

DISTRIBUTION SYSTEM AND COLUMN FOR ELECTRIC SWITCHING
DEVICES

5

The present invention relates to a distribution system for electric switching apparatus, this system comprising
10 a distribution column having vertical non coplanar busbars centered at different levels and a protective case disposed about the bars. It also relates to the distribution column appropriate to such a system.

For electric switching apparatus, is meant here apparatus such as contactors, circuit breakers, circuit makers-
15 breakers, protective apparatus or switches properly speaking comprising several poles for opening and/or closing a power circuit fed from the above mentioned distribution busbars.

It is desirable to associate with electric distribution columns having bars situated in different vertical parallel
20 planes, systems for fixing and connecting electric switching apparatus which allow such apparatus to be mounted conveniently and taking up little space in depth while offering the possibility of disconnecting and resetting with every safety the electric connection between the distribution busbars and
25 the apparatus.

The state of the art is illustrated by US-A-3 321 672, US-A-3 626 253 and FR-A-2 126 115.

The aim of the present invention in particular
30 is to provide compact fixing and disconnectable electric connection of switching apparatus to a distribution column comprising non coplanar busbars.

It also provides a simple and particularly accessible system in which the control of the disconnection and
35 of resetting may be blocked by mechanical detection of the "on" state of the switching apparatus.

In accordance with the invention, in a system of the abovedescribed type, a plurality of supports are provided which extend in a direction parallel to the planes of the bars, each support comprising at least one bearing wall which may be applied to a respective fixing face of the protective case of the column and being adapted for supporting on the one hand, at least one switching apparatus and, on the other, a current tapping and disconnecting member having clips clippable on the distribution bars by insertion through traps provided in one side of the case perpendicular to the planes of the bars, the current tapping and disconnecting member comprising means for connection to the switch apparatus and a mobile disconnecting part adapted to be actuated by manual control means.

The arrangement described and particularly the arrangement of the removable disconnecting member between the side of the case protecting the set of bars and the switching apparatus in association with a support common to said member and to the apparatus, allow a system to be formed with lateral extension; this system therefore takes up little room in depth and allows easy fitting and wiring, as well as good accessibility to the apparatus and to their associated disconnecting blocks.

The invention also concerns a distribution column for switching apparatus arranged on the supports of a distribution system, comprising vertical non coplanar busbars situated in different parallel vertical planes, a protective case disposed about the bars and at least one side perpendicular to the planes of the bars and provided with traps for the passage of clips for clipping a current tapping and disconnecting member associated with each support, characterized by at least one fixing flange perpendicular to the side and provided, at regular intervals, with openings for the passage of tenons and locking members connected to the supports of the switching apparatus.

In a preferred embodiment, the support comprises a fixed portion with respect to the case of the column and a portion adjustable in depth with respect to the fixed portion, the fixed portion of the support comprising
5 a vertical web and at least a horizontal side provided with means for adjusting the adjustable portion, said adjustable portion comprising a platen for fixing switching apparatus.

According to an advantageous embodiment, the current tapping and disconnecting block has a disconnecting
10 platen provided with a front aperture with slits and with a rotary cylinder provided with a housing whose slits are coaxial to the orifice and which is connected for rotating with the rotary shaft, the slits of the orifice of the front platen and of the housing of the rotary cylinder being adapted
15 ed for receiving an operating key and only coinciding in a clipping and in an disconnecting position.

The current tapping and disconnecting block preferably comprises a sensor having a hand lever, a stop and a free end arranged in depth at the level of the control handle of the apparatus, the stop of the sensor cooperating with a bearing surface of the mobile part of the
20 disconnecting block for preventing disconnection and re-clipping when the sensor detects that the handle of the apparatus is in the ON position.

25 There may further be provided a prebreak device which cooperates with a movable portion of the current tapping and disconnecting block for operating at least one prebreak contact associated with the switching apparatus.

