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(54) **Teljesítményrelé járműhöz**

Power relay for a vehicle

The invention relates to a power relay for a vehicle, in particular for a commercial vehicle, in accordance with the preamble of Claim 1. A power relay of this type is disclosed by way of example in DE 10 2010 018 738 A1.

Power relays of the generic type are used in vehicle technology, in particular in the case of commercial vehicles. The power relays are used in order to electrically separate the vehicle battery from the vehicle electrical network. In addition, relays of this type are used in order to connect electrical motors of adjusting apparatus, for example a hydraulic pump or a lifting platform. It is necessary for a power relay of this type in the case of a low voltage of typically 12 volts to 24 volts to be able to connect currents up to a current strength of approximately 300 amps and therefore it is necessary to construct said power relay in an accordingly solid manner. Conventional relays that are used for this purpose are generally embodied from a pot-shaped metal body (for example iron or steel) and a solenoid and a magnetic yoke and also a magnetic armature that is connected to a contact bridge using a double contact are arranged in said metal body.

The power relay conventionally comprises solid connection bolt s (threaded bolts) that are embodied from metal, said bolts typically comprising a diameter of 0.5 cm to 1 cm so as to connect the power relay to a load current circuit that is to be connected in the vehicle. Cable lugs of the connecting lines of the load current circuit that is to be connected are fixed in accordance with their intended use in an electrically contacting manner to these connection bolts by means of screw nuts (contact nuts).

In the installed state of the relay, in particular in a vehicle, by way of example in a truck, vibrations that are caused by operating the truck and are transferred to the power relay are practically unavoidable. This can lead to an undesired increase in the transition resistance between the moving contact bridge and the connection bolts that are fixed to the housing. This problem could indeed be countered by

means of increasing the contact pressure. However, this would require a stronger magnet system, which is not desirable.

The object of the invention is to provide a suitable power relay for a vehicle, in particular a commercial vehicle, with regard to a reliable contact arrangement.

This object is achieved in accordance with the invention by means of the features of Claim 1. Advantageous embodiments and further developments are the subject matter of the dependent claims.

The power relay comprises a housing that is preferably formed from a housing pot and a connecting base and two connection bolts are introduced into said housing for contacting a load current circuit. A coil assembly is arranged in the housing, said coil assembly comprising a solenoid and a magnet armature that is coupled to a contact bridge via a force transfer member and can be shifted under the effect of a magnetic field that is produced by means of the solenoid in the housing.

The contact bridge can move in a reversible manner between a closed position, in which the contact bridge bridges the connection bolts in an electrically conductive manner, and an opened position in which the contact bridge does not contact the connection bolts. The contact bridge supports two contact elements that form a first and a second contact pair with counter contact elements of the connection bolts that are hereunder also described as counter contacts, wherein the contact pairs in the closed position form a three point bearing arrangement or three point supporting arrangement. The counter contacts (counter contact elements) of the connection bolts suitably comprise a planar bearing surface or supporting surface.

In an advantageous embodiment, the first contact pair is formed in such a way that it has only one single, defined (local or locally delimited) bearing site (supporting site). This bearing site is suitably provided centrally in the contact bridge-side contact element of the first contact pair and is embodied in as punctiform a manner as possible with regards to the locally delimited bearing

surface. This is suitably achieved in that the contact bridge-side contact element of the first contact pair has a contact region that is slightly convexly curved towards the bolt-side counter contact element. This is expediently produced by means of secant-type ground surfaces of the preferred plate-like contact element. Consequently, the convex contact region, in other words the region that is curved towards the exterior in relation to the contact surface, suitably extends along the contact bride-side contact element in the bridge longitudinal direction by forming a centrally raised contact region for providing the bearing site.

In a further advantageous embodiment, the second contact pair is formed in such a way that it has two defined bearing sites (supporting sites). In relation to the bolt-side counter contact element, the contact bridge-side contact element of the second contact pair suitably comprises an inwards-drawn contact region that is curved in a concave manner, in other words in relation to the contact surface. Expediently, the concavely curved contact region extends along the contact bridge-side contact element in the bridge longitudinal direction. This embodiment is preferably likewise produced by means of a corresponding grinding process.

An exemplary embodiment of the invention is further explained hereunder with reference to the drawing. In the drawing:

Fig. 1 illustrates in a perspective view inclined from above a power relay having a connecting base,

Fig. 2 illustrates the power relay in a longitudinal section with opened contacts and counter contact in the connecting base,

Fig. 3 illustrates the connecting base in a perspective view with a view of a contact bridge that supports the contacts (contact elements),

Fig. 4 illustrates in a perspective view the contact bridge having contact elements that are embodied in a curved manner so as to form a three point bearing arrangement with the counter contacts,

Fig. 5 illustrates the connecting base in a sectional illustration,

Fig. 6 illustrates a sectional view along the line VI-VI in fig. 5 having a contact bridge-side contact element that is curved outwards in a convex manner,

Fig. 7 illustrates a sectional view along the line VII-VII in fig. 5 having a contact bridge-side contact element that is inwardly curved in a concave manner,

Fig. 8 illustrates the contact bridge in a side view,

Fig. 9 illustrates a sectional view along the line IX-IX in fig. 8 along the contact element that is curved in a convex manner, and

Fig. 10 illustrates a sectional view along the line X-X in fig. 8 along the contact element that is curved in a concave manner.

