March 14, 1950 W. F. FAGEN 2,500,311

ELECTRIC FENCE

Filed Nov. 15, 1943

Fig. 1.

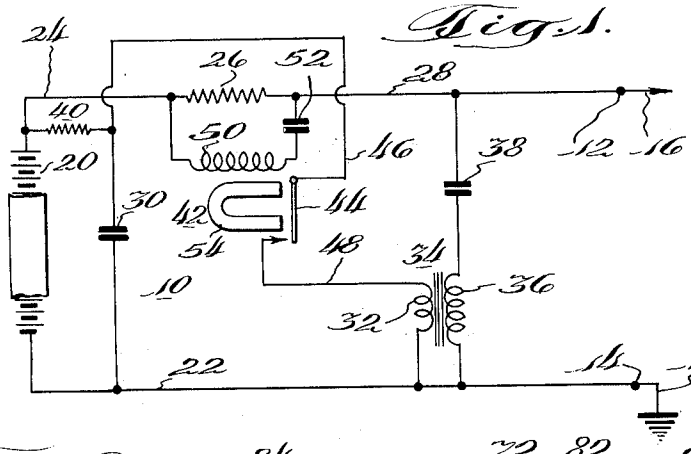


Fig. 2.

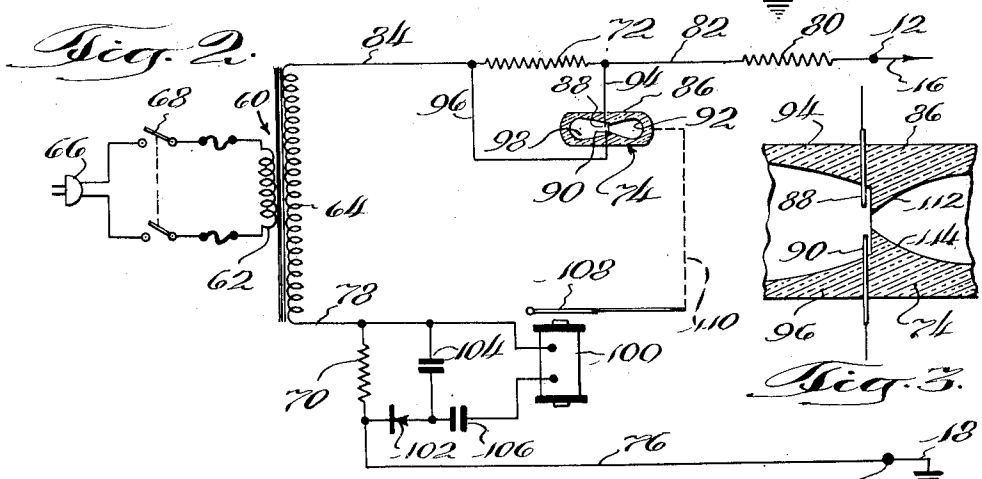


Fig. 3.

Fig. 5.

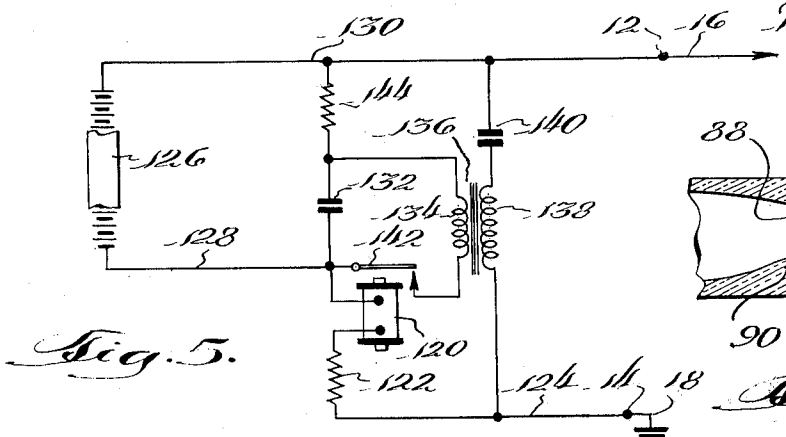
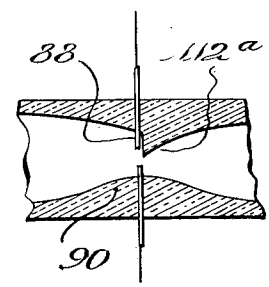


Fig. 4.



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ELECTRIC FENCE

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3 Claims. (Cl. 256—10)

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The present invention relates to electric fences and more particularly to automatically operable fence energizers or chargers of the character wherein a high voltage shocking impulse is applied to the fence when an animal comes into contact with the fence. Certain of the features disclosed in this application are also disclosed and claimed in my Patent No. 2,415,943, granted February 18, 1947.