One embodiment of the invention will be described here by way of non limitative example with reference to
10 the accompanying drawings in which:

Figure 1 shows, in front elevation, an electric distribution system in accordance with the invention;

Figure 2 shows in a perspective view a switching apparatus support fixed to the casing of the distribution
15 column;

Figure 3 shows in a smaller scale perspective view the fixed part of the support of Figure 2, as well as a variant of the adjustable part of the support secured to its fixed portion;

20 Figure 4 is a partial top view on a larger scale of the support of Figure 2;

Figure 5 shows in front elevation a rack and pinion connection between the rotary shaft controlling the disconnection and the portion movable in translation of the current
25 tapping and disconnecting member;

Figure 6 is an elevational view of the same support as shown in Figure 2;

Figure 7 shows in an exploded perspective view a variant of construction of the support;

30 Figure 8 shows in elevation the partitioned supports of the type shown in Figure 7, the partitioning being removed from the lower support so as to show the disconnecting or isolating plate;

Figure 9 is an enlarged top view of the support
35 of Figure 7; and

Figure 10 shows a partial top view of a variant

of construction of the column and of the disconnecting block.

5 The system S shown in Figure 1 is associated with a distribution column C comprising coplanar busbars. B1 to B5 parallel to the same plane P in a protective case E.

10 The system shown is designed for fixing and electrically connecting switching apparatus I, for example contactors, circuit breakers, circuit makers-breakers or switches properly speaking, with which may be possibly associated auxiliary devices not shown such as protective devices, fuses, auxiliary remote control devices. System S comprises supports
15 forming modules M; Figure 1 shows several supports M1-M6 disposed bilaterally with respect to the column on both sides thereof.

Each support or module M has a generally elongate shape and comprises a fixed portion 11 and a platen 12 adjustable in depth, i.e. perpendicularly to the planes of the bars, with respect to the fixed portion (Figures 2, 3 and 4); it also comprises as required at least one bracket 13 increasing the depth adjustment range, this bracket being fixed to the platen 12 (Figure 4); with apparatus of different depths, the platen 12 allows a housing pattern situated
25 behind a plane P1-P1 (Figure 4) to be kept corresponding for example to a door of a cabinet housing the described distribution system. Brackets 13 may for example support vertical or horizontal rails themselves supporting modular
30 switching apparatus and their accessory parts (Figure 3).

The platen 12 is preferably a steel section or chassis having standardized perforations 12a in a web 12b bordered with flanges 12c, 12d; it is provided on its flanges 12c, 12d with fixing holes 12e for passing therethrough
35 screws which also pass through adjustment orifices, for example in the form of button holes 11a, formed in an upper

horizontal wall 11b of the fixed support 11.

In the embodiment shown in Figure 4 bracket 13 has apertures 13a corresponding with apertures 12e in the platen so as to provide depth adjustable fixing of the bracket
 5 13 by means of screws engaged in said apertures, thus allowing modular switching apparatus of smaller depth than apparatus I to be fixed to the support.

In the embodiment shown in Figure 3, platen 12 has a vertically developed surface for supporting, by means
 10 of frontally fixed telescopic lugs 74, several horizontal rails 75 for supporting modular apparatus.

The fixed support 11, best seen in Figure 3, has an upper horizontal wall 11b and a lower horizontal wall 11c comprising the above mentioned button holes 11a for
 15 adjusting the platen 12. Walls 11b, 11c are joined together by a vertical web 11d having an opening 11e for placing opposite a trap formed in a side of the column for passing therethrough blades or clips for clipping onto bars B1-B5.

The fixed support 11 comprises a front wall 11f and a rear wall 11g for fixing to the case E of column C.
 20 Walls 11f, 11g are vertical and are joined at right angles to the vertical web 11d; wall 11f is equipped with a tenon 11h and a locking piece 11i of any type, for example of a quarter turn type. Wall 11g has two tenons 11h; the tenons
 25 11h have truncated cone shaped ends for suitable guiding in housings of the case E.

The protective case E for column C contains the busbars B1-B5. It comprises (Figures 2 and 3) two opposite vertical sides 14, 15 perpendicular to plane P-P and each
 30 one having traps 16 for passing therethrough connection clips proper to each support M. To each of the vertical sides 14, 15 are fixed a front bent flange 14a, 15a and a rear bent flange 14b, 15b. A channel section 17 is fixed at the inner side of case E to the internal faces of the
 35 vertical walls 14, 15 so as to form, set back from flanges 14a, 15a, a chamber 18, whereas a flat piece 19 is fixed