Parts that correspond to one another are always provided with identical reference numerals in all the figures.

The power relay 1 that is illustrated in fig. 1 and fig. 2 comprises a housing 2 that is formed from two parts, namely a connecting base 3 and a housing pot 4. Both the connecting base 3 and also the housing pot 4 are preferably formed as injection molded components from synthetic material.

The connecting base 3 delimits the housing 2 on a connecting side and it is possible on said connecting side to contact the power relay 1 with an external load current circuit and also with external control lines. This connecting side is hereunder - irrespective of the actual orientation of the power relay 1 in the surrounding space - also described as the upper side 5. The housing pot 4 surrounds with four side walls 6 and a housing base 7 the remaining sides of an approximately cuboid-shaped housing interior 8 (fig. 2). The housing base 7 closes the housing 2 on an underside 9 that is remote from the upper side 5, wherein the term "underside" is also used irrespective of the actual orientation of the power relay 1 in the surrounding space.

Two solid connection bolts 10 are fixed in the connecting base 3 so as to connect the two connecting lines of the load current circuit that is to be connected, said

connection bolts protruding in each case with a threaded shaft 11 out the housing 2 towards the exterior. The connection bolts 10 are solid rotary parts embodied from metal, said rotary parts comprising by way of example a diameter of 0.8 cm in the region of the threaded shaft 11. An end side cable lug of this connecting line is attached to the allocated threaded shaft 11 and is contacted in a screwed manner by means of a screw nut (contact nut) so as to connect the respective connecting line of the load current circuit. As an alternative thereto, it is also possible for the connection bolts 10 to be formed by means of sleeves having in each case a threaded hole. In lieu of contact nuts, contact screws are provided in this case for contacting the connecting lines, said contact screws being screwed in to the threaded holes. As is in particular evident in fig. 2, the connection bolts 10 are fixed in the connecting base 3 by means of injection molding with the synthetic material of the connecting base 11.

In order to avoid an electrical overload or other short circuit between the connection bolts 10 and the connecting lines of the load current circuit, said connecting lines being fastened where appropriate to said connection bolts, a dividing wall 12 is formed on the outer side on the connecting base 3, said dividing wall protruding into the intermediate space that is formed between the connection bolts 10.

Furthermore, multiple (in this case in an exemplary manner three) signal terminals 13 are embodied on the connecting base 3 by way of which it is possible to contact in a screwed manner three correspondingly external control lines in each case with an end side cable lug to the power relay 1 so as to control the power relay 1, in other words to trigger switching processes by means of which the power relay 1 is switched on - by means of producing a housing-internal electrically conductive connection between the connection bolts 10 - or is switched off - by means of disconnecting this electrically conductive connection. Each signal terminal 13 is connected in an electrical manner by way of a connecting line 14 in the form of a curved stamped sheet metal part to the housing interior 8. The connecting conductors 14 are inserted between the connecting base 3 and the housing pot 4 or are likewise held in the connecting base 3 by means of

injection molding. A separate synthetic cover 15 that can be latched on protects the signal terminals 13 towards the upper side 5 to prevent physical contact.

In addition to the above described housing parts, namely in addition to the connecting base 3 having the connection bolts 10, which are fastened to said connecting base, and signal terminals 13 and also in addition to the housing pot 4, the power relay 1 comprises a coil assembly 16 that is illustrated in fig. 2. A conductor carrier in the form of a board that is populated with components of a control electronics system is likewise provided, however it is not visible in fig. 2.

The coil assembly 16 that is illustrated comprises a contact bridge 17 that is arranged in the inner region of the connecting base 3, said contact bridge being coupled in a mechanical manner by way of a coupling rod 18 to a magnetic armature 19 of the magnetic circuit. In addition to the magnetic armature 19, the magnetic circuit comprises a magnetic yoke 20. The components that are not visible in a detailed manner are a central, hollow cylindrical core that surrounds the coupling rod 18 in a concentric manner, a U-shaped curved bracket and also two pole lugs that extend towards one another from the arm ends of the bracket, said pole lugs receiving the magnetic armature 19 between them. The magnetic armature 19 and the components of the magnetic yoke 20 are formed from ferromagnetic material.

Furthermore, the coil assembly 16 comprises a solenoid 21 that lies in the volume that is framed by the magnetic yoke 20. The solenoid 21 surrounds the core of the magnetic yoke 20 in a concentric manner and is in turn framed by the bracket and the pole lugs. In addition, the coil assembly 16 comprises two auxiliary conductors 22 that are formed in each case from a curved stamped sheet metal part, and two pressure resilient elements that surround the coupling rod 18, namely a return spring 23 and a contact pressure spring 24.

The above mentioned components of the coil assembly 20 are held together in a mechanical manner by a carrier body 25. The carrier body 25 is a single part, multifunctional injection molded component that is embodied from synthetic

material. The carrier body 25 supports the solenoid 21 and holds the magnetic yoke 20 and the magnetic armature 19. The magnetic armature 19 and the core of the magnetic yoke 20 are received for this purpose in the interior of the carrier body 25. The magnetic armature 19 is mounted directly on the carrier body 20 in such a manner that it can slide.

