N. D. LEVIN.

SWITCH AND CONNECTING DEVICE FOR ELECTRIC CONDUCTORS.

APPLICATION FILED MAR. 25, 1910.

1,045,572.

Patented Nov. 26, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

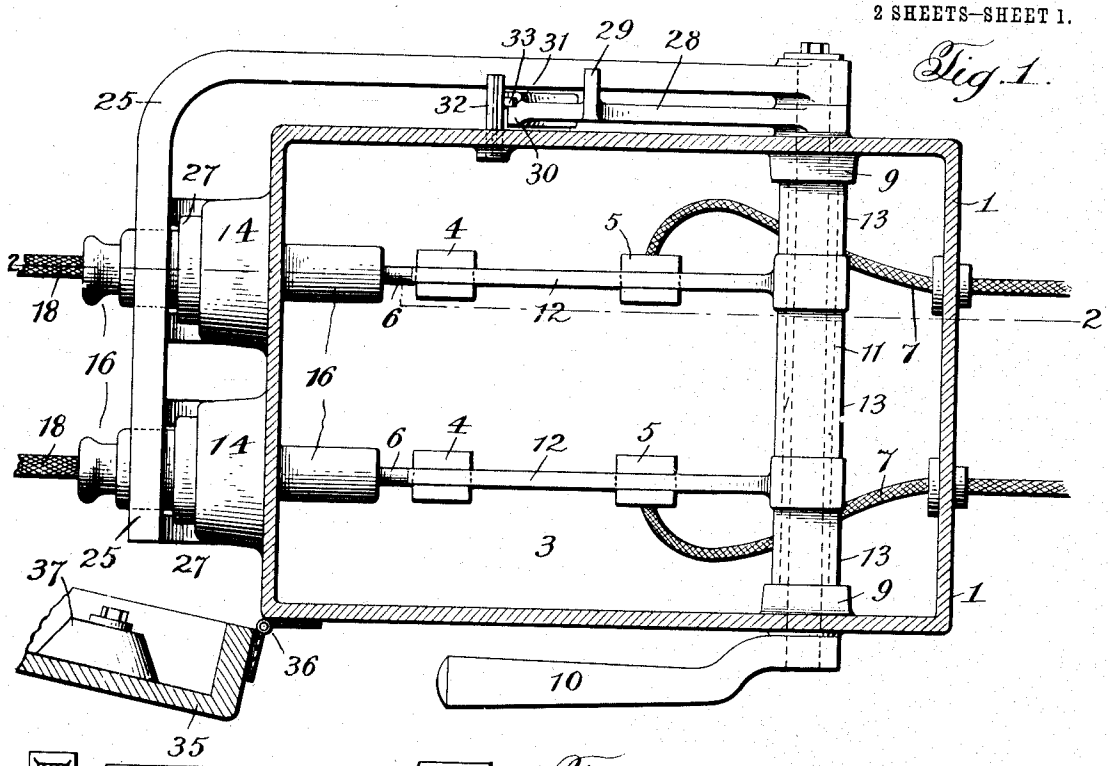

Fig. 2.

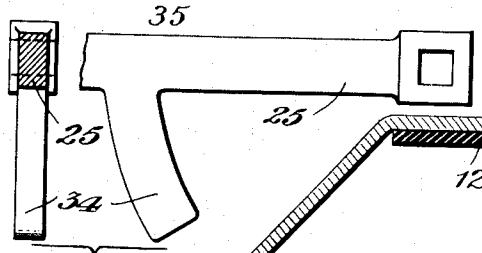

Fig. 8.

Fig. 7.

Witnesses:

Jas. E. Hutchinson.

S. Jay Teller

Inventor:

Nils D. Levin

By H. H. Bliss.

Attorney.

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2 SHEETS—SHEET 2.

Fig. 3.

