Jan. 11, 1927. 1,614,115

H. G. FRENCH

ELECTRIC SWITCHING APPARATUS

Filed Dec. 27, 1921 2 Sheets-Sheet 1

Fig. 1.

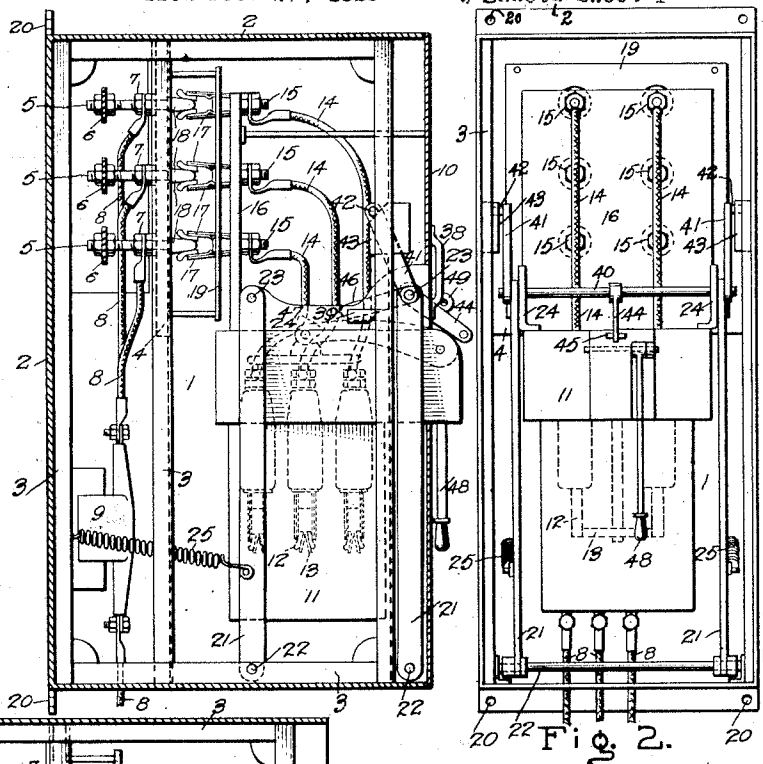

Fig. 2.

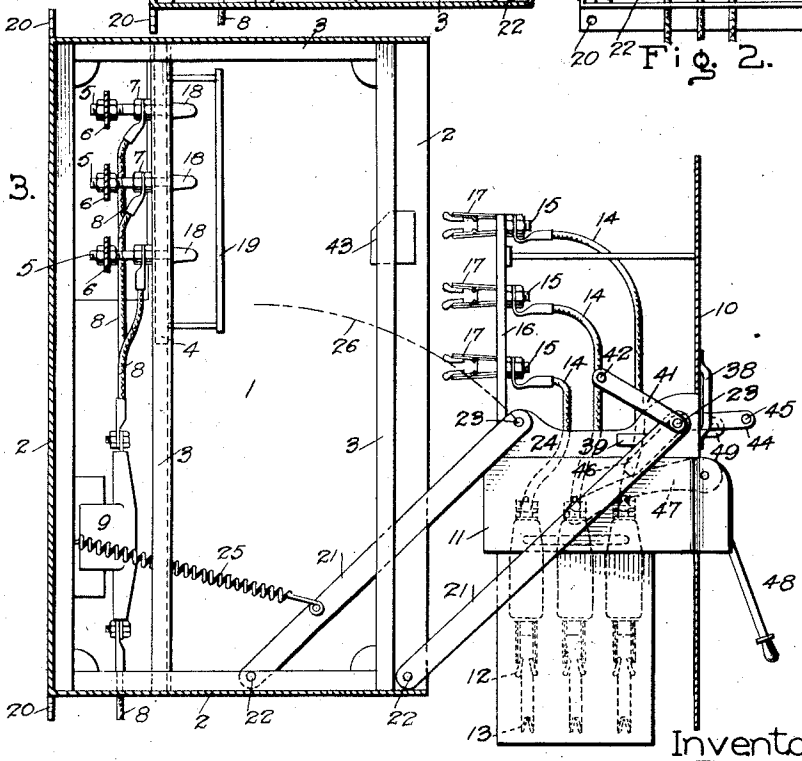

Fig. 3.

