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Boeing

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[54] **PROGRAMMABLE UNIJUNCTION FENCE CHARGER**

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[51] **Int. Cl.** **H05c 1/00**

[58] **Field of Search** ..... 256/10; 307/252 F, 307/261, 282, 132 R

[56] **References Cited**

UNITED STATES PATENTS

3,182,211	5/1965	Maratuech et al.	256/10 X
3,325,717	6/1967	Nellis	256/10 X
3,378,694	4/1968	Griffeth	256/10 X
3,387,825	6/1968	Kreeger	256/10

OTHER PUBLICATIONS

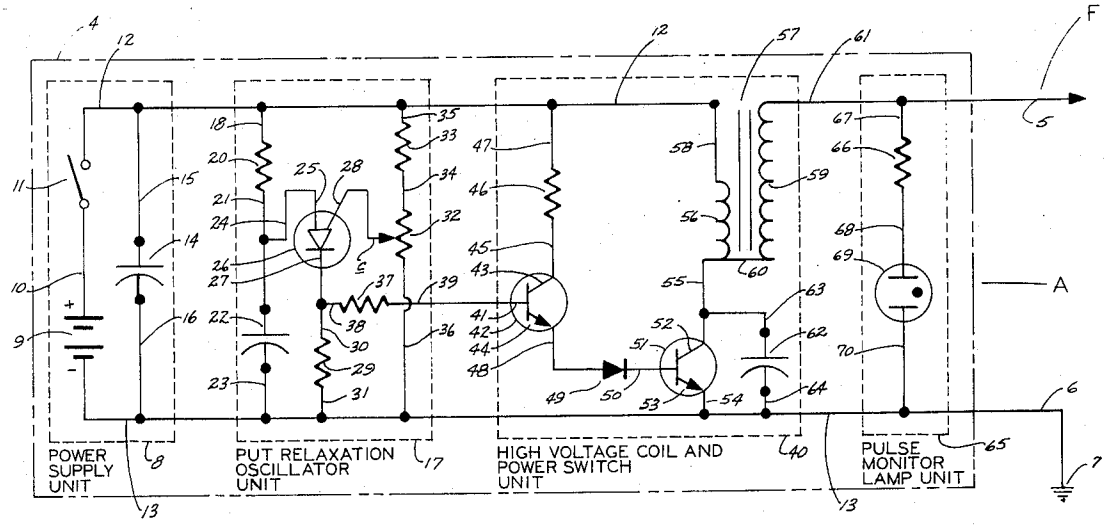
GE Application Note 90,70 11/67 "The D13T-A Programmable UJT" by Spofford.

Primary Examiner—John S. Heyman
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[57] **ABSTRACT**

A portable fence charger which comprises a relaxation oscillator having a programmable unijunction transistor for producing repetitive pulses, circuitry for amplifying and applying said pulses to a fence, and a repetitively flashing light to indicate proper function of the charger and fence.

