March 7, 1944. S. G. KLUMB 2,343,300

ELECTRIC FENCE

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Fig. 1.

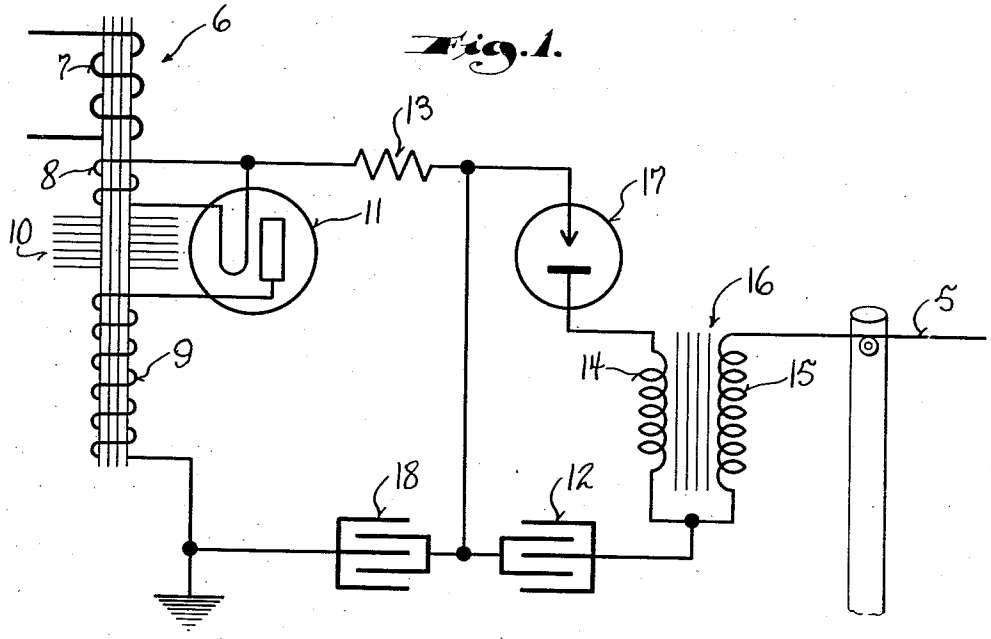

Fig. 2.

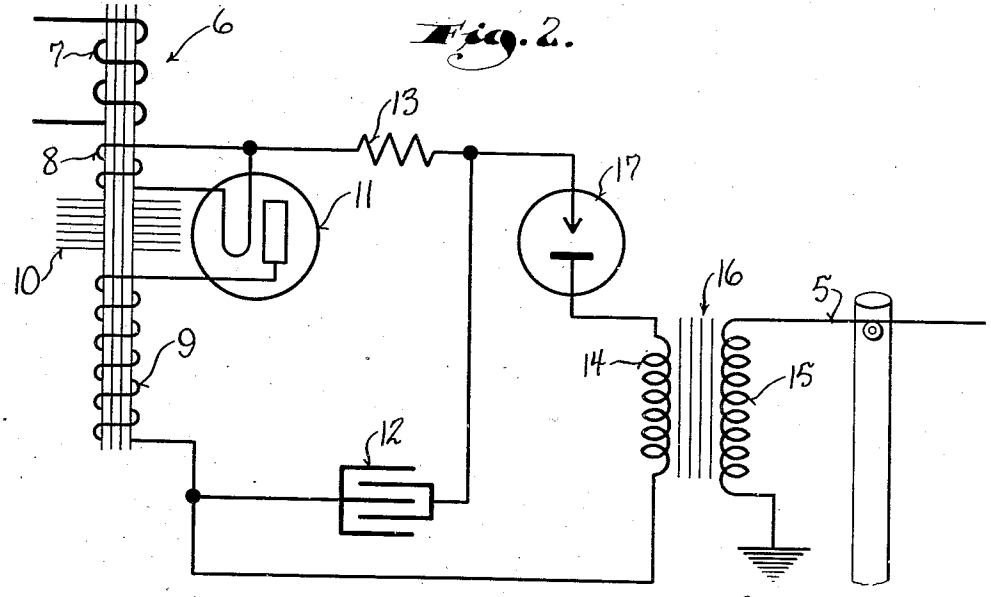

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Fig. 3.