The coil assembly 16 is clipped onto the connecting base 3 that is produced in an injection molding process. For this purpose, the connecting base 3 is provided on its underside with snap-in hooks 26 (fig. 3) that are attached using an injection molding process.

The auxiliary conductors 22 are soldered to (voltage tap) connectors 27. The connectors 27 are allocated in pairs to the connection bolts 10. One of the connectors 27 is consequently contacted by one of the connection bolts 10 while the other connector 27 is contacted by the other connection bolt 10. The connectors 27 are welded in advance for this purpose to the in each case allocated connection bolt 10 and are injection molded together with said bolt to the synthetic material of the connecting base 3.

After assembling the coil assembly 16 and where appropriate the board on the connecting base 3, the housing pot 4 is placed over the coil assembly 16 and latched and screwed to the connecting base 3, whereby the housing 2 is closed. In the closed state of the housing 2, the connecting base 3 lies with a circumferential radial connecting piece 28 on a circumferential shoulder 29 in the wall of the housing pot 4. The housing pot 4 engages with a circumferential collar 30 that delimits the opening of said housing pot on the outer side around the radial connecting piece 28 of the connecting base 3 and protrudes beyond said connecting piece. The collar 30 consequently surrounds the upper side of the radial connecting piece 28 like a balustrade and forms together with the connecting base 3 a trough-shaped structure or trough 31. This trough 31 is filled with a casting compound 32 that is initially a fluid and hardens in the course of a hardening phase so as to seal the connection between the connecting base 3 and the housing pot 4 in a fluid and gas-tight manner. In particular, a two-component

system of an epoxy resin and a mixed hardening agent is used as the casting compound 32.

Furthermore, the feedthroughs of the connecting lines 14 are sealed with the casting compound 32. The connecting lines 14 are guided for this purpose in the region of the trough 31 through the connecting base 3. The feedthroughs of the connection bolts 10 through the connecting base 3 are sealed separately from the trough 31 by means of the casting compound 32.

The connection bolts 10 in each case also form fixed contacts of the main switching device of the power relay 1, said switching device being provided so as to switch the load current circuit. The ends of the connection bolts 10, said ends protruding out the underside of the connecting base 3 into the housing interior 8 are provided for this purpose in each case with a contact element that is hereunder described as the counter contact 33. The corresponding moving contact of the main switching device is formed by the contact bridge 17 that comprises for this purpose in contrast to each counter contact 33 in each case a contact element 34 that is also described hereunder as a contact.

The contact elements 34 that are electrically short-circuited within the contact bridge 17 form in each case a contact pair 33, 34 with the opposite-lying counter contacts 33.

Fig. 2 -likewise fig. 5 - illustrates the power relay 1 in an opened position in which the contact elements 34 are raised by the counter contacts 33 (do not make contact) so that an electrically conductive connection is not produced between the connection bolts 10. The solenoid 21 is energized in order to switch on the power relay 1. As a consequence, a magnetic flux is generated in the magnetic yoke 20 by means of which the magnetic armature 19 is drawn towards the core of the magnetic yoke 20. The contact bridge 17 is deflected upwards with the magnetic armature 19 whilst being conveyed by means of the coupling rod 18 so that the contact elements 34 impact against the corresponding counter contact elements 33. In the closed position of the power relay 1, said closed position being

produced in this manner, a conductive connection is formed by way of the contact bridge 17 between the connection bolts 10. The contact elements 34 and the counter contacts 33 that are arranged in each case lying opposite said contact elements form two contact pairs 33, 34.

The solenoid 21 is energized with a reversed polarization so as to switch off the power relay 1. Under the effect of the magnetic flux that is generated in the magnetic yoke 20, the holding force that is generated by means of permanent magnets is compensated so that the magnetic armature 19 is retracted by means of the return spring 23 from the core and consequently is pressed into the opened position. The magnetic armature 19 in turn brings the contact bridge 17 by way of the coupling rod 18, whereby the contact elements 34 no longer make contact with the corresponding counter contacts 33 when disconnecting the electrical connection between the contact bolts 10. A damping element that is attached to the lower end of the carrier body 25 can intercept this movement so that a spring back effect of the unit that is formed by the magnetic armature 19, the coupling rod 18 and the contact bridge 17 is prevented in the direction of the closed position.

In the illustrated bistable assembly of the power relay 1, each of the two switching positions of the power relay 1 is also stable in the non-energized state of the solenoid 21. It is only necessary to temporarily energize the solenoid 21. The control procedure of the solenoid 21 is performed either directly by way of the signal terminals 14 or by way of the control electronics system that controls the solenoid 21 in dependence upon external or internal control commands that are supplied to the control electronics system by way of the signal terminals 13. By way of the connectors 27, the control electronics system in addition determines in the switched on state of the power relay 1 the voltage that is dropping across the connection bolts 10 as a measurement for the load current strength that is flowing through the power relay 1 or for identifying the relay position.

Fig. 3 illustrates the connecting base in a position that is rotated with respect to that illustrated in fig. 1 with a view of the contact bridge 17 that lies or sits in said connecting base without the coupling rod 18.

