June 1, 1943. G. L. CLAYBOURN ET AL 2,320,849

INTERLOCK SYSTEM

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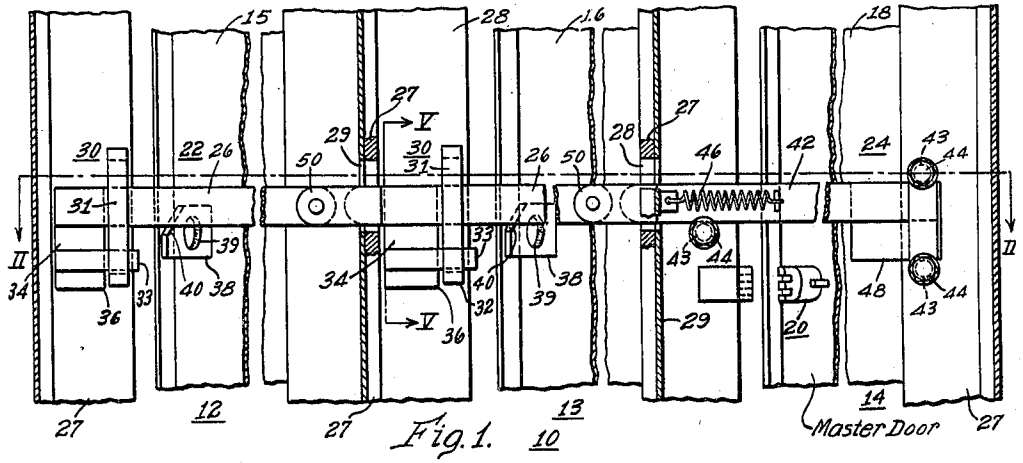


Fig. 1.

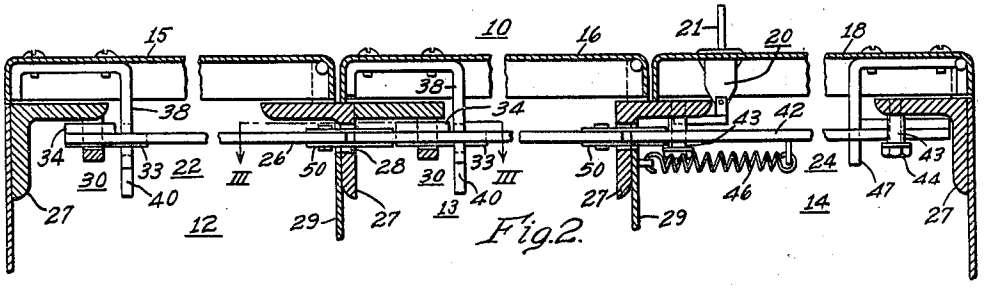


Fig. 2.

Fig. 3.

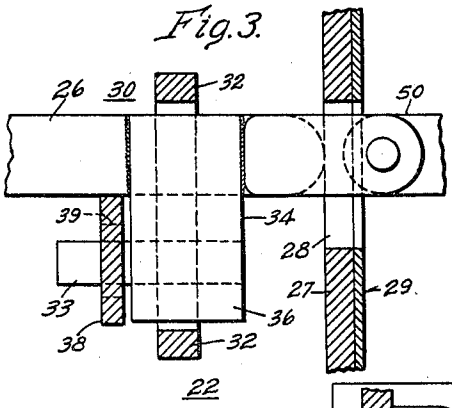


Fig. 4.

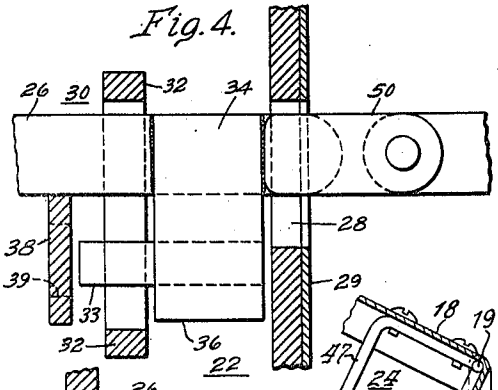


Fig. 5.