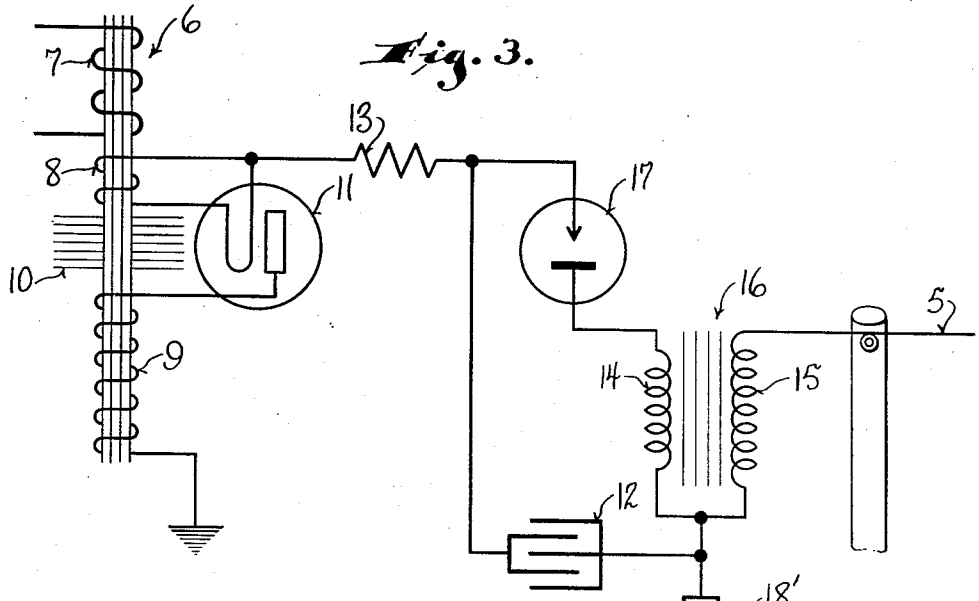
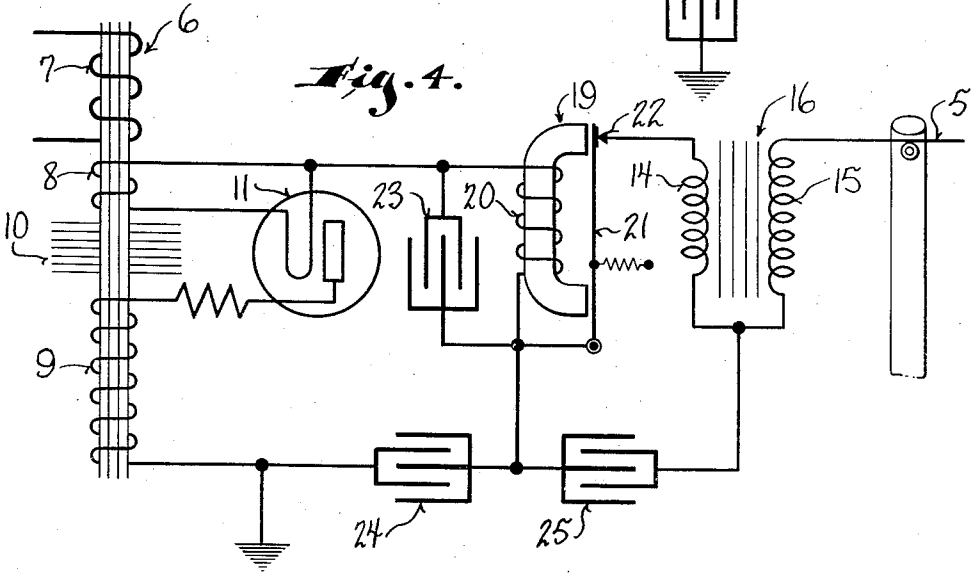


Fig. 4.



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ELECTRIC FENCE

Stanley G. Klumb, Milwaukee, Wis.

Application October 3, 1941, Serial No. 413,555

7 Claims. (Cl. 256—10)

This invention relates to electric fences and has as its object to provide an electric fence which has a more effective shock and at the same time assures the necessary safety by limiting the duration of the shock to an extremely short interval.

In the copending application of Stanley G. Klumb, Serial No. 253,677, filed January 30, 1939 (now Patent 2,259,570, issued October 21, 1941), over which this invention is an improvement, means are provided for loading a condenser and discharging the same onto the fence under the control of a timing unit in the form of a gaseous discharge tube having a critical breakdown value.

The present invention likewise utilizes such a control valve but in lieu of having the condenser discharge directly onto the fence, its discharge effects a surge through the primary of a set-up transformer, the secondary of which is connected to the fence.