10 Claims, 2 Drawing Figures



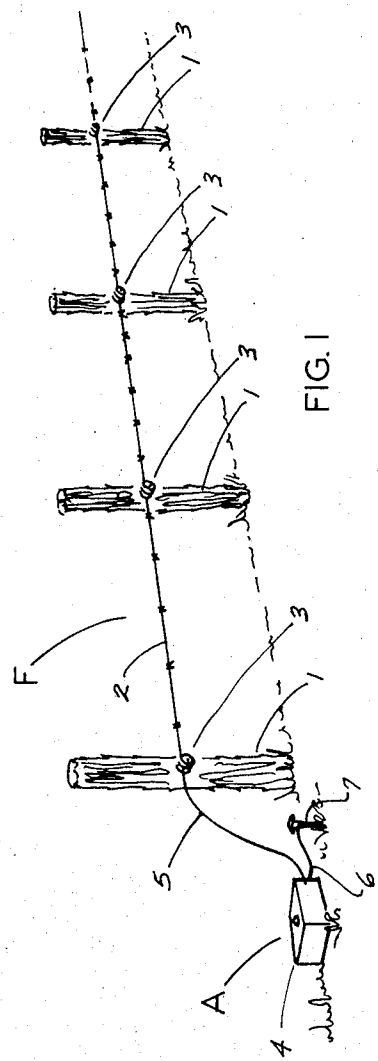

F
A
1
2
3
4
5
6
7

FIG. 1

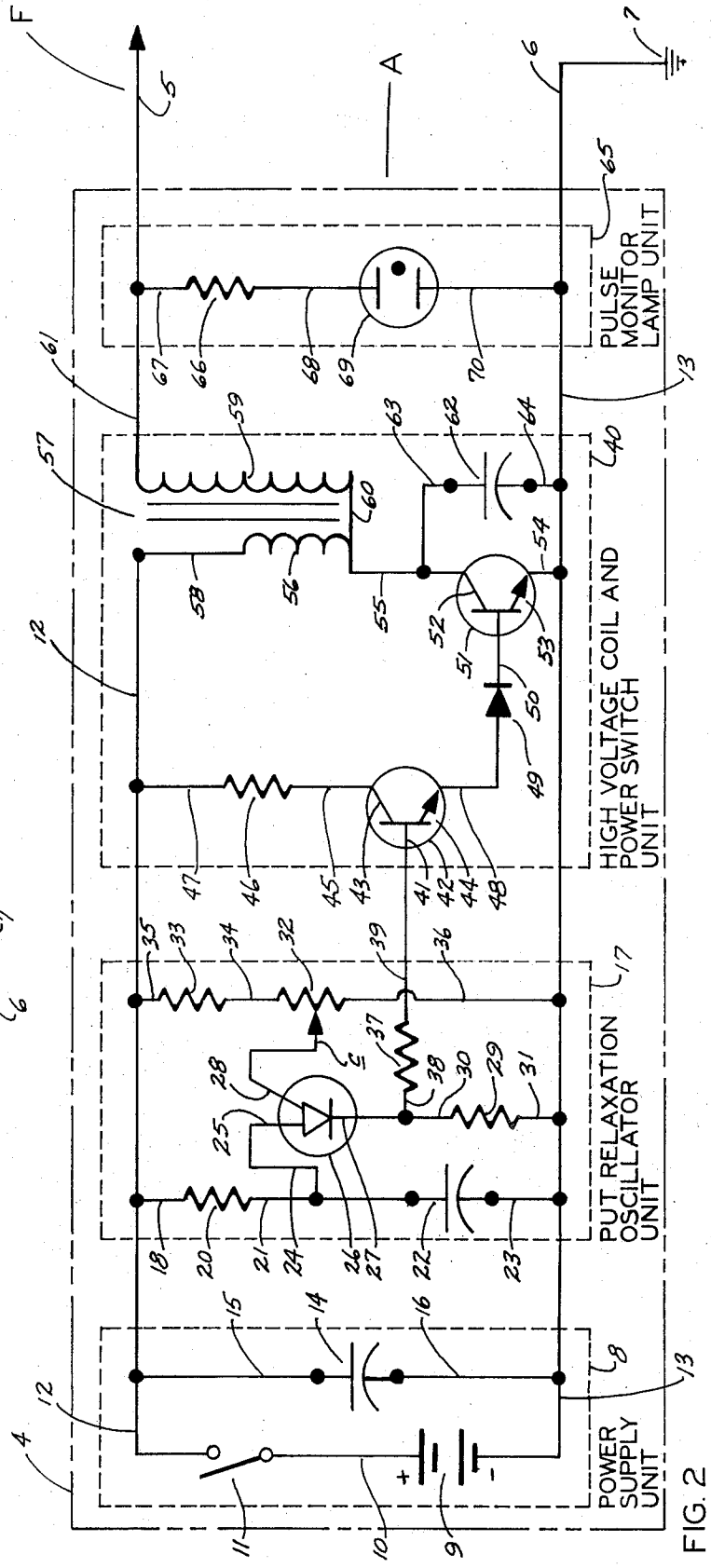

F
A
PULSE MONITOR LAMP UNIT
HIGH VOLTAGE COIL AND POWER SWITCH UNIT
PUT RELAXATION OSCILLATOR UNIT
POWER SUPPLY UNIT

FIG. 2

PROGRAMMABLE UNIJUNCTION FENCE CHARGER

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates in general to pulsing systems and, more particularly, to a pulsing fence charger controlled by a single programmable unijunction transistor.

Heretofore, fence chargers of the type adapted to retain livestock within confined areas have for the most part been of the so-called mechanical character wherein an induction coil is charged and discharged by a spring loaded oscillating switch. Chargers of this type have proved to be relatively short lived primarily because of arcing between the contacts of the oscillating switch, thereby requiring relatively frequent replacement. Additionally, such chargers in practice have proved costly by reason of inordinate drains upon the power supply and failure through shorting of the associated fence.