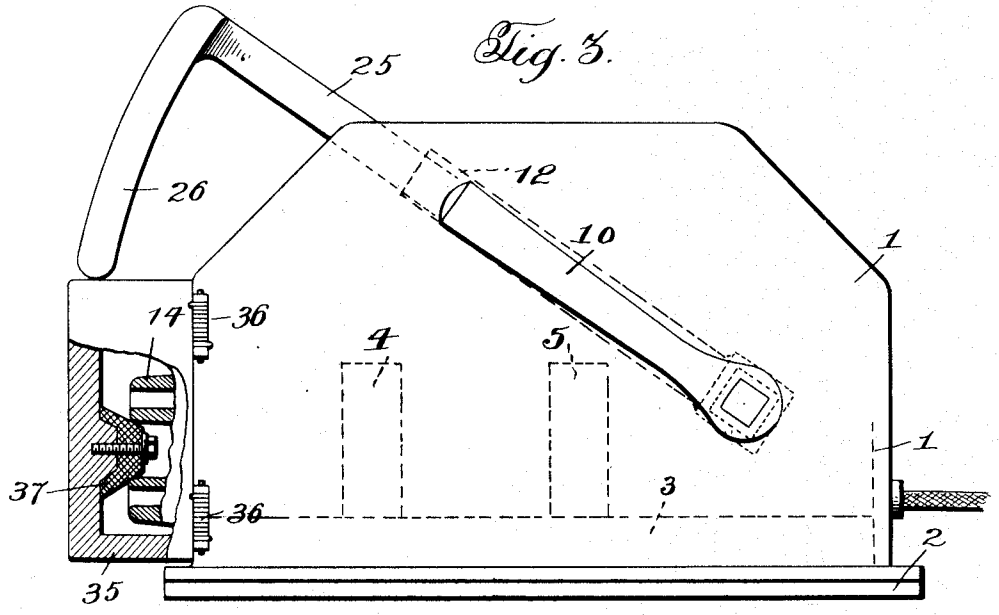


Fig. 4.

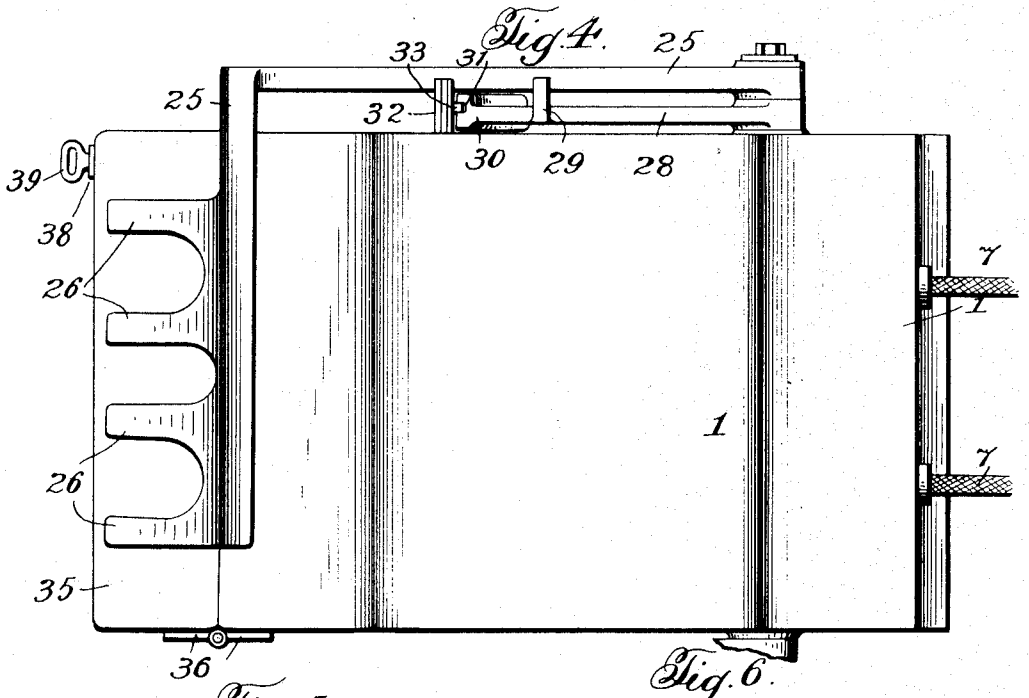
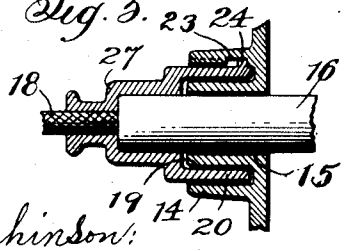
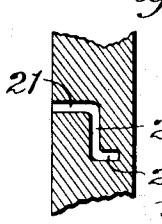


Fig. 6.

