METAL-ENCLOSED SWITCHGEAR WITH IMPROVED INTERLOCK MEANS

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10 Claims

ABSTRACT OF THE DISCLOSURE

Metal-enclosed switchgear comprising improved interlock means for preventing a levering-in operation of a breaker and for preventing simultaneous connection of certain breakers under certain conditions.

Background and objects of the invention

In the art of metal-enclosed switchgear, it is common practice to provide an enclosure having terminals supported thereon; a circuit breaker movably supported on the enclosure for movement between a connected position connected to the enclosure terminals and a disconnected position disconnected from the enclosure terminals; and a levering-in device operable to move the circuit breaker between the connected and disconnected positions. For certain applications, it is desirable to provide an interlock for preventing movement of a circuit breaker into the connected position. Thus, an object of this invention is to provide metal-enclosed switchgear with improved interlock means for preventing a levering-in operation of a circuit breaker. For certain applications, it is desirable to prevent simultaneous connection of certain breakers under certain conditions. For example, it may be desirable to provide a certain sequence of connection of breakers or to provide that only one of two breakers can be in the connected position at any given time. Another object of this invention is to provide metal-enclosed switchgear with improved means for preventing simultaneous connection of certain breakers under certain conditions.

Summary of the invention

Metal-enclosed switchgear comprises an enclosure with terminals supported thereon and a circuit breaker movably supported on the enclosure for movement between a disconnected position and a connected position with relation to the enclosure terminals. A levering mechanism supported on the breaker comprises a levering member that cooperates with a fixed structure on the enclosure. The fixed structure comprises a pair of fixed surfaces with a space therebetween. Interlock means supported on the enclosure comprises an interlock member and a Kirk-type lock having a plunger that is extended to move the interlock member into the space of the fixed structure to an interfering position with the plunger being retracted to permit spring means to move the interlock member out of the space of the fixed structure to a non-interfering position. The Kirk-type lock comprises a key that is locked in position when the plunger is in the retracted position. With the plunger of the lock retracted and the interlock member in the non-interfering position, the levering mechanism may be operated to move the lever member from a disconnected position to a connected position during which movement the lever member moves in the space of the fixed structure against a first of a pair of fixed surfaces to force the breaker from a disconnected position to a connected position wherein the circuit breaker is connected to the terminals of the enclosure. The levering mechanism may then be operated to move the lever member from the connected position to the disconnected position during which movement the lever member moves in the space of the fixed structure against a second of the pair of fixed surfaces to force the breaker from the connected position back out to the disconnected position. With the breaker in the disconnected position, the key of the lock can be retracted to extend the lock plunger during which movement the lock plunger operates the interlock structure to move the interlock member into the space of the fixed structure to an interfering position where the interlock member will prevent movement of the levering member into the space of the fixed structure against the first fixed surface so as to thereby prevent a levering-in operation of the breaker. The levering member is pivotally mounted on the circuit breaker so that as an attempt is made to pivot the levering member into the space of the fixed structure the levering member engages the interlock member, and the force of an attempted connecting operation of the breaker will tend to lift the breaker upward which movement is prevented by stop means on the enclosure. The interlock member may be moved from the interfering position out to the non-interfering position by operation of the key of the lock to retract the plunger whereupon spring means will move the interlock structure to move the interlock member to the non-interfering position and whereupon the key of the lock will be locked on the lock so that the key cannot be removed while the plunger of the lock is in the retracted position. When the circuit breaker is moved to the connected position the levering member, in the space of the fixed structure, prevents movement of the interlock member into the space of the fixed structure so that if an attempt is made to unlock the lock to remove the key, the plunger of the lock, engaging the interlock structure, cannot be extended since the interlock member cannot enter the space of the fixed structure so that the key of the lock is locked in position so long as the breaker is in the connected position. It can be understood that the interlock means can be used for preventing simultaneous connection of certain breakers under certain conditions. For example, if it is desired to provide that only one of two breakers can be in the connected position at a given time, each of the breakers can be mounted in a separate enclosure cubicle with a separate interlock means and lock for each cubicle. A single key can be provided for the two locks. With a first of the breakers in the connected position and the second breaker in the disconnected position the key of the lock of the first breaker will be locked in position and removable only when the first breaker is moved to the disconnected position. By providing one key for the two locks, it can be understood that when it is desired to connect the second breaker the first circuit breaker will have to be disconnected and levered out to permit removal of the key which may then be moved to the lock of the second breaker and operated to permit a levering-in connection of the second breaker whereupon the key will be locked to the lock of the second breaker as long as the second breaker is connected. Thus, each breaker can be connected only when the other breaker is disconnected.

