

A switchgear

The invention relates to a switchgear, especially an automatic cut-out and/or a residual-current circuit breaker, comprising a switch lever for manually closing and/or opening switch contacts, and a tripping apparatus for automatically separating the switch contacts, with the switch lever being rotatably held on a rotational axis which is stationary in the switchgear, and with a control drum, especially with at least one receptacle for a control member, being arranged close to the rotational axis, with the switch lever comprising an actuating extension on which a separate handle part is arranged, with the handle part comprising at least one latching nose and the actuating extension comprising at least one latching shoulder, for the attack of the at least one latching nose, and with the handle part comprising at least one clamping region.

Switchgears are known which comprise switch levers for manually closing and/or opening switch contacts. These switch levers are subjected to numerous loads in operation. In addition to manual actuation, these switch levers must also withstand the loads by an automatic switch-on device. As a result of forces which are exerted by the switch-on device on the switch lever, the switch lever can be damaged or broken. An otherwise fully functional switchgear will thus become useless for operation.

Handle parts for arrangement on a switch lever of a switchgear are known from DE 28 15 129 B1, FR 2 188 909 A, US 3,654,535 A. US 3,081,386 A shows a further switchgear with a switch lever.

DE 196 27 691 A1 describes a switchgear with a handle with two latching shoulders into which the latching noses of a handle part engage, with the handle part being clipped onto the handle.

An automatic reactivation and remote control apparatus is known from DE 103 24 209 A1 which comprises an operating handle which can be connected with the operating handle of a switchgear to be switched by means of an apparatus. The sliding element is slid laterally onto the operating handles to be connected.

It is therefore the object of the invention to provide a switchgear of the kind mentioned above with which the above disadvantages can be avoided and which offers high operational reliability and long service life, even in the operation of the switchgear with a switch-on device.

This is achieved in accordance with the invention in such a way that the actuating extension close to the control drum comprises at least a first section and a second section adjacent to the first section, and with the second section, in a transitional region from the first section to the second section, forming a shoulder, and at least one latching shoulder is arranged in the transitional region.

As a result, the actuating extension can be adjusted to the loads by the switch-on device and the service life of the switch lever, and thus that of the entire switchgear, can be extended. When using a housing which needs to be slid over the switch lever for the assembly of the switching, it can thus be ensured that the actuating extension of the switch lever is wider and/or larger than the breakthrough in the housing and thus ensures better handling and longer service life, as well as a wider point of attack for the switch-on device. This ensures secure fastening of the handle part on the actuating extension. This ensures secure latching of the handle part on the actuating extension, with destruction-free removal of the handle part from the actuating extension being substantially prevented. This ensures secure fastening of the handle part to the actuating extension. As a result, the latching effect of the latching shoulder can be amplified even more through the larger cross section of the second section, thus ensuring an especially secure latching of the handle part on the actuating extension.

According to a further embodiment of the invention it can be provided that the handle part is connected with the actuating extension in an inseparable way. Subsequent removal of the handle part can thus be prevented. It can especially be prevented that the handle part is severed from the actuating extension by the forces which are exerted by the switch-on device on the switch lever. An opening of the switch gear can be prevented in this way in a switchgear with a housing in which a housing part with a breakthrough needs to be inserted over the area with the switch lever in order to seal the switchgear, e.g. the current embodiments of residual-current circuit breakers, because the switch lever can be provided with a larger configuration than the breakthrough in the housing part, and any lifting of the housing part is therefore no longer possible.

In this connection it can be provided in a further development of the invention that the handle part is clipped and/or clamped onto the actuating extension. This ensures both a simple and

rational production of the handle part, as also a simple and rational assembly of the handle part and the actuating extension.

It can be provided in a further embodiment of the invention that the handle part comprises at least one latching nose. This ensures secure fastening of the handle part to the actuating extension.

In this connection it can be provided in a further embodiment of the invention that the actuating extension comprises at least one latching shoulder for attacking the at least one latching nose. This ensures secure latching of the handle part on the actuating extension, thus substantially preventing destruction-free removal of the handle part from the actuating extension.

