United States Patent
Malme

[15] 3,655,995

[45] Apr. 11, 1972

[54] **AUTOMATIC ELECTRIC FENCE CHARGING SYSTEM**

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[22] Filed: **Feb. 8, 1971**

[21] Appl. No.: **113,480**

[52] **U.S. Cl.** ....**307/132 R,** 256/10, 340/254
[51] **Int. Cl.** **H01h 47/00**
[58] **Field of Search**......307/132 R, 132 M, 132 VR, 132 ER, 307/96, 106, 112; 256/10; 340/253, 254

[56] **References Cited**

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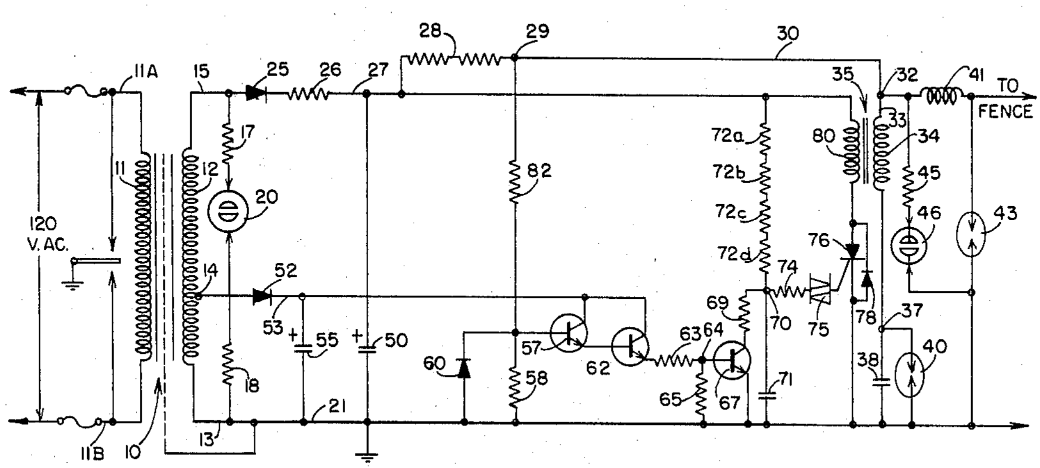
[57] **ABSTRACT**

A fence charging system includes a sensing circuit connected to a fence to be charged. The sensing circuit applies a harmless low voltage which normally maintains a fence charger below operating level so long as the fence is "unloaded" (has a high resistance in the absence of at least one animal grounding the fence). When the fence becomes "loaded," the current drawn by the fence sensing system changes potential distribution in the fence charging system and permits the charger to operate normally, the fence charging system under such conditions impressing high voltage pulses on the fence at predetermined intervals so long as the fence remains "loaded."