Therefore, it is an object of the present invention to provide a fence charger which is adapted for longevity of usage, having a simplicity of durable parts and without the same being movable so as to render the charger resistant to breakdown; and which charger is designed to conserve its power supply.

It is another object of the present invention to provide a fence charger of the type stated which is portable in character and is readily installed in operative position in any convenient location with respect to the fence to be energized.

It is a still further object of the present invention to provide a fence charger of the type stated which is adapted to emit pulses of operator-selected periodicity.

It is another object of the present invention to provide a fence charger of the type stated having means for compensating for voltage decrease as through battery age thereby conducing to the relatively extended life of the power source.

It is a further object of the present invention to provide a fence charger having visual signal means for indicating proper operation of the charger and which also is capable of indicating a malfunction either in the fence or the charger unit.

It is a still further object of the present invention to provide a fence charger which requires but a fraction of the input power requisite for currently used chargers, thereby further promoting marked economy in operation.

It is a further object of the present invention to provide a fence charger of the type stated incorporating means for adjusting the rate of emitted pulses; and which does not contain any parts potentially corrodable.

It is another object of the present invention to provide a fence charger which may be most economically manufactured; and which is durable and reliable in usage.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a livestock fence having connected thereto a charger constructed in accordance with and embodying the present invention.

FIG. 2 is a wiring diagram of the charger.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now by reference characters to the drawings which illustrate the preferred embodiment of the present invention, F indicates a conventional fence, as of the type utilized for restricting cattle or other livestock to defined areas, comprising a plurality of spaced apart posts or uprights **1**, which are interconnected by a single strand of conductive wire or the like, as indicated at **2**; there being the customary insulators **3**, as for example, of glass, for both supporting wire **2** and insulating same from ground. Provided for use with fence F for purpose of charging conductor **2** in a manner to be described more fully hereinbelow is a charger A having a housing or casing **4** for disposition in convenient location with respect to fence F; and including an output lead **5** connected to conductor **2**; and a ground lead **6** suitably grounded, as, for instance, by a metal stake **7**, or any other usual means.

Charger A comprises a power supply unit **8** which comprehends a battery **9** connected in series, by a lead **10**, with an "on-off" switch **11**, between a power bus **12** and a ground bus **13**. In parallel with battery **9** and switch **11** is a capacitor **14**, the opposite sides of which are connected by conductors **15, 16** to power bus **12** and ground bus **13**, respectively. Battery **9** may be of any preselected voltage, but it has been found in practice that a 12 volt battery supplying up to 1.5 amperes, momentarily, is adequate for effectively operating charger A. Furthermore, the commonly found 12 volt "ignition" type carbon-zinc batteries have proven fully efficacious.

Engaged to power supply **8** through busses **12, 13** is a PUT relaxation oscillator unit **17** having a lead **18** extending from power bus **12** to a resistor **20**, the opposite end of which is connected by a conductor **21** to a timing capacitor **22** which latter is in turn engaged to ground bus **13** by a lead **23**.

Engaged to conductor **21** is one end of a conductor **24** which at its other end is connected to the anode lead **25** of a programmable unijunction transistor PUT **26** which latter is provided with the usual cathode lead **27** and gate lead **28**. Cathode lead **27** is in circuit with a resistor **29** through a conductor **30**; said resistor **29** being connected at its other side to the ground bus **13** by a conductor **31**. Gate lead **28** is connected to the center tap *c* of a potentiometer **32** which is in series with a fixed resistor **33** by means of a lead **34**; said resistor **33** being connected to power bus **12** by a short conductor **35**. In its end remote from resistor **33** potentiometer **32** is attached to ground bus **13** through a conductor **36**.

Lead **30** is connected to a resistor **37** by a conductor **38** and with the opposite end of said resistor **37** being connected to the input lead **39** of a high voltage coil and power switch unit **40**. Within said unit **40** input lead **39** is engaged to the base lead **41** of a transistor **42** having a collector lead **43** and an emitter lead **44**; the former being attached by a lead **45** to a resistor **46** which is in turn connected to power bus **12** by a conductor **47**. Said emitter lead **44** of transistor **42** is engaged by a lead **48** to a diode **49** which is connected to the base lead **50** of a transistor **51** also having collector and emitter leads **52,53**, respectively; said transistor **51** is thus in cascade relationship with transistor **42**. Emitter lead **53** of transistor **51** is connected to ground bus

13 by a lead 54 while the associated collector lead 52 is connected by a conductor 55 to one end of the primary coil winding 56 of an induction coil or a transformer 57, the opposite end of which coil is engaged to the terminal end of power bus 12 by a lead 58. Induction coil 57 contains a secondary coil winding 59, one end of which is connected to lead 55 by a conductor 60, while the opposite end of which is engaged to a high voltage lead 61.

