

AN ELECTRICAL BAY HAVING A GASTIGHT METAL TANK

The invention relates to medium-voltage electrical power electricity distribution bays. Each such bay has a metal tank inside which electrical switchgear is
5 installed, such switchgear including at least one circuit-breaker and often a disconnecter, the tank being designed to be gastight and commonly being filled with a protective dielectric gas, and the electrical links
10 between the external link conductors and the switchgear housed inside the tank being implemented via gastight current bushings.

An example of a medium-voltage bay having a gastight metal tank filled with a protective gas is disclosed, in particular, in Gebrauchsmuster No. G94201935. That bay
15 comprises a tank inside and around which various elements of electrical switchgear are placed. The layout of the elements is such as to obtain a high degree of compactness and to enable all in-service operations to be performed from the front face of the bay.

Unfortunately, that bay has a gastight tank which is
20 welded and which is difficult to manufacture because it is provided with a bottom setback for the purpose of connecting the cables. In addition, the link conductors between the circuit-breaker elements and the disconnecter
25 elements have complicated shapes and relatively long lengths because of the differences in position between the circuit-breaker elements provided for the various electricity distribution phases, which elements are disposed widthwise inside the tank, and the disconnecter
30 elements which are disposed depthwise.

Another example of a bay is disclosed by German Patent Application No. 29501081.9. That document presents a variant having longitudinal coupling and including a set of busbars, and a variant having
35 transverse coupling and including two sets of busbars. In the second variant, positioning the elements of the two disconnectors side-by-side with a main axis

perpendicular to the front face of the bay involves implementing a gastight tank different from the tank provided for the first variant.

In addition, the various link conductors also have
5 complicated shapes and relatively long lengths, thereby giving rise to unnecessary dissipation of heat energy by the Joule effect.

The invention therefore proposes a medium-voltage bay having a gastight metal tank that is simpler in shape
10 and that makes it possible to house the various elements of electrical switchgear necessary for implementing variants, and in particular bays having longitudinal coupling or transverse coupling in a volume that is as small as possible and with conductive link lengths
15 between elements that are as short as possible.

The electrical bay of the invention comprises a gastight metal tank containing at least one three-phase circuit-breaker and at least one three-phase
20 disconnecter, for interconnecting external busbars and/or external electrical cables, the busbars and/or the cables being interconnected individually inside the tank via gastight current bushings, the circuit-breaker having interrupting chambers disposed horizontally and
perpendicularly to a front face of the tank, via which
25 face the circuit-breaker and the disconnecter are controlled, the disconnecter having at least two positions and also being controlled via said front face, and having moving blades, each of which is hinged to a conductive stationary carrying part carried by at least
30 one insulating support of an interrupting chamber having a moving contact to which said part is connected.

According to a characteristic of the invention, the tank, which is in the shape of a rectangular block or optimally of a cube, contains a disconnecter whose moving
35 blades are angularly positioned substantially vertically in the connection position, in which the blades are in contact with conductive tabs which are in line

horizontally parallel to the front face, which are situated above the disconnecter relative to the circuit-breaker in the tank, and which are connected to first gastight current bushings carried by a top face of the tank.

According to a characteristic of the invention, the bay is provided with first current bushings disposed on the top face of the tank in a manner such that a central first current bushing is directly above the central tab and directly above the central moving blade of the disconnecter, and the other two first current bushings are in line diagonally relative to the central first current bushing, and each of them is connected to a different tab via an individual first busbar, these busbars being mutually parallel and disposed orthogonally relative to the front face, and being positioned symmetrically about the central first bushing in the tank.

In a characteristic of a variant of the invention, the tank contains an additional disconnecter having moving blades, each of which is hinged to a stationary conductive part carried by insulating supports of an interrupting chamber having a contact connected to said conductive part, the moving blades being angularly positioned vertically in a connection position, in which they are in contact with conductive tabs in line horizontally parallel to the front face, situated above the additional disconnecter relative to the circuit-breaker in the tank, and connected to second gastight current bushings carried by the top face of the tank, said additional disconnecter being situated behind the other disconnecter relative to the front face of the tank.

According to a characteristic of a variant of the invention, in a "grounding" position, each of said moving blades, which are angularly positioned at least approximately horizontally, is in contact with a

respective grounding tab carried by a horizontal strength cross-piece disposed centrally between side walls of the tank, above the interrupting chambers of the circuit-breaker.

5 According to a characteristic of the invention, the tank includes a disconnecter which, in the disconnection position, has its moving blades electrically isolated both from the tabs connected to the first current bushings, and also from the grounding tabs, the blades
10 having been tilted midway between the two other positions, namely the connection position and the grounding position.

 According to a characteristic of a variant of the invention, the bay is provided with second current
15 bushings disposed such that a "central" second current bushing is directly above the central tab and directly above the central moving blade of the additional disconnecter, such that the other two second current bushings are in line diagonally relative to said central
20 second current bushing, and such that each of said second current bushings is connected to a different tab by an individual second busbar, these second busbars being positioned symmetrically about the central bushing corresponding to the central tab of the additional
25 disconnecter in the tank.

 According to a characteristic of a variant of the invention, the disconnecter and the additional disconnecter have their corresponding elements disposed in line and on the same horizontal level in the tank, in
30 the same way as the same-phase first and second busbars are disposed.

