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(54) Titre : STRUCTURE ABSORBANT L'ENERGIE POUVANT ETRE REPLACEE, UTILISEE EN PARTICULIER EN ASSOCIATION AVEC UN TAMPON

(54) Title: REPLACEABLE ENERGY-ABSORBING STRUCTURE, ESPECIALLY FOR USE IN COMBINATION WITH A BUFFER

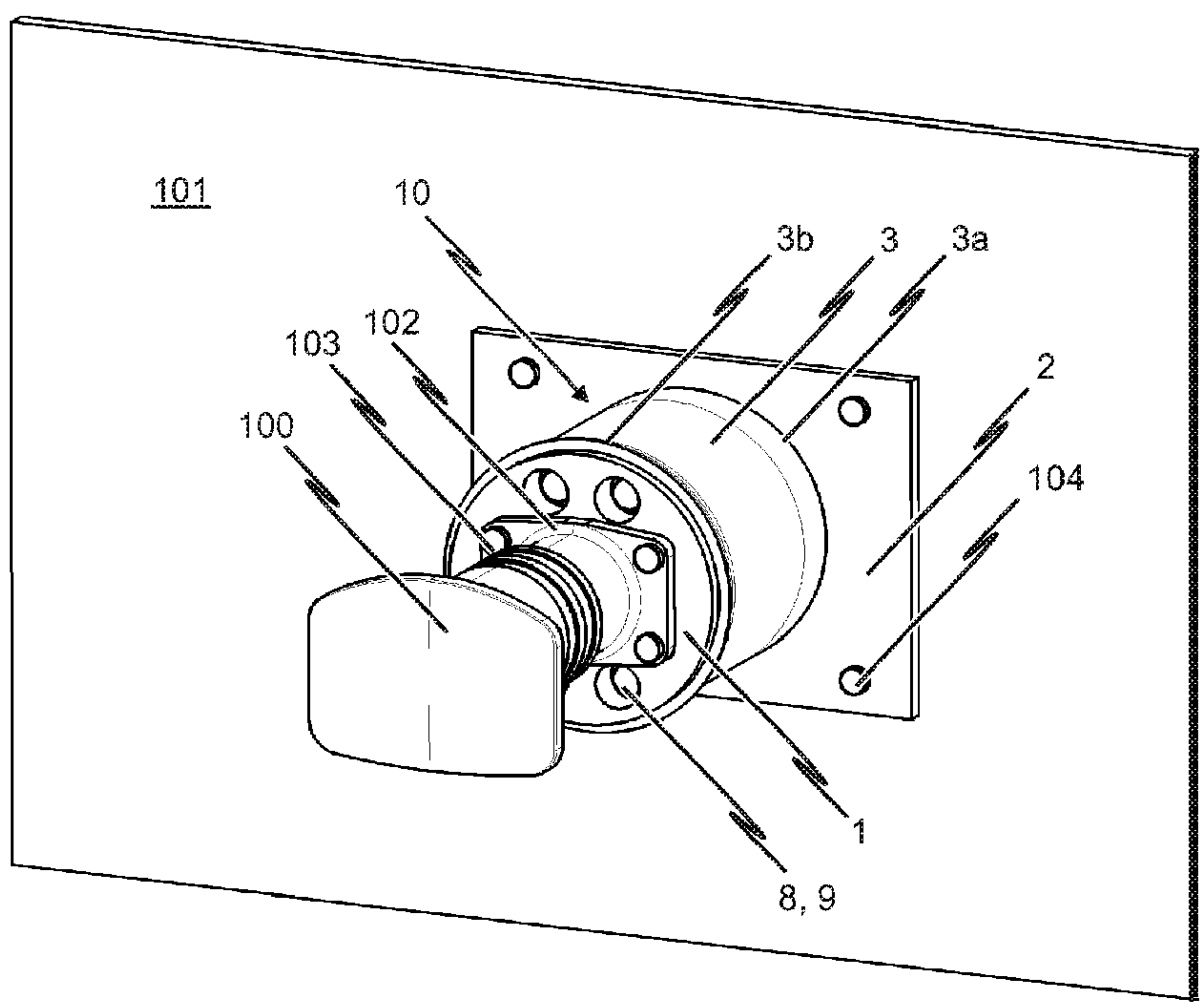

Fig. 1

(57) Abrégé/Abstract:
The invention relates to an energy absorbing unit (10), especially for use in combination with an UIC buffer or side buffer (100). The aim of the invention is to provide an additional irreversible shock absorbing element to be combined with e.g. an UIC buffer, which

(57) Abrégé(suite)/Abstract(continued):
can be retrofitted. According to the invention, an energy absorbing unit (10) has a base plate (2) for connecting the energy absorbing unit (10) to the supporting frame or bogie (101) of the superstructure in a preferably detachable manner, a connecting plate (1) to which e.g. the UIC buffer (100) can be connected, and a sacrificial energy absorbing element (3) which is is tensioned between the base plate (2) and the connecting plate (1) without play.

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[Fortsetzung auf der nächsten Seite]

(54) **Title**: REPLACEABLE ENERGY ABSORBING STRUCTURE, ESPECIALLY FOR USE IN COMBINATION WITH A BUFFER

(54) **Bezeichnung**: AUSTAUSCHBARE ENERGIEVERZEHREINRICHTUNG, INSBESONDERE ZUR VERWENDUNG IN KOMBINATION MIT EINEM PUFFER