Lead 55 substantially intermediate induction coil 57 and transistor 51 is connected to a capacitor 62 through a conductor 63; the opposite end of capacitor 62 being connected by a lead 64 to ground bus 13.

High voltage lead 61 extends through a pulse monitor lamp unit 65 for connection to charger main output lead 5. Within unit 65 there is provided a resistor 66 engaged at one end to high voltage lead 61 through lead 67 and at its other end by a conductor 68 to a pulse monitor lamp 69.

Said lamp 69 is attached to ground bus 13 by means of a lead 70. Ground bus 13 extends through unit 65 for connection to charger main ground lead 6.

In view of the above, the operation of charger A for providing pulses to conductor 2 to shock livestock impinging thereagainst should be apparent. However, in operation, the operator will manually move switch 11 to "closed" or "on" position, connect the positive terminal of battery 9 with power bus 12 thereby establishing current flow through lead 18 and resistor 20, to capacitor 22 for charging of the latter. Concurrently there will be some current flow through conductors 35, resistor 33, potentiometer 32, and conductor 36 causing a voltage at center tap *c* of potentiometer 32 which is determined by a previously effected setting of center tap *c*. When the voltage developed by capacitor 22 reaches an amplitude determined by the voltage at center tap *c* PUT 26 becomes conducting and timing capacitor 22 discharges through lead 24, anode lead 25, PUT 26, and resistor 29, with the resulting discharge current producing a voltage across resistor 29, which latter in turn produces a current through resistor 37 and conductor 39, to base lead 41 of transistor 42 thereby turning "on" the latter and establishing a current from power bus 12 through conductor 47, resistor 46, lead 45, transistor 42, lead 48, and diode 49 to the base lead 50 of transistor 51 thereby switching the said transistor 51 to the "on" state. With transistor 51 thus conducting, a current path is developed through primary coil winding 56 of induction coil 57 from power bus 12 and thence through conductor 55, transistor 51, and lead 54 to ground bus 13.

Concurrently with the initiation of the conducting state of transistors 42 and 51, capacitor 14 will discharge through lead 15, power bus 12, lead 58 and primary coil winding 56 of induction coil 57 to accelerate the build-up of current within said primary coil winding 56 and transistor 51. The PUT 26 remains in a conductive state while capacitor 22 is discharging through PUT 26 until the current decreases exponentially to a value referred to as the "valley current." The valley current is adjusted by the setting of center tap *c* of potentiometer 32. When the current decreases to the value of the valley current PUT 26 returns to the non-conducting state.

It is apparent that PUT 26 remains in a conductive state for a time interval consonant with the choice of values of resistor 33 and potentiometer 32 and the setting of center tap *c*. At the termination of such interval, PUT 26 returns to a non-conducting state thereby interrupting current developed by the discharge of the capacitor 22. The abrupt cessation of current through PUT 26 expectedly terminates current into base lead 41 of transistor 42 thereby turning same "off" so as to interrupt current through said transistor 42 with resultant discontinuance of current being fed to transistor 51, thereby terminating current through primary coil winding 56 of induction coil 57.

With the abrupt arresting of current in primary coil winding 56, the energy stored in primary coil winding 56 is momentarily transferred to capacitor 62 through leads 55 and 63. The value of capacitor 62 is such as to cause the circuit represented by capacitor 62, the primary coil winding 56 and the secondary coil winding 59 to be a slightly undamped second order oscillating system. This allows adequate time for the energy from the primary coil winding 56 to be most efficiently transferred to the secondary coil winding 59 while at the same time reducing the voltage produced from collector lead 52 to emitter lead 53 to within the specified voltage breakdown limits of transistor 51. The energy stored in the magnetic field of the induction coil 57 is thus transferred to the secondary winding 59 in the form of very high voltage pulses. The voltage generated in secondary coil winding 59 is applied through high voltage lead 61 to conductor 2 of fence F thereby energizing same. Upon the generation of the pulse a relatively large voltage appears across lamp 69 for illuminating same and thereby visually signaling the proper operation of charger A. The pulse so produced terminates one operating cycle of charger A.

