G. A. BURNHAM.

REMOVABLE UNIT OIL SWITCH.

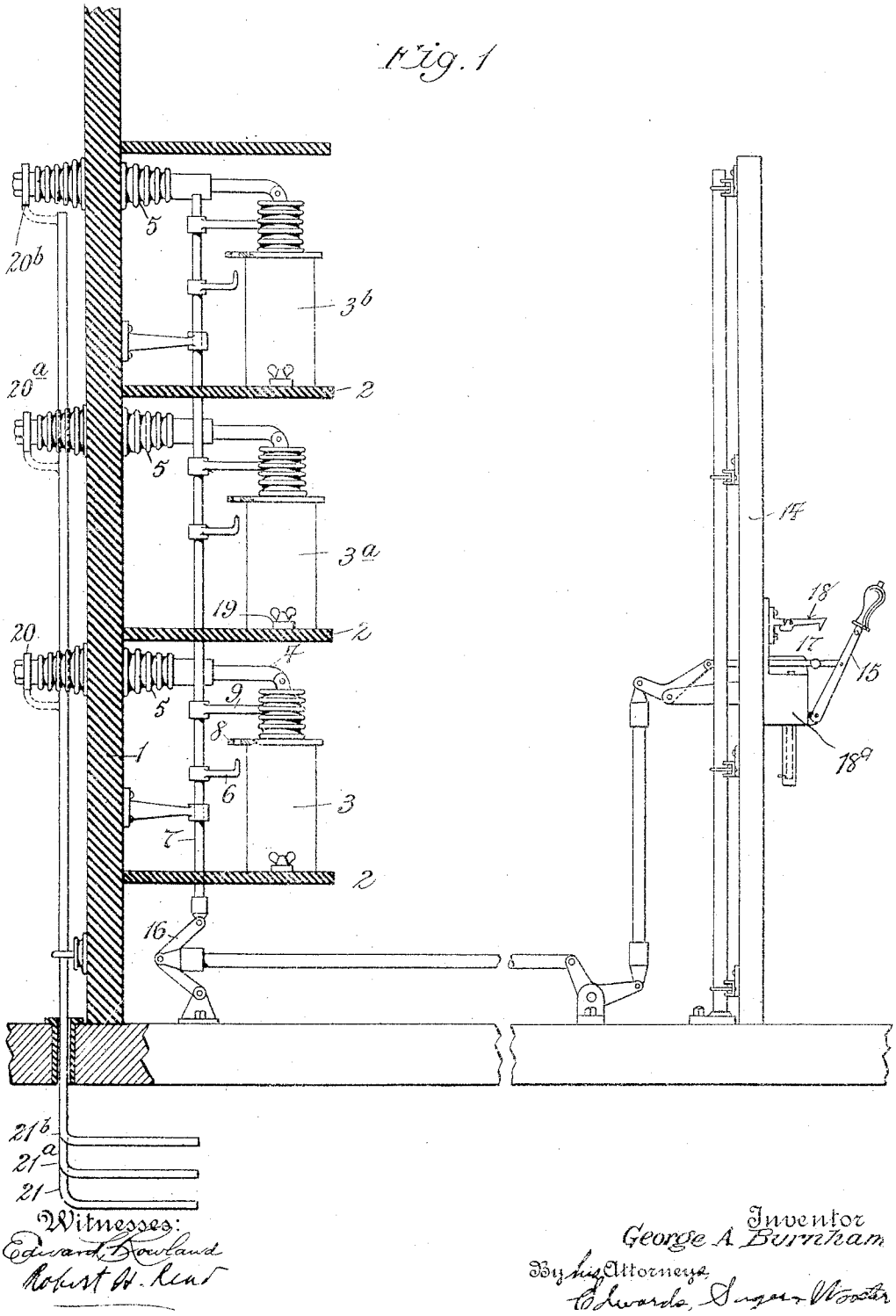
APPLICATION FILED FEB. 8, 1911.