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Fig. 4.

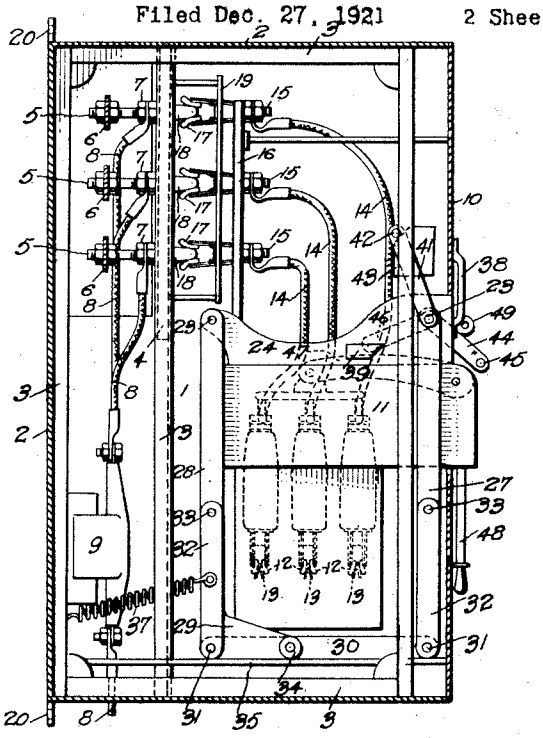
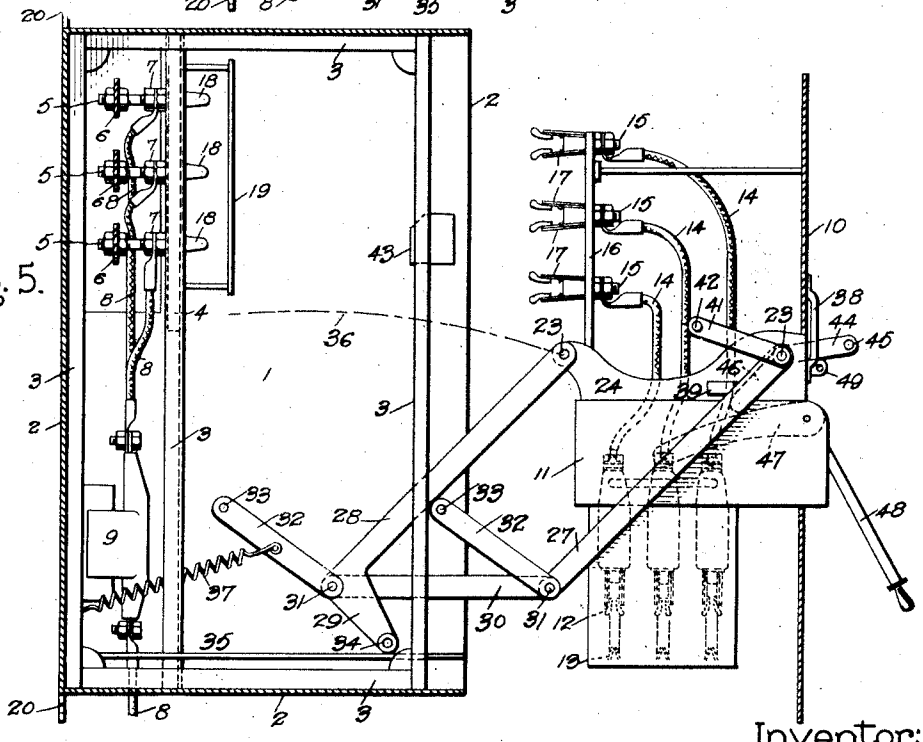


Fig. 5.



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Patented Jan. 11, 1927. 1,614,115

UNITED STATES PATENT OFFICE.

HENRY G. FRENCH, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC SWITCHING APPARATUS.

Application filed December 27, 1921. Serial No. 524,844.

