No. 647,456. Patented Apr. 17, 1900.

T. ALLEMANN.

AUTOMATIC MAXIMAL SWITCH FOR ELECTRIC POWER AND LIGHTING CURRENTS.

(No Model.) (Application filed Dec. 4, 1899.)

3 Sheets—Sheet 1.

FIG - 1 -

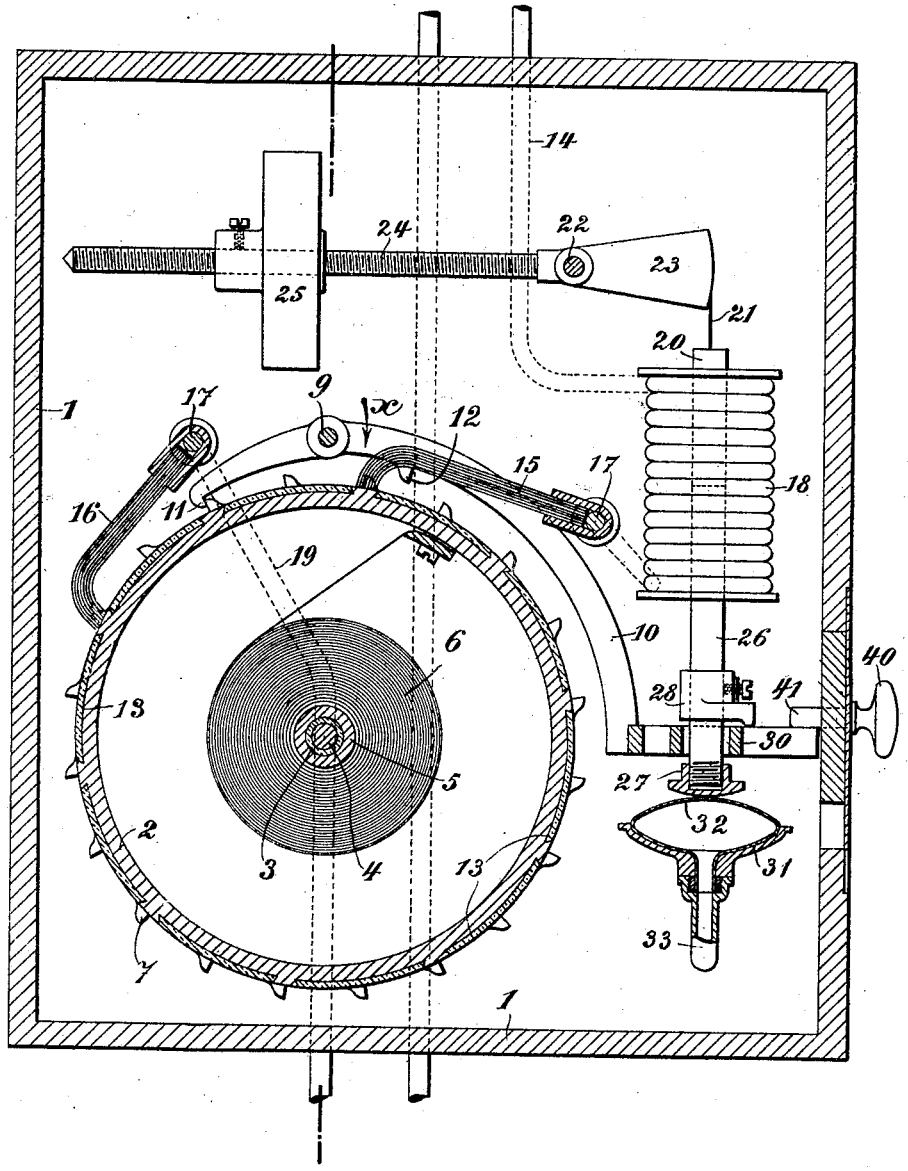

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FIG. 2.

