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Description

Low-voltage switchgear assembly having a locking apparatus for a withdrawable part

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The invention relates to a low-voltage switchgear assembly having a rack, having guide parts which are arranged in a fixed position on the rack, having a withdrawable part which can be moved via the guide parts from a disconnected position to an operating position, and having at least one locking apparatus in which the locking apparatus has a locking bar, a linear movement linkage for moving the locking bar from a rest position, in which the withdrawable part is blocked, to an operating position, which allows the movement, and has an actuating element for operating the linear movement linkage, with the locking bar being arranged in an enclosure for the withdrawable part such that it can pivot, with the locking bar extending transversely with respect to the direction of the movement and essentially over the entire width of the enclosure, and with the locking bar interacting at its ends with a respective positioning link of in each case one of the guide parts, which has latching steps for the disconnected and operating positions.

A low-voltage switchgear assembly of this type has been disclosed in the document US-A-1,706,114. This known low-voltage switchgear assembly has no auxiliary isolating contacts, and thus also has no test position for the withdrawable part.

Against the background of a low-voltage switchgear assembly having the features of the precharacterizing clause of claim 1 (US-A-1,706,114), the invention is based on the object of providing auxiliary isolating

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contacts for providing a test position for the
withdrawable part,

and at the same time of specifying a form in which the withdrawable part can be secured against movement in its test position, in a simple manner.

5 This object is achieved according to the invention in that the withdrawable part has auxiliary isolating contacts, which are arranged such that they can be moved by means of an operating apparatus relative to the enclosure of the withdrawable part in order to
10 engage with associated fixed-position auxiliary isolating contacts, and in that the operating device has a blocking tab which grips the locking bar and blocks the locking bar in its rest position when the auxiliary isolating contacts are engaged.

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A low-voltage switchgear assembly in which a withdrawable part can be secured against movement both in the disconnected and operating positions and in a test position is known per se (DE 32 43 060 - A1 (= EP 0 109 555 B1)). - This document is
20 based on the assumption that it is known for manual locking to be provided in addition to the drive apparatus for a main switch. A solution is then described in which a profiled rail which is arranged on the compartment base is used for guiding the withdrawable part and for locking it in the stated positions
25 by interaction with the drive apparatus for the main switch. This leads to handling which is very convenient and safe for the user, but requires relatively complicated components. This viewpoint may have considerable importance when subject to the condition that manufacturers with widely differing manufacturing
30 means can manufacture identical and equally reliable switchgear assemblies.

The invention is aimed at a low-voltage switchgear assembly form which is particularly suitable for this

purpose and, is in this context based on separate operation of a position lock and of a main switch that is located on the withdrawable part.

5 The embodiment according to the invention of the low-voltage switchgear assembly allows withdrawable parts of any desired width to be locked securely in position but also allows all the other required locks, as will be explained later. These could be added without any
10 major complexity because the extent of the locking bar over the width of the withdrawable part allows additional assemblies for locking to be fitted at any desired point. Thus, in principle, withdrawable parts of different width can be equipped with the same
15 locking assemblies. Only the length of the locking bar in each case differs in this case. However, this condition does not represent any restriction either, since the locking bar can be produced from parts which are connected with a suitable overlap, depending on the
20 width of the withdrawable part.

The interaction that has been mentioned between the locking bar and the guide parts can be ensured, according to one refinement of the invention, in that
25 the locking bar is provided at its ends with locking tabs which each project beyond the outline of the enclosure, and in that the positioning links have depressions for the operating and disconnected positions, which are used for the locking tabs to
30 engage in. This is then used in such a way that the actuating element can in each case be operated in order to change the position of the withdrawable part, for example from the test position to the operating position, in order to pivot the locking bar and to lift its locking tabs out of
35 a step or depression in the positioning link.