My invention relates to improvements in electric switching apparatus and an object of my invention is to provide an improved arrangement of switching apparatus which is particularly adapted for enclosed unit panel construction and arranged to provide safety for apparatus and operator and accessibility for inspection and repairs. Another object of my invention is to provide a unit panel type of switching apparatus which provides simplicity and flexibility in construction and installation and which also provides for extensions of service without the necessity of disturbing or altering prior installations.

My invention will be better understood from the following description taken in connection with the accompanying two sheets of drawings and its scope will be pointed out in the appended claims.

Figure 1 is a side elevation illustrating an embodiment of my invention, the switching apparatus being in position within a supporting structure of which one side is removed for clearness; Fig. 2 is a front elevation of the embodiment of my invention illustrated in Fig. 1, the front or panel of the supporting structure being removed for clearness; Fig. 3 is a side elevation similar to Fig. 1, but with the switching apparatus withdrawn from the supporting structure; Fig. 4 is a side elevation of a modification of the embodiment of my invention shown in Fig. 1, and Fig. 5 is a side elevation similar to Fig. 4 but with the switching apparatus withdrawn from the supporting structure.

In the embodiments of my invention shown in the different figures, a structure or housing 1 which may be made up of plates 2 and angles 3 suitably fastened together has mounted therein a terminal board 4. The terminal board 4 is provided with terminals 5, to which are secured bus-bars 6 running through the structure 1 through openings in the sides thereof and also with terminals 7 to which are connected the conductors of a circuit 8 which is adapted to be connected to the bus-bars 6. There may also be mounted in the structure 1 in circuit with one or more of the conductors 8, suitable devices such as transformers 9 arranged to be connected to meters, relays, etc., which may be mounted on the front plate or panel 10 of the structure 1.

For operatively connecting the conductors 8 to the bus-bars 6, there is provided an electric switching device or circuit breaker 11 which is here shown as of the type having cooperating fixed and movable contacts 12 and 13, respectively, separable in an insulating fluid such as oil. The switching device 11 is supported in the structure 1 so as to be movable into and out of the structure in a manner hereinafter more fully described. Preferably the fixed contacts 12 of the switching device 11 are connected by leads 14 to terminals 15 mounted on a terminal board 16 mounted to move with the switching device 11, the terminals 15 being provided with contact jaws or clips 17 arranged to register with and engage fixed studs or contacts 18 on the terminals 5 and 7. It is obvious that by this means the switching device 11 will be disconnected from the bus-bars 6 and the conductors 8 on moving the switching device 11 outwardly from the structure 1 and connected on moving the switching device 11 inwardly into the structure 1. Also mounted in the structure 1 is a fixed barrier 19 provided with apertures through which the contact clips 17 may pass to engage the contacts 18. The barrier 19 thus acts to render the contacts 18 inaccessible when the switching device 11 is moved or swung out into the position shown in Figs. 3 and 5. In this manner the danger of the operator coming into contact with current carrying members such as the contacts 18 connected to the bus-bars 6 is practically eliminated.

With the arrangement so far described, it is obvious that any number of the structures 1 equipped as shown may be arranged for example side by side with the bus-bars 6 running through all of them. These units may be mounted on a wall or any suitable supporting framework in any suitable manner, as for example, by bolts through holes 20 in the plate and angle construction of the structure 1, the number of independent switching units or switchboards thus arranged depending upon the number of circuits 8 it is desired to connect to the bus-bars 6, each unit constituting a complete independent switchboard or unit panel for the circuit it is arranged to control. Moreover, with a unit panel construction of this type great simplicity and flexibility in construction and installation are provided and ex-

tensions of service are conveniently possible by the simple expedient of adding more units as desired without the necessity of disturbing or altering the prior installations.

Referring now in particular to Figs. 1, 2 and 3, the switching device 11 is supported for movement into and out of the structure 1 by a linkage mechanism comprising links 21 arranged on opposite sides of the switching device 11 and preferably mounted within the structure 1. Each of the links 21 has the same length between fixed pivotal points 22 within the structure 1 and pivotal points 23 where the links 21 are connected to the supporting members 24 of the switching device 11. The pivotal points 22 and 23 are arranged so that the links 21 are substantially parallel in all positions thus insuring the correct alignment of the switching device 11 as it is moved into and out of the structure 1. Connected preferably to the rear links 21 and the structure 1 are energy storing means such as springs 25 which during the outward movement of the switching device 11 are operative to insure a uniform movement and absorb shocks and to store energy for assisting the inward movement of the switching device 11.

