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SPECIFICATION

CONTROLGEAR



159159

TECHNICAL FIELD

The present invention relates to a controlgear (generally it is called control center) designed for performing start control and protection or the like operation for electric motors employed in an electric power plant and others. More particularly, the invention is concerned with a controlgear which may also be referred to as a control console and which accommodates therein a plurality of functional units.

RELATED BACKGROUND

In the controlgear designed for the start control and protection of the electric motors employed in the controlgear console, the functional unit is arranged to be withdrawal frontwards so that the functional unit can assume the withdrawn position at which a main circuit and a control circuit are disconnected. Furthermore, the functional unit can assume a test position at which the functional unit has been withdrawn frontwards by a predetermined distance. However, in the hitherto known controlgear, it is impossible to change the on/off state of the control circuit at a test position mentioned above, providing an obstacle to carry out tests with high efficiency.

With this invention, it is contemplated to provide the controlgear which allows only the control circuit of the functional unit to assume the test position at which the control circuit is in the closed or on-state and which can thus ensure significantly enhanced efficiency for works involved in the test.

DISCLOSURE OF THE INVENTION

The controlgear according to this invention includes unit chambers having openings at a front side of a console for accommodating therein withdrawably frontwards a plurality of functional units extending depthwise of the console in a multi-stage/multi-row array, wherein a main circuit connecting portion for connecting a main

circuit of the functional unit to an external main circuit is provided at a rear side of the unit chamber. The functional unit includes a main circuit connector for connecting the main circuit to the external main circuit, and a control circuit connector for connecting the control circuit to an external circuit. The control circuit connector provided at the rear side of the functional unit is movable in longitudinal direction relative to the functional unit. At a test position where the main circuit connector and the control circuit connector have been displaced frontwards by a predetermined distance from a connected position at which the main circuit connector and the control circuit connector are connected to the external main circuit and the external circuit, the main circuit connector is disconnected from the external main circuit with the control circuit connector remaining connected to the external circuit.

In the control gear, the control circuit connector may be held movably forwards and rearwards on a functional unit base. The functional unit may include a lock means for sustaining the connected position when the functional unit is at the connected position, an unlock means for moving the functional unit to the test position from the connected position, and a pull-out driving means for driving the control circuit connector in a pull-out direction at the test position.

Further, a tension spring may be employed as a driving source for driving the control circuit connector in the pull-out direction by the pull-out driving means.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a perspective view of a control gear according to this invention.

Figure 2 is a perspective view of a functional unit accommodated in the control gear 100.

Figure 3 is a side view showing in section the functional unit in a state withdrawn from the control gear to a test position.

Figure 4 is a side view showing in section the control gear a state in which the functional unit has been removed therefrom.

Figure 5 is a perspective view showing the control gear in a state in which all the functional units have been removed

therefrom.

Figure 6 is a perspective view of a shelf board of the controlgear.

Figure 7 is a top plan view of the shelf board.

Figure 8 is a perspective view of an inner lever.

Figure 9 is a top plan view of the inner lever.

Figure 10 is a perspective view of a first latch.

Figure 11 is a view showing a structure of the first latch as viewed in three directions.

Figure 12 is a perspective view of a second latch.

Figure 13 is a view showing a structure of the second latch as viewed in three directions.

Figure 14 is a perspective view of a third latch.

Figure 15 is a view showing a structure of the third latch as viewed in three directions.

Figure 16 is a top plan view for illustrating various states of the functional unit.

Figure 17 is a sectional view of a major portion taken along a line XVII-XVII in Fig. 16, showing a state in which the functional unit is at a connected position.

Figure 18 is a view showing states of the inner lever and individual latches at the connected position of the functional unit.

Figure 19 is a sectional view of a major portion taken along a line XVIII-XVIII in Fig. 16, showing a state in which the functional unit is at an unlocked position.

Figure 20 is a view showing states of the inner lever and the individual latches at the unlocked position of the functional unit.

Figure 21 is a sectional view of a major portion taken along a line XXI-XXI in Fig. 16, showing a state at which the functional unit is at a test position.

Figure 22 is a view showing states of the inner lever and the individual latches at the test position of the functional unit.

Figure 23 is a sectional view of a major portion taken along a line XXIII-XXIII in Fig. 16, showing the state at which

the functional unit is at a withdrawal/insertion position.

Figure 24 is a view showing the states of the inner lever and the individual latches at the withdrawal/insertion position of the functional unit.