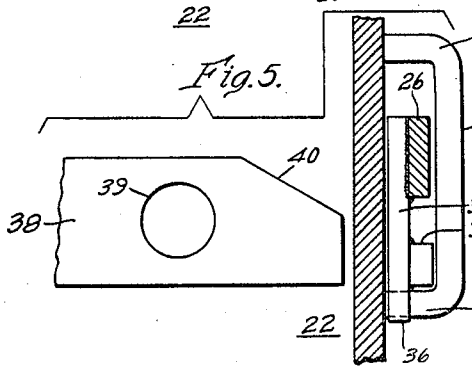


Fig. 6

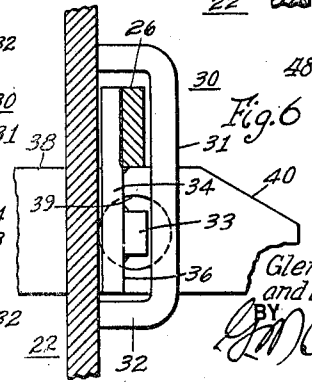
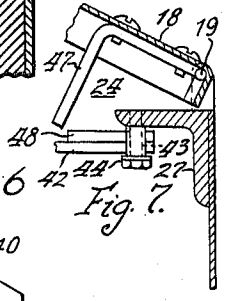


Fig. 7.



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INTERLOCK SYSTEM

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11 Claims. (Cl. 70—265)

Our invention relates, generally, to interlocks, and has reference, in particular, to a mechanical interlock system for a plurality of doors disposed to be operated in a predetermined sequence, such, for example, as the multiple swinging doors or covers on metal enclosed switchgear or other metal enclosures for high voltage equipment.

Generally stated, it is an object of our invention to provide a mechanical interlock system for a plurality of enclosure doors that is simple and inexpensive to manufacture and install and which is positive and reliable in operation.

More specifically it is an object of our invention to provide for mechanically interlocking a plurality of doors with a master door so that the master door cannot be closed until all the other doors are closed, and none of the other doors can be opened until the master door, which may be provided with a separate lock device, is opened.

A further object of the invention is to provide for interlocking a plurality of doors of a switchgear enclosure with a master door so that only a single lock device on the master door is required for securing all of the doors in a closed position.

Yet another object of our invention is to provide for utilizing an interlock mechanism to prevent the closure of a master door of a switchgear enclosure until a plurality of sub-enclosure doors thereof are in the closed position.

Still another object of the invention is to provide for simultaneously actuating the latch members of a plurality of enclosure doors in response to closure of a master door only when the plurality of doors are in predetermined positions.

Other objects will, in part, be obvious and will, in part, be explained hereinafter.

In accordance with our invention, a plurality of sub-enclosure doors positioned in side-by-side relation with a master door may be mechanically interlocked therewith by utilizing a latch mechanism including a plurality of pivotally connected latch bars slidably supported by the enclosure frame adjacent the associated doors for actuating locking pins to lock the said associated doors. Depending stop members on the latch bars lock the latch bars in the open position and projecting keepers with which the lock pins interfere when the associated doors are in closed position are arranged to lift their respective latch bars when the doors are closed, so that the stop members are rendered ineffective to prevent movement of the latch bars to the closed position. The latch bars are operatively connected to the master door by means of a connector bar and a projecting stop on the master door so that the master door cannot be closed until all of the associated sub-enclosure doors are closed, and closure of the master door then actuates the latch bar to lock the associated sub-enclosure doors in the closed position. The master door may then be locked by means of any suitable lock device.