 According to a characteristic of a variant of the invention, the tank is provided with external single-pole curved tubes, each of which is connected to the tank at
35 orifices provided in the rear portion of the plane bottom wall of the tank, each of which tubes enables a different conductor element to pass along it, which element

penetrates into the tank so as to be connected to a stationary conductive part carried by at least one insulating support of an interrupting chamber whose stationary contact is electrically connected to said part, and each of which tubes enables at least one single-pole electrical cable to be connected via a gastight current bushing received at one end of the tube that contains it and angularly positioned horizontally and facing towards the front of the tank under which the tubes are positioned.

According to a characteristic of a variant of the invention, the tank is provided with external straight single-pole tubes, each of which is connected to the tank at orifices provided in the rear portion of the plane bottom wall of the tank, behind those provided for any curved single-pole tubes, each of which straight tubes enables a different conductor element to pass along it and to penetrate into the tank so as to be connected to a stationary conductive part carried by at least one insulating support of an interrupting chamber whose stationary contact is electrically connected to said part, and each of which straight tubes enables, in particular, one phase of an external voltage transformer to be connected.

According to a characteristic of a variant of the invention, the tank is provided with second gastight current bushings carried by the top face of the tank behind the first current bushings in a layout identical to that of said first bushings relative to the front face of the tank, each of the second bushings being connected to a respective one of the first bushings by a common busbar which is received inside the tank parallel to the top face of the tank, the busbars being mutually parallel.

According to a characteristic of a variant of the invention, the bay comprises a tank in which the disconnector and the additional disconnector are disposed

symmetrically about a plane containing the grounding tabs, the additional disconnector having moving blades, each of which is mounted on a conductive carrying part fixed to at least one insulating support of an interrupting chamber, each of the moving blades of the additional disconnector being electrically connected to a stationary contact of one of the interrupting chambers whose moving contact is electrically connected to a moving blade of the disconnector housed in the same tank.

10 According to a variant of the invention, the tank contains an additional disconnector having moving blades, each of which is positioned respectively with the same-phase moving blade of the disconnector with which it is housed in the same tank, on conductive carrying parts
15 which are fixed to at least one stationary and insulating support of an interrupting chamber, and which are electrically interconnected via a link which extends through the space between the interrupting chamber to which the insulating support is assigned and the cross-piece with which the tank is provided.

20 According to a variant of the invention, the bay comprises a tank in which a disconnector and an additional disconnector are disposed symmetrically about a plane containing the grounding tabs, the additional
25 disconnector having moving blades, each of which is mounted on a stationary conductive carrying part electrically connected to a stationary contact of one of the interrupting chambers via a fixed conductive part carried by at least one insulating support of the
30 interrupting chamber, and via two conductor elements connected to gastight bushings and interconnected outside the tank via an insulated and curved conductor and via connectors making it possible to mount current transformers and voltage transformers outside the tank,
35 the conductive part, a first one of the conductor elements, the insulated conductor, a second one of the conductor elements and the stationary conductive part

relating to a blade being electrically in series in this order.

According to a characteristic of a variant of the invention, the bay comprises a tank in which the
5 additional disconnector has moving blades each of which is positioned with the same-phase moving blade of the disconnector with which it is housed in the same tank, on conductive carrying parts which are fixed to at least one
10 stationary and insulating support of an interrupting chamber, and which are electrically interconnected via a link which extends through the space between the interrupting chamber to which the insulating support is assigned and the cross-piece with which the tank is provided.

15 According to another variant of the invention, the tank is provided with current bushings carried by a top face of the tank, and organized to be connected to overhead distribution lines via single-pole link
20 conductors connected to the external portions of respective ones of the current bushings, each conductor being equipped with an insulating elastomer sleeve which covers the end of it and which fits over the external
portion of the current bushing to which the conductor is connected.

25 According to a characteristic of a variant of the invention, the tank is provided with current bushings organized to be connected to overhead distribution lines via single-pole link conductors which are equipped with
30 insulating elastomer sleeves and around which toroidal-type current transformers are mounted.

According to a characteristic of a variant of the invention, the tank is filled with a protective dielectric gas.

The invention, its characteristics and advantages
35 are described in more detail in the following description given with reference to the figures listed below:

Figure 1 is a diagram showing an "incoming-outgoing" bay of the invention seen from the side and in section;

Figure 2 is a a fragmentary diagram showing the principle of a variant of an incoming-outgoing bay
5 assumed to be seen from above and, in imaginary manner, through the top face of the tank of this bay;

Figure 3 is a side section diagram of the variant of the bay shown in Figure 2;

Figure 4 shows the electrical circuit diagram of a
10 "coupling" bay as shown in Figure 3;

Figure 5 is a diagram showing an incoming-outgoing bay of the invention provided with offset busbars, and seen from the side and in section;

Figure 6 is a diagram showing the principle of
15 connecting together the sets of busbars of two incoming-outgoing bays via a longitudinal coupling bay;

Figure 7 is a diagram showing a variant of a longitudinal coupling bay provided with external measurement transformers accessible when the busbars are
20 live;

Figure 8 is an electrical circuit diagram of the variant of the coupling bay shown in Figure 7;

Figure 9 is a diagram showing a variant of a bay having two sets of busbars;

Figure 10 is an electrical circuit diagram showing a
25 variant of the bay having two sets of busbars shown in Figure 9;

Figure 11 is a diagram showing a variant configuration of a bay for outdoor use, having current
30 bushings that can be connected to overhead lines; and

Figure 12 is a plan view of a bay as shown in Figure 11.

