

1,429,948.

Patented Sept. 26, 1922.

2 SHEETS—SHEET 1.

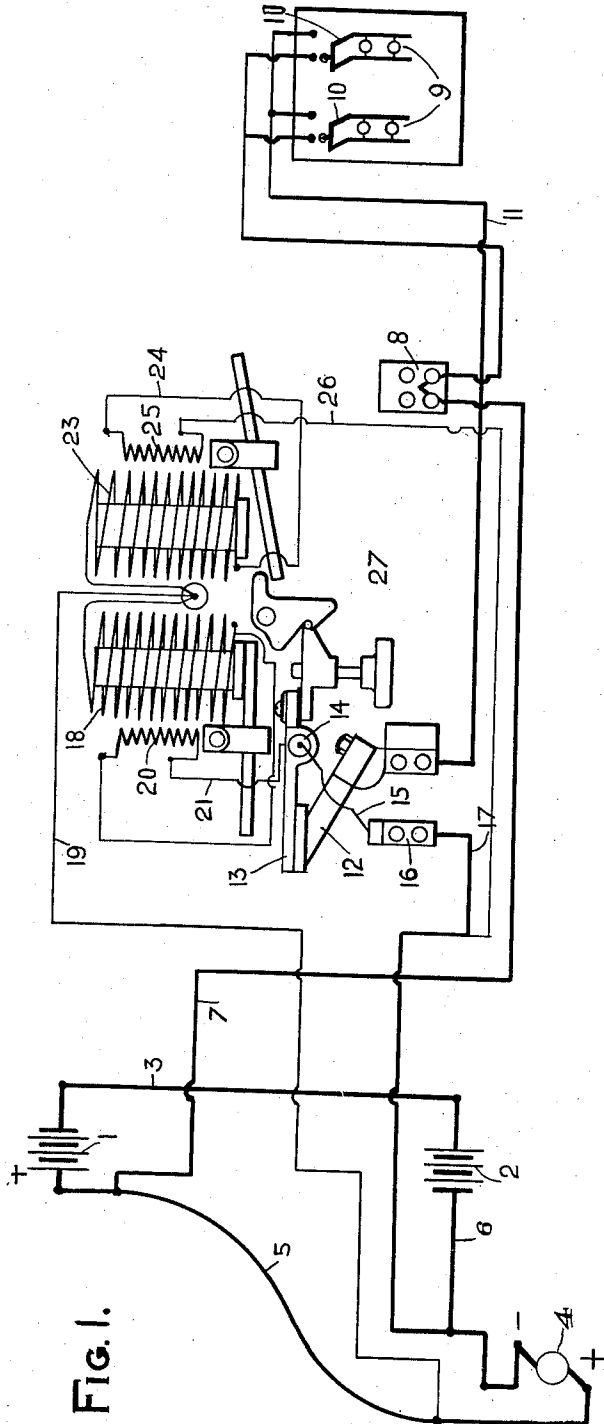


FIG. 1.

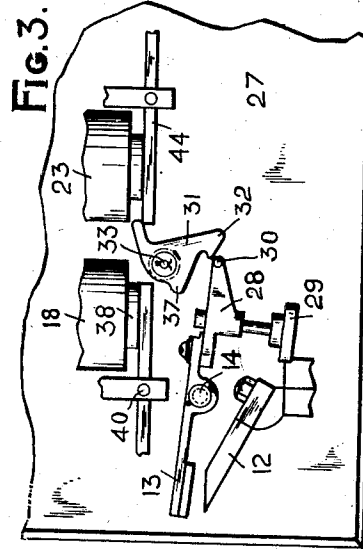


FIG. 3.