For a more complete understanding of the nature and scope of our invention, reference may be had to the accompanying drawing, in which:

Figure 1 is a partly sectioned front elevational view from within a switching enclosure illustrating an interlock system embodying the principal features of the invention with the doors of the enclosure shown in the open position;

Fig. 2 is a sectional view taken along the line II—II of Fig. 1 with the doors in the closed position;

Fig. 3 is an enlarged sectional view of the latch mechanism taken along the line III—III of Fig. 2;

Fig. 4 is an enlarged sectional view of the latch mechanism of Fig. 3 in the semi-open position;

Fig. 5 is an enlarged sectional view of the latch mechanism taken along the line V—V of Fig. 1;

Fig. 6 is an enlarged sectional view of the latch mechanism of Fig. 5 in the closed position; and

Fig. 7 is an enlarged partial view of the section shown in Fig. 2, with the master door in the open position.

Referring to Figs. 1 and 2 of the drawing, the reference numeral 10 may denote, generally, a switchgear enclosure of a type well known in the art having, for example, a plurality of separate compartments 12, 13 and 14 provided with hinged doors 15, 16 and 18, respectively.

The door 18, which will hereinafter be referred to as the master door, may be provided with a hinge pin 19 about which it pivots, and any suitable lock device, such as, for example, a key-operated lock device 20 operated by means of a key 21 normally contained in a lock on other switchgear apparatus (not shown), with the operation of which the master door 18 and the doors 15 and 16, hereinafter referred to as sub-doors, are to be interlocked. For example, it may be desirable under certain conditions to retain the key 21 of the lock device 20 in a similar lock device on a circuit breaker (not shown) so that the key may not be removed therefrom to operate the lock device 20 until the circuit breaker is in the open position, and prevent the opening of the sub-doors 15 and 16, which may also contain switching apparatus connected with the said circuit breaker, until the master door 18 has been opened. In order to effect these results, the sub-doors 15 and 16 may be each provided with suitable lock or latch mechanisms 22 disposed to be operated collectively in response to movement of the master door 18 by a common actuating means 24.

Since the latch mechanisms for any number of subdoors may be substantially the same, it has been deemed necessary to describe only one of them in detail, and similar parts of the latch mechanisms for other sub-doors are identified by corresponding reference numerals. The sub-door 16, for example, may be locked by a latch bar 26 slidably supported on the frame members 27 of the switchgear compartment in openings 28 therein and in the partitions 29 by means of the bracket member 30. The bracket member 30 may comprise a C-shaped body member having a substantially straight center portion 31 which is considerably longer than the width of the latch bar 26 so as to permit it to be raised and lowered therein, and inturned end portions 32, which may be secured to the vertical frame member 27 of the compartment in any suitable manner, such as by means of welding. A lock pin 33 may be secured to the latch bar 26 by means of a depending support member 34 so as to be movable with the latch bar. With a view to retaining the latch bar 26 in the open position, a suitable stop member may be provided such as, for example, the downwardly extending end portion 36 of the lock pin support 34, which may be disposed to interfere with the lower inturned end portion 32 of the bracket 30 when the latch bar is in the open position, as shown in Figs. 1 and 5.

The lock pin 33 is disposed to interfere with suitable means on the sub-door 16 when the door is closed and the lock pin is actuated to the closed position. For example, a projecting keeper 38 may be provided on the door adjacent the lock pin and provided with an opening 39 therein for receiving the lock pin 33 when it is actuated to the closed or locked position.

For the purpose of permitting actuation of the latch bar 26 to a free position when the sub-door 16 is closed, suitable means may be provided for rendering the stop member 36 ineffective to lock the latch bar in the open position. The keeper 38 may, for example, be provided with an inclined upper surface 40 which is disposed to engage the lower side of the latch bar 26 when the sub-door is closed to lift the latch bar and free the stop member 36 from interfering with the lower inturned end portion 32 of the support bracket 30.