1,165,843.

Patented Dec. 28, 1915.

2 SHEETS—SHEET 1.

Fig. 1



Witnesses:
Edward Rowland
Robert A. Rust

Inventor
George A. Burnham
By his Attorneys,
Edwards, Sager & Wooster

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2 SHEETS—SHEET 2.

Fig. 2.

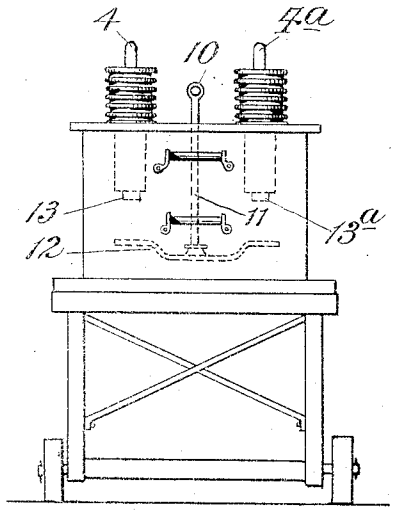


Fig. 3.

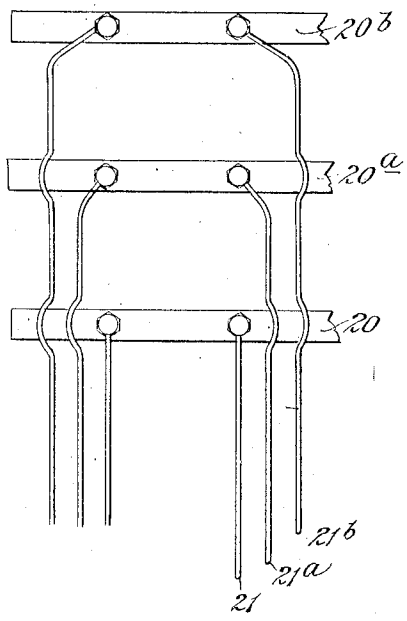
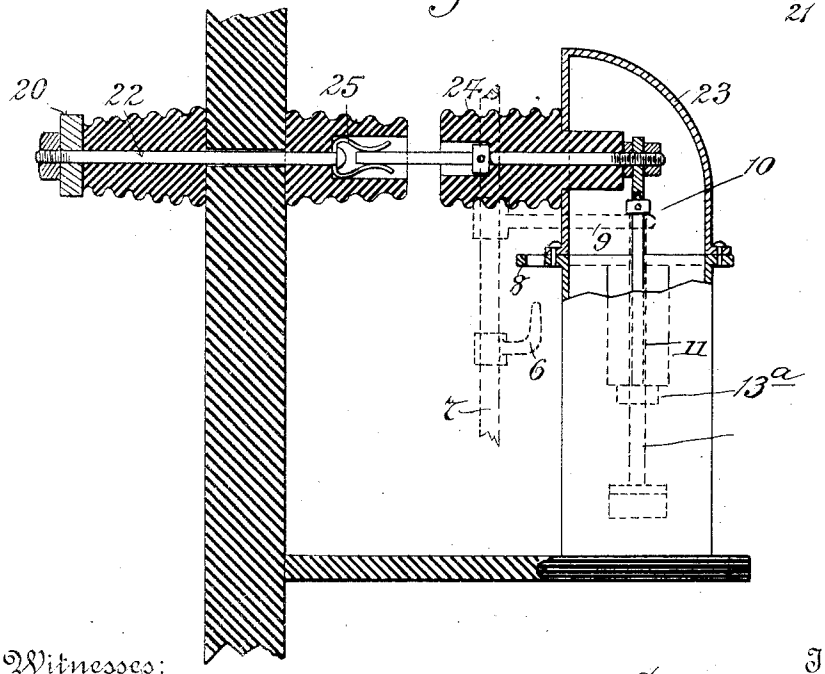


Fig. 4.