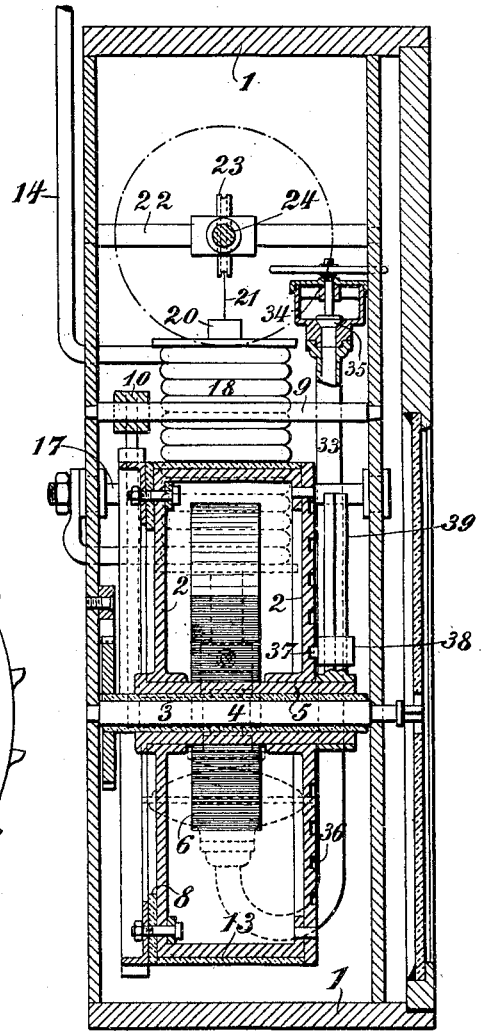

FIG. 3.

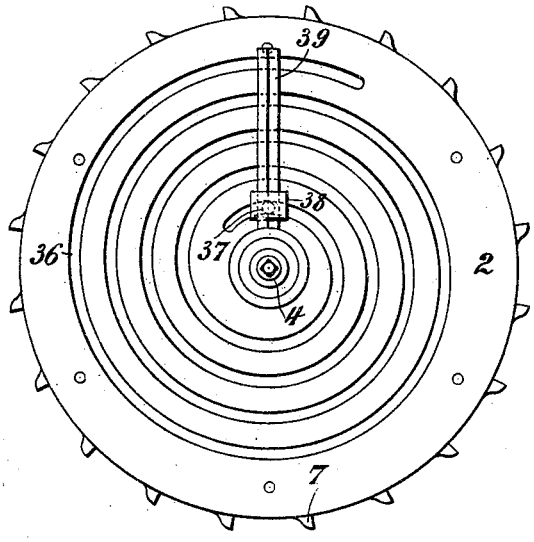

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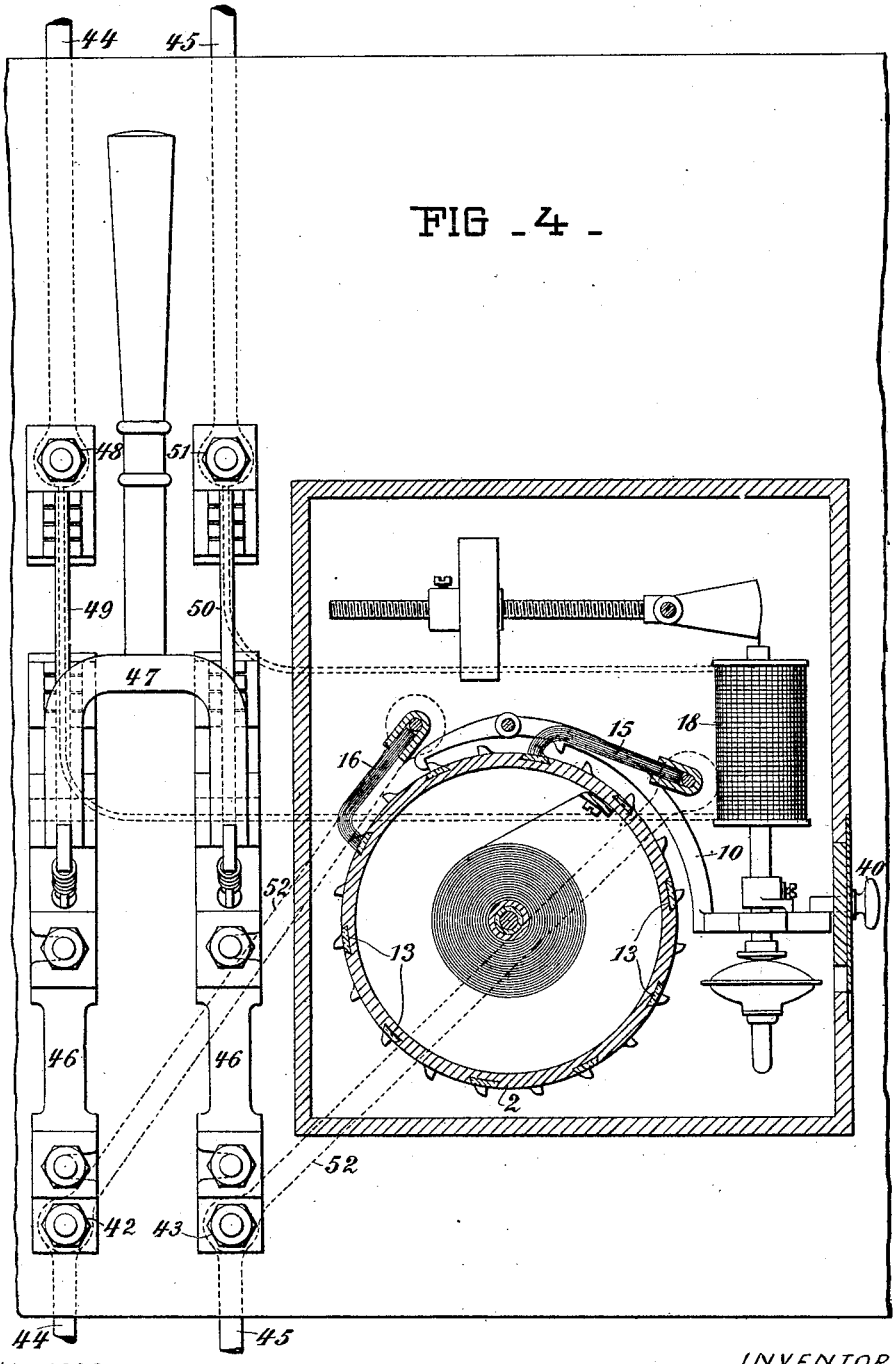
FIG. 4.



