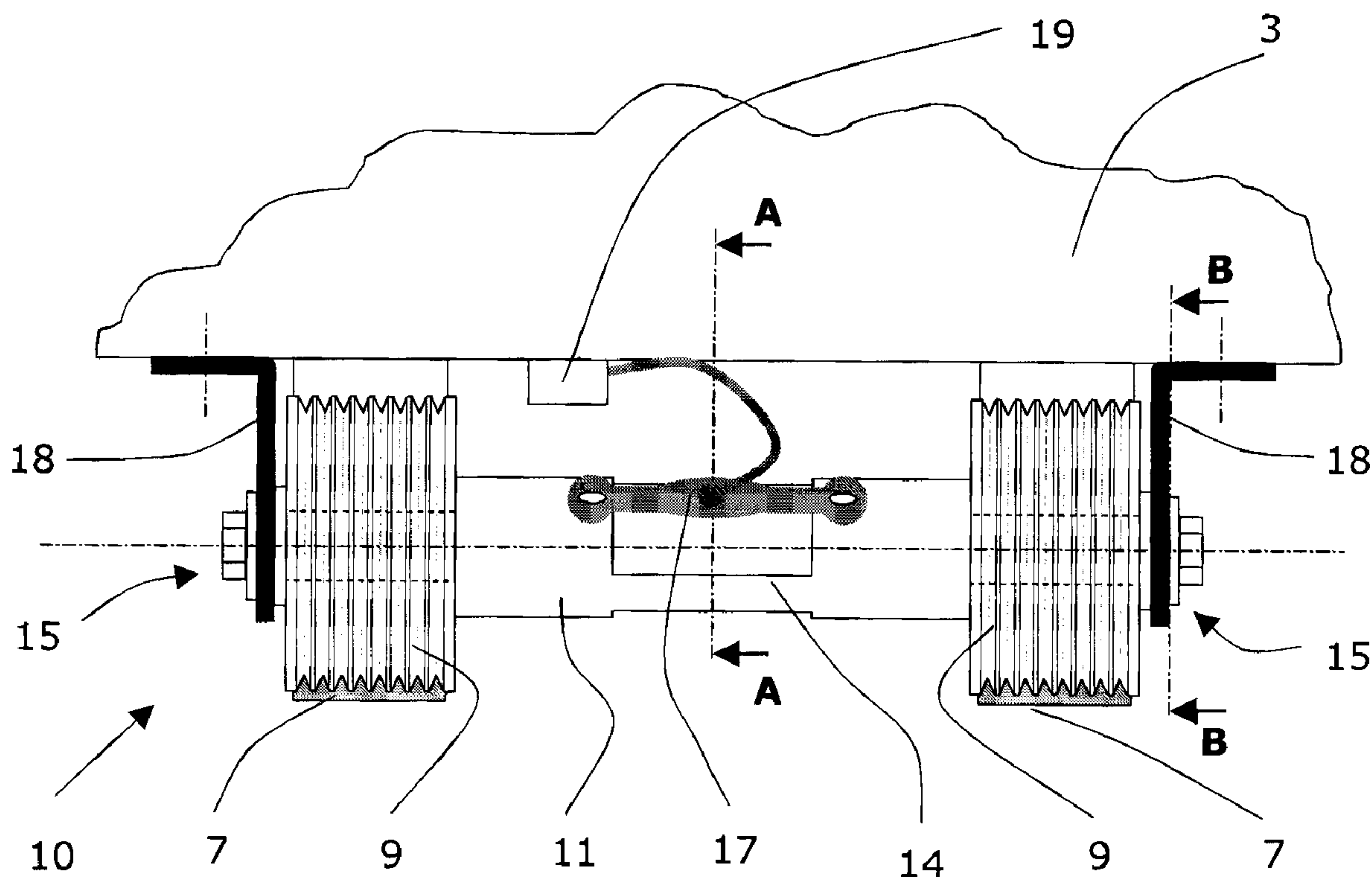




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(54) Titre : ASCENSEUR AVEC CABINE, GALETS DEFLECTEURS, ET METHODE D'INSTALLATION D'UN CAPTEUR DE CHARGE DANS LA CABINE
 (54) Title: LIFT INSTALLATION WITH A CABINE, A DEFLECTING ROLLER FOR A LIFT INSTALLATION, AND A METHOD OF ARRANGING A LOAD SENSOR IN A LIFT CABINE



(57) **Abrégé/Abstract:**

The invention relates to a lift installation (1) comprising a cage (3), a support means (7) for supporting the cage (3) and a load sensor (17), to a deflecting roller unit (10) for a lift installation (1) and to a method for arranging a load sensor (17) in a lift installation (1). The deflecting roller unit (10) is arranged at the cage (3) and comprises at least two deflecting rollers (9) which are rotatable about a common axle (11). According to the invention the load sensor (17) is arranged on the common axle (11) between the two deflecting rollers (9).

Abstract

The invention relates to a lift installation (1) comprising a cage (3), a support means (7) for supporting the cage (3) and a load sensor (17), to a deflecting roller unit (10) for a lift installation (1) and to a method for arranging a load sensor (17) in a lift installation (1). The deflecting roller unit (10) is arranged at the cage (3) and comprises at least two deflecting rollers (9) which are rotatable about a common axle (11). According to the invention the load sensor (17) is arranged on the common axle (11) between the two deflecting rollers (9).

(Fig. 3)

Lift installation with a cage, a deflecting roller for a lift installation, and a method of arranging a load sensor in a lift cage

Description

The invention relates to a lift installation comprising a cage, a support means for supporting the cage and a load sensor, and to a deflecting roller unit for a lift installation and a method of arranging a load sensor in a lift installation, according to the introductory part of the independent patent claims.

The lift installation is installed in a shaft. It substantially consists of a cage connected with a drive by way of support means. The cage is moved along a cage travel path by means of the drive. The support means are connected with the cage by way of deflecting rollers with a multiple slinging. The load-bearing force acting in the support means is reduced by the multiple slinging in correspondence with a slinging factor. The cage is designed to transport a useful load which can vary according to the respective need between empty (0%) and full (100%).

A lift suspension of that kind with a cage and a deflecting roller arrangement, which is mounted at the cage frame, is known from DE 20 221 212, wherein the deflecting roller arrangement comprises at least two deflecting rollers which are rotatable about a common axle.

A further lift installation of that kind with two deflecting rollers arranged in parallel is known from EP 1 446 348, wherein the deflecting rollers are arranged symmetrically with respect to a cage guide.

Lift installations of that kind usually include a load measuring system which, for example, is to detect an overload in the cage or which measures an effective useful load so as thus to be able to preset a required drive torque for the drive. An overload exists when the useful load is more than 100% of the useful load for which the cage is designed. In many cases load measuring systems of that kind are arranged in a cage floor, in that, for example, deformations or spring deflections of the cage floor are measured, or stress measuring elements are mounted at load-bearing structures of the cage.

Proceeding from the known state of the art the object now arises of demonstrating a load measuring system for a lift installation with deflecting rollers arranged in parallel, the system being able to be integrated simply and favourably in cost in a lift installation and being capable of measuring the useful load of the cage with sufficient accuracy. Moreover, use shall advantageously be able to be made of economic measuring elements.

The invention defined in the independent patent claims fulfils the object of integrating a load measuring system in simple and economic manner in a lift installation and it is demonstrated in the dependent claims how accurate yet economic measuring elements can be used.

According to the invention a load sensor is now arranged on the common axle between the two deflecting rollers. In this connection it is advantageous that a force acting on the respective common axle can be detected in simple and economic manner by only one load sensor. The force acting on the common axle very satisfactorily represents changes in a cage useful load. An arrangement of that kind of the load sensor can be integrated in simple manner in a lift installation.

