

Sept. 18, 1928.

1,685,068

W. R. HUTTINGER

SWITCH MECHANISM

Filed June 26, 1925

3 Sheets-Sheet 1

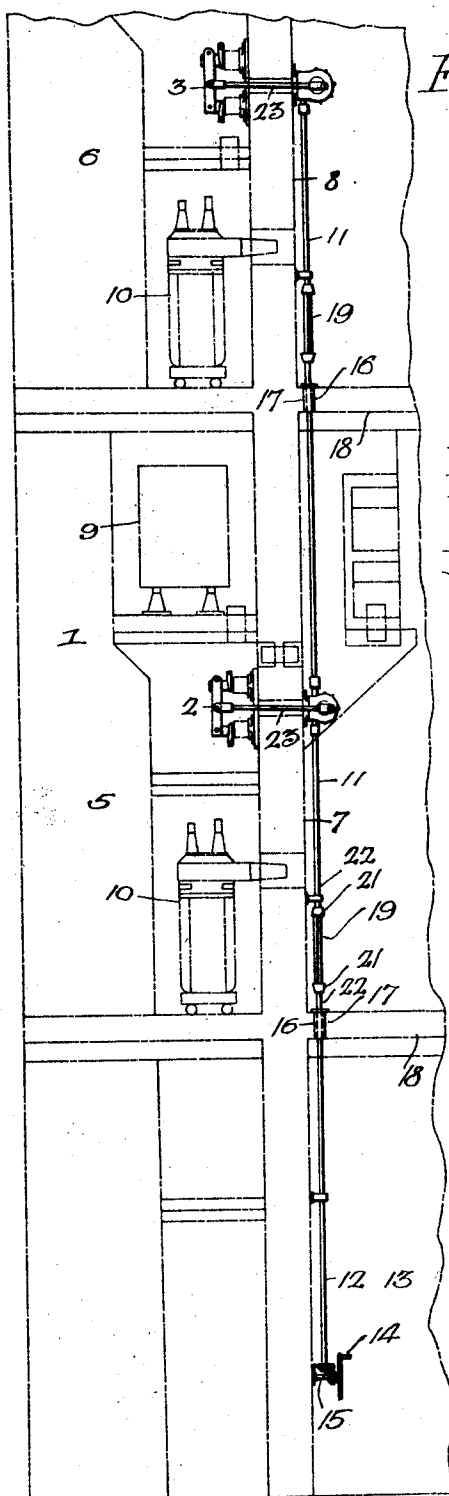


Fig. 1.

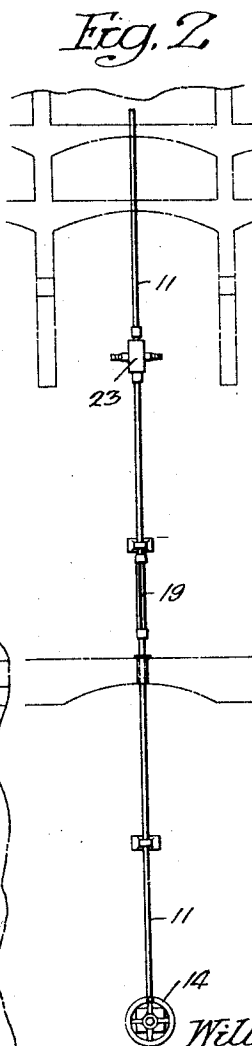


Fig. 2.

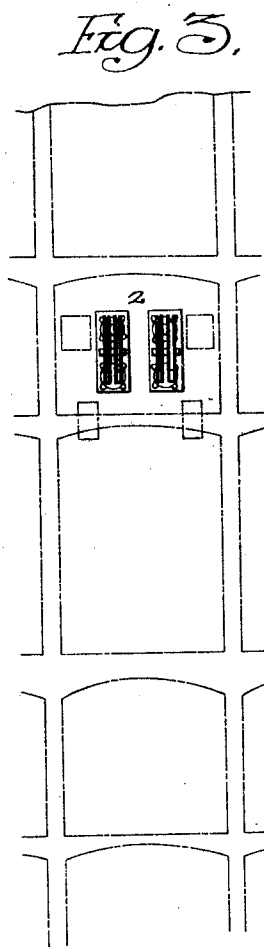


Fig. 3.

