June 3, 1924. 1,496,442

E. H. BECKER ET AL

ELECTRICAL PEAK VOLTAGE CONTROL SYSTEM

Filed July 31, 1922.

Fig. 1

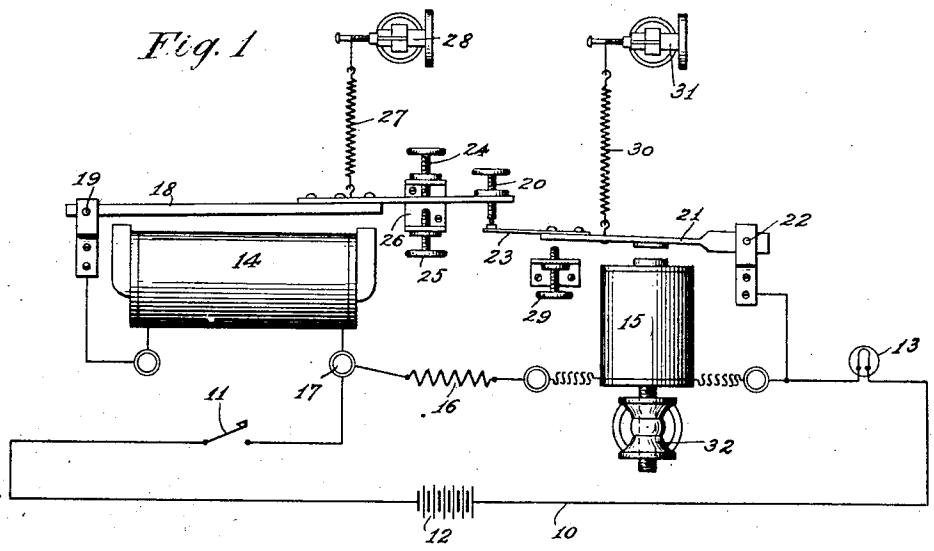


Fig. 3

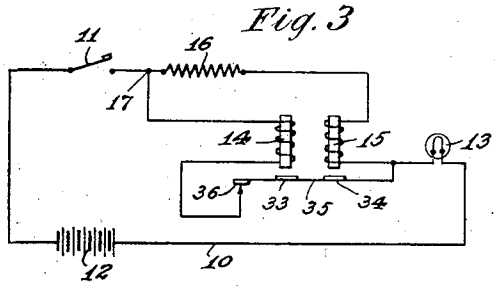


Fig. 2

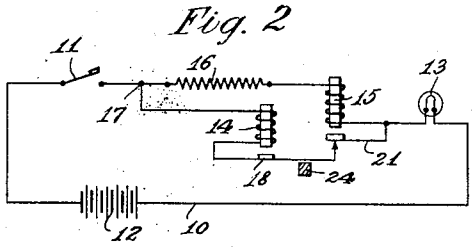
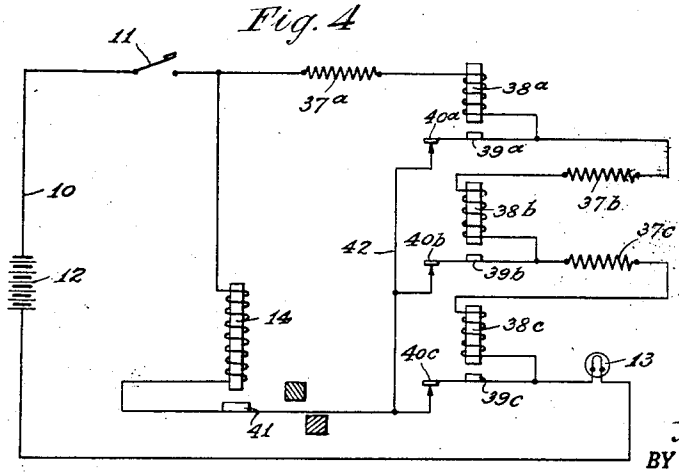


Fig. 4



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UNITED STATES PATENT OFFICE.

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ELECTRICAL PEAK-VOLTAGE-CONTROL SYSTEM.

Application filed July 31, 1922. Serial No. 578,767.

To all whom it may concern:

Be it known that EDMUND H. BECKER and MARTIN L. MARTUS, citizens of the United States, and residents of Waterbury and Woodbury, respectively, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Electrical Peak-Voltage-Control Systems, of which the following is a specification.