Advantageously, in this connection a single load sensor is arranged centrally between the two deflecting rollers and the load sensor measures a bending deformation of the common axle. The central arrangement allows very accurate measurement, wherein a different load distribution to the deflecting rollers at the two sides has virtually no effect on the measurement result. This means that even in the case of an asymmetrical load distribution an accurate measurement is possible by merely one load sensor. The bending deformation of the common axle can be measured in simple manner, since it is a easily determinable load situation, i.e. bending beam on two supports. In an advantageous embodiment the common axle is cut away in the central region, wherein a rectangular cross-section oriented substantially symmetrically with respect to the longitudinal axis of the common axle is left and this cross-section is oriented in such a manner that a resultant deflecting roller force produced by the looping around of the deflecting rollers by way of the support means produces an appropriate bending deformation. An appropriate bending deformation is in this connection a deformation which is satisfactorily matched to a measurement range of the load sensor and it obviously takes into consideration the material characteristics - such as permissible stress, etc. - of the common axle.

Alternatively, the common axle consists of two outer axle sections fixedly connected together by way of a connecting part, wherein this connecting part is in turn shaped and oriented in such a manner that a resultant deflecting roller force caused by the looping around of the deflecting rollers by way of the support means produces an appropriate bending deformation. It is possible by means of this solution to, for example, realise different dispositions or different deflecting roller spacings in simple manner, since it is merely necessary to change the connecting part.

In both embodiments it is advantageous that an ideal measuring precondition for the load sensor can be realised.

In a further advantageous development the common axle is fastened at its two ends to the cage in substantially bending-elastic manner, wherein at least one of the ends has a positioning aid enabling alignment of the common axle with respect to the resultant deflecting roller force. With this embodiment a precise measurement is made possible and incorrect mounting is precluded.

Advantageously, the two deflecting rollers and the common axle, if need be together with support structures for fastening to the cage, are assembled already in a factory to form a deflecting roller unit. Costly mounting time for the lift installation is thus reduced and incorrect combinations are precluded, since the complete deflecting roller unit can be subjected to an inspection at the works. The deflecting roller units can obviously also already be attached to or installed in a structure of the cage at the factory.

The lift installation may comprise two deflecting roller units which are each looped around by, for example, 90°, wherein in this connection at least one of the deflecting roller units includes a load sensor. This is advantageous with regard to cost.

An integration in a control of the lift installation is advantageously carried out in that the load sensor includes a load measurement computer or is connected with a load measurement computer and this load measurement computer determines an effective useful load with use of a load characteristic of the load sensor. This is advantageous, since the load measurement computer can be furnished with a precise characteristic of the respective load sensor. Thus, several load sensors can also be connected together in simple manner. The load measurement computer can also easily carry out a check of the

load sensor in that, for example, an empty weight of the lift cage is used as check magnitude.

In a practical embodiment the load measurement computer detects the effective useful load at intervals during the time period over which access to the lift cage is possible, i.e. when a cage door is opened, and a lift control passes on a respective last measurement signal for determination of a start torque to the lift drive. This allows determination of a precise start torque, whereby a start-up jolt is largely avoided. In addition, the lift control can block a move-off command if an overload is detected.

In this solution it is particularly advantageous that the effective useful load is constantly measured, for example every 500 milliseconds, from a point in time when the lift cage can be left and entered, for example when the lift cage has freed a passage of 0.4 metres, to a point in time when the lift cage can no longer be entered or left, i.e. the cage door is virtually closed. The drive thereby constantly has information available about which drive moment it would have to provide at that instant and on the other hand an overload can be recognised in good time. Specifically, it is thus possible, for example, to actuate a warning buzzer before reaching an overload or if necessary to close the cage door.

In an advantageous embodiment the load sensor is a digital sensor such as described in, for example, EP 1 044 356. This is advantageous, since a sensor of that kind can be evaluated in simple manner. In a correspondingly realised example the digital sensor changes an oscillation frequency as a consequence of its load, which results from, for example, stretching of an outer tension fibre of the common axle. This oscillation frequency is counted by a computer in each instance over a fixedly defined measuring time period of, for example, 250 milliseconds. The oscillation frequency of the digital sensor is thus a measure for the load or for the useful load disposed in the lift cage. The characteristic of the digital sensor is learned during an initialisation of the lift installation in that, for example, the oscillation frequency of the digital sensor with empty cage and with a known test useful load is determined. Thereafter, an associated useful load can be calculated from every further oscillation frequency.

The invention is explained in more detail in the following by way of several examples of embodiment in conjunction with the figures, in which:

- Fig. 1A shows a schematic elevation of a lift installation with deflecting rollers arranged below the cage;
- Fig. 1G shows a schematic plan view of a lift installation corresponding with Fig. 1A;
- Fig. 2A shows a schematic elevation of a lift installation with deflecting rollers arranged above the cage;
- Fig. 2G shows a schematic plan view of a lift installation corresponding with Fig. 2A;
- Fig. 3 shows a basic illustration of a first deflecting roller unit;
- Fig. 3A shows a sectional illustration of a deflecting roller unit with load sensor according to Fig. 3;
- Fig. 3B shows a sectional illustration of a deflecting roller unit with positioning aid according to Fig. 3;
- Fig. 3C shows a perspective view of the deflecting roller unit according to Fig. 3;
- Fig. 4 shows a basic illustration of a further deflecting roller unit;
- Fig. 5 shows a moment diagram of a deflecting roller unit; and
- Fig. 6 shows a time sequence diagram of a load measuring process during a loading process.

A first possible overall arrangement of a lift installation is illustrated in Figs. 1A and 1G. The lift installation 1 in the illustrated example is installed in a shaft 2. It consists substantially of a cage 3 connected by way of support means with a drive 8 and, further, with a counterweight 6. The cage 3 is moved along a cage travel path 4 by means of the drive 8. Cage 3 and counterweight 6 in that case move in respectively opposite directions. The support means 7 are connected with the cage 3 and the counterweight 6 by way of deflecting rollers 9 with a multiple slinging. Two support means 7 are arranged symmetrically with respect to the cage travel path 4 and guided through below the cage 3

by way of two deflecting roller units 10 each including two deflecting rollers 9. The deflecting rollers 9 of the cage 3 are in that case each looped around by 90°. By virtue of the multiple slinging the load-bearing force acting in the support means 7 is reduced in correspondence with a slinging factor, in the illustrated example in correspondence with a slinging factor of two. The illustrated cage 3 is disposed in a loading zone, i.e. a cage door 5 is opened and an access to the cage 3 is correspondingly free.

One of the deflecting roller units 10 of the cage 3 is provided with a digital load sensor 17, the signal of which is now constantly conducted to a load measurement computer 19 during the loading process. The load measurement computer 19 performs the required evaluation and passes on the calculated signals or a calculated effective useful load to a lift control 20. The lift control 20 passes on the effective measured useful load to the drive 8, which can provide a corresponding start torque, or the lift control 20 initialises required measures when an overload is detected. Communication of signals from the load measurement computer 19 to the lift control 20 is carried out by way of known transmission paths such as hanging cable, bus system or wireless. In the illustrated example the load measurement computer 19 and lift control 20 are separate units. These subassemblies can obviously be combined as desired, thus the load measurement computer 19 can be integrated in the deflecting roller unit 10 or it can be integrated in the lift control 20 and the lift control 20 can in turn be arranged at the cage 3 or in an engine room or it can also be integrated in the drive 8.

A further overall arrangement of the lift installation, which is also executed with a looping factor of two, is illustrated in Figs. 2A and 2G. By contrast to the preceding embodiment, the deflecting roller 10 is arranged above the cage 3. The deflecting rollers 9 of the cage 3 are looped around by the support means 7 by 180°, i.e. the support means 7 runs from above to the deflecting roller unit 10, is deflected through 180° and runs again upwardly. The load sensor 17 is installed at the deflecting roller unit 10 at the cage side. Moreover, reference is made to the embodiments of Figs. 1A and 1G. By contrast to Figures 1, in Figures 2 the cage door 5 is illustrated closed. In this state the load measurement computer 19 is inactive, since no exchange of useful load is possible. Obviously, the load measurement computer 19 could if required be switched to be permanently active if, for example, conclusions with respect to acceleration processes or disturbances in the travel sequence are to be collated.