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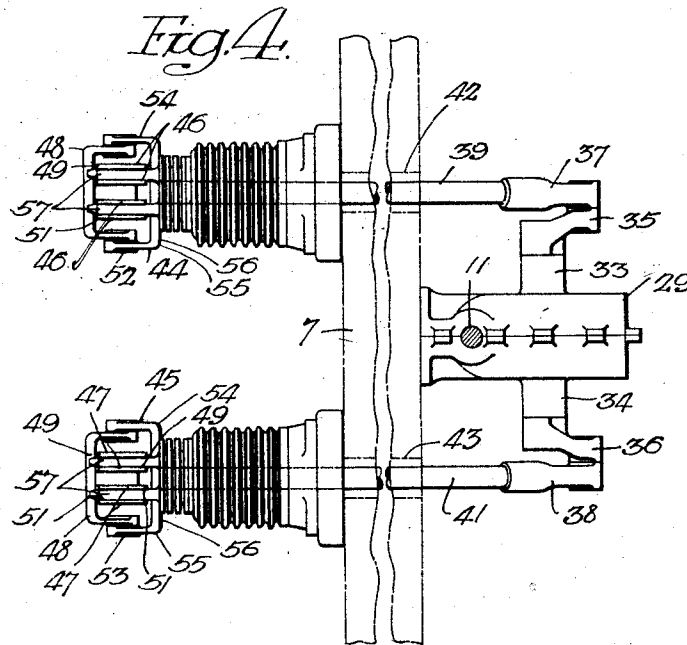
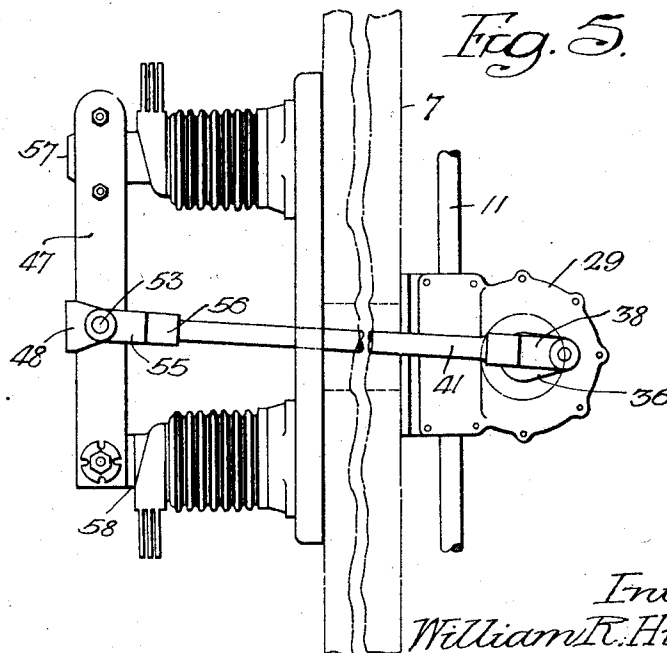
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Fig. 6.