The example of a the three-phase incoming-outgoing bay shown in Figure 1 includes a tank 1 that is in the
35 shape of a rectangular block or optimally of a cube, and that is made in a manner known to the person skilled in the art to be gastight.

The tank 1 is assumed to be made of sheet metal in this example, and it is organized to contain various elements of electrical switchgear, in particular the elements of at least one circuit-breaker having three
5 poles whose respective axes are angularly positioned to be perpendicular to one of the walls of the tank. This wall is designed to be the front face of the bay and it is referenced FA herein.

The poles are disposed side-by-side in a horizontal
10 plane. In this example, they are assumed to be hidden in alignment behind the pole that is represented by one of the three interrupting chambers 2. For example, the chambers may be of the vacuum interrupting chamber type, or of the type filled with a protective dielectric gas
15 such as SF₆.

A drive mechanism 3 for driving the circuit-breaker is positioned in front of the tank. It includes at least one drive rod 4 which passes through the front face FA via a gastight bushing device 5, and which controls the
20 interrupting chambers 2. The interrupting chambers are carried by insulating supports 6 which are fixed inside the tank 1 on the wall constituting the front face FA.

The tank 1 is also organized to be capable of containing the elements of at least one disconnecter
25 which is assumed, in this example, to have three positions, and which is placed above the poles of the circuit-breaker. The disconnecter is provided with three pairs of moving contact blades 7, each of which is hinged directly on a carrying part 8 which is conductive,
30 stationary, and mounted on the insulating supports 6 of an interrupting chamber 2 whose moving contact is electrically connected to said part 8. Only one of the blades is shown.

In a "connection" position, the three moving blades
35 7 are in contact with three conductive tabs 9 carried by busbars 10 disposed under the wall constituting the top face FS of the bay. In this example, the busbars 10 are

rectilinear and they extend perpendicularly to the front face FA of the tank. They are positioned above the disconnecter relative to the circuit-breaker in the tank. For example, the blades may be angularly positioned vertically, as shown in dashed lines.

In a "disconnection" position, the moving blades 7 are spaced apart from the tabs 9 so as to comply with sufficient disconnection distances between blades and tabs 9. In this position, the blades are, for example, tilted into to a position midway between the position described above and the position described below.

In a "grounding" position, the moving blades 7 are in contact with three conductive tabs 11 which are connected to a grounding strip for grounding the tank, only one of these tabs being shown. For example, each moving blade may be angularly positioned substantially horizontally, as shown in solid lines.

In known manner, the moving blades 7 are actuated by a control mechanism 12 outside the tank 1. A drive rod 13 from the control mechanism passes through the front face FA via a gastight bushing device 5A identical or similar to the above-mentioned gastight bushing device 5. This rod acts on a mechanism comprising a shaft 15, levers 16, and insulating connecting rod. The drive rod 13 acts on a lever which causes the shaft 15 to rotate through a portion of one revolution. The shaft drives three levers which individually cause the moving blades 7 to go from one position to another via the insulating connecting rods.

In the example shown, the shaft 15 is carried by bearings 18 fixed to the wall of the front face FA inside the tank 1. Only one of the bearings 18 is shown.

In a preferred embodiment, the grounding tabs 11 are carried by a common support which is, for example, a metal cross-piece 31 positioned in the center of the tank, between the two side walls thereof, the cross-piece

also serving as a strength member and enabling the tank to withstand pressure or possibly suction better.

5 The busbars 10 are designed to be connected to external three-phase conductors A, B, C situated outside the tank via current bushings 17A, 17B, 17C carried by the wall constituting the top face FS of the tank. Each current bushing carries a busbar 10 which, in this example, is assumed to connected via the bushing to an external conductor, e.g. by means of a connector 14A, 10 14B, or 14C. For example, the external conductor may be one of the busbars of a three-phase set of busbars situated outside and above the tank.

In the embodiment proposed, and as shown in Figure 2, the three current bushings 17A, 17B, 17C 15 carried by the tank 1 are disposed diagonally relative to the front face FA on the top face FS of the tank, the top face being rectangular or preferably square, so that the current bushing of the central phase, referenced 17C, is directly above the corresponding tab 9 and directly above 20 the corresponding moving blade 7, when said blade is in the connection position, as shown in Figure 1. The other two current bushings 17A, 17B, diagonally in line on either side of the central phase current bushing 17C, are then connected to the tabs 9 that correspond to them. 25 The corresponding links are provided by the busbars 10 which are identical and are positioned symmetrically about the central phase bushing 17C and about the corresponding tab 9 in the tank 1.

30 In a preferred embodiment, the assembly formed by the functional elements contained in the tank 1 between disconnecter and current bushings, and as described above, is housed in the top front portion of the tank, this portion approximately corresponding to one fourth of the tank.

35 In addition, and as shown in Figure 1, single-pole curved external tubes 19, only one of which is shown in Figure 1, are connected via respective first ones of

their ends to orifices provided in the rear portion of the plane bottom wall FI of the tank 1. Each of these tubes makes it possible to pass a respective curved conductor element 20 that penetrates into the tank so as to be connected to a stationary conductive part 21 carried by the insulating supports 6 of an interrupting chamber 2 whose stationary contact is electrically connected to said part 21.