In a further development of the invention it can be provided that the first section comprises a first cross-sectional area in a plane substantially normal to the rotational axis and the second section comprises a second cross-sectional area in the plane substantially normal to the rotational axis, and the first cross-sectional area is smaller than the second cross-sectional area. An especially handy and durable the handle part can thus be formed which advantageously supports the permanent and inseparable connection of the handle part with the actuating extension because a shoulder is formed on the actuating extension by the different cross sections on which the handle part can rest. According to a further embodiment of the invention in which the actuating extension is formed substantially symmetrically to an axis of symmetry which extends through the rotational axis and lies in a plane substantially normal to the rotational axis, it can be provided that on either side of the axis of symmetry at least one latching shoulder each is arranged in the transitional region from the first section to the second section and that a respectively diametrically opposed latching nose is arranged on the handle part. As a result, an especially secure and permanent hold of the handle part on the actuating extension is achieved in both provided directions of movement of the switch lever, thus ensuring a long service life of the switch even under heavy loads and a destruction-free removal of the handle part from the actuating extension can be prevented.

According to a further embodiment of the invention it can be provided that the actuating extension comprises a pass-through opening which extends substantially parallel to the rotational axis. This ensures simple linking or coupling of several switchgears arranged next to one another in such a way that they can be actuated simultaneously.

In this connection it can be provided in a further development of the invention that the pass-through opening is arranged in the second section of the actuating extension. The available lever arm is thus especially long, through which the force required for exerting the necessary moment can be kept at a low level.

The invention is now described in closer detail by reference to the enclosed drawings which merely show preferred embodiments by way of examples, wherein:

Fig. 1 shows a first embodiment of a switch lever in accordance with the invention with a first embodiment of a handle part;

Fig. 2 shows the switch lever according to Fig. 1 with the first and second embodiment of a handle part in an exploded view;

Fig. 4 shows a switch lever according to Fig. 3 with the fourth embodiment of the handle part in an exploded view;

Fig. 5 shows a switchgear with a switch lever in accordance with the invention.

Figs. 1 and 3 show a switchgear 1 for manually closing and/or opening the switch contacts of a switchgear, and a tripping apparatus for automatically separating the switch contacts, with the switch lever 1 comprising an actuating extension 2, with a separate handle part 3 being arranged on the actuating extension 2.

The switchgear in accordance with the invention may concern any kind of switchgear. Switchgears for electric protective measures are preferred, especially automatic cut-outs and residual-current circuit breakers.

The measures in accordance with the invention ensure that the actuating extension 2 can be adjusted to the loads by a switch-on device for example, and the service life of the switch lever 1 and thus the entire switchgear can be extended. When using a housing which needs to be slid over the switch lever 1 for the assembly of the switching, it can thus be ensured that the actuating extension 2 of the switch lever 1 is wider and/or larger than the breakthrough in the housing and thus ensures better handling and longer service life, as well as a wider point of attack for the switch-on device. An enlargement of the switch lever 1 for adjustment to the loads by the switch-on device is not possible in many cases, or only within limits, because the space in a switchgear is mostly very limited. In the embodiments of switchgears as already mentioned above in which the housing needs to be slid over the switch lever 1, an enlargement of the switch lever 1 is not easily possible.

As already explained, switch lever 1 is used for manual or mechanical actuation of switch contacts in a switchgear, as shown by way of example in Fig. 5. For this purpose, it is provided in especially preferred embodiments of the switchgears in accordance with the invention that the switch lever 1 is held in a pivoting manner on a rotational axis 6 which is held in a stationary way in the switchgear. Switch lever 1 preferably comprises a receptacle 8 for a control member. The control member preferably concerns a push rod. By twisting the switch lever 1 from the opened position to the closed position of the switch contacts, the at least one movable switch contact is pressed against a second, especially immobile switch contact via the push rod which is

held in the receptacle 8 arranged eccentrically on the control drum 7. It can be provided that the motion is deflected via a switch mechanism. The switch drum 7 can also comprise a stop 12, as provided in the illustrated embodiment, on which the push rod rests in the opened position. The control drum 7 further preferably comprises at least one contact area for a spring, especially a torsion spring, which presses the switch lever 1 to the opened position. It can be provided that the entire switch lever 1 is arranged in an integral way together with the actuating extension 2 and the control drum 7. It can also be provided to join the switch lever 1 from separate individual components.

