April 2, 1940. C. H. WILLIS 2,196,046

ELECTRIC FENCE

Filed April 13, 1938

Fig. 1.

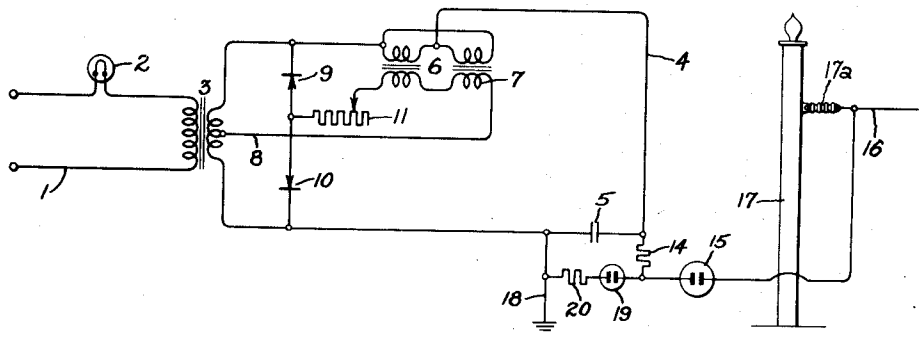
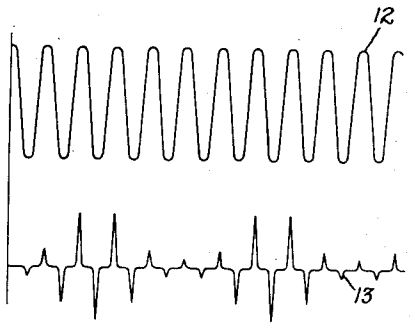


Fig. 2.



Inventor:
Clodius H. Willis,
by Harry E. Dunham
His Attorney.

Patented Apr. 2, 1940

2,196,046

UNITED STATES PATENT OFFICE

2,196,046

ELECTRIC FENCE

Clodius H. Willis, Princeton, N. J., assignor to General Electric Company, a corporation of New York

Application April 13, 1938, Serial No. 201,775

6 Claims. (Cl. 256—10)

My invention relates to electric fences and more particularly to the energization of electric fences, and has for its object a simple and reliable means for producing and controlling the desired energization.

In an electric fence, it is desirable to energize the wire or wires with a potential of varying amplitude to obtain the desired electrical characteristics for confining animals without endangering animal or human life. For this reason the potential on the fence should only be at a high value for a period of minimum duration necessary to achieve the proper results. It is further desirable to have the fence wire in an unenergized condition for sufficiently long intervals to permit an animal to break away from the wire after it has received an electrical stimulus. In accordance with these principles, my invention provides among its features an alternating current source inductively coupled with a pulsating or generating circuit described in United States Patent 1,921,787 to C. G. Suits, which issued August 8, 1933, and is assigned to the present assignee.

This pulsating circuit changes the wave form of the potential from an alternating source of commercial frequency to a pulsating form of varying amplitude having a series of sharply defined high potential peaks and a series of low potential peaks intermediate thereof. The periodical pulsation is adjustable to give pulsation frequencies ranging from ten per second to one in many seconds when connected to a source of alternating current of commercial frequency. Through the use of a device with a minimum operating characteristic such as an electric discharge device or a relay connected between the fence and the pulsating source, it is possible to energize the fence at periods only when the pulsating potential applied is above a certain minimum value. In this way periods of energization and non-energization of the fence can be obtained which are appropriate to the requirements of a safe and effective electric fence.

For a more complete understanding of my invention reference should be had to the accompanying drawing, Fig. 1 of which is a circuit diagram illustrating my invention in one form; Fig. 2 shows the wave forms of the potential plotted in relation to time in different parts of the circuit of Fig. 1.

Referring to the drawing, in Fig. 1 I have shown my invention in one form with an alternating current circuit 1 having in series therein a lamp resistance 2 for limiting the current flow in the circuit 1. The circuit 1 may be connected to a supply of alternating current of commercial frequency or any suitable alternating current supply desired. The circuit 1 is inductively coupled through a transformer 3 to a pulsating circuit 4 comprising a capacitor 5 and a saturable core reactor 6 having a saturating winding 7. The saturating winding 7 may be supplied with direct current from any suitable source whereby the core of the reactor when in operation may become saturated by a unidirectional flux. A convenient manner of supplying direct current to the winding 7 is through a rectifying circuit 8 connected with the alternating current circuit 4 through the rectifiers 9 and 10 and a suitable limiting resistance 11.

Referring now to the curves shown in Fig. 2, the sine curve 12 may represent the voltage wave of the supply circuit 1, while the curve 13 represents the corresponding voltage across the capacitor 5 in the pulsating circuit 4. It will be seen from the curve 13 that the effective value of the alternating voltage in the pulsating circuit 4 alternately increases and decreases in a regularly recurring manner. The operation of the pulsating circuit is due to the fact that it becomes resonant at a low current value, and when a condition of resonance exists in the circuit, the resulting increase in the current of the reactor 6 causes the impedance of the reactor to rise in a manner characteristic of biased core reactors to such a degree that the circuit is detuned from its resonant condition. The current and corresponding voltage then drops to its former low value only to rise again when the resonance is thus re-established. This sequence repeats itself regularly and indefinitely.