The second end of each of the single-pole tubes 19 is connected to a gastight current bushing 22 whose axis is assumed to be horizontal in this example. In this example, each gastight bushing 22 is organized to enable one or more single-pole electrical cables 0 per phase to be connected via the front, by means of connectors that are known per se.

The second end of each of the single-pole tubes 19 optionally includes a portion (a horizontal portion in this example) that enables external toroidal-type current transformers 23 to be received.

In addition, in a variant embodiment also proposed in Figure 1, external single-pole tubes 24 may be connected via respective first ones of their ends to orifices provided in the plane bottom wall FI of the tank 1 behind the holes provided for the external single-pole tubes 19, if they are provided. Each of the tubes 24, which are assumed to be straight in this example, makes it possible to pass a respective conductor element 25 which penetrates into the tank so as to be connected to a stationary conductive part 21 of one of the interrupting chambers 2. The second end of each of the single-pole tubes 24 is provided with a gastight current bushing 26 which is vertical in this example. In this example, each gastight bushing 26 is assumed to be organized to enable at least one T-shaped connection element 27 to be connected to it, which element is organized to enable an external voltage transformer 28 to be connected to it.

An example of a coupling bay, developed from a bay such as the bay described above and including an additional disconnector, is shown in Figure 3. For example, it enables a configuration to be obtained that is as shown by the electrical circuit diagram in Figure 4.

Such a configuration makes it possible to obtain longitudinal coupling between a set of three-phase external conductors A, B, C connected to the current bushings 17A, 17B, 17C and a set of three-phase external conductors A', B', C' connected to current bushings 17'A, 17'B, 17'C disposed behind the first-mentioned bushings on the top face of the tank 1'. In this example, the coupling is obtained via a succession of elements comprising a disconnector having moving blades 7 and a circuit-breaker having interrupting chambers 2, these two elements being analogous to those shown in Figure 1, as well as an additional disconnector having moving blades 7'. In practice, this additional disconnector has each of its moving blades 7' positioned between a stationary contact of a respective one of the interrupting chambers 2 and a respective one of the busbars 10', as shown in Figure 3.

In a preferred embodiment shown in Figure 3, the additional disconnector which is included in the tank 1' of a bay analogous the above-described bay is also a disconnector having three positions and that is identical to the disconnector having moving blades 7. The two disconnectors are disposed symmetrically about a vertical plane (not shown) that is assumed to contain the grounding tabs 11, and that is parallel to the front face FA of the tank.

Each of the moving blades 7' of the additional disconnector is hinged to a carrying part 8' that is stationary and conductive, and that is itself carried by the insulating supports 6 of one of the interrupting

chambers 2 whose stationary contact is electrically connected to said carrying part 8' inside the tank.

5 In the connection position, the three moving blades 7' are in contact with three conductive tabs 9' carried by busbars 10' situated above the additional disconnecter in the tank. For example, these blades may be angularly positioned vertically, as shown in dashed lines.

10 In the grounding position, each of the moving blades 7' are in contact with a tab connected to the grounding strip of the tank. In the embodiment presented, in which the disconnectors are installed symmetrically about a vertical midplane of the tank, which midplane is assumed to be parallel to the wall constituting the front face FA, the tabs connected to
15 ground are tabs 11 which can simultaneously receive the blades 7 and 7' of the two disconnectors.

For example, each moving blade is angularly positioned substantially horizontally, as shown in solid lines.

20 In the disconnection position, the moving blades 7' are, for example, tilted midway between the two above-mentioned positions.

The additional disconnector is provided with a specific control mechanism which is outside the tank 1' as is the control mechanism 12 which is situated adjacent
25 to it in front of said tank. This mechanism includes a drive rod 13' (shown in part) which passes through the front face FA via a gastight bushing device that is identical or similar to the above-mentioned gastight
30 bushing device 5, so as to extend along on of the side walls of the tank and so as to be hinged on one of the levers 16' of a motion-transmission mechanism comprising levers 16' and isolating connecting rods 16'A and analogous to the mechanism comprising the levers 16 and
35 the connecting rods 16A. The levers 16' are carried by a rotary shaft 15', and three of them are connected to the blades 9' via three insulating connecting rods 16'A, so

as to move the moving blades 7 between the above-mentioned positions. The shaft 15' is carried by bearings 18' fixed to the wall that is opposite from the front face FA in the tank.

5 The busbars 10' are designed to be connected to conductors situated outside the tank, via current bushings 17'A, 17'B, 17'C' carried by the wall constituting the top face FS of the tank. Each current bushing 17'A, 17'B, 17'C makes it possible to connect a
10 busbar 10' situated inside the tank to a different external link conductor A', B' or C' situated outside and above said tank.

15 In the example shown in Figure 3 connectors 14'A, 14'B, and 14'C are provided for implementing these links and for enabling them to be disconnected.

20 As shown in Figure 2, the three current bushings 17'A, 17'B, 17'C are organized to be disposed diagonally across the top face FS of the tank, as are the bushings 17A, 17B, 17C. The current bushing 17'C of the central phase is positioned directly above the corresponding tab
25 9' and directly above the corresponding moving blade 7', when said moving blade is in the connection position. The other two current bushings disposed diagonally in line on either side of the central phase current bushing
30 are then connected to the tabs 9' that correspond to them. The corresponding links are provided by means of the busbars 10' which are positioned symmetrically about the vertical plane which contains the central-phase bushings 17C and 17'C and the tabs 9 and 9' and which is
30 perpendicular to the plane defined by the front face FA.