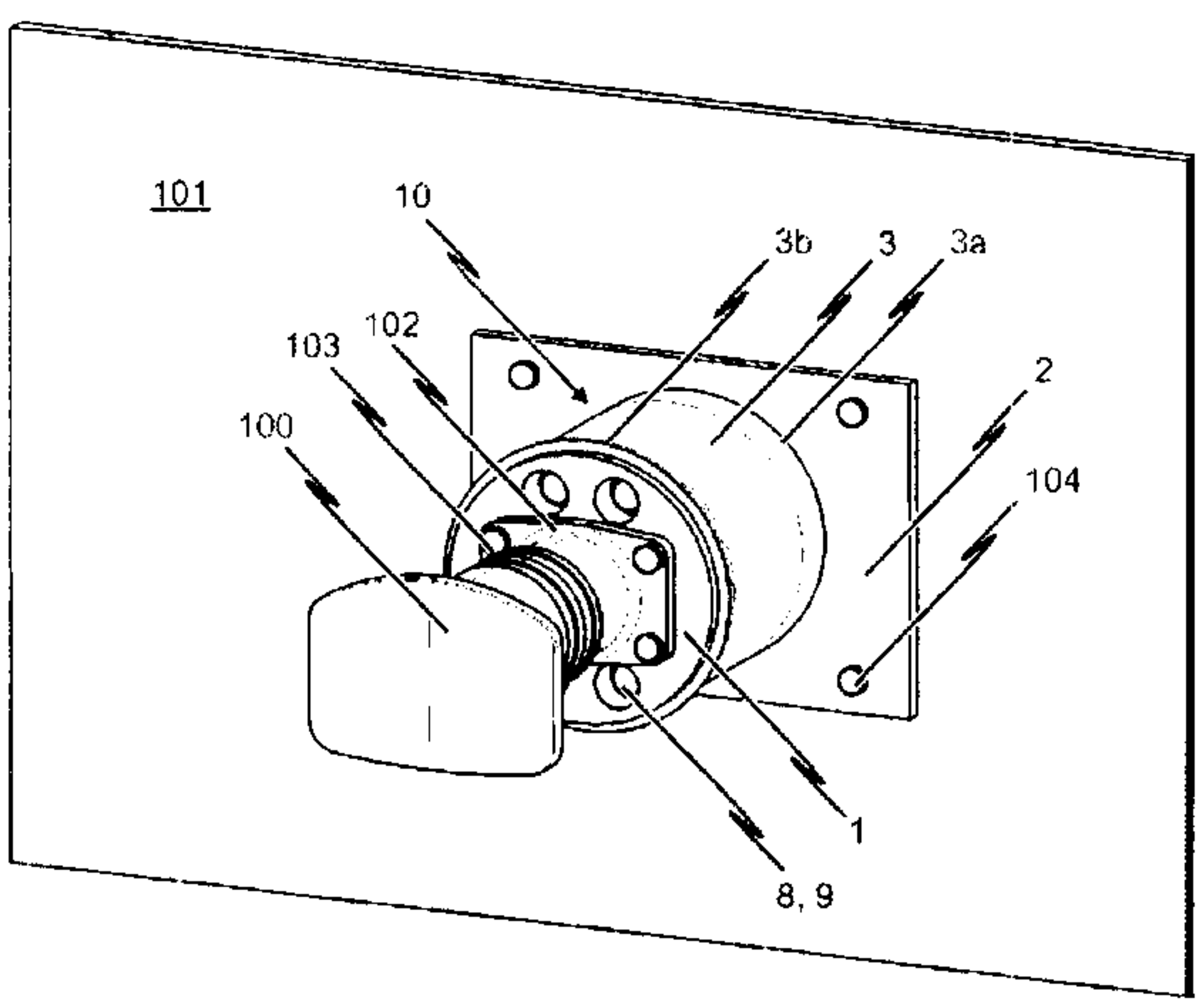

Fig. 1

(57) **Abstract**: The invention relates to an energy absorbing unit (10), especially for use in combination with an UIC buffer or side buffer (100). The aim of the invention is to provide an additional irreversible shock absorbing element to be combined with e.g. an UIC buffer, which can be retrofitted. According to the invention, an energy absorbing unit (10) has a base plate (2) for connecting the energy absorbing unit (10) to the supporting frame or bogie (101) of the superstructure in a preferably detachable manner, a connecting plate (1) to which e.g. the UIC buffer (100) can be connected, and a sacrificial energy absorbing element (3) which is is tensioned between the base plate (2) and the connecting plate (1) without play.

(57) **Zusammenfassung**: Die vorliegende Erfindung betrifft eine Energieverzehreinheit (10), insbesondere zur Verwendung mit einem UIC-Puffer bzw. Seitenpuffer (100). Mit dem Ziel, eine zusätzliche irreversible Stoßsicherungsstufe zu beispielsweise einem UIC-Puffer anzugeben, die nachträglich eingebaut werden kann, wird eine Energieverzehreinheit (10) vorgeschlagen, welcher als eine als ganzes austauschbare Baugruppe an dem Tragrahmen oder Untergestell (101) beispielsweise

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eines Schienenfahrzeuges anbringbar ist. Hierzu weist die Energieverzehreinheit (10) eine Grundplatte (2) zum vorzugsweise lösbaren Verbinden der Energieverzehreinheit (10) an dem Tragrahmen oder Untergestell (101) des Wagenkastens, eine Anschlussplatte (1), an welcher beispielsweise der UIC-Puffer (100) anschließbar ist, und ein destruktiv ausgebildetes Energieverzehrelement (3) auf, welches zwischen der Grundplatte (2) und der Anschlussplatte (1) spielfrei eingespannt ist.

REPLACEABLE ENERGY-ABSORBING STRUCTURE, ESPECIALLY FOR USE IN COMBINATION WITH A BUFFER

FIELD OF THE INVENTION

The present invention relates to an energy-absorbing unit which, together with a component for transferring force, is particularly suited for use as an additional irreversible shock-absorbing stage. Printed publication EP 0 926 381 A1 relates to an impact-absorbing device having a deformation tube. In order to improve the deformation behavior of the deformation tube and to attain the most constant shock absorption possible across the path of deformation after the device has been activated, the deformation tube is arranged, respectively braced at its ends, between two centering elements, with the centering elements, and thus the ends of the deformation tube, being held relative to one another against displacement transverse to the direction of impact. An axial abutment is provided at each end of the deformation tube as an axial brace when the deformation tube deforms upon impact.

BACKGROUND OF THE INVENTION

Printed publication DE 297 03 351 U1 describes an element for absorbing kinetic energy, wherein said element works mechanically according to the plastic deformation principle. Specifically, this prior art proposes an energy-absorbing structure comprising a base plate and a connecting plate, wherein an energy-absorbing element is fixed between these two plates. Said energy-absorbing element is a thick-walled plastic tube which on the one hand exhibits a certain initial elasticity and, on the other, an almost rectangular plastic working stroke. The initial elasticity of the absorption element yields deformation protection upon minor impacts.

A plastic deformation of the section occurs upon a working stroke beyond the yield strength, in consequence of which the section exhibits a reduced length with a bulged enlarged outer diameter.

The DE 747 330 C printed publication relates to a plunger buffer having an integrated energy-absorbing element. This plunger buffer known from the art consists of a buffer rod which, aided by a buffer bar and a buffer spring provided within said buffer rod, is affixed to the front end of a railcar body such that the buffer rod is capable of absorbing moderate impacts. After the maximum available damping stroke has been exhausted, the buffer plate strikes against a flange projecting into the front section of a deformation tube.

A buffer/drawgear mechanism comprising a telescoped arrangement of deformation tubes which plastically deform successively upon the operating load of the buffer/ drawgear mechanism being exceeded is known from the US 3,428,150 printed publication.