The present invention relates to an electrical peak voltage control system, particularly adapted for use with copper oxide, soda and other batteries, for lighting incandescent lamps or operating other signal means or appliances for railroad signals.

These batteries are of the type in which the voltage is high on open circuit, having for instance a peak voltage of approximately .9 volt per cell on open circuit, dropping slowly to about .5 volt per cell when near exhaustion on closed circuit. A lamp may have a given voltage of approximately the peak voltage of the cells, in which case it will burn full candle power, and be protected from excess voltage, but when peak voltage drops the lamp will burn dim. By having the lamp of a lower voltage than the peak voltage of the battery, it will burn full candle power on low voltage, but will burn out or be destroyed by the current due to peak voltage.

It is an object of the invention to provide an electrical system, by means of which the lamp will burn at substantially full candle power at all stages of effective battery voltage. A further object is to provide such a system which will be entirely automatic in operation.

It is proposed in the present invention to provide an electrical system, in which a compensating resistance is automatically placed into the circuit of the lamp, this resistance being inserted when the lamp circuit is first closed at high voltage, and shunted out when the voltage drops to a predetermined point.

With the above and other objects in view, embodiments of the invention are shown, by way of illustration, in the accompanying drawings, and these embodiments will be hereinafter more fully described with reference thereto, and the invention finally pointed out in the claims.

In the drawings:

Fig. 1 is a semi-diagrammatic view of an electrical system and apparatus, according to one embodiment of the invention;

Fig. 2 is a simplified diagrammatic view thereof;

Fig. 3 is a diagrammatic view of a modified and simpler system, according to the invention; and

Fig. 4 is a diagrammatic view of a modified embodiment in which a closer adjustment or regulation of the resistance is made possible.

Similar reference characters indicate corresponding parts throughout the several figures of the drawings.

Generally the invention consists of utilizing the variation in voltage, which occurs during burning of the lamp, to operate a shunt around a resistance by means of electromagnets operating a circuit making and breaking device in the shunt circuit, inserting a resistance when the lamp is turned on at high battery voltage and shunting this resistance out when the voltage drops to a predetermined point.

Referring to Figs. 1 and 2 of the drawings, the device is used with the ordinary track circuit making and breaking the block signal circuit 10, at 11, the circuit having the battery 12 and signal lamp 13 therein, which latter is of low voltage, for example say 6 volts, with a 12 cell battery peak voltage of, say 10.8 volts. This insures the lamp developing its full candle power at all stages of battery operation and to protect the lamp from excess peak voltage resistance must be inserted in series with the lamp, and must be cut out when the battery peak voltage drops. As the fluctuation in voltage occurs every time the lamp is turned on and off, it is necessary to manipulate the compensating resistance automatically, or the duration of the life of the lamp would be very short.

The number of cells required in series to operate the lamp would be dependent upon the voltage of the lamp. It is also within the scope of our invention to arrange it so that it can be adjusted for variations in voltage, but it is also practical and in certain cases the construction would be cheaper to design the apparatus for a certain specified case or condition and when thus designed adjusting methods might be eliminated.

A relatively low resistance electro-magnet coil 14, and a relatively high resistance elec-

tro-magnet coil 15, having a resistance between them are connected in the circuit. The circuit is divided at 17, passing in one instance through the resistance 16 and electro-magnet 15, and in the other through the electromagnet 14, and armature 18 pivoted at 19 and adapted to be attracted by the magnet 14, an adjustable interrupter contact 20, at the extended end of the armature 18, and through an armature 21, pivoted at 22, back to the lamp circuit.

The contact 20 engages a contact 23 at the extended end of the armature 21, as shown, the function of which will be presently more fully described.

The armature 18 is limited in its movement by a pair of spaced abutment screws 24 and 25, adapted to be adjusted in their supporting bracket 26, and when not attracted by the magnet 14 is held in engagement with the upper screw by means of a spring 27, the tension of which may be regulated by means of a regulating device 28.

The armature 21 is limited in its downward movement, when attracted by the magnet 15, by an adjustable abutment screw 29, and limited in its upward movement by engagement of its spring contact end 23 with the interrupter contact 20 of the armature 18. A spring 30 adapted to have its tension adjusted by means of a regulating device 31 maintains the armature 21 in engagement with the contact 20 when not attracted by the magnet 15. The electro-magnet 15 is adjustably mounted at 32.