35 In a preferred embodiment, the assembly formed by the functional elements contained in the tank 1 between the additional disconnecter and the current bushings 17'A, 17'B, 17'C, such as those described above, is
35 housed in the rear top portion of the tank, this portion also corresponding at least approximately to one fourth of the tank. It should be noted that, in this

embodiment, the electrical links between the external busbars and the circuit-breaker via the disconnectors can be particularly short.

5 A variant of an incoming-outgoing bay having a tank 1" is shown in Figure 5. It is developed from an incoming-outgoing bay having a tank 1 as shown in Figure 1. However, it differs therefrom insofar as it is provided with three additional current bushings in addition to the three current bushings 17A, 17B, 17C
10 disposed diagonally relative to the front face FA of the tank. The three additional current bushings 17'A, 17'B, and 17'C are disposed behind the above-mentioned bushings on the top face of the tank 1", like those of a bay having a tank 1' as shown in Figure 3.

15 The electrical link between two current bushings relating to the same phase, such as 17A and 17A', is provided by an "offset" rectilinear busbar 10" fixed to the two current bushings inside the tank 1", the three offset busbars 10" being identical and parallel to one another in the vicinity of the top face FS.
20

In the example shown in Figure 5, external single-pole curved tubes 19 are connected to orifices provided in the rear portion of the plane bottom wall FI of the tank 1 similarly to the tubes of the tank shown in
25 Figure 1.

Figure 6 shows an example of how two incoming-outgoing bays having tanks 1 and 1" can be coupled together via a coupling bay having a tank 1', the three tanks being in alignment.

30 The incoming-outgoing bay having a tank 1 is assumed to be identical to the bay shown in Figure 1.

The coupling bay having a tank 1' is assumed to be identical to the bay shown in Figure 3.

The incoming-outgoing bay having a tank 1" is
35 assumed to be identical to the bay shown in Figure 5.

As shown in Figure 6, the incoming-outgoing tanks 1 and 1" receive respective different sets of three-phase

external conductors, respectively referenced A, B, C and A', B', C'. In the embodiment proposed, in each of the sets, the conductors are parallel to one another and to the front face of the corresponding tank, and from one set to the other, the conductors are in alignment in pairs. In addition, the conductors are connected to respective ones of the current bushings 17A, 17B, 17C situated in the vicinity of the front face of the tank to which they lead.

In the example shown, the electrical link between a three-phase external conductor and a current bushing is assumed to be provided by a connector, such as the X-connectors referenced 14A, 14B, 14C for the conductors A, B, C leading to tank 1.

The tanks 1, 1" of the incoming-outgoing bays are connected to the tank 1' of the coupling bay by respective intermediate busbars which are preferably mutually identical, these insulated and external busbars being referenced AI, BI, CI between tanks 1 and 1' and AI', BI', CI' between tanks 1' and 1". Connectors connect the intermediate busbars to the current bushings interconnected thereby, such as the connectors referenced 14A1, 14B1, 14C1 at tank 1' for the intermediate bars AI, BI, CI connecting this tank to tank 1.

The coupling function for a set of three-phase external conductors is thus performed by means of a single coupling bay comprising standardized elements, such as the circuit-breaker, the disconnectors, and the busbars.

The incoming-outgoing bay having a tank 1" performs the same function as an incoming-outgoing bay 1, i.e. it enables an outgoing cable to be fed from a set of external conductors via a circuit-breaker and via a disconnector. In addition, it makes it possible to compensate, merely by means of busbars 10", for the offset between current bushings of the same phase, due to the tank of the coupling bay 1'.

Another example of a coupling bay tank 1'D is shown in Figure 7. It makes it possible to obtain a configuration such as the one shown in the electrical circuit diagram of Figure 8. This bay is developed from
5 a coupling tank bay 1' as mentioned above. It is provided with an external conductive link enabling the stationary contacts of the interrupting chambers 2 to be connected to the conductive carrying parts 8" for carrying the moving blades 7' of the additional
10 disconnector. In this example, the external link is provided with a current transformer 23 and with a voltage transformer 28, both of which are outside the tank.

These transformers can be reached and in particular removed, if necessary, while the busbars of the bay are
15 live.

The coupling is achieved in the coupling bay via a disconnector having moving blades 7, via a circuit breaker having interrupting chambers 2, and via a disconnector having moving blades 7'.

20 In this example, each of the moving blades 7' of the additional disconnector is hinged to an "auxiliary" conductive carrying part 8" that is slightly different from the carrying parts 8, and 8'. In this example, the auxiliary carrying part 8" is fixed to additional
25 insulating supports 6" carried by a stationary conductive part 21 identical to the part provided in the bay shown in Figure 1.

The part 21 is fixed to the insulating supports 6 of the stationary contact of an interrupting chamber 2 in
30 identical manner. Each auxiliary carrying part 8" is connected to a conductor element 25.

External single-pole curved tubes 19 analogous to the tube shown in Figure 1 are connected via respective first ones of their ends to orifices provided in the rear
35 portion of the plane bottom wall of the tank 1'D. Each of these tubes contains a curved conductor element 20 which penetrates into the tank so as to be connected via

a first one of its ends to a stationary conductive part 21 connected to the stationary contact of an interrupting chamber 2, as described above.

