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ELECTRIC SWITCH ARRANGEMENT

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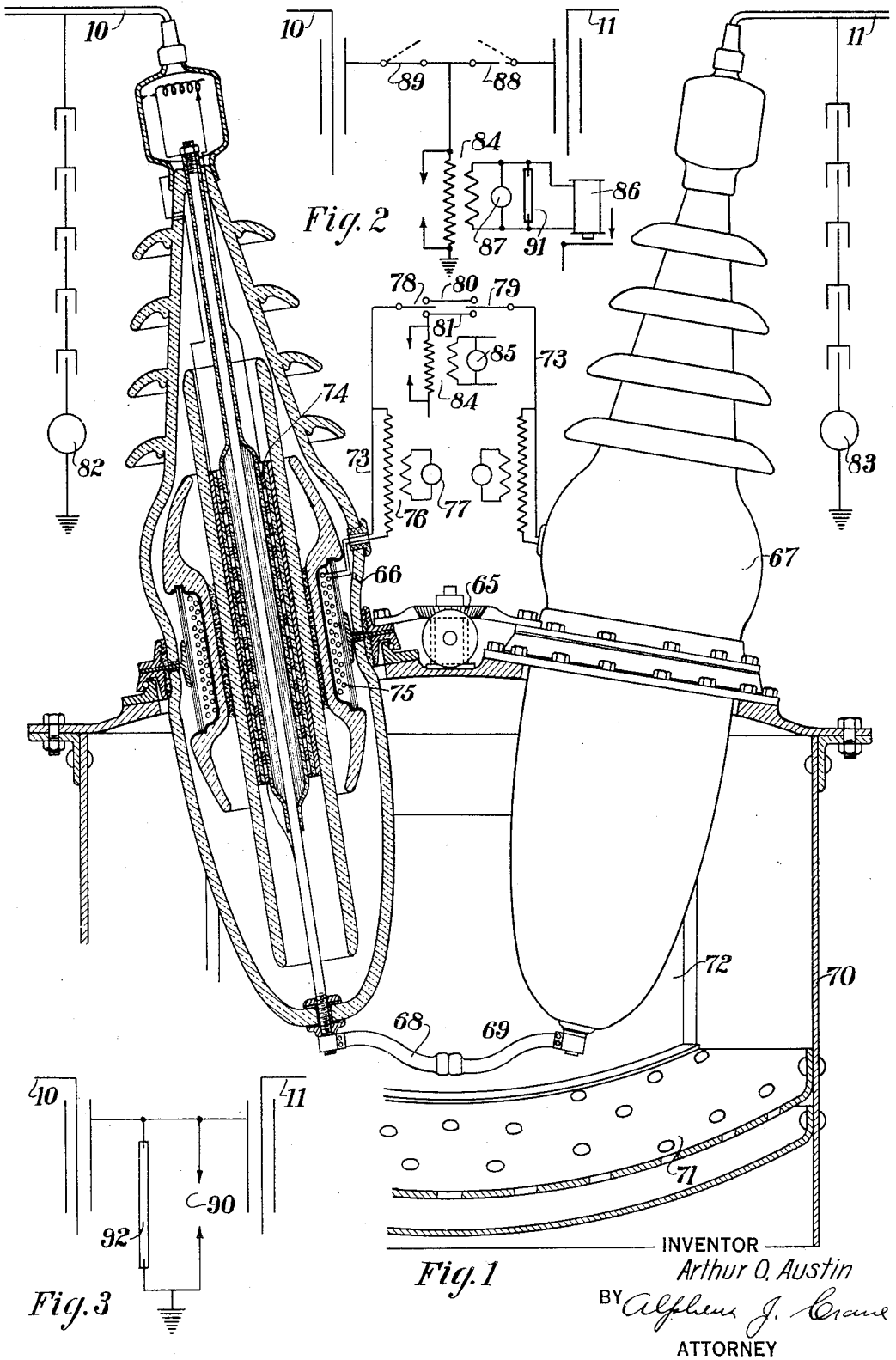

Fig. 2

Fig. 3

Fig. 1

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ELECTRIC SWITCH ARRANGEMENT

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18 Claims. (Cl. 172—245)

This invention relates to switches for high voltage transmission lines and has for one of its objects the provision of an electrostatic connection for transmitting carrier currents past a switch even when the switch is open.

A further object is to provide inductive taps associated with the switch bushings which may be employed both for transmitting carrier currents and for energizing electrical translating devices by energy diverted from the transmission line.

Other objects and advantages will appear from the following description.

The invention is exemplified by the combination and arrangement of parts shown in the accompanying drawing and described in the following specification, and it is more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 is a vertical sectional view of an oil break switch having one embodiment of the present invention applied thereto.

Figs. 2 and 3 are diagrams showing modified arrangements of the invention.

This application is a continuation in part of application Serial Number 432,821, filed March 3, 1930.

