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DESCRIPTION

The invention relates to an overvoltage protection element comprising a housing, terminals for electrically connecting the overvoltage protection element to a current path or a signal path to be protected, two varistors electrically connected in parallel and located within the housing, and a middle electrode located at least partially between the varistors, wherein the housing has two metal housing halves electrically connected to one another, wherein the middle electrode is electrically insulated from the housing halves and each opposite sides of the middle electrode is electrically connected to a respective first connecting region of each of the varistors, and wherein the two varistors and the middle electrode are sandwiched between the housing halves.

Electrical circuits and systems typically work without perturbations in the voltages specified for them, the rated voltage. This does not apply when overvoltages occur. Overvoltages are any voltages which are above the upper tolerance limit of the rated voltage. They mainly include transient overvoltages, which can occur due to atmospheric discharges, but also may occur due to switching actions or short circuits in power supply networks, which can be coupled galvanically, inductively or capacitively into electrical circuits. In order to protect electrical or electronic circuits, in particular electronic measuring, control, regulation and switching circuits, in which they may be used, against transient overvoltages, overvoltage protection elements were developed and have been used for many years.

Due to aging and temporarily occurring overvoltages (TOV) in the range of seconds, an unwanted increase of the leakage current of the varistor at operating voltages occurs, in particular in overvoltage protection elements with a varistor as the arrester. Overvoltage protection elements with a varistor as the arrester, therefore, nowadays often have a thermal disconnecter by which the varistor, which is no longer properly serviceable, is electrically separated from the current path to be monitored. In known overvoltage protection elements, the state of the varistor is monitored according to the principle of a temperature switch. When the varistor overheats, for example due to leakage currents which have occurred, a solder connection provided between the varistor and a disconnection means is broken, which leads to electrical disconnection of

the varistor.

Such an overvoltage protection element is disclosed, for example, in patent document DE 695 03 743 T2. In the known overvoltage protection element, which has two varistors, that are located parallel to one another, the thermal disconnecter is additionally
5 connected to an optical state display so that the state of the overvoltage protection element can be read directly on site using the optical state display. For the optical state display, this overvoltage protection element has a first slide which is located in the housing and which is actuated by separating tongues which form the separating
10 means, and in this respect interacts with a second slide which can be moved relative to a viewing port depending on the position of the first slide.

The disadvantage in the known overvoltage protection devices or the overvoltage protection elements is, however, that each contact opening under operating voltages of
15 greater than 30 volts and high current loads can produce an arc. Thus, when the solder connection is broken an arc can occur between the varistor and the separating means, which can lead to damage of components within the overvoltage protection element or of the overvoltage protection element as a whole, in particular of the plastic housing surrounding the varistor. Since several of such overvoltage protection elements or
20 overvoltage protection devices are often arranged next to one another and to other electronic devices, adjacent overvoltage protection devices or other electronic devices can be destroyed or damaged due to an arc which occurs within the housing.

Patent document DE 601 12 410 T2 discloses an overvoltage protection device which
25 has a varistor wafer which is located in a metal housing and which is braced against the bottom of the pot-shaped housing with the aid of a piston-shaped electrode. The housing is sealed with a cover which is either screwed into the pot-shaped housing or is attached by a spring ring or a clip which locks in a groove in the side wall of the housing. In this respect, there is provided an opening in the cover through which the
30 shaft of the electrode is routed out of the housing for electrical connection of the electrode. In this respect, the second terminal for electrical connection of the overvoltage protection device to the current paths or signal paths to be protected is made on the housing. For electrical insulation of the electrode relative to the housing there is pro-

vided an insulating ring which is located within the housing and which likewise has an opening for the shaft of the electrode. According to another embodiment, the overvoltage protection device disclosed in patent document DE 601 12 410 T2 has two varistor wafers which are each braced against a middle wall of the cylindrical housing with the aid of a piston-shaped electrode. To connect the housing, a housing electrode clip is made on the housing. By making the housing out of aluminum, destruction of the housing when an arc occurs on the varistor is prevented. The electrical contact-making of the varistor and the arrangement thereof in the housing and the arrangement and configuration of the electrodes make the structure and the mounting of the known overvoltage protection device, however, relatively complex.

Patent document DE 10 2007 030 653 A1 discloses an initially described overvoltage protection element which likewise has a metal housing consisting of two housing half shells. Both in the overvoltage protection element disclosed in patent document DE 10 2007 030 653 A1 and in the overvoltage protection element disclosed in patent document DE 601 12 410 T2, the problem is that the varistor wafers located within the housing are subject to tolerances, in particular in their thickness, so that to ensure a reliable contact-making of the connecting regions of the varistors for the two overvoltage protection elements, spring elements in the housing are used.

In the overvoltage protection element disclosed in patent document DE 10 2007 030 653 A1, in this respect according to the preferred embodiment there are two elastic contact elements at a time between one half shell of the housing and the associated first connecting region of a varistor. The electrical connection between the two housing half shells and the two varistors can be implemented by a purely mechanical connection so that welding or soldering operations during mounting of the overvoltage protection element are not necessary. Depending on the actual thickness of each of the two varistors, however, different contact forces arise and, as a result, adversely affect the reliable and continuous operation of the overvoltage protection element under certain circumstances. Moreover the use of elastic contact elements has a disadvantage due to the impedance of the elastic contact elements, which increases the impedance of the electrical connection to the varistors, and thus also raises the possible noise level. In addition, the contact-making surface of the varistors with the housing half shells

is reduced, which further increases the impedance of the electrical connection.

Patent document DE 10 2008 013 447 A1 discloses an overvoltage arrester, in which a temperature-dependent short-circuit switch is arranged within a housing such that, when a predetermined limiting temperature is reached due to an excess heating of the varistor, the varistor is short-circuited.

The present invention is therefore based on the objective of improving the initially described overvoltage protection element such that a noise level that is as low as possible can be achieved with same. Moreover, the overvoltage protection element preferably should be made especially durable and long-lived, and should be built and mountable as simply and economically as possible.

The invention is defined by the features of independent claim 1 and, alternatively, by the features of independent claim 4.

According to the invention, at least one temperature-dependent short-circuit switch is arranged within the housing, such that, when a given boundary temperature T_1 is reached due to an excess heating of at least one of the varistors, at least this varistor is short-circuited. Basically, in this respect it is possible that, when a predetermined limiting temperature is reached due to an excess heating of a varistor, either the two varistors jointly or only the heated varistor is short-circuited and thus the two varistors are short-circuited independently of one another.

As was already stated at the beginning, in varistors due to aging and frequent pulse loading, at the end of their lives the insulating properties are diminished, as a result of which a power loss is converted in the varistor, which leads to heating of the varistor. The temperature of a varistor can rise in this respect so dramatically that there is a risk of fire. In order to prevent this dramatic heating of the varistors, according to a further teaching of the invention, there is provided at least one temperature-dependent short-circuit switch. The short-circuit switch or switches, however, short-circuit only the varistor or the varistors and not as in the state of the art, in which the varistor or varistors are electrically disconnected from the current path to be monitored.

According to the invention, the housing halves are each electrically connected to the second connecting region of a varistor. The two varistors which are connected in parallel thus make contact with the middle electrode located between them, on one hand, and with the two housing halves, on the other hand. The housing is connectable with reference potential and the middle electrode being connected directly or indirectly to a first terminal of the overvoltage protection element for connecting at least one active conductor of the current path of the signal path to be protected.

According to the invention, a temperature-dependent short-circuit switch is provided which has a shorting jumper, an insulating retaining element mechanically connected to the shorting jumper, at least one spring element, and a retaining metal. In the normal state of the varistors, i.e., when the varistors are not overheated, the shorting jumper is located spaced apart from the middle electrode, although on the retaining element a spring force of the spring element acts in the direction to the middle electrode. In this respect, the retaining element is kept in this (first) position by the retaining element. Being supported with a spacer element which projects through an opening in the middle electrode on the retaining metal which is connected to the middle electrode via a solder connection.