to the rear of flanges 14b, 15b for closing the chamber 22 of bars B1-B5. Flanges 14a, 14b, 15a, 15b are parallel to the plane P-P and are provided, at regular intervals h corresponding to the fixing pitch of the modular supports, with apertures 20 for passing therethrough the tenons 11h and with apertures 21 for passing the locking pieces 11i therethrough. It will be readily understood that the supports M are engaged horizontally on the column from the front, i.e. in a direction perpendicular to plane P-P and to the planes of the busbars. B1-B5, so that the tenons 11h and the locking pieces 11i penetrate into the respective apertures 20, 21 of flanges 14a, 14b, 15a, 15b. The sides 14, 15 of case E may advantageously have projections 72, obtained for example by stamping, for serving as a support for support 11 and facilitating the positioning thereof. Bars 5 are five in number but may of course be smaller in number. Bars B1-B5 correspond to the conductors of a three phase electric network with distributed neutral and protective conductor. In another method of construction, the protective conductor may be formed by the case E itself when this latter is made from an electrically conducting material, or by means of a protective conductor fixed to the case when this latter is made from an insulating material. This latter construction will be described further on with reference to Figure 10.

The current tapping and disconnecting member is a block 30 secured in the fixed support 11 by fixing means, but it could of course itself form this fixed support and/or be formed of a current tapping and disconnecting member. The vertical web 11d of the fixed support 11 may be fixed to the side 14 of case E.

Block 30 is molded from an insulating material and has current tapping clips 31 which may be clipped onto the busbars B1-B5 and unclipped therefrom by the translational movement of a simple disconnecting slide 32 controlled by a rotary shaft 33; the clips 31 are housed individually

in compartments formed in slide 32.

Block 30 further has fixed means for connection for example by means of screws with power terminals of the switching device I. The control of the translational movement of the slide takes place in response to the rotation of shaft 33 through at least one movement transformation connection, for example of the rack and pinion type.

Figure 5 shows this type of connection with the pinion 35 mounted on the rotary shaft 33 and meshing with the rack 36 formed on the upper face of slide 32, so as to transform the rotational movement of the shaft into a translational movement of the slide; in Figure 5, clip 31 is shown in the position clipped onto the busbar B2 for example.

Of course any other appropriate member may be used for forming the disconnectable current tapping member, for example by means of pivoting clips.

The rotation of shaft 33 is caused by means of a key not shown whose impression may penetrate into an appropriate housing 43 in a cylinder 40 fixed to the shaft (Figure 4). This cylinder 40 may be guided axially along shaft 33 and be urged towards a disconnecting plate 50 by a spring 41, so as to be able to move axially slightly backwards with respect to shaft 33 when the disconnection control key is introduced so as to actuate a prebreak contact 42 associated with the switching device I for making sure that breaking takes place off load.

Of course, as disconnection control means there may also be provided a lever or flywheel permanently disposed but able to be inhibited by the plate and to control a prebreak device directly at the beginning of the disconnecting movement.

The disconnection plate 50 is fixed for example by snap fitting on the front face of the disconnection block 30 or of the fixed support 11.

This plate 50 comprises (Figure 4) a sensor 51

movable manually parallel to the plane P1-P1 in the direction of an arrow A against the force of a recall spring not shown. The sensor is housed and guided in the plate, while being provided with a manual operating member. This member is
 5 for example an operating button 52 passing through an oblong window 53 in the plate (Figures 2 and 6) or a grip 52 formed by a bend in the sensor (Figures 8 and 9). The free end of the sensor may thus be brought from the rest position 1 to the "on" or "off" detection position 2 or to the detection position 3 for sensing the "break", "tripped" or "open" state of the position taken by button B of the switching apparatus I. Sensor 51 has in addition a stop, not shown, cooperating with a bearing surface, for example a cam 44 of the cylinder 40 for preventing disconnection and reclip-
 10 ping when the sensor can only come into position 2.
 15

A rotary detection may of course also be provided. Sensors 51 of different shapes may be provided in association with switching apparatus of different dimensions and/or switching apparatus equipped with buttons or levers adapted
 20 differently.

The front face of the plate has furthermore an aperture with slits 55 for introducing the key controlling the disconnection and resetting, an indication window 56 opposite which comes an indication "0" or "1" carried by
 25 a face interlocked for rotation with shaft 33, for example the front face of the cylinder 40, and an oblong window 57 adapted to coincide with a corresponding window 58 in the cylinder for padlocking or locking shaft 33 in its disconnection position.

