

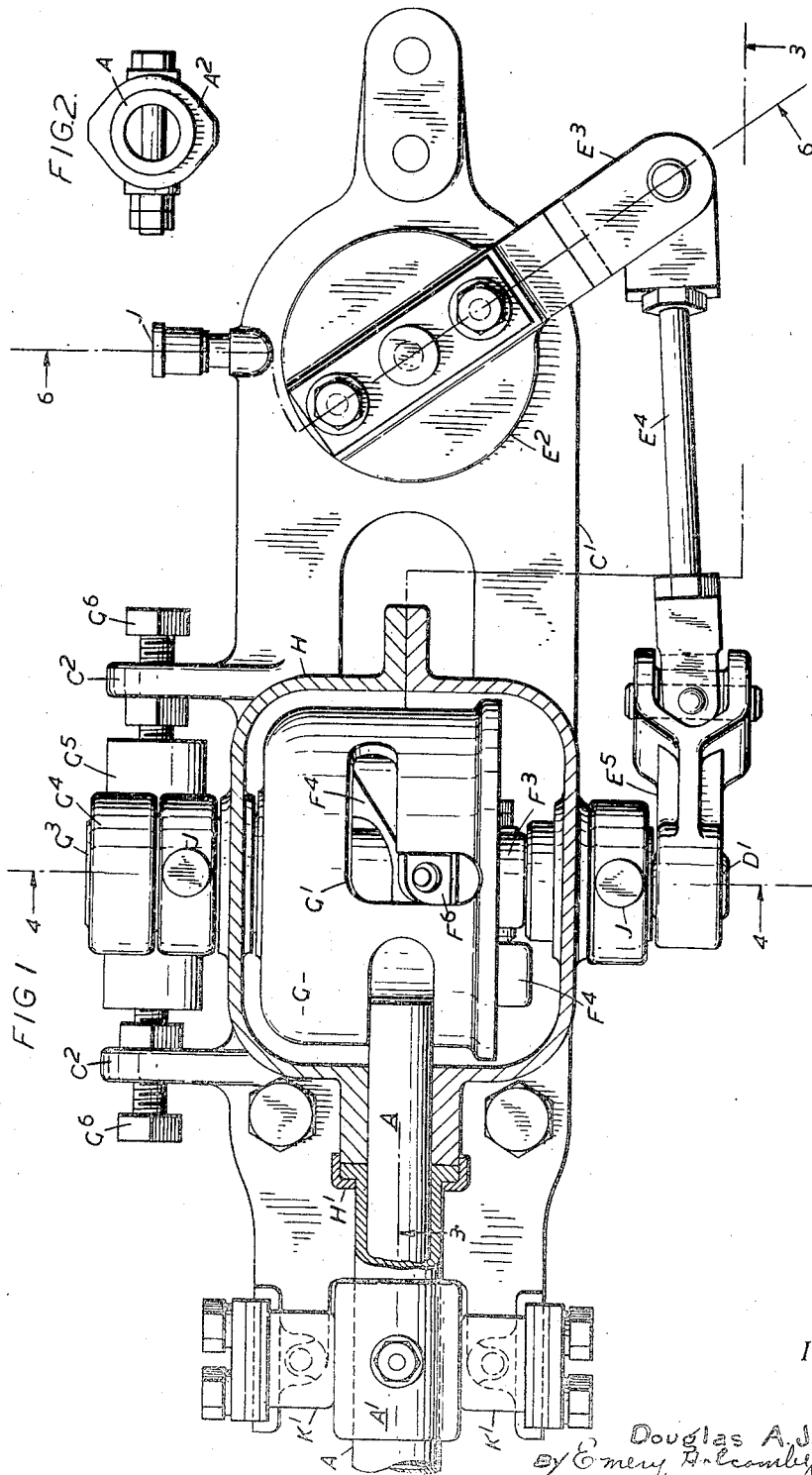
Jan. 3, 1950

D. A. J. OXLEY
ELECTRIC SWITCHGEAR

2,493,689

Filed March 15, 1948

4 Sheets-Sheet 1



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