Brief description of the drawings

FIG. 1 is a perspective view, parts broken away, of metal-enclosed switchgear constructed in accordance with principles of this invention;

FIG. 2 is a side view, with parts broken away, of the switchgear of FIG. 1 with the levering member shown in full lines in the disconnected position and in broken lines in the connected position;

FIG. 3 is a plan sectional view of part of the switchgear of FIGS. 1 and 2 illustrating the interlock means in the interfering position and the breaker in the disconnected position;
Fig. 4 is a view similar to Fig. 3 with the interlock means in the non-interfering position and the breaker in the connected position; and Fig. 5 is a side view of the fixed structure seen in Figs. 1–3.

Description of the preferred embodiment

Referring to the drawings, there is shown in Fig. 1, a metal-arc shielded switch 3 comprising an enclosure 5 and a draw-out type circuit breaker 7. The enclosure 5 comprises sheet-metal and supports formed to provide a plurality of cubicles, one of which is illustrated at 9. The enclosure 5 may comprise a plurality of adjacent vertical rows of cubicles. Each of the cubicles 9 comprises a metallic base plate 11, a metallic back barrier plate 13, and a pair of metallic side wall plates 15 only one of which is illustrated in Fig. 1. As is shown in Fig. 1, the cubicle 9 is open at the front thereof. An openable cover (not shown) is supported at the front of the cubicle 9 and movably between open and closed positions in a manner well known in the art. As is seen in Fig. 1, there is a space 17 above the cubicle 9 for another cubicle that would be constructed in the same manner as the cubicle 9 for receiving another circuit breaker 7. The side walls 15 of the enclosure extend back past the barrier 13 to a back wall 18 to provide a back bus-bar compartment between the side walls 15 and back wall 18.

An insulating support 19, having a plurality of openings therein, is supported on the barrier plate 13, and a plurality of conducting stab-type quick-detachable terminals 21 extend through the insulating support 19 into a cubicle 9. The stab terminals 21 extend behind the plate 9 to stab supports 20 that are supported on the enclosure 5 between the barrier plate 13 and back wall 18.

A pair of elongated spaced parallel tracks 25, of suitable construction, are fixedly supported in the cubicle 9. The circuit breaker 7 is provided with a pair of wheels 27 supported at each of the two opposite sides thereof which rest on the tracks 25 to permit easy movement of the circuit breaker 7 between the connected and disconnected positions in a manner well known in the art. The tracks 25 are shown in Fig. 1 as the upper surfaces of the generally U-shaped base member 11. It can be understood that the tracks 25 could be constructed in any of a multitude of ways to provide track means for movement of the circuit breaker 7. For example, the track means may be constructed in the manner more specifically described in the patent application of Fred Bould et al., entitled "Circuit Breaker," Ser. No. 770,296, filed Oct. 24, 1968, and assigned to the assignee of the subject application. The circuit breaker 7 is a multipole circuit breaker with each pole comprising a pair of spaced quick-detachable clip-on type terminal structures 31 (Fig. 2) for connecting the associated pole unit to the associated stab-type conductors 21 that are supported on the enclosure 5. The circuit breaker terminals 31 may be of the type specifically described in the pending application of Richard Hauser, entitled "Disconnecting Contact Assembly," Ser. No. 778,374, filed Oct. 24, 1968, and assigned to the subject application. When the circuit breaker 7 is moved to the right (Fig. 2) to the connected position, the terminals 31 automatically clip on to the stabs 21 to connect the breaker to the stabs 21, and when the breaker is moved to the left to the position shown in Fig. 2 the terminals 31 of the breaker 7 are automatically disconnected from the stabs 21.