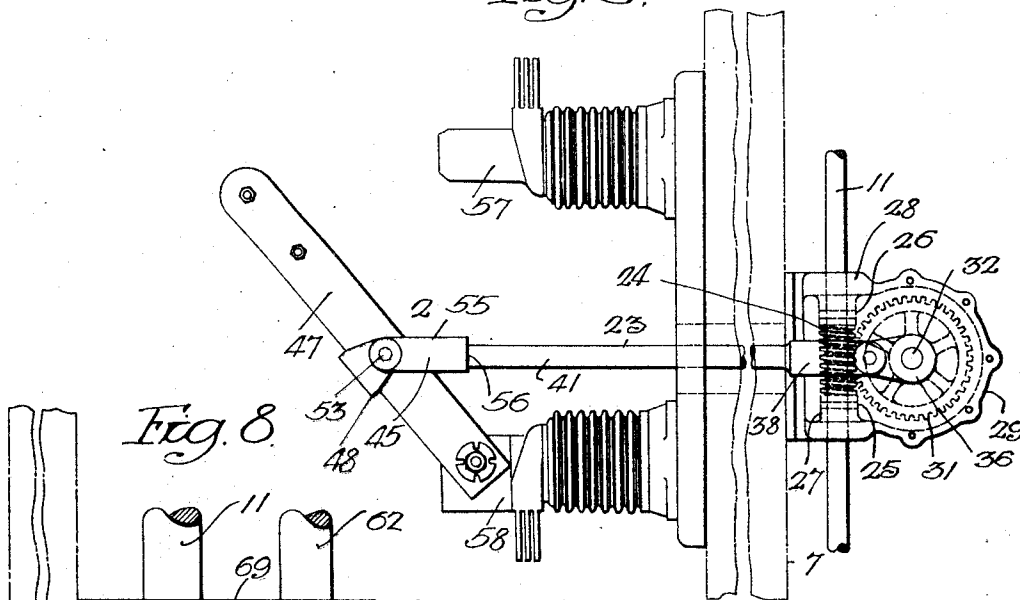


Fig. 8.

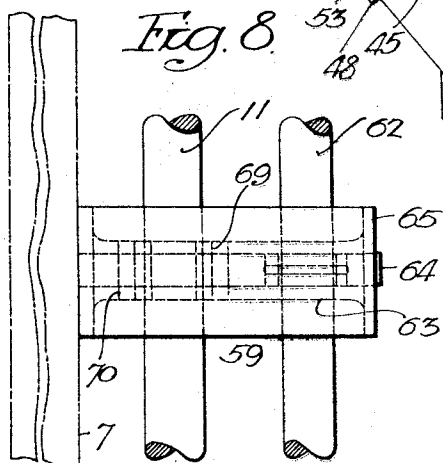


Fig. 9.

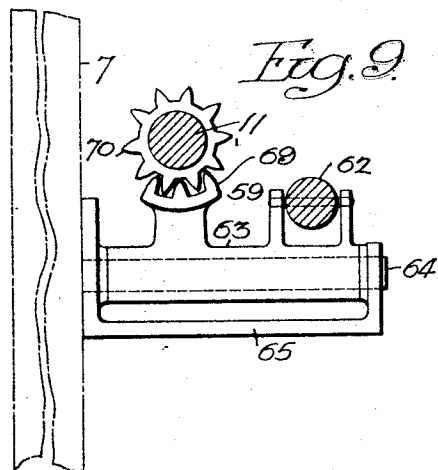
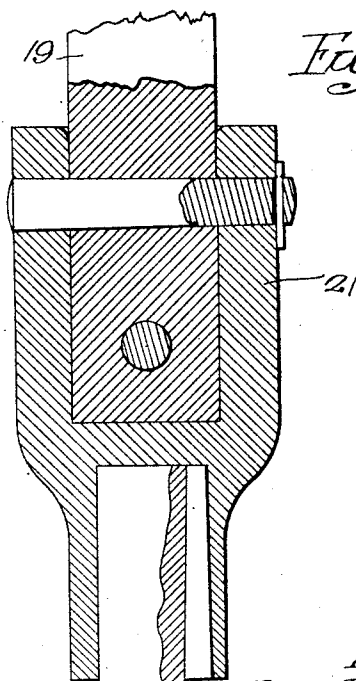


Fig. 7.



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SWITCH MECHANISM.

Application filed June 26, 1925. Serial No. 39,790.

My invention relates to switches, and it has particular relation to operating mechanism therefor.