5 A second end of each single-pole curved tube 24 is provided with a gastight bushing 22 which receives a T-shaped connector 29 of known type.

10 A busbar 30 covered with insulation and mounted outside the tank makes it possible for each conductor element 20 to be connected to that one of the conductor elements 25 which corresponds to the same phase inside the tank. In this example, each busbar 30 is connected to two current bushings 20 and 26 relating to the same phase by two connectors 27 and 29, e.g. via the middle outlets thereof.

15 In the embodiment proposed, the connectors 27 are positioned vertically with their respective middle outlets facing forwards, and the connectors 29 are positioned horizontally with their respective middle outlets facing downwards and each of the busbars 30 is
20 provided with a bend and is mounted between the respective middle outlets of two connectors 27, 29 relating to the same phase.

Current transformers 23 and voltage transformers 28 are associated with the various conductor elements 20 and
25 25, in the same way as they are in the tank bay 1 shown in Figure 1. They make it possible respectively to measure the current flowing along the busbars 30, and to measure the voltage across said busbars.

30 Provided that both of the disconnectors contained in the tank of a bay as shown in Figure 7 are simultaneously in the grounding position, it is possible to access the transformers 23 and 28 associated with the tank, while the external busbars A, B, C and/or A', B', C' to which the bay is connected are live. In particular, it is
35 possible to remove the current transformers 23 after disconnecting the busbars 30 and the connectors 29.

An additional variant of a bay having two sets of busbars is shown in Figure 9. It makes it possible to obtain a configuration as shown in the electrical circuit diagram of Figure 10.

5 This diagram shows an example of a tank 1''' of a bay serving to feed an outgoing cable from two sets of three-phase external conductors A, B, C, and A', B', C' (two sets of busbars in this example). Like the tanks 1' and 1'D, this tank contains a circuit-breaker and two
10 disconnectors 7 and 7'.

 The configuration of the tank 1''' shown in Figure 9 differs from the above-described tanks in that the disconnector having moving blades 7 and the disconnector having moving blades 7' have their same-phase blades
15 hinged to the carrying parts 8 and 8''' which are fixed to the insulating supports 6, and which are electrically interconnected in pairs, as shown in Figure 9 for the two parts 8 and 8''' shown in that figure. In this example, the link set up between two parts 8 and 8''' connected to
20 the moving contact of one of the circuit-breaker interrupting chambers 2 includes an elongate portion which extends parallel to the chamber in the space between said chamber and the strength cross-piece 31 with which the tank is provided.

25 The links between the stationary contact of each interrupting chamber 2 and the external electrical cables 0 is implemented in the same way as in the embodiment shown in Figure 1.

30 The above-mentioned bay having two sets of busbars offers the important advantage of implementing components already used in bays 1 and 1''.

 The configuration of the bay shown in Figure 11 is more specifically suited to the case when the bay (which is of the "dead tank" type) of the invention is to be
35 used outdoors in association with overhead lines to which at least some of the current bushings of the bay are connected.

The bay itself is analogous to the bay shown in Figure 3 except for the fact that the current bushings of the tank 1'''' that it comprises are optionally in line parallel to the front face FA in one or two (as in this example) rows of bushings as shown in Figure 12 for the bushings respectively referenced 17A to 17C, and 17A' to 17C'. In this case, each of the conductive tabs 9 and optionally 9' with which the disconnecter(s) is/are provided is thus situated directly under a respective bushing to which the tab is electrically connected via a part of limited size, corresponding functionally to one of the busbars 10 or 10' of the above-described embodiments. A sleeve made of an insulating elastomer material 32 covers a single-pole link conductor 33 for connecting to one of the phase wires of an overhead link which is connected to the tank 1'''' at one of the current bushings, such as 17C, carried by the top face FS of the tank. The sleeve fits over the external portion of the current bushing. It is dimensioned in a manner known per se to make it possible to obtain the necessary dielectric distances between the phase conductors, and between the phase conductors and the ground conductor. It is provided with fins so as to increase the creepage distance.

The single-pole link conductors are curved in a manner known per se so as to increase the dielectric distances at the ends of the bushings.

In a preferred embodiment, each of the insulating sleeves 32 includes a cylindrical portion covered with a grounded conductive layer enabling it to cover and protect one or more current transformers 34 of the toroidal type, surrounding the single-pole conductor 33 which passes along the sleeve in question, the transformer(s) being positioned at the external portion of the current bushing in question, e.g. on a cylindrical portion of the sleeve fitted over the external portion of the bushing and under a second portion of the sleeve.

The conductive layer provided on each sleeve terminates in a flare or in a circular arc at the second portion, above the bushings, so as to reduce the electric field at the end of the conductive layer.

5 Tanks such as 1''' of the invention can be used to make medium-voltage gas-insulated bays for outdoor use and connectable to overhead distribution lines, such a bay containing a circuit-breaker, one or more
10 disconnectors and some of the essential electrical link elements housed in a container that is of relatively low volume compared with known bay configurations, and using standardized component elements, at least some of which are common to different variants of bays of the invention. Insofar as the disconnectors electrically
15 situated on either side of the circuit-breaker are organized to be of the type having three positions as indicated above, it is possible to ground and/or to short-circuit either one of or both of upstream and downstream overhead lines connected to respective ones of
20 the disconnectors.