It will be evident that with the linkage mechanism above described, the path of movement of the switching device 11 into and out of the structure 1, or the path of any point thereof such as the rear pivotal point 23 is substantially an arc of a circle whose radius is equal to the length of one of the links 21, this path being shown for example by the broken line 26, Fig. 3. Obviously, the shorter the length of the links 21 the greater will be the extent of vertical movement of the switching device 11 in its outward and inward movements and the greater the effort necessary to make these movements. Furthermore the farther the switching device travels in its outward movement the more conveniently accessible it becomes, but this also means a greater extent of vertical movement. For a given outward movement of the switching device 11, the extent of vertical movement can of course be decreased by lengthening the links 21, but this means increasing the size of the structure 1 for this purpose only and it is therefore not an economical way of obtaining the desired movement.

Accordingly, I provide means shown in Figs. 4 and 5 whereby the extent of vertical movement is decreased and at the same time the extent of outward movement of the breaker is increased to provide more convenience in accessibility. This means comprises a linkage mechanism supporting the switching device 11 whereby the path of movement of the same, although somewhat arcuate is very flat, being in fact substantially rectilinear so that the vertical movement of the switching device 11 is reduced to a minimum.

This linkage mechanism comprises a plurality of links arranged on opposite sides of the switching device 11 and preferably within the structure 1. Links 27 and 28 are connected to the switching device 11 at the pivotal points 23 of the supporting members 24; the links 28 have an additional arm 29 rigidly related thereto, preferably at right angles. The links 27 and 28 are connected at their lower ends by paralleling links 30 at pivotal points 31. The lengths of the links 27, 28 are equal and the length of the paralleling links 30 between the pivotal points 31 is the same as the distance between the pivotal points 23. Consequently, the links 27, 28 will be substantially parallel in all positions thus insuring the correct alignment of the switching device 11 as it is moved into and out of the structure 1. The pivotal points 31 are connected to the structure 1 by the links 32 at fixed pivotal points 23 and the arms 29 of the links 28 are preferably provided with rollers 34 arranged to bear upon and roll over a supporting member or track 35 of the structure 1 as the switching device 11 is moved into and out of the structure. With this arrangement it is obobvious that as the switching device 11 is moved outward from the position shown in Fig. 4 to that shown in Fig. 5 the pivotal points 31 revolve about the fixed pivotal points 33 as the roller 34 moves over the supports 35, thereby varying the distance between the line of the pivotal points 31 or paralleling links 30 and the support 35. There is therefore imparted to the links 27 and 28 a motion of rotation and translation such that any point on the switching device such as pivotal point 23 travels in a very flat arcuate path as shown by the broken line 36, Fig. 5, so that the movement of the switching device 11 is substantially rectilinear and a minimum of effort is required as it is not necessary to raise the device through any appreciable height. The flatness of the arcuate path or its approach to a substantially rectilinear path is governed by suitably proportioning the lengths of the tie links 32 and the arm 29 of links 28. Connected preferably to the rear tie links 32 and the structure 1 are energy storing means such as springs 37 which during the outward movement of the switching device 11 are operative to insure a uniform movement and absorb shocks and to store energy for assisting in the inward movement of the switching device 11.

Referring again to all the figures, there is mounted to move with the switching device 11 upon the actuation of the linkage mechanism a panel 10 which is provided with suitable handles 38 to facilitate the operation of moving the switching device 11 into and

out of the structure 1. In order to limit the extent of outward movement of the switching device 11 lugs or stops 39 preferably secured to the supporting members 24 are arranged to engage the front levers 21 of Figs. 1, 2 and 3 or the front levers 27 of Figs. 4 and 5 upon a predetermined outward movement of the switching device 11.