A damping element for a vehicle comprising at least one irreversibly-designed energy-absorbing element in the form of a deformation tube is known from the GB 1 419 698 A printed publication.

Printed publication EP 0 826 569 A2 describes an impact protection device for rail-borne vehicles comprising a side buffer and an energy-absorbing unit downstream said side buffer. Specifically, the energy-absorbing unit is in principle designed as a "crash box" detachably affixable at one side to the front end of the railcar body while the side buffer can likewise be detachably affixed to the other side of the crash box. This prior art explicitly teaches using a box-shaped crash box tapering toward the side buffer as the energy-absorbing unit so as to enable the most controlled possible buckling of the energy-absorbing element in the event of a crash.

It is therefore generally known in the field of rail vehicle technology to equip for example the individual car bodies of a multi-member vehicle with so-called side buffers or UIC buffers when the car bodies are not connected together by a bogie and thus the distance between two coupled car bodies can vary during normal vehicle operation. These side buffers thereby serve to absorb and dampen impacts occurring during normal vehicle operation, for example when braking or bringing up to speed.

A telescoped structure is normally utilized for the side buffer which comprises a buffer housing, a force-transferring member accommodated therein and a damping element in the form of a spring or an elastomer body. With this type of structure, the buffer housing serves as a longitudinal guide and for the supporting of transverse forces while the damping element accommodated in the buffer housing serves in transferring force in the longitudinal direction.

European regulations (e.g. the UIC 526 and 528 leaflets) standardize overall length as well as buffer stroke; i.e. the spring travel of the damping element, for certain vehicle categories. The buffer stroke for a standardized UIC buffer, for example, is within a range of from 100 to 110 mm. After reaching maximum buffer stroke, the damping characteristic of the side buffer is exhausted, in consequence of which impact forces which exceed the characteristic operating load of the side buffer are routed to the vehicle undercarriage undampened.

While the impact forces which occur during normal operation of the vehicle, for example between individual car bodies of a multi-member vehicle, are thus for example absorbed by the regeneratively-designed damping element integrated in the side buffer, when the operating load of the side buffer is exceeded, however, for instance when the vehicle collides with an obstacle or when the vehicle is abruptly braked, the damping element integrated in the side buffer is usually unable to absorb the total resulting energy. The shock absorbance provided by the side buffer is thus no longer integrated into the energy-absorbing concept of the vehicle as a whole such that the resulting impact forces are transmitted directly to the vehicle undercarriage. This subjects the latter to extreme loads with the potential to damage or even destroy same.

With the aim of preventing such damage, it is generally known in the prior art to design the guiding members of the plunger buffer such that after the maximum buffer stroke has been exhausted; i.e. after the guiding members of the side buffer (buffer sleeve and buffer rod) strike defined arresters, there is an additional contracting possibility with controlled deformation.

For example, the WO 2005/115818 A1 printed publication describes a plunger buffer in which after the energy absorption provided by the regeneratively-designed damping element has been exhausted, predetermined break joints break away so as to thus increase the buffer's contracting length. This increased contracting length allows the plastic deformation of the buffer housing upon overload so that this solution enables a destructive conversion of impact energy into the work of deformation and heat. The resulting deformation of the buffer housing which occurs upon overload thus provides an additional protection against impacts to the shock absorbance provided by the side buffer.

Even if this side buffer known in the art can protect the vehicle undercarriage up to a certain degree from damage upon severe collisions, it is thereby not possible to adapt the additional shock absorber to specific applications. To do so would require commensurately designing the force-path characteristic for the deformation of the buffer housing so as to enable a predictable, defined absorption of energy. In particular, the known solution is unsuited for many applications since the maximum energy absorption achievable with the deformation of the buffer housing is often too low. A further disadvantage can be seen in the fact that once the additional shock absorber has been activated, the entire side buffer needs to be replaced since the shock absorber is integrated in the side buffer and because due to the at least partial deformation of the buffer housing, the side buffer can no longer be used in normal vehicle operation.

Based on the given problem as set forth, the invention is thus based on the task of specifying an energy-absorbing unit for a component for transferring forces which arise during normal vehicle operation, in particular a side buffer, with which on the one hand, the impact energy transferred via the side buffer upon an extreme impact can be reliably dissipated and, on the other, the force-path characteristic of the energy-absorbing unit can be adapted to individual applications as exactingly as possible. Additionally, the energy-absorbing unit is to lend itself to subsequent installation into or retrofitting of a conventional side buffer in which no destructive shock absorbance has been provided.

The task on which the invention is based is solved by an energy-absorbing unit which is mountable to the support frame or undercarriage of a car body of a multi-member vehicle, in particular a rail-borne vehicle, as one complete replaceable module, wherein the energy-absorbing unit comprises a base plate for the preferably detachable connecting of the energy-absorbing structure to a supporting structure, for example to the support frame or undercarriage of a railcar body, a connecting plate to which a component for transferring forces occurring during normal vehicle operation and upon crashes can be connected, and a destructive energy-absorbing element braced without play between the base plate and the connecting plate. The energy-absorbing element is thereby integrated into the energy-absorbing unit such that impact forces can be transmitted in the longitudinal direction of said energy-absorbing unit, and will do so by having the force flow resulting from the transfer of force run at least partly through the energy-absorbing element. The energy-absorbing element itself is designed such that the base plate and the connecting plate remain substantially rigid relative one another in the

longitudinal direction of the energy-absorbing unit up to a definable amount of energy transferred by the force flow through said energy-absorbing element, and that upon the definable amount of energy transferred by the force flow through the energy-absorbing element being exceeded, the base plate and the connecting plate are displaced relative one another in the longitudinal direction of the energy-absorbing unit by the simultaneous plastic deformation of the energy-absorbing element.

The inventive solution thus relates to an energy-absorbing structure configured as a module; i.e., as one complete replaceable functional group. It is thus possible to also retroactively equip e.g. side buffers or other components for transferring force with additional shock absorbance. All that would be needed to do so is to fit the energy-absorbing unit between the side buffer or force-transferring component and the support frame or undercarriage of e.g. the railcar body. When the inventive solution is used in combination with a side buffer, the side buffer thus serves as a regeneratively-designed shock absorber in which impact forces occurring during normal vehicle operation, for example between the individual car bodies of a multi-member vehicle, are absorbed or damped. Upon the operating load of the regeneratively-designed damping element integrated in the side buffer being exceeded, however, the energy-absorbing unit downstream the side buffer is activated, whereby the impact energy is converted into the work of deformation and heat by a defined plastic deformation of the destructive energy-absorbing element. Thus, the regeneratively-designed damping element (spring device) of the side buffer as well as the other components of the side buffer can be effectively protected against destruction or damage in the event of a crash. In fact, it is only the energy-absorbing unit which needs to be replaced as a complete module after a crash.