BEST MODES FOR CARRYING OUT THE INVENTION

Embodiment 1

Figure 1 is a perspective view of the control gear according to this invention. Accommodated within the control gear 100 implemented in the form of a substantially rectangular box-like shape are a plurality of functional units 1 disposed regularly in a gridiron-like array in the vertical and horizontal directions. In the case of the control gear 100 according to the instant embodiment of the invention, four functional units 1 are disposed in each of the horizontal rows with ten stages of the functional units being provided in the vertical direction. Thus, the forty functional unit 1 in total are accommodated within the control gear 100.

Figure 2 is a perspective view showing a functional unit adapted to be accommodated in the control gear 100. The functional unit 1 is implemented in a substantially rectangular parallelepiped shape elongated in the direction depthwise of the control gear 100. The functional unit 1 has a unit base 2 forming one lateral side and a bottom side of the rectangular parallelepiped. The functional unit 1 has various devices mounted therein for controlling external equipment/machinery. At a rear side of the control gear, there are provided a main circuit connector 3 and a control circuit connector 4 connected to the internal devices. Mounted on the functional unit 1 at a front side thereof is a manipulating handle for turning on/off a breaker device installed as one of the inner devices. Further, a manipulating lever 7 is provided below the manipulating handle, extending frontwards from the functional unit. Description in detail of this lever will be made later on.

Figure 3 is a side view showing in section the functional unit 1 in the state withdrawn from the control gear 100 to a test position. The control circuit connector 4 is fixedly secured to a control circuit connector mounting fixture 5. The control circuit connector mounting fixture 5 is provided at a rear portion of the

functional unit 1 so as to be movable reciprocatively relative to the unit base 2 in the direction depthwise of the functional unit 1, i.e., in the direction in which the functional unit 1 is withdrawn and inserted. In other words, the control circuit connector mounting fixture 5 is mounted on the unit base 2 to be movable in the longitudinal direction of the functional unit 1.

A tension spring 6 is spanned between the control circuit connector mounting fixture 5 and the unit base 2. The tension spring 6 urges resiliently the control circuit connector mounting fixture 5 frontwards of the functional unit 1. In the test position shown in Fig. 3, the control circuit connector 4 is connected to a console-side control circuit connector 14, i.e., the control circuit connector mounted on the console of the controlgear. The console-side control circuit connector 14 is connected to an external circuit such as a motor control circuit or the like through a cable not shown.

An inner lever 8 of an elongated plate-like shape is provided underneath the unit base 2. The inner lever 8 is provided movably in the longitudinal direction relative to the unit base 2. The inner lever 8 is coupled at a front end portion to the manipulating lever 7.

A first latch 9, a second latch 10 and a third latch 11 are mounted on the unit base 2 erecting upwardly and movably in the vertical direction.

The functional unit 1 of the structure described above is disposed on a shelf board (partitioning plate) 12 of the controlgear 100.

Figure 4 is a side view showing in section the controlgear in the state in which the functional unit has been removed therefrom. Figure 5 is a perspective view showing the controlgear 100 in the state in which all the functional units 1 have been removed therefrom. The controlgear 100 is partitioned by the shelf boards (partitioning plate) 12 into a plurality of unit chambers formed and arrayed in the vertical direction. The unit chamber 12 formed above a given one shelf board 12 is further partitioned into four compartments or chambers by means of four compartmenting plates. The functional unit 1 is inserted into each of the substantially rectangular

parallelepiped chambers each so formed as to extend depthwise.

Figure 6 is a perspective view of the shelf board 12 of the controlgear 100. Figure 7 is a top plan view of the shelf board 12. In the controlgear according to the instant embodiment of the invention, four functional units 1 are disposed in juxtaposition on one sheet of the shelf board 12. To this end, triplets of rectangular holes with which the latches of the functional unit 1 engage are formed in the shelf board 12. More specifically, there are pierced in the shelf board a first rectangular hole 12a with which the first latch 9 or the second latch 10 engages and the second rectangular hole 12b with which the third latch 11 engages.

Figure 8 is a perspective view of the inner lever 8. Figure 9 is a top plan view of the inner lever 8. The inner lever 8 is formed in a substantially elongated flat plate-like shape and pierced with slits with which the latches of the functional unit 1 engage. More specifically, there are pierced in a front portion of the inner lever 8 a first slit 8a with which the first latch 9 or the second latch 10 are destined to engage, while pierced in a rear portion are second slits 8b with which the third latch 11 is destined to engage. The inner lever 8 is operatively connected to the manipulating lever 7 through the medium of a round hole 8c formed in a front end portion of the inner lever.