30 Cylinder 40 has been illustrated in Figure 6 with continuous lines in its disconnection position and with broken lines in its reset position. The shape of the key and of aperture 55 ensure that the key can only be inserted and withdrawn in the two "disconnected" and "reset" positions
 35 by rotating a quarter of a revolution for going over from one to the other while preventing the key from being withdrawn

in its intermediate position.

The downstream power wiring of the switching apparatus and possible control wiring thereof may be readily gathered together laterally of the modular supports M.

- 5 The system shown may be installed as a self contained unit or in a distribution cabinet. In a first embodiment, horizontal insulating walls 60a are provided between the different supports M (Figures 1 and 2).

- 10 In a second embodiment (Figure 7), each support M is housed in a box 60 comprising a back wall 61, a front wall 62, an upper wall 63 and a lower wall 64, as well as on the side opposite the fixed portion 11 of the support two spacers 65 and 66 and a side wall 67. The rigidity of walls 62, 67 of the box combined with that of support M
15 provides the desired mechanical strength of the assembly. Walls 63 and 64 have hinges 63a, 64a, for a swinging door 68.

- The front wall 62 forms an apparatus plate for the switching apparatus and comprises at least one window
20 62a for passing therethrough the button B of each apparatus, while being shaped and mounted so as to leave the disconnection plate 50 and sensor 51 accessible (Figures 7 and 8). Door 68 has an opening 68a for acceding to the button B and to the operating grip 52 of the sensor 51. The sensor
25 further has an aperture for padlocking the sensor in the open position 3 of the switching device; it can thus be seen that the operator may test button B and lock the apparatus in the open state without having to open the door 68, the disconnection block being able to remain clipped in position.

- 30 Some walls of the box, for example the lower wall 64, may play the role of cabinet dividing wall. There are further provided in the disconnection plate 50 three apertures 70a, 70b, 70c coinciding in the disconnection position of block 30 with three corresponding apertures in the cylinder
35 40 or in the slide for a "three padlock" type of locking of the block.

In the lower part of the disconnection plate 50 shown at the bottom of Figure 8 may be seen a window 71 by which the operator can check effective breaking by means of indicator means connected to the mobile part of block 30 and appearing in this window in the disconnection position.

In Figure 9, a padlock 73 has been shown engaged in an aperture 40a of the cylinder 40 and in a corresponding aperture 70 of the disconnection plate 50. Plate 50 has in its rear portion a facet 50a which hides a screw not shown for fixing the apparatus plate 62 to the support. Plate 50 is retractable, for example by pivoting about a pin 50b for releasing the fixing screw. It will thus be understood that action on the switching device I or removal thereof can only take place after the disconnection plate 50 has been pivoted for removing the apparatus plate 62. In addition, the plate 50 can only pivot into the open position 50c in the disconnection position of the mobile part of block 30; cooperating portions are provided for this purpose on the plate and on the mobile part, for example cylinder 40, of the block 30 for preventing the plate 50 from being opened in the clipped on position.

Case E of the distribution column illustrated in Figure 10 houses several bars B and has, on its rear outer part, an added angle iron 76. To this angle iron is fixed on the disconnection block 30 side a flat protective conductor 77; this conductor 77 is disposed optionally and is placed in contact in the clipped on position of block 30 with a resilient conducting piece 78 provided on the block.

The above described distribution system operates as follows.

With the distribution column C mounted in the open air or in a casing, for example a cabinet, the operator who desires to dispose on the column a lateral modular support M positions this support horizontally for engaging the tenons 11h and locking pieces 11i in the respective

apertures 20, 21 of the front 14a, 15a, and rear 14b, 15b flanges of case E, whereas the support is held applied against projections 72 then he fixes the support by locking the quarter of a turn piece 11i.

5 For a disconnection operation, the operator grips the button or grip 52 and moves the sensor 51 in the direction of arrow A (Figures 2 and 4) until the end of the sensor abuts against the button B of the switching apparatus I.

