Nov. 30, 1937. K. PAULSON ET AL 2,100,722

SWITCH OPERATING MECHANISM

Filed Aug. 7, 1936 2 Sheets-Sheet 1

Fig. 1.

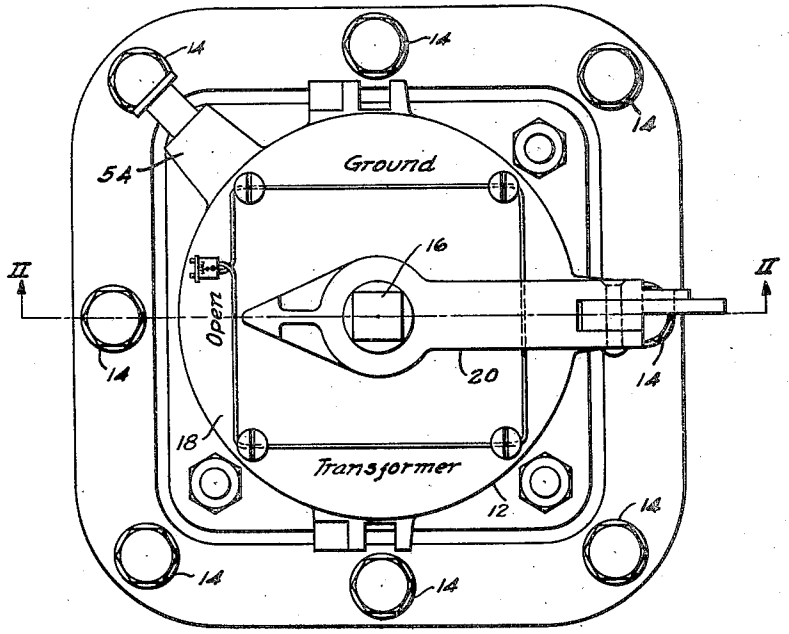
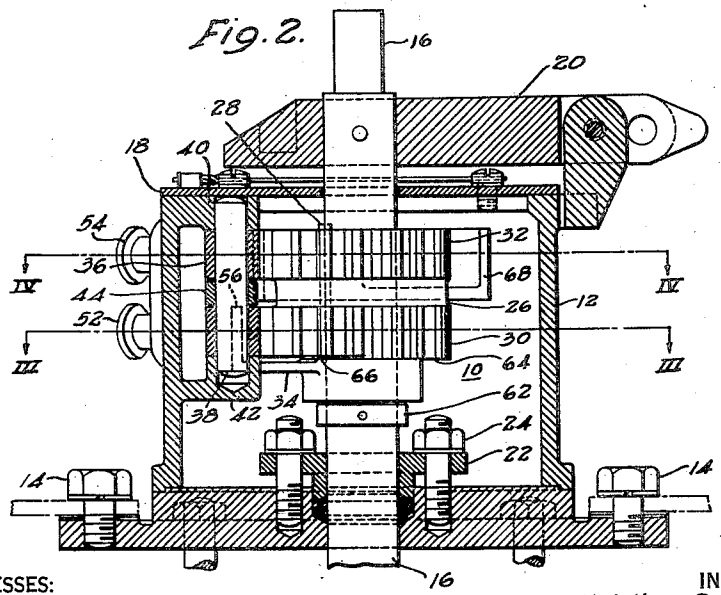


Fig. 2.



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Fig. 3.