In order to interlock the operation of the latch bar 26 with the operation of the master door 18, the operating means 24 may, for example, comprise an elongated connector 42 slidably supported on the vertical frame members 27 of the compartment 14 in any suitable manner, such as by means of the rollers 43 secured to the frame members by means of bolts 44. The spring 46 may be provided for normally urging the connector to the open position, and an operating connection with the door 18 may be effected by the projecting lug 47 on the master door, which may engage a depending stop 48 on the connector. The stop 48 may be so positioned as to be engaged by the projecting lug 47 on the master door as it pivots about the hinge pin 19 to actuate the connector 42 and the latch bars 26 towards the right as shown to the locked position when the master door 18 is closed, and prevent closure of the master door 18 by interfering with the lug 47 until the latch bars 26 of all of the latch mechanisms are actuated to a free position by the closure of their respective sub-doors. In order to permit the latch bars 26 to be individually actuated to the free position, they may be pivotally connected to each other, and the latch bar for the sub-door 16 may be piovtally connected to the connector 42 by means of hinged joints 50.

When the master door 18 and sub-doors 15 and 16 are in the open position, as shown in Fig. 1, the connector 42 is biased toward the left by means of the spring 46, and the lock pins 33 are withdrawn so as to be free of the keepers 38. Under these conditions, the latch bars 26 are in their open position and the depending stops 36 interfere with the lower inturned end portions 32 of the support brackets 30, locking the latch bars in this position. The master door 18 cannot be closed under these circumstances since the projecting lug 47 on the door 18 interferes with the stop member 48 of the connector 42, which is prevented from moving to the right.

When the sub-doors and the master door are in the open position, the latch mechanisms of the sub-doors are in the positions shown most clearly in Figs. 1 and 5. The lug 47 of the master door and the stop 48 of the connector are in the position best shown in Figs. 1 and 7. As each sub-door is closed, the inclined upper surface 40 of the keeper 38 engages the lower surface of its associated latch bar 26, raising it to the position shown in Fig. 4 so that the depending stop 36 clears the lower inturned end portion 32 of the support bracket 30. When all of the sub-doors associated with the master door 18 are closed, the connector 42 and the latch bars 26 may be moved to the right by closing the master door 18. The lock pins 33 of the latch bars 26 are thus actuated into the openings 39 of the door lock members as shown in Figs. 3 and 6, to lock the sub-doors. The master door 18 may then be locked by operating the key operated lock device 20, and the key 21 removed to operate an associated lock mechanism, or the like (not shown).

When the sub-doors and the master door are thus locked, the sub-doors cannot be opened until the master door 18 is first opened, permitting the connector 42 to actuate the latch bars 26 to the open position.

From the above description and accompanying drawing it will be apparent that we have provided in a simple and effective manner for interlocking the operation of a plurality of sub-doors with a master door, which may in turn be interlocked with associated switching apparatus, such as disconnect switches, circuit breakers, or the like, by means of any suitable lock device, cam-operated, key-operated or otherwise. The sub-doors and master door may be opened and closed only in a predetermined sequence since the sub-doors cannot be opened until the master door is first opened and the master door cannot be closed until the sub-doors are first all closed, whereupon they are simultaneously locked by the closing of the master door. Such an interlock system is simple to construct, is positive and foolproof in operation, and requires but a single lock device for the master door to interlock the operation of all the doors with the associated apparatus.

Since different embodiments of the invention may be made and departures may be made from the particular description thereof, yet still be within the scope of the invention, it is intended that all the matter contained in the above description or shown in the accompanying drawing shall be considered as illustrative and not in a limiting sense.

We claim as our invention:

1. A latch mechanism for a sub-door and a master door comprising, a latch member for locking the sub-door in the closed position, connect-

ing means for actuating the latch member, means to bias the connecting means to the open position to free the sub-door when the master door is opened, and operating means to actuate the connecting means in response to closure of the master door and prevent closing of the master door while the sub-door is open.

2. An interlocking latch mechanism for a sub-door positioned adjacent a master door comprising, a latch member operable to lock the sub-door, means to lock the latch member in the open position, means responsive to closure of the sub-door to free the latch member, and means responsive to closure of the master door to operate the latch member only when the sub-door is closed first.