The increasing size of power houses has necessitated radical changes in the design and arrangement of switch gearing, whereby short circuits may be prevented from damaging the total structure. The present trend of development is toward the so-called isolated phase system, wherein one bus bar and its associated disconnecting and oil switches are placed on one floor, and the other phases with their equipment on other floors. Such arrangement necessitates the operation of all the disconnecting switches from a remote point.

One method of operating the disconnecting switches involves the use of two sets of connecting rods, of which one is in tension when the switches are opened and the other in tension when said switches are closed. Since these rods are connected to walking beams on each floor, expansion and contraction of the rods establishes undue strains on the bearings and the walking beams and, in some cases, affects the adjustment of the apparatus. Moreover, the connecting rods constitute a continuous metal conductor between the several floors of the switch houses, so that when a fault develops on one floor due to the failure of an oil switch tank or a flash-over upon an insulator, current is communicated to the other floors, thereby defeating the very purpose of isolating the phases.

Furthermore, since the connecting rods are attached to walking beams, the connecting rods have a transverse as well as a longitudinal component of travel, thereby requiring an opening in the floor sufficient to permit the transverse movement. In certain designs, the connecting rods serve as locking means for the switches, but this is undesirable inasmuch as the switches might be blown open under short circuit conditions should some part of the operating mechanism be disconnected.

An object of my invention, therefore, is to provide switch operating mechanism which shall avoid the above mentioned undesirable results and which shall be characterized by the fact that temperature changes have substantially no effect on the adjustment of the mechanism; that stresses in the operating shaft are reduced to a minimum; that the switches are self-locking in any position, even with the operating shaft disconnected; and

that the operating mechanism of one switch may be completely removed without disturbing the adjustment of the remaining switches.

Another object of my invention is to provide a worm wheel drive for each switch, together with means for absorbing the thrust of the worm, whereby the operating shaft may be subjected to torsional stresses only.

A further object of my invention is to provide a connecting link between a switch blade and an operating crank, the connecting link being on dead center when the switch is in predetermined positions, whereby the mechanism may be self locking.

A still further object of my invention is to provide a main operating shaft for the disconnecting switches which is fitted with insulating sections between floor levels, whereby a fault developing on one floor may be prevented from being communicated to another floor.

A still further object of my invention is to provide gas tight bushings at the floor levels for the disconnecting switch operating shaft so as to prevent high temperature current-conducting gases passing from one floor to another.

A still further object of my invention is to provide simple and effective means for mechanically interlocking the disconnecting switches and the oil switches.

With these and other objects in mind, my invention further consists in the details of construction and operation and arrangement, hereinafter described and claimed and illustrated in the accompanying drawings, wherein

Fig. 1 is a detail elevational view of a multiphase switch-operating mechanism embodying my invention;

Figs. 2 and 3 are side elevational views looking from the right and left, respectively;

Figs. 4 and 5 are enlarged, detail, top plan and side elevational views, respectively, of a disconnecting switch and its associated actuating mechanism;

Fig. 6 is a view similar to Fig. 5 but showing the switch in the open position and also illustrating the screw-jack connection between the main operating shaft and the crank arms;

Fig. 7 is an enlarged detail view, partially in section, of the connection between the conducting and non-conducting portions of the main operating shaft; and

Figs. 8 and 9 are side elevational and top

plan views, respectively, of the interlocking mechanism between the disconnecting switches and the oil switches.

In the illustrated embodiment of my invention shown in the drawings, a multiphase electrical system 1 includes a plurality of disconnecting switches, of which only switches 2 and 3 are shown. The switches 2 and 3 are positioned on floors 5 and 6 of an electrical station and are secured to vertically aligned wall sections 7 and 8, respectively. A reactor 9 and an oil switch 10 of usual design are electrically associated with each disconnecting switch in the usual manner.

In accordance with my invention, the several disconnecting switches of the multiphase system 1 are operated by means of a single sectional shaft 11, a lower end 12 of which is positioned on a floor 13 below the upper floors 5 and 6. A rotative movement may be imparted to the control shaft 11 by means of an operating handle 14 which is operatively associated with the shaft 11 by bevel gearing 15.