Fig. 5.





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Jas. E. Hutchinson.

S. Jay Teller

Inventor:

Nils D. Levin

By H. H. Bliss

Attorney.

UNITED STATES PATENT OFFICE.

NILS D. LEVIN, OF COLUMBUS, OHIO, ASSIGNOR TO THE JEFFREY MANUFACTURING COMPANY, A CORPORATION OF OHIO.

SWITCH AND CONNECTING DEVICE FOR ELECTRIC CONDUCTORS.

1,045,572. Specification of Letters Patent. Patented Nov. 26, 1912.

Application filed March 25, 1910. Serial No. 551,598.

To all whom it may concern:

Be it known that I, NILS D. LEVIN, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Switch and Connecting Devices for Electric Conductors, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in switches and connecting devices for electric conductors.

A device embodying my invention is especially adapted for use in mines or other places where an atmosphere of explosive gases is apt to be met with.

The object of the invention is to provide a device of the class described, in which there is no possibility of the communication to the external atmosphere of sparks or flame caused by the making or breaking of an electric circuit.

My invention may be embodied in any one of a variety of constructions, but for purposes of illustration I have shown in the accompanying drawings the embodiment which I now prefer.

Of the drawings, Figure 1 is a cross sectional plan view of a device embodying my invention taken along the line 1—1 of Fig. 2. Fig. 2 is a cross sectional elevation taken along the line 2—2 of Fig. 1. Fig. 3 is a side elevation of the device with the cover in closed position. Part of the cover is shown in cross section. Fig. 4 is a plan view with the cover in closed position. Fig. 5 is a detail cross sectional view of the plugs showing the locking means. Fig. 6 is a fragmentary development of the surface of one of the plug-flange receiving grooves showing the locking groove for the plug. Fig. 7 is a detail view of the operating cam for the locking latch. Fig. 8 shows a part of the locking lever in detail.

Referring to the drawings, 1 represents the casing proper. This casing is secured to the base or backing 2 by means of suitable bolts. The joint between the casing parts 1 and 2 is made flame proof by means of suitable packing or in any other desired manner. 3 is a slab of insulating material, such as slate or marble, secured to the base 2. On this slab 3 are mounted the switch poles or contacts 4, 4 and 5, 5. The contacts 4, 4 are provided with split terminal studs or pins 6, 6. The contacts 5, 5 are connected to suitable conductors 7, 7 which pass out through suitable insulated apertures in the casing wall.

8 is a shaft rotatably mounted in suitable bearings 9, 9 and extends through the opposite walls of the casing. At one end, the shaft 8 is provided with an operating handle 10. For the sake of convenience I prefer to make the central part of the shaft rectangular. The rectangular shaft is covered with a rectangular tubular sleeve 11 composed of a suitable insulating material.

12, 12 are switch blades, each adapted to electrically engage a contact 4 and a contact 5. The blades 12, 12 are mounted on the sleeve 11 of the shaft 8, each of the blades being provided with a rectangular aperture, with the walls of which the sleeve 11 closely engages. Spacing sleeves 13, 13, are provided outside of the sleeve 11 and serve to hold the blades 12, 12 in proper longitudinal position relative to the shaft. When in their lower position, as shown in Fig. 2, the blades 12, 12 establish electrical connection between the contacts 4, 4 and 5, 5. When in their upper position, as shown by dotted lines in Fig. 3, electrical connection between the contacts 4, 4 and 5, 5 is broken. A pad 12^a of insulating material is preferably provided to limit the upward movement of the blades and to prevent their contact with the top of the casing.

One wall of the casing is provided with bosses 14 having apertures 15 in alinement with the pins 6, 6. These apertures are adapted to receive the conductor terminal plugs 16, 16. The apertures are of slightly greater diameter than the plugs so that there is a slight clearance when the plugs are in place. Each plug is provided with a socket 17 formed of conducting material and adapted to engage a pin 6. The socket 17 is electrically connected to a conductor wire or cable 18. The outer part of each of the bosses 14 is provided with a deep annular groove 19 concentric with the aperture 15. Each of the plugs 16 is provided with a flange 20 adapted to enter the groove 19, but of such a size and shape that there will

be a slight clearance at all points between the surfaces of the flange and groove. In this way, thin tortuous passageways are provided when the plugs are in place between the interior and the exterior of the casing.