In order to ensure that the user does not need to pay particular attention to the operation processes, it is recommended that the positioning link have a main channel with a mouth for insertion of the locking tab, and stop surfaces for positively stopping the movement of the withdrawable part during insertion of the withdrawable part into the guide parts. This prevents the withdrawable part from being able to move directly to the disconnected or operating position after insertion into the guide parts. The insertion process is also interrupted, when carried out correctly by using the actuating element for the locking bar.

The need for the user to pay particular attention can equally well be reduced by using projections to cover a depression in a slotted link that is associated with the disconnected position of the withdrawable part, with these projections supporting the locking tab of the locking bar against being released inadvertently in both directions of movement. These projections, which expediently extend over only a small portion of the length of the depression for the disconnected position, trap the locking tabs when they jump or bounce, and are accidentally lifted up to the upper edge of the depression, as a result of the withdrawable part being operated excessively roughly.

The arrangement which is known per se for blocking the main switch against irregular switching on by means of a locking rod which can be moved by means of an operating shaft of the main switch in order to engage in an opening in a compartment base to which the withdrawable part is fitted can be added to within the scope of the invention such that the locking bar or its

linear movement linkage can be blocked by means of a blocking piece which is operated at the same time. In this way, all the assemblies which are dependent on the locking bar are deactivated at the same time.

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While withdrawable parts for low and medium power levels can be moved to the operating position by hand, the isolating contacts for relatively high power levels are relatively difficult to move. In this case, it is therefore known for the withdrawable parts to be fitted with a drive. The locking bar according to the invention in this context offers a simple and effective means for allowing operation of the drive only when the withdrawable part is in an appropriate operating state. This can be achieved by fitting a closure shutter to the locking bar in order to conceal an insertion hole for the operating tool for a drive for the withdrawable part, such that the drive is inaccessible when the locking bar is in its rest position.

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Irrespective of whether all the locks that have been mentioned above are present, or only some of them, at least one handle can be fitted to the front control panel of the withdrawable part, with the actuating element which is provided for operation of the locking bar being arranged at such a distance from the handle and in such a position that the thumb is opposite the push button when the handle is gripped with the four fingers of one hand. The user can thus unlock the withdrawable part and move it with his hand in the same position.

In order to ensure that the withdrawable part is kept in the desired positions, it is necessary to avoid the locking tabs being disengaged from the positioning link by lifting of the withdrawable part. According to one

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development, this can be achieved in that the arrangement of compartment bases restricts the vertical play of the withdrawable part to an extent which is less than the depressions in the positioning link.

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The invention will be explained in more detail in the following text with reference to the exemplary embodiment which is illustrated in the figures.

10 Figure 1 shows a perspective illustration of a withdrawable part for a low-voltage switchgear assembly.

Figure 2 shows the withdrawable part as shown in
15 Figure 1, from above, in its operating position.

Figure 3 shows an enlarged detail of a positioning link and of a locking pin, which has assumed the operating position in the positioning link, as shown in Figure 2.

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Figures 4 and 5 are illustrations corresponding to Figures 2 and 3, in which the withdrawable part and the locking pin are in the test position. Auxiliary isolating contacts are shown open.

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Figures 6 and 7 correspond to Figures 4 and 5 with the difference that the auxiliary isolating contacts are closed.

30 Likewise illustrated in the same way as in the preceding figures, Figures 8 and 9 show the withdrawable part in the disconnected position.

The withdrawable part 1 which is shown in Figure 1 has an enclosure 2 like a rack with a rear wall 3, a mounting plate 4 parallel to it and a front control panel 5. The withdrawable part 1 is located on a compartment base 6 which has side edges 7 and 8 as guide parts for the withdrawable part. The compartment base 6 can be mounted in a known manner in the rack of a low-voltage switchgear assembly, for example by means of holding lugs 10 that are shown in Figure 1. Details of this arrangement are not illustrated, firstly because these details are known per se, and secondly because they are not required for understanding of the invention.