By appropriate setting of center tap *c* of potentiometer 32, the pulse rate can be varied between 4 and 33 pulses per second. It is apparent that the number of pulses emitted in any given time interval will depend upon the voltage supplied by battery 9, as well as the choice of resistors 33 and potentiometer 32 and the setting of center tap *c* of the latter. However, the present system has proven highly efficacious in usage with a twelve volt battery as the source of power, being productive of a pulse rate which can be varied roughly between 3 and 30 pulses per second depending upon the setting of center tap *c* of potentiometer 32. As the battery ages, the voltage it is capable of supplying decreases but charger A can be retained in operation by reason of appropriate resetting of center tap *c* of potentiometer 32.

Pulse monitor lamp 69 is of milti-purpose character in that when tap repetitively it signals that charger A is pulsing properly and that fence conductor 2 is being energized; and when not flashing, it indicates a malfunctioning either in charger A or a short circuit in fence F. In this latter circumstance, charger A may be disconnected from fence F to permit isolation of the source of malfunction; that is, if charger A is operating properly, lamp 65 will flash upon such disconnection thereby indicating the presence of a short circuit in fence F. Manifestly, if lamp 65 does not flash upon disconnection the source of trouble may be expected to reside in the age of battery 9. Such latter contingency may be compensated by appropriate resetting of center cap *c* of potentiometer 32, or that, failing to restore operation, battery 9 may be replaced.

Additional reliability of charger A is accomplished by diode 49 which protects transistor 51 against possible

base-emitter breakdown of transistor **51**. Diode **49** permits the base potential of transistor **51** to float while said resistor is in cut-off condition. This prevents the base to emitter voltage of transistor **51** during cut-off exceeding the reverse base to emitter breakdown voltage of said transistor.

Fence charger F may be comprised of very simple components, such as a 12 volt battery as above described and with induction coil **57** being a conventional automobile ignition coil which latter may be obtained in a most economical manner. The economies in operation of charger A are indeed apparent and the relative longevity of usage is equally manifest when one considers the relatively low input power requirements.

I claim:

1. For use with a conductive fence, a charger comprising a source of electrical power, a relaxation oscillator, first circuit means connecting said power source and said oscillator to enable said oscillator to produce electrical pulses, said oscillator comprising a programmable unijunction transistor, means for controlling the periodicity of said pulses being connected to said transistor, means for controlling the width of said pulses connected to said transistor, means for amplifying the time and width controlled pulses, second circuit means connecting said amplifying means to said oscillator, and third circuit means connecting said amplifying means to said fence.

2. For use with a conductive fence, a charger as defined in claim **1** and further characterized by said source of electrical power being a low voltage battery.

3. For use with a conductive fence, a charger as defined in claim **1** and further characterized by said programmable unijunction transistor having an anode and a cathode, said means for controlling the periodicity of said pulses being connected to the anode of said transistor, and said means for controlling the width of said pulses being connected to said cathode of said transistor.

4. For use with a conductive fence, a charger as defined in claim **3** and further characterized by said transistor also having a gate, and biasing means connected to the gate of said transistor.

5. For use with a conductive fence, a charger as defined in claim **4** and further characterized by said biasing means being adjustable to compensate for any diminution in the power source.

6. For use with a conductive fence, a charger as defined in claim **3** and further characterized by said means for controlling the pulse periodicity comprising a fixed resistor and a fixed capacitor.

7. For use with a conductive fence, a charger as defined in claim **6** and further characterized by said means for controlling the pulse width comprising a first fixed resistor connected between the cathode of said programmable unijunction transistor and said power source.

8. For use with a conductive fence, a charger as defined in claim **7** and further characterized by said biasing means comprising a fixed resistor and a variable resistor connected to said power source, and with there being a conductor between said variable resistor and the gate of said transistor.

9. For use with a conductive fence, a charger as defined in claim **1** and further characterized by said amplifying means comprising a first transistor, a second transistor, said first and second transistors being in cascade relationship, and a transformer being between said cascaded first and second transistors and said third circuit means.

10. For use with a conductive fence, a charger as defined in claim **7** and further characterized by said second circuit means comprising a second fixed resistor one end of which is connected to said cathode of said programmable unijunction transistor of said oscillator.

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