In the inner surface of each of the grooves 19 are formed three connecting grooves 21, 22 and 23. The groove 21 is parallel to the axis of the aperture 15, the groove 22 is at right angles to the groove 21, and the groove 23 is parallel to the groove 21. On each of the flanges 20 is located a pin 24 adapted to enter the grooves. It will be noted that for the full insertion of the plug 16, it must first be moved inwardly then rotated through a slight angle and again moved inward. The purpose of this will be more fully set forth hereinafter.

25 represents a locking lever for the plugs 16. This lever is loosely mounted at one end on the shaft 8 and at its other end is provided with forks 26, 26, the prongs of which are adapted to fit over the outer ends of the plugs and engage the shoulders 27 formed thereon. These forks 26, 26, when in the position shown in Figs. 1 and 2 serve to prevent the insertion or removal of the plugs 16, 16. It will be noted that on account of the shoulders 27 of the plugs, the forks 26, 26 cannot be moved to the locking position when the plugs are only partly inserted. In order for the fork prongs to clear the shoulders 27, 27, the plugs must be fully inserted with the pins 24 in the grooves 23.

The locking arm 25 is so connected with the shaft 8 that the arm must always be in its locking position when the switch blades 12 are in closed position. The mechanism which I have shown for connecting and interlocking the shaft 8 with the arm 25, 25 comprises an arm 28 rigidly secured to the shaft 8. This arm carries a stop 29 adapted to engage the arm 25 in such a way as to prevent the downward movement of the switch blades independently of the arm or the upward movement of the arm independently of the switch blades. At the end of the arm there is provided a curved segment 30, which is concentric with the shaft 8. This segment is provided with a groove 31, the upper part of which lies in a plane perpendicular to the shaft 8. The lower part of the groove, however, is at an oblique angle to the upper part, as shown in Fig. 7.

32 is a latch slidably mounted in an aperture in the casing. This aperture is provided with a key which engages a keyway in the latch to prevent its rotation. The latch 32 is provided with a pin 33 adapted to enter the groove 31 of the segment 30. The latch 32 is adapted, when in its outer position, to engage the upper side of the arm 25 to hold it in its locking position. When the latch is moved inward the arm is released. The shape of the groove 31 in the segment 30 is such that it acts as a cam to move the latch inward as the switch blades approach their uppermost position and to move the latch outward as the switch blades leave their uppermost position. The arm 25 is provided with a depending finger 34, which is parallel to the segment 30. The purpose of this finger 34 is to prevent the outward movement of the latch 32 and consequently the downward movement of the switch blades 12 when the arm 25 is not in its locking position. It will be observed that on account of this construction the locking arm is automatically held in locking position when the switch is closed. Furthermore, the arm is not released until the switch blades have reached the extreme limit of their motion. The finger 34 prevents the downward movement of the switch blades before the finger 25 reaches its lower position. Without such a device, it would be possible to move the arm and the blades down simultaneously, the latch 32 being thrown outward to engage the bottom instead of the top of the arm 25. This engagement with the bottom would prevent the closing of the switch without first moving it again to its uppermost position.

35 represents a swinging door at the front of the device. This door is provided with spring hinges 36 which tend to move it into closed position. The inner side of the door is provided with pads 37 of soft rubber or other suitable material. These pads are adapted to engage and entirely close the outer ends of the apertures 15. A lock 38 operable by a key 39 is preferably provided for maintaining the door in closed position. When the door is closed, the locking arm 25 and the switch blades 12 are held in their upper position, as shown in Fig. 3.