By employing the destructive energy-absorbing element braced without play between the base plate and the connecting plate, which is activated upon a specific (definable) amount of energy, it is possible to exactingly adapt the behavior of the energy-absorbing element to individual applications. It is thus in particular possible to predefine the actuating force and the maximum amount of energy absorbable by the energy-absorbing unit and explicitly adapt same to specific applications. Thus, not only the response behavior but also the sequence of events to the energy absorption is predefinable.

The expression "substantially rigid" as used in conjunction hereto denotes that in the ideal case, there no play whatsoever between the base plate and the connecting plate, including prior to the activation of the energy-absorbing element or energy-absorbing unit respectively.

Advantageous embodiments of the inventive energy-absorbing unit are set forth in the subclaims.

It is thus particularly preferred for essentially the full force flow ensuing upon the transfer of impact forces in the longitudinal direction of the energy-absorbing unit to run through the energy-absorbing element. What this achieves is that the energy absorption of the energy-absorbing unit, and in particular the characteristic actuating force for energy absorption, can be precisely predefined by the design to the energy-absorbing element. Of course, however, it is also conceivable for only a portion of the force flow ensuing upon the transfer of impact force in the longitudinal direction of the energy-absorbing unit to run through the energy-absorbing element, whereby the remaining portion of the force flow is guided past the energy-absorbing element by means of the appropriate devices such that this portion is transmitted directly from the connecting plate to the base plate.

One preferred realization of the energy-absorbing unit provides for configuring the energy-absorbing element as a deformation tube which plastically deforms upon the exceeding of the definable amount of energy transferred by the force flow through the energy-absorbing element, preferably by cross-sectional expanding, and permits the relative movement of the base plate and the connecting plate to one another. An energy-absorbing unit in which a deformation tube is employed as the energy-absorbing element is characterized by exhibiting a defined actuating force with no spikes in the force. By virtue of this characteristic ensuing in substantially rectangular manner, maximum energy absorption is thus ensured after the energy-absorbing unit has been activated. Particularly preferred is for the deformation tube to plastically deform along with simultaneous cross-sectional expanding upon activation of the energy-absorbing unit. Of course, however, energy absorption along with simultaneous cross-sectional decreasing of the deformation tube is also conceivable; necessary hereto would be the pressing of the deformation tube through a nozzle opening provided e.g. in the base plate of the energy-absorbing unit so that the plastically deformed energy-absorbing element would be expelled from the energy-absorbing unit. A deformation tube which plastically deforms upon activation of the energy-absorbing unit by expanding in cross-section avoids this type of expelling of the deformed energy-absorbing element. For this reason, the preferred embodiment at the present time is the deformable energy-absorbing element with cross-sectional expansion.

A preferred development of the latter embodiment in which the energy-absorbing element is configured as a deformation tube provides for the deformation tube to be braced be-tween the base plate and the connecting plate by means of at least one tensioning element connecting the base plate to the connecting plate. This ensures a no-play integration of the energy-absorbing element in the energy-absorbing structure, whereby with the appropriate initial load, the response behavior of the energy-absorbing element can also be influenced, respectively predefined. For example, stud bolts can be utilized as such tensioning elements which are on the one hand fixedly connected to the base plate and, on the other, extend through the connecting plate and are locked there in a nut or other similar screw fitting. Such stud bolts, tensioning element respectively, serve not only to brace the deformation tube between the connecting plate and the base plate, but also assume a longitudinal guide function when the deformation tube plastically deforms after the energy-absorbing unit is activated and the connecting plate is moved toward the base plate. Because the tensioning element is also accorded a guiding function, this prevents any wedging or canting of the individual components of the energy-absorbing unit during the process of energy absorption. It is thus possible to prevent "seizing" or wedging, in particular upon vertical or oblique; i.e. not fully axial, load on the deformation tube so as to in principle provide a reliable destructive energy-absorbing function.

By correspondingly selecting the wall thickness and the material for the deformation tube, the characteristic amount of energy transferred by the force flow through the energy-absorbing element for the activation of said energy-absorbing element can be preset. This is a further substantial advantage of a deformation tube as employed in the inventive energy-absorbing unit.

One preferred embodiment of the energy-absorbing unit provides for the deformation tube to be in a material fit connection or positively locked by its base plate-side end to the base plate, while a section of expanded cross-section compared to a section situated closer to the base plate is provided at its connecting plate-side end. With this preferred embodiment, the energy-absorbing unit further exhibits a conical ring configured integrally with a guide element, its connecting plate-side end section connected to the connecting plate and its base plate-side end section extending at least partly into the widened section of the deformation tube and resting against the inner surface of this deformation tube section.

The advantages attainable with this embodiment are obvious. On the one hand, providing a deformation tube which is braced between the base plate and the connecting plate of the energy-absorbing unit yields an energy-absorbing device which enables maximum energy absorption at the lowest possible space requirements. By utilizing a deformation tube which plastically deforms by cross-sectional expanding, it is in particular not necessary to provide additional space for expelling a plastically deformed deformation tube. On the other hand, by providing the guide element, the preferred embodiment also allows a very exact predefining of the sequence of events ensuing in energy absorption, for example in the event of a crash.

Said guide element, configured integrally with the conical ring and connected by its connecting plate-side end to the connecting plate of the energy-absorbing unit, extends by its base plate-side end section at least partly into the deformation tube section already exhibiting an expanded cross-section prior to activation of the energy-absorbing unit compared to a section of the deformation tube situated closer to the base plate. Since, on the one hand, the guide element extends at least partly into the expanded section of the deformation tube and rests against the inner surface of said tube section, when the energy-absorbing unit is activated, meaning when the connecting plate with the conical ring and the guide element moves relative the base plate and the deformation tube positively locked or in a material fit connection with the base plate toward said base plate, the base plate-side end section of the guide element runs along the inner surface of the (as of yet) non-expanded deformation tube section and thus effects an axial guidance for the energy absorption. This axial guidance prevents a canting of the connecting plate, conical ring respectively, in the deformation tube upon the activating of the energy-absorbing unit so that the plastic deformation of the deformation tube (i.e. the plastic cross-sectional expanding of the deformation tube) ensues in a precisely predictable manner and the sequence of events to the energy absorption during a crash as a whole is precisely predictable.

In the latter preferred embodiment, it is advantageous in terms of the manufacturing of an energy-absorbing structure for the conical ring and the guide element to be configured integrally with the connecting plate. Of course, however, it is also conceivable for the conical ring with the guide element to be correspondingly coupled to the connecting plate by means of positive-fit engagement or a non-positive connection.