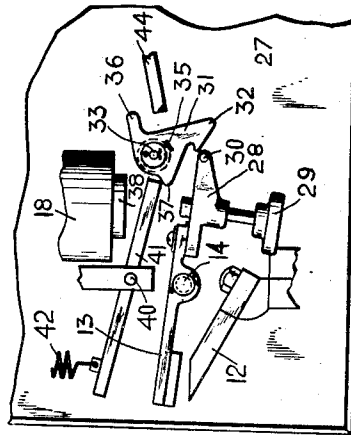


FIG. 2.

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ELECTRICAL APPARATUS.
APPLICATION FILED FEB. 16, 1917.

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2 SHEETS—SHEET 2.

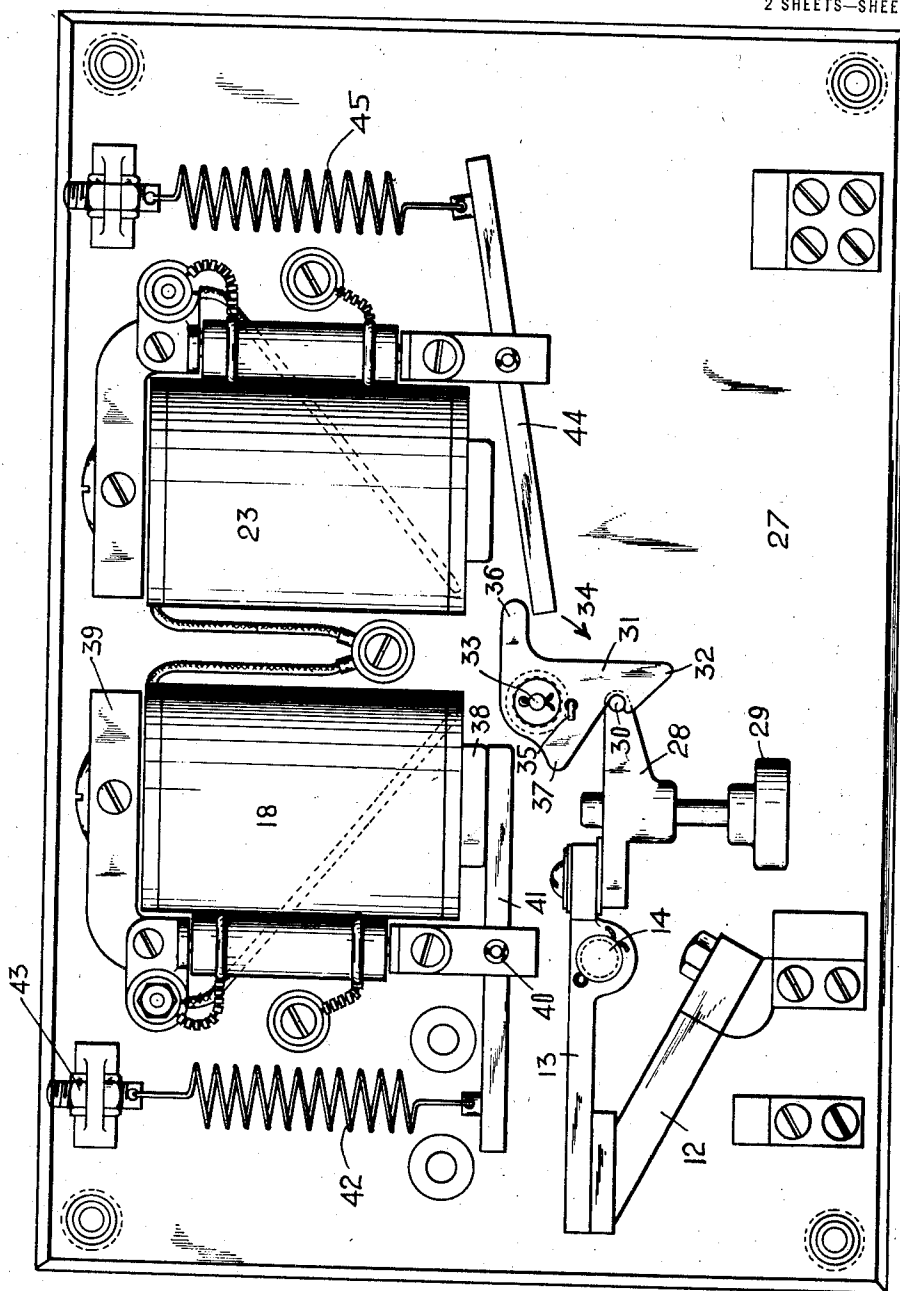


FIG. 4.