A possible deflecting roller unit 10 such as is usable in the lift installation 1 according to Figures 1 is illustrated in Fig. 3. The deflecting roller unit 10 comprises a common axle 11 with two deflecting rollers 9 rotatably mounted in the region of the outer ends 15 of the axle 11. The common axle 11 is, in the example, connected with the cage 3 by means of supports 18. The axle 11 is in this connection fastened fixedly, at least non-rotatably, to the supports 18. The support 18 in the example is formed from shaped steel plate and it defines for the common axle 11 a support point or support which retains the axle 11 approximately free of bending or in bending-elastic manner. In addition, this fastening is effected in such a manner that the free rotatability of the deflecting rollers 9 themselves is guaranteed. The two deflecting rollers have a spacing from one another which enables, for example, an arrangement of cage guides 4 in the region between the two deflecting rollers, as apparent in Fig. 1G. The load sensor 17 is arranged in the centre between the two deflecting rollers 9. In the centre means that the deflecting rollers 9 and the fastening to the supports 18 are substantially symmetrical with respect to this centre. The common axle 11 is reduced in cross-section or cut away in a central region, as illustrated in Fig. 3B. A rectangular cross-section 14 oriented substantially symmetrically with respect to the longitudinal axis of the common axle 11 remains. This cross-section 14 is oriented in such a manner that a resultant deflecting roller force 23 produced by the looping around of the deflecting rollers 9 by way of the support means 7, or a support means force 22, produces a proportionate bending deformation. In the arrangement selected in accordance with Figures 1 the support means 7 are led through below the cage. As a result, the individual deflecting roller unit 10 is, as apparent from Fig. 3B, looped around by 90°. The resulting deflecting roller force 23 is correspondingly turned through 45° relative to the support means forces 22 and the rectangular cross-section 14 is oriented in correspondence with the direction of this resultant deflecting roller force 23, so that an optimal bending deformation results. In the indicated example the rectangular cross-section 14 or cut-out is selected in such a manner that the load sensor 17 experiences a length change of approximately 0.2 millimetres over the anticipated load or useful load range. The load range in this connection results from the difference between empty and fully laden cage 3. As further apparent in Fig. 3B one end 15 of the common axle 11 can be provided with a positioning aid 16 which enables an unequivocal orientation of the common axle 11 with respect to the supports 18 and additionally with respect to the cage 3. In the example, the end 15 of the common axle 11 is for that purpose provided with a mechanically positively coupling shape 16 which defines the position of the assembly. Fig. 3C shows in a perspective view the arrangement according to the invention of the load sensor 17 as

described in Fig. 3. The load sensor 17 is as a rule connected with the load measurement computer 19 by means of cable. In the example the load measurement computer 19 is arranged at the cage 3. In many cases the load measurement computer 19 can be arranged directly at or integrated directly in the load sensor 17.

Fig. 4 shows an alternative embodiment of the deflecting roller unit 10. In this example the common axle 11 is divided into two outer axle sections 12, which form the mount for the deflecting rollers 9 and at the same time enable connection with the support 18. The two outer axle sections 12 are joined together by way of a connecting part 13 to form the complete common axle 11. The connecting part 13 includes the load sensor 17 and is again shaped in such a manner that the optimal loading or bending conditions for the load sensor 17 result. Obviously the connecting locations of the axle sections 12 to the connecting part 13 and to the support 18 are also executed in this form of embodiment in such a manner that an orientation of the common axle 11 in correspondence with a load direction necessarily takes place.

The illustrated embodiments are by way of example and can be changed with knowledge of the invention. Thus, obviously also several deflecting rollers can be used instead of two spaced-apart deflecting rollers 9, wherein, for example, four deflecting rollers would be arranged in pairs at a spacing from one another.

The symmetrical arrangement of the load sensor 17 in the centre between the two deflecting rollers 9 gives the advantage, as illustrated in Fig. 5, that an asymmetrical distribution of support means forces to the two support means 7 does not have a significant effect on a measurement deviation in the load sensor 17. In the case of a normal load distribution between two support means 7.1, 7.2, a bending moment course M_N in the common axle 11 results, which has a substantially constant value between the two deflecting rollers 9.1, 9.2. The load sensor 17, which is arranged in the centre between the two deflecting rollers 9.1, 9.2, detects a bending deformation value which results in correspondence with a bending stress M_{NM} .

In the case of a different load distribution between the two support means 7.1, 7.2, which is illustrated in Fig. 5 in such a manner that the starting point is a total failure of a respective one of the support means 7.1, 7.2, a bending moment course M_1 results when the support means 7.2 fails and a bending moment course M_2 if the support means 7.1

should fail. As apparent from comparison of the bending moment courses M_N , M_1 , M_2 the bending deformation value M_{1M} , M_{2M} detected by the load sensor 17, which is arranged in the middle between the two deflecting rollers 9, remains unchanged in comparison with the bending deformation value M_{NM} . A maximum measurement deviation dM in the bending deformation value results.

Fig. 6 shows a measurement process in the operating sequence of the lift installation. The lift cage 3 approaches a stopping point at an operating speed V_K of 100% and decelerates to standstill. Shortly before attaining standstill the lift cage initiates opening of the cage door 5. The cage door 5 begins to open and frees access to the cage 3 in correspondence with an opening travel S_{KT} . As soon as a minimum passage of, for example, 30% or a minimum passage of, for example, 0.4 metres exists the load measuring or the load measurement computer 19 is switched on and delivers at time intervals t_M a signal L_K , which corresponds with the effective useful load, to the lift control 20. The lift control can now, as illustrated in the example, recognise a 80% useful load and stop further loading by means of a warning buzzer or an information display "cage full" (not illustrated) and initiate closing of the cage door. As soon as the cage door is now closed to such an extent that an access can no longer be effected, in the illustrated example at 60%, the load measurement computer 19 stops evaluation of the load measurement signal and the lift control 20 uses the last measurement value L_{KE} for determination of the start torque of the lift drive. As soon as the opening travel of the cage door 5 is at 0% (closed), a move-off travel of the cage 3 is correspondingly initiated.

If now the lift control signal detects an overload L_{KU} on the basis of the load measurement signal L_A a demand for reduction of the useful load is issued and a closing process of the cage door would be prevented as long as an overload exists. The control can obviously provide that other criteria are defined in special operation. Thus, for example, in the case of emergency operation such as a fire alarm a higher overload limit could be permitted.

With knowledge of the present invention the lift expert can change the desired shapes and arrangements as desired. For example, the illustrated lift control can further evaluate the signal of the load measurement computer in that, for example, the time instant of the warning signal is defined in dependence on a speed of loading. Moreover, a corresponding deflecting roller unit with load sensor can also be arranged, for example, in the shaft or at the drive.

We claim:

1. Lift installation comprising a cage (3), a support means (7) for supporting the cage (3) and a load sensor (17), which support means (7) is connected with the cage (3) by means of at least two deflecting rollers (9), wherein the support means (7) partly loops around the deflecting rollers (9) and the two deflecting rollers (9) are rotatably mounted on a common axle (11), and wherein the load sensor (17) is arranged on the common axle (11) between the two deflecting rollers (9).
2. Lift installation according to claim 1, characterised in that the load sensor (17) is centrally arranged between the two deflecting rollers (9) and that the load sensor (17) measures a bending deformation of the common axle (11).
3. Lift installation according to claim 1 or 2, characterised in that the common axle (11) is cut away in the centre region, wherein a rectangular cross-section (14) oriented substantially symmetrically with respect to the longitudinal axis of the common axle (11) is left and this cross-section (14) is so oriented that a resultant deflecting roller force (23) produced by the looping-around of the deflecting rollers (9) by way of the support means (7) causes an appropriate bending deformation or that the common axle (11) consists of two outer axle sections (12) fixedly connected together by a connecting part (13) and this connecting part (13) is so shaped and oriented that a resultant deflecting roller force (23) produced by the looping-around of the deflecting rollers (9) by way of the support means (7) causes an appropriate bending deformation.
4. Lift installation according to claim 3, characterised in that the common axle (11) is fastened at its two ends (15) to the cage (3) to be substantially resilient in bending, wherein at least one of the end (15) has a positioning aid (16) enabling alignment of the common axle (11) with respect to the resultant deflecting roller force (23).

5. Lift installation according to any one of claims 1 to 4, characterised in that the two deflecting rollers (9) and the common axle (11) are assembled to form a deflecting roller unit (10).

