

A COMPACT SWITCHGEAR AND A SHUTTER ARRANGEMENT THEREFOR

FIELD

The invention relates to a switchgear and more particularly to a compact switchgear having more simplified construction.

BACKGROUND

In the present electrical energy distribution system, switchgear plays a crucial role. According to the present scheme, the switchgear performs three primary functions in relation to electrical energy distribution. These primary functions are electrical protection, electrical isolation of sections of an installation, and control. Electrical protection function of the switchgear relates to protection of circuit elements against the thermal and mechanical stresses of short-circuit currents, protection of persons in the event of insulation failure and protection of appliances and apparatus being supplied with power. Electrical isolation function of the switchgear relates to de-energizing or isolating equipment to allow work to be done safely on the isolated part. Control functions of the switchgear allow operating personnel to modify a loaded distribution system at any moment, according to requirements. Control functions of the switchgear include routine switching, emergency switching and maintenance operations on the power system.

The above mentioned functions are provided by the switchgear through various functional units of the switchgear. The different functions are subdivided among different components within the functional units of the switchgear. One of the key units in the switchgear is the circuit breaker. The size of the switchgear is often governed by circuit breaker used in the construction of the switchgear. One other factor affecting the size of the switchgear is the type of racking. Conventionally on the basis of the type of racking of circuit breaker, there exist two types of construction for switchgear namely vertical isolation and horizontal isolation. However in both the types of construction, the contact arms of the circuit breaker occupy a large amount of space. Moreover, due to long contact arms of the circuit breaker, the cost of material is also high. The long contact arms leads to a longer current flow path which contributes to power loss, generation of heat and excess material usage. Also there is difficulty in assembling the switchgear, as

various components of the switchgear are assembled onsite and not pre-assembled. Also the presence of dual shutter mechanism and a vent for mounting the gas duct causes the switchgear to be vulnerable to dust. This causes the ingress protection rating of the switchgear to suffer.

Switchgears are often used in built-up areas or other spatially restricted areas. Hence the compactness of the switchgear is very important, in addition to the performance, simplicity of construction and assembly. Therefore there is a need for a compact switchgear having more simplified construction and more improved performance.

OBJECTS OF THE INVENTION

It is an object of the invention to provide a compact switchgear which has a more simplified construction.

Another object of the invention is to provide a compact switchgear which is cost effective

Yet another object of the inventions is to provide a compact switchgear having increased cable termination height.

It is also another object of the invention is to provide a compact switchgear having a current path which is shorter and has better ingress protection.

It is yet another object of the invention is to provide a shutter arrangement for the compact switchgear of the invention.

SUMMARY OF THE INVENTION

Accordingly, the invention provides a switchgear having a circuit breaker and a monoblock. The circuit breaker has two sets of movable contacts, one set of movable contacts electrically connectible to the jumpers and the other set of movable contacts electrically connectible to the current transformer. The monoblock has two sets of stationary contacts, one set of stationary contacts being electrically connected to the jumpers and the other set of stationary contacts being electrically connected to the current transformer. The monoblock is electrically connectible to the circuit breaker. The one set of movable contacts of the circuit breaker and the other set of movable contacts of the circuit breaker are slidable over the corresponding one set of stationary contacts of the monoblock and the corresponding other set of stationary contacts of the

monoblock respectively, to allow engagement or disengagement. This engagement or disengagement electrically connects or disconnects the circuit breaker and the monoblock, respectively.

The invention also provides a shutter arrangement for the switchgear of the invention. A shutter arrangement for switchgear comprises of a shutter provided between the two sets of movable contacts of the circuit breaker and two sets of stationary contacts of the monoblock when they are disengaged, and an operating means for operating the shutter. The said shutter is located in corresponding relation to the said two sets of movable contacts of the said circuit breaker and the said two sets of stationary contacts of the said monoblock, such that it moves to allow the engagement or disengagement of the said two sets of movable contacts of the said circuit breaker with the corresponding said two sets of the stationary contacts of the monoblock, in accordance to the relative movement of the said circuit breaker

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram of conventional horizontal isolation switchgear according to prior art;

Fig. 2a is a schematic diagram of the switchgear according to the invention with the contacts of the circuit breaker and the monoblock in disengaged position;

Fig. 2b is a schematic diagram of the switchgear according to the invention with the contacts of the circuit breaker and the monoblock in engaged position;

Fig. 3 is an isometric view of the circuit breaker according to the invention;

Fig. 4a is an isometric view of the monoblock according to the invention; and

Fig. 4b shows the monoblock of Fig. 4a according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

The invention relates to a compact switchgear having more simplified construction. The invention is described more in detail with reference to an exemplary embodiment.

