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ISOLATED PHASE SWITCHING APPARATUS

Filed May 23, 1925

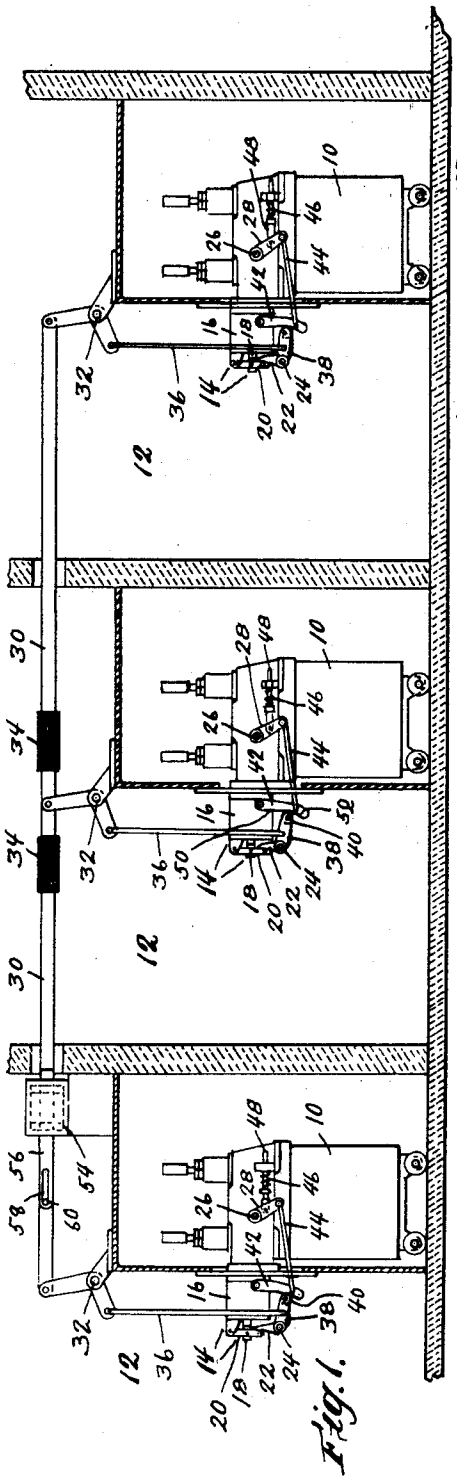


Fig. 1.

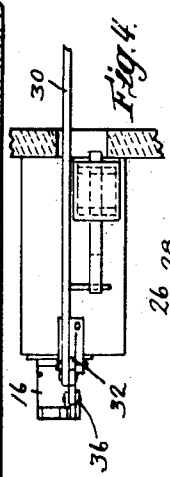


Fig. 4.

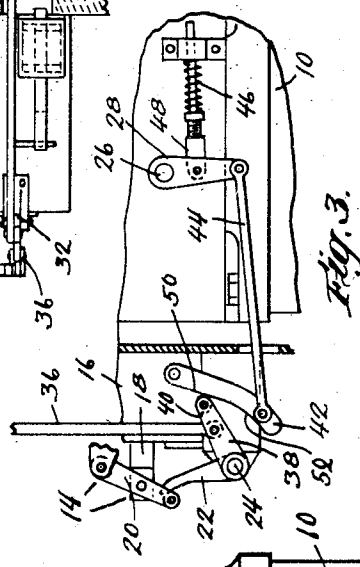


Fig. 3.

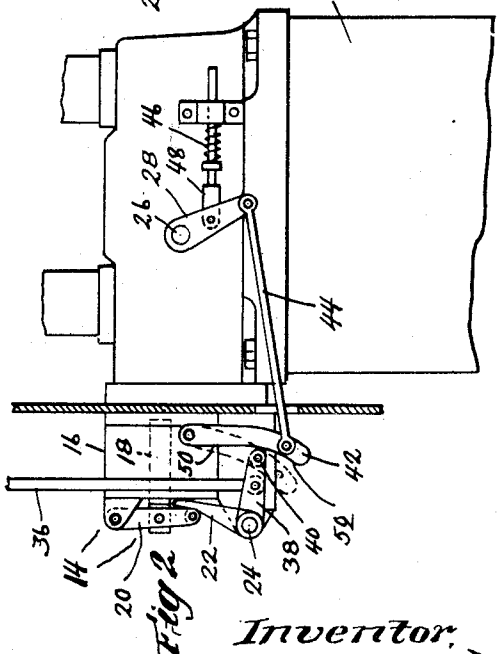


Fig. 2

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UNITED STATES PATENT OFFICE

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ISOLATED-PHASE-SWITCHING APPARATUS

Application filed May 23, 1925. Serial No. 32,469.