Lastly to be cited as a further advantage of the latter embodiment is that the characteristic actuating force for the activation of the deformation tube can be precisely predefined by means of the wall thickness to the deformation tube, the material of the deformation tube as well as the degree of expansion to the connecting plate-side section of the deformation tube.

To summarize briefly, it is to be noted that the energy-absorbing unit according to the invention provides a shock absorber with which both the response behavior as well as the sequence of events during energy absorption can be predefined. By making the appropriate selection respective the energy-absorbing element, maximum energy absorption is also possible at a smaller overall size. The energy-absorbing unit is in particular suited for retrofitting a side buffer or UIC buffer as an additional irreversible shock-absorbing stage, wherein said side buffer or UIC buffer is preferably detachably fixed to the connecting plate of the energy-absorbing unit.

BRIEF DESCRIPTION OF THE DRAWINGS

The following will make reference to the accompanying drawings in describing a preferred embodiment of the inventive energy-absorbing unit in greater detail.

Shown are:

Fig. 1: the preferred embodiment of the energy-absorbing unit according to the invention as an additional shock-absorbing stage for an UIC buffer;

Fig. 2: a detail drawing of the energy-absorbing unit according to Fig. 1; and

Fig. 3: a cross-sectional view through the energy-absorbing unit according to Fig. 2.

DETAILED DESCRIPTION OF THE DRAWINGS

The energy-absorbing unit 10 depicted in Fig. 1 is employed in conjunction with a conventional side buffer or UIC buffer 100, wherein said buffer has, for example, not been equipped with an additional shock absorber. The UIC buffer 100 is hereto affixed by its connecting flange 102 to the connecting plate 1 of energy-absorbing unit 10.

Lending itself well hereto are the fixing means 103 already provided for the connecting flange 102 of buffer 100 which, in the embodiment as depicted, consists of a total of four bolts which can be screwed into the corresponding threaded bores 103' provided in connecting plate 1.

The energy-absorbing unit 10 further comprises a base plate 2, with which the energy-absorbing unit 10 can be connected for example to a support frame or undercarriage of a railcar body 101 or however also to another fixed or flexible supporting structure. Employed for this purpose in the embodiment as depicted are a total of four fixing bolts 104 which extend through the throughholes 104' correspondingly provided in base plate 2 and are received in the appropriate threaded bores (not explicitly shown in the figures).

Because the energy-absorbing unit 10 can be detachably fixed to the supporting structure 101 via the base plate 2 on the one hand and, on the other, a further additional component 100, such as for example a side buffer or a UIC buffer, can likewise be detachably mounted to the connecting plate 1 of energy-absorbing structure 10, the energy-absorbing unit constitutes a single functional group which is replaceable as a whole, which is particularly applicable for subsequent installation or exchange without needing to make modifications to the supporting structure 101 or to the component 100.

In addition to the base plate 2 and the connecting plate 1 described above, the energy-absorbing unit 10 of the preferred embodiment depicted in the drawings further comprises a deformation tube as a destructive energy-absorbing element 3 which is braced without play between the base plate 2 and the connecting plate 1. As can be seen especially in Fig. 3, tensioning elements 4 in the form of stud bolts are utilized hereto. The tensioning elements are connected in a positive-fit, non-positive-fit or material-fit connection to the base plate 2 by their base plate-side ends, extend through almost the entire length of the deformation tube 3, and run through the throughholes correspondingly disposed in connecting plate 1. The front side end of the tensioning element 4 is secured to connecting plate 4 by nut 9. In order to ensure a level or flat front end to connecting plate 1, recesses 8 are positioned in the connecting plate to receive the respective nuts 9.

As noted above, the tensioning elements 4 serve to brace the deformation tube 3 between the base plate 2 and the connecting plate 1. The tensioning elements 4 are additionally accorded a further guiding function since, due to their construction, they correspondingly guide the connecting plate 1 when the connecting plate 1 moves relative to the deformation tube 3 and the base plate 2 toward said base plate 2 subsequent activation of the energy-absorbing unit 10.

A further axial guidance is provided with the conical ring 7 configured with guide element 6. In the embodiment as depicted, the guide element 6, the conical ring 7 and the connecting plate 1 are of integral configuration; although this is not mandatory.

Specifically, and as can be particularly noted from Fig. 3, the deformation tube 3 is connected in a positive-fit, non-positive-fit or material-fit connection to the base plate 2 at its base plate-side end 3a. On the other side, the deformation tube 3 has a section 5 at its connecting plate-side end 3b which is of expanded cross-section in comparison to a section situated closer to the base plate 2. This expanded deformation tube section 5 interacts with the guide element 6 and the conical ring 7. The base plate-side end section of the guide element 6 thereby extends at least partly into the expanded deformation tube section 5 and rests against the inner surface of said deformation tube section 5. Upon activation of the energy-absorbing unit 10, meaning when the connecting plate 1 then moves relative to the base plate 2 and the deformation tube 3 fixedly attached to said base plate 2 toward said base plate 2, the base plate-side end section of guide element 6 runs along the inner surface of the (as of yet) non-expanded deformation tube section and thus effects – together with the tensioning elements 4 – an axial guiding of base plate 2. This axial guiding of base plate 2 prevents a canting of said base plate 2, the conical ring 7 and the guide element 6 respectively, in the deformation tube 5 when the energy-absorbing unit 10 is activated, whereby this also holds true when forces other than just purely axial are being transferred. All told, the plastic deformation of the deformation tube; i.e. the plastic cross-sectional expanding of deformation tube 5, thus progresses in a predictable manner, and the sequence of events to the energy absorption in a crash situation is altogether predictable as a whole.

The implementation of the invention is not limited to the embodiment described with reference to the figures. In particular, it is also conceivable for the energy-absorbing unit not to be used together with a side buffer, but instead with e.g. a bumper bar mount or other such similar impact force-transferring component.