If the sensor detects the position 3, i.e. the
 10 "open" or "off" position of the apparatus (Figure 2), the operator may fit the key controlling the disconnection into the slotted aperture 55 and into the corresponding coaxial housing 43 of cylinder 40, the respective slots of the aperture and of the housing being aligned. By turning the key,
 15 the operator then causes the shaft to pivot and slide 32 to move. The prebreak microcontact 42 is actuated by the rearward movement of cylinder 40 against the return spring 41 when the operator introduces the key. The operator may then without risk actuate the switching apparatus and check
 20 the auxiliary devices thereof.

If the sensor detects the position 2, i.e. "closed" or "on" position of the apparatus, its insufficient movement does not allow housing 43 to come opposite aperture 55, so that the disconnection control key cannot be inserted.

25 When, after disconnection, the operator desires to reconnect the slide 32, he cannot effect this operation if the switching apparatus I is in the "on" position, since hereagain the insufficient travel of the sensor prevents the key from being inserted.

30 It should be noted that the system described offers safety during assembly and disassembly operations carried out on supports 11 of column C. Because the engagement/disengagement direction of the supports 11 is perpendicular to the clipping-unclipping direction of the disconnection block 30, it is impossible,

when the mobile part of block 30 is in the withdrawn position, to engage support 11 on the column or, when the support is mounted on the column, to disengage it therefrom.



CLAIMS

1. A distribution system for electric switching apparatus (I), comprising a distribution column (C) which comprises vertical non coplanar busbars (B1-B5) centered in different parallel vertical planes, and a protective case (E) disposed about the bars, characterized by :

- a plurality of supports (M) which extend in a direction parallel to the plane of said bars (B1-B5), each support comprising at least one bearing wall (11f, 11g) which may be applied against a respective fixing face (14a, 14b, 15a, 15b) of the protective casing (E) of the column (C) and being adapted for supporting :

- . on the one hand, at least one switching apparatus (I),
- . on the other hand, a current tapping and disconnecting member (30) having clips (31) clippable on the distribution bars (B) by introducing them through traps (16) provided in one side (14, 15) of the case perpendicular to the planes of the bars,

- the current tapping and disconnecting member (30) comprising means for connection to the switching apparatus and a mobile disconnecting part (32) adapted to be actuated by manual control means.

2. The system according to claim 1, characterized in that the fixing faces (14a, 14b, 15a, 15b) provided on the protective case (E) for receiving the bearing walls (11f, 11g) of the supports (M) are perpendicular to the sides (14, 15) of the case in which the traps (16) are formed for passing the connecting clips (31).

3. The system according to claim 2, characterized in that said clipping traps (16) are provided



on two opposite sides (14, 15) of the case (E) of the distribution column (C), bearing projections (72) being also provided for the supports (11) on said sides (14, 15).

4. The system according to claims 2 or 3, characterized in that the case (E) of said distribution column (C) has at least one fixing flange (14a, 14b, 15a, 15b) perpendicular to said side (14, 15) formed with traps (16) for passing the connecting clips therethrough, the fixing flange comprising, at regular intervals (h), passage apertures (20, 21) for tenons and locking pieces connected to the apparatus supports.

5. The system according to claim 4, characterized in that each support (M) comprises a vertical fixing front (11f) and rear (11g) wall joined by a web (11d) having an opening (11e) for passing the connection clips therethrough, the front fixing wall being provided with at least one tenon (11h) and one locking piece (11i), said rear wall being provided with at least two tenons (11h) having axes perpendicular to the planes of the bars.

6. The system according to one of the claims 1 to 5, characterized in that the support (M) comprises a portion (11) fixed with respect to the case (E) of the column and a portion (12) which is adjustable in depth with respect to the fixed portion of the support comprising the vertical web (11d) and at least one horizontal face (11b, 11c) having means (11a) for adjusting the adjustable portion, the adjustable portion comprising a fixing platen for the switching apparatus (I).

7. The system according to claim 6, characterized in that said adjustable portion (12) of said support (M) is a platen having evenly spaced perforations (12a) for fixing switching apparatus (I).



8. The system according to claim 7, characterized in that said adjustable platen (12) supports, by means of telescopic lugs (74), several horizontal rails (75) for supporting modular switching apparatus.

9. The system according to one of the claims 1 to 8, characterized in that each support (M) is provided with means for fixing the current tapping and disconnecting block (30).