The operation is as follows:

Normally the switch 11 is open and the magnet coils 14 and 15 are de-energized, the armatures 18 and 21 are moved to their upper positions, shown in Fig. 1, by the springs 27 and 30, their ends contacting through the interrupter contacts 20 and 23.

The resistance of the resistance 16 and the magnet coil 15 is proportioned to compensate for peak voltage of the battery, which is in excess of the lamp voltage. The resistance of the magnet coil 14 is the minimum required to sufficiently energize the magnet and attract its armature 18. This low resistance is necessary as it practically short circuits the resistance 16 and magnet coil 15, when the battery has lost its peak voltage.

When the switch 11 is closed as when a train enters a block, the circuit divides at 17, flowing through the magnet coil 14, the armature 18, interrupter 20, and armature 21 to the lamp and negative terminal of the battery, and part through the resistance 16 and magnet coil 15.

Assuming that the battery has been on open circuit sufficient time to regain its peak voltage, an excess of current will flow when switch 11 is closed, energizing both magnet coils 14 and 15, instantly attracting the armatures 18 and 21, and opening the shunt circuit through separation of the interrupter contact from the spring end 23, the magnet coil 14 being then de-energized to release the armature 18. The limiting screws are adjusted to permit the desired separation of the contacts.

To derive sufficient attraction from coil 14, as this is the power coil, its circuit must remain closed until armature 21 is within approximately 1/64th of an inch of its travel, allowing the coil 15 to continue its attraction and open the circuit at the interrupter contacts 20 and 23. To accomplish this, the contact 20 on armature 18, follows the contact 23 on armature 21, armature 18 assuming instantly its open position, increasing the separation between the contacts 20 and 23, to prevent continual vibration, as occurs in the ordinary vibrating bell. Due to the comparatively wide range through which the armature must travel vibration is prevented, and a constant flow of current is maintained with a minimum of fluctuation to operate the regulator. In view of "Columbs' law" that magnetic attractions and repulsions are inversely as the square of the distances, the distance between the coil 15 and its armature 21 is reduced to a minimum, the coil being practically only required to hold the armature, as distinguished from previous devices, in which the control coil attracts the armature through a wide range of travel, thereby requiring an excessive flow of current through the coil to attract the armature, resulting in an excessive drop in the current to release it. Thus, for instance, if the travel of the armature 21 were limited to 1/8th inch, it would require an attraction of sixty-four times greater than at a distance of 1/64th inch. The power coil 14 allows armature 21 to be adjusted to travel over a wide range to prevent any chance of vibration, the power coil reseating it as one might do with their finger, this being possible as the interrupter is allowed to remain practically closed until coil 14 has performed its function. The construction disclosed is positive in such action, does not vibrate, and eliminates all unnecessary friction. The travel of the contact points is independent and can be adjusted through the springs 27 and 30, and the limiting screws to the desired relation. The device allows of much closer adjustment than 1/64th inch, as a few thousandths of an inch would suffice to prevent arcing in a battery circuit.

The coil 14 now being out of the circuit, this condition exists until the battery voltage drops to a pre-determined point, when the magnet coil 15 is weakened sufficiently to release the armature 21, thereby closing the shunt circuit at 20 and 23, and decreas-

ing the resistance of the circuit. The lamp is therefore protected against the excess peak voltage when the circuit is first closed, through the automatic compensating resistance.

It will be noted that should the contact fail at the interrupter contact 20, the lamp will receive its supply of current through the resistance 16 and magnet coil 15, although it may be dim. This is essential in railroad signalling to prevent a false clear.

In Fig. 3 there is illustrated a somewhat simplified system, in which the two electromagnets 14 and 15 operate armatures 33 and 34 provided upon a single lever arm 35, having an interrupter contact 36 at its end for breaking the circuit of the magnet 14, upon energization of the two magnets. The function of the coil 14 in this modification, is to give the armature a momentum by producing an excessive magnetic field forming a complete magnetic circuit at the instant that, switch 11 is closed thereby, having the same effect as a hammer blow on the armature. The operation is substantially the same as in the form illustrated in Figs. 1 and 2, except for the independent operation of the two armatures in that form, which allows both points of the interrupter to move together thereby preventing a vibrating action.