If the varistors heat up, this also leads to heating of the middle electrode. At a given temperature of for example 140° this leads to melting or breaking of the solder connection so that the shorting jumper or the retaining element is no longer held in the first position by the retaining metal. The spring force of the spring element then moves the retaining element and, thus, also the shorting jumper, into a second position at which the shorting jumper makes contact both with the middle electrode and with the housing so that the varistors are short-circuited via the shorting jumper.

In this respect, according to a preferred configuration, the shorting jumper is made essentially U-shaped so that the shorting jumper has one U-back and two U-legs. In the case of a short circuit, the U-back makes contact with the middle electrode and the two U-legs make contact with the housing. For this purpose, corresponding contact sections which make contact with the U-legs in the case of a short circuit are formed on the housing.

According to an alternative of the overvoltage protection element according to the invention, the middle electrode is connected to the first terminal for connecting at least one active conductor of the current path of signal path to be protected and there is one connecting metal at a time between the housing halves and the facing second connecting regions of each of the varistors. The connecting metals are each insulated from the housing halves by an insulating element. Thus, in this embodiment, the two varistors, which are connected in parallel, make contact with the middle electrode, which is located between them, on one hand, and with the connecting metal, on the other hand. The connecting metals are connected directly or indirectly to the housing. The two varistors, however, are not connected directly flat to the two housing halves, as in the above described first embodiment, but are preferably likewise connected flat to one connecting metal at a time.

In this respect, a short-circuit switch at a time is assigned to the two varistors. Each short circuit switch has a flexible conductor section, an actuating pin and a spring element. In this respect, the first end of the flexible conductor section is electrically connected to a contact section on the assigned connecting metal, and the second end of the flexible conductor section is connected to an end of the associated actuating pin. In the normal state of the varistor assigned to the short-circuit switch, the second end of the flexible conductor section is spaced apart from a contact section which is on the middle electrode. The spring force of the spring element acts in the direction of the contact section of the middle electrode on the actuating pin. The spring force of the spring element in the normal state opposes a thermosensitive element by which the actuating pin is kept in its first position against the spring force of the spring element.

If the varistor heats up, then this leads to softening of the thermosensitive element at a given temperature so that the second end of the flexible conductor section is moved by the spring force of the spring element acting on the actuating pin into a second position at which the second end of the flexible conductor section makes contact with the contact section of the middle electrode. The varistor is then short-circuited via the flexible conductor section since the middle electrode, which is connected to the first connecting region of the varistor, is connected in an electrically conductive manner via the flexible conductor section to the connecting metal which is connected to the

second connecting region of the varistor.

In this embodiment variant, the actuating pins are preferably each guided into a hole in a corresponding contact section of the connecting metal and the spring elements are each located between the first end of the actuating pins and the contact section of the connecting metal. In this respect, in the normal state of the varistors, the spring elements can be compressed against the spring force, and the actuating pins are thereby held in their first position by there being in each of the actuating pins one thermosensitive pin which is located on the side of the contact section of the connecting metal opposite the spring element and adjoining same. If the varistor heats up, then this also leads to heating of the connecting metal, which makes contact with the varistor and, thus, also heating of the contact section of the connecting metal. This leads to the thermosensitive pin likewise heating up and, thus, losing its stability after a given temperature so that the pin can no longer keep the actuating pin in the first position against the spring force of the spring element.

According to one preferred variant of this embodiment, a back-up fuse, in particular a safety fuse, is assigned to each of the two varistors. One terminal of the back-up fuses is connected in an electrically conductive manner to the assigned connecting metal. The second terminal of the back-up fuse is directly or indirectly connected to the housing of the overvoltage protection element.

By integrating the back-up fuses in the housing of the overvoltage protection element, the use of additional, separate back-up fuses can be avoided. Moreover, this embodiment has the advantage that only the overloaded varistor is short-circuited and subsequently, when a short-circuit current occurs, it is disconnected by the back-up fuse from the current path or signal path to be monitored and, thus, from the supply voltage. If an overloaded varistor is disconnected from the supply voltage, then the protective function of the overvoltage protection element is reduced, but basic protection remains however ensured by the second varistor which continues to be active.

Safety fuses, which are generally used as back-up fuses, are only conditionally resistant to pulsed currents according to the characteristic melt integral. Since two short-

circuit switches and two back-up fuses are provided in the above described embodiment, an overvoltage-dependent pulsed current is distributed between the two fuses so that the rates values of the fuse can be made smaller. Moreover, in the case of a short circuit, lower short circuit currents with a shorter current flow time form, as a result of which the voltage dip caused by the short-circuit current is reduced. In this way, system fuses are less stressed, network quality is improved, and overall availability of the system is increased.

Alternatively, for the use of a back-up fuse and of a thermal short-circuit switch, (only) a fuse with a melting strip can also be used, which is then made and arranged such that it assumes both the function of the back-up fuse and the function of the thermal short-circuit switch. The fuse, which is connected in an electrically conductive manner to a varistor, is made such that, when a predetermined limiting temperature is reached due to an excess heating of the varistor and when a short circuit occurs, the fuse triggers and, thus, disconnects the assigned varistor electrically from the circuit.

For this purpose, the fuse preferably has a safety fuse made of a material with a low melting point, for example tin, so that the fuse, in contrast to conventional fuses, triggers not only when a short-circuit current occurs but also in the event of too strong heating, by the safety fuse being destroyed by means of the short-circuit current or the heating. An arc which occurs within the fuse is extinguished by suitable extinguishing aids, for example sand.

In one embodiment of the overvoltage protection element, in which the middle electrode is connected to a first terminal for connecting at least one active conductor of the current path of the signal path to be protected, and in which there is one connecting metal at a time between the two housing halves and the facing second connecting regions of the two varistors, the connecting metals are each insulated by an insulating element from the housing halves. The first terminal of the further arrester is connected directly or indirectly to the housing and the second terminal of the further arrester is connected to the two connecting metals. Thus, in this embodiment, the first terminal of the overvoltage protection element, which is connected to an active conductor, is connected with the middle electrode. The middle electrode with its opposite sides is

electrically connected to the first connecting region of each of the varistors, the two varistors with their second connecting region are connected to the two connecting metals, the two connecting metals each directly or indirectly to the second terminal of the further arrester and the first terminal of the further arrester to the housing of the overvoltage protection element. The housing is also connectable here to the reference potential via a second terminal.

As was stated above, the second terminal of the further arrester is connected directly or indirectly to the two connecting metals. If the second terminal of the further arrester is directly connected to the two connecting metals, then there is permanently an electrically conductive connection between the second terminal and the two connecting metals. According to a preferred configuration of this embodiment, the second terminal of the further arrester is, however, (only) indirectly connected to the two connecting metals, by there being one back-up fuse, in particular a safety fuse, between the second terminal of the further arrester and the two connecting metals. The connecting metals each have one contact section which is connected in an electrically conductive manner to the first terminal of the assigned back-up fuse, while the second terminals of the two back-up fuses are connected in an electrically conductive manner to the second terminal of the further arrester.

As has already been stated above, the metallic housing can be connected to the reference potential via a second terminal. Structurally, in this respect, the second terminal can be implemented according to one embodiment in that the housing has an attachment region via which the housing can be connected to a mounting plate as the reference potential. Alternatively or additionally, the housing, in particular the first housing half, has a safety fuse terminal as the second terminal via which (additionally) one safety fuse can be electrically connected to the housing.

The first terminal of the overvoltage protection element for connecting at least one active conductor of the current path of the signal path to be protected can be formed according to a preferred embodiment by a high current bushing terminal which is located preferably on one face side, in particular the top, of the first housing half. By using a high current bushing terminal, a contact-protected installation of the connect-

ing line or the connecting lines is possible, the potential being routed insulated into the housing with the capacity to carry high currents. The clearance and creepage distances in this region can be further increased by using additional molded insulating parts within the housing.