Fig. 1 is a schematic diagram of conventional horizontal isolation switchgear 100 consisting of power cable 110, current transformer 120 connected to current transformer side stationary contact 140, jumpers 130, busbars 160 connected to bus side stationary contact 150, gas duct 170, circuit breaker 180 and dual shutter mechanism 190. The circuit breaker includes a circuit breaker pole 183 on which two contact arms 184 and 185, are located. The contact arms 184 and 185 have contacts 186 and 189 respectively. The contact 186 of the circuit breaker 180 is electrically connectible to the current transformer side contact 140. The contact 189 of the circuit breaker 180 is electrically connectible to the bus side contact 150. Additionally a vent 175 is provided on the top of the switchgear 100 for integration of gas duct 170.

During the normal course of operation there exists an electrical connection between the bus side stationary contact 150 and current transformer side stationary contact 140. When the circuit breaker 180 becomes active, the circuit breaker pole 183 moves in a horizontal manner, causing the dual shutter mechanism 190 to be drawn. On movement of the circuit breaker pole 183, the two shutters of the dual shutter mechanism 190 are pulled away from each other by the operating mechanism of the dual shutter mechanism 190 in a vertical manner. This causes the stationary contacts 150 and 140, to be exposed to the contacts 186 and 189 of the circuit breaker 180, whereby the contacts 186 and 189 of the circuit breaker 180 come into contact with the stationary contacts 140 and 150 thereby having engagement of contacts.

This movement of the circuit breaker pole 183 requires vacant space in the switchgear 100. The space to be left vacant is in direct relation to the length of the contact arms 184 and 185 of the circuit breaker 180. Hence switchgears having circuit breaker with longer contact arms are large in size. This is an undesirable feature in switchgears. The space above the circuit breaker 180 is also not utilized in the conventional design of switchgear 100. Additionally when contact arms of the circuit breaker are long, the cost of material is also high. In the conventional design the current carrying path is long. This results in power loss, increased generation of heat and excess copper usage. Moreover in the conventional design, an increase in the cable termination length (a desired feature that would help to improve thermal life of the switchgear) would result in increasing the dimensions of the switchgear which is not desired. The vent 175 provided in the conventional design on the top for integration of gas duct 170 causes dust to get into the switchgear 100. This causes the ingress protection class ratings of the switchgear to suffer.

The invention solves these problems by proposing a new construction for the switchgear. Fig. 2a and 2b are schematic diagrams of the switchgear 200 according to the invention. For the sake of simplicity, only the relevant parts of the switchgear which have been rearranged are illustrated in the figures.

Fig. 2a is a schematic diagram of the switchgear 200 according to the invention with the movable contacts and stationary contacts in disengaged position and with the shutter in between the movable contacts and stationary contacts. The circuit breaker 210 has two sets of movable contact 216 and 219, which are perpendicular to the axis of circuit breaker pole 213. The current transformer 250 is located on top of the circuit breaker 210. In an exemplary embodiment, the current transformer 250 along with the power cable 270 is side mounted on the top of the circuit breaker 210. Adjacent to the current transformer 250, the jumpers 230 are present. The jumpers 230 are located on top of a monoblock 260. This monoblock has two sets of stationary contacts 263 and 266, one set of stationary contacts 263 electrically connected to the jumpers 230 and the other set of stationary contacts 266 electrically connected to the current transformer 250. Both the sets of stationary contacts 263 and 266 are located in the monoblock 260. The monoblock 260 is located in corresponding relation to the circuit breaker 210 in such a manner that both the sets of movable contacts 216 and 219 of the circuit breaker 210 can be accommodated within the lower portion of the monoblock 260, in which the lower portion of the monoblock is hollow. The lower portion of the monoblock has compartments which can accommodate both the sets of movable contacts 216 and 219 of the circuit breaker 210. A shutter arrangement 220 is provided for the switchgear 200. The circuit breaker 210 of the invention has a moving means / arrangement to move the circuit breaker 210. In the exemplary embodiment this moving arrangement is shown by a racking handle 283, racking screw 286 and a frame with wheels 289. By operating the racking handle 283, the operator can move the circuit breaker 210 in switchgear 200.