In Fig. 4, there is illustrated a modification in which a plurality of compensating resistances 37^a, 37^b and 37^c are connected in series with their respective control magnets 38^a, 38^b and 38^c, their respective armatures 39^a 39^b and 39^c, have interrupter contacts 40^a, 40^b and 40^c at the end of the armature lever arms for breaking their respective circuits, through the common return lever contacts, and conductor 42. The three interrupter contacts cooperate with the contact end of an armature 41 adapted to be attracted by the magnet 14. By providing the armatures of different weights decreasing with 39^c, or providing equivalent means, as adjustable tensioning springs, the armatures will be released in succession, thereby cutting out the resistances proportionately as the battery voltage gradually drops.

In operation the several electro-magnets 14, 38^a, 38^b and 38^c are all energized upon closing the circuit at peak voltage, the several interrupter contacts becoming separated, and the electro-magnet 14 being immediately cut out of the circuit its attraction for armature 41 ceases, allowing its lever to drop, increasing the interrupter openings. As the battery voltage diminishes the armature 39^a is released shunting out the resistances of the resistance 37^a and magnet 38^a, the magnet 14 being then again placed in the circuit through the conducting lead 42, to complete the circuit to the magnet 38^b, through the armature 39^a. The armatures 39^b and 39^c are released in a similar manner in succession as the battery voltage continues to drop, and finally the resistances are all shunted out through the relatively low resistance of the magnet coil 14, the lamp burning full candle power throughout the entire period of effective battery consumption. The resistances may be provided in any desired number, and may be cut out in two or more stages, depending upon the regulation.

The resistance and winding of the magnet coils and the fixed resistances, may vary greatly, depending upon the particular work to be done.

We have illustrated preferred and satisfactory embodiments of the invention, but it is obvious that changes may be made therein within the spirit and scope thereof, as defined in the appended claims.

We claim:

1. In an electrical system, a source of current, a regulator comprising independent electromagnets and armatures having contact points and limiting stops, one of said electromagnets arranged in series with said contact points and in parallel with the other electromagnet, said limiting stops being adjustable to allow said contact points to remain closed until the said armatures have entered a magnetic field of maximum attraction.

2. In an electrical system the combination of an electrical circuit, a regulator comprising a low resistance circuit adapted to conduct the current at low voltage supply, a high resistance circuit adapted to conduct the current at high voltage supply, each of said circuits including an electromagnet with independent armatures, said armatures co-operating at a point of contact, said contact being opened automatically when the current in the electrical circuit is in excess of the predetermined current and closed when the current in said circuit drops below the predetermined limit.

3. In an electrical system a circuit including a source of current, means for closing the circuit, a regulator comprising a power coil and a holding coil, a lamp or signal, and a resistance, means adapted to connect said resistance in shunt relation to the power coil when the current in holding coil is less than the predetermined current and in series with the holding coil and source of current when the current is in excess of the predetermined current, said resistance operating to automatically maintain a limited flow of current in the external circuit.

4. In an electrical system, a circuit including a source of current, a lamp or signal, means for closing the circuit, a regulator comprising a low resistance power circuit and a relatively high resistance holding cir-

cuit, independent armatures carrying co-operating contact means, limiting stops for same, independent electromagnets respectively associated with said circuits and adapted to break the said low resistance circuit upon attraction of said armatures and to insert said low resistance circuit upon release of the holding armature, the adjustment of the armature limiting stops and the strength of the electric current flowing through the said electric system, governing the relative position of the armatures.

5. In an electrical circuit, an electrically operated regulator comprising a non-vibrating interrupter, having two co-acting contact points, a high resistance holding circuit, a relatively low resistance power circuit, said power circuit being in shunt relation to said holding circuit when said interrupter is closed, each of said circuits automatically controlling one contact point of said interrupter.

6. In an electrical system, a circuit including a regulator, a battery, a lamp or signal and switch for closing the circuit, a low resistance power circuit, a relatively high resistance holding circuit, said low resistance power circuit in shunt relation to the holding circuit, said relatively high resistance holding circuit in shunt relation to the power circuit and adapted to conduct the current at peak battery voltage and including electromagnets, armatures for the electro-magnets adapted to be attracted upon initial closing of the circuit and co-operating interrupter contact points independently controlled by said armatures and adapted to break the low resistance shunt circuit upon energization of the magnets and attraction of the armatures, and adapted to insert the low resistance power circuit upon de-energization of the magnet of the high resistance shunt circuit through battery consumption.