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UNITED STATES PATENT OFFICE.

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ELECTRICAL APPARATUS.

Application filed February 16, 1917. Serial No. 149,013.

To all whom it may concern:

Be it known that I, GEORGE E. HULSE, 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 certain more specific features thereof, to electrical controlling and protective apparatus. One of the objects thereof is to provide apparatus of the above nature of sensitive and reliable action. Another object is to provide practical apparatus of the above nature of simple and inexpensive construction. Another object is to provide apparatus of the above nature in which the parts dependably co-act and are yet capable of independent 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 showing electrical circuits;

Figure 2 is a diagrammatic view of mechanism showing a method of release;

Figure 3 is a similar view showing the parts in another position; and

Figure 4 is a front elevation showing the parts in normal position.

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

Referring now to Figure 1 of the drawings, there is shown a storage battery comprising the sections 1 and 2 connected in series as by the heavy conductors 3. This battery is connected as a whole across the terminals of a generator 4 by the conductors 5, and 6, heavy conductors of the circuit being used to reduce the resistance and accordingly permit the use of extremely high charging currents.

From the positive terminal of the battery, a heavy conductor 7 leads through a binding post 8 and thence to banks of lamps 9,

upon the switches or cut-outs 10 being closed. When these are closed, the circuit to the lamp is completed through a heavy conductor 11 leading to a fixed contact 12 which is mounted on the switchboard or panel hereinafter described, and with the parts in normal position, the circuit leads from the member 12 through the swinging contact 13 to its pivot 14 and thence through conductor 15, binding post 16 and conductor 17 to the negative lead of the battery. It will thus be seen that the lamps and battery may be connected in parallel across the source of current 4, or when a stationary source of current such as a storage battery, for example, is employed in connection with an electric lighting system for railway cars, for which relation this apparatus is peculiarly adapted, the lamps may be connected across the battery merely by closing the cut-outs 10.

This action assumes the closed position of the contact 13 and the controlling means for the latter member form a dominant portion of this invention.

Bridged across the battery is a voltage coil 18, the connection being made to one battery lead by means of a conductor 19, and at the other end of the coil through a resistance member 20 of zero temperature co-efficient and conductor 21 to the pivotal point 14, thence through conductor 15, binding post 16, and to the negative main 17. The field of this coil will accordingly be substantially proportional to the voltage of the storage battery. A coil 23, also of the voltage type, is connected with the battery lead 5 adjacent the source of charging current by means of the conductor 19. The circuit from the opposite end of the coil 23 leads through conductor 24, resistance of zero temperature co-efficient, and conductor 26 to the conductor 17. The field of the coil 23 is substantially proportional to the voltage across the battery and this voltage will vary in accordance with the rate at which the battery may be charged for a given state of charge of the battery itself. Thus, for example, should the battery be approximately fully charged, and should the charging rate be excessively high, the voltage impressed across the battery in order to maintain such an excessive charging rate will be much higher than the normal battery voltage for the assumed state

of charge. The coil 23, in responding to the voltage impressed across the battery, will thus be strongly energized when the charging rate of the battery is greatly above normal. When such a condition is reached, this magnet 23 acts as hereinafter described.

It may also be noted at this point that the voltage of the battery during discharge varies with the state of charge of the battery and that, for example, when the battery reaches a state of low charge, the battery voltage falls rapidly; and when the discharge of the battery is carried on to a relatively excessive extent, the battery voltage will reach a value that is materially less than the average battery voltage. The coil 18, being responsive to the voltage of the storage battery, is arranged to respond and to act in the manner hereinafter described when the battery voltage reaches a low value which corresponds to a state of low charge beyond which it becomes detrimental to discharge the battery to a further extent.