List of reference numerals

1	connecting plate
2	base plate
3	energy-absorbing element/deformation tube
3a	base plate-side end of the deformation tube
3b	connecting plate-side end of the deformation tube
4	tensioning element
5	deformation tube section of expanded cross-section
6	guide element
7	conical ring
8	recess
9	nut
10	energy-absorbing unit
100	UIC buffer/side buffer
101	supporting structure/railcar body
102	connecting flange of the UIC buffer/side buffer
103	fixing means
103'	threaded holes
104	fixing means
104'	fixing holes

Claims

We Claim:

1. A side buffer (100), in particular a UIC buffer, comprising an energy-absorbing unit (10) as an additional irreversible shock-absorbing stage, wherein the side buffer (100) can be detachably mounted to a connecting plate (1) of the energy-absorbing unit (10), and wherein the energy-absorbing unit (10) is mountable to a supporting structure (101) as one complete replaceable module, and wherein the energy-absorbing unit (10) comprises the following:
    - a base plate (2) for the preferably detachable connecting of the energy-absorbing unit (10) to a supporting structure (101), for example to the support frame or undercarriage of a car body of a multi-member vehicle, in particular a rail-borne vehicle;
    - the connecting plate (1) to which the side buffer (100) is mounted; and
    - a destructively-configured energy-absorbing element (3) in the form of a deformation tube which is integrated into said energy-absorbing unit (10) such that impact forces can be transmitted in the longitudinal direction of said energy-absorbing unit (10) by the force flow resulting from the transfer of force running at least partly through the energy-absorbing element (3) and which is designed such that the base plate (2) and the connecting plate (1) are substantially rigid relative one another in the longitudinal direction of the energy-absorbing unit (10) up to a definable amount of energy transferred by the force flow through the energy-absorbing element (3), and that upon the definable amount of energy transferred by the force flow through the energy-absorbing element (3) being exceeded, the base plate (2) and the connecting plate (1) are displaced relative one another in the longitudinal direction of the energy-absorbing unit (10) by the simultaneous plastic deformation of the energy-absorbing element (3), characterized in that the energy-absorbing element (3) is braced between the base plate (2) and the connecting plate (1) by means of at least one tensioning element (4) connecting the base plate (2) to the connecting plate (1).

2. The side buffer (100) according to claim 1, wherein essentially the full force flow ensuing upon the transfer of impact and tractive forces in the longitudinal direction of the energy-absorbing unit (10) runs through the energy-absorbing element (3).

3. The side buffer (100) according to claim 1 or 2, wherein the energy-absorbing element (3) is configured as a deformation tube which plastically deforms upon the exceeding of the definable amount of energy transferred by the force flow through the energy-absorbing element (3) by cross-sectional expanding or cross-sectional decreasing and permits the relative movement of the base plate (2) and the connecting plate (1) to one another.

4. The side buffer (100) according to any one of the preceding claims, wherein the deformation tube (3) is braced between the base plate (2) and the connecting plate (1) by means of at least one tensioning element (4) so as to exert an appropriate initial load by means of which the response behavior of the energy-absorbing element (3) can be predefined.

5. The side buffer (100) according to any one of the preceding claims, wherein the characteristic amount of energy transferred by the force flow through the energy-absorbing element (3) for the activation of said energy-absorbing element (3) can be preset as a function of the wall thickness and the material of the deformation tube.

6. The side buffer (100) according to any one of the preceding claims, wherein the deformation tube (3) is in a material fit connection with or positively locked to the base plate (2) by its base plate-side end (3a), and exhibits a section (5) on its connecting plate-side end (3b) which is of expanded cross-section compared to a section situated closer to the base plate (2), and wherein the energy-absorbing unit (3) further comprises a conical ring (7) configured integrally with a guide element (6), its connecting plate-side end section connected to the connecting plate (1) and its base plate-side end section extending at least partly into the widened section (5) of the deformation tube (3) and resting against the inner surface of said deformation tube section (5).

7. The side buffer (100) according to claim 6, wherein the conical ring (7) with the guide element (6) is configured integrally with the connecting plate (1).

8. The side buffer (100) according to claim 6 or 7, wherein the characteristic actutating force for the activation of the deformation tube (3) can be predefined as a function of the wall thickness to the deformation tube (3), the material of the deformation tube (3) as well as the degree of expansion to the connecting plate-side section (5) of the deformation tube.

Abstract

The invention relates to an energy absorbing unit (10), especially for use in combination with an UIC buffer or side buffer (100). The aim of the invention is to provide an additional irreversible shock absorbing element to be combined with e.g. an UIC buffer, which can be retrofitted. According to the invention, an energy absorbing unit (10) has a base plate (2) for connecting the energy absorbing unit (10) to the supporting frame or bogie (101) of the superstructure in a preferably detachable manner, a connecting plate (1) to which e.g. the UIC buffer (100) can be connected, and a sacrificial energy absorbing element (3) which is is tensioned between the base plate (2) and the connecting plate (1) without play.