Intermittent energization of the fence wire as distinguished from continuous energization is now a prerequisite established by regulatory state legislation. Heretofore, this intermittent energization of the fence wire has been effected in a number of different ways, sometimes by means of mechanical make and break devices connected in the energizing circuit and sometimes through the use of a gaseous discharge tube as described in the aforesaid copending application, but in all cases the controller operated continuously sending regularly timed intermittent impulses out onto the fence.

This is obviously a waste of electrical energy and an unnecessary use of the equipment for it may be hours and perhaps days between actual need for a shock on the fence. It is, therefore, an object of the present invention to provide an electric fence which is wholly inactive until grounding contact is made with the fence wire whereupon the controller functions to send an impulse or shocking current out onto the fence wire.

More specifically, it is an object of this invention to provide an electric fence of the type wherein the voltage for the shocking current is derived from a condenser and wherein the charging circuit for the condenser remains open until the fence wire is grounded whereupon the condenser charges to a predetermined peak voltage within a fraction of a second and then discharges through the fence.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate several complete examples of the physical embodiment of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a diagrammatic illustration of an electric fence illustrating the preferred embodiment of this invention wherein the unit is idle until grounding contact is made with the fence;

Figure 2 is a diagrammatic illustration of that embodiment of the invention wherein the controller functions continuously to periodically charge the fence;

Figure 3 is a view illustrating a slight variation from that form of the invention shown in Figure 1; and

Figure 4 is a diagrammatic view of the type of controller shown in Figure 1 but substituting a relay for the gaseous discharge tube.

Referring now particularly to the accompanying drawings, in which like numerals indicate like parts, the numeral 5 designates a bare fence wire strung on posts or other supports but insulated from the ground. The wire, as is well known, constitutes the fence proper and is adapted to be electrically grounded by an animal contacting the same.

In the embodiments of the invention illustrated in Figures 1, 3 and 4, grounding of the fence wire initiates the functioning of the controller to impress a shocking voltage on the wire. In other words, in these embodiments of the invention the controller is idle until contact is actually made with the fence, whereupon it becomes active to give the animal contacting the fence a shock.

To this end the controller comprises a power transformer indicated generally by the numeral 6 having a primary 7 adapted to be connected to an alternating 110 volt source of supply, and a split secondary consisting of a filament winding 8 and a power supply winding 9, one side of which is grounded.

Shunt blocks 10 are used to limit current in the charging circuit connected with the secondary winding 9 to a safe minimum.

The output of the power transformer is rectified by a thermionic rectifier tube 11, the filament or cathode of which is energized from the

filament winding 8 and the plate or anode of which is connected to one side of the secondary winding 9.

The cathode terminal of the tube is connected to one side of a condenser 12 through a limiting resistance 13 which limits the condenser charging current to a definite value. The other side of the condenser is connected to the connected ends of the primary 14 and secondary 15 of a step-up transformer 16.

Through the limiting resistance 13, the cathode of the tube 11 also connects with one electrode of a gaseous discharge tube 17, the other electrode of which is connected to the open end of the transformer primary 14.

The open end of the transformer secondary is connected to the fence wire.

The gaseous discharge tube 17 has a critical breakdown value below which it will not pass current so that until the voltage impressed across this tube reaches this breakdown value, current will not flow through the tube, and consequently will not flow through the primary 14 of the transformer.

Any suitable discharge tube may be used for this purpose, but it has been found preferable to employ a tube containing a rare gas at subatmospheric pressure.

In the operation of this embodiment of the invention it will be apparent that there is no closed condenser charging circuit as there is in the aforesaid copending application and in the embodiment of the invention shown in Figure 2. Instead, the condenser charging circuit is open and requires grounding of the fence wire for its closure. Hence, when the fence wire is grounded a condenser charging circuit is established as follows:

From the grounded side of the power transformer secondary winding 9 through the ground to the animal or other grounding connection touching the wire 5; then through the wire to the secondary 15 of the transformer and to one side of the condenser.

From the other side of the condenser the circuit is completed through the controlling resistance 13 and the rectifier tube 11 to the opposite side of the power transformer secondary 9.

Within a fraction of a second, the condenser 12 is loaded or charged to a peak voltage in excess of the R. M. S. voltage of the power transformer output, and when the charge on the condenser 12 reaches the critical value or the breakdown voltage of the discharge tube 17 the tube becomes conductive and spontaneously discharges the condenser 12 through the primary 14 of the transformer 16.