The withdrawable part 1 can be moved in the direction of a double-headed arrow 11 which is shown in Figure 1, in order to produce the characteristic positions, that is to say the disconnected position, the test position and the operating position. Before describing these positions in more detail, further features of the withdrawable part 1 will be explained first of all.

Two handles 12 and 13, which are shown in Figure 1, are available for the user to handle the withdrawable part 1, and are fitted to the front control panel 5. The illustrated arrangement, with the handle 12 horizontal and the handle 13 vertical, has been found to be ergonomically expedient, but can be modified as required. In addition, the withdrawable part 1 has a drive which includes, in particular, a drive shaft 14 which passes through the enclosure 2 in the direction of the arrow 11 and has a threaded section, and a nut which is arranged on the rear face of the compartment base 6, as is likewise known per se. A hand crank 15, which is provided as an operating tool for the drive can, as is indicated by dashed-dotted lines, be inserted into an insertion opening 16 which is arranged

on the front control panel 5, in order to operate the drive shaft 14 as required.

Figure 1 shows the withdrawable part 1 in its operating position, in which rear-face isolating contacts 17 (feed) and 18 (output) engage with field rails 20 and connecting pieces 21, respectively. At the same time, auxiliary isolating contacts 22, which are arranged such that they can move in the direction of the arrow 11 relative to the enclosure 2, engage with a fixed-position auxiliary isolating contact 23.

As is shown in Figure 1, a force is required in order to move to the operating position, in order to make the (main) isolating contacts 17 and 18 and the auxiliary isolating contacts 22 engage with the fixed-position mating pieces. This force obviously depends on the current for which the isolating contacts 17 and 18 are designed. Withdrawable parts for low-power loads are thus easier to handle than those for high power levels. In a corresponding manner, the drive shaft 14 is required only for "large" withdrawable parts. However, it is shown in Figures 1, 2, 4, 6 and 8 in order to illustrate that, within the scope of the invention, a drive can freely be integrated into the system of locking apparatuses that are still to be explained.

The withdrawable part 1 is shown without wiring or cabling, in order not to conceal the locking apparatuses that are significant for the invention. Furthermore, the switching, control and protection devices which are associated with a device combination for motor controllers are not all shown, with only one main switch 24 being shown. This is mounted on the mounting plate 4 that has been mentioned and can be switched on and off by means of an operating shaft 25 which is accessible on the front control panel 5.

One major feature of the locking apparatus according to the invention is a locking bar 26, which extends in the front part of the enclosure 2, parallel to the front control panel 5 and over the entire width of the enclosure 2. At its ends, the locking bar 26 is fitted with pivoting arms 30 and 31 which are parallel to the side walls 27 and 28 of the enclosure 2. These pivoting arms each have a bearing pin which engages in an opening in the side walls 27 and 28 and they allow the locking bar 26 to carry out a pivoting movement, which is essentially in the form of raising or lowering relative to the compartment base 6. At its ends, the locking bar 26 is also provided with locking tabs 32 and 33, which project through windows 34 and 35 in the side walls 27 and 28 and interact with positioning links 34 and 35, which are incorporated in the edges 7 and 8 of the compartment base 6. Details of this arrangement will be explained later with reference to Figures 3, 5, 7 and 9.

When the locking bar 26 is in its lower rest position, then the withdrawable part 1 is blocked against movement. In order to allow movement, the locking bar 26 must be raised to its operating position, and this is made possible by a linear movement linkage 36. This includes a slotted link slide 37 with a bent slotted link 38, in which a linear movement pin 40 engages that is seated on the locking bar 26. An initial part of the slotted link 38 extends parallel to the compartment base 6. When the linear movement pin 40 is located in this initial part, then the locking bar 26 is blocked and cannot be raised directly by hand or by any other influences into its operating position. This can be done exclusively by operating the slotted link slide 37 by means of an actuating element 41 which is fitted to the front control panel 5

and is in the form of a pushbutton. In this case, the linear movement pin 40 moves into a rising part of the slotted link 38, as a result of which the locking bar 26 is moved about its pivoting arms 30 and 31, and is correspondingly raised.