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Alternatively to using a high current bushing terminal, a terminal electrode connected preferably integrally to the middle electrode can be routed through an insulating housing penetration into the housing interior.

10 According to one configuration of the overvoltage protection element according to the invention, an optical display device and, preferably, in addition also a remote display device are made or arranged on the housing for displaying the state of the varistors. Preferably, in this respect, the display device has a circuit board on which there are several LEDs. Moreover, the display device has even more temperature fuses which
15 are in thermal contact with the middle electrode. If the temperature of the middle electrode reaches a first given boundary temperature, then the first temperature fuse triggers, which leads to a preferably green LED that displays the fault-free state being extinguished. At the same time, a second, preferably red LED starts to light up, as a result of which a fault case is displayed. A second temperature fuse which is preferably
20 bly provided can be interrogated via a plug-in circuit board connector as a remote function display. Moreover, there can be provided a third temperature fuse which is matched in its trigger temperature to the switching of a short-circuit switch so that also the switching of the short-circuit switch or reaching the switching temperature of the short-circuit switch can be remotely transmitted.

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In particular, there is a plurality of possibilities to configure and improve the overvoltage protection element according to the invention. In this respect, reference is made both to the claims depending on claim 1 and the following description of preferred embodiments in connection with the drawings.

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Figure 1 shows an overvoltage protection element, with the cover removed,

Figure 2 shows an exploded view of the overvoltage protection element according to

Figure 1,

Figure 3 shows a sectional view of the overvoltage protection element, with a shorting jumper in the normal state of the varistors and in the case of a short circuit,

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Figure 4 shows a sectional view of a variant of the overvoltage protection device according to Figure 1,

Figure 5 shows an overvoltage protection element, with the cover removed,

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Figure 6 shows an exploded view of the overvoltage protection element according to Figure 5 and

Figure 7 shows a sectional view of one part of the overvoltage protection device according to Figure 1.

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The drawings show two examples of an overvoltage protection element 1. A first embodiment is depicted in particular in Figures 1, 2 and 3 and a second embodiment in Figures 5 and 6. In contrast to the depicted embodiments, not all the components depicted in the housing need to be implemented in the overvoltage protection element 1 according to the invention. Moreover, individual features depicted in one embodiment can also be implemented in the other embodiment. Also in particular the features depicted in Figures 4 and 7 can also be implemented both in the first embodiment and in the second embodiment.

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The overvoltage protection element 1 depicted in the drawings has a housing with terminals 2, 3 for electrically connecting the overvoltage protection element 1 to a current path of a signal path to be protected. Within the housing there are two varistors 4, 5, which are connected electrically in parallel and which each have a circular base surface, the diameter of the two varistors 4, 5, aside from tolerance-dictated deviations, being the same. Between the two varistors 4, 5 there is a middle electrode 6 which is insulated from the two housing halves 7, 8 forming the housing. The middle electrode 6, with its opposing sides is connected in an electrically conductive manner

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to the first connecting region 9 of each of the varistors 4, 5, the two varistors 4, 5 and the middle electrode 6, as is apparent in particular from Figures 2 and 6, being sandwiched between the housing halves 7, 8.

5 In particular it is apparent from Figures 2 and 3 that the two housing halves 7, 8 are made differently. The second housing half 8 is made as a cover which has a covering section 10 and a recessed engagement section 11. In the connected state of the housing halves 7, 8 (see Figure 3), the engagement section 11 of the cover 8 engages the corresponding receiving space 12 formed by the first housing half 7, while the receiving
10 space 12 is covered by the covering section 10. It is moreover apparent from Figure 3 that also in the connected state of the housing halves 7, 8, there is a viewing gap 13 between the housing halves 7, 8. The width B of the viewing gap 13 varies in this respect depending on the thickness of each of the varistors 4, 5. In this respect, the two housing halves 7, 8 are made such that, in any case when using the allowable varistors
15 4, 5, the maximum width B of the viewing gap 13 is always smaller than the corresponding extension, i.e., the width b of the engagement section 11.

A production-dictated thickness tolerance of the varistors 4, 5 can be easily balanced
20 by the configuration of the viewing gap 13 without additional elements being necessary for the tolerance balancing. The required contact pressure between the housing halves 7, 8 and the varistors 4, 5 or between the varistors 4, 5 and the middle electrode 6 can be easily achieved by screwing down the two housing halves 7, 8.

The middle electrode 6 has a flat section 14 whose dimension or whose diameter essentially corresponds to the diameter of the varistors 4, 5 so that the first connecting
25 regions 9 of the varistors, which are opposite the two sides of the middle electrode 6 and which are provided with a metal coating, make flat contact with the middle electrode 6. In the embodiment according to Figures 1 and 2, the varistors 4, 5 with their second connecting region 15 make contact directly with the two housing halves 7, 8 so
30 that the two connecting regions 9, 15 of each of the varistors 4, 5 make flat contact, as a result of which a low-impedance terminal of the varistors 4, 5 is achieved. The flat connection of each of the two varistors 4, 5 with the two housing halves 7, 8 lead, moreover, to optimum heat dissipation from the varistors 4, 5 to the housing, which

benefits the performance and the service life of the varistors 4, 5.

Figure 4 depicts a variant of the overvoltage protection element 1 according to Figures 1 to 3, in which the middle electrode 6 consist of two metal parts 6a, 6b which are electrically connected to one another and which are arranged parallel to one another. In the region between the two varistors 4, 5, the two metal parts 6a, 6b are spaced apart from one another. In the intermediate space 16 formed in this way, there is a spring element 17, which is preferably a sinuous spring. The spring element 17 pushes the two metal parts 6a, 6b apart so that the two metal parts 6a, 6b, with their sides facing away from one another, are pressed against the first connecting region 9 of a varistor 4, 5 and thus the two varistors 4, 5 make contact. In contrast, in the region located outside the two varistors 4, 5, the two metal parts 6a, 6b are directly connected flatly to one another, and the two metal parts 6a, 6b are fixed in this region via a lock nut 18. The production of the two metal parts 6a, 6b is made especially simple in that the two metal parts 6a, 6b are made the same and bent or angled and mounted turned only 180° to one another.

In the examples depicted in the drawings of an overvoltage protection element 1, there is at least one temperature-dependent short-circuit switch within the housing so that, when a given boundary temperature T_1 is reached due to an excess heating of at least one of the varistors 4, 5, either two varistors 4, 5 (embodiment 1) or only the heated varistor 4, 5 (embodiment 2) is short-circuited. A fire risk resulting from overly dramatic heating of a varistor 4, 5, which could lead not only to destruction of a varistor 4, 5 but moreover also to destruction of further components and optionally to damage of adjacent devices or even to endangerment of individuals, is thereby prevented.

In the example according to Figures 1 to 3, within the housing there is only a short-circuit switch which has a shorting jumper 19, an insulating retaining element 20 mechanically connected to the shorting jumper 19, two spring elements 21, and a retaining metal 22. In the normal state of the varistors 4, 5, which is depicted in Figure 3a, the shorting jumper 19 is located spaced apart from the middle electrode 6, although the retaining element 20 is exposed to a spring force in the direction to the middle electrode 6 by the spring elements 21 which are compressed against their spring force.

In the normal state of the varistors 4, 5 the shorting jumper 19 is kept in the first position spaced apart from the middle electrode 6 because the retaining element 20 is supported with a spacer element 24 which projects through an opening 23 in the middle electrode 6 on the retaining metal 22, which is connected to the bottom of the middle electrode 6 via a solder connection.