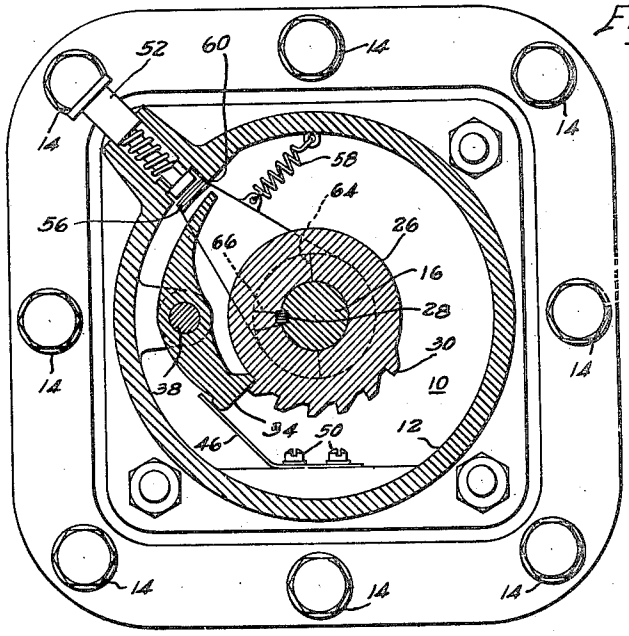
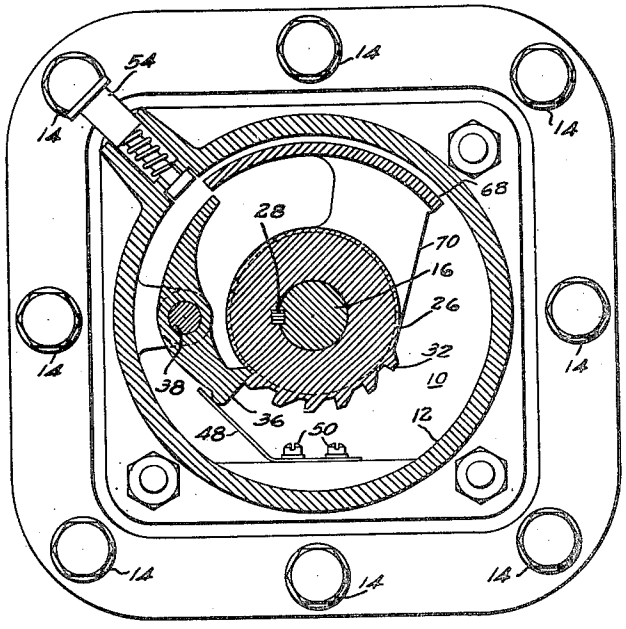


Fig. 4.



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SWITCH OPERATING MECHANISM

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7 Claims. (Cl. 74—483)

This invention relates to transformer grounding switches and particularly to the operating mechanism for actuating grounding switches.

In the operation of electrical apparatus, such as transformers, it is desirable to disconnect the transformer from the power circuit when repairs or changes are to be made and to so ground the feeder from the power source that the transformer is not again connected to the feeder circuit until repairs and changes have been made. Since serious damage to apparatus and life may result if the grounding switch controlling the transformer is operated from an open position to ground position when the transformer is energized, it is advisable to provide an actuating mechanism for the grounding switch which will necessitate actuating the grounding switch from the open position to the transformer position before actuating it to the ground position.

In a large number of the transformer grounding switches commonly employed in the industry, the open position of the switch is between the ground and transformer positions. In this type of grounding switch it has been quite difficult to enforce the desired sequence of operation of the grounding switch or to secure free movement of the switch from the open position to the transformer position and from the transformer position to the open position.

An object of this invention is the provision of an operating mechanism for controlling the sequence of operating positions of a grounding switch.

Another object of this invention is the provision of an operating mechanism for obtaining a positive movement of a transformer grounding switch from an open position through a transformer position to the ground position.

A more specific object of this invention is the provision of an operating mechanism for effecting a positive movement of a transformer grounding switch from an open position through a transformer position to the ground position and preventing a return movement of the grounding switch to the ground position after it has once been advanced from the ground position without first going through a predetermined cycle of operation.