The conducting gases generally formed under short circuit conditions may be prevented from following the shaft 11 from one floor to another by gas tight bushings 16. As particularly illustrated in Fig. 1, each of the bushings 16 is positioned in a shaft passage 17 formed in each supporting floor level 18, and it closely fits the portion of the shaft 11 extending therethrough.

As above noted, the connecting rods of the prior art have in effect formed continuous metal conductors between the several floors of a switch house, with the result that a fault developing on one floor was communicated to the other floors. In the present invention, metallic connections between successive floors is eliminated by providing the operating shaft 11 with insulating sections 19 on each of the floors. The section 19 may be of wood or other insulating material, and its ends are pinned to connecting elements 21, which are respectively keyed to adjacent portions 22 of the operating shaft 11, as illustrated in Figs. 1 and 7, thereby establishing a longitudinally keyed connection therewith.

My invention further contemplates mechanism 23, whereby each disconnecting switch may be operatively associated with the common control shaft 11. Since the construction of the mechanism 23 is identical for each of the several disconnecting switches 2 and 3, it will be described in connection with the former switch only. Referring to Figs. 4, 5 and 6, the mechanism 23 involves the use of a worm 24 which is mounted on the shaft 11 intermediate antifriction bearings 25 and 26 carried by bearing portions 27 and 28, respectively, of a housing 29 secured to the wall section 7 directly opposite to the disconnecting switch 2. The bearings 25 and 26 cause the thrust of the worm 24 to be absorbed within the housing 29, with the result that the

only stress in the shaft 11 incident to the opening and closing of the disconnecting switch 2 is a torsional one.

A worm wheel 31 meshes with the worm 24 and it is mounted on a shaft 32 journaled in bearings 33 and 34 positioned on opposite sides of the housing 29, respectively. The opposite ends of the shaft 32 terminate in crank arms 35 and 36 which are pivotally connected to corresponding ends 37 and 38 of connecting links 39 and 41. The worm wheel 31 may also be operatively associated with the links 39 and 41 by means of an eccentric. The links 39 and 41 extend through apertures 42 and 43 in the wall section 7 and are pivotally secured by devices 44 and 45 to switch blades 46 and 47, respectively. The devices 44 and 45 comprise a base section 48 which is secured to spaced elements 49 and 51 of each switch blade 46, 47. The ends of the base portion 48 are bent toward the wall section 7 and are apertured to receive pivot pins 52 and 53 extending respectively from arms 54 and 55 of a yoke member 56 rigidly mounted on the adjacent end of each connecting link 39, 41. The point of connection of the yoke member 48 with each of the switch blades is substantially intermediate an upper stationary contact member 57 and a lower pivot post 58, as illustrated in Fig. 5.

The relation of the crank arms 35 and 36 to the blades 46 and 47 is such that when the latter are in the open position shown in Fig. 6, the connecting links 37 and 38 are on dead center and when the blades 46 and 47 are in the closed position shown in Fig. 5, said connecting links are again on dead center. Hence this mechanism is self locking for both the open and closed positions of the disconnecting switches.

The screw-jack drive afforded by the worm-and-wheel mechanism 24, constitutes an important feature of my invention since by the use of such mechanism, the torsional strain on the operating shaft 11, incident to the opening and closing of the switches 2 and 3, is reduced to a minimum and it also permits the elimination of the very complicated and expensive operating mechanisms of the prior art. The worm 24 has a relatively flat pitch, so that the worm and wheel 24 and 31 may be non-reversing under the action of the switch blades 46, 51. The non-overhauling or non-reversing characteristic is particularly advantageous inasmuch as the switch blades 46 and 47 may be retained in any desired position regardless of whether the connecting links 39 and 41 are on dead center. As a result, it is possible to remove completely the operating mechanism 23 of any one switch or even the operating shaft 11 without disturbing the adjustment of the remaining switches.