If the varistors 4, 5 heat up excessively, this also leads to heating of the middle electrode 6, as a result of which starting from a certain temperature of for example 140°C, the solder connection between the middle electrode 6 and the retaining metal 22 is broken. The retaining metal 22 or the solder connection can thus no longer apply the counterforce to the spring force. In this way, the retaining metal 22 due to the spring force of the spring elements 21 is forced down by the spacer element 24 of the retaining element 20 away from the middle electrode 6 and the shorting jumper 19, which is held by the retaining element 20, is pressed onto the middle electrode 6. In this second position of the retaining element 20, the shorting jumper 19 makes contact both with the middle electrode 6 and with the first housing half 7 so that the varistors 4, 5 are short-circuited via the shorting jumper 19 (Figure 3b). Since the retaining metal 22 is held via catch points on the two guide pins, which are located on the retaining element 20, the retaining metal 22 is also prevented from dropping after the solder connection is broken.

The shorting jumper 19 in the normal state of the varistors 4, 5 is located mechanically unloaded in the housing, specifically accommodated by the retaining element 20. Since the shorting jumper 19 for breaking the solder connection between the middle electrode 6 and the retaining metal 22 must not be made elastic, the shorting jumper 19, with its cross section and its conduction value, can be matched optimally to the electrical requirements of the overvoltage protection element 1 in the case of a short circuit. Since the spring elements 21 are tensioned only during mounting by the closing of the cover 8, a simple and, thus, economical mounting of the individual components in the first housing half 7 is possible since all the components can be used free of mechanical stresses; additional fixing parts are thus unnecessary.

As can be seen in Figure 3, the shorting jumper 19 has a U-back 25 and two U-legs 26

which in the case of a short circuit adjoin the corresponding contact sections 27 of the housing part 7. Adjacent to the contact sections 27 on the housing half 7, contact ribs 28 are formed which in the case of a short circuit likewise make contact with the U-legs 26 of the shorting jumper 19. For this purpose the ends of the U-legs 26 each have a bent-back end section 29 which in the case of a short circuit adjoins one of the contact ribs 28 at a time.

By means of the U-shaped configuration of the shorting jumper 19 and the configuration of the bent-back end sections 29 of the U-legs 26, the dynamic current forces in the case of a short circuit are advantageously used to improve the contact properties. In the U-legs 26 and the bent-back end sections 29, which have an angle α to one another, in the case of a short circuit an opposite current flows. This leads to the U-legs 26 and the bent-back end sections 29 being bent apart from one another by the current forces, i.e. the angle α is increased. This leads to an increase of the contact forces between the shorting jumper 19 and the housing part 7 both on the contact sections 27 and on the contact ribs 28. Moreover, the contact pressure between the U-legs 26 and the contact sections 27 is also increased by the angle α between the U-back 25 and the two U-legs 26 being likewise increase by the current forces which are caused by the short-circuit current flowing through the shorting jumper 19. Overall, a good current transition between the shorting jumper 19 and the housing half 7 is thus achieved by the preferred configuration of the shorting jumper 19 and the configuration of the housing half 7.

In the example according to Figures 5 and 6, one short-circuit switch at a time is assigned to the two varistors 4, 5. In this embodiment, the middle electrode 6 is connected to a connection electrode 30, which is guided through one housing penetration 31 insulated into the housing interior. The middle electrode 6 can be connected to an active conductor via the connection electrode 30. The second connecting regions 15 of each of the varistors 4, 5 each make contact with the connecting metal 32 which is located on the side of the varistors 4, 5 facing away from the middle electrode 6. Between the housing halves 7, 8 and the connecting metals 32 there is one insulating element 33 at a time which can be formed for example by a silicone film or an insulating paper, as a result of which the two connecting metals 32 are insulated from the

housing halves 7, 8.

The two short-circuit switches each have a flexible conductor section 34, an actuating pin 35 and a spring element 36. The first end 37 of a flexible conductor section 34 is connected in this respect to a contact section 38 of a connecting metal 32 and the second end 39 of the flexible conductor section 34 is connected to one end 40 of the actuating pin 35. In the normal state of the assigned varistor 4, 5 (see Figure 5), the second end 39 of the flexible conductor section 34 is spaced apart from a contact section 41 of the middle electrode 6. In this respect, the spring element 36, surrounding a section of the actuating pin 35, is located between the contact section 38 of the connecting metal 32 and the plate-shaped end 40 of the actuating pin 35, the spring element 36 being compressed against its spring force. The actuating pin 35 is kept in this first position against the spring force of the spring element 36 by a thermosensitive element 42 in the form of a pin.

If the varistor 4, 5 heats up, this likewise lead to heating of the assigned connecting metal 32 and of the contact section 38, as a result of which the thermosensitive element 42 likewise heats up until it loses its stability when a certain boundary temperature is achieved so that it can no longer apply the counterforce to the spring force of the spring element 36. The actuating pin 35 is then forced down by the spring element 36, as shown in the depiction according to Figure 3, and thus the second end 39 of the flexible conductor section 34 is moved into a second position in which the second end 39 makes contact with the contact section 41 of the middle electrode 6 so that the varistor 4, 5 is short circuited via the flexible conductor section 34. In this respect, the actuating pin 35 is routed into a hole formed in the contact section 38 of the connecting metal 32. The material for the thermosensitive pin 42 can be a plastic or a metal which at a predefined temperature loses its stability so that the desired short circuit of the overheated varistor 4, 5 occurs by the middle electrode 6 being connected in an electrically conductive manner to the connecting metal 32 via the flexible conductor section 34.

In the examples depicted in Figures 5 and 6 of the overvoltage protection element 1, a back-up fuse 43 is assigned to each of the two varistors 4, 5. In this respect, a corre-

sponding contact section 44 of the connecting metals 32 makes contact with a first terminal 45 of the assigned back-up fuse 43.

Both in the examples depicted in Figures 1 and 2 and in the embodiment depicted in
5 Figures 5 and 6 of the overvoltage protection element 1, in addition to the two varistors 4, 5 there is a gas-filled overvoltage arrester 46 as further arrester in the housing. In this respect, the gas-filled overvoltage arrester 46 is located in series to the parallel connection of each of the varistors 4, 5. Because a gas-filled overvoltage arrester 46 is connected in series to the varistors 4, 5, which are connected in parallel, the overvoltage protection element 1 then also has an overvoltage protection function if one varistor or both varistors 4, 5 are short-circuited. If after short circuiting of the varistors 4,
10 5 an overvoltage occurs, then this leads to ignition of the gas-filled overvoltage arrester 46 so that a device or a system the protection of which requires using the overvoltage protection element 1 is not damage by the overvoltage.

15 In the example according to Figures 1 and 2, the first terminal 47 of the gas-filled overvoltage arrester 46 is connected in an electrically conductive manner to the first terminal 2 of the overvoltage protection element 1 for connection of one active conductor and the second terminal 48 is connected to the middle electrode 6. In this respect, in the region of the gas-filled overvoltage arrester 46 an additional insulation 49
20 is located within the housing which additionally insulates at least the further overvoltage arrester 46 and the connection region of the first terminal 47 of the overvoltage arrester 46 to a first terminal 2 of the overvoltage protection element 1 from the housing. In this way, the clearance and creepage distances are increased so that the gas-filled overvoltage arrester 46 can be mounted in a reduced installation space.
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In the example according to Figures 5 and 6, the first terminal 47 of the gas-filled overvoltage arrester 46 is conversely connected to the housing and, more precisely, to the housing half 7. The second terminal 48 is connected to the two connecting metals
30 32 via the two back-up fuses 43. To allow the two back-up fuses 43 to be electrically connected in parallel to the second terminal 48 of the gas-filled overvoltage arrester 46, there is located a contact metal 51 between the second terminal 48 of the gas-filled overvoltage arrester 46 and the second terminals 50 of the back-up fuses 43.

