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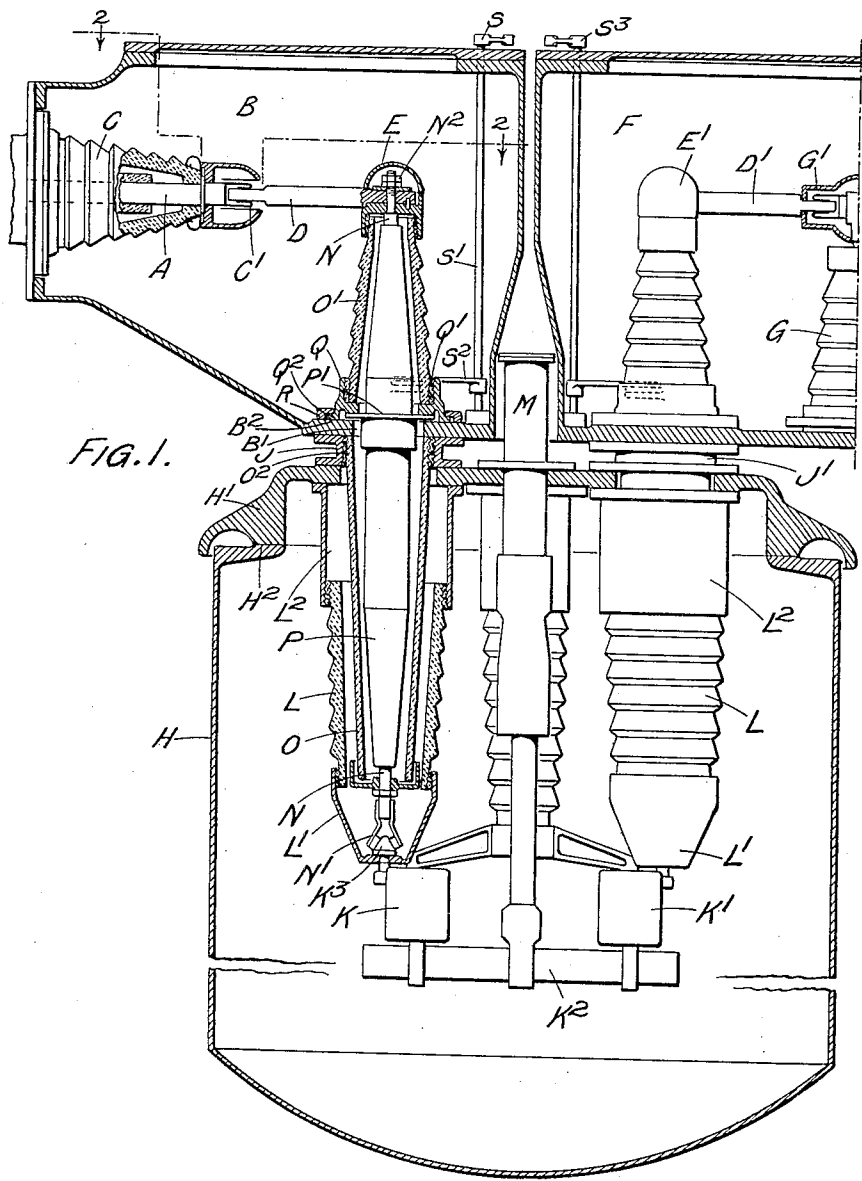
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ELECTRIC SWITCH GEAR