10. The system according to one of the claims 1 to 9, characterized in that said current tapping and disconnecting block (30) comprises a fixed portion having means for connection to the switching apparatus and supporting manual disconnection control means and comprises a mobile portion including a slide (32) having clips (31) clippable on the distribution bars (B1 - B5) and unclippable therefrom, the translational movement of the slide being caused so as to provide connection and respectively disconnection by the rotation of a rotary shaft (33) controlled by the manual control means.

11. The system according to claim 10, characterized in that the translational movement of said slide (32) takes place in response to the rotation of said rotary shaft (33) by at least one rack (36) and pinion (35) connection.

12. The system according to one of the claims 10 and 11, characterized in that said current tapping and disconnecting block (30) has a disconnection plate (50) with a front slotted aperture (55) and having a rotary cylinder (40) which comprises a slotted housing (43) coaxial with said aperture and which is interlocked for rotation with said rotary shaft (33), the slots of the aperture of the plate



and of the housing of the cylinder being adapted to receive an operating key and only coinciding in a connection position and in a disconnection position.

13. The system according to one of the claims 1 to 12, for fitting switching apparatus (I) comprising a manual button or lever (B), characterized in that said current tapping and disconnecting block (30) comprises a sensor (51) having a manual grip (52), a stop and a free end disposed in depth at the level of the control lever of the apparatus, the stop of the sensor cooperating with a bearing surface of the mobile part of the disconnecting block for preventing the disconnection and re-connection when the sensor detects that the lever of the apparatus is in the "on" position.

14. The system according to one of the claims 12 and 13, characterized by the fact that the stop of the sensor cooperates with a cam (44) belonging to the rotary cylinder (40) driving the disconnection control shaft (33).

15. The system according to one of the claims 12 to 14, characterized in that there are provided on the mobile disconnection part (32) elements indicating the respective connection and disconnection states, and in the disconnection plate (50) a window (56, 71) opposite which the indicator elements are able to appear.

16. The system according to one of the claims 1 to 15, characterized in that said fixed portion and said mobile portion of the current tapping and disconnection block (30) each have at least one aperture (57), which apertures are opposite each other in the disconnection position so as to allow in this position the insertion of a padlock.

17. The system as claimed in one of the claims



13 to 16,
characterized in that the sensor has an aperture for introducing a padlock for locking the sensor in its position detecting the "open" state of the switching apparatus.

18. The system according to one of the claims 1 to 17,
characterized in that a prebreak device cooperates with a mobile portion of the current tapping and disconnecting block for actuating at least one prebreak contact associated with the switching apparatus (I).

19. The system as claimed in claim 18,
characterized in that said prebreak device comprises a microcontact (42) responsive to the movement of the sensor (51) from its rest position.

20. The system as claimed in claim 18,
characterized in that said rotary cylinder (40) of the current tapping and disconnection block (30) is mounted for translational movement on the rotary shaft (33) while being urged by a return spring (41), the cylinder being caused to move against the force of the spring during manual control of the disconnection, the prebreak device comprising a microcontact (42) responsive to the movement of the cylinder along the axis of the shaft.

21. The system according to one of the claims 1 to 20,
characterized in that each support (M) with the associated disconnection block is enclosed in a box having an apparatus plate (62) and a pivoting door (68).

22. The system as claimed in claim 21,
characterized in that the disconnection plate (50) covers a fixing zone of the apparatus plate (62) to the support, said disconnection plate (50) being retractable for disengaging this fixing zone.



23. The system according to claim 22, characterized in that said disconnection plate (50) and said mobile portion (32) of said disconnection block (30) have cooperating means preventing the disconnection plate (50) from being retracted in the clipped-on position of the block.

24. A distribution column for switching apparatus (I) disposed on supports (M) of a distribution system, comprising vertical non coplanar busbars (B1-B5) centered in different vertical parallel planes, a protective envelope (E) disposed about the bars and at least a side (14, 15) perpendicular to the planes of the bars (B1-B5) and having passage traps (16) for passing therethrough clips for connection of a current tapping and disconnecting member (30) associated with each support. characterized in that at least one fixing flange (14a, 14b, 15a, 15b) perpendicular to said side (14, 15) and having, at regular intervals (h), apertures (20, 21) for passing tenons and locking pieces connected to the supports (M) of the switching apparatus (I).