The switch lever 1, the actuating extension 2 and/or the handle part 3 are preferably made of an insulating material, with any insulating material being provided which is suitable to form the respective components. It can especially also be provided to form different components from different materials. It is especially provided that the insulating material concerns a plastic material which is suitable for injection-molding and extrusion processes.

It can be provided that the handle part 3 and the actuating extension 2 are joined with each other in a manner that can be freely chosen. It is preferably provided, in order to prevent subsequent removal of the handle part 3 and especially to prevent a separation of the handle part 3 from the actuating extension 2 under the action of a switch-on device on the switch lever 1, that the handle part 3 is connected in an inseparable way with the actuating extension 2. An inseparable connection can be understood as being any kind of linkage or connection which renders impossible the separation of two parts without at least partly destroying one of the two parts, therefore the handle part 3 and/or the actuating extension 2. Any kind of inseparable connection can be provided such as gluing, welding, especially ultrasonic welding, clipping and/or pressing two parts together.

It is especially preferably provided that the handle part 3 is clipped and/or clamped onto the actuating extension 2. This ensures both a simple and rational production of the handle part 3 as well as a similarly simple and rational assembly of the handle part 3 and the actuating extension 2. For this purpose, it can be provided in especially preferred embodiments of the switch lever 1 in accordance with the invention that the handle part 3 comprises at least one clamping section 4 and/or that the handle part 3 comprises at least one latching nose 5.

The handle part 3 generally has a shape which is diametrically opposed to the actuating extension 2. The shape of the actuating extension 2 supports a favorable joining of the handle

part 3 to the actuating extension 2. It can be provided for this purpose that the actuating extension 2 close to the control drum 7 comprises at least a first section 9 with a first cross-sectional area in a plane substantially normal to the rotational axis 6 and a second section 10 adjacent to the first section 9 with a second cross-sectional area in the plane substantially normal to the rotational axis 6, and the first cross-sectional area is smaller than the second cross-sectional area. It can thus be ensured that the handle part 3 reaches around the actuating extension 2 and can rest on the shoulder 15 with the latching nose 5, which shoulder is formed by the larger second section 10, or is anchored on said shoulder 15. The first and/or second cross-sectional area can be determined especially without recesses or pass-through openings 11 optionally arranged in the first section 9 and/or in the second section 10.

As in the illustrated embodiments, the handle part 3 comprises a body 14 which can be provided with different configurations in respect of its outer shape accessible to the user and whose inner shape corresponds to the outer shape of the actuating extension 2, so that the handle part 3 can advantageously sit close in an especially intimate way on the actuating extension 2. Two legs 13 are formed on the body 14 in the preferred embodiments, as shown in Figs. 1 and 2. It can be provided that the legs 13 form a clamping region 4, with the clamping effect being achieved together with the body 14 which is preferably provided with a slightly smaller arrangement than the respective diametrically opposed part of the actuating extension 2. Furthermore, at least one latching nose 5 can be arranged in the transitional area from body 14 to the legs 13. It can also be provided to provide at least one latching nose 5, and especially a predeterminable number of the same, on the inside of the legs 13 facing the actuating extension 2. For an especially favorable, intimate and durable fastening of the handle part 3 to the actuating extension 2, both the shaping of the handle part 3 as well as the shaping of the actuating extension 2 can especially be involved to a relevant extent, because the connection is especially advantageous when the handle part 3 and the actuating extension 2 fit into each other in the manner of a plug and socket.

In the embodiments shown in Figs. 3 and 4, it can be provided for improving the connection of handle part 3 to actuating extension 2 that the actuating extension 2 comprises at least one latching shoulder 16 for attacking the at least one latching nose 5. The latching shoulder 16 and the latching nose 5 are especially arranged in a substantially diametrically opposed way. As already illustrated, it can preferably be provided that the latching nose 5 is arranged in the form of a triangular wedge which is formed on the inside of at least one of the legs 13. Other shapes can also be provided such as that of a truncated cone. In accordance with the invention, the at least one latching nose 5 can be formed at any location or any region of the handle part 3. It is

provided that the latching shoulder 16 is arranged in a respectively diametrically opposed way on the actuating extension 2, e.g. with a substantially triangular depression or groove which forms a latching shoulder 16, as shown in Figs. 3 and 4.