Filed Jan. 10, 1930

3 Sheets-Sheet 1



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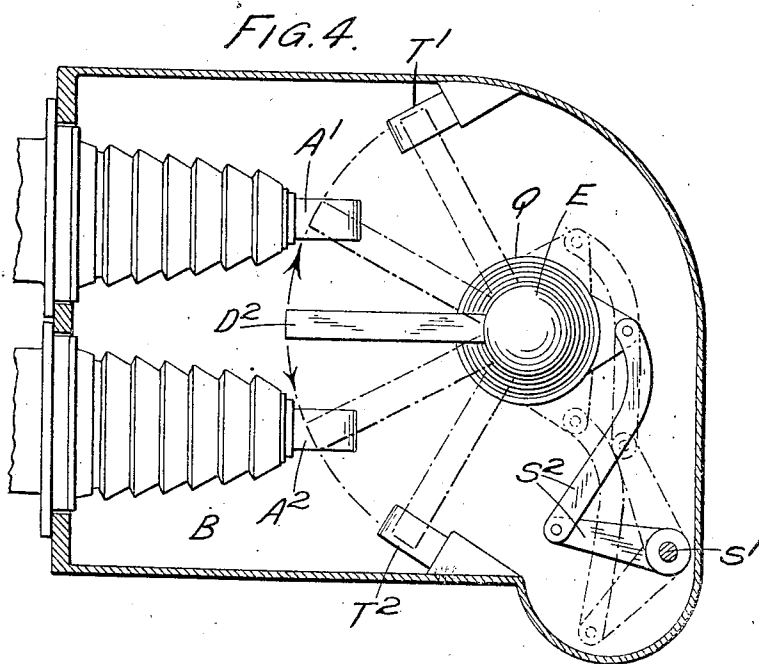
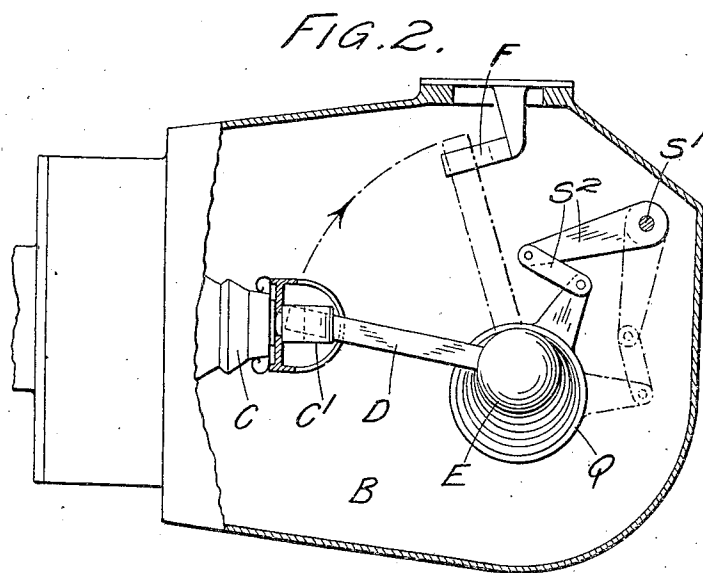
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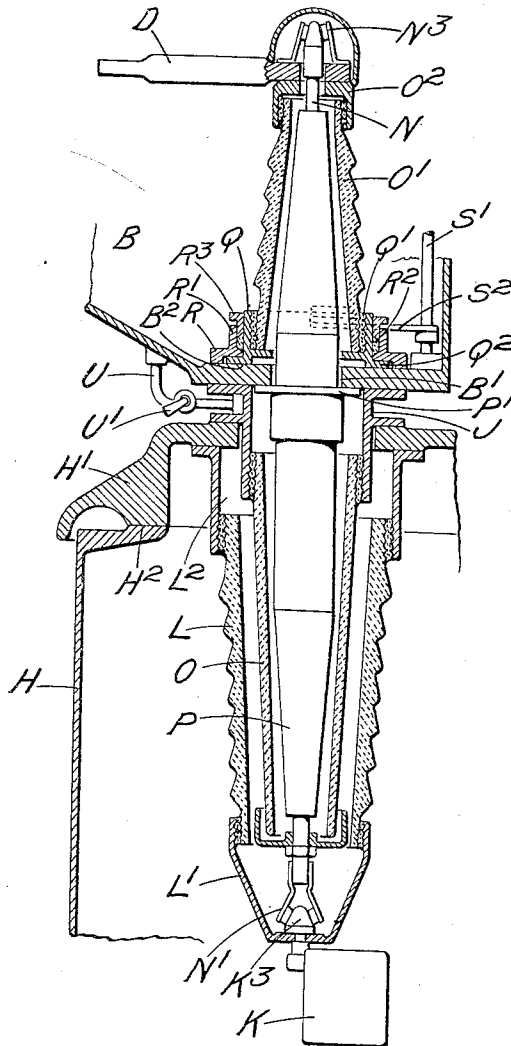
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ELECTRIC SWITCH GEAR

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FIG. 3.