In an embodiment variant, not shown here, according to Figures 5 and 6, the two thermal short-circuit switches and the two back-up fuses 43 are each replaced with one fuse with one melting strip. The two fuses are then connected, on one hand, to a varistor 4, 5 via a connecting metal 32 and, on the other hand, to the gas-filled over-voltage arrester 46 via the contact metal 51. Heating of a varistor is thus transferred to the fuses so that the safety fuse consisting of a material with a low melting point is thermally destroyed. In the case of a short circuit, the safety fuse is destroyed by the short-circuit current which flowing at that time, so that in both cases the assigned varistor is electrically separated from the circuit.

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In order to be able to connect the metallic housing to the reference potential (PE), the housing half 7 according to Figures 1 and 2 as a second terminal 3 has an attachment region 52 with which the housing half 7 can be attached to a mounting plate. On the bottom of the attachment region 52, a depression 53 is formed in the housing half 7 with which a mounting rail, which may be present, can be roofed. With the aid of the screws inserted in the attachment grooves 54, the housing can then be reliably attached, at the same time while an electrical connection of the housing half 7 to the mounting plate takes place. In addition, a safety fuse terminal 55 is formed as a second terminal 3 laterally on the housing half 7, via which a safety fuse can be electrically connected to the housing. For this purpose, the safety fuse terminal 55 has a mounting slot 56 into which a screw can be inserted and locked for connection of a ring cable lug which is connected to a safety fuse and can be pressed against the side wall of the housing half 7. Also in the embodiment according to Figures 5 and 6, a corresponding attachment region and preferably also a safety fuse terminal can be made as the second terminal 3.

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In the example according to Figures 1 and 2, a high current bushing terminal 57 is attached as a first terminal 2 on the top of the housing half 7, via which the potential of an active conductor is routed insulated into the housing interior with the capacity to carry high currents. An insulating part 58 increases the clearance and creepage distances in this region, in addition, and is used at the same time as a torque support when the conductors are connected. The two terminals of the high current bushing terminal 57 are electrically connected to the first terminal 47 of the gas-filled over-

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voltage arrester 46 via an elbow coupling 59. The terminals of the high current bushing terminal 57 can be wired as a parallel connection.

5 Figures 1 and 2 furthermore show that within the housing a two-part inner housing is formed which surrounds at least the varistors 4, 5, the section 14 of the middle electrode 6 and the short-circuit switches, and which consists of a first housing part 60 that is connected to the first housing half 7, and a second housing part 61 that is connected to the cover 8. In order to a complete sealing of the inner housing, a sealing cord 62 is inserted into a groove in the first housing part 60 and an insulating penetration 63,
10 through which the middle electrode 6 is inserted into the inner housing and, thus, insulated relative to the housing, is slipped on the middle electrode 6.

Figure 7 shows an example of a display device for displaying the state of the varistors 4, 5, which enables both an optical display device on the housing and a remote state
15 display. The display device has a circuit board 64, which is connected to a base strip of a plug 65, which is routed out of the housing. The local optical display device is operated with auxiliary energy via the plug 65. On the circuit board 64 there are green LEDs 66, which light up in the normal state, and a red LED 67, which does not light up in the normal state. Moreover, there are several temperature fuses 68 provided
20 which are connected, on one hand, to the circuit board 64 and are on the other hand in a good thermal contact with the middle electrode 6 via the temperature fuse holder 69, which is attached to the middle electrode 6.

If the temperature of the middle electrode 6 reaches a first given boundary temperature, then the first temperature fuse 68 triggers, which leads to the green LED 66 that
25 displays the fault-free state being extinguished. At the same time, the red LED 67 starts to light up, as a result of which a fault case is displayed. The light of the LEDs 66, 67 is routed via a light conductor 70 to a display window in the top of the housing half 7. A second temperature fuse 68 can be interrogated via the plug 65 as a remote
30 function display. Via the third temperature fuse 68 which is matched in its trigger temperature to the switching of the short-circuit switch, reaching the switching temperature of the short-circuit switch can be interrogated.

PATENTKRAV

1. Strygestation (1) som består af et strygebræt (2), med en sammenfoldelig ramme
5 (3) placeret på en stand, som er designet som en søjle (4) og har en dampgenerator
(5) til et strygejern, en fjernbar vandtank (6), som forsyner dampgeneratoren (5)
med vand i søjlen (4), et vandfilter (8), som er placeret op mod dampgeneratoren
(5), som er placeret i ladestationen (7) for vandtanken (6) karakteriseret ved, at der
10 er en aftagelig hættelignende enhed (9), som er placeret på ladestationen (7) og
kan bruges som et værktøj til at tage vandfiltret (8) og den forseglende ring (10) ud
af ladestationen (7), og at det hættelignende element (9) består af et skalhus (11),
som tildækker ladestationen (7) delvist når den er placeret derpå, og at værktøjerne
(12) og (13) er integreret i skalhuset.
- 15 2. Strygestation er ifølge krav 1 karakteriseret ved, at mindst en ventil kan bevæges i
forhold til en handling udført af en fjeder på bunden af vandtanken (6) og samar-
bejder med ladestationen (7), som er placeret på dampgeneratoren (5), så ventilen
løsnes når vandtanken (6) fjernes og åbnes når vandtanken (6) indsættes.
- 20 3. Strygestationen er ifølge krav 1 karakteriseret ved, at et af værktøjerne (12) består
af en krog til at fjerne forseglingsringen (10), som er isat i ladestationen (7).
4. Strygestationen er ifølge krav 1 karakteriseret ved, at det andet værktøj (13) består
af en klemme til at fjerne vandfiltret (8), som er placeret i ladestationen (7).
- 25 5. Strygestationen er ifølge krav 1 karakteriseret ved, at hættten (9) består af to skal-
huse (11.1) og (11.2), som er forbundet med et forbindelsesstykke (14), et skalhus
(11.1) dækker ventilationsfatningen (15) og det andet skalhus (11.2) dækker lade-
stationen (7) når den er monteret der.
- 30 6. Strygestationen er ifølge krav 3 og 5 karakteriseret ved, at krogen er integreret i et
af skalhusene (11.1) og klemmen er integreret i det andet skalhus (11.2).

- 5
7. Strygestationen er ifølge krav 5 karakteriseret ved, at et øje (16) er integreret i forbindelse med stykket (14), hvilket betyder, at øjet på hætteelementet (9) kan fastlåses på det tildækkede del (17) af dampgeneratoren (5).
- 10
8. Strygestationen er ifølge krav 5 eller krav 7 karakteriseret ved, at en tværgående afstivelse (18) er integreret på undersiden af forbindelsesstykket (14) for at stabilisere forbindelsesstykkets overflade.
- 15
9. Strygestationen er ifølge krav 5 karakteriseret ved, at fordybninger (19) for centreringsring er tilvejebragt i væggene af skalhusene (11.1) og (11.2) og, når den er i sin indsatte tilstand, kommunikere den med fanebladene (20), som er integreret på fatningerne (7, 15).
10. Strygestationen er ifølge krav 1 til 9 karakteriseret ved, at hætteelementet (9) er produceret af plastikdele, som er lavet i et stykke.