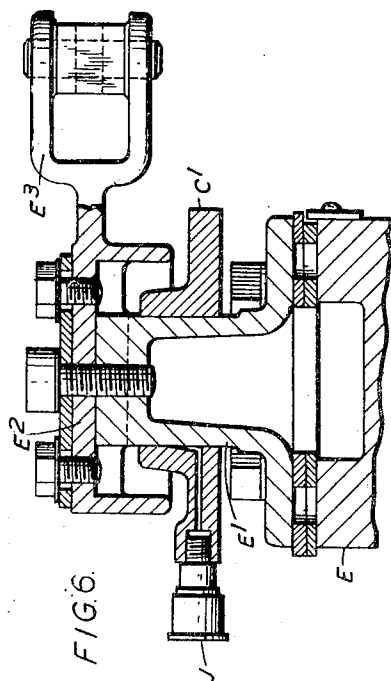
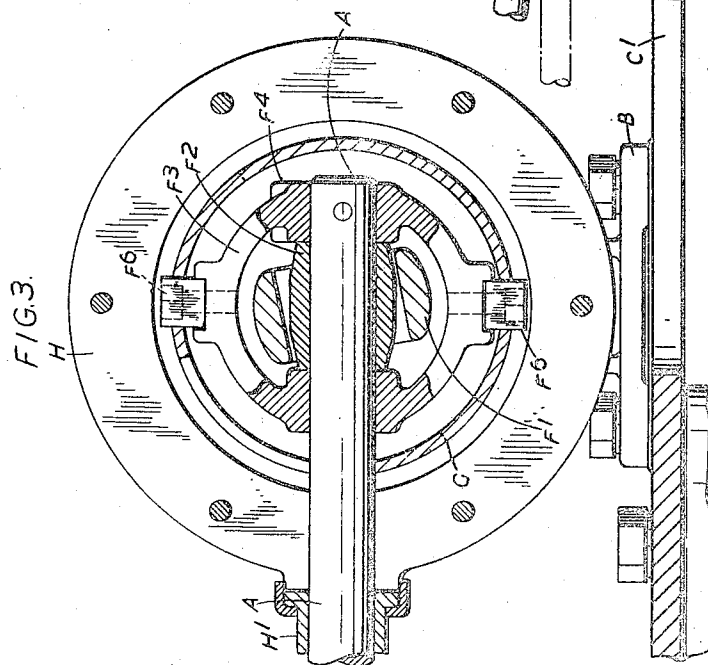
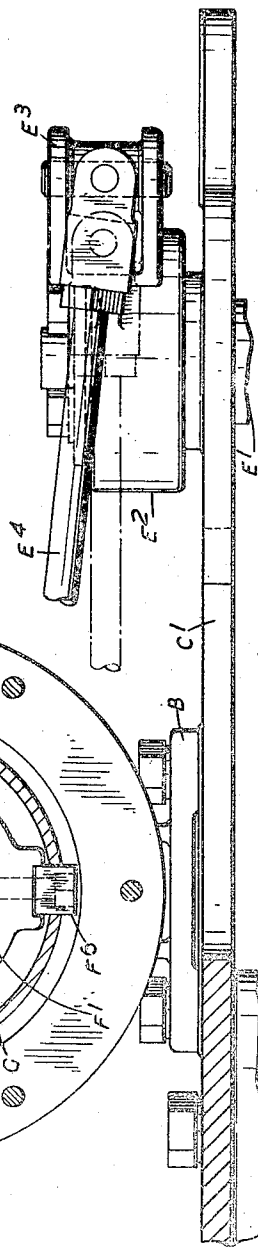
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FIG. 4.