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AUTOMATIC MAXIMAL SWITCH FOR ELECTRIC POWER AND LIGHTING CURRENTS.

SPECIFICATION forming part of Letters Patent No. 647,456, dated April 17, 1900.

Application filed December 4, 1899. Serial No. 739,106. (No model.)

To all whom it may concern:

Be it known that I, THEODOR ALLEMANN, engineer, a citizen of the Swiss Republic, and a resident of Olten, canton of Soleure, Switzerland, have invented a new and useful Automatic Maximal Switch for Electric Power and Lighting Current, of which the following is a clear, full, and exact specification.

The object of the present invention consists of an automatic maximal switch for electric power and lighting current, which is intended to prevent the consumer to whom current is supplied on certain terms and conditions from obtaining more than the hired quantity of current for power or lighting purposes. Thus, for instance, by means of this switch the current is automatically cut off from a consumer who has to receive an agreed maximum quantity of current as soon as he has exceeded the maximum amount of current contracted for.

In the accompanying drawings are illustrated a constructional form of this switch and a suitable connection to the main conductor for securing sparkless working.

Figures 1 and 2 show the apparatus proper in two vertical sections at right angles to one another. Fig. 3 illustrates a detail; and Fig. 4 shows the suitable system of connecting the apparatus to the main line, together with the necessary additional devices, in order to secure the sparkless working of the switch.

In a closed casing 1 is a switch-drum 2, formed like a spring-box. This drum is located loosely on a sleeve 5, firmly connected to the winding-shaft 4 under interposition of an insulating-sleeve 3. The driving-spring 6 of the switch-drum 2 is attached at its one end to the inner periphery of the latter and at its other end to the sleeve 5.

To the back of the drum 2 a ratchet-wheel 7 is firmly attached with insulation 8, and above this ratchet-wheel is located on an axle 9 a stopping-lever 10, having two hooks 11 and 12, which can engage with the teeth of the ratchet-wheel 7.

Within the drum 2, which consists of electrically-conducting material, there is inserted on the periphery at regular distances apart a number of insulating-strips 13 of equal width. The distance between the centers of each of these insulating-strips is exactly twice as great as that between the teeth of the ratchet-wheel 7, and the hooks 11 and 12 are so placed on the lever 10 that when one engages with a tooth of the ratchet-wheel the other is out of engagement with the toothing and is exactly on the middle between two successive teeth.