Witnesses:
Edward Rowland
Robert A. Read

Inventor
George A. Burnham
By his Attorneys
Edwards, Sager & Wooster

UNITED STATES PATENT OFFICE.

GEORGE AUGUSTUS BURNHAM, OF CLIFTONDALE, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

REMOVABLE-UNIT OIL-SWITCH.

1,165,843. Specification of Letters Patent. **Patented Dec. 28, 1915.**

Application filed February 8, 1911. Serial No. 607,367.

To all whom it may concern:

Be it known that I, GEORGE A. BURNHAM, a citizen of the United States, residing at Cliftondale, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Removable-Unit Oil-Switches, of which the following is a full, clear, and exact specification.

This invention relates to high potential switches.

In modern engineering practice the voltages of electric transmission systems daily grow higher as the distance over which the current is to be transmitted to reach new consumption customers becomes greater, and it becomes a question of more serious importance to insure the safety of the operators, whose duty it is to keep in order the various types of apparatus carrying the high potentials. Whereas a few years ago voltages of ten and fifteen thousand in alternating current transmission were generally the limit, voltages of fifty and sixty thousand are now frequently met with, and even one hundred thousand occasionally employed. The control of central station apparatus at these high voltages is a matter of extreme importance, not only from the standpoint of the station operator's safety, but also from the necessity of keeping the supply system in uninterrupted service. The high potential switches necessary to connect the receiving and supply apparatus of such systems is a necessary element, and one which frequently, by extraordinary conditions, becomes incapacitated or in such poor working order that repair or replacement becomes necessary. This class of apparatus, where high potentials are employed, and especially where currents of large amperage are employed, involves the use of oil, and the switch units are commonly made a stable structure, which cannot be examined or repaired without danger to the operator. It is a common practice to provide means for cutting the switch out or rendering it dead, but the provisions are inadequate to insure safety of the operators with very high voltages.

It is the object of my invention to guard against any danger to the operator and to permit ready and rapid removal of a defective switch and the equally rapid substitution of a spare one in good working order. In carrying out this object I mount the switch in such a way that it is slidably related to the high potential bus bars with which it is normally connected, and I provide a mechanical lock inter-related to the same operating mechanism which governs the making and breaking of the circuit, so that when the circuit is closed the switch element is mechanically locked in position, but when the circuit is broken and the switch parts are electrically dead the mechanical lock is disengaged and the switch unit may be removed bodily, if necessary. Thus, in case of damage to any switch unit it may be very quickly removed from its position with relation to the distribution circuit and a sound unit be substituted for it. Thus, there is but a brief interruption of service on the circuit or circuits which the switch controls and no serious discomfort to the consumers occurs. I preferably so arrange the parts in communication with the bus bars that when the switch is removed no opportunity will exist for accidental contact of the operator in the course of his duty with exposed high potential parts.

My invention therefore consists of a high potential switch or circuit breaker in the form of a removable unit, which may be withdrawn bodily from the high potential conductors, and means for controlling the switch at a safe distance and locking it against removal from its proper relation to the supply circuit except when the switch is open. It embodies also a switch of this character, which may be removed as a unit when damaged, combined with a disconnecting switch completing the electric connection through buried contacts communicating

with points behind an insulating barrier, so that no danger exists for an operator after the switch has been removed.

It embodies other features, the novelty of which will be more particularly hereinafter described and will be definitely indicated in the claims.

In the accompanying drawings, which illustrate several forms of construction embodying my invention, Figure 1 is a sectional elevation of a switchboard embodying a group of switch units embodying my invention. Fig. 2 is a view showing one of the units in a stage of its removal from the supply or distribution circuit. Fig. 3 is a detail view of the switchboard of Fig. 1. Fig. 4 is a sectional view showing a modified form of removable switch unit embodying my invention.