Fig. 4 illustrates the contact bridge 17 in a position that is in turn rotated with respect to fig. 3 with a view of the two contact elements 34. The left-hand side contact element 34 in fig. 4 forms a first contact pair with the corresponding counter contact 33, while the right-hand contact element 34 in figure 4 forms a second contact pair with the corresponding counter contact 33. The contact element 34 of the first contact pair comprises a contact region 34a that is curved in a convex manner and that extends in the longitudinal direction 35 of the contact bridge 17.

This curved (convex) contact region 34a is formed by way of example by means of corresponding, secant-type ground surfaces 34b - when viewed in a transverse manner with respect to the longitudinal direction 35 - on the two sides of the outwardly curved contact region 34a. The shape of the outwardly curved contact region 34a is embodied in such a manner that in its central region and consequently in the middle region of the contact surface 36 of the contact element 34 a locally delimited, suitably practically punctiform bearing or support site 37 is formed.

The contact element 34 of the second contact pair comprises a contact region 34c that likewise extends in the longitudinal direction 35 of the contact bridge 17 and is inwardly curved (in a concave manner). As a consequence, - in turn when viewed in a transverse manner with respect to the longitudinal direction 35 – secant-type raised contact surface regions 34d are formed on the two sides of this contact region 34c, by way of example in turn by means of a suitable grinding technique. The contact surface regions 34d in turn form bearing or support sites 38, 39 that are preferably raised or exposed in the center or middle and that are likewise indicated for clarity in an identical manner to the defined bearing site 37 of the contact element 34 of the first contact pair with a small circle.

The contact elements 34 consequently form altogether on the contact bridge-side having the three bearing sites 37, 38, 39 a defined three point bearing arrangement of a three-point support arrangement with the two bolt-side counter contacts 33. An improved contact behavior is achieved with this construction even in the event of vibrations of the power circuit relay 1 in its intended installed state.

Fig. 6 illustrates the contact bridge-side contact element 34 of the first contact pair having its contact region 34a that is outwardly curved in a convex manner so as to form the defined bearing site 27, while fig. 7 illustrates the contact element 34 of the second contact pair with its contact region 34c that is inwardly curved when forming the further two defined bearing sites 38 and 39.

It is evident that the contact elements 34 and the counter contacts or counter contact elements 33 are embodied in a rivet-like manner. For this purpose, the counter contacts 33 comprise a contact surface head 33a and a joining shaft 33b. The bridge-side contact elements 34 likewise comprise a joining shaft 34e and a contact surface head 34f. The counter contacts 33 are joined to the respective connection bolt 10 by way of their joining shafts 33b and consequently fixedly connected to said connection bolt. In a similar manner, the contact elements 34 are joined to the contact bridge 17 by way of their joining shafts 34e and consequently are fixedly connected to said contact bridge.

While fig. 8 illustrates the the contact bridge 17 in a side view, the figures 9 and 10 illustrate sectional illustrations along or through the two contact elements 34. It is comparatively clearly evident that the contact element 34 of the first contact pair comprises the contact region 34a that is outwardly curved in a convex manner. The shape of the outwardly curved contact region 34a leads in accordance with fig. 9 to the fact that in the centered region of the contact surface 36 of the contact element 34 a locally delimited, punctiform bearing or support site 37 is formed. The contact element 34 of the second contact pair evidently comprises the inwardly curved (concave) contact region 34c, whereby the raised contact surface regions 34d are formed on the two sides of the contact region 34c.

These contact surface regions 34d form the exposed bearing or support sites 38, 39.

List of reference numerals

1	Power relay
2	Housing
3	Connecting base
4	Housing pot
5	Upper side
6	Side wall
7	Housing base
8	Housing interior
9	Underside
10	Connection bolt
11	Thread shaft
12	Dividing wall
13	Signal terminal
14	Connecting conductor
15	Cover
16	Coil assembly
17	Contact bridge
18	Coupling rod
19	Magnetic armature
20	Magnetic yoke
21	Solenoid
22	Auxiliary conductor
23	Return spring
24	Contact pressure spring
25	Carrier body
26	Snap-in hook
27	(Voltage tap-) connector
28	Radial connecting piece
29	Shoulder
30	Collar
31	Trough

32 Casting compound
33 Bolt-side counter contact/counter contact element
33a Contact surface head
33b Joining shaft
34 Contact bridge-side contact element
34a (convex) contact region
34b Ground surface
34c (Concave) contact region
34d Raised contact surface region
34e Joining shaft
34f Contact surface head
35 Longitudinal direction
36 Contact surface
37 Bearing/support site
38 Bearing/support site
39 Bearing/support site

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TELJESÍTMÉNYRELÉ JÁRMŰHÖZ

SZABADALMI IGÉNYPONTOK

1. Teljesítményrelé (1) járműhöz, főleg haszonjárműhöz, amelynek van egy háza (2), amiben egy terhelőáramkörrel való érintkezésre el van helyezve két csatlakozócsap (10), és van egy, a házban (2) van elhelyezett tekercsegysége (16), és magában foglal egy mágnestekercset (21) és egy mágneshorgonyt (19), ami egy erőátvivő tagon (23) keresztül össze van kapcsolva egy záróhelyzet és egy nyitóhelyzet között mozgatható érintkezőhíddal (17), továbbá a mágnestekercsel (21) létrehozott mágneses tér hatására a házban (2) eltolható,

azzal jellemezve,

hogy az érintkezőhíd (17) két érintkezőelemet (34) tart, amelyek a csatlakozócsapok (10) ellenérintkezőivel (33) egy első érintkezőpárt (33, 34) és egy második érintkezőpárt (33, 34) képeznek, és az érintkezőpárok (33, 34) a záróhelyzetben hárompontos felfekvést adnak.