A latching nose 5 and latching shoulder 16 can be arranged in any region of the handle part 3 or the actuating extension 2. It is preferably provided that the at least one latching shoulder 16 is arranged in a transitional region 17 from the first section 9 to the second section 10. It can be provided that the latching shoulder 16 is adjacent to an optionally provided shoulder 15 and amplifies its effect. It can also be provided that several latching noses 5 and latching shoulders 16 are arranged in the area of a leg 13.

It is provided especially preferably that the actuating extension 2 is arranged symmetrically relative to an axis of symmetry 18 which extends through the rotational axis 6 and is situated in a plane substantially normal to the rotational axis 6. It is provided that on either side of the axis of symmetry 18 at least one latching shoulder 16 is each arranged in the transitional region 17 from the first section 9 to the second section 10, and a respectively diametrically opposed latching nose 5 each is arranged on the handle part 3. As shown in Figs. 3 and 4, the latching shoulders 16 are arranged as sectional tapering portions of the first cross-sectional area of the first section 9 and especially have a triangular cross section. It can also be provided that at least one of the latching shoulders 16 extends merely over sections of the actuating extension 2. As a result of the especially preferred embodiment according to Figs. 3 and 4, an especially durable and permanent connection can be created between the handle part 3 and the actuating extension 2.

For simple linkage or coupling of several switchgears arranged next to one another by means of a long thin element such as a wire for example, which enables a simultaneous actuation of these coupled switchgears, it can be provided that the actuating extension 2 comprises a pass-through opening 11 for guiding through the long thin element, especially the wire, which extends substantially parallel to the rotational axis 6. By arranging the pass-through opening 11 in the second section 10 of the actuating extension 2, an especially long lever arm can be achieved, through which the force required for exerting the necessary moment can be kept at a low level.

A combination of individual or all features of the described different embodiments within the terms of the invention can be provided.

CLAIMS:

1. A switchgear, especially an automatic cut-out and/or a residual-current circuit breaker, comprising a switch lever (1) for manually closing and/or opening switch contacts, and a tripping apparatus for automatically separating the switch contacts, with the switch lever (1) being rotatably held on a rotational axis (6) which is stationary in the switchgear, and with a control drum (7), especially with at least one receptacle (8) for a control member, being arranged close to the rotational axis (6), with the switch lever (1) comprising an actuating extension (2) on which a separate handle part (3) is arranged, with the handle part (3) comprising at least one latching nose (5) and the actuating extension (2) comprising at least one latching shoulder (16), for the attack of the at least one latching nose (5), and with the handle part (3) comprising at least one clamping region (4), characterized in that the actuating extension (2) close to the control drum (7) comprises at least a first section (9) and a second section (10) adjacent to the first section (9), and with the second section, in a transitional region (17) from the first section (9) to the second section (10), forming a shoulder, and at least one latching shoulder (16) is arranged in the transitional region (17).
2. A switchgear according to claim 1, characterized in that the handle part (3) is inseparably connected with the actuating extension (2).
3. A switchgear according to claim 1 or 2, characterized in that the handle part (3) is clipped and/or clamped onto the actuating extension (2).
4. A switchgear according to one of the claims 1 to 3, characterized in that the first section (9) comprises a first cross-sectional area in a plane substantially normal to the rotational axis (6) and the second section (10) comprises a second cross-sectional area in the plane substantially normal to the rotational axis (6), and the first cross-sectional area is smaller than the second cross-sectional area.
5. A switchgear according to one of the claims 1 to 4, with the actuating extension (2) being formed substantially symmetrically to an axis of symmetry (18) which extends through the rotational axis (6) and lies in a plane substantially normal to the rotational axis (6), characterized in that on either side of the axis of symmetry

(18) at least one latching shoulder (16) each is arranged in the transitional region (17) from the first section (9) to the second section (10) and that a respectively diametrically opposed latching nose (5) is arranged on the handle part (3).

6. A switchgear according to one of the claims 1 to 5, characterized in that the actuating extension (2) comprises a pass-through opening (11) which extends substantially parallel to the rotational axis (6).
7. A switchgear according to claim 6, characterized in that the pass-through opening (11) is arranged in the second section (10) of the actuating extension (2).