Referring now in detail to the drawings, and first with reference to Figs. 1, 2 and 3, 1 represents a switchboard, which may be made of slate, marble or other similar fireproof insulating material, and carrying a plurality of shelves or brackets 2 forming open-front cells for a group of oil switches 3, 3^a, 3^b, each of which has a pair of connecting switches 4, 4^a (see Fig. 2) leading to terminals beneath the oil in the containing tanks and arranged to yield for purposes of alinement as by a pivotal connection, as seen in Fig. 1, so that it can be slid into and out of engagement with a buried clip or contact in an insulator 5 mounted on the switchboard. When in service, each switch is locked in place by a hook 6 carried by a slidable rod 7, which may be raised and lowered by an operator when necessary, and when in its raised position passes through an opening in a casting 8 secured to a switch. The rod 7 also carries an arm 9 which engages an eye 10 attached to a wooden rod 11 carrying bridging contacts by which the circuit is closed in the oil cell. When the oil switch is slid into position, the rod 9 engages the eye 10 by passing through it. Thus, it will be evident that when the rod 7 is pushed up, the bridging contact 12 is brought into engagement with the fixed contacts 13, 13^a which closes the circuit of the switch, and simultaneously with this closure the hook arm 6 enters the opening in the casting 8 and mechanically locks the switch unit from being moved until, by a proper downward movement of the rod 7, the circuit of the switch is opened, and simultaneously therewith the switch is disconnected so that it may then, being dead, safely be handled. It is therefore, impossible to remove the switch except when the circuit through it is broken. The control mechanism for effecting these operations is located at a point distant from the high potential mechanism on another insulating board 14, on which is mounted an operating lever 15 connecting by a linkage system and bell cranks, as indicated in the figure, with a toggle 16 by which the rod 7 may be raised and lowered. This operating lever preferably connects with the linkage system by means of a toggle 17, or some equivalent means in operative relation to a trip magnet 18^a in inductive relation, as by a current transformer or some similar device, to the high potential circuit so that in case of overload on the circuit the coil will act automatically to open the switches, as in the example shown, by breaking the toggle 17 and permitting the movable switch element to open by gravity or otherwise.

18 indicates a latch by which the parts may be held in closed position under normal conditions.

Each switch unit may, if desired, be securely locked by a stud on the bracket 2 projecting into a slotted lug 19 attached to the switch and fastened, if desired, by a wing nut, as indicated.

The insulators 5 are of porcelain and connect on the rear side with bus-bars 20, 20^a, 20^b leading to the high potential mains, or the mains themselves may be brought to the board, as indicated at 21, 21^a, 21^b and connect with rods threading the insulator. This structure is clearly indicated in Fig. 4, in which 20 represents one of the bus-bars and 22 a copper or phosphor-bronze rod threaded at one end to engage a nut and carrying at the other end a connecting clip 25 nesting in a recess in the end of the insulator in front of the board. With this structure, it will be apparent that when a switch is disabled, or for any other reason requires attention, it is the work of an instant to trip the switch, thereby simultaneously opening the circuit and mechanically opening the safety lock at 6. The wing nuts at 19 then permit the switch, if any trouble is apparent, to be slid away from the circuit and lifted to a truck, as indicated in Fig. 2, for removal to a part of the station where it can be properly examined. A new switch to replace the defective one may at the same time be slid in its place and the operating lever then unlatched and thrown to close the circuit and lock the switch in place. A group of switches may be mounted on the single board vertically above one another and all similarly controlled from the operating board, as clearly seen in Fig. 1. In Fig. 4 I have shown an arrangement by which still further precautions are taken to prevent accidental contact with a live part of the switch. In this case I provide a hood or cover 23 around each of the connecting switches, the hood having a slot therein

through which the rod 9 may operate. In this case I mount also a second insulator 24 on the rear side of the hood in alinement with the clip 25 so that when the switch unit is slid toward the board the connection will be automatically established. In this case there are no live exposed parts, all surfaces carrying high potential on the front of the board being inaccessible to contact on the part of an operator. The oil vessels may be of any approved construction, as for example, a galvanized or wrought iron tank suitably mounted with insulating fiber, a construction common in the art.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A high potential switch comprising a plurality of oil tanks mounted in separate insulating compartments, each provided with fixed and movable contacts, high potential terminals in the compartments inclosed within insulating walls, disconnecting switches connected with the fixed switch contacts and adapted to be slid into engagement with the inclosed terminals, whereby the switch may be bodily withdrawn and another switch substituted, means for locking the switch against removal, an operating board located at a distance from the support for the oil switch, means upon the operating board for operating the switch locking means and connections between the switch locking means and the operating means therefor upon said operating board.