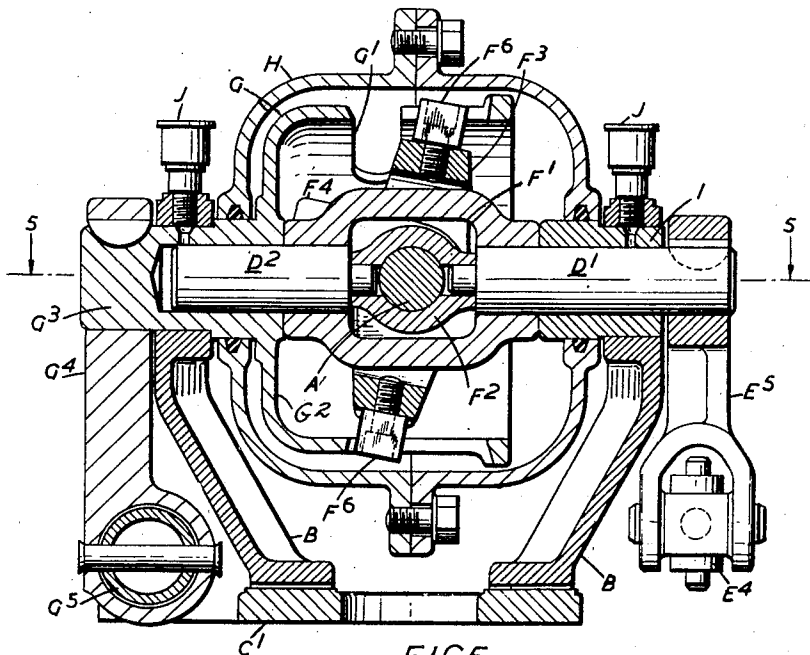
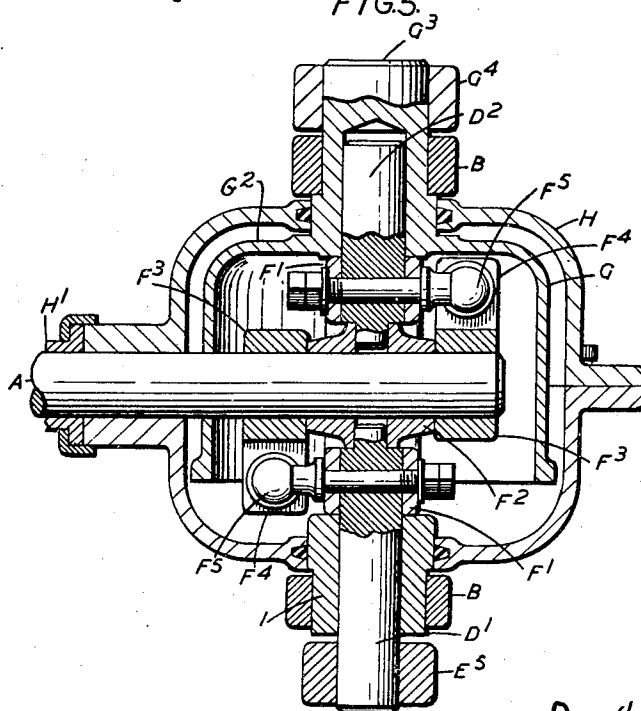


FIG. 5.



