W. I. THOMSON.

ELECTRICAL APPARATUS.

APPLICATION FILED FEB. 16, 1917.

1,336,764.

Patented Apr. 13, 1920.

3 SHEETS—SHEET 1.

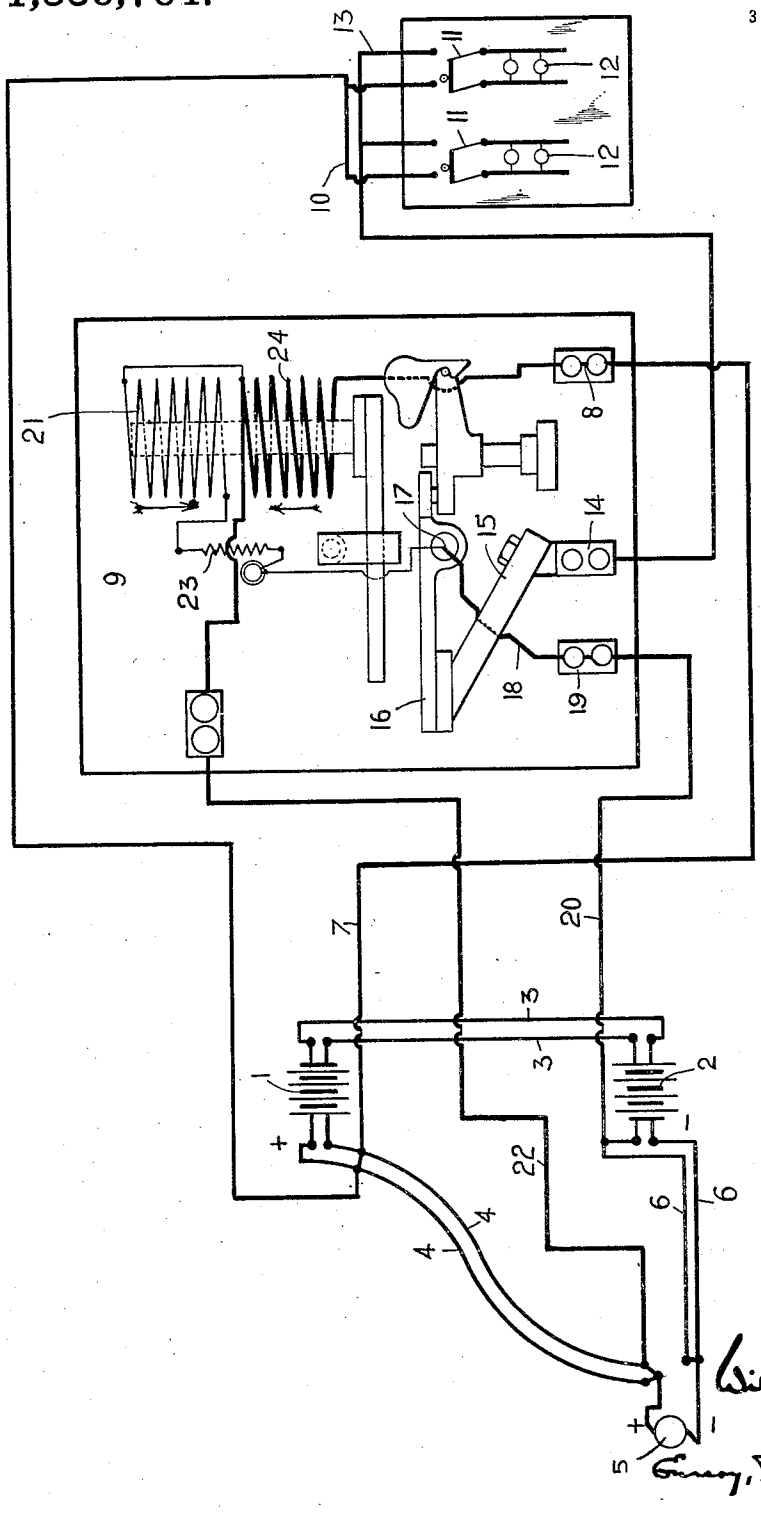

FIG. 1.