These coils 18 and 23 are mounted upon a suitable panel 27 which bears the switch mechanism hereinbefore described, and it may here be noted that the term "switch" is broadly used throughout to comprehend any equivalent type of apparatus.

Referring now to Figure 4 of the drawings, it will be seen that the switch member 13, pivoted at 14 as hereinbefore described, is provided at the opposite end from the contact 12 with an extension 28 to which is secured a hand grip 29, either insulated therefrom or formed of insulating material. These parts are so proportioned that when free from restraint, the switch member 13 tends to swing upwardly out of contact with the member 12, as indicated in Figures 2 and 3 of the drawings; a spiral spring at the pivot being employed to quicken this action if desired. The swinging member is provided at its extreme end with a pin 30 preferably insulated therefrom, and interlocking with this pin is a latch 31 having a hooked lower end 32 and pivotally mounted to swing about the axis 33. This latch, the term being broadly used, is normally urged in the direction indicated by the arrow 34 by means of a spring 35, coiled about its pivot, and it is provided with the projecting lugs or arms 36 and 37, respectively disposed on opposite sides of its axis.

The coil 18 is mounted upon a suitable core 38 to which is secured a steel angle arm 39. Pivoted at the lower end of this arm at 40 is an armature 41 provided with a spring 42 tending to swing it out of engagement with the core 38, this spring being adjustable as by means of the nuts 43. If the field strength of the coil 18 fall beneath that required to maintain the armature 41 in position in opposition to the pull of the spring 42, then the armature will swing

downwardly as indicated in Figure 2 of the drawings, engaging the lug 37 of the latch 31, and swinging it into releasing position. This action will immediately result in the contact 13 being swung away from the contact 12 and the circuit between the storage battery and the lamps is thus interrupted irrespective of the position of the switches 10. As hereinbefore noted, the field strength of the coil 18 depends on the voltage across the battery, and when the battery is discharged to such an extent that further discharge would be injurious, then the connection with the lamps or other current utilizing devices, is automatically broken and the battery thus protected from injury.

The coil 23 is mounted upon and serves to magnetize a core and angle arm similar to those of the magnet first described, the swinging armature in this case being shown at 44 and retracted by the adjustable spring 45. This armature is normally held in retracted position as shown in Figure 4 of the drawings, but upon the strength of the magnet 23 increasing to a predetermined value, then the armature will be retracted as shown in Figure 3 of the drawings, engaging and throwing upwardly the lug 36 of the latch 31. This action will also result in the opening of the lamp circuit, as indicated in Figure 3 of the drawings, and protect the lamps against injury which might result if they were continuously connected while the battery was being charged at an extremely high rate. It will be understood that for a given state of charge of the battery the voltage impressed across the battery corresponding to an excessively high charging rate may assume such high values that the lamps 9 would be endangered, and that such a dangerously high voltage may be impressed across the battery at almost any state of charge of the battery when the charging rate reaches exceedingly high values. It is to guard against such high voltages that the action hereinbefore described takes place. This method of battery charge is peculiarly adapted for use in connection with apparatus of the nature herein dealt with.

The operation of the above described apparatus may be briefly recapitulated as follows:—