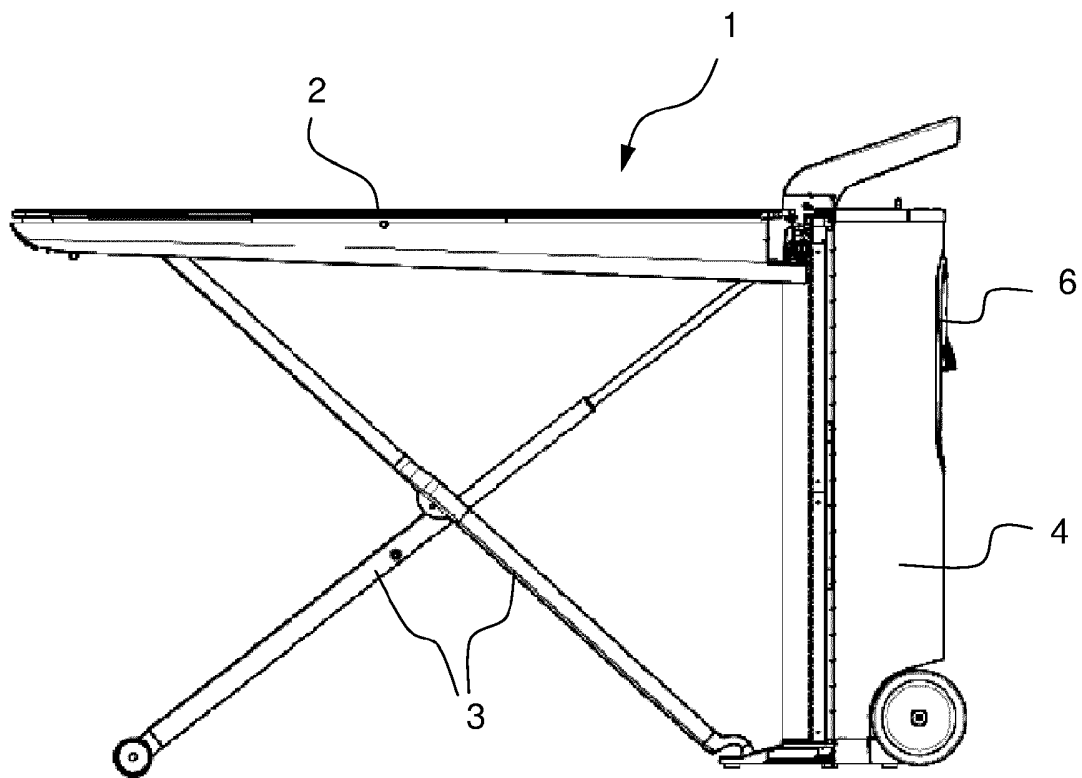


Fig. 1

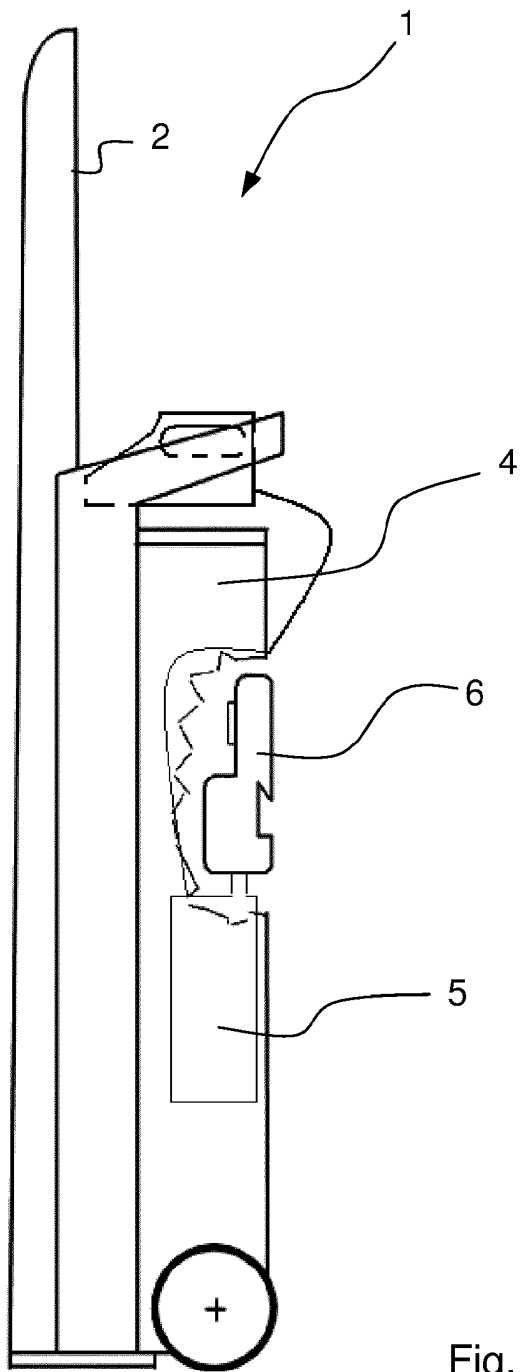


Fig. 2