To prevent outward movement of the switching device 11 while the contacts 12 and 13 thereof are in the circuit closed position which would interrupt the circuit 8 through contact jaws 17 and contacts 18 which are not ordinarily designed so to function and also to hold or lock the switching device 11 within the structure 1, there is provided a locking arrangement comprising a shaft 40 journaled in the supporting members 24 and also preferably acting as the pivotal supports 23 of the front links 21 of Figs. 1, 2 and 3 or the links 27 of Figs. 4 and 5. Mounted on the shaft 40 to turn therewith and preferably near the ends thereof are locking links 41 provided at one end with studs or projections 42 arranged to engage catches or stops such as plates 43 suitably supported by or mounted on the structure 1. The shaft 40 is provided preferably intermediate its bearings with a double arm lever or bell crank 44 whereby the shaft 40 may be turned to move the studs 42 out of engagement with the catches 43, one arm 44 of the crank being provided with a handle 45 for this purpose. The other arm 46 of the crank 44 is arranged to be engaged by a part of the contact operating mechanism of the switching device 11 when the contacts 12—13 are in the circuit closed position as, for example, the movable contact operating arm 47. Thus when the switching device 11 is within the structure 1 as shown in Figs. 1 and 4 and the contacts 12—13 are in the circuit closed position, the contact operating arm 47 prevents movement of the arm 46 of the crank 44 so that the shaft 40 cannot be turned to release the studs 42 from the catches 43. Therefore, before the crank 44 can be turned, the contacts 12—13 must be placed in the circuit opened position by actuating the contact operating mechanism of the switching device 11 either by electro-responsive devices or a hand lever 48 in a manner well known to the art. This causes the operating arm 47 to drop down far enough to permit the shaft 40 to be turned so as to release the studs 42 from the catches 43, see Figs. 3 and 5. Similarly, if the contacts 12—13 of the switching device 11 are in the circuit closed position and the switching device is outside the structure 1, a complete inward movement of the switching device 11 is impossible as the shaft 40 would be in such a position relative to the crank arm 46 that the studs 42 would butt against the catches 43 which project outwardly far enough to stop the inward movement of the switching device 11 before the contact clips 17 touch the contacts 18. If it were not for this safety feature an operator could connect the circuit 8 to the busses 6 through contact jaws 17 and contacts 18 before locking the switching device 11 in the housing 1 and forgetting so to lock the device 11 whether through carelessness, inadvertence or having his attention directed elsewhere, the device might swing outwardly with the probability of drawing destructive arcs at the contact clips 17 and contacts 18, and similarly for any irregularities in the inward movement causing a partial closing and subsequent opening of the contact clips 17 and contacts 18. Moreover, assuming that a complete inward movement of the switching device 11 has been made, the contacts 12—13, being of course in the circuit opened position, it is impossible for the operator to move the contacts into the circuit closed position without first locking the switching device 11 in the housing 1. With the constructions shown, it is, therefore, impossible for the operator to move the switching device 11 outwardly without first moving the contacts 12—13 thereof to the circuit opened position and it is also impossible to complete the inward movement of the switching device 11 as long as the contacts thereof are in the circuit closed position and after having completed the inward movement of the switching device it is impossible to move the contacts thereof to circuit closing position without first locking the switching device in the structure. In order to prevent unauthorized withdrawal of the switching device 11 from the housing 1 there may be provided a locking means comprising a hook or eye 49 preferably secured to the panel 10 adjacent the arm 44 of the operating crank and adapted when the switching device 11 is locked within the structure 1 to receive a locking bar or other device such as a padlock to prevent the movement of the crank 44 even though the operating handle 48 may be moved to the position which separates contacts 12 and 13.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. Switching means for an electric circuit comprising a switch supporting structure, an electric switching device provided with relatively movable cooperating contacts for controlling said circuit, and a linkage mechanism arranged to support said device and adapted to be operated to move the same into and out of said structure in a substantially rectilinear path.

2. In combination with a plurality of electric circuits, a switch supporting structure, an electric switching device provided with cooperating fixed and movable contacts for controlling said circuits, a linkage mechanism arranged to support said device and

adapted to be operated to move the same into and out of said structure, means for connecting said fixed contacts to said circuits arranged to be disconnected on the outward movement of said device and connected on the inward movement of the same, means for limiting the extent of outward movement of said device, and means for locking said mechanism to hold said device in said structure adapted to be released when the contacts of said device are in the circuit opened position and arranged to prevent connecting said connecting means on the inward movement of said device when the contacts thereof are in circuit closed position.