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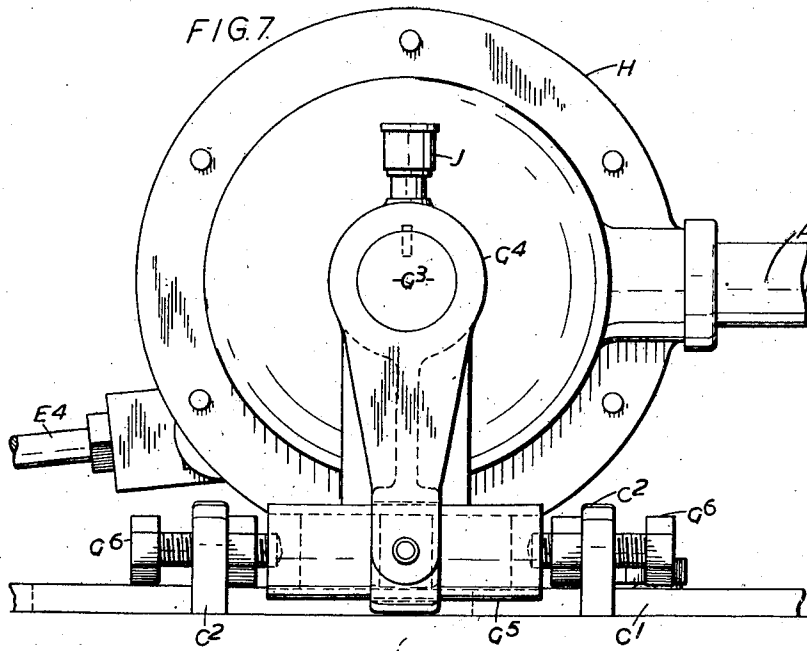
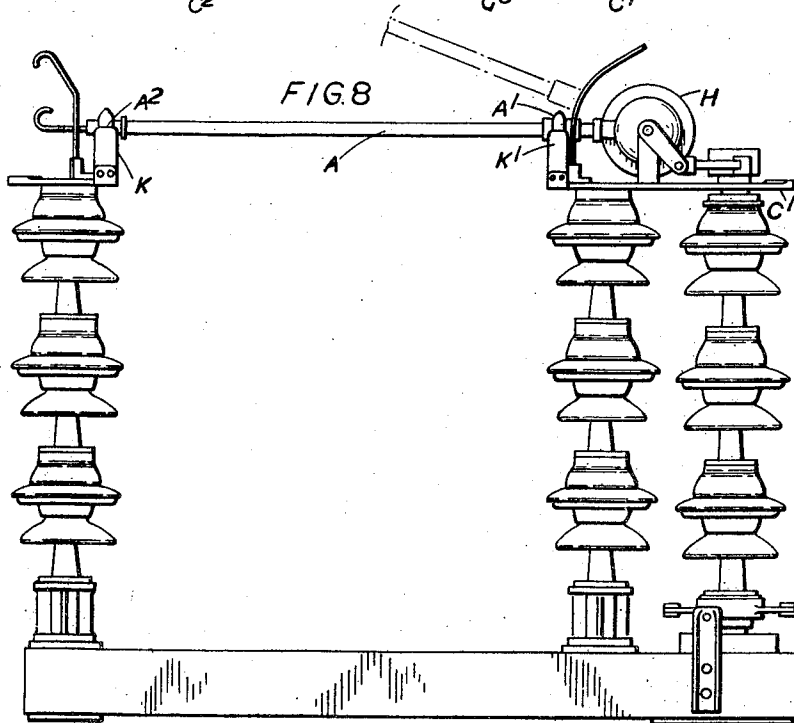
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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCHGEAR

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11 Claims. (Cl. 200—48)

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This invention relates to electric switchgear of the type in which the moving contact is carried at one end of an arm pivoted at its other end to move about an axis substantially perpendicular to the length of the arm. Such switchgear is widely used under external conditions for high voltage isolating switches and the like.

To enable large currents to be efficiently conducted it is generally desirable to employ high contact pressure, and in addition it may, on occasion, be necessary to separate the contacts when they have been bonded together by a layer of ice. As the arm may be several feet in length the torque required to overcome any considerable resistance to separation of the contacts may be very substantial, and it must be borne in mind that the fixed contact, and the pivot of the moving arm, will be mounted on high voltage insulators of limited mechanical strength.

It has therefore been proposed to provide means for producing a small initial relative movement between the contacts to free them from one another before starting the main movement of the arm about its pivotal axis. One type of initial movement consists of twisting the arm about its longitudinal axis, and the present invention is concerned with the provision of improved mechanism for this purpose.

According to the present invention, operating mechanism for electric switchgear of the type specified, comprises mechanism for producing a twisting movement of the arm, followed by movement of the arm about its pivot, such mechanism being totally enclosed within a casing surrounding the pivot.

In one form of the invention, the mechanism comprises an operating shaft about the axis of which the arm pivots, a member secured to the shaft and spaced from it in a direction substantially parallel to the arm, and engaging a member secured to the arm and spaced from it in a direction substantially parallel to the shaft, together with stops for limiting the twisting movement of the arm.

In order to balance the thrusts, a symmetrical arrangement may be employed comprising two opposed members spaced from the shaft in opposite directions parallel to the length of the arm and on opposite sides of the arm, and engaging two opposed members spaced from the arm in opposite directions parallel to the shaft and on opposite sides of the shaft.

Preferably, the arrangement also includes an interlocking member secured to the arm and

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spaced from it in a direction substantially perpendicular to the axes both of the shaft and of the arm, and confined in an L shaped slot in a fixed part so that in the opening movement it prevents pivotal movement of the arm until the predetermined twisting movement is completed and vice versa when closing.