For example, grounding takes place with a disconnector whose blades are in the connection position and are thus connected to the current bushings, such as 17A, 17B, and 17C serving the line to be short-circuited
25 by putting the blades of the second disconnector in the grounding position, and by closing the circuit-breaker by using the short-circuit closure capability specific thereto. Naturally, the operation can be performed in equivalent manner by inverting the positioning of the
30 disconnectors when the line is served via the current bushings 17'A, 17'B, and 17'C.

When the disconnectors are in the disconnection position, it is possible to verify the circuit-breaker, while the overhead lines are live. It is therefore very
35 easy and very safe for the operator to take such action.

Naturally, provision is made to raise the tank 1''' by means of a support frame, not shown, so as to satisfy

the minimum height requirement for live elements of such medium-voltage facilities.

Provision is also made to implement tanks analogous to the tank 1''' and in which the circuit-breaker is
 5 connected directly to the current bushings, when no disconnecter is present in the tank. The link elements required for such a configuration are not shown herein. For example, they may be constituted by busbars connecting respective ones of the moving contacts and of
 10 the stationary contacts of the phase interrupting chambers of the circuit-breaker to internal portions of respective ones of the current bushings carried by the wall constituted by the top face FS of the tank.

Provision is also made to equip the bottom wall of a
 15 tank 1''' in the same way as the top portions of the tanks 1, 1", or 1''', respectively shown in Figures 1, 7, and 9, are equipped, so as to enable toroidal current transformers or voltage transformers to be connected to external single-pole cables by means of suitable
 20 connectors and connector outlets. This is not described in any more detail herein insofar as such equipping can be achieved as indicated above with reference to the above-mentioned figures.

In a variant bay (not shown) of the "dead tank" type, as defined above, each of the gastight current
 25 bushings 17 is fixed to one end of a respective sloping metal tube whose other end is fixed to the tank at orifices provided in the top face FS for these current bushings. The difference between the slopes of the tubes
 30 is then chosen so as to satisfy the required dielectric distance between the insulating sleeves with which the bushings are respectively equipped.

The sleeves can therefore be straight sleeves that are simpler and less costly than those shown in
 35 Figure 11. In addition, it is then possible to mount the toroidal-type current transformers directly around the

sloping metal tubes, thereby also simplifying manufacture and assembly.



☐	Description	: paged		to paged	
☒	Claim(s)	: paged	25	to paged	30
☐	Drawing(s)	: paged		to paged	
☒	Abstract	: paged	31	to paged	31

CLAIMS

- 1/ An electrical bay having a gastight metal tank containing at least one three-phase circuit-breaker and at least one three-phase disconnecter, for
- 5 interconnecting external busbars and/or external electrical cables, the busbars and/or the cables being interconnected individually inside the tank via gastight current bushings, the circuit-breaker having interrupting chambers (2) disposed horizontally and perpendicularly to
- 10 a front face (FA) of the tank, via which face the circuit-breaker and the disconnecter are controlled, the disconnecter having moving blades (7) mounted to move between at least a "connection" position and a
- 15 "disconnection" position, each blade being hinged to a conductive stationary carrying part (8) carried by at least one insulating support (6) of an interrupting chamber having a moving contact to which said part is connected, said bay being characterized in that the tank,
- 20 which is in the shape of a rectangular block or optimally of a cube, contains a disconnecter whose moving blades are angularly positioned substantially vertically in the connection position, in which the blades are in contact with conductive tabs (9) which are in line horizontally parallel to the front face, which are situated above the
- 25 disconnecter relative to the circuit-breaker in the tank, and which are connected to first gastight current bushings (17A, 17B, 17C) carried by a top face (FS) of the tank.
- 30 2/ A bay according to claim 1, characterized in that it is provided with first current bushings disposed on the top face of the tank in a manner such that a central first current bushing (17C) is directly above the central tab and directly above the central moving blade of the
- 35 disconnecter, and in that the other two first current bushings are in line diagonally relative to the central first current bushing, and each of them is connected to a





different tab via an individual first busbar (10), these busbars being mutually parallel and disposed orthogonally relative to the front face, and being positioned symmetrically about the central first bushing in the tank.

3/ A bay according to claim 1 or 2, characterized in that it comprises a tank containing an additional disconnecter having a moving blades (7'), each of which is also hinged to a stationary conductive part (8', 8'', or 8''') carried by insulating supports (6, 6'') of an interrupting chamber (2) having a contact connected to said conductive part, the moving blades also being angularly positioned vertically in a connection position, in which they are in contact with conductive tabs (9') in line horizontally parallel to the front face, situated above the additional disconnecter relative to the circuit-breaker in the tank, and connected to second gastight current bushings (17'A, 17'B, 17'C) carried by the top face of the tank, said additional disconnecter being situated behind the other disconnecter relative to the front face of the tank.

4/ A bay according to any one of claims 1 to 3, characterized in that, in a "grounding" position, each of said moving blades, which are angularly positioned at least approximately horizontally, is in contact with a respective grounding tab (11) carried by a horizontal strength cross-piece (31) disposed centrally between side walls of the tank, above the interrupting chambers of the circuit-breaker.

5/ A bay according to any one of claims 1 to 4, characterized in that it includes a disconnecter which, in the disconnection position, has its moving blades electrically isolated both from the tabs (9) connected to the first current bushings, and also from the grounding tabs (11) included in the tank, the blades having been





tilted midway between the two other positions, namely the connection position and the grounding position.