While the battery is being charged with the parts in their normal position indicated in Figure 4 of the drawings, the lamps may be freely used unless the charging rate rises to such an extent for a given state of charge of the battery that the corresponding voltage across the mains might result in injury to the lamps. When this field strength of the magnet 23 is reached, it snaps the armature 44 upwardly as indicated in Figure 3 of the drawings, thus breaking the circuit leading to the lamps. It may also be noted that this

protection is gained even though the excess of voltage across the mains is due to some cause other than that resulting from an excessive charging rate. In like manner, when the voltage of the battery in use drops down to such a point that further discharge would be harmful, at that point the field strength of the coil or magnet 18 becomes so weak that armature 41 is retracted by the spring 42, thus releasing the latch and opening the lamp circuit by swinging the parts into the position indicated in Figure 2 of the drawings, as above described. This action is also independent of magnet 18, and hence may be accurately predetermined. The parts are readily reset by merely throwing the hand grip 29 upwardly until it is locked into position by the latch which is assumed to have been set free, due to a return to normal conditions in the system. This, moreover, is achieved by the simplest apparatus, and although the actions are independent, nevertheless one switch or cut-out only is required.

It will thus be seen that there is provided apparatus in which the several objects of this invention are achieved.

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, means adapted to charge said battery, current utilizing devices adapted to be connected to said battery, a switch for connecting said devices to said battery, a mechanical means adapted to hold said switch closed, means adapted to operate said mechanical means to open said switch upon the voltage across said battery attaining a predetermined maximum value and resulting in an excessive charging current through said battery, and means independent of said charging current adapted to operate said mechanical means to open said switch upon the voltage of said battery falling below a predetermined value.

2. In apparatus of the class described, in combination, a storage battery, means adapted to charge said battery, current utilizing devices, a switch for connecting said devices to said battery, a spring pressed mechanical device tending to hold said switch in closed position, electromagnetic means adapted to operate said spring pressed mechanism to open said switch when the voltage of said storage battery reaches a predetermined maximum value corresponding to an excessive charging current for a given state of charge of said battery, and

electromagnetic means adapted to operate said spring pressed mechanism to open said switch when the voltage of said storage battery reaches a predetermined minimum value corresponding to a predetermined low state of charge of said battery, the magnetic circuits of said two electromagnetic means being independent of one another.

3. In apparatus of the class described, in combination, a storage battery, means adapted to charge said battery, current utilizing devices a circuit connecting said devices and said battery and including a switch, means tending to move said switch into open position, a latch tending to hold said switch closed, electromagnetic means adapted to release said latch upon the voltage of said battery reaching a predetermined maximum value corresponding to an excessive charging current for a given state of charge of said battery, and independent electromagnetic means adapted to release said latch upon the voltage of said battery falling below a certain value.

4. In apparatus of the class described, in combination, a storage battery, means adapted to charge said battery, current utilizing devices, a circuit connecting said current utilizing devices with said battery and comprising a switch, means tending to open said switch, a latch tending to hold said switch in closed position, a pair of magnets, a pair of armatures respectively coacting with said magnets, one of said armatures being mounted to release said latch upon being attracted by its magnet and the other being mounted to release said latch upon being released by its magnet, a winding forming part of one of said magnets, said winding being adapted to respond to an excessively high voltage across said battery corresponding to an excessively high charging rate for a given state of charge of said battery and a winding forming part of the other of said magnets wound and connected to present a field substantially proportional to the voltage of said battery and adapted to respond to a predetermined low voltage of said battery corresponding to a predetermined minimum state of charge.

5. In apparatus of the class described, in combination, a storage battery, means adapted to charge said battery, current utilizing devices, a circuit connecting said current utilizing devices with said battery and comprising a switch, means tending to open said switch, a latch tending to hold said switch in closed position, a pair of magnets, a pair of armatures respectively coacting with said magnets, one of said armatures being mounted to release said latch upon being attracted by its magnet and the other being mounted to release said latch upon being released by its magnet, a winding forming part of one of said magnets,

said winding being adapted to respond to an excessively high voltage across said battery corresponding to an excessively high charging rate for a given state of charge of said battery and a winding forming part
5 of the other of said magnets wound and connected to present a field substantially proportional of the voltage of said battery,

the magnetic circuits of said magnets being substantially independent one from the other. 10

In testimony whereof, I have signed my name to this specification this 14th day of February, 1917.

GEORGE E. HULSE.