2. The combination of a high potential terminal, a switch mounted to permit bodily movement thereof toward and away from said terminal and comprising relatively movable coöperating contacts, a switch actuating member movable only in a direction transverse to the direction of bodily movement of said switch, a detachable electrical connection between said terminal and one of said contacts, and automatic clutching means for mechanically connecting said coöperating contact to said actuating member and automatically unclutching it from said member in response to bodily movement of said switch toward and away from said terminal.

3. The combination with an insulating support, of a plurality of removable oil switches in separate insulating cells one upon the other on the front side of the support, high potential terminals adapted to make a separate connection with the switches, a lock bar for engaging each of the switches while they are in closed circuit relation and means operated at a distance from the switch for actuating the lock bar and simultaneously opening the circuit.

4. The combination of circuit terminals, an oil switch bodily movable toward and away from said terminals, telescoping connections embedded in insulation and mounted to engage and establish electrical connection between said terminals and corresponding contacts of said switch when said switch is moved into operative position, a non-removable switch actuating member, means for automatically attaching the movable contact of the switch to said member by movement of said switch into operative position, an insulating hood mounted on said switch to prevent access to all live parts while said switch is in operative position, and locking means controlled by said actuating member to prevent the removal of said switch while closed.

5. The combination of an insulating support, a plurality of high potential switches slidably mounted thereon in open end cells and detachably connected therewith by a slip joint, means for locking the switches against removal, and an operating board distant from the switches provided with devices for coördinately controlling the circuit of the switches and the locking means.

6. The combination of circuit terminals, an oil switch bodily removable from electrical connection with said terminals and comprising fixed contacts and a movable contact, non-removable operating means for actuating said movable contact, clutching mechanism for rigidly connecting said movable contact to said operating means automatically by the placing of the switch in operative relation to said terminals, and a locking member actuated by said operating means for locking said switch in position while said switch is closed.

7. The combination with an oil switch having fixed and movable contacts and being removable from its operating position, of non-removable operating means for said switch, and stationary terminals in connection with which the fixed contacts of the switch are adapted to be placed, said switch and said operating means being adapted to be placed in operative relation and its fixed contacts placed in conducting relation to said stationary terminals by the placing of the switch in its operating position.

8. The combination with a switch operating mechanism and fixed terminals adjacent said mechanism, of an oil switch mounted for bodily movement toward and away from said terminals and said mechanism, said switch comprising fixed contacts normally in electrical connection with said terminals and a movable contact normally locked to said operating mechanism, means for permitting said contact to be electrically and mechanically disconnected from said mecha-

nism by bodily movement of said switch, and a locking member mounted on said actuating mechanism to engage said switch and prevent bodily movement thereof, away from said terminals while said switch is closed.

9. The combination of stationary terminals, a switch operating mechanism adjacent said terminals and comprising a vertically movable member having a horizontal projection thereon, an oil switch mounted for bodily horizontal movement toward and away from said terminals and comprising fixed contacts normally connected electrically to said terminals when said switch is in normal position and a vertically movable cooperating contact having an eye engaged by said projection when said switch is in normal position to lock said movable contact to said vertically movable member, and interlocking means on said member and on said switch to prevent horizontal movement thereof away from said terminals while said switch is closed.

In testimony whereof I affix my signature, in presence of two witnesses.

GEORGE AUGUSTUS BURNHAM.

Witnesses:

A. C. NELSON,

E. C. WATERHOUSE.