The actuating element 41 is arranged in the vicinity of the left-hand handle 12, in a position such that it is within the area which can be gripped by the thumb of the left human hand when the fingers of the same hand are gripping the handle 12. The locking bar 26 can thus be operated, and the withdrawable part 1 moved, with the hand in the same position.

A blocking lever system 42 is seated on the operating shaft 25 of the main switch 24 and has, in a known manner, a pivoting lever that is connected to the operating shaft 25 and a locking rod 43, which is connected in a hinged manner to the pivoting lever or is coupled to it by means of a slotted link, and is approximately at right angles to the compartment base 6. A locking plate 45 which is connected to the actuating element 41 is guided on guide lugs parallel to the base of the enclosure 2 or parallel to the compartment base 6. The locking plate 45 has a locking opening 44, in which the locking rod 43 can engage only when the actuating element 41 is in its unoperated rest position. The compartment base 10 has a locking opening 44 in which the locking rod can engage only. When the withdrawable part 1 is in its operating position (Figures 1 and 2). The main switch 24 can thus be switched on only when the locking plate 45 is in this position. The locking plate 45 has two locking openings 44 in order that the main switch 24 can be mounted in a different position, or can be used in another main switch, when the actuating element 41 and the locking plate 45 are fitted as shown.

The moveable auxiliary isolating contact 22 is seated on a contact slide 46, which is guided such that it can move in the direction of the double-headed arrow 11 and can be moved by means of a push rod 50 and an operating handle 47 that is mounted on it. A bayonet guide 51 is used to lock the push rod 50 in the end positions (auxiliary isolating contact 22 open or closed). Instead of being operated by the push rod 50, the auxiliary isolating contacts 22 can also be operated by means of a screw drive or worm drive, for example as disclosed in DE 27 17 691. The essential feature in any case is a blocking tab 48 which can be inserted into an opening in the locking bar 26, in order to block this against being lifted into the operating position when the auxiliary isolating contacts 22, 23 are closed.

The contact slide 46 can be blocked in its basic position by means of a blocking piece 62. For this purpose, the blocking piece can move about a pivoting bearing 63 which is arranged on the side wall 28 of the enclosure 2, and can be lowered in the direction of an arrow 65 by releasing a holding screw 64. In this lowered position, a blocking tab engages in a corresponding recess (both of which are concealed) on the contact slide 46. If, as described above, the withdrawable part is equipped with a drive, then it should be impossible to access the drive shaft when the main switch 24 is switched on. This is achieved by means of a closure panel 52, which is fitted to the locking bar 26 and which, when the locking bar 26 is in the rest position, is located behind the insertion opening 16 such that the hand crank 15, which is provided as an operating tool for the drive shaft 14, cannot be plugged onto the drive shaft 14.

The method of operation of the position lock will be explained in more detail in the following text with reference to Figures 2 to 9.

5 In the Figure 2, the withdrawable part 1 is once again shown in its operating position, with the positioning link 34 being shown with adjacent parts illustrated cut away, as an enlarged detail in Figure 3. The positioning link 34 has a contour with two or more steps, and which interacts with the locking tab 32 on
10 the locking bar 26. A main channel 54 has a mouth 59 located at the front, a stop surface 60 arranged underneath this mouth 59, and a stop surface 61 arranged above it. When the withdrawable part 1 is in
15 the operating position, it is secured by the locking tab 32 entering a depression 53 in the positioning link. A secure support is achieved by the locking pin 33 interacting in this sense with the positioning link 35 on the opposite side of the withdrawable rack 2.
20 This prevents damage resulting from an attempt to tilt the withdrawable part, as a form of misuse.