Other objects of this invention will be apparent from the following description, when taken in conjunction with the accompanying drawings, in which

Figure 1 is an elevational view of the enclosing housing of the operating mechanism as embodied in this invention,

Fig. 2 is a view in section of the operating mechanism taken along the line II—II of Fig. 1,

Fig. 3 is a view in section taken along the line III—III of Fig. 2, and

Fig. 4 is a view in section taken along the line IV—IV of Fig. 2.

The operating mechanism comprising this invention is adapted for the operation of various well known forms of three-position grounding switches in which the switch is adapted to connect a feeder circuit in an open position or to the primary winding of a transformer or to a ground, which positions are commonly known as the "open", "transformer" and "ground" positions.

Referring to the drawings, the switch operating mechanism 10 which comprises this invention is illustrated as substantially enclosed in a housing 12 that is suitably mounted by means of the bolts 14 to the housing of the grounding switch (not shown). In order to actuate the grounding switch through different switching operations, a switch operating shaft 16 is rotatably mounted in the housing 12. One end of the operating shaft 16 projects through the cover 18 of the housing 12 and carries an operating and locking handle 20. The other end of the operating shaft 16 projects through a stuffing box 22 suitably mounted in the housing as by means of the bolts 24 and may be connected to the grounding switch in any well known manner. The stuffing box 22 is oil-tight to prevent the leaking of oil along the operating shaft 16 from the switch housing into the operating mechanism.

In order to control the movement of the operating shaft 16 to actuate the grounding switch through a predetermined sequence of switching operations, a ratchet wheel 26 is fixedly mounted on the operating shaft 16 by means of a key 28. The ratchet wheel 26 is provided with two toothed sections 30 and 32 which are in separate parallel planes and each of which extends over approximately a quarter of the periphery of the ratchet wheel so that when the operating shaft 16 is moved as hereinafter explained to actuate the grounding switch to the ground position, the toothed sections 30 and 32 of the ratchet wheel extend about the periphery of the ratchet wheel from the ground position to the open position.

In order to control the movement of the operating shaft 16, a plurality of pawls 34 and 36 are provided for engaging the toothed sections 30 and 32, respectively, of the ratchet wheel 26 to prevent movement of the operating shaft to the ground position. The pawls 34 and 36 are pivotally mounted on shaft 38 which is suitably

carried between flanges 40 and 42 provided on the side walls of the housing 12 and are separated from each other by means of a spacer 44. The spacer 44 is of such a size as to maintain the pawls 34 and 36 in the planes of the sections 30 and 32, respectively. In order that the pawls 34 and 36 may be normally biased to engage the sections 30 and 32, respectively, spring members 46 and 48 are provided for abutting the engaging ends of the pawls 34 and 36 to bias them into engagement with the toothed sections 30 and 32, respectively. The spring members 46 and 48 may be suitably mounted to the side walls of the housing 12 as by means of the bolts 50.

As shown in the drawings and particularly Figs. 3 and 4, the pawls 34 and 36 engage the toothed sections 30 and 32 of the ratchet wheel 26 when the operating mechanism is in the open position to prevent movement of the operating mechanism to the ground position. In order to provide for causing the pawls 34 and 36 to release the toothed sections 30 and 32, respectively, spring biased plungers 52 and 54 are suitably mounted in the housing 12. The spring biased plungers 52 and 54 are adapted for manual operation to abut the tails of the pawls 34 and 36, respectively, to cause the pawls to rotate about the pivot pin 38 to release the ratchet wheel 26.

Since it is desired to prevent the release of the ratchet wheel 26 when the grounding switch is in the open position, a stop 56 is pivotally carried on the operating shaft 16 and projects between the plunger 52 and the pawl 34 to prevent the manual operation of the plunger. In order to maintain the stop 56 in the position where it prevents the manual operation of the plunger 52 except when the grounding switch is in a transformer position, a spring 58 is provided for biasing the stop 56 to its interfering position. In this position the stop 56 abuts a projection 60 which is provided on the housing 12 for limiting the movement of the stop 56. A collar 62 is keyed to the operating shaft in order to prevent the stop 56 from slipping along the operating shaft 16 to a position where the stop will not interfere with the manual operation of the plunger 52.