The low frequency pulsating potential across the condenser 5 is applied through a series connected limiting resistance 14 and a device having a minimum operating characteristic, for example, an electric glow discharge device 15, to a fence wire 16 which is insulated from and supported by a fence post 17 in any suitable manner, such as by insulator 17a. One side of the condenser 5 is connected to ground by a conductor 18 to complete a circuit through ground, the body resistance of an animal which may come in contact with the fence, the fence wire 16, the glow discharge device 15, and the resistance 14 to the opposite side of the condenser 5. The glow discharge device 15 has a critical breakdown potential below which it is not operable. Therefore, this device 15 will serve to remove the low

values of voltage from the fence wire 16 whenever the potential falls below the critical value.

In operation of the fence, the voltage across condenser 5 is pulsating at a lower frequency than the frequency of the supply in circuit 1. During each pulsation when the potential reaches a value greater than the critical breakdown potential of the glow discharge device 15, current is enabled to flow through the device 15 to energize the fence wire 16. When the potential across the condenser 5 falls to the lower values of its pulsating cycle below the critical breakdown potential of device 15, the flow of energy to the fence is interrupted and the wire 16 remains unenergized for a portion of the pulsating cycle. The glow discharge device 15 is therefore alternately lighted and darkened during each pulsation cycle. In this way, the fence is alternately energized by a peaked potential of short duration and then deenergized.

Connected in parallel with the condenser 5 from the ground conductor 18 to the glow discharge device 15 is an indicating device, preferably another glow discharge device 19, although it is obvious that an incandescent lamp or other suitable indicating means may be used, and a resistance 20 connected in series therewith. When the fence is not short circuited by an animal or some other cause such as a fallen branch, the device 19 will glow with a pulsating intensity following the pulsating potential across the condenser 5. This pulsating light will serve to indicate that the circuits 1 and 4 are operating in a normal way. Should the fence wire be electrically shorted for any reason, the potential across the device 19 will fall to a low value. Thereupon, the device 19 will break down and darken if the short is severe, because the potential across the device 19 will fall below the minimum or critical breakdown potential of this device. If the short is not severe enough to reduce the potential of the glow discharge device 19 below its critical potential, it will cause device 19 to glow only intermittently or dim the device sufficiently to inform the operator that the fence is shorted.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The combination with an electric fence wire of means for supplying an alternating potential, and means including a capacitor and a saturable core reactor connected to said supply means and said fence wire for producing a periodically varying potential whose frequency is less than the frequency of said supply means.

2. The combination in a system for energizing a fence of means for supplying an alternating potential, means including a capacitor and a saturable core reactor connected to said supply means and the fence for periodically varying the potential supplied to the fence from high to low values of potential at a frequency less than the frequency of said supply means, means for connecting said potential varying means and the fence, and means including a device having a minimum operating characteristic for interrupting said connecting means at said low values of varying potential.

3. The combination in a system for energizing a fence of means for supplying an alternating potential, an alternating pulsation circuit connected to be supplied therefrom including a saturable core reactor and a capacitor connecting in series circuit for causing the voltage across said capacitor to undergo regularly recurring variations from high to low values of voltage at a frequency less than the alternating frequency of said supply means, connecting means across said capacitor including a connection to the fence and a connection to ground, and means including a glow discharge device in series circuit with said connecting means to the fence for interrupting said connecting means.

4. The combination with an electric fence wire of means for supplying an alternating potential, and means including a capacitor and a saturable core reactor connected to said supply means and said fence wire for producing a periodically varying potential whose frequency is less than the frequency of said supply means, and means connected in parallel circuit with said capacitor for indicating a condition of operation of said last mentioned means.

5. The combination in a system for energizing a fence of means for supplying an alternating potential, an alternating pulsation circuit connected to be supplied therefrom including a saturable core reactor and a capacitor connecting in series circuit for causing the voltage across said capacitor to undergo regularly recurring variations from high to low values of voltage at a frequency less than the alternating frequency of said supply means, connecting means across said capacitor including a connection to the fence and a connection to ground, means including a glow discharge device in series circuit with said connecting means to the fence for interrupting said connecting means, and means including another glow discharge device connected in parallel with said capacitor from said ground connection to said first glow discharge device for indicating a condition of operation of said system.

6. The combination in a system for energizing a fence of means for supplying a potential of commercial frequency, a pulsation circuit connected intermediate said fence and said supply means for periodically changing the potential supplied to the fence from high to low values of potential at a frequency less than the frequency of said supply means comprising a series connected capacitance element and an inductance element having a saturable magnetic core, means including a direct current winding on said core for producing a unidirectional saturating flux in said core, means connecting the fence and said pulsation circuit from one side of said capacitance element including a glow discharge device for removing said low values of pulsating potential from the fence, a connection to ground from said pulsation circuit from the other side of said capacitance element, and means including a glow discharge device and a series resistance connected in parallel with said capacitance element from said ground connection to said fence connection for indicating a condition of operation of said system.

CLODIUS H. WILLIS.