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3 SHEETS—SHEET 2.

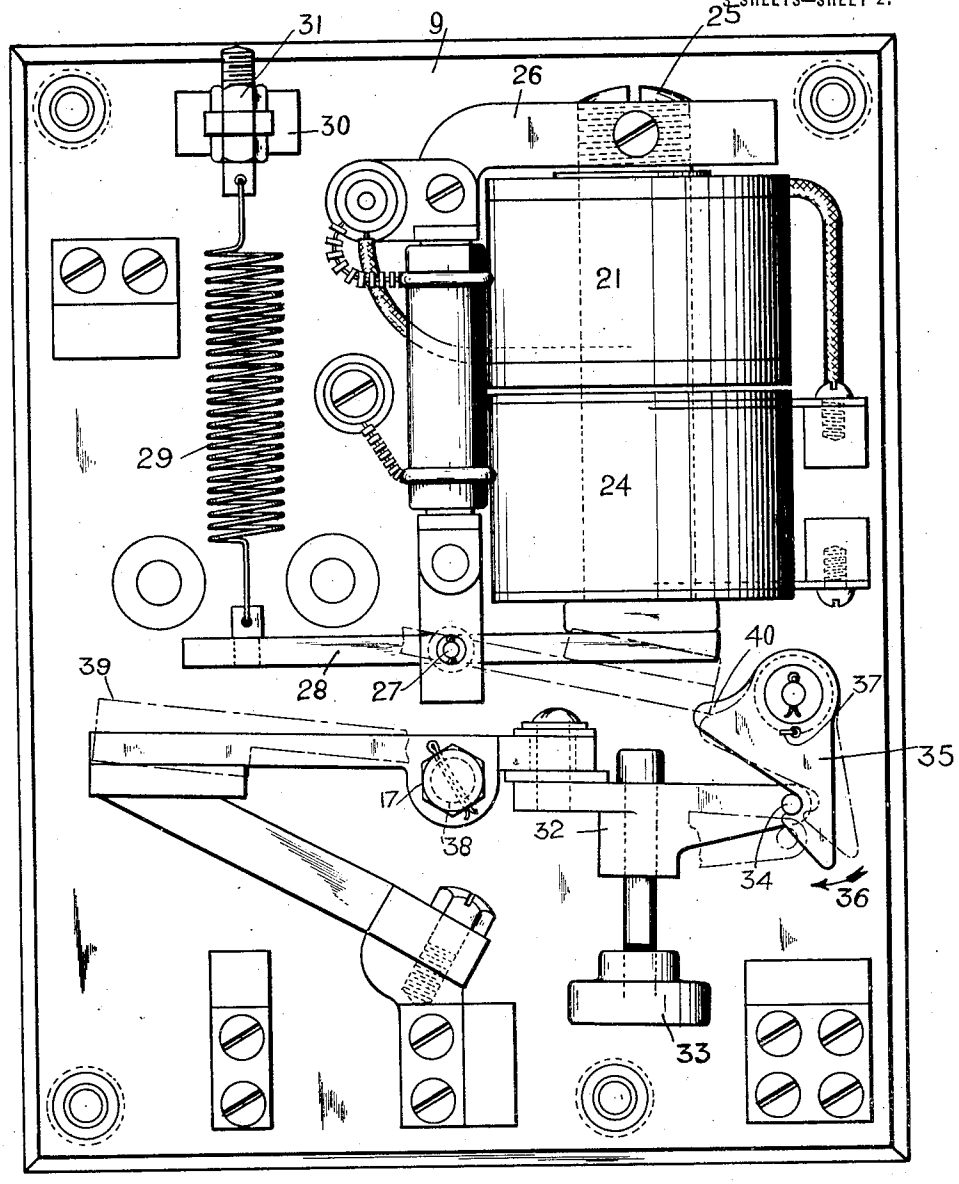

FIG. 2.

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3 SHEETS—SHEET 3.