In order to cause the movement of the stop 56 to a position where it will not prevent the manual operation of the plunger 52, a lug 64 is provided on the ratchet wheel 26 for engaging a projection 66 carried on the flange of the stop 56 when the operating shaft is moved to the transformer position. The lost motion found as the lug 64 moves to engage the projection 66 permits the operating shaft to be moved almost to the transformer position before lug 64 engages the projection 66 to actuate the stop 56 to a position where it will not prevent the manual operation of the spring biased plunger 52.

Referring to Fig. 4 of the drawings, the toothed sections 32 of the ratchet wheel 26 and its associated elements are shown in the open position of the grounding switch. The toothed section 32 is provided with a stop 68 carried on an arm 70 of the ratchet wheel 26. The stop 68 is so disposed that it permits manual operation of the spring biased plunger 54 to cause the pawl 36 to release the toothed section 32 when the grounding switch is in the open position. As the grounding switch is actuated to the transformer position to move the stop 56 to a position where the plunger 52 may be operated to cause the pawl 34 to release the toothed section 30, the stop 68 is rotated with the operating shaft 16 to a position between the plunger 54 and the pawl 36 where it prevents the manual operation of the plunger 54.

With the grounding switch in the transformer position and the stop 56 moved from its interfering position with the plunger 52, the plunger 52 may be manually operated to cause a rotation of the pawl 34 about its pivot pin 38 against the biasing force of the spring 46 to a position where the pawl clears the toothed section 30 of the ratchet wheel 26. In this position of the grounding switch, the plunger 54 cannot be operated to cause a movement of the pawl 36 to release the ratchet wheel 26, since the stop 68 is positioned between the plunger 54 and the pawl 36. In order to cause the pawl 36 to release the ratchet wheel 26, the grounding switch must be first moved to the open position where the stop 68 clears the plunger 54 and the pawl 36.

If the operating shaft and consequently the ratchet wheel 26 is moved to the open position without maintaining the plunger 52 in a position where it biases the pawl 34 to release the ratchet wheel 26, the spring 58 biases the stop 56 to the position where it abuts the stop 60 and interferes with the manual operation of the plunger 52. Since the plunger 52 can not be manually operated the pawl 34 engages the toothed section 30 and prevents movement of the operating shaft to actuate the grounding switch to the ground position.

If the plunger 52 is operated to and held in a position to cause the pawl 34 to release the ratchet wheel 26 when the grounding switch is in the transformer position, the grounding switch may be moved to the open position where the stop 68 clears the plunger 54. In this position the plunger 54 may be operated to cause the pawl 36 to release the ratchet wheel 26.

With both of the plungers 52 and 54 held in a position to cause the pawls 34 and 36, respectively, to release their associated toothed sections, the grounding switch may be actuated from the open position to the ground position. If at any time during the movement of the grounding switch from the open position to the ground position either of the plungers 52 or 54 is released, the associated pawl 34 or 36 will be biased by its respective spring 46 or 48 to engage the associated toothed section 30 or 32, to prevent further movement of the grounding switch to the ground position.

After the grounding switch is in the ground position and the plungers are released, a movement of the operating handle 20 to cause a movement of the operating shaft 16 to actuate the grounding switch towards the open position makes it impossible to return the grounding switch to the ground position without first going through the transformer position. This is because the stop 56 is normally held in the interfering position to prevent the operation of the plunger 52 to effect the release of the toothed section 30.