The surge through the primary as a result of the breakdown of the tube 17 induces a surge in the secondary to energize the fence and give the animal contacting it a shock.

As stated, this entire operation takes place within a fraction of a second so that an animal touching the wire and initiating the operation of the controller will receive a shock before contact ceases.

To protect the rectifier and power transformer and also to avoid objectionable sparking which might cause radio interference, the secondary surge is grounded through a condenser 18 connected between that side of the condenser 12 fed from the cathode of the rectifier and the ground. The presence of this condenser precludes the secondary surge jumping from the cathode to the anode in the rectifier tube and also precludes possible arcing between the filament and secondary windings and the grounded core of the transformer.

In the embodiment of the invention illustrated in Figure 1, the secondary surge passes through the condensers 12 and 18. Hence, both of these condensers are subject to failure due to an excessive secondary surge, and if either one of them fails the entire system is rendered inoperative.

If the power condenser burns out the device is obviously inoperative and if the surge condenser 18 fails the resulting short circuit precludes charging of the power condenser. To avoid this possibility, the circuit may be arranged as shown in Figure 3. In this case, the surge condenser 18' is connected between the common tap on the step-up transformer and the ground. Thus, the secondary surge in seeking ground is shunted past the condenser 12 thereby protecting it against failure, and if the surge condenser 18' burns out a closed charging circuit like that of Figure 2 merely results, but the unit remains operative as a fence controller.

In actual practice it has been found satisfactory to employ a 2 microfarad condenser at 12 and a .25 microfarad condenser at 18'.

In that embodiment of the invention illustrated in Figure 4 the circuit is substantially the same as that of Figure 1 except that instead of the gaseous discharge valve 17 a relay 19 is provided. This relay consists of an electromagnet having a winding 20 and an armature 21 biased to a position engaging a contact 22 and adapted to be drawn out of contact making position whenever current flows in the winding 20.

A high capacity low voltage electrolytic condenser 23 is connected across the winding 20 to iron out the ripple due to the pulsations of the unidirectional rectifier output.

The operation of this unit is as follows:

When the power switch is closed, the unidirectional current from the rectifier flows through the winding 20 to charge condenser 24 which corresponds to condenser 18 in Figure 1. During this charging interval the armature 21 is drawn home so that it is disconnected from the contact 22.

When the condenser 24 is charged so that current flow through the winding 20 ceases, the biasing spring of the armature 21 re-engages the armature with the contact 22 to connect the condenser 24 with one side of the primary of the step-up transformer. The unit then remains in this condition until the fence wire is grounded.

Immediately upon grounding of the fence wire the condenser 24 is discharged but also a circuit is established by which the condenser 25 which corresponds to condenser 12 in Figure 1 as well as condenser 24 is charged.

During this charging interval as before the armature 21 is drawn away from the contact 22. Upon cessation of current flow through the winding 20 which occurs when the condensers are charged, the armature 21 re-engages the contact 22 to thus directly connect the primary of the step-up transformer across the condenser 25.

The surge through the primary which follows because of the spontaneous discharge of the condenser through the primary winding results in an induced surge in the secondary and a shocking impulse on the fence.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides an important im-

provement in electric fence controllers in that it reduces considerably the drain on the power source and the wear and tear on the mechanism by leaving the controller entirely inactive until a ground on the fence actually occurs.

What I claim as my invention is:

1. A control for an electric fence by which a fence wire insulated from ground is charged with electricity derived from a suitable source whenever an animal or other grounding connection imposes a resistance across the wire and ground, comprising: a transformer having a primary and a secondary; a condenser, a two-element gaseous discharge tube; means for electrically connecting the transformer secondary with the fence wire and ground to provide a high potential fence charging circuit; means electrically connecting the transformer primary, the tube and the condenser in series circuit so that discharge of the condenser, which can take place only when the charge thereon exceeds the breakdown voltage of the tube, sends a surge of current through the transformer primary to energize the secondary and send an impulse out onto the fence wire; and a condenser charging circuit for electrically connecting the same condenser across the source to charge the same above the breakdown voltage of the tube including the fence wire and ground and completed whenever an animal or other grounding connection contacts the fence wire.