Figure 10 is a perspective view of the first latch 9. Figure 11 is a view illustrating the structure of the first latch 9 as viewed in three directions. The first latch 9 is composed of a body member formed by bending a flat plate so as to have a substantially C-like cross-section and a shaft portion extending through the body member. A claw portion 9a and an engaging portion 9b are formed at both lateral sides of the body member, wherein the claw portion 9a is adapted to be fit into the first rectangular hole 12a of the shelf board 12 while the engaging portion 9b is adapted to engage with the first slit 8a. The first latch 9 is fixedly secured to the unit base 2 at the bottom end of the shaft portion and supported such that the body member can move in the vertical direction relative to the unit base 2. Thus, the claw portion 9a can be projected outwardly from the bottom surface of the unit base 2 and retracted in accompanying the vertical or up-and-down motion

of the body member relative to the unit base 2. Further, a compression coil spring (not shown) is disposed in the compressed state between a hexagonal head provided at the top of the shaft portion of the first latch 9 and the body member thereof, whereby the claw portion 9a is constantly urged to project outwardly under the efforts of the compression coil spring.

Figure 12 is a perspective view of the second latch 10. Figure 13 is a view illustrating the structure of the second latch 10 as viewed in three directions. The second latch 10 is implemented in a structure substantially similar to that of the first latch 9. A claw portion 10a and an engaging portion 10b are formed, respectively, at both lateral sides of the body member, wherein the claw portion 10a is adapted to be fit into the first rectangular hole 12a while the engaging portion 10b is adapted to engage with the first slit 8a. The claw portion 9a of the first latch 9 is formed in an arcuate shape at a corner on one side. By contrast, the claw portion 10a of the second latch 10 is rounded in the arcuate shape at both corner portions thereof. The second latch 10 is fixedly secured to the unit base 2 at the bottom end of the shaft portion and supported such that the body member can move in the vertical direction relative to the unit base 2. Thus, the claw portion 10a can project outwardly from the bottom surface of the unit base 2 and retract in accompanying the up-and-down motion of the body member relative to the unit base 2. Further, a compression coil spring not shown is disposed in the compressed state between a hexagonal head provided at the top of the shaft portion of the tenth latch 10 and the body member thereof, whereby the claw portion 10a is constantly urged to project outwardly from the bottom surface of the unit base 2 under the efforts of the compression coil spring.

Figure 14 is a perspective view of the third latch 11. Figure 15 is a view illustrating the structure of the third latch 11 as viewed in three directions. The third latch 11 is composed of a body member formed by bending a flat plate so as to have a substantially C-like cross-section and a shaft portion. A pair of claw portions 11a are formed at both lateral sides of the body member, wherein the claw portions 11a is adapted to be fit into the second rectangular holes 12b, respectively, of the shelf board 12. The

third latch 11 is fixedly secured to the unit base 2 at the bottom end of the shaft portion and supported such that the body member can move in the vertical direction relative to the unit base 2. Thus, the two claw portions 11a can project outwardly from the bottom surface of the unit base 2 and retract in accompanying the up-and-down motion of the body member relative to the unit base 2. Further, a compression coil spring not shown is disposed in the compressed state between a hexagonal head provided at the top of the shaft portion of the third latch 11 and the body member thereof, whereby the claw portions 11a are constantly urged to project outwardly from the bottom surface of the unit base 2 under the efforts of the compression coil spring.

Figure 16 is a top plan view for illustrating various states which the functional unit 1 can assume and shows the functional unit at a connected position, an unlocked position, a test position and a withdrawal/insertion position in this order from the left-hand side as viewed toward the plane of the drawing.

Figure 17 is a sectional view showing a major portion taken along a line XVII-XVII in Fig. 16, showing the state at which the functional unit 1 is at the connected position. Figure 18 is a view showing the states or postures of the inner lever 8 and the latches 9, 10 and 11 at the connected position of the functional unit 1. By revolving the manipulating lever 7 clockwise as viewed in the direction toward the shelf board 12 in the plane of Fig. 16 when the functional unit 1 movable on and along the longitudinal direction is at the connected position, the first latch 9 is fit into the first rectangular hole 12a of the shelf board 12 with the third latch 11 being fit into the second rectangular hole 12b, whereby the functional unit is placed in the locked state and thus the movement thereof in the longitudinal direction is suppressed. The engaging portion 9b of the first latch 9 engages with the first slit 8a of the inner lever, whereby the first latch 9 is lowered to a predetermined position at which the claw portion 9a is fit into the first rectangular hole 12a of the shelf board 12. The claw portion 11a of the third latch 11 extends through the second slit 8b of the inner lever 8 to be fit into the second rectangular hole 12b of the shelf board 12.