A levering-in device 35 (Fig. 1) is provided for moving the circuit breaker 7 between the connected and disconnected positions thereof. The levering-in device comprises a levering arm member 37 that is supported on one end of an elongated rod 39 that is supported on the circuit breaker 7 for rotation about the elongated axis thereof.

The levering member 37 is an arm member having a roller 41 supported at the one end thereof. The levering arm member 37 cooperates with a fixed structure 43 that is fixedly secured in the enclosure 5 on the plate member 11. As can be understood with reference to Fig. 5, the fixed structure 43 is a rigid metallic plate member comprising a pair of arms 45, 47 with a slot or space 49 therebetween to provide a first fixed surface 51 on a side and fixed surface 53 for cooperating with the roller 41 of the levering member 37 in a manner to be hereinafter described.

The levering-in device 35 comprises a mechanism 55 for rotating the levering arm member 37. The mechanism 55 comprises a gear member 57 that is fixedly connected to the rod 39; a worm gear 59 that is suitably supported for rotation on the circuit breaker 7; and a handle structure 61 for rotating the worm gear 59.

Interlock means 65 (Fig. 1) is supported on the enclosure 5. The interlock means 65 comprises an elongated rigid steel rod member 67 supported for pivotal movement about the elongated axis thereof. A rigid steel actuating lever member 69 is welded or otherwise fixedly secured to the rod 67 in proximity to the top of the cubicle 9. A rigid steel L-shaped interlock member 71 is welded or otherwise fixedly secured to the rod 67 in proximity to the fixed structure 43. A torsion spring 75 is supported on the rod 67 to bias the rod 67 to rotate in an upward (1) direction. A pair of steel brackets 77, 79 are fixedly mounted on the one side wall of the enclosure 5 and the rod 67 extends through the openings in the brackets 77, 79, which support the rod for pivotal movement about the elongated axis of the rod. As can be understood with reference to Fig. 2, the torsion spring 75 is also a compression spring that engages the bracket 77 at the lower end thereof and the interlock member 71 at the upper end thereof to resiliently support the interlock means 65 on the bracket 77. Downward movement of the interlock means 65, under the force of the roller 41 when the levering member 37 is in the interfering position in a manner to be hereinafter described, is limited by the engagement of the member 71 with the member 43 at the bottom of the slot 49. Upward movement of the interlock means 65 may be limited by suitable pins (not shown) in the rod 67 that engage the undersurfaces of the member 43 and 77 and 49.

A lock 81 is fixedly supported on a front panel of the enclosure 5 in proximity to the upper end of the cubicle 9. The lock 81 comprises a body portion 83 supported within the cubicle 9, a plunger 85 supported on the body portion 43 and a front key-receiving portion 87 that extends out through a suitable opening in the front panel for receiving a key 89 (Fig. 4) in a manner to be hereinafter described. The lock 81 may be a standard type of lock well known in the art as a Kirk key interlock. This type of lock is manufactured and sold by the R & E division of the J-T-E Circuit Breaker Company. The lock 81 is constructed such that the key 89 is rotated in one direction to extend the plunger 85 and lock the plunger 85 in the extended position. The key 89 can be removed only when the plunger 85 is in the extended position. The key 89 is rotated in the opposite direction to retract the plunger 85 and lock the plunger 85 in the retracted position. The key 89 is locked in the extended position in a lock body 81 when the plunger 81 in the retracted position.