I am aware that it has been heretofore proposed in devices of this character to provide a locking means for holding the terminal plugs in engaging position when the switch is closed. In some of these devices, however, it has been possible for explosive gases to collect inside of the casing and to be fired by the flame caused by the opening of the switch. The plugs have been almost simultaneously unlocked with the opening of the switch, and it has therefore been possible for these to be blown outward before the force of the explosion has been dissipated. In my device, I provide two independent locking devices for the plugs, neither of which can be released until an appreciable time has elapsed after the separation of the switch contacts. Not until the switch blades 12 have moved to their extreme upward position can the arm 25 be lifted to release the plugs. Not until the

arm 25 has been lifted can the plugs be partly withdrawn and turned to release the pin 24 from the grooves 21, 22 and 23. The successive operation of these different parts requires sufficient time for the release of gas pressure within the casing due to an explosion. The relief of this pressure is made possible by the clearance spaces surrounding the plugs 16 and extending around the flanges 20. This clearance space is so narrow that the gases in passing through it will, by contact with the metallic walls, be sufficiently cooled to prevent the possibility of the ignition of external gases. The passageway which I have provided for the relief of the pressure within the casing is similar to that shown and described in the co-pending application of Robert R. Dunlop, filed February 14, 1910, Serial No. 543,737, and I do not therefore claim the improvements set forth in the said application.

The door 35 will be automatically closed as soon as the plugs have been removed. In this way the pads 37 will be brought into position to close the apertures 15. It is desirable that these apertures be closed at all times when the device is not in use, as, otherwise, explosive gases might accumulate inside of the casing. While the device is intended to prevent any harm being caused by an explosion within the casing, it is at the same time desirable to prevent such explosions so far as possible. The locking arm and the switch are automatically held in their upper position on account of the contact of the fork prongs with the top of the door by means of the lock 38. It is, therefore, possible to prevent any irresponsible persons from operating the device.

What I claim is—

1. In a device of the class described, the combination of a flame proof casing, a circuit making and breaking mechanism within the casing, a terminal connected to the said mechanism, a conductor adapted to engage the terminal, and a plurality of independently operable means for locking the plug in engagement with the terminal when the circuit making and breaking mechanism is in closed position, substantially as set forth.

2. In a device of the class described, the combination of two contact mechanisms connected in series, means surrounding one of them for preventing the communication of sparks or flame to the external atmosphere, and two independently operable locking means for the other mechanism, each adapted to hold the said mechanism in closed position when the first mechanism is in closed position, substantially as set forth.

3. In a device of the class described, the combination of a circuit making and breaking mechanism, a terminal connected to the said mechanism, a flame proof casing surrounding said mechanism and the said terminal and having an aperture opposite to the terminal, a conductor plug adapted to engage the terminal through the aperture and to close the said aperture in a flame proof manner, and a plurality of separate means for locking the plug in engagement with the terminal when the contact making and breaking device is in closed position, substantially as set forth.

4. In a device of the class described, the combination of two contact mechanisms connected in series, means surrounding one of them for preventing the communication of sparks or flame to the external atmosphere, two separate locking means for holding the second mechanism in closed position when the first is in closed position, and means for preventing the releasing of one of said locking means before the releasing of the other, substantially as set forth.

5. In a device of the class described, the combination of two contact devices connected in series, means surrounding one of them for preventing the communication of sparks or flame to the external atmosphere, a plurality of devices for locking one of the said mechanisms in closed position when the other is in closed position, and means for preventing the simultaneous movement of the said locking devices out of locking positions, substantially as set forth.

6. In a device of the class described, the combination of two contact mechanisms connected in series, one of said contact mechanisms being flame proof, means connected with the flame proof mechanism for locking the other mechanism in closed position when the flame proof mechanism is in closed position, a supplementary means for locking the second mechanism in closed position, and means whereby the first locking means is held inoperative when the supplementary locking means is in inoperative position, substantially as set forth.

7. In a device of the class described, the combination of a switch, a casing inclosing the switch, a terminal for the switch, a conductor plug adapted to enter the casing and engage the terminal, a mechanism, operable independently of the switch, for locking the plug in engagement or out of engagement with the terminal, and means positively connected with the switch for holding the locking mechanism in operative position at all times when the switch is in closed position, substantially as set forth.

8. In a device of the class described, the combination of a flame proof switch having a terminal, a conductor plug adapted to engage the terminal, a means for holding the plug in engagement with the terminal, and a means independent of the holding means for preventing the closing of the switch

when the plug is partly but not fully engaged with the terminal, substantially as set forth.