On the periphery of the drum rest two brushes 15 16, supported by axles 17, in insulated bearings of which brushes 15 are in electric connection with a solenoid 18, through which the current from the main conductor 14 first flows, while the other brush 16 is arranged to conduct the current away into the conductor 19. The core 20 of this solenoid 18 is suspended by means of a flexible connection 21 from the upper end of a segment 23, pivoted at 22, which is integral with a screw-bolt 24, on which is an adjustable counterweight 25. At its other end the core 20 of the solenoid is connected with a vertically-movable rod 26, which passes freely through a hole 30 in the horizontal prolongation of the stopping-lever 10 and can act thereon in its downward movement by means of the adjustable piece 28 and in its upward movement by means of the cap 27.

In order to be able to retard at will the rod 26 in its downward movement, a cushion 32 is supported by a cup 31, arranged immediately under the cushion, which is composed of some elastic material, such as india-rubber, open underneath and connected with a bent tube 33. This cushion 32 and the tube 33 are filled with water or other liquor, and the latter discharges into a closed chamber 34, which contains a brake-valve 35, adjustable by means of a micrometer-screw, by which is effected the larger or smaller opening of the pipe 33. This hydraulic braking device, as will be seen, is completely boxed in all around, so that impurities, such as dust and the like, cannot affect its working. It is for the purpose of delaying the cutting off of the current for a merely short harmless increase of current in order to supply the excess of current needed for a short time for starting the motors without thereby causing the automatic cutting off of the current.

The switch-drum 2 is provided in front, Figs. 2 and 3, with a spiral groove 36, into

which penetrates a stud 37 of a sleeve 38, which is movable on a square guide-bar 39, fixed to the sleeve 5, so that the drum 2 can be stopped after a number of revolutions by the stud 37 reaching the outer end of the spiral groove 36. The length of this spiral groove 36 is so arranged that when the drum 2 is stopped the brushes 15 and 16 rest on insulating-strips 13 of the drum, and therefore the current is interrupted.

In one of the sides of the casing 1 a knob 40, with peg 41 projecting inwardly, is vertically movable. This knob 40 is designed to enable the lever 10 to be displaced from outside and serves, on the one hand, for stopping the motion in one direction of the lever 10 and, on the other hand, as will be more particularly explained below, for switching in the current again.

The operation of the switch is as follows: Fig. 1 shows the position of the various parts of the maximal switch with current flowing through it. Before it is permanently inserted in the circuit it is regulated to the desired maximum strength, the counterweight 25 being adjusted in such a manner that it accurately counterbalances the magnetic attraction which under influence of the current is created in the solenoid 18, acting on the core thereof. The cap 27 and the stop 28 are then so adjusted that the first touches the cushion 32 of the braking device and the latter touches the eye 30 of the lever 10. Then, assuming an excess charge of, say, ten or twenty per cent., the brake-valve 35 of the braking device is so regulated that a short time (for instance, a minute) elapses before the switch automatically cuts off the current. Now the switch is ready to be inserted in its conductor. The current coming from the conductor 14 takes its course, Fig. 1, through the solenoid 18 and the brush 15 to the switch-drum 2 in order to reach the conductor 19 through the brush 16. The switch-drum remains stationary, retained by the hook 11 of the stopping-lever 10. As soon as the current exceeds its fixed maximal amount the core 20 of the solenoid 18 is drawn into the latter by means of the increased magnetic force, the rod 26 is moved down, and the lever 10 is moved in the direction of the arrow x by means of the piece 28. At the same time, however, the cap 27 exerts pressure on the elastic cushion 32, and the water or other liquor is forced through the opening allowed it by the brake-valve 35, which results in retarding of the movement of the rod 26, and consequently that of the lever 10, so that the ratchet-wheel 7 is only released by the hook 11 gradually and after a short delay. When the ratchet-wheel 7 and the drum 2 are released, the drum revolves until another tooth of the ratchet-wheel is caught, this time by the hook 12 of the lever 10, and stops the drum 2. The ratchet-wheel has moved forward half the distance between two teeth, whereby the brushes 15 and 16 run on insulating-strips 13 of the switch-drum 2 and have interrupted the current—that is to say, the consumer obtains no more current. Moreover, as no more current passes through the solenoid 18 the core 20 loses its magnetism, so that the counterweight 25 draws up the rod 26 and can turn the lever 10 by means of its cap 27 in the opposite direction to the arrow x until its horizontal end abuts on the pin 41 of the knob 40, which is in its upper position, and stops the rod 26. Meanwhile the hook 11 has again caught in a tooth of the ratchet-wheel, the latter having moved forward another half-division. The brushes 15 and 16 still, however, slide on the insulating-strips of the drum 2, and are consequently still in the deënergized position. The consumer is consequently without current. In order to obtain current again, he must press the knob 40 downward once more, which causes the ratchet-wheel 7, with the drum 2, to move on another half-division. The brushes 15 and 16 still rest on their respective insulating-strips of the drum. Finally the knob 40 must be put back again into its upper position. As the core of the solenoid 18 is still unmagnetized, the weight 25 moves the lever 10 by means of the rod 26 again in the opposite direction to that shown by the arrow x, whereupon the ratchet-wheel 7 and the drum 2 again move on a half-division and the brushes 15 and 16 pass onto respective conducting parts of the drum. The circuit is consequently again closed. In this manner the parts of the switch are returned to the positions shown in Fig. 1 after the ratchet-wheel has progressed two whole divisions, and the consumer again obtains current. As will be seen, if the consumer wishes to obtain current he is obliged to bring the knob 40 into its upper position, as in its lower position the current is always cut off. It is therefore impossible for him to prevent the switch acting by fastening the knob 40 in its lower position. This operation is repeated as soon as the current exceeds the maximal amount and the spring 6 of the drum gradually uncoils until at last the drum is stopped by the stud 37 of the sleeve 38, the brushes then resting on insulating-strips 13. If the consumer wishes to obtain current, he must wind up the motive spring 6 of the drum 2 by means of the winding-shaft 4 and so put the switch in operation again.