2. Az 1. igénypont szerinti teljesítményrelé (1),

azzal jellemezve,

hogy az első érintkezőpár (33, 34) olyan módon van kialakítva, hogy csupán egy definiált felfekvési helye (37) van.

3. Az 1. vagy 2. igénypont egyike szerinti teljesítményrelé (1),

azzal jellemezve,

hogy az első érintkezőpár (33, 34) érintkezőhíd-oldali érintkezőeleme (34) a csapoldali ellenérintkező (34) felé konvexen domborított érintkezőterülettel (34a) rendelkezik.

4. A 3. igénypont szerinti teljesítményrelé (1),

azzal jellemezve,

hogy a konvexen domborított érintkezőterület (34a) hídhosszirányban (35) a felfekvési hely (37) létrehozása végett centrálisan kiemelkedő érintkezőterületet képezve az érintkezőhíd-oldali érintkezőelemen (34) végigmegy.

5. Az 1–4. igénypont egyike szerinti teljesítményrelé (1),

azzal jellemezve,

hogy a második érintkezőpár (33, 34) olyan módon van kialakítva, hogy két definiált felfekvési helye (38, 39) van.

6. Az 1–5. igénypont egyike szerinti teljesítményrelé (1),

azzal jellemezve,

hogy a második érintkezőpár (33, 34) érintkezőhíd-oldali érintkezőeleme (34) – a csapoldali ellenérintkezőre (33) vonatkoztatva – konkávan bedomborított érintkezőterülettel (34c) rendelkezik.

7. A 6. igénypont szerinti teljesítményrelé (1),

azzal jellemezve,

hogy a konkáv bedomborított érintkezőterület (34c) hídhosszirányban (35) két vele szomszédos és kiemelkedő érintkezőterületet (34d) képezve az érintkezőhíd-oldali érintkezőelemen (34) végigmegy.

8. Az 1–7. igénypont egyike szerinti teljesítményrelé (1),

azzal jellemezve,

hogy a csapoldali ellenérintkezőknek (33) sík felfekvési felületük van.

9. Az 1–8. igénypont egyike szerinti teljesítményrelé (1),

azzal jellemezve,

hogy az ellenérintkezőknek (33) és/vagy az érintkezőelemeknek (34) egy illesztőszáruk (33b, 34e) és egy kör alakú, előnyösen lapkaszerű érintkezőfelület-fejük (33a, 34f) van.

10. Az 1–9. igénypont egyike szerinti teljesítményrelé (1),

azzal jellemezve,

hogy a ház (2) magában foglal egy házfazekat (4) és egy azzal összeilleszthető vagy abba részben behelyezhető csatlakozóaljzatot (3), amibe a csatlakozócsapok (10) be vannak szerelve.

11. A 10. igénypont szerinti teljesítményrelé (1),

azzal jellemezve,

hogy összeszerelt állapotban az érintkezőhíd (17) legalábbis részben a csatlakozóaljzatban (3) helyezkedik el.