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ELECTRIC SWITCH GEAR

Application filed January 10, 1929, Serial No. 419,964, and in Great Britain February 11, 1929.

This invention relates to electric switchgear, particularly to oil-immersed gear comprising a main circuit-breaker and one or more isolating switches.

The object of the present invention is the construction of oil-immersed gear of this general type wherein a convenient and efficient arrangement of rotary isolating switch is employed.

In switchgear according to this invention the isolating switch is actuated by a rotary member consisting of, or forming part of the casing of, one of the conductors passing through the top plate or fixed cover of the tank containing the main oil circuit-breaker and leading to the relatively fixed contacts of the main circuit-breaker, the phrase "relatively fixed" meaning in this connection the contacts which do not move in the ordinary opening and closing movement of the main circuit-breaker.

Conveniently the conductor, which constitutes the rotary member or is enclosed by a casing forming that member, makes a draw-out or plug and socket connection at its lower end with the "relatively fixed" main switch contact, that contact itself being held in an oil-tight cap at the bottom of a hollow insulator which at its upper end is fixed to the cover proper of the main circuit-breaker oil tank, i. e. to the cover which moves downwards with the circuit-breaker when it is lowered. The casing of the conductor is preferably more or less spindle-shaped and is formed at its upper and lower portions of hollow insulators.

When the conductor itself constitutes the rotary member the ends thereof pass through the hollow casing insulators the bottom end making a rotatable draw-out or plug and socket connection with the relatively fixed contact of the main circuit-breaker, whilst the upper end carries the blade of the isolating switch. In the alternative arrangement the hollow insulator surrounding the upper part of the conductor constitutes the rotary member and has a conducting top or cap which makes a rotatable connection, preferably also of the draw-out type, with the upper end of the conductor.

The casing is oil-filled and it passes through an oil-filled chamber forming part of or carried by the top plate or fixed cover of the main circuit-breaker. Oil from this chamber can pass to the space between the lower part of the casing and the hollow insulator fixed in the main circuit-breaker oil tank.

The following is a description, by way of example, of an oil-immersed circuit-breaker arrangement provided with isolating switches according to this invention with reference to the accompanying drawings, in which

Figure 1 shows a sectional elevation of the circuit-breaker and isolating switches,

Figure 2 is a plan view, on an enlarged scale, of the isolating switch on the line 2-2 of Figure 1,

Figure 3 is a sectional elevation of part of the circuit-breaker showing an alternative arrangement of isolating switch, and Figure 4 is a view similar to Figure 2 showing an isolating switch for a duplicate busbar system.

Referring to Figures 1 and 2, an oil-immersed switchgear arrangement is shown in which a main circuit-breaker is provided for connecting a busbar system to a feeder. The conductor A which forms part of or is connected to the busbar system is led into an oil-filled chamber B through an oil-tight insulator C carrying at its inner end a contact C¹. This contact cooperates with an isolating switch blade D fixed on the upper end of one terminal E of the circuit-breaker which projects into the chamber B through an opening B¹ in the bottom thereof. A second oil-filled chamber F, into which the other terminal E¹ of the circuit-breaker projects in a similar manner, contains a sealing insulator G for the feeder (not shown), a contact G¹ on this insulator cooperating with an isolating switch blade D¹ fixed to the end of the terminal E¹.