A further feature of my invention involves mechanism 59 constituting an interlock be-

tween the shaft 11 and a vertically adjustable control shaft 62 for the oil switches (not shown). As illustrated in Figs. 8 and 9, a sleeve 63 is pivotally mounted on a pin 64 carried by brackets 65 extending from one of the wall sections 6, 7. A pair of arms 66 and 67 embrace the oil switch shaft 62, whereby the sleeve 63 may be rocked in accordance with the vertical movement thereof. The sleeve 63 is further provided with a toothed sector 69 which is moveable into and out of mesh with teeth 70 formed on the operating shaft 11. When the interlocking mechanism 59 is in the position shown in Fig. 9, the disconnecting switches 2 and 3 and the oil switches 10 are closed and it is impossible to open the disconnecting switches by the operating handle 14. When the oil switch control shaft 62 is moved so as to open the oil switches 10, the toothed sector 69 is actuated out of engagement with the teeth 70 of the operating shaft 11, with the result that the disconnecting switches 2 and 3 may now be opened by the actuation of the shaft 11 from the operating handle 14.

When the disconnecting switches 2 and 3 are in the closed position shown in Figs. 1, 4 and 5 of the drawing, the connecting links 39 and 41 are on dead center, so that said switches are locked in position. When the shaft 11 is rotated by means of the operating handle 14, the crank arms 35 and 36 are correspondingly turned, with the result that the switch blades are actuated into the open position, shown in Fig. 6. The switch blades 46 and 47 are also interlocked in this position, inasmuch as the connecting links 39 and 41 are again on dead center. An opposite movement of the operating handle causes the closing of the disconnecting switches 2 and 3. By reason of the anti-friction bearings 25 and 26, the thrust of the worm 24 is absorbed by the housing 29. Thus the shaft 11 is subjected to torsional strains only.

While I have shown only one embodiment of my invention, for the purpose of describing the same and illustrating its principles of construction and operation, it is apparent that various changes and modifications may be made therein, without departing from the spirit of my invention, and I desire, therefore, that only such limitations shall be imposed thereon as are indicated in the appended claims or as are demanded by the prior art.

I claim:

1. In combination, a pair of switch blades, a driving worm, a driven wheel having a pair of crank arms, and means for interconnecting said arms and said switch blades, respectively, said worm having a flat pitch, whereby said worm and wheel may be non-reversing under the load of said switch blades.

2. In combination, a switch blade movable into a closed position, a driving crank arm, and a connecting link interconnecting said

switch blade and said arm, said connecting link being substantially on dead center when said switch blade occupies said closed position, whereby the latter may be locked in said position.

3. In combination, a switch blade, a driving crank arm and a connecting link therebetween, said connecting link being on dead center when said switch blade occupies a closed position, whereby said blade may be locked in said position, a worm wheel operatively associated with said crank arm, and a driving worm therefor, said worm and wheel being non-reversing under the load of said blade.

4. In combination, a pair of switch blades, a pair of crank arms, a pair of connecting links respectively interconnecting said crank arms and said switch blades, said connecting links being on dead center when said switch blades occupy a predetermined position, a driving worm, and a driven wheel operatively associated with said crank arms, said worm having a relatively flat pitch, whereby said worm and wheel may be non-reversing under the load of said switch blades.

5. In combination, a switch blade, a driving crank arm, a connecting link therebetween, said connecting link being on dead center when said switch blade occupies open and closed positions, respectively, whereby said blade may be locked in said positions, said worm and wheel being non-reversing under the load of said blade, an actuating member for said worm, and means adapted to absorb the thrust of said worm.

6. Operating mechanism for a multiphase electrical system comprising a main operating member, a switch individual to each phase, means for operatively associating each switch and said operating member, said means including a worm mounted on said operating member, a wheel and linkage interconnecting said wheel and the switch, said worm having a relatively flat pitch, whereby the worm and wheel may be non-reversing under the load of the switch, and anti-friction means including a housing tending to absorb the thrust of said worm incident to the opening of said switch.