It is preferable to regulate the motive power of the spring 6 in such a manner that the space of time required by the switch-drum 2 to allow of the brushes 15 and 16 passing from the conducting-strips onto the insulating-strips of the drum, and vice versa, is not too short in order that the switching on and off of the current is not effected too quickly, as with quicksilver contacts. By this results the great advantage that the reactive current, which is realized on opening and closing the circuit, cannot attain such a high tension as occurs with instantaneous interrupters.

The advantages of the automatic switch above described for power and lighting current are briefly as follows:

First. The switching in and out of the current is effected at the requisite speed.

Second. The amount and duration of the overloading can be accurately regulated.

Third. When the consumer wishes to obtain current, he is obliged to keep the switch in operation and place the switching-knob in its upper position, as in its lower position the current is always cut off.

Fourth. The switch is of exceedingly-simple construction and works correctly and accurately.

In order to suppress entirely the formation of sparks, it is preferable to connect the apparatus to the main line in the manner shown in Fig. 4. In contradistinction to the mounting above described in this arrangement the drum 2 is deënergized in normal working, while the collector-brushes 15 and 16 are connected to the main line by means of branch wires 52 at the terminals 42 and 43 on the wires 44 and 45 of the main-current line, and the drum is set in shunt-circuit. In normal working the brushes 15 and 16 rest on insulating-strips 13 of the drum 2, so that the shunt-circuit is broken. There is, moreover, in the apparatus a safety-fuse 46, interpolated in the main-line circuit, and this contains also an ordinary hand contact-breaker 47, in this case bipolar. Moreover, the solenoid 18, acting upon the lever 10, is set in shunt-circuit to the main-current line, its coil being joined to the terminals 48 and 51 and being therefore traversed only by a small part of the main current. However, the solenoid might also be put directly in the main-line circuit, so that the entire current would pass through its coil. This latter system of connecting the solenoid is preferable when the apparatus is to be used in circuits of high tension.

As will be seen in the mounting of Fig. 4, the current arrives in normal working from the source of current, following the conducting-wire 44, through the terminal 48, contact-piece 49 of the contact-breaker 47, the one strip 46 of the safety-fuse, and terminal 42 to the place of consumption—to a motor, for instance—and from there through the other wire 45, through terminal 43, the other strip 46 of the safety-fuse, the contact 50 of the contact-breaker 47, and terminal 51 back to the source of current. No current can flow through the drum, as the collector-brushes 15 and 16 stand on insulating-strips 13 thereof. If the drum is released by means of the lever 10, as described above, the brushes 15 and 16 slide onto conducting material of the drum, and consequently effect the short circuit. The current takes, therefore, the shorter and more convenient path through the drum and immediately increases, so that the safety-fuse 46 is melted and the main-line circuit is interrupted.