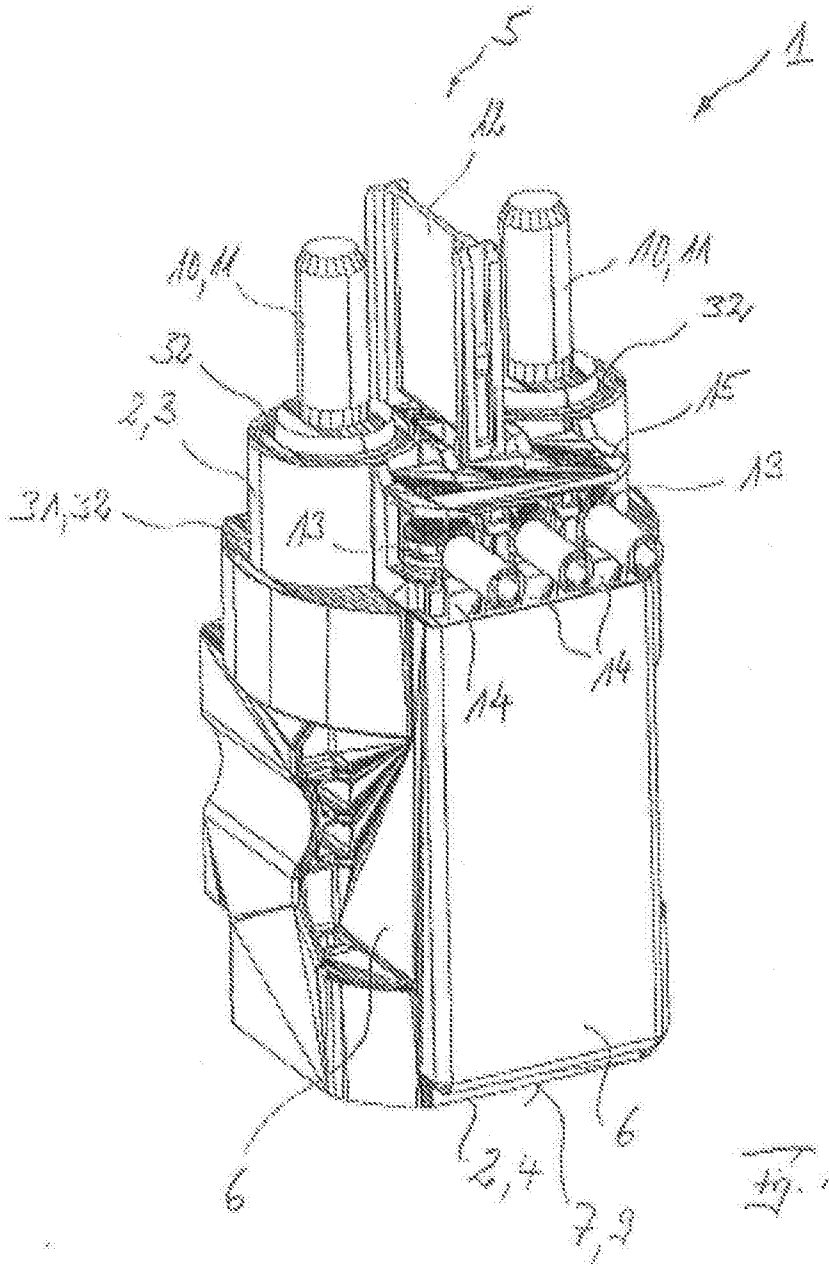

Fig. 1

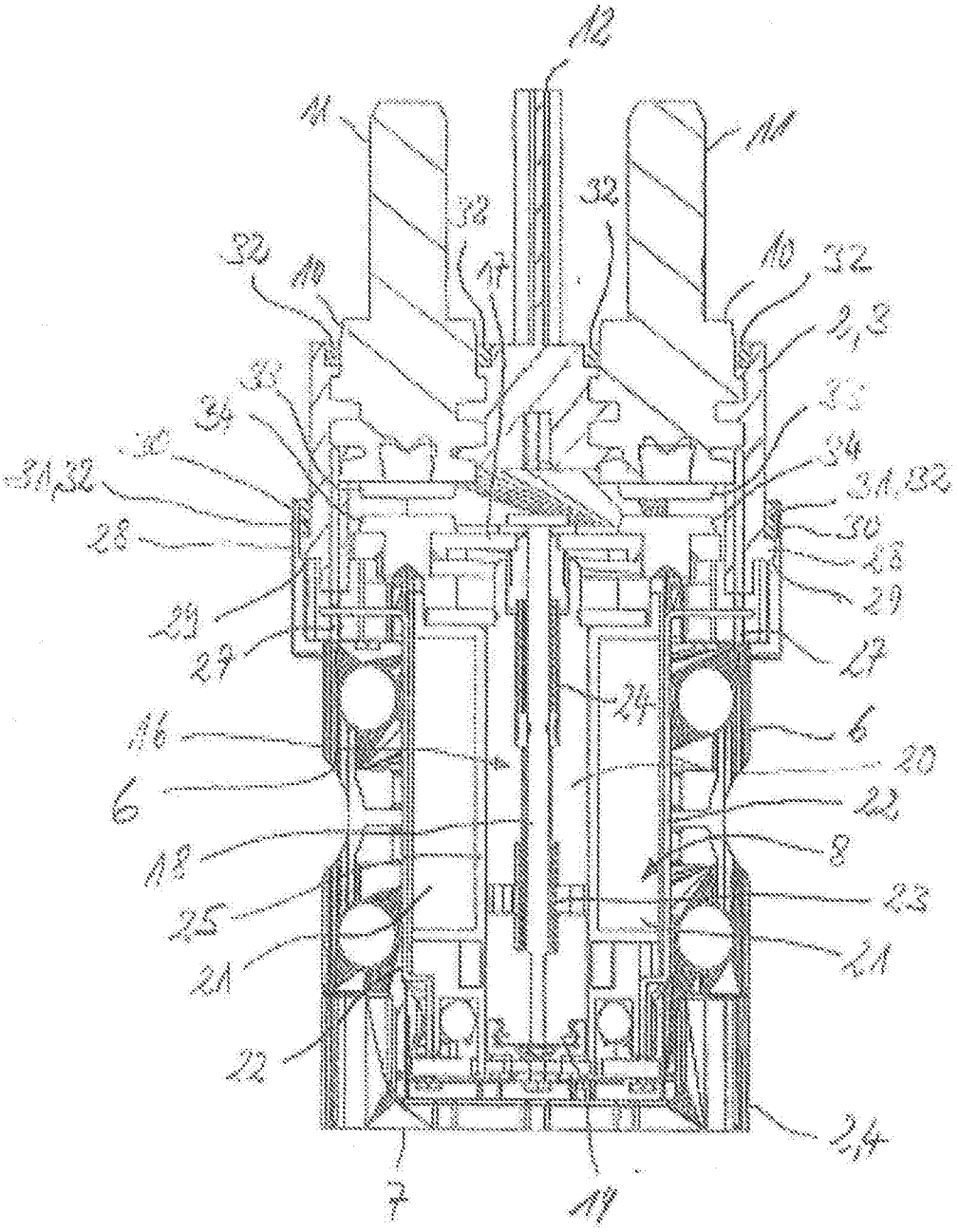
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Fig. 2

