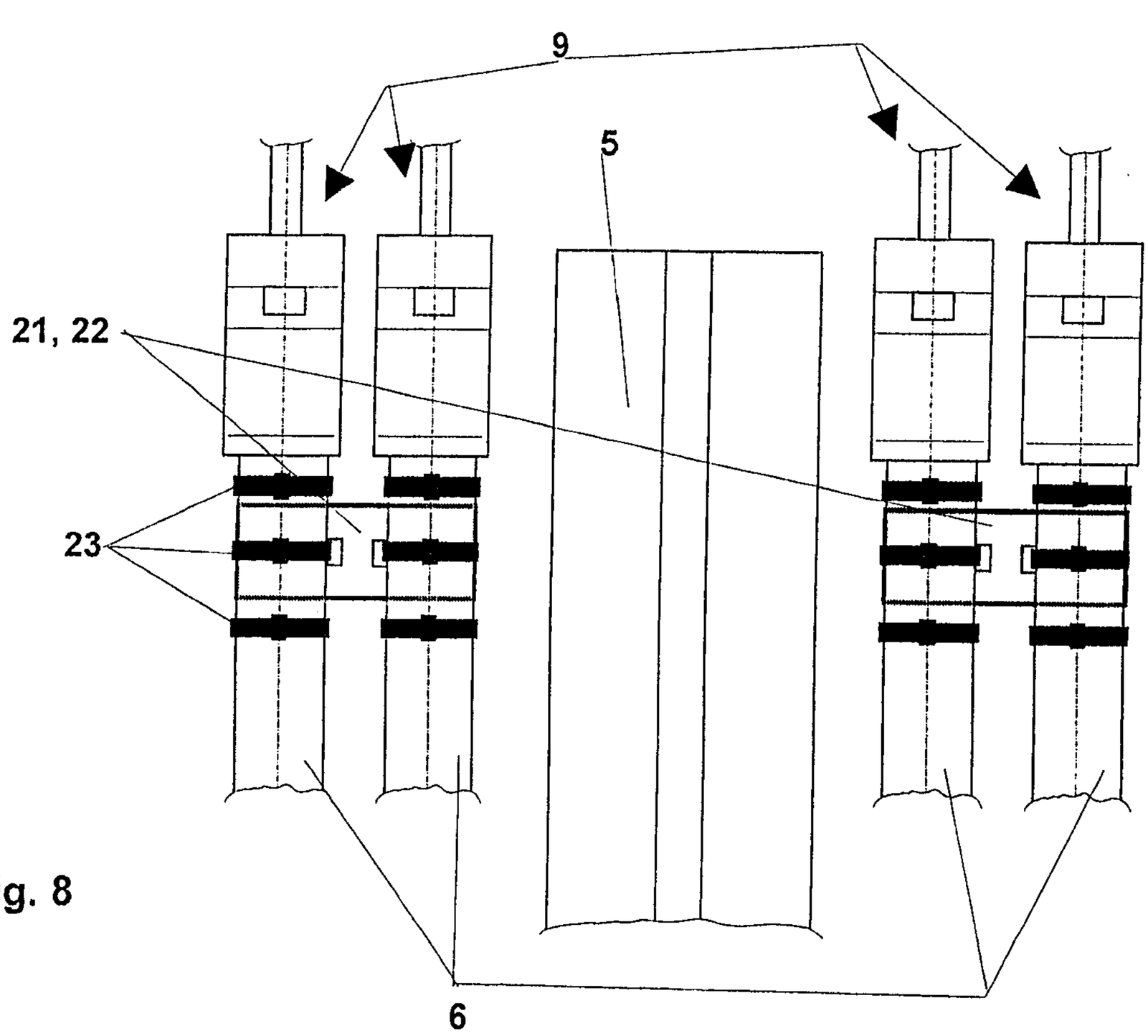
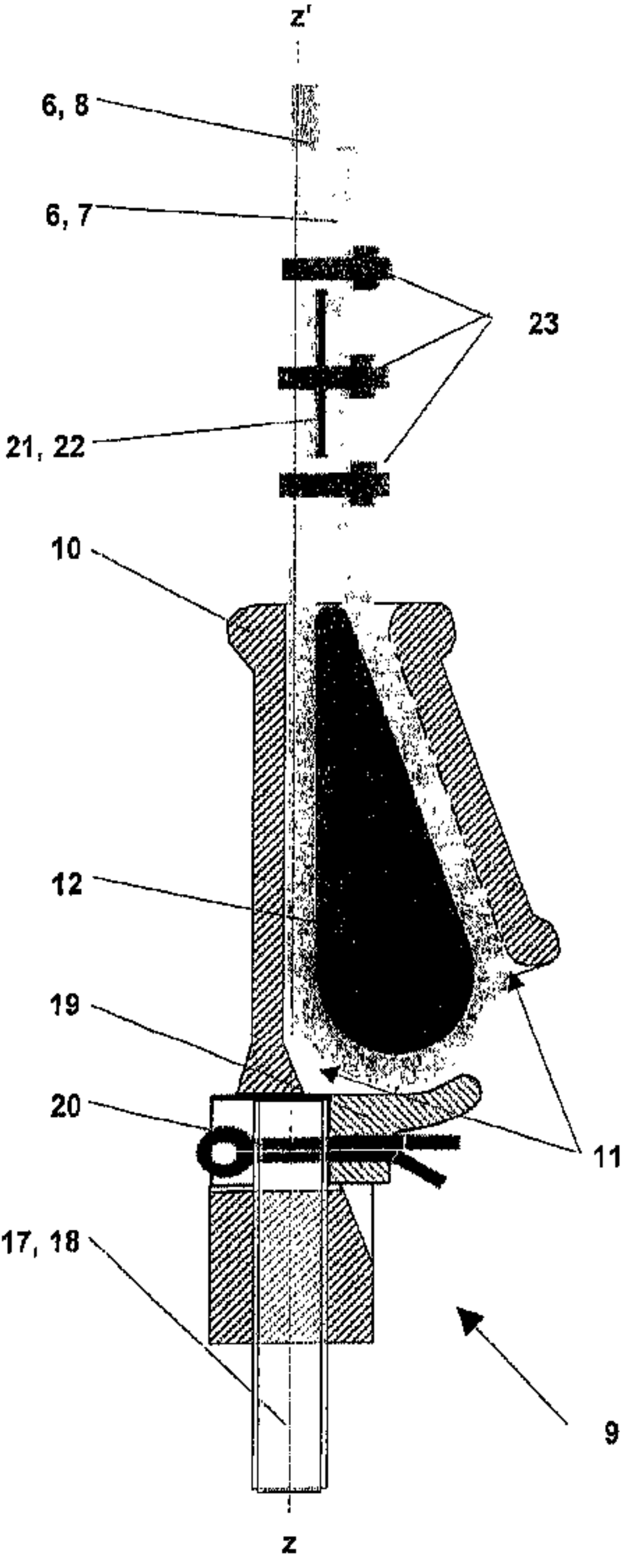


Fig. 8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