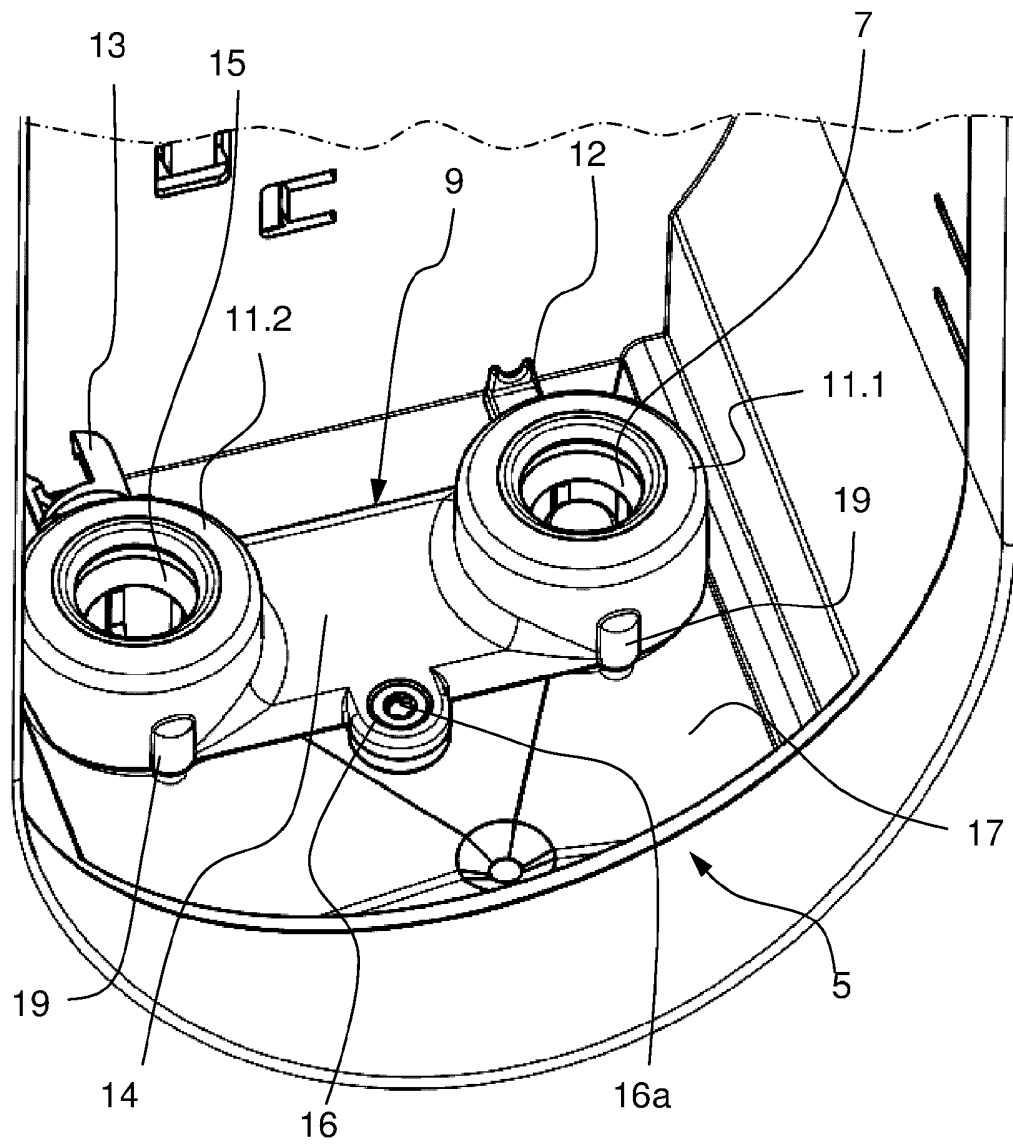


Fig. 3

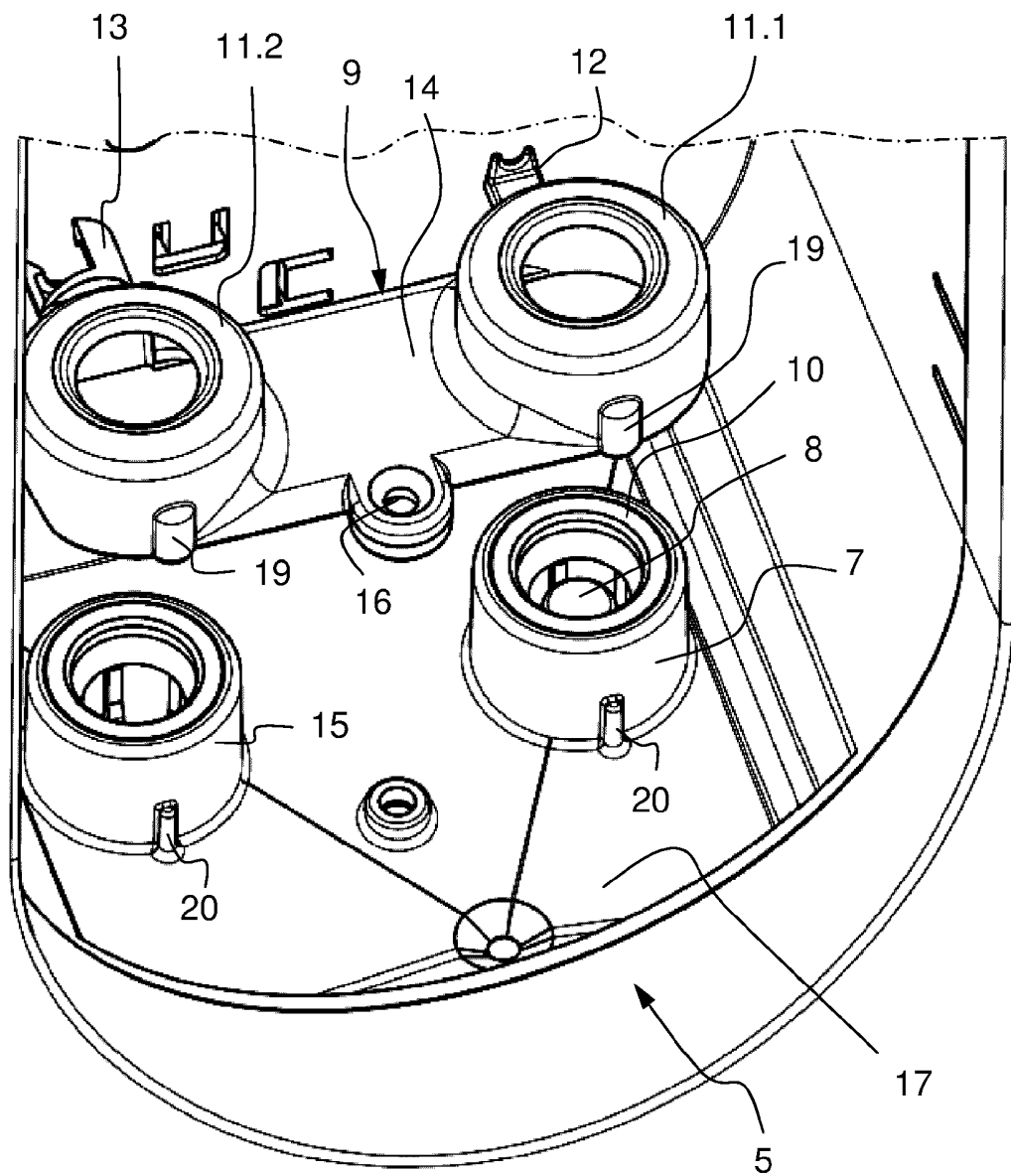


Fig. 4

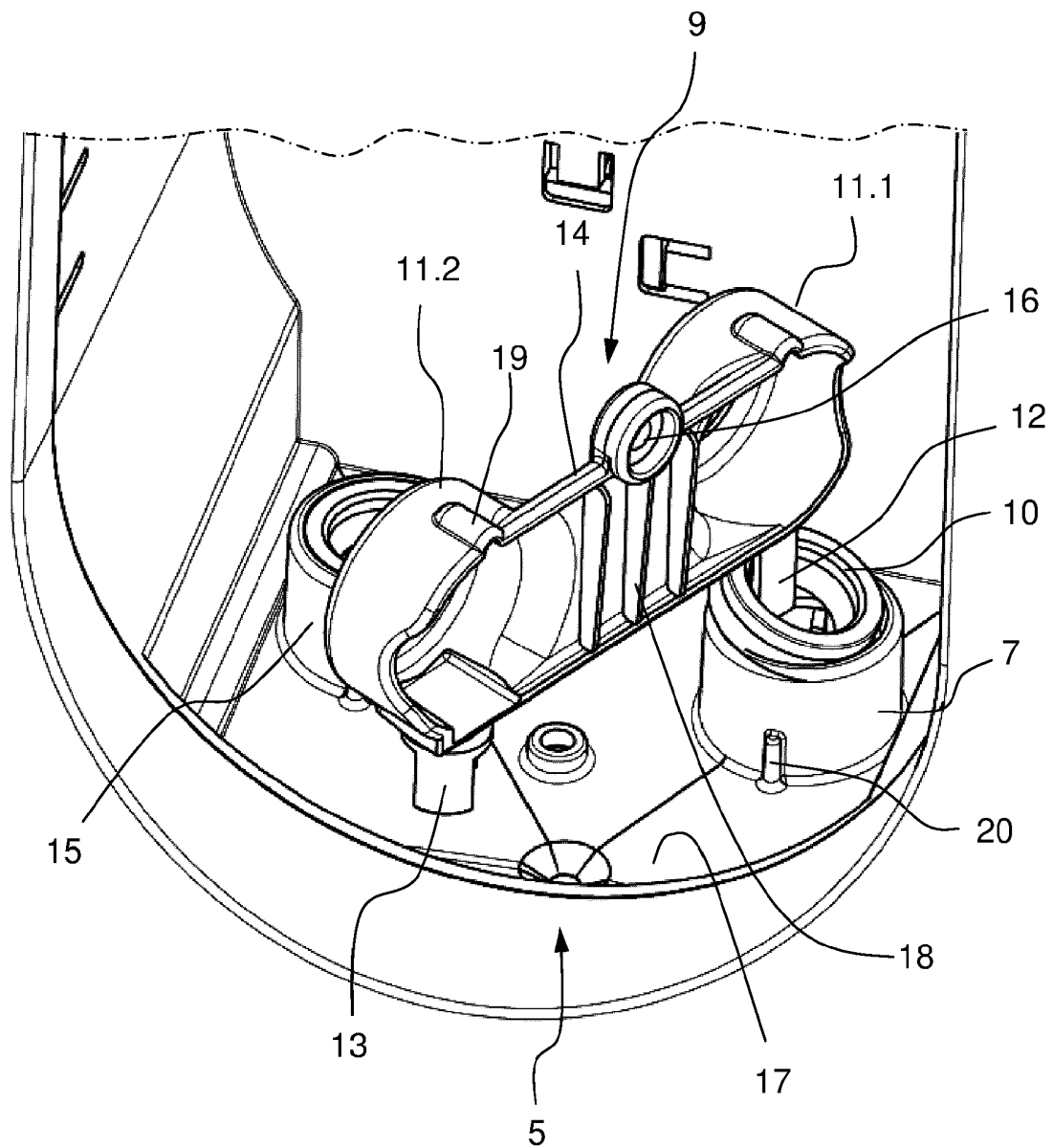