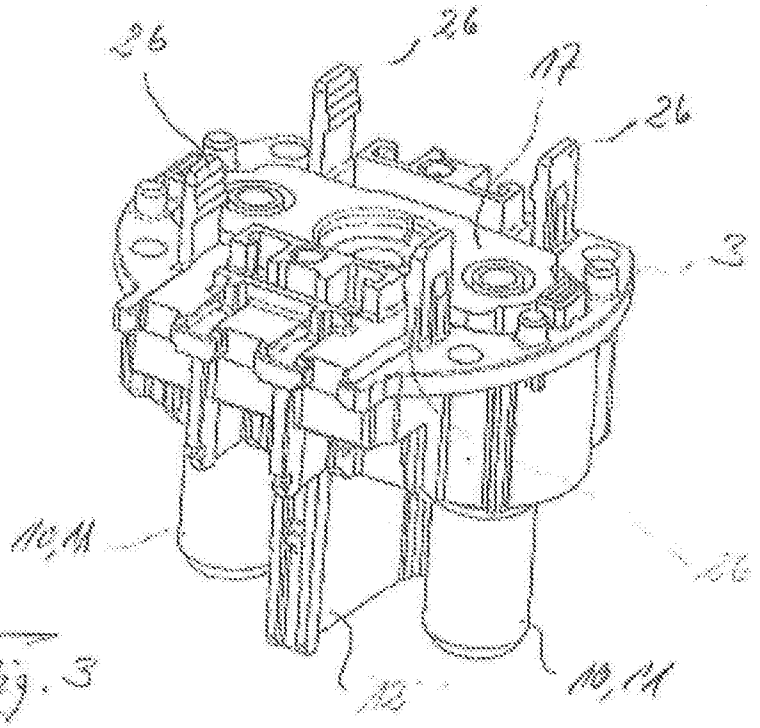
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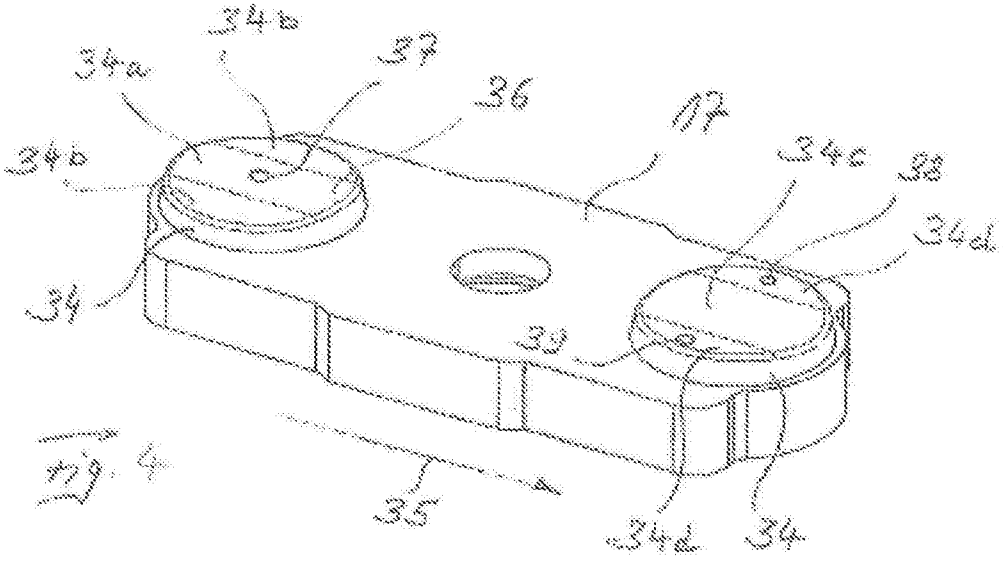
Fig. 3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34c
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34b
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34c
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Fig. 4