3 Claims, 1 Drawing Figure



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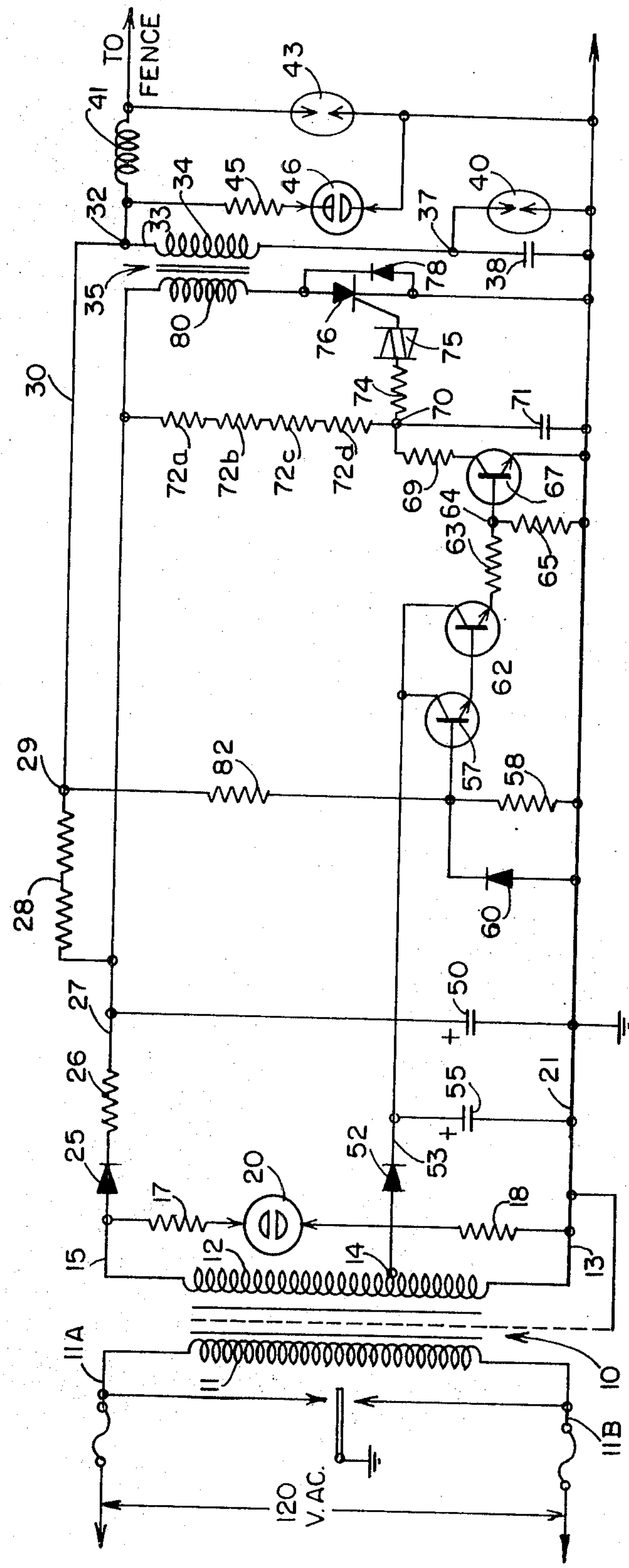

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AUTOMATIC ELECTRIC FENCE CHARGING SYSTEM

This invention relates to an electric fence charger for intermittently charging a fence to train cattle or animals from pressing against such fence. As is well known, such chargers are designed to impress an electric charge on a fence containing a metal wire usually of iron, such charge lasting only a few milliseconds and at spaced time intervals. It is desirable to minimize the actual time during which a fence is charged in comparison to times when a fence is not charged so that consumption of power for the charger is minimized. This is particularly true where chargers are designed for battery operation although such considerations may be true to some extent in connection with chargers energized from a conventional power line such as a 60 cycle 120 volt line.

In my co-pending application filed of even date with the present application, I have disclosed a fence charger system wherein a sensing action of fence conditions is provided to reduce the fence charger power input when fence conditions are appropriate. As is true with the present invention, the fence charger described in the companion application referred to above has a mode of operation which is based upon the electrical condition of a fence when "loaded" (where an animal is contacting the metal of the fence) and where a fence is "unloaded" (when no animal is touching the fence metal or where no low resistance grounds such as water, snow or certain weeds are at the fence metal). The present invention improves upon the invention disclosed in the aforementioned application by continuously impressing sensing low voltage on the fence to be charged and maintaining such charger in what might be designated as a relatively inactive stand-by condition so long as the fence remains "unloaded." The new fence charger will condition the circuitry so that normal fence charging potentials are impressed upon the fence at appropriate intervals when such fence is "loaded." The sensing potential impressed upon the fence has a low value in the general order of about 50 volts or less and the voltage regulation and resistance of the circuit supplying such sensing potential is such that there is no possibility of a dangerous or damaging current that can be drawn, irrespective of fence conditions.

For a full understanding or the invention reference will now be made to the drawing wherein the single FIGURE shows a wiring diagram of the new fence charger.