Fig.2b shows both the sets of the movable contacts 216 and 219 of the circuit breaker 210 engaging with both the sets of stationary contacts 263 and 266 of the monoblock 260. The shutter 223 of the shutter arrangement 220 is moved so as to allow the engagement of the contacts of the circuit breaker and of the monoblock.

Fig. 3 shows a circuit breaker of the switchgear in accordance with the invention. From the Fig. 3 it is seen that both the sets of movable contacts 216 and 219 of the circuit breaker 210 are mounted directly on the circuit breaker pole 213, thereby eliminating the contact arms 184 and 185 of the circuit breaker shown in Fig. 1.

Figs. 4a and 4b show the monoblock 260 of the invention. The two sets of the stationary contacts 263 and 266 are located in the monoblock 260.

Upon activation, the circuit breaker 210 moves horizontally towards the monoblock. This causes the circuit breaker pole 213 to move into the compartment in lower portion of the monoblock 260, causing the both sets of movable contacts 216 and 219 of the circuit breaker 210 to engage with the both the sets of stationary contacts 263 and 266 of the monoblock 260 by sliding over them. In the invention, the gas duct 240 is permanently attached to the switchgear 200, thereby eliminating the vent 175 present in the conventional design.

The shutter arrangement 220 prevents both sets of movable contacts 216 and 219 of the circuit breaker 210 from electrically connecting to both the sets of stationary contacts 263 and 266 of the monoblock 260, accidentally. The shutter arrangement comprises a shutter 223 and operating means 226. The two sets of movable contacts 216 and 219 of the said circuit breaker 210, two sets of stationary contacts 263 and 266 of the monoblock 260 and the shutter 223 are located in corresponding relation to each other, wherein the shutter 223 moves to allow the engagement or disengagement of the said two sets of movable contacts 216 and 219 of the circuit breaker 210 and the said two sets of the stationary contacts 263 and 266 of the monoblock 260, in accordance to the relative movement of the circuit breaker 210. The operating means 226 of the shutter arrangement 220 operates the shutter 223 on the basis of the movement of the circuit breaker 210. The operating means 226 consists of shutter guide 227 and operating levers 228. The movement of the shutter 223 is guided by the shutter guide 227. The shutter 223 is moved through the operating levers 228 which are mechanically connected to the circuit breaker 210.

Due to this novel and inventive construction through the use of monoblock, the switchgear is more compact. By removing the contact arms of the circuit breaker, the cost of material is also reduced, increasing the cost effectiveness of the switchgear. Due to the monoblock, the switchgear gains a modular character to itself, thereby simplifying assembly process. The

monoblock assembly can be independently assembled. This also reduces or eliminates incorrect assembly. Similarly, due to the introduction of the monoblock for connection, the need for having the current transformer within close proximity of the circuit breaker is also eliminated. This allows for placing the current transformer in a higher plane so as to increase the cable termination length without increasing the height of the circuit breaker. By reducing the size of the switchgear and by eliminating the contact arms of the circuit breaker, the current carrying path is also reduced. This helps in improving the efficiency, reducing power loss, improving thermal life and reducing material usage.

Also through the usage of a single shutter arrangement and the removal of the vent on the top of the switchgear, the switchgear is less vulnerable to dust. This helps improve the ingress protection class.

Therefore the invention provides a compact switchgear which is cost effective, and has current path which is shorter, simple construction, better thermal life management, easy assembly, and better ingress protection.