Figure 19 is a sectional view of a major portion taken along a line XVIII-XVIII in Fig. 16, showing the state in which the functional unit 1 is at the unlocked position. Figure 20 is a view showing the states and postures of the inner lever 8 and the latches 9, 10 and 11 at the unlocked position of the functional unit. When the manipulating lever 7 is revolved counterclockwise from the connected position mentioned previously as viewed toward the plane of Fig. 16, the inner lever 8 is moved rearwards, whereby the first latch 9 is pushed upwardly, resulting in that the functional unit 1 is released from the locked state. The engaging portion 9b of the first latch 9 is pushed outwardly from the first slit 8a of the inner lever 8 with the engaging portion 9b riding on the major surface of the inner lever 8, whereby the claw portion 9a is pulled out from the first rectangular hole 12a. The claw portion 11a of the third latch 11 remains fit into the second rectangular hole 12b of the shelf board 12.

Figure 21 is a sectional view of a major portion taken along a line XXI-XXI in Fig. 16, showing the state at which the functional unit 1 is at the test position. Figure 22 is a view showing the states and postures of the inner lever 8 and the latches 9, 10 and 11 at the test position of the functional unit 1. In Figs. 21 and 22, the functional unit 1 is in the state moved frontwards from the unlocked state shown in Figs. 19 and 20. More specifically, the functional unit lies at the test position at which the functional unit 1 has been displaced frontwards till the second latch 10 is fit into the first rectangular hole 12a of the shelf board 12. At this test position, the main circuit connector 3 is in the state disconnected or separated from the console-side main circuit connector 13. However, the control circuit connector mounting fixture 5 remains fixed to the shelf board 12 by means of the latch 11, whereby the connection state between the control circuit connector 4 and the console-side control circuit connector 14 is maintained. In this state, the tension spring 6 mounted between the unit base 2 and the control circuit connector mounting fixture 5 is extended by a proportion corresponding to the displacement of the functional unit 1.

Figure 23 is a sectional view of a major portion taken

along a line XXIII-XXIII in Fig. 16, showing the state at which the functional unit 1 assumes the withdrawal/insertion position. Figure 24 is a view showing the states and postures of the inner lever 8 and the latches 9, 10 and 11 at the withdrawal/insertion position of the functional unit 1. When the manipulating lever 7 is shifted clockwise as viewed toward the plane of Fig. 16, the inner lever 8 is moved frontwards, whereby the latch 11 is pushed upwardly, resulting in that the control circuit connector mounting fixture 5 is unlocked from the shelf board 12 with the control circuit connector mounting fixture 5 resuming the position adjacent to the unit base 2 under the efforts of the tension spring 6, and thus the control circuit connector 4 and the console-side control circuit connector 14 are separated from each other. Further, the latch 10 is pushed upwardly as the inner lever 8 is moved frontwards, and thus the functional unit 1 assumes the state capable of being withdrawn or pulled out.

As is apparent from the foregoing, in the control gear according to the instant embodiment of the invention, four states, i.e., the connected state, the lock-released state, the test state and the pulled-out state can, respectively, be established by shifting the manipulating lever 7 counterclockwise and clockwise. Besides, the test position which allows the operation of the control circuit to be validated can be realized even in the main-circuit broken state. Thus, the efficiency of work involved in the test can be enhanced because it is unnecessary to supply the electric power from the exterior for the test, to an advantageous effect.

As is apparent from the foregoing description, in the control gear according to the illustrated embodiment of this invention which includes a plurality of unit chambers having openings formed at the front side for mounting therein withdrawably the units 1 and the main circuit connecting portions for connecting the main circuits of the functional units 1 to the main circuit constituted by the bus circuit by means of the main circuit connectors 3 provided at the rear side of the unit chambers, the control circuit connector 4 is provided for the functional unit 1 for connecting the control circuit thereof to the external circuit such as the motor control circuit or the like, wherein the control circuit connector 4 provided

at the rear side of the functional unit 1 can be displaced forwardly and rearwards relative to the functional unit 1 so as to be capable of being connected to the above-mentioned external circuit such as the motor control circuit or the like. The control circuit connector 4 is held movably in the forward and rearward directions and is provided with the lock means composed of the latches 9 and 11 for sustaining the connected position when the functional unit 1 is at the connected position, the unlock means composed of the manipulating lever 7 and the inner lever 8 for moving the unit to the test position from the connected position, and the pull-out driving means including the tension spring 6 as a driving source for driving the control circuit connector 4 in the pull-out direction at the test position. Thus, operation for pulling out the control circuit connector 4 can properly and positively be effectuated by the driving source composed of the tension spring 6. By virtue of this feature, there can be realized the controlgear which allows the efficiency of works involved in the test to be significantly enhanced.