6/ A bay according to any one of claims 3 to 5,
5 characterized in that it is provided with second current bushings disposed such that a "central" second current bushing (17'C) is directly above the central tab and directly above the central moving blade of the additional
10 disconnector, such that the other two second current bushings (17'A, 17'B) are in line diagonally relative to said central second current bushing, and such that each of said second current bushings is connected to a different tab by an individual second busbar (10), these
15 second busbars being positioned symmetrically about the central bushing corresponding to the central tab of the additional disconnector in the tank.

7/ A bay according to any one of claims 3 to 6,
20 characterized in that the disconnector and the additional disconnector have their corresponding elements (7, 7' and 9, 9') disposed in line and on the same horizontal level in the tank, in the same way as the same-phase first and second busbars (10, 10') are disposed.

25 8/ A bay according to any one of claims 1 to 7, characterized in that it comprises a tank provided with external single-pole curved tubes (19), each of which is connected to the tank at orifices provided in the rear
30 portion of the plane bottom wall (F1) of the tank, each of which tubes enables a different conductor element (20) to pass along it, which element penetrates into the tank so as to be connected to a stationary conductive part (21) carried by at least one insulating support (6) of an
35 interrupting chamber (2) whose stationary contact is electrically connected to said part, and each of which tubes enables at least one single-pole electrical cable (0) to be connected via a gastight current bushing (22)





received at one end of the tube that contains it and angularly positioned horizontally and facing towards the front of the tank under which the tubes are positioned.

5 9/ A bay according to any one of claims 1 to 8,
characterized in that it comprises a tank provided with
external straight single-pole tubes (24), each of which
is connected to the tank at orifices provided in the rear
portion of the plane bottom wall of the tank, behind
10 those provided for any curved single-pole tubes, each of
which straight tubes enables a different conductor
element (25) to pass along it and to penetrate into the
tank so as to be connected to a stationary conductive
part (21) carried by at least one insulating support (6)
15 of an interrupting chamber (2) whose stationary contact
is electrically connected to said part, and each of which
straight tubes enables, in particular, one phase of an
external voltage transformer (28) to be connected.

20 10/ A bay according to any one of claims 3 to 5,
characterized in that it is provided with second gastight
current bushings (17'A, 17'B, 17'C) carried by the top
face (FS) of the tank behind the first current bushings
(17A, 17B, 17C) in a layout identical that of said first
25 bushings relative to the front face (FA) of the tank,
each of the second bushings being connected to a
respective one of the first bushings by a common busbar
(10") which is received inside the tank parallel to the
top face of the tank, the busbars being mutually
30 parallel.

11/ A bay according to any one of claims 3 to 7,
characterized in that it comprises a tank in which the
disconnecter (7, 9, 10) and the additional disconnecter
35 (7', 9', 10') are disposed symmetrically about a plane
containing the ^{parte 213} grounding tabs (11), the additional
disconnecter having moving blades (7'), each of which is





mounted on a conductive carrying part (8') fixed to at least one insulating support (6) of an interrupting chamber, each of the moving blades of the additional disconnector being electrically connected to a stationary
5 contact of one of the interrupting chambers (2) whose moving contact is electrically connected to a moving blade (7) of the disconnector housed in the same tank.

12/ A bay according to claim 9, characterized in that it
10 comprises a tank in which a disconnector (7, 9, 10) and an additional disconnector (7', 9', 10') are disposed symmetrically about a plane containing the grounding tabs (11), the additional disconnector having moving blades, each of which is mounted on a stationary conductive
15 carrying part (8'') electrically connected to a stationary contact of one of the interrupting chambers (2) via a fixed conductive part (21) carried by at least one insulating support (6) of the interrupting chamber, and via two conductor elements (25, 20) connected to gastight
20 bushings (26, 22) and interconnected outside the tank via an insulated and curved conductor (30) and via connectors (27, 29) making it possible to mount current transformers and voltage transformers outside the tank, the conductive part (8''), a first one of the conductor elements (25),
25 the insulated conductor (30), a second one of the conductor elements (20) and the stationary conductive part (21) relating to a blade being electrically in series in this order.

30 13/ A bay according to any one of claims 3 to 9, characterized in that it comprises a tank in which the additional disconnector has moving blades (7') each of which is positioned with the same-phase moving blade (7) of the disconnector with which it is housed in the same
35 tank, on conductive carrying parts (8, 8'') which are fixed to at least one stationary and insulating support (6) of an interrupting chamber, and which are





electrically interconnected via a link which extends through the space between the interrupting chamber to which the insulating support is assigned and the cross-piece (31) with which the tank is provided.

5

14/ A bay according to any one of claims 1, 3, 4, 5, 7, 8, 9, and 11, characterized in that it is provided with current bushings carried by a top face (FS) of the tank (1'''), and organized to be connected to overhead
10 distribution lines via single-pole link conductors (33) connected to the external portions of respective ones of the current bushings, each conductor being equipped with an insulating elastomer sleeve (32) which covers the end
15 of it and which fits over the external portion of the current bushing to which the conductor is connected.

15/ A bay according to claim 14, characterized in that it is provided with current bushings organized to be connected to overhead distribution lines via single-pole
20 link conductors (33) which are equipped with insulating elastomer sleeves and around which toroidal-type current transformers (34) are mounted.

16/ A bay according to any one of claims 1 to 15,
25 characterized in that it is filled with a protective dielectric gas.

This Sheet Has Been Replaced