From the foregoing disclosure it is evident that the operating mechanism of this invention provides for the actuation of a grounding switch to a ground position through a predetermined sequence of switching operations. The operating mechanism of the switch insures against the grounding of the feeder when the transformer circuits are closed, since the switch must first be actuated to a transformer position before it is actuated to the ground position. Further, by means of this invention, it is evident that free movement of the operating switch between the open and the transformer positions and the

transformer to open positions may be obtained. Because of the stops carried by the operating shafts, it is impossible to obtain a simultaneous initial operation of the plungers controlling the release of the ratchet wheel so that in order to actuate the switch to the ground position it is necessary to first actuate the grounding switch through its predetermined sequence of operation to obtain the release of the ratchet wheel.

Although this invention has been described with reference to a particular embodiment thereof, it is, of course, to be understood that it is not to be limited thereto except insofar as is necessitated by the prior art and the spirit of the appended claims.

We claim as our invention:

1. In an operating mechanism for effecting the movement of a transformer grounding switch from an open position, through a transformer position to a ground position, in combination, a housing for the operating mechanism, a shaft rotatably mounted in the housing for actuating the grounding switch, a ratchet wheel carried by the shaft, a plurality of pawls associated with the ratchet wheel for preventing movement of the shaft to actuate the grounding switch to the ground position, means disposed for manual operation to actuate the pawls to release the ratchet wheel and permit movement of the shaft to actuate the grounding switch to the ground position, and means for preventing the manual operation of the pawl actuating means for effecting the release of the ratchet wheel unless the shaft is first moved to actuate the grounding switch to transformer position.

2. In an operating mechanism for effecting the movement of a transformer grounding switch from an open position, through a transformer position to a ground position, in combination, a housing for the operating mechanism, a shaft rotatably mounted in the housing for actuating the grounding switch, a ratchet wheel carried by the shaft, a plurality of pawls associated with the ratchet wheel for preventing movement of the shaft to actuate the grounding switch to the ground position, spring means associated with each of the pawls and disposed to bias the pawls to engage the ratchet wheel, spring biased means disposed for manual operation to actuate the pawls to release the ratchet wheel and permit movement of the shaft to actuate the grounding switch to the ground position, and means for preventing the manual operation of the pawl actuating means for effecting the release of the ratchet wheel unless the shaft is first moved to actuate the grounding switch to transformer position.

3. In an operating mechanism for effecting the movement of a transformer grounding switch from an open position, through a transformer position to a ground position, in combination, a housing for the operating mechanism, a shaft rotatably mounted in the housing for actuating the grounding switch, a ratchet wheel carried by the shaft, a plurality of pawls associated with the ratchet wheel for preventing movement of the shaft to actuate the grounding switch to the ground position, spring biased means associated with each of the pawls and disposed for manual operation to actuate the pawls to release the ratchet wheel and permit movement of the shaft to actuate the grounding switch to the ground position, and a plurality of means for preventing the simultaneous manual operation of the spring biased means when the grounding switch is in predetermined positions.

4. In an operating mechanism for effecting the movement of a transformer grounding switch from an open position, through a transformer position to a ground position, in combination, a housing for the operating mechanism, a shaft rotatably mounted in the housing for actuating the grounding switch, a ratchet wheel carried by the shaft, a plurality of pawls associated with the ratchet wheel for preventing movement of the shaft to actuate the grounding switch to the ground position, spring biased means associated with each of the pawls and disposed for manual operation to actuate the pawls to release the ratchet wheel and permit movement of the shaft to actuate the grounding switch to the ground position, and a plurality of means for preventing the simultaneous manual operation of the spring biased means when the grounding switch is in predetermined positions, one of said plurality of means preventing the manual operation of one of the spring biased means except when the grounding switch is in the transformer position, another of said plurality of means preventing the manual operation of another of the spring biased means when the grounding switch is in the transformer position and permitting the manual operation of the spring biased means when the grounding switch is in the open position.