In order to put in a fresh safety-fuse and make the apparatus again ready for use, the contact-breaker 47 must be opened. Otherwise short circuit would again occur. After the lever 10 has been brought back by the weight 25, as no more current flows through the solenoid 18, the switching-knob 40 is to be moved up and down, and the drum assumes again a position in which the brushes rest on insulating-strips 13 thereof. This causes the breaking of the shunt-circuit. Immediately after this movement of the drum the consumer has to close the contact-breaker 47 again in proportion to the current he wishes to obtain, and the current again takes its course, as stated above, without flowing through the switch-drum. By this system of mounting the apparatus properly works, even with powerful current, entirely sparkless, as the sparking is localized in the safety-fuse.

What I claim is—

1. Automatic maximal switch for electric power and lighting current comprising a switch-drum of electric conducting material rotating periodically under the influence of a motive force, insulating-strips inserted on the periphery of the drum at regular distances apart, collector-brushes resting on the periphery of the said drum, which together with the latter switch the current off and on alternately, a ratchet-wheel firmly attached to the said drum, a two-hook lever, the coöperation of which with the ratchet-wheel makes the drum move periodically, a solenoid with a movable core counterbalanced according to the maximum current strength, which core for interrupting the current acts on the said lever and thus releases the drum, and a hand-knob which engages above one end of the aforesaid lever and by moving up and down effects the restoration of the circuit.

2. In an automatic maximal switch for electric power and lighting current the combination of a rotary switch device moving stepwise under the influence of a motive force, contacts coöperating with the same and a solenoid with the core balanced to correspond with the maximum current strength and which effects the release of the said switch device, with a hydraulic braking device designed to maintain the switch insensible to merely short, harmless overloads and capable of being regulated according to the different admissible overloads and durations thereof.

3. In an automatic maximal switch for electric power and lighting current the combination of a rotary switch device moving stepwise under the influence of a motive force, contacts coöperating with the same and a solenoid with the core balanced to correspond with the maximum current strength and which effects the release of the said switch device, with a rubber cushion or the like, a tube filled with fluid and communicating with a closed chamber into which said tube discharges, and a brake-valve in the chamber

which is adjustable by hand, and makes the opening of the tube into the chamber smaller or greater according to need.

4. In an automatic maximal switch for electric power and lighting current, the combination of a switch device rotating by periodic steps under the influence of a motive force, contacts in coöperation therewith, a solenoid with the core balanced to correspond with the maximum strength of current and which effects the release of the said switch device, and a hydraulic braking device for the said movable solenoid-core, with an adjustable intermediate piece connected to the lower end of this core and designed to engage with the movable part of the hydraulic braking device.

5. In an automatic maximal switch for electric power and lighting current the combination of a switch device rotating in periodic steps under the influence of a motive power, contacts operating therewith, and a solenoid with the core counterbalanced to correspond with the maximum strength of current for effecting the release of the switch device, with a spiral groove on the latter of fixed length, a guide-bar firmly fixed on the axle of said device, and a movable stud traveling on the said guide-bar and fitting in said spiral groove, in order to stop the switch device after a certain number of revolutions according to the length of the spiral groove in a position in which the current is cut out.

6. In an automatic maximal switch for electric power and lighting current, the combination of a switch device of electrically-conducting material with insulating-strips rotating in periodic steps under the influence of a motive force, contacts coöperating therewith, and a solenoid with the core counterbalanced to correspond with the maximum strength of current for effecting the release of the switch device, with a safety-fuse and an ordinary contact-breaker, both inserted in the main-current circuit in front of the apparatus, and shunting-wires from the main line to the said contacts, this arrangement allowing the latter to pass for breaking the main-current line by short circuit and fusion of the safety-fuse from insulating-strips of the switch device onto conducting parts thereof and thus preventing sparks on the switching motion of the said switch device.

In witness whereof I have hereunto signed my name, this 17th day of November, 1899, in the presence of two subscribing witnesses.

THEODOR ALLEMANN.

Witnesses:
GEORGE GIFFORD,
AMAND RITTER.