The circuit-breaker main oil tank H has a cover H¹ to which it is attached by bolts or the like (not shown) so as to make an oil-tight joint at H², the cover being in turn connected to the chambers B and F by means of channel-shaped rings J and J¹ respec-

tively. The "relatively fixed" contacts **K** and **K¹** of the circuit-breaker are mounted on oil-tight end caps **L¹** at the bottom of the hollow insulators **L** fixed at their upper ends to cylindrical chambers **L²** which are fastened to the cover **H¹**. The circuit-breaker operating mechanism **M** which, since it forms no part of the present invention, is only illustrated diagrammatically, is also carried by the cover **H¹** and actuates a movable bridge piece **K²** which, when the circuit-breaker is in the closed position as shown in Figure 1, connects the fixed contacts **K** **K¹**.

The terminal **E** of the circuit-breaker (shown in section in Figure 1), which also forms the rotary member for the isolating switch **D**, has a central conductor **N** carrying at its lower end flexibly mounted contact blocks **N¹**. The contact blocks **N¹** cooperate with a fixed contact **K³** mounted within the end cap **L¹** and suitably rounded so as to form a connection of the draw-out or plug and socket type and also to permit the terminal **E** to be rotated. The conductor **N** is connected at its upper end by clamping nuts **N²** to the isolating switch blade **D** and is contained in a spindle-shaped casing the lower part of which is formed by a hollow insulator **O** inside the insulator **L** and cemented as at **O²** to the ring **J**. The upper portion of the spindle-shaped casing is formed by another hollow insulator **O¹** which projects into the chamber **B**. The casing insulators **O** and **O¹** are oil-filled as are also the hollow insulator **L** and its supporting chamber **L²**, an aperture being provided in the chamber **L²** or the end cap **L¹** to permit oil to flow from the main switch tank **H** into the chamber **L²**, the insulator **L** and the end cap **L¹**. The conductor **N** is also insulated inside the casing in any suitable manner, a condenser bushing insulator **P** having a central flange **P¹** being used in the arrangement shown.

The terminal **E** is supported by means of a flanged ring **Q** cemented at **Q¹** to the lower end of the insulator **O¹** and having a machined surface **Q²** which rests on a corresponding machined surface **B²** surrounding the opening **B¹** of the chamber **B**. The ring **Q** is held in position by means of an internally flanged ring **R** bolted to the chamber **B**, the two rings being so arranged as to permit rotation of the terminal. The flange **P¹** of the insulator **P** is fixed to the lower side of the ring **Q** so that this insulator and the conductor **N** rotate with the casing insulator **O¹**.

The terminal **E** is rotated and consequently the isolating switch **D** operated by means of a lever **S** carried on the end of a shaft **S¹** which projects through the top of the chamber **B** and is connected to the ring **Q** by link mechanism **S²** (Figure 2). An earth-

ing contact **T** is mounted on the side of the chamber **B** in line with the blade **D** so that the fixed contact **K** of the circuit-breaker is earthed when the terminal **E** is rotated until the blade **D** is in the position shown in chain lines in Figure 2.

In the alternative arrangement shown in Figure 3 the flange **P¹** of the insulator is fixed by bolts (not shown) to the underside of the bottom of the chamber **B** and a rotatable draw-out or plug and socket joint is provided by means of the contact blocks **N³** between the top of the conductor **N** and the cap **O²** of the insulator **O¹**. The isolating switch blade **D** is then carried by the cap **O²** and is operated by rotating the hollow insulator **O¹**, the conductor **N** and its bushing insulator **P** remaining stationary. The flange **P¹** forms an oil-tight joint between the chamber **B** and the lower insulator **O** so that, in the event of the insulator **O** being damaged, oil will not run from the chamber **B** into the switch tank. The lower insulator **O** is maintained full of oil by means of a by-pass connection **U** having a control cock **U¹** which connects this chamber to the chamber **B**. The control cock **U¹** permits the by-pass to be closed when the main cover is lowered or during an emergency, as for example when the insulator **O** is fractured.

The connection between the top of the conductor **N** and the cap **O²** must necessarily be rotatable and is preferably of the draw-out type as shown to permit the conductor **N** and its insulator **P** to be withdrawn when the tank is lowered for inspection or renewal. In order that this may be done without running the oil out of the chamber **B** an oil-tight joint is formed between the rings **R** and **Q** by means of the flange **R¹** on the ring **R**, the gland **R³** and the packing **R²**. In other respects the construction of this alternative arrangement is similar to that shown in Figure 1.