This invention relates to isolated-phase distribution systems and switching apparatus therein.

The electric switches of a multi-phase system arranged for phase-isolation are usually disposed at considerable distances from each other. The switches are usually mechanically inter-connected for conjoint operation, the power for closing the switches being transmitted through the inter-connecting mechanism, in some cases, or, in other cases, each switch may be provided with a closing magnet and the inter-connecting mechanism serves to ensure the simultaneous closing of the switches. The switches are usually provided with latches which are arranged independently to lock each switch mechanism releasably in closed position.

Due to the relatively great length of the inter-connecting mechanism between the switches, the mechanism is greatly influenced by temperature variations and expands and contracts to such a degree that its action is unreliable and sometimes fails to move the switch mechanism sufficiently into switch closed positions to permit the latches to lock the switches closed and, consequently, damage to the contact-members of the switches may result when the circuits are energized.

An object of this invention is the provision of switch-operating and inter-connecting mechanism so arranged that the switches can be closed, and held closed, regardless of variations in the length of the inter-connecting mechanism due to temperature changes or other causes.

This object is attained generally by having a lost-motion connection between the switch-mechanisms and the inter-connecting mechanism and so arranged that after the switches have been moved into closed position a further movement of the inter-connecting mechanism in a closing direction can take place without affecting the switch-mechanisms.

A further object is generally to improve the construction and operation of electric switches.

Fig. 1 is an elevation through a switch house arranged for phase isolation and equipped with mechanically inter-connected electric switches embodying the invention.

Fig. 2 is an enlarged side elevation of a portion of one of the switches of Fig. 1 and illustrating the disposition of the mechanism in switch-closed position.

Fig. 3 is a detail of the mechanism of Fig. 2 in switch-open position.

Fig. 4 is a plan detail illustrating the relation of the switch-tripping coil to the inter-connecting mechanism.

As here shown, the invention is applied to the switches 10, each of which is associated with a phase of a multi-phase distribution system, and the switches are contained in isolated compartments or cells 12 and spaced a considerable distance from each other, or are remotely disposed. The switches may be of any suitable type and are here shown as enclosed oil switches, each of which is provided with an external electrically-actuated closing mechanism 14. These switches, as is well known, have a definite extent of movement between open and closed positions and have a definite closed position and cannot be urged further in a switch closed direction without danger of damage to the contact brushes and the like. The closing mechanisms of the switches may be identical and each may include a closing solenoid 16. The plunger 18 of the solenoid is arranged to actuate a pivoted lever 20 which engages an arm 22 fixed to an operating shaft 24. The operating shaft is connected, through suitable mechanism forming a part of this invention, with internal switch mechanism which includes a shaft 26 extended through the switch casing and an arm 28 fixed to the extended end of said shaft.

The operating mechanisms of the switches are mechanically inter-connected for conjoint operation by suitable means as the rods 30, which rods may be pivotally connected and supported by the upper arms of bell-crank levers 32. Insulators 34 may be interposed in said rods whereby electrically to isolate the mechanisms. The lower arms of said bell-crank levers are pivotally connected through links 36 with arms 38 fixed to said operating shafts 24 of the operating mech-

anisms. Since each switch is provided with its own closing mechanism the rods 30 serve mainly as a governing mechanism to insure the simultaneous closing and opening of the switches although, if one of the closing solenoids fails to operate, power to close the switch associated with that solenoid will be transmitted through said rods from the other closing solenoids.

The closing and interconnecting mechanisms are provided with loose or lost-motion connection with the switch mechanisms. To this end and as here shown, the arms 38 of the operating mechanisms are provided with rollers 40 which are adapted to engage depending pivoted levers 42; and said levers 42 are connected through links 44 with the arms 28 of the switch mechanisms. Springs 46 acting on said arms 28 through rods 48 serve to maintain said levers 42 in engagement with said rollers and also to assist in opening the switches.

Said levers 42 are provided with upper or working cam faces 50 which are adapted to be engaged by said rollers 40 for the purpose of closing the switches, and are also provided with contiguous lower or dwell cam faces 52 over which said rollers can move without effectively moving the switch mechanisms in the switch-closed positions thereof.

As thus arranged, the energization of the closing solenoids 16 serves to move said arms 38 downwardly and thereby to pass the rollers 40 over the working cam faces 50 of said levers 42, whereby to effect the closing of the switches. Continued movement of said arms in the same direction may take place but without effect on the switches as the rollers merely ride over the dwell faces 52 without moving said levers. The initial disposition of the various elements is adapted to be such that, in switch-closed position, variations in the length of the inter-connecting rods 30, due to temperature variations, or variations in stroke of the closing mechanisms, merely varies the position of the rollers on the dwell faces of the levers 42, without effectively moving the switches. The disposition of the arms 38 and levers 42 is also such that, in the position illustrated in Fig. 2, the switches are held closed, thereby avoiding the necessity for latches or other locking means. The angularity of the bell-crank levers 32 may also be so disposed that the weight of the rods 30 and associated parts of the interconnecting mechanism also serves to hold the mechanism in the switch-closed position illustrated in Fig. 2.