Referring now to the drawing, transformer **10** is a conventional iron core transformer having primary winding **11** and secondary winding **12**. Preferably an electrostatic shield is disposed around primary winding **11** to prevent the possibility of high potentials being impressed or appearing in secondary winding **12**. Such electrostatic shielding is old and well known. Primary winding **11** is adapted to be supplied from line wires **11A** and **11B** through fuses from a conventional 60 cycle power line.

Instead of primary winding **11** being energized from a power line, a battery may be used as a source of power, the battery current being interrupted by suitable means such as a blocking oscillator, chopper or the like.

Secondary winding **12** has terminals **13**, **14** and **15**. In the case of a 120 volt power line for energizing the system, secondary winding **12** would normally step up the voltage between terminals **13** and **15** by a ratio of about 2 to 1. Connected across terminals **13** and **15** are ballast resistors **17** and **18** between which are connected neon glow lamp **20**. Terminal **13** is connected to wire **21** which is used as a ground for the entire system.

Terminal **15** of the secondary winding is connected to the positive terminal of rectifier **25**, the negative terminal of which is connected through resistor **26** to wire **27**. Connected to wire **27** is high resistance **28** as about 1.2 megohms going to junction point **29**. Wire **30** goes from junction point **29** to junction point **32**. Connected to junction point **32** is terminal **33** of secondary winding **34** of step-up pulse transformer **35**. The remaining terminal of secondary winding **34** is connected to one terminal **37** of capacitor **38** whose other terminal is connected to ground wire **21**. Shunting capacitor **38** is spark gap **40** adapted with regard to spacing and electrode shape and gas environment to spark-over at about 300 volts.

Junction point **32** is connected to one terminal of choke winding **41**, the other terminal of which is connected to a fence to be charged. Across the fence to be charged and ground is spark-gap **43** adapted to break down at about 8,000 volts. Connected across choke **41** and spark-gap **43** in series is ballast resistor **45** and neon lamp **46**. Ballast resistor **45** has a high enough value (almost a megohm) so that there is no danger of the fence system appearing as "loaded" to the charger output terminals **32** and ground.

Connected between wire **27** and ground wire **21** is capacitor **50** normally having substantial capacitance (such as about 16 mf.) and capable of withstanding the full potential across secondary winding **12**.

Terminal **14** of secondary winding **12** is connected to such a point on the secondary winding as to provide for a suitable voltage for operating transistors. This voltage will depend upon the types of transistors used and, as an example, may be suitable for providing a DC voltage of about 12. Secondary winding terminal **14** is connected to the positive or anode electrode of rectifier **52**, the negative electrode of which is connected to wire **53**. Connected between the negative electrode of rectifier **52** and ground **21** is capacitor **55**. Capacitor **55** will normally have substantial capacitance (as an example 130 μf.) but need only withstand a relatively low voltage, such as, for example, 15 volts if wire **53** carries 12 volts. Thus capacitor **55** acts as a filter.

Wire **53** is connected to the collector electrode of NPN-transistor **57**. Transistor **57** has its base connected through bias resistor **58** to ground wire **21**, the latter being shunted by diode **60** having the anode grounded and the cathode connected to the base of transistor **57**. Power supply wire **53** is also connected to the collector of transistor **62** whose base is directly connected to the emitter of transistor **57**. The emitter of transistor **62** is connected through bias resistor **63** to junction point **64**. The latter junction point **64** is grounded through bias resistor **65** and is also connected to the base of transistor **67**. All the transistors are of the same type, in this instance being NPN. Transistor **67** has its emitter directly grounded and has its collector connected through load resistor **69** to junction point **70**. Between junction point **70** and ground, capacitor **71** is connected. This capacitor has a substantial value of the order of about 22 **mf. as an example but normally need not withstand any voltage greater than about** 35 volts in an exemplary system having resistors whose values are hereinafter given. Junction point **70** is connected through four resistors **72A** to D inclusive to wire **27**. The four resistors each have substantial value of the order of about 360 k ohms and are normally required by Underwriters' Laboratories to minimize the possibility of damage because of failure of a resistor. In any event the total value of the resistor network will run in the general order of about 1.5 megohms, as an example.