6. Lift installation according to claim 5, characterised in that the lift installation comprises two deflecting roller units (10), wherein at least one of the deflecting roller units (10) includes said load sensor (17).

7. Lift installation according to any one of claims 1 to 6, characterised in that the load sensor (17) includes a load measurement computer (9) or is connected with a load measurement computer (19) and this load measurement computer (9) determines an effective useful load with use of a load characteristic of the load sensor (17).

8. Lift installation according to claim 7, characterised in that the load measurement computer (19) determines the effective useful load (L_K) at intervals during the period over which access to the lift cage is possible and a lift control (20) passes on a respective last measurement signal (L_{KE}) of the load measurement computer (19) to a lift drive (8) for determination of a start torque or the lift control (20) blocks a move-off command if an overload is detected.

9. Lift installation according to any one of claims 1 to 8, characterised in that the load sensor (17) is a digital sensor.

10. Deflecting roller unit for connecting a support means (7) with a lift cage, which deflecting roller unit (10) includes two deflecting rollers (9) and a common axle (11), wherein the two deflecting rollers (9) are rotatably mounted on the common axle (11), and wherein a load sensor (17) is arranged on the common axle (11) between the two deflecting rollers (9).

11. Method of arranging a load sensor (17) in a lift installation, which lift installation (1) includes a cage (3) and a support means (7) for supporting the cage (3), wherein the support means (7) is connected with the cage by means of at least two deflecting rollers (9) and the two

deflecting rollers (9) are rotatably mounted on a common axle (11), characterised in that the load sensor (17) is arranged on the common axle (11) between the two deflecting rollers (9).

12. Method according to claim 11, characterised in that the effective useful load is determined by means of a load measurement computer at intervals during the period over which access to the lift cage (3) and that the respective last effective useful load is, for determination of a start torque, passed on to the lift drive (8) by means of a lift control (20) or a move-off command is blocked by means of the lift control (20) if an overload is detected.