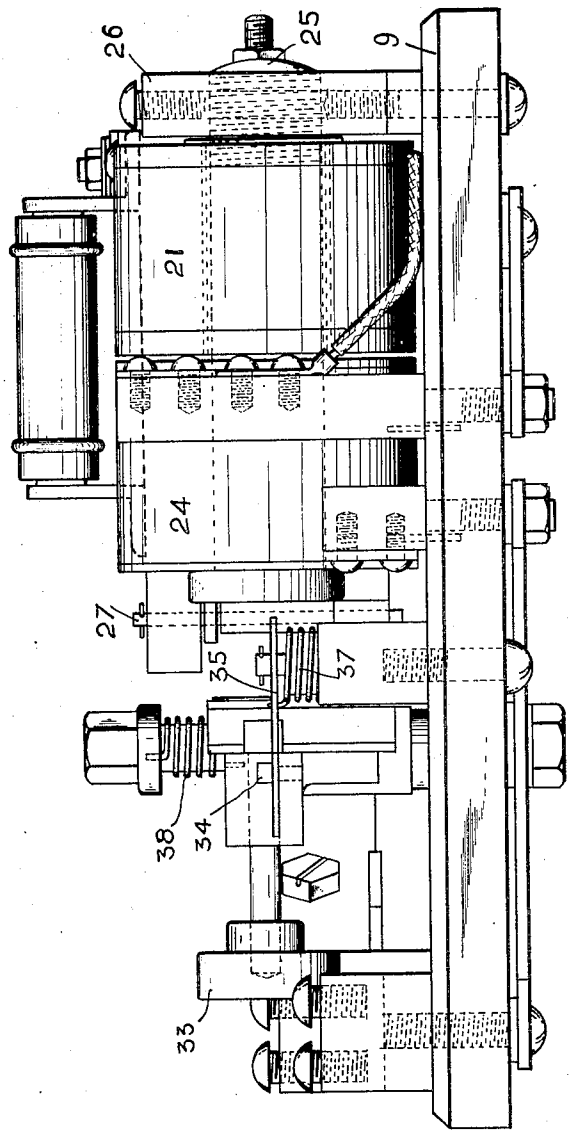

FIG. 3.

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UNITED STATES PATENT OFFICE.

WILLIAM I. THOMSON, OF NEWARK, NEW JERSEY, ASSIGNOR TO SAFETY CAR HEATING & LIGHTING COMPANY, A CORPORATION OF NEW JERSEY.

ELECTRICAL APPARATUS.

1,336,764. Specification of Letters Patent. Patented Apr. 13, 1920.

Application filed February 16, 1917. Serial No. 148,927.

To all whom it may concern:

Be it known that I, WILLIAM I. THOMSON, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have invented an Improvement in Electrical Apparatus, of which the following is a specification.

This invention relates to electrical apparatus and with regard to its more specific features, to electrical controlling or protective apparatus. One of the objects thereof is to provide practical and reliable means for permitting the rapid charging of a storage battery without injury to devices associated or connected therewith. Another object is to provide means of the above type for preventing excessive discharge of storage batteries. Other objects are to provide apparatus of the above natures of simple construction and efficient action. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the structure hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which is shown one of various possible embodiments of this invention,

Figure 1 is a diagrammatic plan of circuits and related parts.

Fig. 2 is a front elevation; and

Fig. 3 is a side elevation.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to Fig. 1 of the drawings, there is indicated a storage battery comprising the two sections 1 and 2. These battery sections are connected by the parallel conductors 3, one with another, and section 1 is connected by the parallel conductors 4 with one terminal of a generator or other source of current 5. The remaining terminal of the generator is connected by the parallel conductors 6 with the remaining terminal of the battery section 2. The source of current is such that the charging current may attain an extremely high value for rapid charging, and accordingly the charging circuit preferably comprises various conductors in parallel in order to reduce the resistance and thus avoid an undue potential drop and large heating losses.