Junction **70** is connected through current limiting resistor **74** to one terminal of a diac **75** whose other terminal is connected to the gate electrode of SCR **76** (silicon controlled rectifier). Diac **75** (conduction in only one direction is involved and hence could be replaced by a diode having desired discharge barrier characteristics) normally will conduct at about 29–35 volts. Shunted across SCR **76** is rectifier **78** reversely poled to protect SCR **76** against reverse voltage. High potential wire **27** is connected to one terminal of primary winding **80** of pulse transformer **35**, the remaining terminal of this winding being connected to the positive electrode of SCR **76**. Referring to junction point **29**, a wire goes to one terminal of resistor **82**, the other terminal of which is connected by wire to the base of transistor **57**.

The operation of this system is as follows:

Capacitor **50** is charged to the maximum voltage of power supply transformer **10**. In an assumed example, capacitor **50** may be charged to about 350 volts DC. Resistor **26** normally has a low enough value (as an example, about 1,500 ohms) so that capacitor **50** becomes charged fully within a small fraction of a second. Wire **27** will therefore have a DC potential normally at about 350 volts. The resistance network from wire **27** through resistors **28, 82** and **58** will normally be such that in stand-by position a sensing potential of the order of less than 50 volts, such as 35 volts, will be applied to the fence. Due to poor voltage regulation of the charger system, this sensing voltage may drop considerably when the charger system is impressing high potentials on the fence.

During stand-by, the potential at junction **29** will be such that transistor **57** will have its base potential maintained so that transistor **57** will be conducting. The conducting condition of transistor **57** (in the configuration illustrated) will cause transistor **62** to be conducting. Transistor **67** will also be conducting. In a system embodying the present invention, the various resistors are so arranged that the potential of junction point **70** will normally be somewhat lower than is required for fence charger operation when a fence is "loaded." As an example, the voltage at junction point **70** may be 25 volts so that timing capacitor **71** becomes partially charged. The potential at junction point **70** will be somewhat lower than the breakdown voltage of barrier trigger device **75**. Under stand-by conditions, SCR **76** will not discharge and no current will flow through primary winding **80** of pulse transformer **35**.

As soon as the resistance facing transformer secondary winding **34** drops below a desired high value so that the pulse transformer faces a "loaded" fence, then the sensing current drawn by the fence from junction point **32** becomes greater. This increased current flow through resistor **28** drops the potential at junction point **29**, dropping the potential of the base of transistor **57** and cutting off current flow through transistor **57**. This is followed by transistor **62** cutting off and in turn by transistor **67** cutting off. As a result, the current through resistor **69** normally drawn by transistor **67** is cut-off and the potential of junction point **70** rises.

As an example, the normal voltage of junction point **70** in stand-by may be 25 volts but will now rise to a value between about 29 and about 35 volts, depending upon the values of various resistors. Barrier trigger device **75** is adapted to break down at a voltage between say 29 and 35 so that SCR **76** will conduct. The breakdown permits a rush of current from capacitor **50** to flow through primary winding **80** of the pulse transformer. The duration of such discharge is extremely short and results in a steep pulse created in the secondary of the pulse transformer. A high voltage pulse will thus be impressed upon the fence. When capacitor **50** is discharged, SCR **76** stops conducting. When SCR **76** breaks down, timing capacitor **71** will also discharge, the drop in voltage at junction point **70** being limited by the duration of conduction through SCR **76** between gate and negative electrodes. In the meantime, after SCR **76** cuts off, the potential at junction point **70** begins to rise as capacitor **71** charges.

Thus the potential at junction point **70** has a generally sawtooth shape with the maximum voltage of a sawtooth being about 35 or so volts and suddenly dropping to a lower voltage, depending upon how completely timing capacitor **71** discharges. Capacitor **55** will filter and thus maintain the stability of the transistors. Once the "load" on the fence is removed, the potential at junction point **32** tends to rise due to reduced IR drop and the system assumes normal standby. Thus the potential at junction point **70** will be stabilized at a stand-by value such as 25 volts and will be prevented from rising. This stabilization will prevent SCR **76** from operating.