Fig. 1A

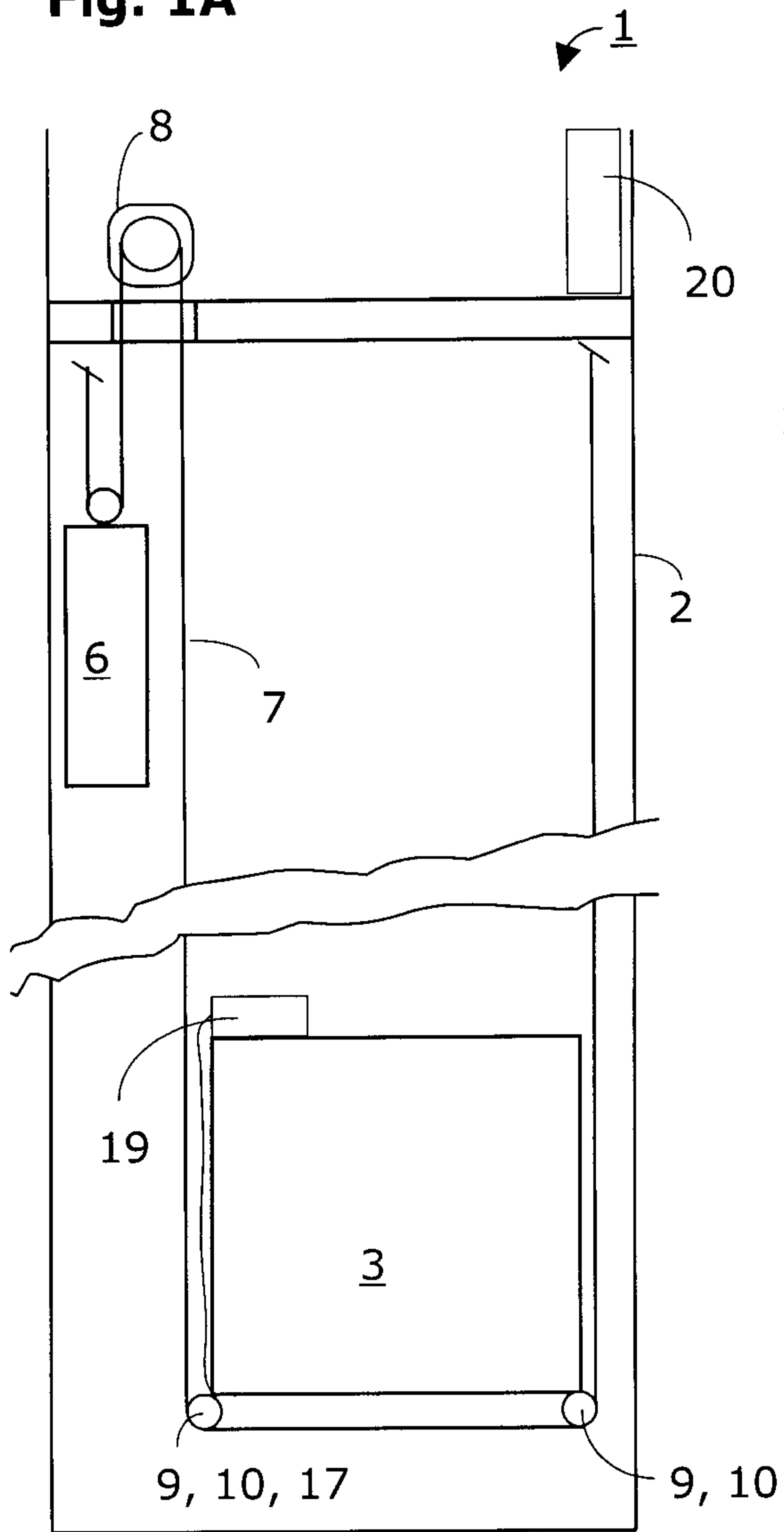


Fig. 2A

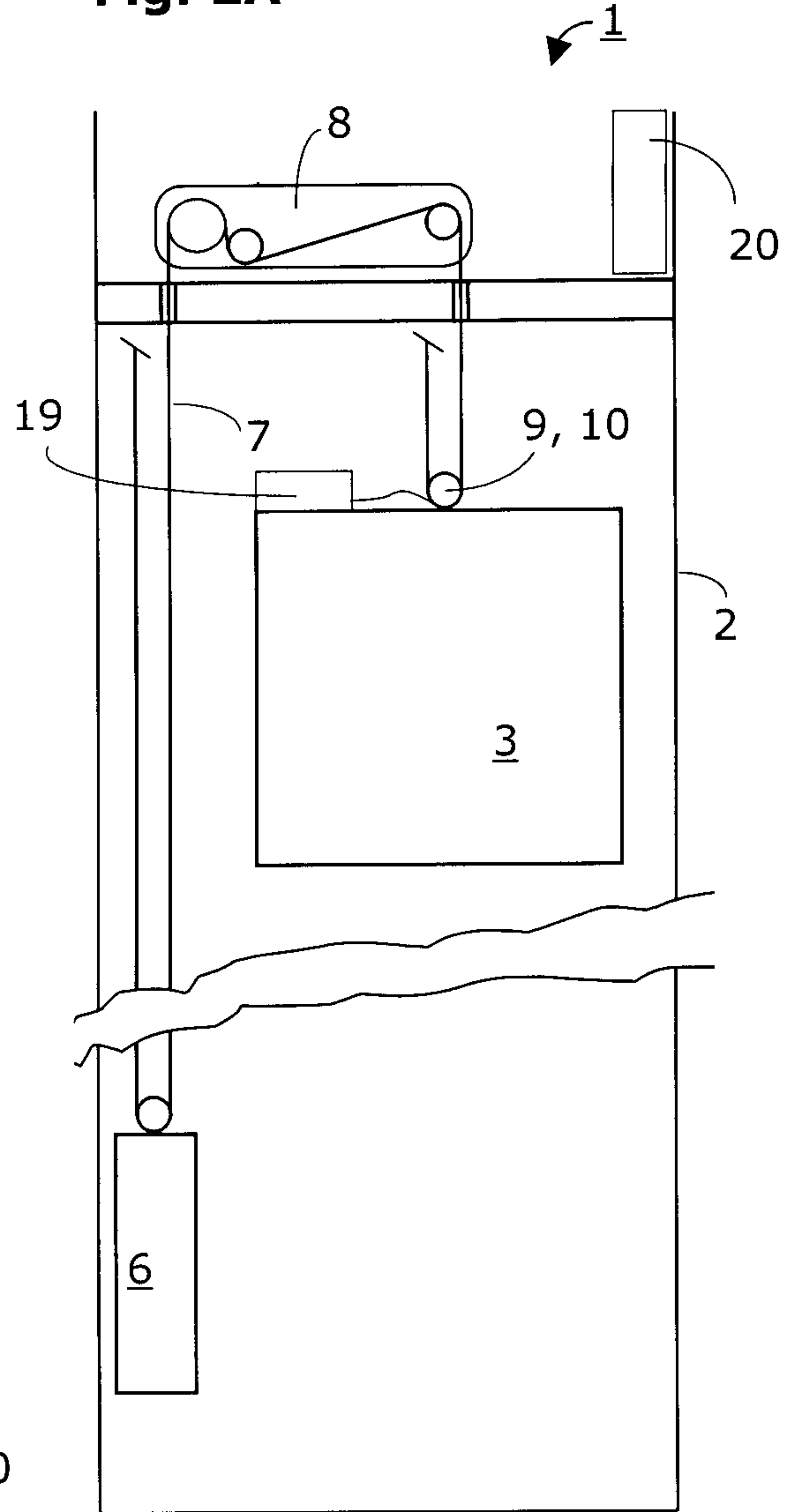


Fig. 1G

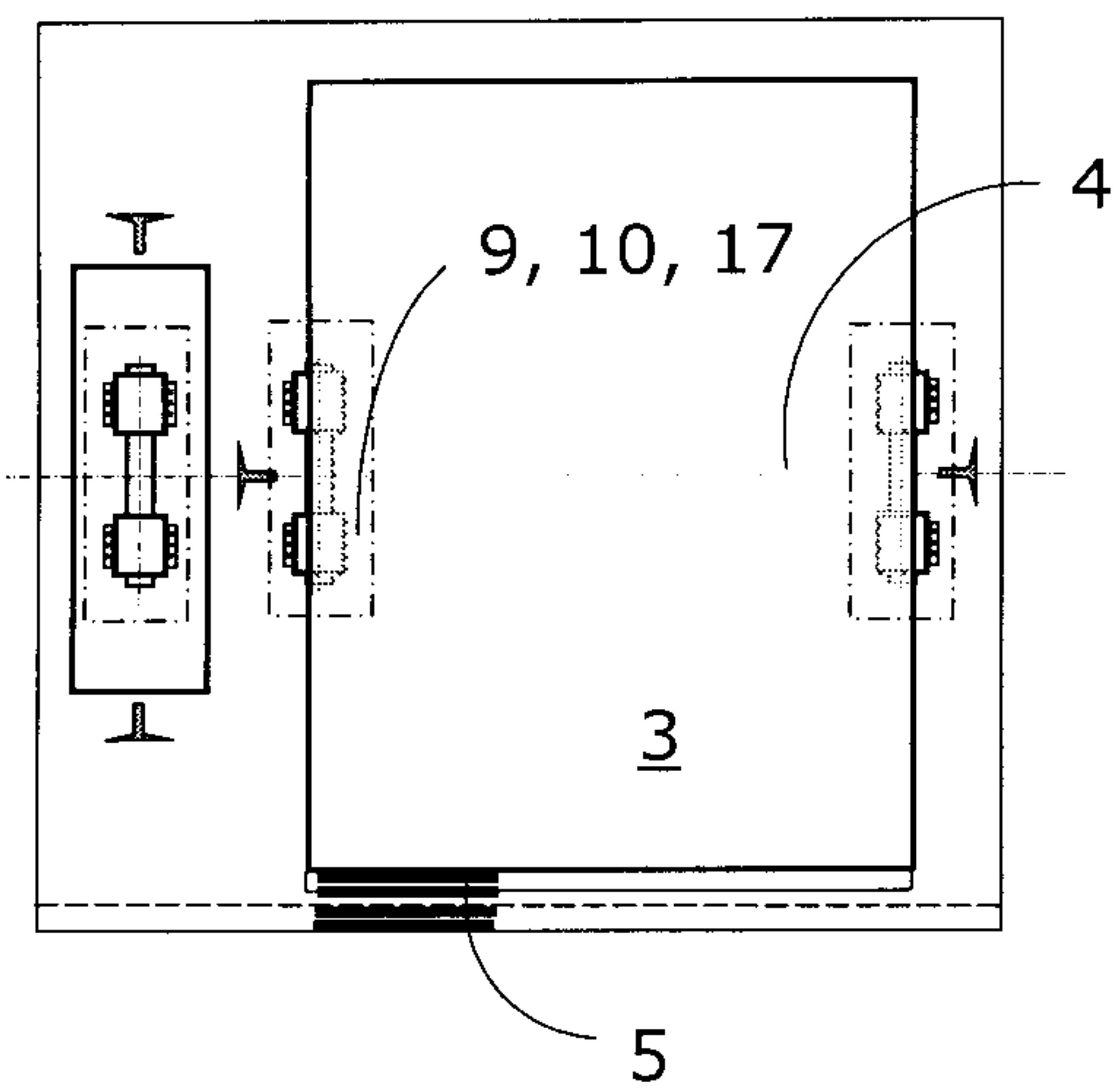