As illustrated, the invention is applied to a form of switch having rotating bushings 66 and 67 which carry contact arms 68 and 69 respectively and which are operated by gearing 65, in a manner more fully explained and claimed in my prior application 282,214, filed June 1, 1928. The housing 70 is provided with a perforated false bottom 71 and expansion tanks 72 which communicate with the space beneath the bottom 71. The bushings 66 and 67 are provided with capacitance taps 73 which may be constructed in a manner similar to that shown in my prior Patent #1,723,170, dated September 17, 1929. The bushings are also provided with current transformers having primary windings 74 and secondary windings 75. One end of the secondary winding 75 is connected with the capacitance tap 73 while the other lead 75 is insulated and the circuit is connected through an insulating transformer 76 to any desired electrical translating device 77, such as a meter or relay. The capacitance taps 73 from the two bushings are connected to switches 78 and 79 respectively by which they may be connected together, through either contacts 80 or 81. A transformer 84 has one terminal of its primary winding connected to contact 81 and the other terminal grounded. A current indicating device 85 is connected in circuit with the secondary of the transformer 84. When the switch 78 engages the contact 81, the transformer 84 will be energized by charging current for the capacitance coupling of the bushing 66 and the current flowing in 85 will be a function of the voltage on the line 10. If, on the other hand, the switch 79 is closed on the terminal 81, the indicator 85 will be energized in proportion to the voltage in the line 11. If both 78 and 79 are closed on 81, the indicator 85 may be used for synchronizing since the current flowing will be proportional to the algebraic sums of the voltages on the two lines. If the two voltages are in synchronism the indication of 85 will be maximum but if they are not in step, the reading will be reduced in proportion to the amount of displacement.

In operation when the main switch is open, the leads 73 may be connected either through 80 or 81 for transmitting carrier currents. If it is desired to close the switch 68—69, the switches 78 and 79 will be closed on 81 and the energizing unit for one of the lines 10 or 11 regulated until the indicator 85 shows the two lines to be in synchronism when the switch 68—69 may be closed. Carrier current apparatus connected with the leads 10 and 11 is indicated diagrammatically at 82 and 83.

The multiple connection with the line formed by the capacitance couplings located on opposite sides of a switch or in two circuits which may be synchronized or operated in multiple has particular advantages over types of connection where a single capacitance coupling is used. Where two capacitance couplings, as shown in Fig. 1, are connected in multiple, the available energy, when the switch is closed or the voltage is the same for the two circuits, is approximately twice as much as would be available if only one of the couplings were used. This is frequently of material advantage for the operation of relays or other equipment, particularly where a single stepdown transformer is used as in Fig. 2.

With the arrangement shown in Fig. 2, a single stepdown transformer 84 only is necessary for the operation of relays 86, voltage indication apparatus 87 or for other purposes. By the proper placing of switches 88 and 89 connected to the capacitance couplings, it is possible to determine which incoming circuit 10 or 11 is alive when only one is energized. The voltage indication apparatus will indicate little or no voltage when the potential in the incoming leads is in opposition. When the potential is the same in the two circuits, maximum voltage indication will result.

It is therefore seen that with this arrangement any simple voltage indicating device may be used for synchronizing. A spark gap 90 connected directly to the capacitance couplings may be used as an indicating means, as this gap if properly set will discharge only when the voltage in the two circuits is in phase. A neon light may be attached to the step-down transformer, as shown at 91, Fig. 2, or directly to the capacitance coupling as shown at 92, Fig. 3, particularly where the voltage is such that the light will furnish an indication only when the voltage is near the maximum. In many cases it may be possible to leave all the apparatus connected continuously to the step-down transformer as energy will not be needed for the operation of relays when the switch is open. If desired, apparatus which is not needed may be readily disconnected providing more energy for the operation of other equipment. The use of the single step-down transformer, however, reduces the losses absorbed by the step-down transformer, making more energy available than where two transformers are used as is necessary for the operation of a synchroscope. The arrangement may have particular advantages at remote switching points or where it is desired to obtain information as to the approximate phase or potential difference in two circuits.

I claim:

1. The combination with circuits to be synchronized, of a single electrode having a separate capacitance coupling with each of said respective circuits, and a current indicator having one terminal thereof grounded and the other terminal thereof electrically connected with said electrode to indicate the phase relation of the voltages in said circuits.

2. The combination with circuits to be synchronized, of means forming capacitance couplings with said circuits respectively, a transformer having one terminal of the primary winding thereof grounded and the other terminal of said primary winding connected with both of said coupling means, and a current indicator in circuit with the secondary winding of said transformer for indicating the phase relation of the voltages in said respective circuits.

3. The combination with a switch for connecting electrical circuits, of a conductor having a capacitance coupling with each of said circuits for transmitting carrier currents past said switch when said switch is open, and a voltage indicator connected between said conductor and ground for indicating the phase relation of the voltages in said respective circuits.