The resistor network bypass from junction point **29** to ground wire **21** through resistors **82** and **58** should have sufficiently high resistance to permit the potential of point **29** to vary with fence conditions. Thus, as long as the fence part of the system has an "unloaded" resistance of at least about one-fourth megohms then resistor **82**, as an example, could be about 1 megohm and resistor **58** could be about 1.5 megohms with resistor **28** being about 1.2 megohms. These values are illustrative only. The fence resistance can go down to about 100,000 ohms for "loading." In fact, "loading" may bring the fence resistance down to a few thousand ohms.

Diode **60** in the system protects against voltage reversal on the base of transistor **57** when the voltage at junction point **32** goes negative during the end of a fence charging cycle. This negative voltage would be fed back to junction point **29** and then through resistor **83** in the absence of diode **60**.

Capacitor **38** prevents the sensing voltage from being shorted to ground. Capacitor **38** should be large enough to bypass the pulse output from transformer secondary **34**. Choke **41** and spark gap **43** may be used where lightning protection is desired. Spark gap **40** may function as a voltage barrier device to protect capacitor **38** against breakdown.

The sensing portion of the system may be applied to various kinds of fence chargers.

What is claimed is:

1. A fence charging system for impressing a shocking potential upon a "loaded" fence at predetermined time intervals, said fence being adapted to be "loaded" or "unloaded" depending upon whether the electric resistance presented by the fence is below or above an arbitrary voltage, said fence charger system including a capacitor, means for charging the same to a predetermined maximum potential and thereafter discharging the same after said potential has reached a predetermined value, said fence charger including means for utilizing said discharge in generating a high shocking potential, said system including sensing means for connection to a fence load, said sensing means impressing a low direct voltage of the general order of about **50** volts continuously on said fence durint the time that said fence is "unloaded," and means controlled by normal sensing voltage conditions in said sensing system for disabling said fence charging system so long as said fence is "unloaded," said means becoming inoperative when the voltage conditions in said sensing system charge in response to fence "loading," whereby said fence charger operates to impress high potentials at time intervals on said "loaded" fence.

2. An automatic electric fence charging system comprising a sensing system including a resistance network, said sensing system being adapted to be connected to a fence to be charged, means for energizing said sensing system so that a maximum voltage of no more than about 50 volts can normally be impressed upon said fence, said fence load normally being adapted to permit a minute current to flow from said sensing system to ground with the IR drop being such as to maintain said sensing voltage, electric fence charging means including a relaxation type oscillator having a capacitor and a capacitor discharge circuit for permitting pulse discharge of said capacitor when the capacitor potential reaches a predetermined value, said capacitor thereafter being charged relatively slowly to repeat the discharge cycle, and means responsive to the voltage conditions in said sensing resistor network for disabling said capacitor charging system and preventing the potential across said capacitor from reaching a breakdown value so long as said fence remains "unloaded," the "loading" on said fence reducing the fence load and increasing the current from said sensing system whereby said means responsive to the voltage conditions operates to permit said capacitor to reach a pulse discharge value and operate the fence charging system in a normal fashion.

3. The system according to claim **2** wherein said sensing portion of the system includes at least one resistor whose value is in the megohm range, said resistor having one end for direct connection to a fence, and voltage dividing means connected to said high resistance and transistorized means connected to said voltage dividing means, said transistorized means functioning as a switch to control a circuit to said capacitor for controlling the potential level to which said capacitor is charged, said transistorized means itself being controlled by the potential level at said voltage dividing means.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,655,995 Dated April 11, 1972

Inventor(s) Elmer K. Malme

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 22, "voltage" should read -- value --; line 31, "durint" should read -- during --.

Signed and sealed this 31st day of October 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

UNITED STATES PATENT OFFICE

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FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
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