To say in another way, the controlgear according to this invention which is equipped with the main circuit connecting portion for connecting the main circuits of the units to the external main circuit at the rear side of the plurality of unit chambers having respective openings at the front side for mounting therein withdrawably the units is provided with the control circuit connectors for connecting the control circuits of the units to the external circuits, wherein the control circuit connector provided at the rear side of the unit is made movable in the longitudinal direction relative to the unit so that the control circuit can be connected to the external circuit mentioned above at the test position of the unit. Owing to this arrangement, work efficiency for the test can significantly be enhanced.

Furthermore, because the control circuit connector is held movably on and along the unit base in the longitudinal direction and is provided with the lock means for sustaining the unit at the connected position when the unit is at the connected position, the unlock means for enabling the unit to move from the connected position to the test position, and the pull-out driving means for driving

the control circuit connector mentioned above in the pull-out direction, the control circuit connector pull-out operation can properly be effected. Thus, there can be realized the controlgear which allows the efficiency of work involved in the test to be significantly enhanced.

Besides, because the tension spring is employed as the driving source for driving the control circuit connector in the pull-out direction by the pull-out driving means, operation for driving the control circuit connector can properly and positively be performed by means of the driving source composed of the tension spring, and thus there can be obtained the controlgear which enjoys highly enhanced work efficiency for the test operation.

INDUSTRIAL APPLICABILITY

This invention has provided the controlgear which includes the unit chambers having openings at the front side of the console for accommodating therein withdrawably frontwards a plurality of functional units extending depthwise of the console in the multi-stage/multi-row array, wherein the main circuit connecting portion for connecting the main circuit of the functional unit to the external main circuit is provided at the rear side of the unit chamber. The functional unit includes the main circuit connector for connecting the main circuit to the external main circuit, and the control circuit connector for connecting the control circuit to the external circuit, wherein the control circuit connector provided at the rear side of the functional unit is movable in longitudinal direction relative to the functional unit, and wherein at the test position where the main circuit connector and the control circuit connector have been displaced frontwards by the predetermined distance from the connected position at which the main circuit connector and the control circuit connector are connected to the external main circuit and the external circuit, the main circuit connector is disconnected from the external main circuit with the control circuit connector remaining connected to the external circuit. By virtue of the arrangement described above, efficiency of works involved in tests performed at the test position can be enhanced.

In the controlgear described above, the control circuit connector can be held movably forwards and rearwards on the functional unit base, and the functional unit can include a lock means for sustaining the connected position when the functional unit is at the connected position, an unlock means for moving the functional unit to the test position from the connected position, and a pull-out driving means for driving the control circuit connector in a pull-out direction at the test position. With this arrangement, the pull-out operation of the control circuit connector can properly be carried out, whereby efficiency of the work involved in the test can further be enhanced.

Furthermore, the tension spring can be employed as the driving source for driving the control circuit connector in the pull-out direction by the pull-out driving means. Owing to this feature, the control circuit connector pull-out operation can be effected by the driving source composed of the tension spring without fail, whereby reliability of the apparatus can be enhanced.

SCOPE OF CLAIMS

1. A controlgear including unit chambers having openings at a front side of a console for accommodating therein withdrawably frontwards a plurality of functional units extending depthwise of the console in a multi-stage/multi-row array, wherein a main circuit connecting portion for connecting a main circuit of said functional unit to an external main circuit is provided at a rear side of said unit chamber,

characterized in that said functional unit comprises:

a main circuit connector for connecting the main circuit to the external main circuit; and

a control circuit connector for connecting the control circuit to an external circuit;

that said control circuit connector provided at the rear of said functional unit is movable in longitudinal direction relative to said functional unit, and

that at a test position where said main circuit connector and said control circuit connector have been displaced frontwards by a predetermined distance from a connected position at which said main circuit connector and said control circuit connector are connected to said external main circuit and said external circuit, said main circuit connector is disconnected from said external main circuit with said control circuit connector remaining connected to said external circuit.

2. A controlgear set forth in claim 1,

characterized in that said control circuit connector is held movably forwards and rearwards on a functional unit base, and

that said functional unit comprises lock means for sustaining the connected position when said functional unit is at the connected position;

unlock means for moving said functional unit to said test position from said connected position; and

pull-out driving means for driving said control circuit connector in a pull-out direction at said test position.

3. A controlgear set forth in claim 2,
 characterized in that a tension spring is employed as
a driving source for driving said control circuit connector in the
pull-out direction by said pull-out driving means.