Fig. 2G

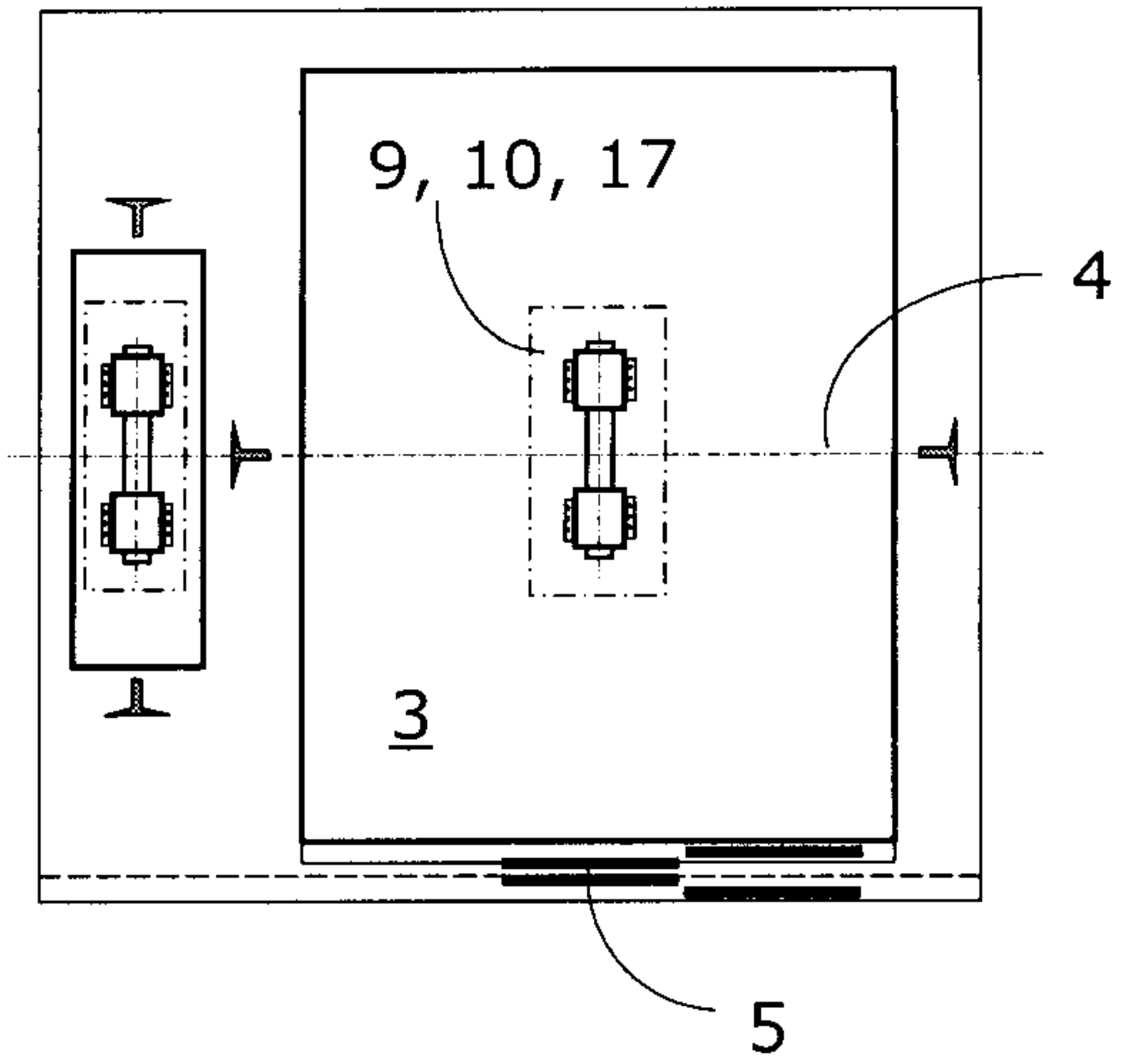
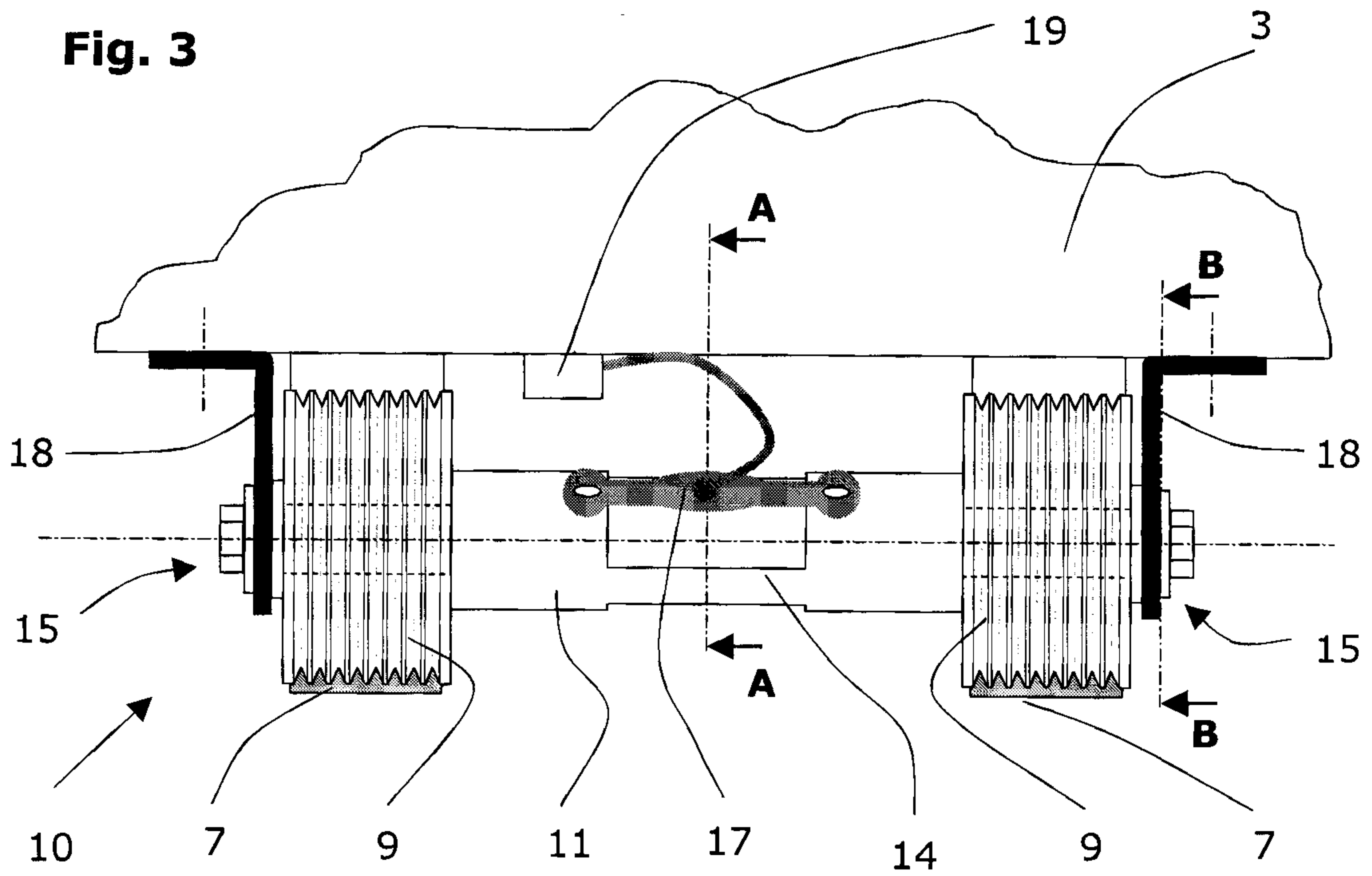
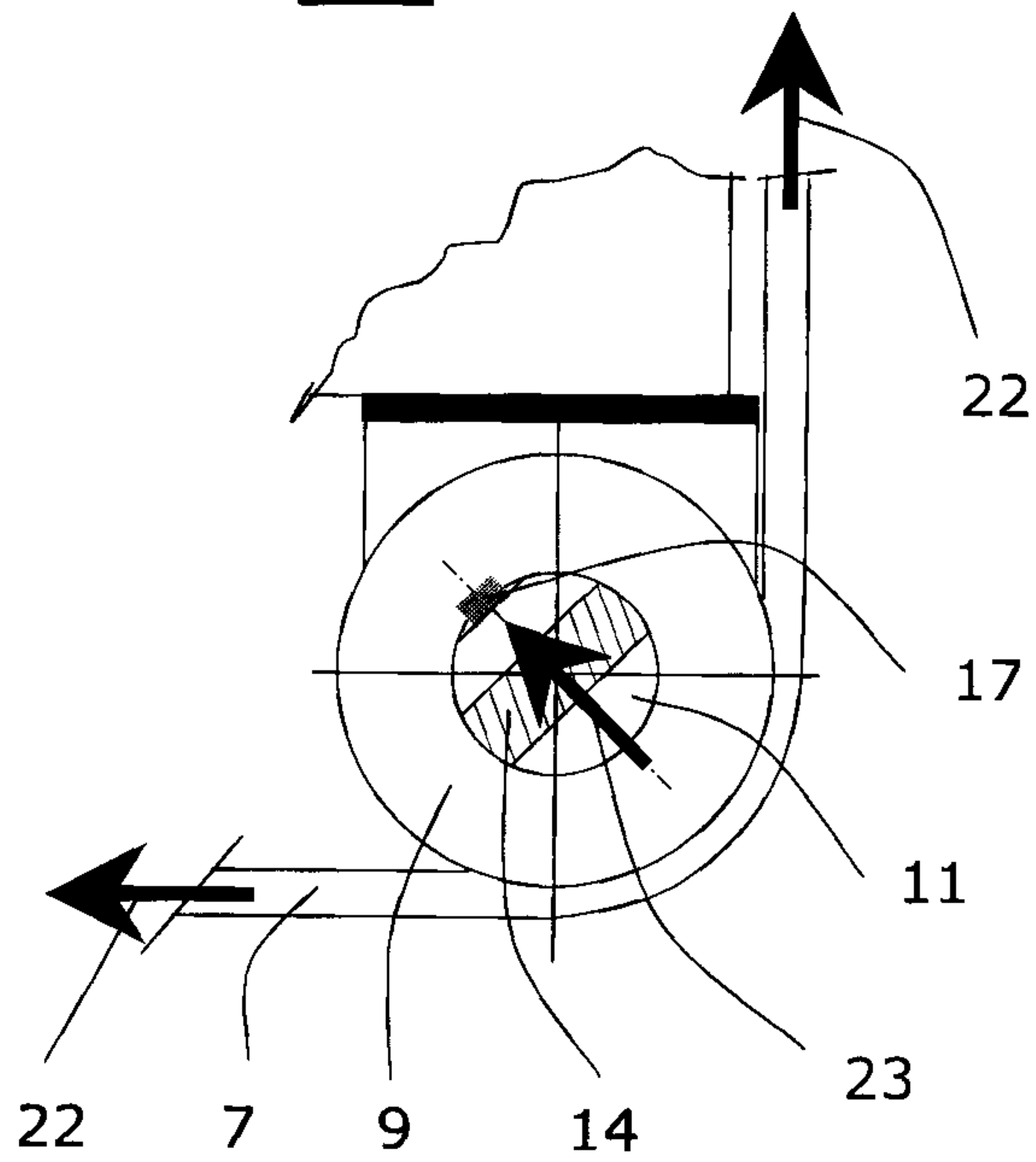