5. In an operating mechanism for effecting the movement of a transformer grounding switch from an open position, through a transformer position to a ground position, in combination, a housing for the operating mechanism, a shaft rotatably mounted in the housing for actuating the grounding switch, a ratchet wheel carried by the shaft, the ratchet wheel comprising two toothed sections disposed in different parallel planes, a pawl associated with each of the toothed sections for preventing movement of the shaft to actuate the grounding switch to the ground position, spring means associated with each of the pawls and disposed to bias the pawls to engage the toothed sections of the ratchet wheel, a spring biased plunger associated with each of the pawls and disposed for manual operation to actuate the pawls to release the ratchet wheel and permit movement of the shaft to actuate the grounding switch to the ground position, a spring biased stop disposed between one of the pawls and its associated plunger for preventing the manual operation of the plunger when the grounding switch is in the open position, means carried by the ratchet wheel for engaging the spring biased stop as the grounding switch is actuated to the transformer position to move the stop to a position where it is inoperative to prevent the manual operation of the plunger, a second stop carried by the shaft and disposed to be moved to a position between the other pawl and its associated plunger as the grounding switch is actuated from the open position to the transformer position to prevent the manual operation of said associated plunger, and to a position where it is inoperative to prevent the manual operation of the associated plunger when the grounding switch is returned to the open position.

6. In an operating mechanism for effecting the movement of a transformer grounding switch from an open position, through a transformer position to a ground position, in combination, a housing for the operating mechanism, a shaft rotatably mounted in the housing for actuating

the grounding switch, a ratchet wheel carried by the shaft, the ratchet wheel comprising two toothed sections disposed in different parallel planes, a pawl associated with each of the toothed sections for preventing movement of the shaft to actuate the grounding switch to the ground position, spring means associated with each of the pawls and disposed to bias the pawls to engage the toothed sections of the ratchet wheel, a spring biased plunger associated with each of the pawls and disposed for manual operation to actuate the pawls to release the ratchet wheel and permit movement of the shaft to actuate the grounding switch to the ground position, a plurality of stops carried by the shaft for preventing a simultaneous initial manual operation of the spring biased plungers when the grounding switch is in the open or transformer positions, one of the stops disposed to project between one of the pawls and its associated plunger to prevent the manual operation of the associated plunger when the grounding switch is in the open position, means carried by the ratchet wheel for engaging said one of the stops as the grounding switch is actuated to the transformer position to move it to a position where it is inoperative to prevent the manual operation of the plunger, another of the stops disposed to be moved to a position between the other pawl and its associated plunger as the grounding switch is actuated from the open position to the transformer position to prevent the manual operation of said associated plunger, and to a position where it is inoperative to prevent the manual operation of the associated plunger when the grounding switch is returned to the open position.

7. In an operating mechanism for effecting the movement of a transformer grounding switch from an open position, through a transformer position to a ground position, in combination, a housing for the operating mechanism, a shaft rotatably mounted in the housing for actuating the grounding switch, a ratchet wheel carried by the shaft, a plurality of pawls associated with the ratchet wheel for preventing movement of the shaft to actuate the grounding switch to the ground position, spring biased means associated with each of the pawls and disposed for manual operation to actuate the pawls to release the ratchet wheel, a spring biased stop disposed between one of the pawls and its associated spring biased means for preventing the manual operation of the associated spring biased means when the grounding switch is in the open position, means for actuating the spring biased stop to a predetermined position when the grounding switch is in the transformer position where it is inoperative to prevent the manual operation of the associated spring biased means, and a second stop carried by the shaft and disposed for movement to a position between the second pawl and its associated spring biased means when the grounding switch is actuated to its transformer position to prevent the manual operation of the spring biased means associated with the second pawl, the second stop also disposed for movement to a predetermined position when the grounding switch is actuated to the open position to permit the manual operation of the spring biased means associated with the second pawl, the manual operation of the spring biased means associated with the one pawl when the grounding switch is in the transformer position and of the spring biased means associated with the second pawl when the grounding switch is in the open position effecting the release of the ratchet wheel and permitting movement of the shaft to actuate the grounding switch to the ground position.

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