Referring to Figs. 1–3, it will be noted that the circuit breaker 7 is in the disconnected position with the interlock means 65 locked, by means of the lock 81, in the interfering position wherein the interlock member 71 extends into the space 49 between the terminal structure 31 of the fixed structure 43. With the parts in the position shown, if the handle 61 of the levering mechanism 35 is rotated to rotate the worm gear 59 to thereby rotate the gear 57, rod 39 and levering member 37 in a clockwise (Figs. 1 and 2) direction, the roller 41 will engage the levering member 71 and move the rod 67 and member 71 down, against the bias of the spring 75, until the mem-
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ber 71 engages the fixed structure 43 at the base of the slot 49 whereupon increased force on the handle 61 will tend to lift the circuit breaker 7 whereupon the circuit breaker 7 will engage fixed stop means 93 secured to the enclosure and prevent upward movement of the breaker 7 in which case an operator will not be able to rotate the handle 61 so that the operator will not be able to lever the circuit breaker 7 into the connected position. The stop means is shown at 93 as a rigid steel member welded to the sidewall 15. It can be understood that the top of the cubicle 9 could serve as the stop means to prevent upward movement of the circuit breaker. The members 67, 71, 69 and 43 are rigid steel members to withstand the forces that may be applied to these members at the installation.

When it is desired to move the circuit breaker 7 into the connected position, the key 89 (FIG. 4) is inserted into the lock 81 and rotated to retract the plunger 85 from the locked extended position seen in FIG. 3 to the locked retracted position seen in FIG. 4. Upon retraction of the plunger 85, the actuating lever 69 is released permitting clockwise (FIGS. 3 and 4) movement of the rod 67 to engage the spring 75 and to move the rod 67 from the interfering position seen in FIG. 3 to the non-interfering position seen in FIG. 4 in which position the interlock member 71 is withdrawn from the space 49 (FIG. 5) between the fixed surfaces 51, 53. With the interlock means 65 in the non-interfering position, an operator can operate the handle 61 (FIG. 1) to rotate the levering member 37 in a clockwise (FIG. 2) direction. During this movement, the roller 41 moves into the space 49 (FIG. 5) engaging the fixed surface 51 of the fixed structure 43, and as the member 37 is rotated on the circuit breaker 7 from the position seen in full lines in FIG. 2 to the position seen in broken lines in FIG. 2, the roller 41 operates against the fixed surface 51 to force the circuit breaker 7 on the track 25 to the right to the connected position wherein the terminals 31 are clipped on the stab-type terminal conductors 21. The terminals 31 are shown in the connected position in FIG. 2 by means of broken lines.

When it is desired to operate the circuit breaker 7 from the connected position to the disconnected position, the operating handle 61 is rotated in the opposite direction to rotate the levering member 37 in a counterclockwise (FIG. 2) direction from the position shown in broken lines in FIG. 2 to the position shown in full lines in FIG. 2. During this movement, the roller 41 operates against the fixed surface 53 (FIG. 5) of the fixed structure 43 to force the breaker to the left from the position wherein the breaker terminals 31 are connected to the stab conductors 21 to the disconnected position seen in full lines in FIG. 2.

When the plunger 85 of the lock 81 is in the retracted position shown in FIG. 4, the plunger 85 is locked in the retracted position and the key 89 is locked to the lock body 81. With the circuit breaker 7 in the connected position, if an attempt is made to remove the key 89 by operating the key 89 to the position wherein the plunger 85 is extended, the plunger 85 will engage the actuating member 69 tending to force the rod 67 in a counterclockwise (FIG. 4) direction, and the interlock member 71 will engage the roller 41 to prevent this counterclockwise movement of the interlock means 65 thereby preventing an operation of the key 89 that would extend the plunger 85. If the key 89 cannot be removed unless the plunger 85 is extended, it can be understood that when the breaker 7 is in the connected position the key 89 is locked to the lock body 81.