2. A control for an electric fence, by which a fence wire insulated from the ground is charged with electricity only whenever the fence wire is contacted by an animal or other grounding connection, comprising: a transformer for energizing the fence wire and having a primary and a secondary, the secondary having one end connected to the fence wire; a condenser having one side connected to the opposite side of the secondary and one side of the primary; a source of unidirectional current connected to the other side of the condenser and having a ground connection so that upon grounding of the fence wire a closed condenser charging circuit is established from one side of the source, through the condenser, the secondary, the fence wire, the grounding connection, and ground back to the other side of the source; and a control unit connected between the opposite end of the primary and the side of the condenser connected to the source, said control unit allowing current flow from the condenser and through the primary when the charge on the condenser reaches a predetermined value so that a surge of current rushes through the primary of the transformer when the charge on the condenser reaches said value to induce a high voltage surge in the secondary, and consequently the fence wire.

3. An electric fence controller for energizing an electric fence whenever the fence is contacted by an animal or other grounding connection comprising: a transformer; a condenser; a critical value control device; the transformer having a primary and a secondary; means for connecting the secondary with the electric fence so that a surge in the secondary is manifested by a charge on the fence wire; a primary energizing circuit including, a primary of the transformer, the condenser, and the critical value control device by which the primary circuit is held open until a predetermined charge has been built up in said condenser; and a condenser charging circuit for connecting said condenser across a source of current, said condenser charging circuit comprising the condenser, the secondary of the transformer, ground, a fence wire connected with the secondary, the source of current and a grounding connection between the fence wire and ground all in series circuit so that grounding of the fence wire is required for completion of the charging circuit whereby the controller remains inactive until the fence wire is actually grounded.

4. A control for an electric fence by which a fence wire insulated from the ground is charged with electricity whenever the wire is contacted by an animal or other grounding connection, comprising: a transformer having a primary and a secondary; means for connecting one side of the secondary with the fence wire; a surge condenser for cushioning the surge in the secondary; means for connecting the surge condenser between ground and the other side of the secondary and one side of the primary; a source of unidirectional pulsating current having a grounded side; a power condenser; means connecting the power condenser between the live side of said source and the connected ends of the primary and secondary so that grounding of the fence wire establishes a condenser charging circuit through the wire and the secondary of the transformer; and means for connecting the primary of said transformer across said power condenser, said means including a critical value control device which keeps the primary circuit open until the charge on said power condenser reaches a predetermined value whereupon closure of the primary circuit effects a power surge through the primary and an induced surge through the secondary.

5. A control for an electric fence by which a fence wire insulated from the ground is charged with electricity whenever the wire is contacted by an animal or other grounding connection, comprising: a transformer having a primary and a secondary; means for connecting the secondary with the fence wire and ground so that voltage induced in the secondary charges the fence wire; means for momentarily energizing the primary of the transformer upon grounding of the wire, said means comprising a condenser, a two-element gaseous discharge tube, and means connecting the condenser and tube in series across the primary so that the condenser discharges through the primary when the tube becomes conductive, said tube remaining nonconductive until the charge on the condenser reaches a predetermined value; an electrical connection between said condenser and the end of the secondary not connected with the fence wire; and a circuit for charging said condenser including the secondary and established through the fence wire and ground upon grounding of the fence wire.

6. An electric fence controller for energizing a fence wire whenever the wire is contacted by a grounded object or body comprising: a transformer having a primary and a secondary; means for connecting one end of the secondary with a fence wire to be energized; a primary circuit including the primary of the transformer, a normally discharged condenser, and a two-element gaseous discharge tube by which the primary circuit is held open until a predetermined charge is built up in said condenser; a grounded source of E. M. F. for charging said condenser; and a condenser charging circuit for charging said normally discharged condenser completed through the fence wire and ground whenever a grounded object or body contacts the fence wire and comprising the grounded source of E. M. F., a connection between said live side of said source and one

side of the condenser, the secondary, and a connection between the other side of the condenser and the side of the secondary not connected with the fence wire.

7. An electric fence controller for energizing a fence wire whenever the wire is contacted by a grounded object or body and wherein the energizing current is obtained by the discharge of a condenser through the primary of a transformer, characterized by the fact that: the condenser is connected in series with the primary of the transformer through a two-element gaseous discharge tube which holds the primary circuit open until the charge on the condenser exceeds the breakdown voltage of the tube, and further by the fact that the charging of the same condenser is effected by completing a circuit including the condenser, a source of E. M. F., the secondary of the transformer and the fence wire whenever a grounded object or body contacts the fence wire.

STANLEY G. KLUMB.