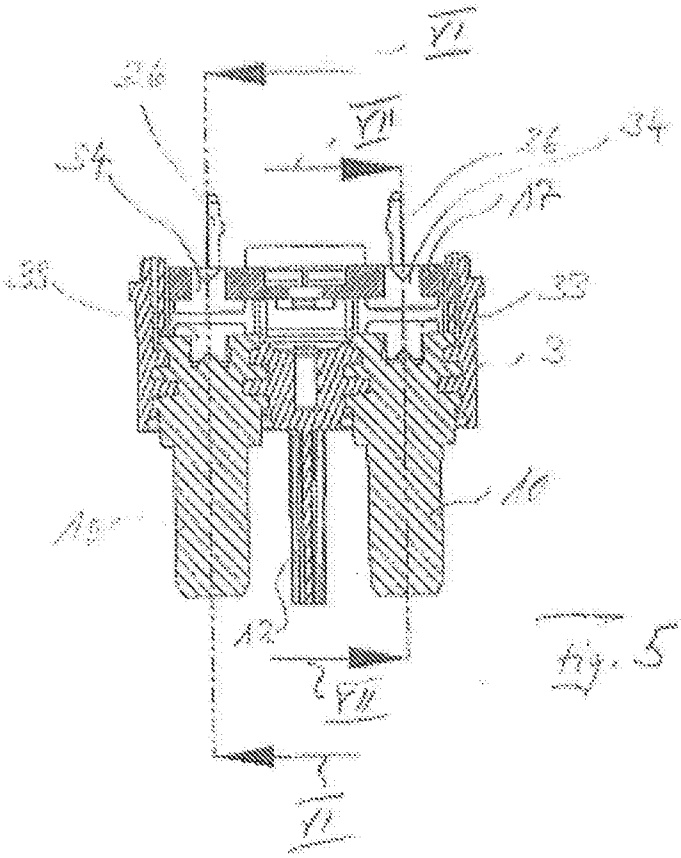

Fig. 5

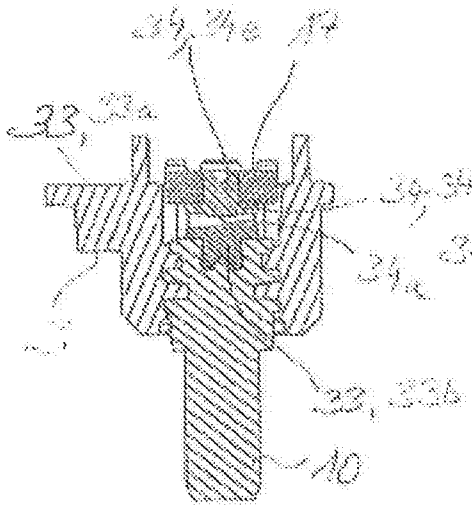

Fig. 6

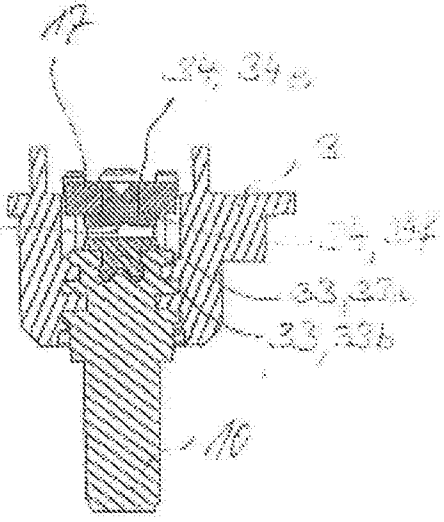

Fig. 7

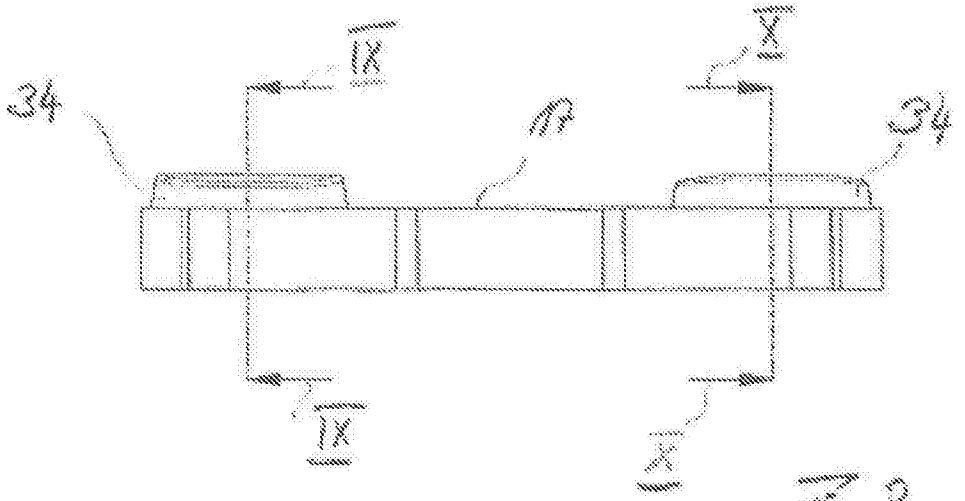

Fig. 8

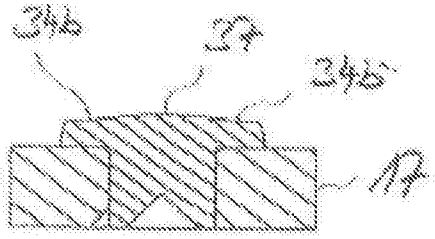

Fig. 9

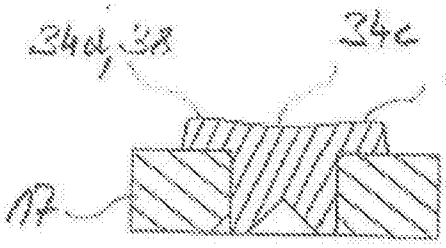

Fig. 10