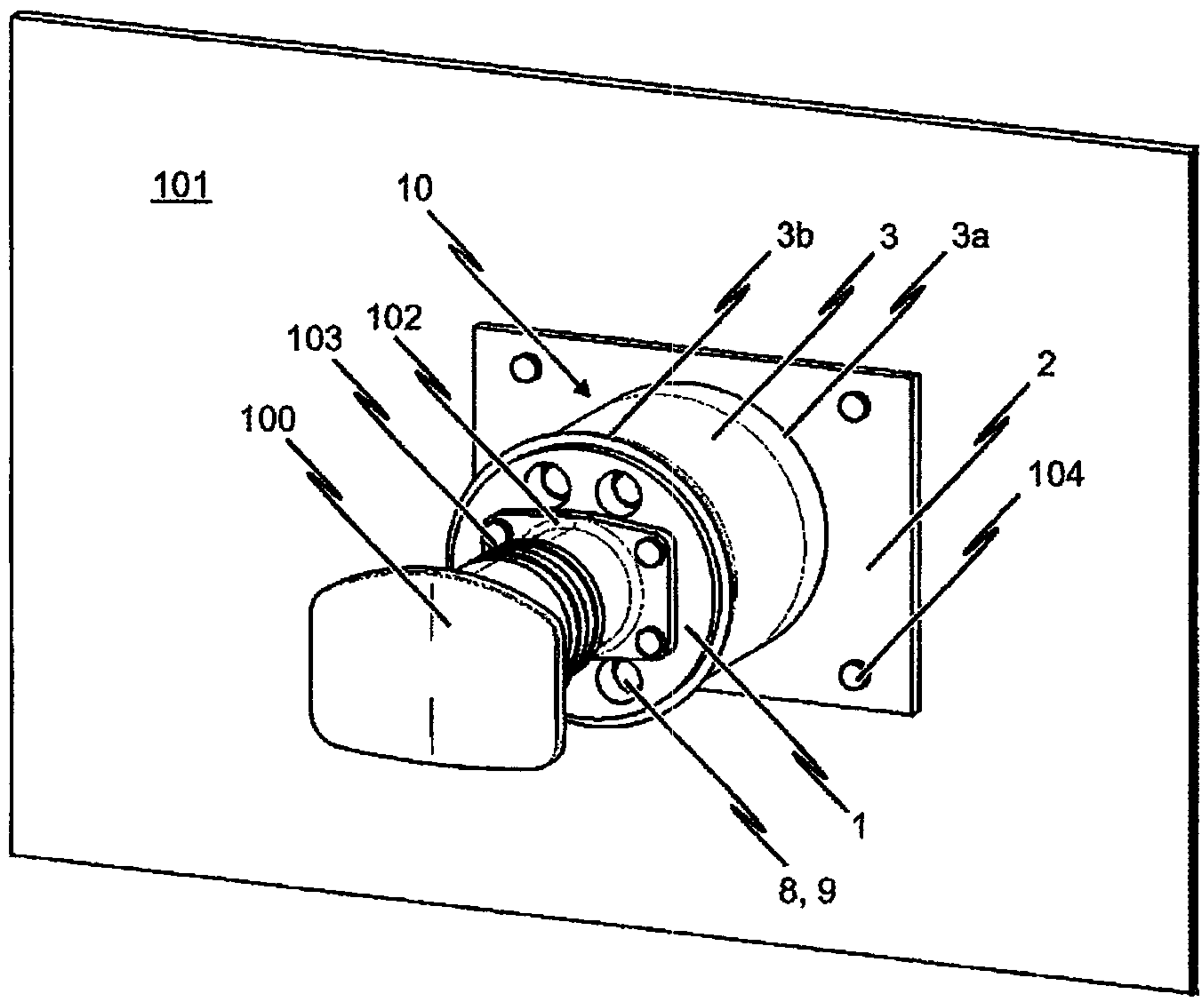

Fig. 1

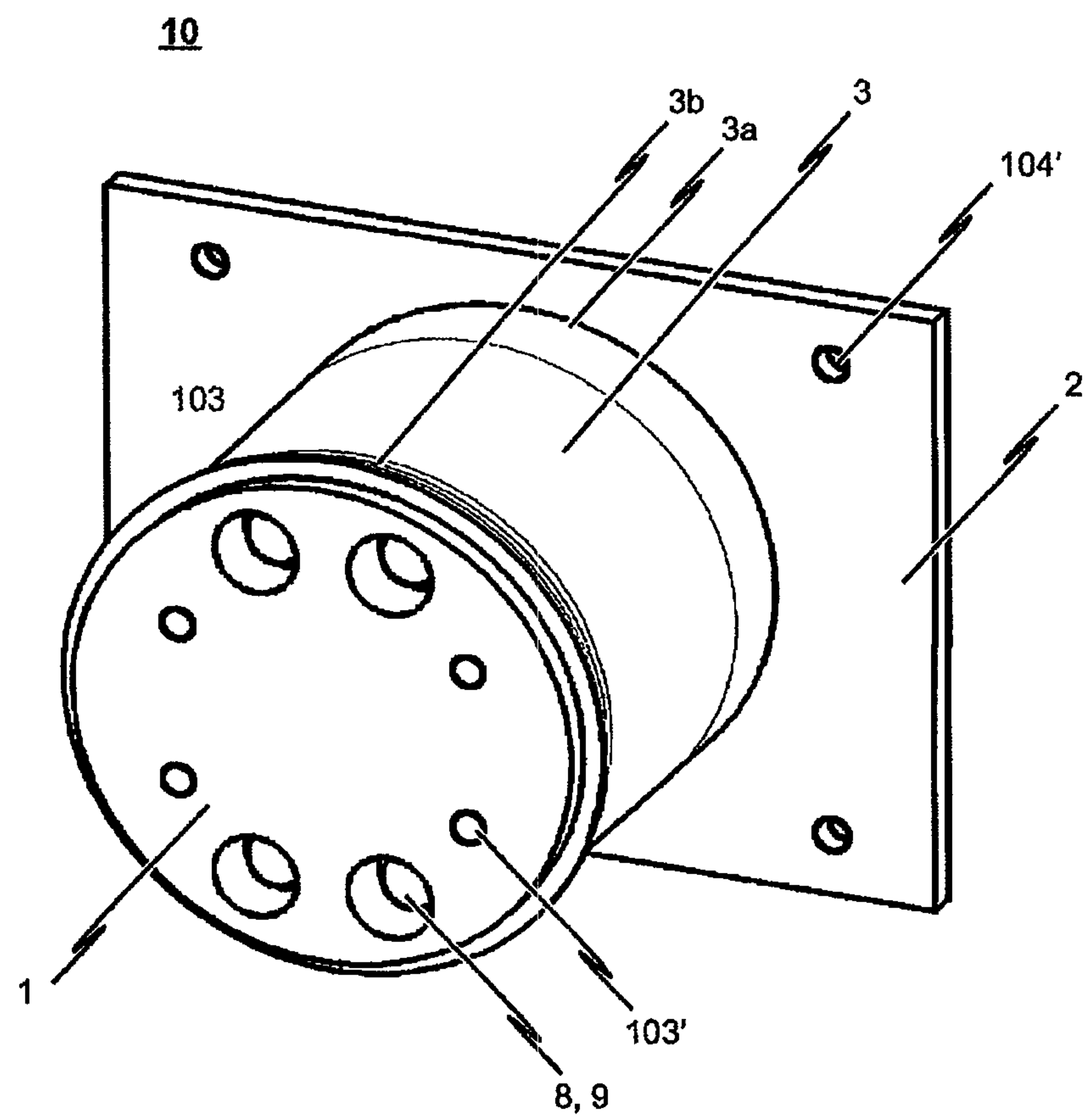

Fig. 2