It can be understood that the invention provides interlock means that can be used to prevent simultaneous contradictory movements under simultaneous key for, example, as when it is desired to provide that only one of two breakers can be in the connected position at any given time. For example, two breakers 7 can both be mounted in two separate cubicles 9 with a separate interlock means 65 in each cubicle and a separate lock 81 for operating each interlock means 65, and with a single key 89 provided for the two locks 81. In this case, when a first breaker 7 is in the connected position the single key 89 is locked in position on the associated lock 81. The single key 89 is removable from the associated lock 81 only after the first breaker 7 is drawn out to the disconnected position. When it is desired to connect the second breaker, the first breaker 7 must be drawn out from the connected to the disconnected position whereabouts the key 89 may be operated to retract the associated plunger 85 in which case the associated interlock means 65 will be operated to the interfering position (FIG. 3) and the key 89 can then be removed from the lock 81 and moved over to the lock 81 that is associated with the second breaker to operate the interlock means 65, that is associated with the second breaker, to the non-interfering position. The second breaker can then be levered into the connected position in which case the single key 89 will then be locked to the lock, that is associated with the second breaker, until the second breaker is drawn out to the disconnected position.

As can be understood with reference to FIG. 1, a single rod 67 could be elongated in an enclosure 5 to simultaneously operate a plurality of interlocks in a plurality of vertical cubicles.

I claim as my invention:

1. Metal enclosed switchgear comprising an enclosure, enclosure terminal means supported on said enclosure, a circuit breaker comprising a terminal means for cooperatively engaging said enclosure terminal means, means supporting said breaker on said enclosure for movement between a disconnected position wherein said breaker terminal means is disconnected from said enclosure terminal means and a connected position wherein said breaker terminal means is connected to said enclosure terminal means, a levering mechanism supported on said breaker and comprising a levering member, said levering mechanism comprising operating means for moving said levering member between a disconnected position and a connected position, a fixed structure supported on said enclosure and comprising a pair of fixed surfaces with a space therebetween, interlock means supported on said enclosure, said interlock means comprising an interlock member and means for moving said interlock member between a non-interfering position wherein said interlock member is out of said space and an interfering position wherein said interlock member is in said space, said interlock member in said non-interfering position, said levering member being movable from a disconnected position to a connected position during which movement said levering member moves in said space against a first of said fixed surfaces to force said breaker from the disconnected position to the connected position, said interlock member in said non-interfering position said levering member being movable from said connected position to said disconnected position during which movement said levering member moves in said space against the second of said fixed surfaces to force said breaker from the disconnected position to the connected position, said interlock member in said interfering position said interlock member preventing movement of said levering member into said space against said interfering surface to thereby prevent movement of said breaker from said disconnected position to said connected position.

2. Metal enclosed switchgear according to claim 1, said lock means supported on said enclosure, said lock means comprising a lock body a lock plunger movable on said lock body between a retracted position and an extended position, a key insertable into said lock body and operable to move said plunger between said retracted and extended positions, upon operation of said key to move said
plunger to said extended position said plunger operating against said interlock means to move said interlock member to said interfering position, said key being removable from said lock body when said plunger is locked to said extended position, said interlock means comprising biasing means biasing said interlock means toward the non-interfering position, upon operation of said key to move said plunger to said retracted position said biasing means biasing said interlock means to move said interlock member to said non-interfering position, said lock comprising means locking said key to said lock body when said plunger is in said retracted position, and with said breaker in the connected position and said interlock means in said non-interfering position and said plunger in said retracted position with said key locked to said lock body said leveraging member engaging said interlock member to prevent movement of said interlock means from said non-interfering position to said interfering position and said interlock means engaging said plunger to prevent movement of said plunger to said extended position whereby said plunger is maintained in the retracted position and said key is locked to said lock body so long as said breaker is in said connected position.