An object of the present invention is to provide new and improved fence charging apparatus.

A further object of the present invention is to provide fence charging apparatus containing a minimum of operating parts and which may be constructed readily and economically. More specifically, the apparatus includes but a single relay adapted to be energized when an animal contacts the fence and mechanism controlled by the relay.

Further objects and advantages of the present invention will become apparent from the description of preferred embodiments thereof, in the course of which reference is had to the accompanying drawing in which:

Fig. 1 is a diagrammatic illustration of one embodiment of the invention;

Fig. 2 is a similar illustration of another embodiment of the invention;

Figs. 3 and 4 are enlarged fragmentary cross-sectional views of two switches which may be utilized in the embodiment of the invention illustrated in Fig. 2; and

Fig. 5 is a diagrammatic illustration of a third embodiment of the invention.

Referring first to Fig. 1, the fence charger is illustrated generally by reference character 10. It includes a pair of output terminals 12 and 14, the former of which is preferably connected to the fence wire 16 and the latter to ground through a connection 18. The fence wire 16 is of the bare conductive type. However, it should be understood that instead of using a ground connection, a second conductive wire could be utilized. It should be understood also that the apparatus of the present invention may be applied to various types of fences or enclosures preventing or tending to prevent the escape of animals or human beings from various types of enclosures.

Power is supplied from a suitable low voltage

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source, such, for instance, as battery 20 supplying a voltage say of about 45 volts. The negative terminal of the battery is connected to the terminal 14 and ground through conductor 22, whereas the positive terminal of the battery is connected to the terminal 12 and fence wire 16 through conductor 24, a control resistor 26, the purpose of which will be described in greater detail hereinafter, and conductor 28.

A low direct current control voltage is thus applied at all times to the fence. When an animal comes into contact with the fence, the flow of current through resistor 26 suddenly increases, thereby to produce a change in voltage drop thereacross. This change in voltage is utilized to produce a high voltage shocking impulse across the fence and the animal in contact therewith. The high voltage impulse is produced by discharging a condenser 30 through the primary winding 32 of a transformer 34, the secondary winding 36 of which is connected across the fence through a blocking condenser 38 and conductors 22 and 28. The condenser 30 is normally charged substantially to a battery voltage inasmuch as it is connected across the battery through a resistor 40.

When an animal contacts the fence and the voltage drop across the control resistor is suddenly increased, the condenser 30 is connected to the primary winding 32 by a sensitive polarized relay indicated generally by reference character 42 and including a normally open switch 44 adapted to connect conductors 46 and 48. Conductor 46 is connected to the condenser and conductor 48 to the primary winding. The relay includes a winding 50 connected across the control resistor 26 through a condenser 52 provided for the purpose of rendering the relay inoperative in response to gradual changes in voltage drop thereacross, as might be occasioned by rainfall and the like. The relay includes also a permanent magnet 54. The relay is so polarized that switch 44 is closed only when an animal contacts the fence, i. e., only when there is an increase in voltage drop across resistor 26. Thus, no shocking impulse is applied to the fence when an animal disengages itself from the fence.

In operation, a relatively low direct current control voltage is supplied to the fence by the battery 20. Under normal conditions there is a

relatively small current flow through the resistor 26, the magnitude being determined by the leakage resistance existing between the fence and ground. When an animal contacts the fence, the current flow through resistor 26 changes rapidly as does the voltage drop across it. As a result, relay winding 50 is energized and the switch 44 closed to connect the condenser 30 across the primary winding 32 of the transformer. The condenser discharges through the primary winding and a high voltage is induced in the secondary winding. This high voltage is supplied to the fence and provides the desired shocking impulse. The switch 44 remains closed but for a short interval, after which it opens and the condenser 30 is again charged ready to supply another current impulse through the primary winding when there is a further quick change in the flow of current through control resistor 26.

It may be seen, therefore, that but a single shocking impulse is applied when an animal contacts the fence, but that successive impulses are applied in response to successive contacts between the fence and one or more animals. The time between impulses is determined by the values of condenser 30 and the resistor 40 through which the condenser is charged. The apparatus of the present invention lends itself readily to operation from a battery inasmuch as but little power is expended under normal conditions. The battery may also be of the low voltage type, such for instance, as 45 volts. The transformer may be constructed and arranged as a step-up transformer so as to produce a relatively high voltage across the secondary winding. This voltage may be as high as several thousand volts under open circuit conditions.