In order to move the withdrawable part 1, it is necessary to raise the locking bar 26 to its operating
25 position by operating the actuating element 41, with the locking pin 32 then moving out of the depression 53 into the main channel 54 of the positioning link 34. The withdrawable part 1 can now be moved by means of the drive shaft 14 to its disconnected position, which is defined by
30 a further depression 55 in the positioning link 34. If the withdrawal movement is relatively slow, as is the case when using the drive, the locking pin automatically moves into the depression 55. However, if the withdrawable part does not have a drive and is moved in a corresponding manner by hand, then a
35 projection 56 which projects into the main channel 54

above the mouth 59 ensures that the withdrawing movement of the withdrawable part 1 is necessarily interrupted.

5 In the disconnected position as shown in Figures 4 and 5, both the (main) isolating contacts 17 and 18 and the auxiliary isolating contacts 22 are disconnected from their fixed-position mating pieces 20, 21 and 23, respectively. Starting with the withdrawable part 1 in
10 this position in the withdrawable rack 7, it is now possible to move to the test position, as is shown in Figure 6, by using the push rod 50 and the contact slide 46 to move the moveable auxiliary isolating contact 22 such that it engages with the fixed-position
15 auxiliary isolating contact 23. The associated Figure 7 corresponds to Figure 5, since the withdrawable part 1 has not changed its position overall with respect to the compartment base 6. The locking tab 32 is thus still located in the depression 55.

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As a further position, the arrangement according to the invention has an extended or removed position as shown in Figures 8 and 9. The withdrawable part 1 is moved to this position by operating the actuating element 41 to
25 lift the locking tabs out of the depression 55. Once the locking tabs have passed the mouth 59 of the main channel 54 of the positioning links 34, 35 while the withdrawable part 1 is being withdrawn, then they are once again stopped by means of a projection 57 which is
30 located above the stop surface 60, and which can likewise be overcome by operating the actuating element 41. After this, the locking pins 32 and 33 are located outside the positioning links 34 and 35, and the withdrawable part 1 can now be removed from the
35 compartment base 6.

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As a further special feature, it is possible to lock the withdrawable part 1 in the disconnected position, as shown in Figures 4 and 5. To do this, the contact slide 46 is first of all

blocked in the basic position by pivoting the blocking piece 62 after releasing the holding screw 64. Since the blocking piece 62 is fitted on the side wall 28, this can only be done when the withdrawable part 1 is located outside the switchgear assembly. The withdrawable part 1 is then inserted in the described manner into the switchgear assembly and is moved on the compartment base 6 until it reaches the disconnected position. The main switch 24 can now be switched on and can be locked in a known manner (padlock on the switching handle 29). In this case, the locking rod 43 passes through the locking opening 44 in the locking plate 45, and continues through the opening in the compartment base 6 (known, not shown). The withdrawable part is in this way secured against movement. The drive, if present, can likewise not be operated, because the insertion opening for the hand crank 15 is concealed by the closure panel 52.

When the withdrawable part is inserted into the withdrawable rack, starting from the position shown in Figures 8 and 9, the locking tabs 32 and 33 abut against the stop surface 60 that is located underneath the mouth 59. If the actuating element 41 is operated, then the locking tabs 32, 33 are raised and can now pass over the stop surface 60. The locking tabs 32, 33 then abut against the upper stop surface 61. The friction between the locking tabs 32, 33 and the stop surface 61 is overcome by a slight rearward movement, and the locking tabs move into the main channel 54, from where they can enter the depression 55 for the disconnected position. In order to ensure that the locking tabs 32, 33 cannot be moved inadvertently by vibration or bouncing out of the depression 55 and directly into the main channel 54, a further projection 58 is arranged at the junction from the depression 55 to the main channel 54, in the direction of the depression 53.