The switches are adapted to be opened by means including an opening solenoid 54, the core 56 of which may be connected through a slot 58 and pin 60 with a suitable part of the inter-connecting mechanism, as one of the rods 30. Said solenoid, when energized, is arranged to exert a pull on said mechanism in a direction to rotate the arms 38 in a counter-clockwise direction and thereby move them out of switch-closed position. Thus released, the switch mechanisms are free to move into switch-open position by gravity, or by the action of said springs 46, and independently of the inter-connecting mechanism.

The opening solenoid need merely initiate the switch-opening movement, or move the interconnecting rods 30 to the right, Fig. 1, until their weight is exerted in switch-opening direction; and move the rollers 40 from the dwell to the working cam faces of the levers 42. Further movement of the mechanism may take place independently of the opening solenoid, such movement being permitted by the slotted, or lost-motion, connection between the opening solenoid and the mechanism.

The structure may be otherwise modified without departing from the spirit of the invention.

I claim:

1. The combination of a plurality of electric switches having a definite extent of movement between open and closed positions, operating mechanism therefor, and mechanism mechanically inter-connecting said switches for conjoint opening and closing movement and including means arranged to effect the same extent of closing movement of all the switches at the same time regardless of minor variations in the length of said interconnecting mechanism, said means including cooperative elements one of which moves the other into a definite position regardless of minor variations in extent of its own movement.

2. The combination of a plurality of electric switches having a definite extent of movement between open and closed positions, operating mechanism therefor, and mechanism mechanically inter-connecting said switches for opening all of them at the same time and also for closing all of them at the same time, including means admitting of the expansion and contraction of said inter-connecting mechanism without affecting the extent of closing movement of the switches.

3. The combination of a plurality of remotely disposed electric switches having a definite extent of movement between open and closed positions and adapted to be operated in unison in the same sense, operating mechanism therefor, and mechanism mechanically inter-connecting said switches and operating mechanism and including cooperating members one of which is movable free from effective movement of the other and both of which are arranged to effect the movement of all of the switches at the same time into and to hold them in completely closed position regardless of minor variations in the length of said inter-connecting mechanism.

4. The combination of a plurality of remotely disposed electric switches having a definite extent of movement between open and closed positions and adapted to be operated in unison in the same sense, operating mechanism therefor, inter-connecting mechanism for said switches and operating mechanism including a long rod extended between said switches and susceptible to detrimental variations in length when subjected to temperature variations, and means including a lost motion connection between said rod and operating mechanism arranged to permit the movement of all of the switches at the same time into completely closed positions and to hold them in such position regardless of minor variations in the length of said rod under variable temperature conditions.

5. The combination of a plurality of remotely disposed electric switches having a definite extent of movement between open and closed positions and adapted to be operated in unison in the same sense, each switch having a closing mechanism associated with it, inter-connecting mechanism for the switches including a long rod extended between the switches and having connections with all of the closing mechanisms, and means to effect the complete closing of all of the switches at the same time regardless of variations in the length of said rod under operating conditions including lost-motion connections between said closing mechanisms and switches.

6. The combination of a plurality of remotely disposed electric switches having a definite extent of movement between open and closed positions and adapted to be operated in unison in the same sense, closing mechanism therefor, and mechanism interconnecting said switches and closing mechanism including a long rod extended between said switches and having an operative connection with said closing mechanism and cooperating with said closing mechanism to close all of the switches at the same time, and lost-motion connections between said rod and each of said switches arranged to prevent overtravel of the switches due to expansion of said rod.

7. The combination of an electric switch, closing mechanism therefor and means constituting a motion-absorbing device operatively connecting said closing mechanism with the switch arranged to permit a substantial degree of movement of said closing mechanism beyond completely switch-closed position while cooperating therewith to hold the switch in completely-closed position, said means including a pivoted actuating arm having a cam follower at its free end, and a cooperating pivoted cam member having a working face over which said follower is adapted to move during its switch closing movement and also an arcuate dwell face over which said follower is subsequently adapted to move.

8. The combination of an electric switch, a closing mechanism therefor and means constituting a motion-absorbing device operatively connecting said closing mechanism with the switch arranged to permit a substantial degree of movement of said closing mechanism both away from and beyond completely switch-closed position while cooperating therewith to hold the switch in completely-closed position, said means including a pivoted actuating arm having a cam follower at its free end, and a cooperating pivoted cam member having a working face over which said follower is adapted to move during its switch closing movement and also an arcuate dwell face over which said follower is subsequently adapted to move.