In the embodiment of the invention illustrated in Fig. 2, a relatively low alternating current control voltage is applied to the output terminals 12 and 14 and thus to the fence wire 16 and ground connection 18. This control voltage is supplied by a transformer 60 having a primary winding 62 and a secondary winding 64. The former is connected to a plug connector 66 through a power switch 68. The plug connector may be connected to a suitable source of alternating current, such as the usual 110 volt means.

The control voltage is applied to the fence and ground through a control resistor 70 and a resistor 72 having associated therewith a switch 74 to provide a shocking impulse when an animal contacts the fence. The control resistor is connected between terminal 14 and one terminal of the secondary winding 64 by connector 76 and 78. The resistor 72 is connected to terminal 12 and the other terminal of the secondary winding through a current limiting resistor 80 and conductors 82 and 84. The resistors 70, 72 and 80 may have values, for instance, of about 20,000 ohms, 2 megohms and 160,000 ohms.

The shocking impulse is produced by short circuiting resistor 72 for a brief interval when an animal comes into contact with the fence. The resistor is short circuited by the previously referred to switch 74, which is of the mercury type and of a construction illustrated in greater detail in Fig. 3, to which reference will be had shortly. The switch includes a housing 86, preferably made of some insulating material such as glass, a pair of electrodes 88 and 90 extending within a central aperture 92 formed within the housing and connected to opposite ends of resistor 72 through conductors 94 and 96, respectively. The switch is so constructed and arranged that when it is moved angularly in a clockwise direction (as viewed in Fig. 2), the electrodes 88 and 90 are connected for a predetermined length of time by the mercury 98 located within the aperture 92. When the switch moves back to its initial position, i. e., in a counter-clockwise direction, the mercury does not complete a connection across the electrodes.

When an animal comes into contact with the fence, the voltage drop across resistor 70 increases rapidly. This change in voltage drop is utilized to effect the energization of a relay 100. In order to secure more efficient operation of the relay, it is preferably energized by a unidirectional current. The unidirectional current is provided by a rectifier 102, which may be of conventional type, connected across the resistor 70 through a condenser 104. The relay is connected across condenser 104 through a condenser 106 of a value such that the relay will be energized or operated only on sudden changes in current and voltage drop across resistor 70. Thus, the apparatus will not produce a shocking impulse in response to gradual increases in current flow, such as those occasioned by changes in humidity, rain and the like. The condensers 104 and 106 may have values of about 10 and 100 microfarads. These condensers are also so correlated relative to the other apparatus that the relay 100 cannot be energized successively within periods less than a certain length of time, such as one second.

The short circuiting switch 74 is operated by the relay 100, to the armature 108 of which the switch is connected through suitable mechanical connections diagrammatically indicated by the reference character 110.

The switch 74 is illustrated in greater detail in Fig. 3, from which it may be seen that the electrodes 88 and 90 are located opposite to each other and that their ends are spaced apart a short distance. Located to one side of the electrodes (the right, as viewed in Figs. 2 and 3) are a pair of opposed projections 112 and 114 preferably formed integral with the housing 86. The innermost ends of the projections are spaced apart a distance somewhat less than the space between the electrodes, so that when the mercury flows from left to right the mercury completes the circuit between the electrodes, but when the mercury flows from right to left (as it does when the relay 100 is deenergized), the mercury flows past the two electrodes without completing a circuit thereacross.

The short circuiting switch may take a form illustrated in Fig. 4 wherein the electrodes 88 and 90 are constructed as above described, but wherein only the upper electrode 88 has a projection 112A associated with it. In this embodiment the mercury completes a circuit across the electrodes when flowing from left to right, but while contacting electrode 90 when flowing from left to right does not contact the electrode 88 which is effectively shielded by the projection 112A.

In operation, a relatively low alternating current control voltage is applied to the fence by the transformer 60 and through the resistors 70, 72 and 80. These resistors are preferably so constructed relative to the transformer secondary voltage that under normal conditions a current of about 2 milliamperes flows through the fence. When an animal contacts the fence the current flow through resistor 70 changes rapidly as does the voltage drop across it. This voltage

drop is rectified by rectifier 102 and the relay 100 is energized. Relay 100 thus operates the short circuiting switch 74, with the result that the mercury flows from one end thereof to the other. In so flowing the mercury completes a circuit across electrodes 88 and 90 to short circuit resistor 72, thereby to provide a shocking impulse, which may be about 25 milliamperes. The switch and relay are constructed and arranged so that the short circuit across resistor 72 persists but for a short interval of time, the length of which may conform to code requirements. After the change in voltage drop has taken place, the relay 100 is deenergized and the switch 74 returns to its initial position. During this return the resistor 72 is not short circuited because of the provision of the shields 112 and 114, so that but one impulse is applied to the fence when an animal contacts the fence.