3. Metal enclosed switchgear according to claim 1, said interlock means comprising an elongated rod member supported for pivotal movement about the elongated axis thereof, said interlock member being fixedly connected to said elongated rod spaced from said interlock member, lock means supported on said enclosure and comprising a lock plunger movable to an extended position to operate against said actuating lever to move said interlock member to the interfering position with said plunger being movable to the retracted position to release said actuating lever to effect movement of said interlock member to the non-interfering position.

4. Metal enclosed switchgear according to claim 1, said fixed structure supported on said enclosure comprising a generally U-shaped member with said space being the space between the legs of said U-shaped member and with said pair of fixed surfaces being surfaces on the legs of said U-shaped member, and said interlock member being movable into said space between the legs of said U-shaped member in the interfering position of said interlock member.

5. Metal enclosed switchgear according to claim 1, said interlock means comprising an elongated rod supported for pivotal movement about the elongated axis thereof, said interlock member comprising a member fixed to said rod and movable with said rod, an actuating member fixed to said rod spaced from said interlock member, said interlock means comprising spring means biasing said rod in a first direction to the non-interfering position thereof, lock means comprising a movable plunger movable to an extended position to operate against said actuating lever to move said interlock member into said interfering position, said plunger being movable to a retracted position to release said actuating lever whereby when said space means biases said actuating lever said rod and said interlock member to the non-interfering position.

6. A metal enclosed switchgear according to claim 1, said actuating lever member comprising a lever arm supported on said breaker for movement of said breaker, a part carried on said lever arm for cooperation with said fixed surfaces, upon rotation of said lever arm in a first direction said part operating against said fixed surface to move said breaker to said connected position, upon rotation of said lever arm in the opposite direction said part operating against said second fixed surface to move said breaker to said disconnected position, with said interlock member in said interfering position said part engaging said lever member such that a force applied to rotate said lever member will tend to lift said breaker, and stops means on said enclosure preventing lifting of said breaker to thereby prevent movement of said breaker to the connected position when said breaker is in said interfering position.

7. Metal enclosed switchgear according to claim 6, said interlock means comprising an elongated rod supported for movement about the elongated axis thereof, said interlock member being fixedly secured to said elongated rod, an actuating lever fixedly secured to said elongated rod spaced from said interlock member, spring means biasing said interlock means toward said non-interfering position, lock means fixedly supported on said enclosure, said lock means comprising a lock body and a plunger movable on said lock body across a retracted position and an extended position, a key insertable in said lock body and movable to retract and extend said plunger, with said breaker in said disconnected position said key being operable to extend said plunger whereby said plunger operates against said actuating lever to move said interlock means to move said interlock member to said interfering position, stops said key being removable from said lock body when said plunger is locked in said extended position, upon insertion of said key into said lock body and operation of said key to retract said plunger said actuating lever being released and said spring means biasing said interlock means to move said interlock member from said interfering position to said non-interfering position, with said plunger locked in said retracted position said key being locked to said lock body, and with said circuit breaker operated to said connected position said part of said lever arm engaging said interlock member to prevent movement of said interlock member said rod and said actuating lever to said interfering position whereby if an attempt is made to operate said key to extend said plunger said actuating lever engaging said plunger will prevent movement of said plunger to said extended position whereby said key is locked to said lock body so long as said breaker is in said connected position.

8. Metal enclosed switchgear according to claim 7, said fixed structure comprising a generally U-shaped structure with said space between the legs of said U-shaped structure, and said interlock member moving into and out of the space between the legs of said generally U-shaped structure upon operation of said interlock means.

9. Metal enclosed switchgear according to claim 8, said enclosure comprising horizontal track means, said breaker comprising roller means supported on said horizontal track means, said breaker being movable horizontally to the connected and disconnected positions thereof, said interlock means comprising said elongated rod member extending vertically on said enclosure and movable about a vertical axis between said interfering and non-interfering positions.

10. Metal enclosed switchgear according to claim 9, said enclosure terminal means comprising stab-type terminals, and said circuit breaker terminal means comprising quick-detachable clip-on type terminal means for cooperating with said stab-type terminals.