The invention may be carried into practice in various ways, but one specific embodiment will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of an isolating switch, partly in section;

Figure 2 is an end view of one of the movable contacts;

Figure 3 is a side elevation, partly in section on the line 3—3 of Figure 1, showing details of the pivot mechanism;

Figure 4 is an end elevation in section on the line 4—4 of Figure 1, showing details of the pivot mechanism;

Figure 5 is a plan view in section on the line 5—5 of Figure 4, showing details of the pivot mechanism;

Figure 6 is an elevation in section on the line 6—6 of Figure 1, showing details of the actuating mechanism;

Figure 7 is a side elevation showing the outer casing and the anchoring means of the embodiment, and

Figure 8 is a diagram on a smaller scale showing the general layout of the switch.

In this embodiment of the invention the contact arm A carrying its moving contacts A¹ and A² is arranged to pivot at its end about a horizontal axis perpendicular to its length, in a fixed bearing provided by a fork B mounted on top of an insulator C. The fork supports bearings for a pair of trunnions or stub shafts D¹ and D², one of which D¹ constitutes an operating shaft.

As shown in Figures 3 and 6, an operating insulator E, arranged to rotate with its axis substantially vertical, has mounted on its upper end a metal boss E¹ which can rotate in a bearing forming part of a plate C¹ extending from the companion insulator C. A cap E² is bolted to the boss E¹ and carries a horizontal arm E³ pivoted at its outer end to one end of a link E⁴. The link E⁴ is pivoted at its other end to an arm E⁵ carried by the operating shaft D¹ and rigidly secured to it. Accordingly, if the lower end of the operating insulator E is rotated by mechanism at earth potential, the trunnion D¹ constituting the operating shaft will be rotated. The

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plate C¹ serves to relieve the insulator E of stresses other than pure torque.

The two trunnions or stub shafts D¹ and D² are firmly secured in diametrically opposite points of an inner ring F¹, mounted as shown in Figures 3, 4 and 5 with its axis substantially coincident with that of the contact arm A. The ends of these stub shafts project through the inner ring into diametrically opposite holes in a sleeve F² which is thereby pivoted so that it can move about the axis of the operating shaft D¹.

The contact arm A carries an outer ring F³ rigidly secured to it with its axis approximately coincident with that of the operating shaft D¹. Both the inner ring F¹ and the sleeve F² are within the outer ring F³. Projecting from one face of the outer ring F³ is a pair of lugs constituting a fork F⁴ between which extends a ball-ended arm F⁵ projecting from one face of the inner ring F¹. The centre of the ball lies approximately in the plane containing the axes of the operating shaft D¹ and of the contact arm A, from both of which it is approximately equidistant. The ball-ended arm F⁵ on the inner ring F¹ and the fork F⁴ on the outer ring F³ co-operate in the manner of a pair of bevel gears so that if the operating shaft, and with it the inner ring, is turned, it will tend to rotate the outer ring, and hence the contact arm, about the axis of the latter.

In order to balance thrusts, a second ball-ended arm F⁵ is provided projecting from a diametrically opposite point of the opposite face of the inner ring F¹, and engages a second fork F⁴ projecting from a diametrically opposite point of the opposite face of the outer ring F³, as shown in Figure 5.

In order to ensure the correct sequence of movements, the outer ring F³ carries a pair of interlocking members in the form of square projections F⁶ placed at diametrically opposite points on the outer ring and spaced from the intersection of the axes of the contact arm A and the operating shaft D¹, in a direction perpendicular to both these axes. The projections F⁶ fit into a pair of L-shaped slots G¹ in a fixed hollow cylinder G carried by one arm of the fork B. When the switch is in the closed position, each of the projections F⁶ is at one end of the base of its slot G¹ which lies parallel to the axis of the operating shaft D¹. Accordingly, the outer ring F³ is prevented from moving pivotally about the axis of the operating shaft D¹ and can only move about the axis of the contact arm A. Due to the bevel action of the ball-ended arms F⁵ and the forks F⁴, such a twisting movement about the axis of the contact arm occurs until the projections F⁶ reach the angles of the L-shaped slots G¹. Further twisting motion is then prevented and thereafter continued movement of the operating shaft D¹ about its axis produces bodily movement of the contact arm A together with the outer and inner rings F³ and F¹ about the axis of the operating shaft D¹. Conversely, when the switch is being closed by turning the operating shaft D¹ in the opposite direction, no twisting movement can occur until the axis of the contact arm A is in its fully closed position. The fixed cylinder G has a circumferential slot in it through which the contact arm A projects.