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Patent Claims

1. A low-voltage switchgear assembly having a rack, having guide parts (7, 8) which are arranged in a fixed position on the rack, having a withdrawable part (1) which can be moved via the guide parts from a disconnected position to an operating position, and having at least one locking apparatus
- in which the locking apparatus has a locking bar (26), a linear movement linkage (36) for moving the locking bar (26) from a rest position, in which the withdrawable part (1) is blocked, to an operating position, which allows the movement, and has an actuating element (41) for operating the linear movement linkage (36),
 - with the locking bar (26) being arranged in an enclosure (2) for the withdrawable part (1) such that it can pivot,
 - with the locking bar (26) extending transversely with respect to the direction of the movement (11) and essentially over the entire width of the enclosure (2), and
 - with the locking bar interacting at its ends with a respective positioning link (34) of in each case one of the guide parts (7, 8), which has latching steps for the disconnected and operating positions,
- characterized
- in that the withdrawable part has auxiliary isolating contacts (22), which are arranged such that they can be moved by means of an operating apparatus relative to the enclosure (2) of the

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withdrawable part (1) in order to engage with associated fixed-position auxiliary isolating contacts (33), and

- in that the operating device has a blocking tab (48) which grips the locking bar and blocks the locking bar in its rest position when the auxiliary isolating contacts (22, 23) are engaged.
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2. The low-voltage switchgear assembly as claimed in claim 1,

characterized

- in that the locking bar (26) is provided at its ends with locking tabs (32, 33) which each project beyond the outline of the enclosure (2), and
- in that the positioning links (34, 35) have depressions (53, 55) for the operating and disconnected positions, which are used for the locking tabs (32, 33) to engage in.

3. The low-voltage switchgear assembly as claimed in one of claims 1 or 2, characterized in that

- the positioning link has a main channel (54) with a mouth (59) for the insertion of the locking tab (32, 33), and stop surfaces (60, 61) for positively stopping a movement of the withdrawable part (1) when the withdrawable part (1) is being inserted into the guide parts.

4. The low-voltage switchgear assembly as claimed in one of the preceding claims, characterized in that

- a depression (55) in the positioning link (34), which is associated with the disconnected position of the withdrawable part (1), is covered by projections (56, 58) which support the locking tab (32, 33) of the locking bar (26) against inadvertent release in both directions of movement.

5. The low-voltage switchgear assembly as claimed in one of the preceding claims, characterized

- in that the enclosure (2) is fitted with a main switch (24), and

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- in that in order to block the main switch (24) against irregular connection, a locking rod (43) can be moved in a known manner by means of an operating shaft (25) of the main switch (24) in order to engage in an opening (44) in a compartment base (10) to which the withdrawable part (1) is fitted, and in that the locking bar (26) or its linear movement linkage (36) can be blocked by means of a blocking piece (45) which is operated at the same time.

6. The low-voltage switchgear assembly as claimed in one of the preceding claims, characterized in that

15 a closure panel (52) is fitted to the locking bar (26) in order to conceal an insertion hole (16) for an operating tool for a drive for the withdrawable part (1), such that the drive is inaccessible when the locking bar (26) is in its rest position.

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7. The low-voltage switchgear assembly as claimed in one of the preceding claims, characterized in that

at least one handle (12, 13) is fitted to the front control panel (5) of the withdrawable part (1), and in that the actuating element (41) which is provided for operation of the locking bar (26) is arranged at such a distance from the handle (12, 13) and in such a position that the thumb is opposite the actuating element (41) when the handle (12, 13) is gripped with the four fingers of one hand.

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8. The low-voltage switchgear assembly as claimed in one of the preceding claims,

characterized in that
the arrangement of compartment bases (6) restricts the
vertical play of the withdrawable part (1) to an extent
which is less than the depressions (53, 55) in the
5. positioning link (34).

9. The low-voltage switchgear assembly as claimed in
one of the preceding claims,
characterized in that

10 the operating apparatus has a contact slide (46) for
movement of the auxiliary isolating contacts (23), in
which case the contact slide (46) can be blocked by
means of a blocking piece (62) in the disconnected
position of the auxiliary isolating contact (22).