9. The combination of a plurality of remotely-disposed electric switches having a definite extent of movement between open and closed positions, means including a long rod interconnecting said switches arranged to operate them in the same direction in unison, and means constituting a motion-absorbing device in the connections arranged to provide for a substantial degree of movement of said rod beyond completely switch-closed position without effectively moving the switches from completely closed position.

10. The combination of a plurality of remotely-disposed electric switches having a definite extent of movement between open and closed positions, means including a long rod interconnecting said switches, arranged to operate them in the same direction in unison, and lost motion means in the connections arranged to provide for a substantial degree of movement of said rod, both away from and beyond completely switch-closed position without effectively moving the switches from completely closed position.

11. An electric switch having a predetermined extent of movement between open and closed positions, and closing mechanism therefor having means connecting it with the switch arranged to effect the complete closing of the switch and provide for continued movement of the mechanism in a switch-closing direction without effectively moving the switch and while cooperating with said closing mechanism to hold the switch closed, said means including a motion-absorbing connection between said switch and said closing mechanism including a pivoted arm having a cam follower at its free end and a pivoted cam member having contiguous straight and arcuate cam faces over which said follower is adapted to travel during closing movement of said switch, said arcuate cam face arranged to coincide with the path of travel of said follower in the switch closed position of said cam member.

12. The combination of a plurality of re-

motely-disposed electric switches having predetermined extents of movement between open and closed positions, interconnecting mechanism including a long rod extended between said switches and arranged to operate them in the same direction in unison and means connecting said rods and switches arranged to provide for a combined movement of said rods and switches into the completely closed positions of said switches and for a further movement of said rod alone without effectively moving said switches and while holding said switches closed, said means comprising a motion absorbing connection between said rods and said switches.

13. The combination of an electric switch having a pivotally-movable cam-lever provided with a working face and a contiguous arcuate dwell face, and closing mechanism for the switch having an operating arm pivoted at one end and having a follower at its free end movable over the working face of said cam-lever to effect the closing of the switch and adapted to move over the dwell face without moving the switch, said dwell face of said cam lever being struck about a radius equal to the length of said operating arm and adapted to cooperate therewith to hold the switch closed.

14. The combination of a plurality of remotely disposed electric switches each having a cam-lever provided with a working face and a contiguous dwell face, operating arms movable over the working faces to effect the closing of the switches and adapted to pass over the dwell faces without moving the switches, said dwell faces and said operating arms cooperating to hold the switches closed, mechanism mechanically interconnecting said operating arms for conjoint operation, and switch-closing mechanism associated with said interconnecting mechanism.

15. The combination of a plurality of remotely disposed electric switches each having a cam-lever provided with a working face and a contiguous dwell face, operating arms movable over the working faces to effect the closing of the switches and adapted to pass over the dwell faces without moving the switches, said dwell faces and said operating arms cooperating to hold the switches closed, mechanism mechanically interconnecting said operating arms for conjoint operation, and a switch closing mechanism associated with each switch and having an operative connection with its operating arm.

16. The combination of a plurality of remotely disposed electric switches, separate power-operated closing mechanisms for each of said switches whereby the switches can close each independently of the others, control means connecting the switches arranged to ensure the simultaneous closing of the switches when said closing mechanisms are energized at the same time including a rod interconnecting the switches arranged when in one position to hold the switches closed by its weight and when moved out of said position to move by its weight further in the same direction to permit the switches to open, supporting means for said rod arranged to provide the aforesaid movement of said rod, and electrically-actuated switch-opening means arranged to move said rod out of said first position such distance that it can move by its weight independently of said switch-opening means in a switch-opening direction, whereby to effect the opening of the switches.

17. The combination of a plurality of remotely disposed electric switches, closing mechanism for said switches, a rod interconnecting said switches, supporting means for said rod arranged when in one direction to bias said rod for switch-closing movement and when in another position to bias said rod for switch-opening movement, and electrically-actuated means to move said rod in a switch-opening direction and a lost-motion connection between said electrically-actuated means and said rod arranged to permit said rod to move in a switch-opening direction independently of said electrically-actuated means.

18. The combination of a plurality of electric switches, closing mechanism therefor arranged to close said switches simultaneously and hold them closed and including a member which is movable between switch open and closed positions and is arranged when moved part way in a switch-opening direction to effect the release of the switches and to move further in an opening direction conjointly with the corresponding movement of said switches, and switch-opening means arranged to move said member sufficiently in a switch-opening direction to effect the opening of the switches.

In testimony whereof, I have signed my name to this specification.

MORRIS B. WOOD.