From the positive terminal of the battery a heavy conductor 7 leads to the post 8 of a panel 9, and also from the conductor 7, a conductor 10 leads through switches 11 to banks of lamps 12. The circuit through the lamps is completed by means of a conductor 13 to the post 14 on the panel and thence through fixed contact 15 and a swinging contact 16 to the pivot 17 of the latter. This pivot is connected by conductor 18 with a post 19 to a conductor 20 which terminates at the negative terminal of the battery. In this manner, with all switches closed, the lamps 12 are connected across the storage battery or if the latter be connected with the source of current, then the lamps are also connected therewith in parallel with the battery.

A voltage coil 21 is connected with the positive terminal of the source of current by means of a conductor 22 and the circuit thence leads through a resistance 23 of zero temperature co-efficient to the pivot 17 which in turn is connected with the negative side of the charging line.

The field of this coil is accordingly substantially proportional to the charging voltage, or, with the charging current disconnected, to the voltage of the battery.

A coil 24 is connected between conductor 22 and the post 8 which in turn is in connection, as above described, with the positive terminal of the battery. This coil accordingly presents a field which is substantially proportional to the I. R. drop in the charging conductor 4, and as the resistance of the latter is constant, this field is substantially proportional to the value of the charging current. In other words, the coil 24 carries a fixed fraction of the total charging current and hence its field varies directly with the latter.

Coils 21 and 24 are differentially wound, and the former is of preponderating effect. The aggregate or combined field of the two coils is thus equal to the ampere turns of the coil 21, diminished in effect by the ampere turns of the coil 24. There are thus two conditions at which the aggregate field of

these two coils becomes abnormally low:— first, when the current flowing in the coil 21 is of an unusually low value, and second, when the current flowing in the coil 24 is unduly high.

Turning now to Figs. 2 and 3 of the drawings, there is shown more in detail the various parts mounted on the panel 9. The coils 21 and 24 are provided with a common core 25 which is mounted in a steel support 26 at the lower end of which is a pivot 27. Mounted for oscillation on this pivot is an armature 28, one end of which is adapted to co-act with the lower end of the core 25. The remaining end of this armature is urged into raised position by means of a spring 29 secured between this end and a bracket 30 by means of suitable adjusting nuts 31. Against the force of this spring the armature is normally held in the position shown in full lines in Fig. 2 of the drawings, by the magnetic force of the differential magnet comprising coils 21 and 24.

Pivotally mounted at 17 immediately below the pivot 27 is the swinging contact hereinbefore referred to, and this part has secured to one end the arm 32 having a handle or grip 33 which is preferably formed of insulating material or is insulated from the parts to which it is secured. The arm 32 is provided at its end with a pin 34 adapted to co-act with a swinging latch 35 which is urged in the direction indicated by the arrow 36 by means of a coil spring 37. This latch thus normally locks the part 32 in raised position and holds the contact 16 in circuit-closing position against the force of a coil spring 38 at the pivot 17, tending to urge the latter contact into the open circuit position indicated by dotted lines at 39 in Fig. 2 of the drawings.

Latch 35 is provided with a shoulder or lug 40 in the path of the swinging armature 28, and the parts are so disposed that upon the armature 28 being retracted by means of the spring 29, the latch is thrown into the releasing position indicated by dotted lines, thus permitting the spring 38 to break the lighting circuit, as immediately above described. It is to be understood that the expression "break" with regard to a circuit is herein broadly used as denoting not necessarily a complete interruption but any equivalent action. It may also be noted that the terms "latch" and "switch" are used with their broadest meanings.

The action of the above described apparatus is substantially as follows: During the charging of the battery, the current may reach such a high value that injury might be done the lamps due to excessive voltage if the switches 11 were closed. Such an excessive charging current, however, would result in a corresponding excess of field strength of the coil 24 and thus would so diminish the field strength of coil 21 that the armature 28 would no longer be held in attracted position against spring 29, and it would fall to the position indicated in dotted lines in Fig. 2 of the drawings. This, by the action above described, would release the latch 35 and permit the contact 16 to swing into open circuiting position, thus incidentally disconnecting the lamps if the switches 11 are closed or preventing their subsequent connection while such abnormal condition remains. When normal condition is resumed, the contact 16 is swung against the contact 15 by means of an upward pressure on the grip 33 and the parts are locked in such position by the latch 35 which is then free from the armature 28, the latter having been raised by the increased attraction of the magnet, together with the effect of the spring 37 acting through the latch.