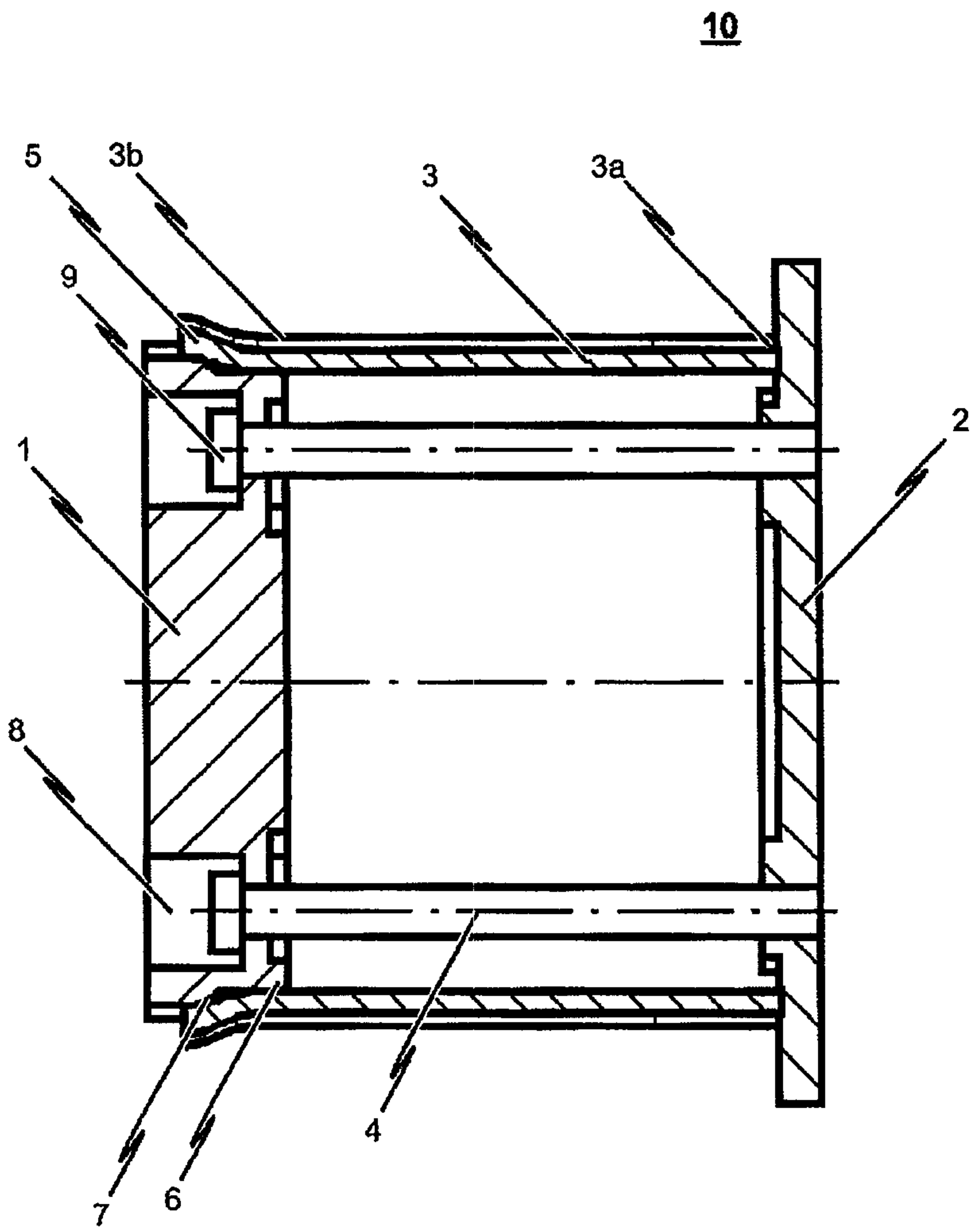

Fig. 3

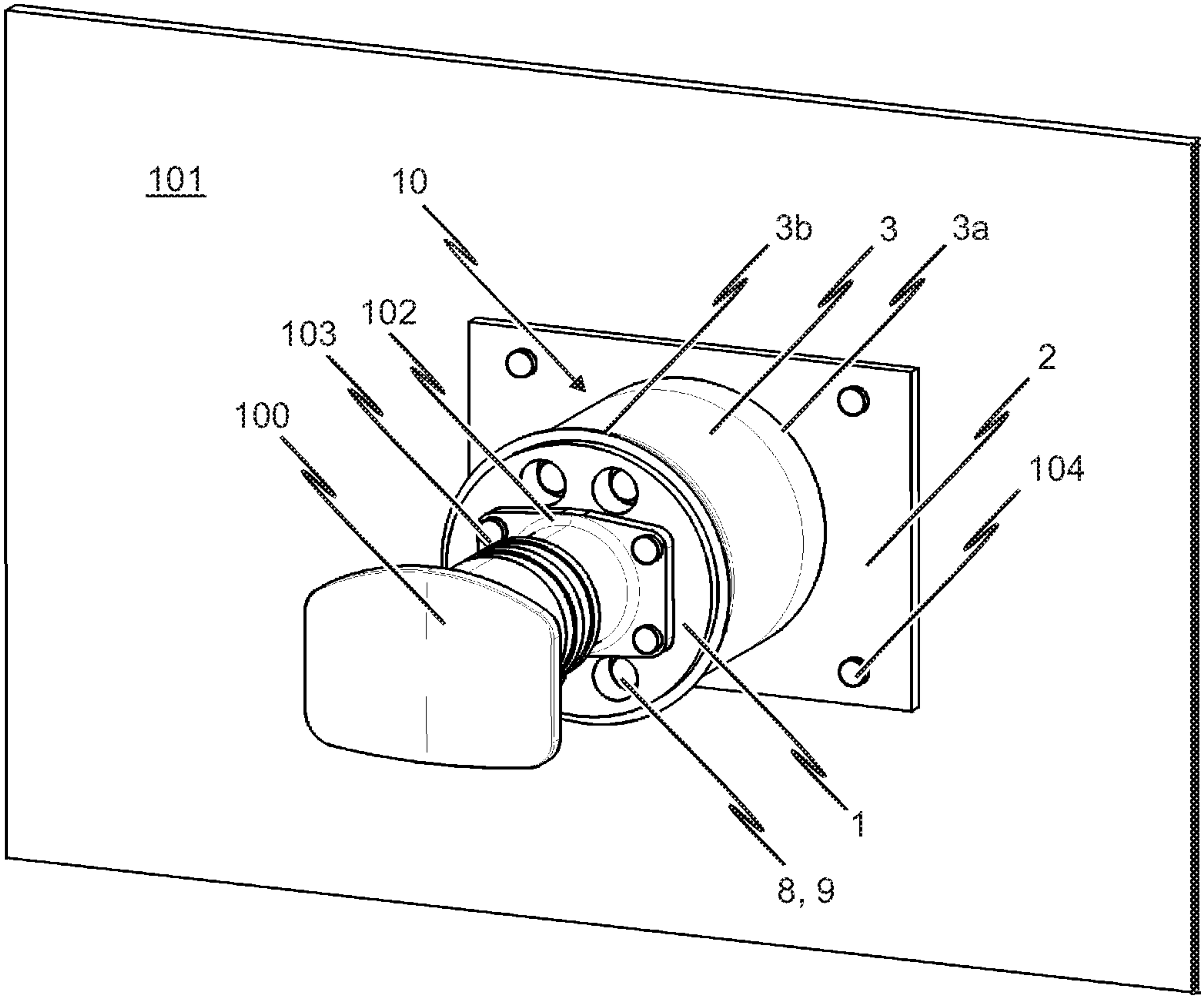

Fig. 1