In Figure 4 an arrangement of the isolating switch for a duplicate busbar system is shown, the isolating switch being used both for isolating and for busbar selection. When the blade **D²** is in the position shown it acts purely as an isolating switch while, as will be apparent from the four positions shown in chain lines, it can be used to connect the circuit-breaker to either of the busbars **A¹**, **A²** or to either of the earthing contacts **T¹**, **T²**.

It will be appreciated that this construction of circuit-breaker and isolating switch provides a simple and compact arrangement which enables the whole of the cooperating current-carrying parts to be efficiently oil-insulated and in which isolation can be obtained without lowering or withdrawing the whole circuit-breaker as is usually necessary in "draw-out" type switchgear. When the isolating switches are opened the circuit-breaker oil tank alone can be lowered by opening the joint **H²** and the contacts inspected

or the whole circuit-breaker with its cover and operating mechanism can be lowered by opening the joint between the cover H^1 and the rings J and J^1 , this latter operation being possible without disturbing in any way the terminal insulators or the isolating switches. In multiphase switchgear the circuit-breaker for each phase may have isolating switches according to the invention and the operating mechanisms for the switches in the several phases may be linked together so that they can be operated by a single handle or by a common source of power.

Interlocking mechanism of any suitable form may be provided, for instance, for preventing the operation of the isolating switches until the circuit has been broken by the main circuit-breaker or when the tank or circuit-breaker is in the lowered position and for preventing the lowering of the main circuit-breaker tank until the contacts of the isolating switches have themselves been isolated or earthed, but these details do not in themselves form part of the present invention and the functions of such interlocking mechanism are well known.

It will be appreciated that the above description is by way of example only and that many modifications may be made within the scope of the invention. Thus for example although the rotary member has been described as carrying the blade of the isolating switch, obviously the blade might be fixed and the rotary member might carry a series of contacts.

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

1. Oil-immersed electric switchgear including in combination a main oil tank, a cover for the tank, a circuit-breaker in the tank, at least one terminal passing through the cover and leading to the circuit-breaker, an isolating switch mounted on the end of the terminal outside the tank, and means for rotating at least a part of the terminal so as to operate the isolating switch.

2. Oil-immersed electric switchgear including in combination a main oil tank, a cover for the tank, a circuit-breaker in the tank, at least one hollow insulator fixed to the cover and projecting into the tank, an oil-tight cap at the bottom of the insulator, fixed and movable contacts for the circuit-breaker a fixed contact being carried on the cap, a terminal passing through the cover into the hollow insulator, a draw-out connection between the lower end of the terminal and the fixed contact on the cap, an isolating switch mounted on the upper end of the terminal outside the tank, and means for rotating at least a part of the terminal so as to operate the isolating switch.

3. Oil-immersed electric switchgear including in combination a main oil tank, a cover for the tank, a circuit-breaker in the tank,

at least one hollow insulator fixed to the cover and projecting into the tank, an oil-tight cap at the bottom of the insulator, fixed and movable contacts for the circuit-breaker a fixed contact being carried on the cap, a conductor, a casing for the conductor, hollow casing insulators forming the ends of the casing, the conductor and casing passing through the cover of the tank so that the lower casing insulator is surrounded by the hollow insulator, a draw-out connection between the lower end of the conductor and the fixed contact on the cap, an isolating switch blade mounted on the end of the upper casing insulator, a connection between the upper end of the conductor and the switch blade, and means for rotating at least a part of the terminal so as to operate the isolating switch blade.