I / WE CLAIM:

1. A switchgear comprising:
a circuit breaker; and
a monoblock, wherein the said monoblock is electrically connectible to the said circuit breaker.
2. The switchgear as claimed in claim 1, wherein the said switchgear further comprises a shutter arrangement.
3. The switchgear as claimed in claim 1, wherein the said monoblock is located on top of the said circuit breaker.
4. The switchgear as claimed in claim 1, wherein the said circuit breaker is movable.
5. The switchgear as claimed in claim 4, wherein the said circuit breaker includes moving arrangement to move the said circuit breaker.
6. The switchgear as claimed in claim 1, wherein the said monoblock has jumpers.
7. The switchgear as claimed in claim 1, further comprises a gas duct.
8. The switchgear as claimed in claim 1, wherein the said circuit breaker includes two sets of movable contacts, one set of movable contacts being electrically connectible to the jumpers and other set of movable contacts being electrically connectible to the current transformer.
9. The switchgear as claimed in claim 1, wherein the said monoblock includes two sets of stationary contacts, one set of stationary contacts being electrically connected to the jumpers and other set of stationary contacts being electrically connected to the current transformer.
10. The switchgear as claimed in claim 1 further comprising a power cable connected to the current transformer.

11. The switchgear as claimed in claim 10, wherein the length of the said power cable connected to the current transformer is independent of the position of the said circuit breaker.
12. The switchgear as claimed in claims 8, wherein one or more movable contacts of the said one set of movable contacts and the corresponding one or more movable contacts of the said other set of movable contacts, of the said circuit breaker are located on different planes.
13. The switchgear as claimed in claims 9, wherein one or more stationary contacts of the said one set of stationary contacts and the corresponding one or more stationary contacts of the said other set of stationary contacts, of the said monoblock are located on different planes.
14. The switchgear as claimed in claims 8 and 9, wherein the said monoblock further comprises a hollow space to accommodate the said two sets of movable contacts of the said circuit breaker.
15. The switchgear as claimed in claims 8 and 9, or 14, wherein the said one set of movable contacts of the said circuit breaker and the said other set of movable contacts of the said circuit breaker are slidable over the corresponding said one set of stationary contacts of the said monoblock and the corresponding said other set of stationary contacts of the said monoblock respectively, to allow engagement or disengagement; to electrically connect or disconnect the said circuit breaker and the said monoblock.
16. A shutter arrangement, for a switchgear as claimed in any one of the preceding claims, comprising:
 - a shutter provided between the said two sets of movable contacts of the said circuit breaker, and said two said sets of stationary contacts of the said monoblock; and
 - an operating means for operating the said shutter, wherein the said shutter is located in corresponding relation to the said two sets of movable contacts of the said circuit breaker and the said two sets of stationary contacts of the said monoblock, to allow the engagement or disengagement of the said two sets of movable contacts of the said circuit breaker with the corresponding said two sets of the stationary contacts of the monoblock, in accordance to the relative movement of the said circuit breaker.

17. The shutter arrangement as claimed in claim 16, wherein the said shutter has a layer of epoxy.

18. The shutter arrangement as claimed in claim 16, wherein the said shutter is flexible.

19. The shutter arrangement as claimed in claim 16, wherein the said operating means comprises:

a shutter guide for guiding the movement of the said shutter; and
operating levers to move the said shutter, the said operating levers being mechanically connected to the said circuit breaker.

20. A method of operating the switchgear as claimed in any one of the claims 1 to 15 having a shutter arrangement as claimed in any one of the claims 16 to 19, the said method comprising:
moving the said circuit breaker of the said switchgear;
operating the operating means of the shutter arrangement in accordance with corresponding movement of the said circuit breaker;
operating the shutter of the said shutter arrangement to open or close by its corresponding and / or relative movement at an instance, by operating the said operating means during the engagement or disengagement of one set of movable contacts and other set of moveable contacts, of the said circuit breaker correspondingly with the one set of stationary contacts and other set of stationary contacts of the monoblock of the said switchgear respectively in accordance with the respective movement of the said circuit breaker of the said switchgear thereof; and
electrically connecting the said monoblock to the said circuit breaker.