The condenser 106, as heretofore described in detail, prevents the relay from operating in response to gradual changes in current flow, and this condenser and condenser 104 prevent the relay from operating more frequently than once per second.

The embodiment of the invention illustrated in Fig. 5 differs from the previously described embodiments primarily in that the impulse producing relay, indicated by reference character 120, is operated in response to the total flow of current through the fence and not in response to a change in the current flow. The relay 120 is connected directly in the fence circuit through a current limiting resistor 122. One terminal of the resistor is connected to the relay and the other terminal through conductor 124 to terminal 14 and ground connection 18. The other terminal of the relay is connected to the negative terminal of a power supplying battery 126 through a conductor 128. The positive terminal of the battery is connected to the fence wire 16 through conductor 130 and the terminal 12.

When the current flow across the fence and ground increases to a predetermined value, the relay 120 is energized sufficiently to operate it. When the relay is operated it produces a shocking impulse which is applied across the fence. The shocking impulse is produced by discharging a condenser 132 across the primary winding 134 of a transformer 136, the secondary winding 138 of which is connected across the terminals 12 and 14 through a blocking condenser 140. The discharge circuit for the condenser is completed through a switch 142 adapted to be closed by the relay. The condenser is adapted to be charged through a resistor 144 connecting the condenser across the battery.

In operation, the battery 126 supplies the fence with a relatively low direct current control voltage. Under normal conditions there is a relatively small flow of current through the resistor 122 (which may have a value of about 50,000 ohms) and the relay 120. When an animal contacts the fence, the flow of current increases, with the result that relay 120 operates to close switch 142 to effect the discharge of condenser 132 through the primary winding 134 of the transformer. The high voltage induced in the secondary winding is applied to the fence to provide the shocking impulse. Once the switch 142 is closed it remains closed until the current flow through the relay decreases, as when the animal detaches itself from the fence. When the switch opens the apparatus is returned to its initial condition, whereupon the condenser 132 is recharged and made ready for a further operation. The resistor 144 (which may have a value of about 100,000 ohms) determines the charging time of condenser 132, so that impulses cannot be produced except at predetermined intervals.

Although the invention has been disclosed in connection with the specific details of preferred embodiments thereof, it should be understood that such details are not to be limitative of the invention except in so far as set forth in the accompanying claims.

What I claim is new and desire to secure by United States Letters Patent is:

1. Apparatus for energizing a fence comprising a conductive wire adapted to be placed in circuit with the body of an animal contacting the wire, including in combination, normally inoperative energy impulse supplying means adapted to be coupled to the fence wire and effective to supply energy for a single shocking period when operated, said means including a source of voltage, a resistor adapted to connect said source to the fence circuit and a switch operable briefly to short circuit said resistor, means also adapted to be coupled to the fence circuit for producing a change in current flow when an animal contacts the fence wire, and a single current change responsive electromagnetic actuating means operatively connected to said switch and connected to the fence circuit effective when the wire is engaged by the body of an animal to operate said switch and render said impulse supplying means operative to supply energy for the single shocking period.

2. Apparatus for energizing a fence comprising a conductive wire adapted to be placed in circuit with the body of an animal contacting the wire, including in combination, normally inoperative energy impulse supplying means adapted to be coupled to the fence wire and effective to supply energy for a single shocking period when operated, said means including a source of voltage, a resistor adapted to connect said source to the fence circuit and a two position switch effective when operated from one of its positions to the other briefly to short circuit said resistor, means also adapted to be coupled to the fence circuit for producing a change in current flow when an animal contacts the fence wire, and a single current change responsive electromagnetic actuating means operatively connected to said switch and connected to the fence circuit effective when the wire is engaged by the body of an animal to operate said switch and render said impulse supplying means operative to supply energy for the single shocking period.

3. Apparatus for energizing a fence comprising a conductive wire adapted to be placed in circuit with the body of an animal contacting the wire, including in combination, normally inoperative energy impulse supplying means adapted to be coupled to the fence wire and effective to supply energy for a single shocking period when rendered operative, said means including a source of alternating current energy, a resistor adapted to connect said source to the fence wire, and a switch operable to short circuit said resistor, means including a resistor adapted to be connected in series with the fence circuit for producing a change in current flow when an animal contacts the fence wire, and a single current change responsive electromagnetic actuating means operatively connected to said switch and a rectifier electrically connecting said actuating means across said resistor effective when the wire

is engaged by the body of an animal to operate said switch and render said impulse supplying means operative to supply energy for the single shocking period.

WILLIAM F. FAGEN.

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