9. In a device of the class described, the combination of a flame proof switch having a terminal, a conductor plug adapted to engage the terminal, a means for locking the plug in position when it is fully engaged with the terminal, a second locking means adapted to engage the plug only when the locking means is in operative position, and means for preventing the closing of the switch when the second locking means is not in operative position, substantially as set forth

10. In a device of the class described, the combination of a flame proof switch having a terminal, a conductor plug adapted to engage the terminal, a mechanism for locking the plug in engagement with the terminal, the said mechanism being operable independently of the switch, and means for preventing the closing of the switch when the locking mechanism is in inoperative position, substantially as set forth.

11. In a device of the class described, the combination of a flame proof switch having a terminal, a conductor plug adapted to engage the terminal, a mechanism for locking the plug in engagement with the terminal, the said mechanism being operable independently of the switch, means for preventing the closing of the switch when the locking mechanism is in inoperative position, and means for holding the locking mechanism in operative position when the switch is closed, substantially as set forth.

12. In a device of the class described, the combination of a flame proof switch, a terminal connected to the switch, a conductor plug adapted to engage the terminal and provided with a shoulder, a locking arm connected with the switch and provided with a fork having prongs adapted to engage the shoulder of the plug to hold the plug in engagement with the terminal, said prongs being so arranged that they cannot engage the shoulder when the plug is not in full engagement with the terminal, and means for preventing the closing of the switch when the prongs are not in engagement with the shoulder, substantially as set forth.

13. In a device of the class described, the combination of a contact mechanism having a terminal, an apertured flame proof casing surrounding the terminal, a conductor plug adapted to enter the aperture and engage the terminal, means for locking the plug in engagement with the terminal, the said means comprising a pin and a three-part groove, the first part of said groove being substantially parallel to the plug axis, the second at right angles to the first and the third parallel to the first, and a locking means connected with the contact mechanism and adapted to engage the plug only when it is in position with the pin in the third part of the groove, substantially as set forth.

14. In a device of the class described, the combination of a contact mechanism, a terminal connected with the contact mechanism, an apertured flame proof casing surrounding the terminal, a conductor plug adapted to enter the aperture and engage the terminal, a locking means for the plug comprising a three-part groove, and a pin adapted to engage the groove, the first part of the groove lying substantially parallel to the plug axis, the second lying at right angles to the first, and the third parallel to the first, and means for preventing the closing of the switch when the plug is in position with the pin in engagement with the first or second parts of the groove, substantially as set forth.

15. In a device of the class described, the combination of a contact mechanism, a terminal connected with the contact mechanism, an apertured flame proof casing surrounding the terminal, a conductor plug adapted to enter the aperture and engage the terminal, a locking means for the plug comprising a three-part groove, and a pin adapted to engage the groove, the first part of the groove lying substantially parallel to the plug axis, the second at right angles to the first, and the third parallel to the first, and means for preventing the release of the locking means when the contact mechanism is closed, substantially as set forth.

16. In a device of the class described, the combination of a conductor terminal, an apertured flame proof casing surrounding the terminal, a boss surrounding the aperture and provided with a groove parallel to and concentric with the aperture, and a conductor plug adapted to enter the aperture with clearance at all points to engage the terminal, the said plug being provided with a flange adapted to enter the groove in the boss with clearance at all points, substantially as set forth.

17. In a device of the class described, the combination of a conductor terminal, an apertured flame proof casing surrounding the terminal, a boss surrounding the aperture and provided with a groove parallel to and concentric with the aperture, a conductor plug adapted to enter the aperture with clearance at all points and to engage the terminal, the said plug being provided with a flange adapted to enter the groove in the boss with clearance at all points, and means for locking the plug in engagement with the terminal, substantially as set forth.

18. In a device of the class described, the combination of a conductor terminal, a con-

ductor plug adapted to engage the terminal, a flame proof casing surrounding the terminal, and a plurality of concentric cylindrical sleeves alternately connected with the plug and with the casing and adapted to interlace with each other with a small clearance at all points to form a continuous tortuous passageway between the interior and the exterior of the casing, substantially as set forth.

19. In a device of the class described, the combination of a switch having a terminal, an apertured flame-proof casing surrounding the switch and the terminal, a conductor plug adapted to enter the aperture to engage the terminal, a cover for closing the aperture when the plug is removed, means for locking the cover in closed position, and means for holding the switch open when the said cover is in its closed position, substantially as set forth.

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

NILS D. LEVIN.

Witnesses:
R. R. DUNLOP,
H. B. ALEXANDER.