Fig. 3



**Fig. 3B
A-A**



**Fig. 3B
B-B**

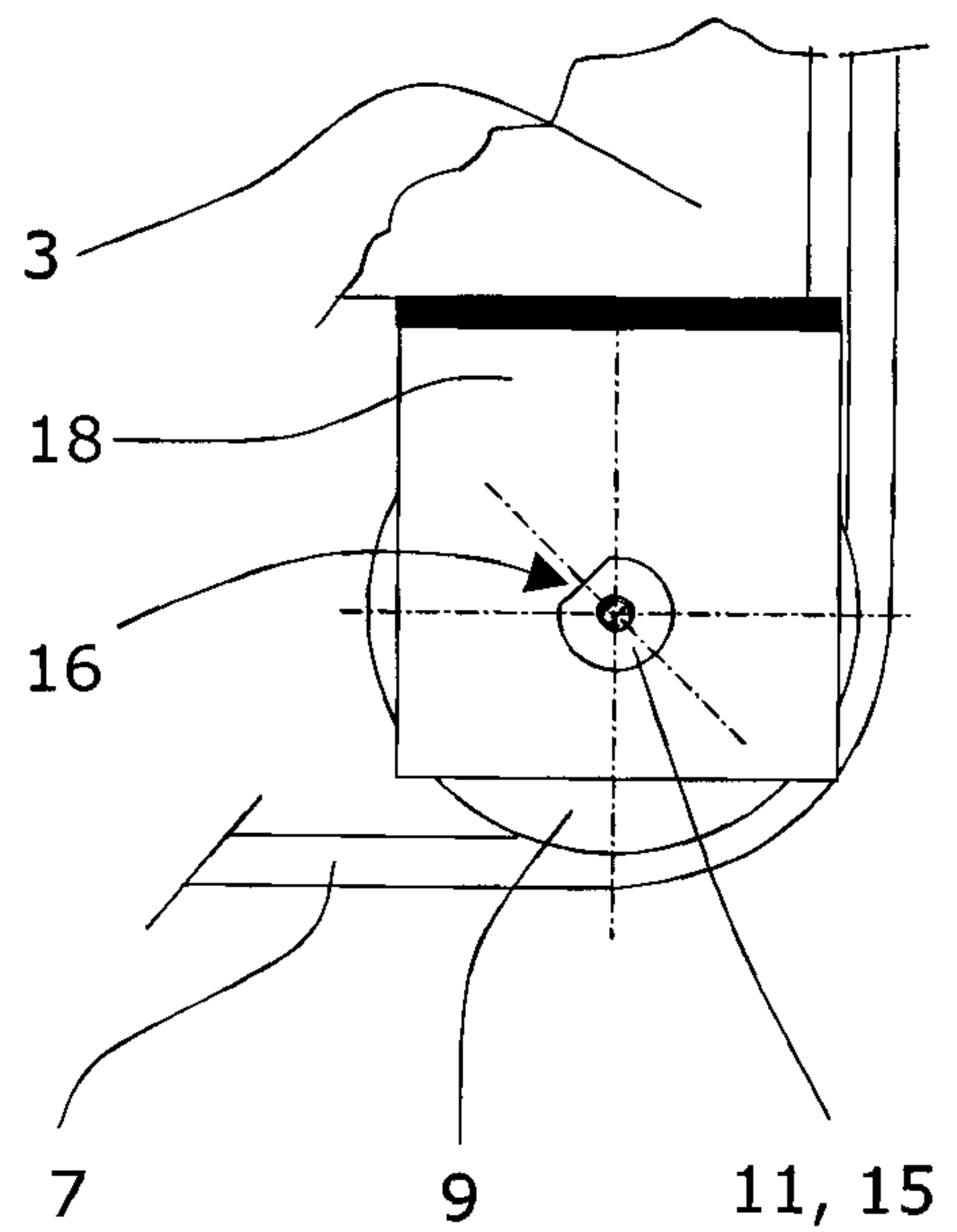


Fig. 3C

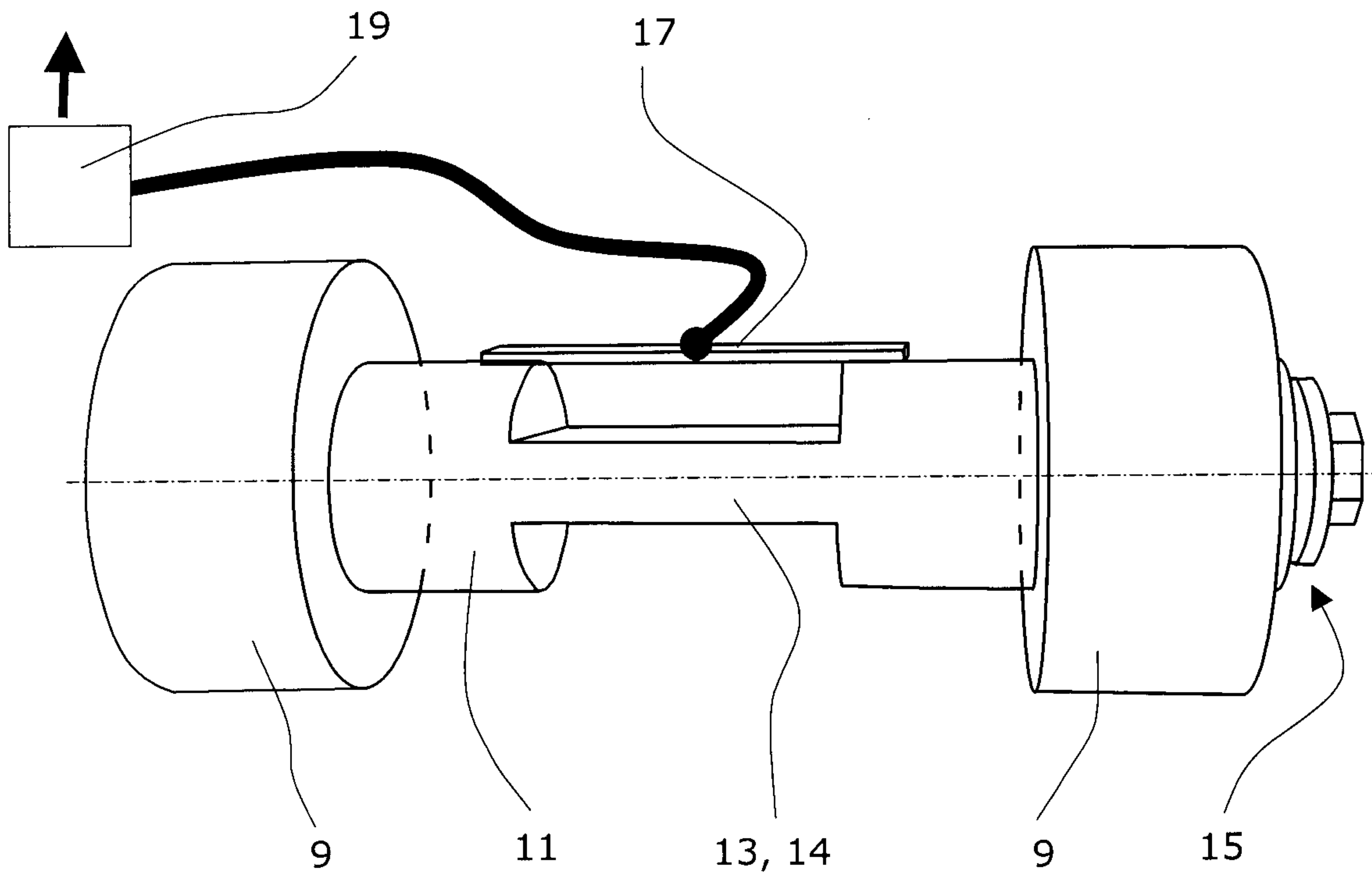