7. In apparatus of the class described, a plurality of floor levels, a main operating shaft adapted to pass through said floor levels, switches mounted on said floor levels, means including screw gearing for operatively associating said switches and said shaft, and a gas tight bushing adapted to prevent gases from following said shaft from one floor level to the other.

8. In a device of the class described, a plurality of walls provided with apertures, an operating shaft extending through said apertures, gas tight bushings for said apertures, switches having operative connections

to said shaft, said connections including a plurality of worm elements mounted on said shaft, and separate supporting means for said worm elements.

9. In a multiphase system, the combination with a plurality of disconnecting switches, of a single operating shaft therefor, each switch being operatively associated with said shaft through non-reversing gearing, and means tending to prevent the thrust of said gearing from being transferred to said shaft, the latter having non-conducting portions.

10. In a multiphase system, the combination with a plurality of disconnecting switches, of a single operating shaft therefor, each switch being operatively associated with said shaft through nonreversing gearing, means tending to prevent the thrust of said gearing from being transferred to said shaft, the latter having non-conducting portions, a wall apertured to provide a passage for said shaft, and a gas tight bushing for said aperture adapted to prevent the passage there-through of gases from one side of said wall to the other.

11. In a device of the class described, a rotatable shaft provided with teeth, a longitudinally movable shaft, and a member movable into and out of mesh with said teeth in accordance with the actuation of said second mentioned shaft.

12. In combination, a disconnecting-switch operating shaft provided with teeth, an oil-switch control shaft, and a member movable into and out of mesh with said teeth, said member being actuated by said control shaft.

13. A rotatable disconnecting-switch operating shaft provided with teeth, a vertically movable oil-switch control shaft, and a pivoted member movable into and out of mesh with said teeth, said member having an operative connection with said control shaft.

14. In combination, a switch, a main operating member, a worm mounted on said member, a worm wheel having an operative connection with said switch, and a protective housing for said worm and wheel adapted to absorb the thrust of said worm incident to the opening of said switch.

15. Operating mechanism for a multiphase electrical system comprising a main operating member, a switch individual to each phase, means for operatively associating each switch and said operating member, said means including a worm mounted on said operating member, a wheel and linkage interconnecting said wheel and the switch, said worm having a relatively flat pitch, whereby the worm and wheel may be non-reversing

under the load of the switch, said linkage being substantially on dead center upon the opening of the switch, and a housing for each worm and wheel adapted to absorb the thrust of said worm.

16. In a multiphase system, the combination with a plurality of disconnecting switches, of a single operating shaft therefor, each switch being operatively associated with said shaft through non-reversing gearing, and means constituting a protective housing for said gearing adapted to prevent the thrust of said gearing being transferred to said shaft.

17. In a multiphase system, the combination with a plurality of disconnecting switches, of a single operating shaft therefor, each switch being operatively associated with said shaft through worm-and-wheel mechanism, and means for housing said worm-and-wheel mechanism and for preventing the thrust of said mechanism being transferred to said shaft.

18. In a multiphase electrical system, the combination with a plurality of switches for said system, of an operating member, means for operatively associating said switches and said operating member including a plurality of worm elements mounted on said operating member, and means tending to prevent the thrust of said worm elements from being transferred to said operating member.

19. In a multiphase electrical system, the combination with a plurality of switch elements, of a rotatable line of shafting comprising a plurality of sections, means for operatively associating said switch elements and said shafting including a plurality of worm elements mounted on said shafting, and separate supporting means for the sections of said shafting.

20. In combination, a plurality of switch elements, a sectional operating member therefor, means for operatively associating said switch elements and said operating member, at least one of the sections of said operating member having an insulating portion, and means whereby said insulating portion may have a longitudinally keyed connection to an adjacent portion of said member.

21. In an electrical system, the combination with a plurality of switches, of a rotatable operating shaft therefor, means for operatively associating said shaft and said switches, said means including a plurality of worm elements, and means for housing said worm elements and for preventing the thrust thereof from being transferred to said shaft.

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