3. A latch mechanism for a master door having a lock device and a plurality of associated doors positioned in side-by-side relation comprising, means operable in the open position to prevent closure of the master door said means being also responsive to movement of the master door to simultaneously lock the associated doors, means for retaining the aforesaid means in the open position, and additional means operatively connected to the associated doors operable only when all the associated doors are closed to release the first-mentioned means.

4. A latch system for a master door having a lock device and a plurality of associated doors comprising, a plurality of locking means actuable to lock the associated doors in the closed position in response to closure of the master door, means effective to prevent actuation of the locking means, and means responsive to the closure of the associated doors to render the last mentioned means ineffective and permit closure of the master door only when all of the associated doors are first closed.

5. An interlock system for a master door and a plurality of sub-doors to be interlocked therewith comprising, a lock member movably supported adjacent each sub-door, means on each sub-door cooperative with the lock member in the closed position to prevent opening of the sub-door, means for operating the lock members in unison, means preventing operation of the lock members while any one of the sub-doors is open, and means actuated by the master door cooperating with the lock members to prevent closure of the master door while any one of the sub-doors is open.

6. An interlock system for a plurality of sub-doors and a master door comprising, a plurality of operatively connected latch members having lock pins for each of the sub-doors, means associated with each sub-door to lock each latch member in the open position, means connected with each sub-door disposed to actuate its latch member to a free position only when the sub-door is closed, and means operatively connecting the latch members to the master door to permit closure of the master door only when the sub-doors are closed to actuate the lock members to the closed position so that the lock pins engage the lock members.

7. The combination in an interlock system for a plurality of enclosure sub-doors to be interlocked with an enclosure master door having an independently operated lock device, of a plurality of pivotally connected latch bars supported on the frame of the enclosures adjacent the sub-doors, a latch pin carried by each latch bar, means for locking each of the latch bars in the open position, means on each sub-door to actuate its associated latch bar to a free position, and means associated with the master door and the latch bars preventing closure of the master door until all of the sub-doors have been closed.

8. An interlock system for a plurality of sub-doors and a master door comprising, a plurality of pivotally connected latch bars slidably supported adjacent the sub-doors, a latch pin actuated by each latch bar to lock the associated sub-door in the closed position, means on each latch bar to lock said latch bar in the open position, means operable on the closure of each sub-door to free the associated latch bar from the open position, and means to actuate the latch bars to the closed position when freed in response to closure of the master door.

9. A latch mechanism for a plurality of sub-doors to be opened and closed in a predetermined sequence relative to a master door comprising, a latch member for each sub-door actuable to open and closed positions, means to lock each latch member in the open position, means actuable in response to closure of each sub-door to render the aforesaid means ineffective, and operating means connected to the latch members effective only when all of the first-mentioned means are rendered ineffective to actuate the latch members to the closed position in response to closure of the master door.

10. An interlock system for an enclosure sub-door and a master door having an independently operated lock device comprising, a slidable latch bar supported adjacent the sub-door with a lock pin secured thereto and a depending projection disposed to interfere with means on the frame of the enclosure to lock the latch bar in the open position, a projecting lug on the sub-door having an inclined upper surface portion effective to raise the latch bar to a free position so that the projection clears the means on the frame when the sub-door is closed and a recess to receive the lock pin, a slidable operating member operatively connected to the latch bar, and means actuated by the master door to actuate the latch bar to the closed position and prevent closure of the master door before the latch bar is in the free position.

11. An interlock system for a plurality of sub-doors disposed to be opened and closed in predetermined sequence relative to a master door comprising, a plurality of pivotally connected latch members slidably supported adjacent the sub-doors having lock pins secured thereto and projecting stop members disposed to interfere with a stationary member to lock the latch members in the open position, means on each sub-door operable to actuate its associated latch member to free the stop member when the sub-door is closed, a connecting member operatively connected to one of the latch members, and means secured to the master door to engage the connecting member to operate the latch members to the closed position.

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