3. Switching means for electric circuits comprising a housing through the interior of which said circuits pass, an electric switching device comprising cooperating fixed and movable contacts, a linkage mechanism arranged to support said device and adapted to be operated to move the same into and out of said housing, means for connecting said fixed contacts to said circuits arranged to be disconnected on the outward movement of said device and connected on the inward movement of the same, a panel mounted to move with said device and adapted to form a part of said housing, means for locking said mechanism to hold said device in said housing adapted to be released when the contacts of said device are in the circuit opened position, means for limiting the extent of outward movement of said device, and means in which energy is stored during the outward movement of the device acting to absorb shocks during said outward movement and to assist in the inward movement of the device.

4. Switching means for electric circuits comprising a switch supporting structure, an electric switching device provided with cooperating relatively movable contacts for controlling said circuits, a linkage mechanism arranged to support said device and adapted to be operated to move the same into and out of said structure, means for connecting said contacts to said circuits arranged to be disconnected on the outward movement of said device and connected on the inward movement of the same, means for locking said device in said structure against outward movement therefrom while said contacts are in the circuit closed position, and means for limiting the outward movement of said mechanism.

5. Switching means for electric circuits comprising a housing through the interior of which said circuits pass, an electric switching device provided with relatively movable cooperating contacts for controlling said circuits, a linkage mechanism mounted in said housing and supporting said device adapted to be operated to move the same into and out of said housing, a panel mounted to move with said device and adapted to form a part of said housing, means for connecting said contacts to said circuits, and means for locking said mechanism in said housing against outward movement therefrom while said contacts are in the circuit closed position.

6. In combination with a supply circuit and a load circuit, a housing through the interior of which said circuits pass, a circuit breaker for controlling said load circuit, a linkage mechanism mounted in said housing arranged to support said circuit breaker and adapted to be operated to move the same into and out of said housing, means for connecting said circuit breaker to said circuits arranged to be disconnected on the outward movement of said breaker and connected on the inward movement of the same, and means for locking said mechanism in said housing to hold said breaker therein adapted to be released when the breaker is in the circuit opened position.

7. In combination with a supply circuit and a load circuit, a housing through the interior of which said circuits pass, an electric switching device provided with relatively movable cooperating contacts for controlling said load circuit, a linkage mechanism arranged to support said device and adapted to be operated to move the same into and out of said housing, means for connecting said contacts to said circuits arranged to be connected on the inward movement of said device and disconnected on the outward movement of the same, and means for limiting the extent of said outward movement, means for locking said mechanism to hold said device in said housing adapted to be released when said contacts are in the circuit opened position.

8. Switching means for an electric circuit comprising a switch enclosing structure, a switch including a receptacle containing insulating fluid and having relatively movable contacts immersed therein for controlling said circuit, and a linkage mechanism secured to said switch and to said structure for supporting said switch and permitting a limited withdrawal of the switch from the structure.

9. Switching means for an electric circuit comprising a stationary supporting structure having a plurality of contacts, a movable switch structure having a plurality of contacts adapted in certain positions of said switch structure to cooperate with said first contacts, and a linkage mechanism pivoted to said supporting structure and to said switch structure, said linkage mechanism comprising a member having a shiftable point of contact with said supporting structure whereby said switch structure is caused to move in a substantially rectilinear path.

10. Switching means for an electric cir-

cuit comprising a stationary supporting structure having a plurality of contacts, a movable switch structure having a plurality of contacts adapted in certain positions of said switch structure to cooperate with said first contacts, supporting mechanism for said switch structure comprising a plurality of parallel links pivotally connected with said supporting structure, said supporting structure having a track and one of said parallel links having an extension thereon provided with a roller for engaging said track, and energy absorbing means actuated by an outward movement of said switch structure for absorbing shock and for assisting the return movement of said switch structure.

In witness whereof, I have hereunto set my hand this 24th day of December, 1921.

HENRY G. FRENCH.