The cylinder G has been described as fixed, but it is preferred that it should be resiliently secured so as to be capable of slight movement to accommodate shocks. For this purpose it is closed at

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one end by a disc G² carried by a sleeve G³ which surrounds the trunnion D² and acts as a bearing within which the trunnion can rotate. The sleeve itself can rotate in a bearing provided by one arm of the fork B, and carries at its outer end an arm G⁴, the end of which is secured, as shown in Figure 7, through a resilient link G⁵ to lugs C² forming part of the plate C¹. Adjusting screws G⁶ allow the limits of travel of the contact arm A to be accurately controlled.

The hollow cylinder G is surrounded by an outer casing H comprising two dish-shaped pieces bolted together to form a closed cylinder. The outer casing H has holes which allow it to fit closely round the bearing sleeve G³ and round a corresponding bearing sleeve I for the operating shaft D¹, and a hole registering with a radial sleeve H¹ which fits round the contact arm A. Accordingly, the operating shaft D¹ and the contact arm A are capable of rotating slightly in relation to the outer casing during twisting movement, while during pivotal movement the outer casing H moves bodily with them about the axis of the operating shaft.

For lubrication purposes, grease cups J are provided at the bearings of the trunnions D¹ and D² and of the insulator boss E¹ in the plate C¹.

The fixed contacts K¹ and K² are of the form shown in Figure 1, each comprising a pair of resiliently mounted blocks between which the moving contact A¹ or A² enters. Figure 2 shows a cross-section of the moving contact A¹ or A², which will descend into the space between the fixed contacts K¹ or K² with its greatest width vertical or approximately so, and will then be twisted so as to tend to separate the fixed contacts and ensure a high-pressure contact. The pairs of fixed contacts K¹ and K² are open at the bottom so as to prevent the accumulation of ice or snow.

The interlocking arrangement described provides means for locking the moving contact in the closed position and preventing it from being blown out by the magnetic effect of current surges. The outer casing H has in it only three holes, namely for the two trunnions D¹ and D² and the contact arm A, which are in every case a close fit and can be sealed satisfactorily, since no relative movement occurs except a limited rotary movement. Accordingly, all the mechanical parts liable to cause trouble by the long exposure to which external switchgear is subjected, are enclosed within the outer casing and are protected from such adverse conditions. This applies equally to the stops by which the twisting movement and pivotal movement are limited, so that the correct engagement of these stops cannot be interfered with by the presence, for example, of ice and snow.

The mechanism, in addition to being protected from external influences, has a low moment of inertia thereby facilitating the opening and closing of the switch.

Preferably the operating mechanism by which the operating shaft is turned includes a resilient member tending to move it slightly beyond the closed position. This is particularly advantageous in the case of a switch having several poles or phases which are operated simultaneously, where satisfactory completion of the twisting movement might otherwise be interfered with by slight lack of adjustment or alignment between one phase and another.

What I claim as my invention and desire to secure by Letters Patent is:

1. Electric switchgear including an arm pivoted

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at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, mechanism for producing a twisting movement of the arm about its longitudinal axis followed by a swinging movement about its transverse pivotal axis, such mechanism including an operating shaft coaxial with the said transverse pivotal axis of the arm, interengaging members one secured to the shaft and spaced from it in a direction substantially parallel to the length of the arm, and the other secured to the arm and spaced from it in a direction substantially parallel to the shaft.

2. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, mechanism for producing a twisting movement of the arm about its longitudinal axis followed by a swinging movement about its transverse pivotal axis including an operating shaft coaxial with the said transverse pivotal axis of the arm, interengaging members one secured to the shaft and spaced from it in a direction substantially parallel to the length of the arm, and the other secured to the arm and spaced from it in a direction substantially parallel to the shaft, and a casing totally enclosing such mechanism.

3. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, mechanism for producing a twisting movement of the arm about its longitudinal axis followed by a swinging movement about its transverse pivotal axis including an operating shaft coaxial with the said transverse pivotal axis of the arm, interengaging members one secured to the shaft and spaced from it in a direction substantially parallel to the length of the arm, and the other secured to the arm and spaced from it in a direction substantially parallel to the shaft, and interlocking means serving to prevent swinging movement until the twisting movement is completed when opening, and to prevent twisting movement until the swinging movement is completed when closing the switch.

4. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, mechanism for producing a twisting movement of the arm about its longitudinal axis followed by a swinging movement about its transverse pivotal axis, such mechanism including an operating shaft coaxial with the said transverse pivotal axis of the arm, two interengaging pairs of members including two opposed members secured to the shaft and spaced from it in opposite directions parallel to the lengths of the arm and on opposite sides of the arm, and two opposed members secured to the arm and spaced from it in opposite directions parallel to the shaft and on opposite sides of the shaft.

5. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, mechanism for producing a twisting movement of the arm about its longitudinal axis followed by a swinging movement about its transverse pivotal axis, comprising an operating shaft coaxial with the said transverse pivotal axis, an inner ring substantially coaxial with the arm and

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secured to the operating shaft, a sleeve pivoted in the inner ring about the transverse pivotal axis and receiving the arm which can turn in it about its longitudinal axis, an outer ring substantially coaxial with the operating shaft and secured to the arm, and at least one pair of interengaging members carried respectively by the outer and inner rings and engaging one another at a position spaced from both the longitudinal and transverse pivotal axes of the arm but adjacent to the plane containing those axes.

6. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, mechanism for producing a twisting movement of the arm about its longitudinal axis followed by a swinging movement about its transverse pivotal axis, comprising an operating shaft coaxial with the said transverse pivotal axis, an inner ring substantially coaxial with the arm and secured to the operating shaft, a sleeve pivoted in the inner ring about the transverse pivotal axis and receiving the arm which can turn in it about its longitudinal axis, an outer ring substantially coaxial with the operating shaft and secured to the arm, and at least one pair of interengaging members carried respectively by the outer and inner rings and engaging one another at a position spaced from both the longitudinal and transverse pivotal axes of the arm but adjacent to the plane containing those axes, and interlocking means serving to prevent swinging movement until the twisting movement is completed when opening, and to prevent twisting movement until the swinging movement is completed when closing the switch.

7. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, mechanism for producing a twisting movement of the arm about its longitudinal axis followed by a swinging movement about its transverse pivotal axis, comprising an operating shaft coaxial with the said transverse pivotal axis, an inner ring substantially coaxial with the arm and secured to the operating shaft, a sleeve pivoted in the inner ring about the transverse pivotal axis and receiving the arm which can turn in it about its longitudinal axis, an outer ring substantially coaxial with the operating shaft and secured to the arm, and at least one pair of interengaging members carried respectively by the outer and inner rings and engaging one another at a position spaced from both the longitudinal and transverse pivotal axes of the arm but adjacent to the plane containing those axes, and a casing totally enclosing such mechanism.

8. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, an operating shaft coaxial with the said transverse pivotal axis, mechanism operated by the said shaft for producing a twisting movement of the said arm about a longitudinal axis followed by a swinging movement about its transverse pivotal axis when opening the switch, and a casing totally enclosing such mechanism.

9. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, an operating shaft coaxial with the said transverse pivotal axis, mechanism operated by the

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said shaft for producing a twisting movement of the said arm about a longitudinal axis followed by a swinging movement about its transverse pivotal axis when opening the switch, and interlocking means serving to prevent swinging movement until the twisting movement is completed when opening and to prevent twisting movement until the swinging movement is completed when closing the switch, and a casing totally enclosing such mechanism.

10. Electric switchgear including an arm pivoted at one end to move about a transverse pivotal axis substantially perpendicular to its length, a moving contact carried by the arm near its other end, an operating shaft coaxial with the said transverse pivotal axis, mechanism operated by the said shaft for producing a twisting movement of the said arm about a longitudinal axis followed by a swinging movement about its transverse pivotal axis when opening the switch, and interlocking means serving to prevent swinging movement until the twisting movement is completed when opening and to prevent twisting movement until the swinging movement is completed when closing the switch, such interlocking

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means comprising an interlocking member secured to the arm and spaced from it in a direction substantially perpendicular to the axes both of the shaft and of the arm, and a stationary part formed with a slot in which the interlocking member is confined, the slot being L-shaped in a plane parallel to the plane containing the axes of the shaft and of the arm.

11. Electric switchgear as claimed in claim 10 in which the stationary member formed with the L-shaped slot is anchored by resilient means.

DOUGLAS ARTHUR JAMES OXLEY.

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