Fig. 5

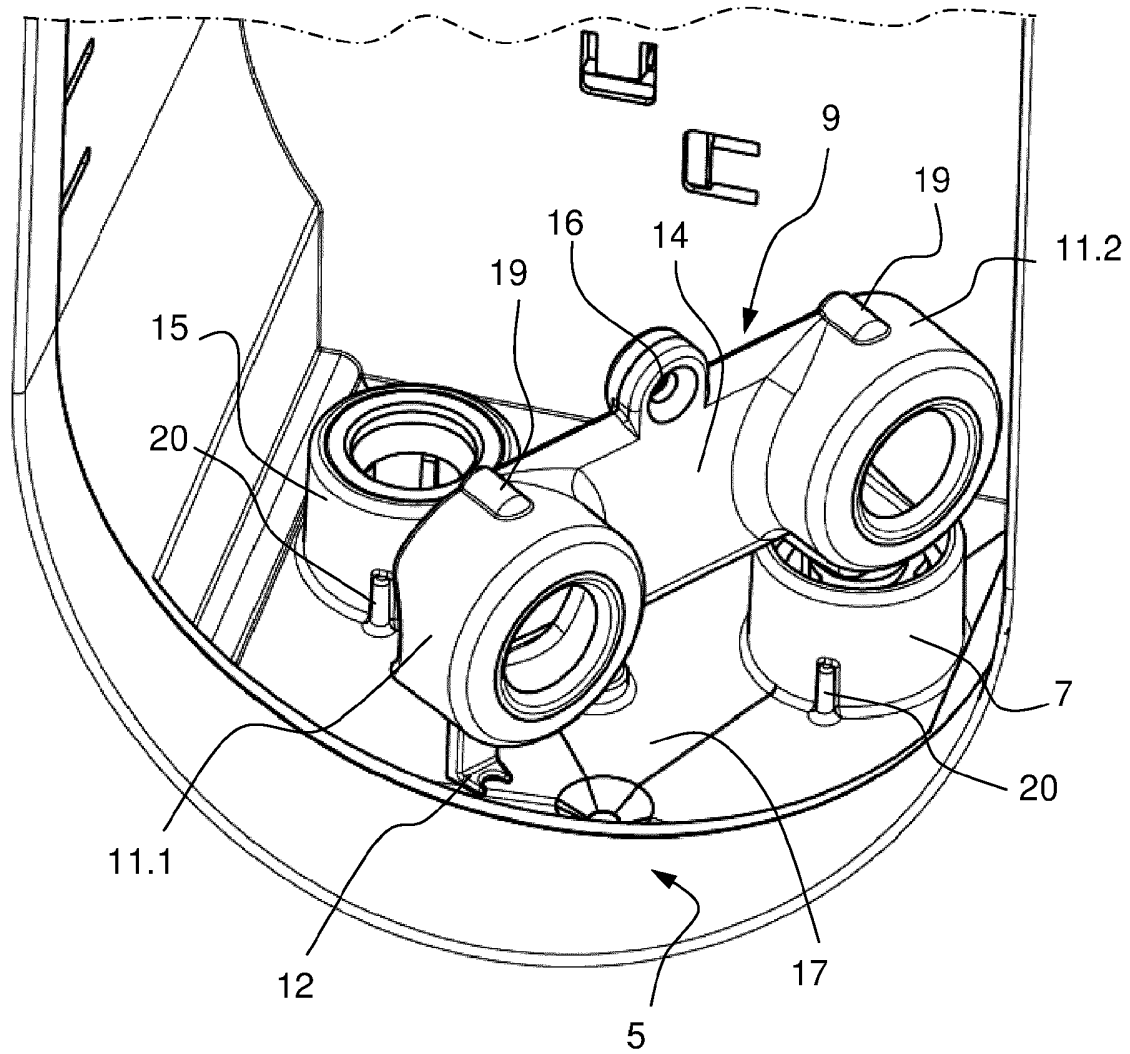


Fig. 6

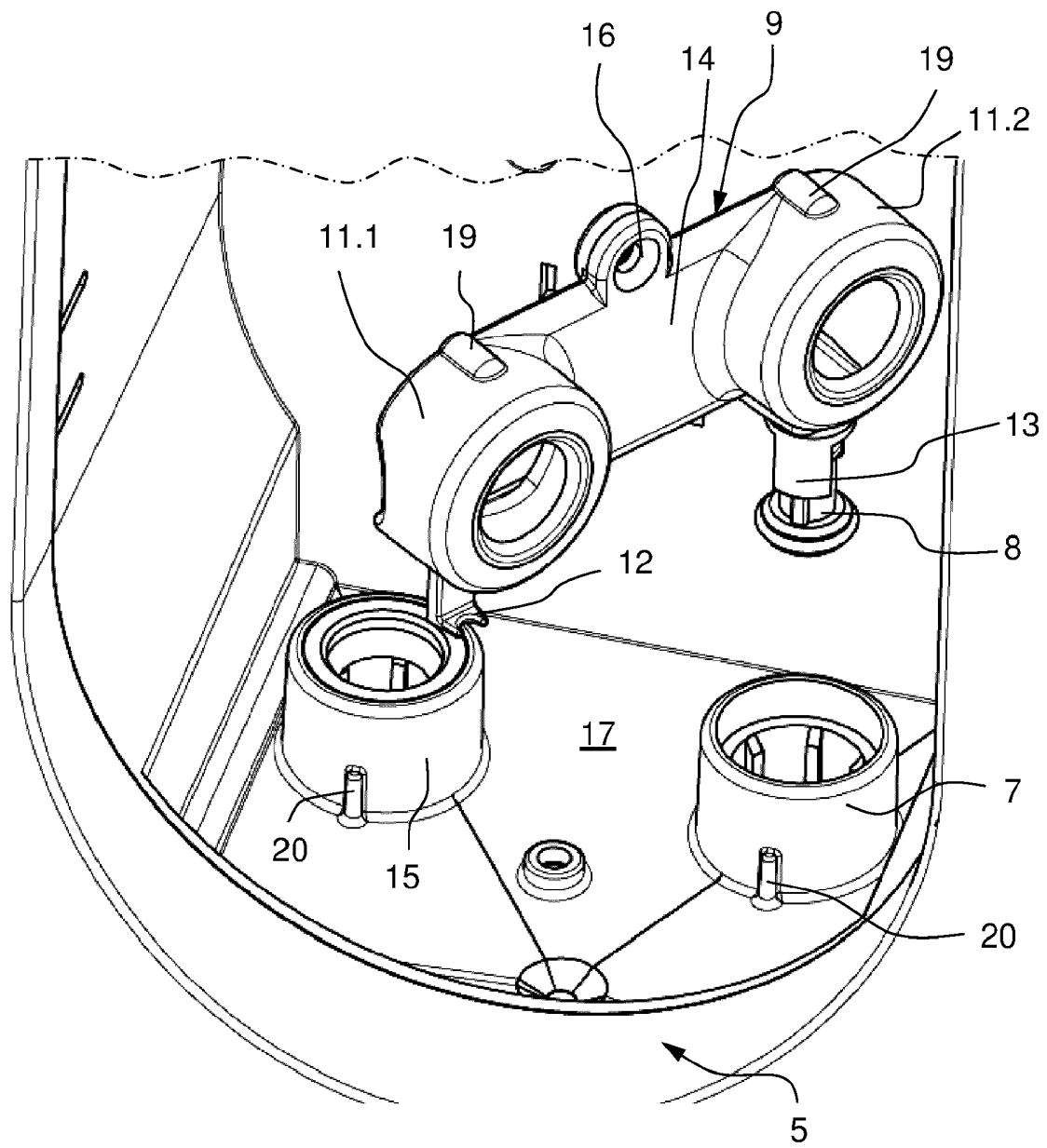


Fig. 7