If, on the other hand, the charge of the battery be reduced to such point that there is a possibility of injuring the battery by further discharge, then the voltage coil 21 will be correspondingly weakened which will permit the release of the armature 28 and break the mains of the lamp circuit, as above described. The parts may be replaced in normal position after this action in precisely the same manner as after the releasing action due to excessive charging current. In this manner, the charging of the battery may be carried on at any desired rate without chance of injury to the lamps; and furthermore the lamps may be freely used without necessity for carefully watching the condition of the battery as the latter is automatically guarded against excessive discharge. These advantages are gained, moreover, by simple and inexpensive apparatus, and it is to be noted that many of the features of construction and action of this apparatus may be utilized in other relations although peculiarly adapted for that herein set forth.

As various possible embodiments might be made of the above invention and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In apparatus of the class described, in combination, a storage battery, current utilizing means, a switch, a circuit comprising said battery, current utilizing means and said switch, and controlling means for said switch comprising a pair of normally differential coils adapted to open said switch by either increase of current in the magnetically weaker coil or decrease of current in the stronger coil.

2. In apparatus of the class described,

in combination, a storage battery, means adapted to charge said battery, current utilizing means connected with said battery to receive current therefrom, means actuated upon the charging current becoming excessive adapted automatically to protect said current utilizing means, and means adapted to protect said battery against over-discharge through said current utilizing means.

3. In apparatus of the class described, in combination, a storage battery, means adapted to charge said battery, current utilizing means connected with said battery to receive current therefrom, means actuated upon the charging current becoming excessive automatically to break the circuit between said battery and said current utilizing means, and means affected by the voltage of said battery adapted automatically to break said circuit upon said voltage falling below a certain value.

4. In apparatus of the class described, in combination, a storage battery, current utilizing means, a circuit comprising said battery and said means, a switch connected in said circuit, means tending to open said switch, electromagnetic means adapted to release said switch, and means affected by the voltage of said battery adapted automatically to open said switch upon said battery voltage becoming excessively low.

5. In apparatus of the class described, in combination, a circuit comprising a switch member, means tending to urge said member into circuit opening position, a latch holding said member closed, a storage battery, means adapted to charge said battery, and means comprising a differential magnet adapted to render said latch inoperative, one of the coils of said magnet being wound and connected to present a field substantially proportional to the charging current, and one of said coils being mounted to present a field substantially proportional to the voltage of said battery, the former coil being connected to be out of circuit when said battery is discharging.

6. In apparatus of the class described, in combination, a circuit comprising a switch member, means tending to urge said member into circuit opening position, a latch holding said member closed, means adapted to charge said battery, and means adapted to release said latch upon the charging current becoming excessive and adapted to release said latch upon the battery voltage becoming excessively low.

7. In apparatus of the class described, in combination, a storage battery, means adapted to charge said battery, current utilizing means, a circuit connecting said battery and said current utilizing means, a switch in said circuit, means tending to open said switch, a latch tending to hold said switch in closed position, an electromagnet, means adapted upon the field of said magnet falling below a certain value to release said latch and cause the opening of said switch, a winding upon said electromagnet connected to present a field substantially proportional to the voltage of said battery, and a differential and normally weaker winding on said magnet connected to present a field opposed to the field of said first winding and substantially proportional to the charging current of said battery.

8. In apparatus of the class described, in combination, a generator, a storage battery, a load, a switch for making connection between said sources of current and said load, controlling means for said switch comprising a voltage coil and a current coil acting conjointly while said battery is being charged, said current coil being inoperative during discharging action of said battery.

In testimony whereof, I have signed my name to this specification this 14th day of February, 1916.

WILLIAM I. THOMSON.