Fig. 4

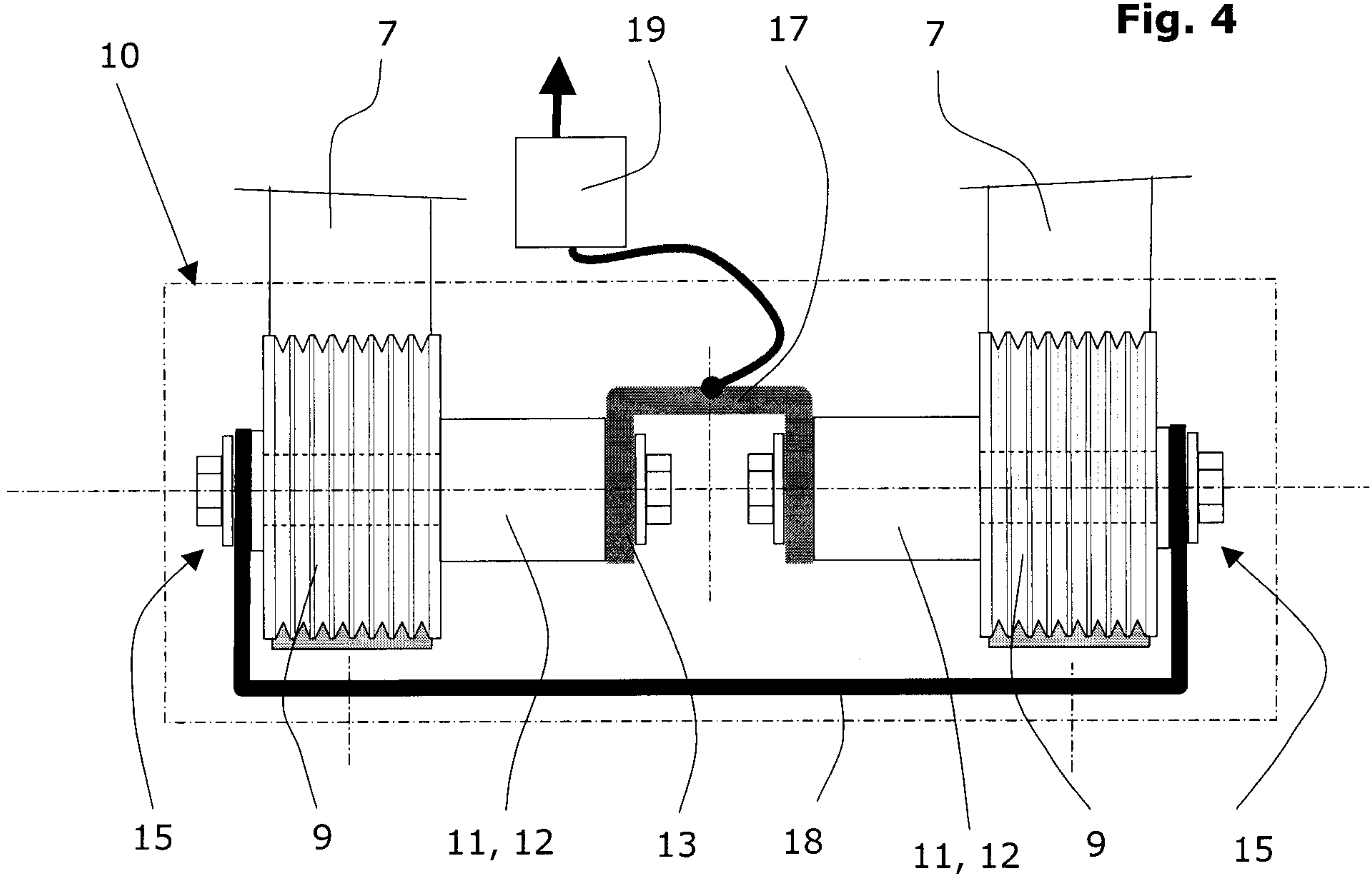


Fig. 5

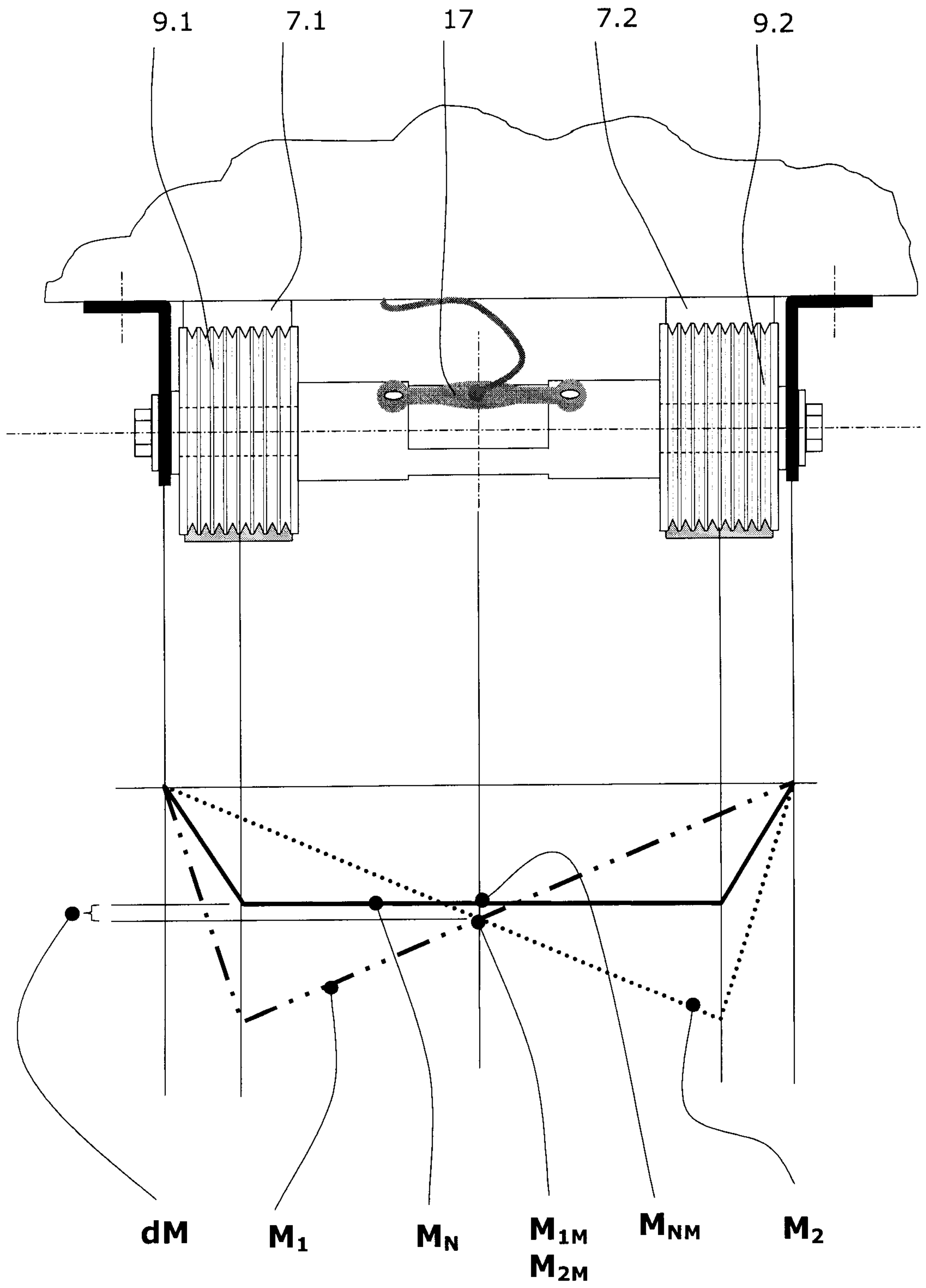


Fig. 6