4. The combination with a switch for connecting electrical circuits, of capacitance coupling means joining said circuits, a voltage indicator having one terminal thereof grounded and means for selectively connecting the other terminal of said voltage indicator through said coupling means with either one or both of said circuits.

5. The combination with a switch for connecting electrical circuits, of capacitance couplings, one of which is associated with each of said respective circuits, a current indicating means having one terminal thereof grounded and switching means for connecting the other terminal of said indicating means selectively with either of said circuits through its capacitance coupling, said switching means being adapted to connect said couplings together and to said indicating means.

6. A switch for connecting electrical circuits comprising bushing insulators for said respective circuits, capacitance couplings carried by said insulators and energized by said respective circuits, means for connecting said capacitance couplings together to form a path for carrier currents past said switch, and means for indicating the voltage between said connecting means and ground to show the phase relation of the voltages in said respective circuits.

7. A switch for connecting electrical circuits comprising bushing insulators for said respective circuits current transformers associated with said insulators respectively, capacitance taps for said respective insulators, the current transformer and capacitance tap for each insulator having a common conductor, translating devices energized by said current transformers and insulating transformers interposed between said translating devices and their respective current transformer circuits.

8. A switch comprising a pair of bushing insulators, conductors extending through said insulators, electrical circuits connected with said conductors and joined by said switch, capacitance couplings carried by said bushing insulators respectively and energized by said conductors, means joining said capacitance couplings and forming a circuit for carrier currents past said switch when said switch is open, a transformer having one terminal of the primary thereof grounded, means for connecting the other terminal of said primary to said capacitance couplings, and a current indicator in circuit with the secondary of said transformer for indicating the phase relation of the voltages of said circuits.

9. An electric switch comprising a pair of bushing insulators, each having a conductor extending therethrough, switching contacts for connecting said conductors, capacitance members carried by said insulators and energized by said respective conductors, a current transformer connected with one of said insulators and energized by its conductor, a conductor lead connecting said capacitance members to each other to form a path for carrier currents between the terminals of said switch when said switch is open, a transformer having its primary winding conductively connected between said lead and ground, a current indicator in circuit with the secondary of said transformer, and switches for opening said lead between said transformer and either capacitance member.

10. The combination with a switch for connecting and disconnecting two circuits, of capacitance means for connecting said circuits when said switch is open, and a switch for opening the capacitance connection between said circuits.

11. The combination with a switch for high voltage transmission lines having bushing insulators for said lines, inductive taps connected with said bushing insulators, a switch for joining the taps of the respective insulators, and an electrical translating device energized by one of said taps.

12. The combination with transmission lines, of insulators for said lines, switch elements associated with said insulators for connecting said lines, capacitance taps associated with said insulators and energized by said respective lines, means insulated from ground for connecting said capacitance taps to transmit carrier currents over said lines past said switch elements, and a switch for breaking the connection between said capacitance taps.

13. The combination with transmission lines, of a switch for connecting said lines, said switch

comprising a housing, bushing insulators extending through the wall of said housing, conductors extending through said bushing insulators and connected with said respective lines, switch elements carried by said bushing insulators for connecting said conductors, capacitance taps insulated by said bushing insulators and energized by said respective conductors, means insulated from ground for conductively joining said capacitance taps, and an electrical translating device electrically connected with said joining means.

14. The combination with transmission lines, of a switch for joining said lines, said switch comprising a housing, bushing insulators mounted on said housing, capacitance taps and current transformers carried by said bushing insulators, and energized by said respective lines, means for joining said capacitance taps for transmitting carrier currents past said switch, an insulating transformer having one winding thereof electrically connected between said connecting means and ground, and an electrical translating device energized by the other winding of said transformer.

15. The combination with high potential conductors, of a common member of conducting material having capacitance couplings with said conductors, a step-down transformer having its high voltage winding connected between said member and ground, and voltage indicating means in circuit with the low voltage winding of said transformer.

16. The combination with a circuit breaker having conductors connected to the respective terminals thereof, of means forming capacitance couplings with each of said conductors, a voltage indicator and means for connecting one terminal of said voltage indicator to either one or both of said conductors through their respective capacitance couplings and means for connecting the other terminal of said indicator to ground.

17. The combination with a circuit breaker having conductors connected to the respective terminals thereof, of means forming capacitance couplings with said conductors, a step-down transformer, an electrical translating device and a voltage indicator energized by said transformer, and means for selectively connecting said transformer with either one or both of said conductors through their capacitance couplings.

18. The combination with conductors to be synchronized, of an electrode having capacitance couplings with said conductors, and an arcing gap having one terminal thereof connected with said electrode and the other terminal grounded, said gap being set to discharge only when the voltages in said conductors are approximately in synchronism.

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