4. Oil-immersed electric switchgear including in combination a main oil tank, a cover for the tank, a circuit-breaker in the tank, at least one oil-filled chamber fixed to the inner side of the cover, a hollow insulator mounted on the lower end of the chamber, an oil-tight cap at the bottom of the insulator, fixed and movable contacts for the circuit-breaker a fixed contact being carried on the cap, a conductor, a casing for the conductor, hollow casing insulators forming ends of the casing, the conductor and casing passing through the cover of the tank and the oil-filled chamber so that the lower casing insulator is surrounded by the hollow insulator, a draw-out connection between the lower end of the conductor and the fixed contact on the cap, an isolating switch blade mounted on the end of the upper casing insulator, a connection between the upper end of the conductor and the switch blade, and means for rotating at least a part of the terminal so as to operate the isolating switch blade.

5. In oil-immersed electric switchgear the combination of a main oil tank, a cover for the tank, a circuit-breaker in the tank, at least one conductor passing through the cover and leading to the circuit-breaker, a casing for the conductor, hollow casing insulators forming the ends of the casing, means for supporting the upper casing insulator on the outside of the cover, an isolating switch blade carried by the upper casing insulator, a connection between the end of the conductor and the switch blade, and means for rotating the upper casing insulator so as to operate the switch blade.

6. An oil-immersed electric switchgear the combination of a main oil tank, a cover for the tank, a circuit-breaker in the tank, at least one conductor passing through the cover and leading to the circuit-breaker, a casing for the conductor, hollow casing insulators forming the ends of the casing, means for supporting the upper casing insulator on the outside of the cover, an isolating switch blade

- carried by the upper casing insulator, a rotatable draw-out connection between the upper end of the conductor and the switch blade, and means for rotating the upper casing insulator so as to operate the switch blade. 70
- 5 7. In oil-immersed electric switchgear the combination of a main oil tank, a cover for the tank, a circuit-breaker in the tank, at least one conductor passing through the cover and leading to the circuit-breaker, a casing for the conductor, hollow casing insulators forming the ends of the casing, means for supporting the upper casing insulator on the outside of the cover, an oil-tight joint between the lower end of the upper casing insulator and the cover which permits rotation of the insulator, an isolating switch blade carried by the upper casing insulator, a rotatable draw-out connection between the upper end of the conductor and the switch blade, and means for rotating the upper casing insulator so as to operate the switch blade. 85
- 10 8. Oil-immersed electric switchgear including in combination a main oil tank, a cover for the tank, a circuit-breaker in the tank, at least one hollow insulator fixed to the inner side of the cover, an oil-tight cap at the bottom of the insulator, fixed and movable contacts for the circuit-breaker a fixed contact being carried on the cap, at least one insulated conductor passing through the cover into the hollow insulator, a casing for the conductor, hollow casing insulators forming the ends of the casing, an oil-tight joint between the lower end of the upper casing insulator and the outside of the cover which permits rotation of the insulator, a draw-out connection between the lower end of the conductor and the fixed contact in the cap, an isolating switch blade carried by the upper casing insulator, a rotatable draw-out connection between the upper end of the conductor and the switch blade, and means for rotating the upper casing insulator so as to operate the isolating switch blade. 100
- 15 9. Oil-immersed electric switchgear including in combination a main oil tank, a cover for the tank, a circuit-breaker in the tank, at least one hollow insulator fixed to the inner side of the cover, an oil-tight cap at the bottom of the insulator, fixed and movable contacts for the circuit-breaker a fixed contact being carried on the cap, at least one insulated conductor passing through the cover into the hollow insulator, a casing for the conductor, hollow casing insulators forming the ends of the casing, an oil-tight joint between the lower end of the upper casing insulator and the outside of the cover which permits rotation of the insulator, an oil-filled chamber surrounding the upper casing insulator, a draw-out connection between the lower end of the conductor and the fixed contact in the cap, an isolating switch blade carried by the upper casing insulator, cooperat- 105
- 20 ing contacts for the switch blade supported in the oil-filled chamber, a rotatable draw-out connection between the upper end of the conductor and the switch blade, and means for rotating the upper casing insulator so as to operate the isolating switch blade. 110
- 25 In testimony whereof I have signed my name to this specification. 115
- ARCHIBALD ALLAN. 120
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