7. In an electrical system, a circuit including a regulator, a battery, a lamp or signal and a switch for closing the circuit, a high resistance holding circuit, a low resistance power circuit, said low resistance power circuit including an electro-magnet in shunt relation to the holding circuit, said relatively high resistance holding circuit including an electro-magnet in shunt relation to the power circuit and adapted to conduct the peak battery voltage, armatures for the electro-magnets adapted to be attracted upon initial closing of the circuit, levers independently supporting said armatures, co-operating interrupter contact means carried by said levers, and adapted to break the low resistance shunt circuit upon energization of the magnets and attraction of the armatures, and adapted to insert the low resistance shunt circuit upon de-energization of the magnet of the high resistance shunt circuit through effective battery consumption.

8. In an electrical system, a circuit including a regulator, a battery, a lamp or signal and a switch for closing the circuit, a high resistance holding circuit, a low resistance power circuit, said low resistance power circuit including an electro-magnet in shunt relation to the holding circuit said relatively high resistance holding circuit including an electro-magnet in shunt relation to the power circuit and adapted to conduct the current at peak battery voltage, independent armatures for the electro-magnets adapted to be attracted upon initial closing of the circuit, levers independently supporting said armatures, co-operating interrupter contact means carried by said levers, and adapted to maintain contact to a pre-determined point of movement of said armatures to prevent vibration, and adapted to break the low resistance shunt circuit upon energization of the magnets and attraction of the armatures, and adapted to insert the low resistance shunt circuit through battery consumption.

9. In an electrical system, a circuit including a regulator, a battery, a lamp or signal and a switch for closing the circuit, a high resistance holding circuit, a low resistance power circuit, said low resistance power circuit including an electro-magnet in shunt relation to the holding circuit said relatively high resistance holding circuit including an electro-magnet in shunt relation to the power circuit and adapted to conduct the current at peak battery voltage, independent armatures for the electro-magnets adapted to be attracted upon initial closing of the circuit, means for adjusting the mechanical resistance of said armatures, co-operating interrupter contacts controlled by said armatures and adapted to break the low resistance circuit upon energization of the magnets and attraction of the armatures, and adapted to insert the low resistance shunt circuit upon weakening of the magnet of the high resistance shunt circuit through battery consumption.

10. In an electrical system, a circuit including a regulator, a battery, a lamp or signal and a switch for closing the circuit, a high resistance holding circuit, a low resistance power circuit, said low resistance power circuit including an electro-magnet in shunt relation to the holding circuit, said relatively high resistance holding circuit including an electro-magnet in shunt relation to the power circuit and adapted to conduct the current at peak battery voltage, armatures for the electro-magnets adapted to be attracted upon initial closing of the circuit, levers independently supporting said armatures, co-operating interrupter contact means carried by said levers, and means for

adjusting the relative movement of said levers, said contact means adapted to break the low resistance shunt circuit upon energization of the magnets and attraction of the armatures, and adapted to insert the low resistance shunt circuit upon weakening or de-energization of the magnet of the high resistance shunt circuit through battery consumption.

11. In an electrical system, a circuit including a regulator, a low resistance power coil, a high resistance holding coil, a battery, a lamp or signal and a switch for closing the circuit, independent armatures controlled by said coils, co-operating contact points carried by said armatures and adapted to be actuated by said coils to connect the said power coil circuit in shunt relation to the said holding coil when the current in said holding coil is less than the predetermined current.

12. In an electrical system, a circuit including a regulator, a low resistance power circuit, a high resistance holding circuit, a battery, a lamp or signal, a switch for closing the circuit, said low resistance power circuit in shunt relation to the holding circuit, said holding circuit comprising a plurality of resistances in series and adapted to conduct the current at peak battery voltage, and means closing said low resistance power circuit as the voltage diminishes.

13. In an electrical system, a circuit including a regulator, a low resistance power circuit, a high resistance holding circuit, a battery, a lamp or signal and a switch for closing the circuit, said low resistance power circuit in shunt relation to the holding circuit, said relatively high resistance holding circuit in shunt relation to the power circuit and adapted to conduct the current at peak battery voltage and means for automatically cutting out the said high resistance holding circuit and inserting the said low resistance power circuit as the voltage diminishes.

Signed at Waterbury in the county of New Haven and State of Connecticut this 28 day of July A. D., 1922.

EDMUND HENRY BECKER.
MARTIN L. MARTUS.

Witnesses:
HARRY T. HUBERT,
HAROLD B. SCHOENMEHL.